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Unusual Incised Stab Wound Produced by a Single Edged Weapon: A Case Report

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ABSTRACT

Stab wound examination yields valuable information about the weapon. Some amount of information about the hilt can also be obtained at times. In this case of murder by stabbing, the cutting edge of the (single edged) blade had a blunt portion (ricasso) adjacent to the handle and the hilt was projecting beyond the cutting edge. The ricasso had modified the sharp cut end of the stab wound and the blunt end of the knife had produced fish tailing. These events had altered the external appearance of the wound in such a way that the end which corresponded with the sharp edge of the knife looked blunt and the other end looked sharp. However, despite the confusing appearance of the skin wound, the actual orientation of the blade could still be determined from the hilt bruise.

Keywords: Boat Mark, Cutting Edge, Fish Tailing, Guard, Hilt, Incised Stab Wound, Penetrating Wound, Ricasso, Single Edged Knife, Square Edge, Stab

INTRODUCTION

Stab wounds contribute a significant portion of trauma deaths.^{1, 2, 3} From careful examination of the external appearance and internal characteristics of the stab wound, the pathologist is usually able to offer opinion upon the dimensions of the weapon (including width of the blade and minimum length); the type of the weapon (whether it was single edged or double edged); the taper of the blade; movement of knife in the wound⁴; the depth of the thrust; the direction of the thrust and the amount of force used. Some information about the guard (hilt) can also be gleaned from the presence of hilt bruises.^{5,6} Accurate information about the type of weapon has special significance in crime investigations.

The type of weapon is determined by examining the margins and ends of the wound. If one end is sharply cut and the other end is either rounded off, square cut or shows splitting of skin (fish tail appearance), we can safely assume that the injury was produced by a single edged weapon.

However, this is an oversimplification. On occasion, both the ends may appear sharply cut even in single edged weapons. This can occur when the skin splits behind the blunt edge to produce a symmetrical

appearance.⁵ This can also happen when the thrust is directed in such a way that, one sharply cut end of the wound is produced by the sharp tip of the knife⁷ and the other end is made by the sharp edge of the blade. In this situation, the blunt edge of the blade does not influence the shape of the wound.

The blade of a single edged knife often has a ricasso (blunt segment of the blade adjacent to the hilt). The significance of the ricasso is that the blade has two blunt edges at this portion. So if the knife is inserted up to the ricasso, the wound may have two blunt ends.⁶

The injuries sustained to deeper tissues (especially cartilage or bone)⁶ can also be helpful in differentiating between the blunt edge and the sharp edge. It is possible that when the skin wounds are ambiguous, the type of the weapon can be determined with ease from a close examination of the deeper structures.

CASE REPORT

A 32 year old male was stabbed to death. The fatal injury was an incised penetrating wound situated on the left half of front of chest which had entered the chest cavity through the 3rd intercostal space, perforated the upper lobe of left lung and had

terminated by entering the chamber of left ventricle (Figure 1). The wound was horizontally placed and showed gaping of edges.

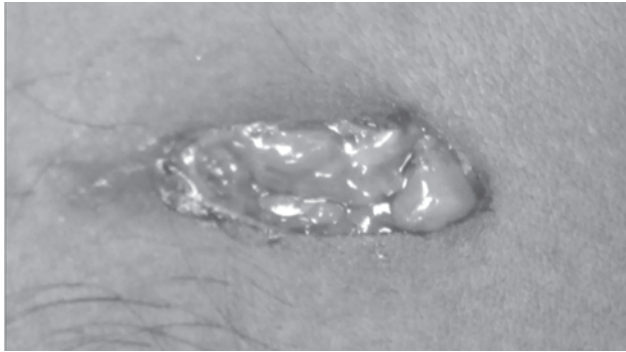


Fig. 1. The stab wound on the left half of front of chest.

The length of the wound (measured after approximating the edges) was 3.6 cm. The medial end was rounded and showed an adjacent contusion measuring 0.5 X 0.4 cm (see Figure 1). The lateral end of the wound showed skin splitting giving the impression that it was sharply cut. On external examination, it appeared as though the wound was made by a single edged weapon and the blunt edge of the weapon corresponded with the medial end and the sharp edge with the lateral end.

Internal examination showed that the intercostal muscles, lung and myocardium along the medial aspect of the wound track were sharply cut (Figure 2). On closer examination, it was noted that the lateral end of the wound showed two skin splits or "fish tailing" (Figure 3) strongly suggesting that the corresponding knife edge was square cut. The edges of gaping wounds need to be approximated⁵ to clearly visualize the shape of the wound and accurately measure the dimensions.

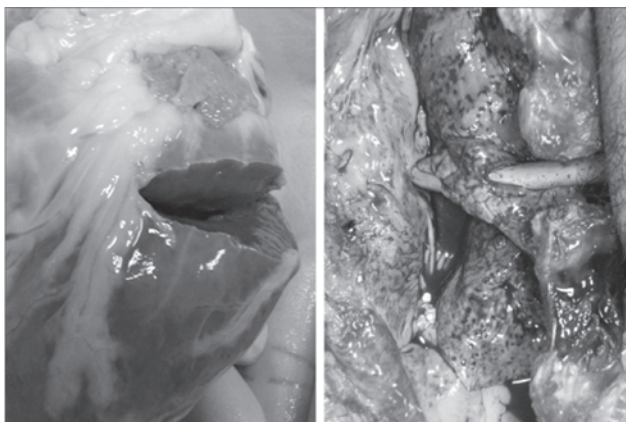


Fig. 2. The picture on the left shows the myocardial injury. The picture on the right shows the injured left lung with a probe passed through the wound track.

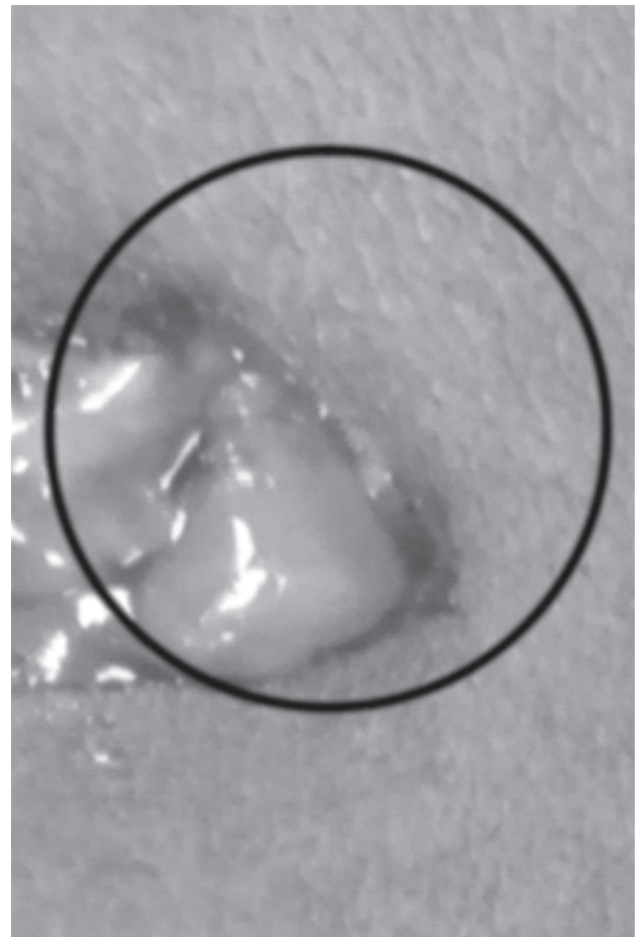


Fig. 3. The circled portion of the magnified photograph shows "fish tailing". The lower "tail" could easily be confused as sharp end of the wound and the upper "tail" is easily misinterpreted as a side cut or overlooked.

WEAPON

The weapon recovered by the investigating agency was of a peculiar design (Figure 4). The maximum width of the sharp portion of the blade was 3.4 cm just above the ricasso. The ricasso was projecting beyond the cutting edge but was continuous with the spine of the knife (the square edge). The blade was 3.6 cm broad at the level of the ricasso. The hilt was seen to be projecting another 5mm beyond the ricasso. The shape and placement of the contusion (hilt mark) adjacent to the medial end of the stab wound corresponded well with the hilt of the suspected knife. The width of the blade (at the level of the ricasso) corresponded with the length of the wound.

The spine of the blade had a thickness of 0.3 cm and had a square cross section which corresponded with the presence of fish tailing.



Fig. 4. The Knife recovered. Note the rounded and prominent ricasso below the cutting edge. The hilt which projected beyond the cutting edge corresponded well with the contusion adjacent to the medial end of the skin wound.

DISCUSSION

From a careful analysis of the findings, it was possible to deduce which end of the wound corresponded with the sharp edge of the knife and which end corresponded with the blunt edge even though cursory examination suggests the opposite. Rounded end of a wound does not necessarily mean that it was produced by the blunt edge of a blade; the rounded ricasso may well be the reason why the end is rounded. It should also be kept in mind by that skin splitting produced by the blunt edge of a knife may cause the wound to appear like sharply cut.

Clues like hilt marks and internal injuries are important and must be weighed carefully before an opinion about the type of weapon is furnished.

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Conflict of interest

We confirm that there are no known conflicts of interests associated with the publication of the article.

Ethics clearance:

Clearance has been obtained from the Ethics Committee, General Hospital, Ernakulam.

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Analysis of Pattern of Emergency Cases in the Casualty of a University

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ABSTRACT

Objective: To study the case mix pattern of emergency cases attending the casualty department by grouping them under various specialties and to analyze the disposition of such patients. Another objective was to determine the pattern of medicolegal cases attending the casualty department.

Materials and Method: A total 500 cases of patients attending the casualty were studied from the casualty records. The data was collected from the casualty registers/records and the medical record department. To study the case mix pattern, the patients coming to the casualty were grouped under the broad speciality headings of Medical, Surgical, Orthopedic, Pediatrics and Others.

Results: The analysis revealed that highest number of patients attending casualty belonged to Medicine and its allied speciality. It was found that large proportions of patients attending the casualty department were casual attenders and as such did not constitute real clinical emergencies.

Conclusion: It can be concluded that almost 50% of the patients attending the casualty department had trivial complaints which did not required much attention. The massive influx of such casual attendees results into increase workload on the staff especially on the junior medical and paramedical staff.

Keywords: *Casualty, Emergency Medicine Department, Case Mix Pattern, Casual Attenders*

INTRODUCTION

The Accident and Emergency (A & E) Department constitutes one of the vital entry points of patients into the healthcare facility of the hospital world over. This facility responds to and manages variety of cases in all the clinical areas. The A & E department of any hospital provides an insight to the quality of care available in the institution.¹ Emergency refers to a crisis which requires immediate life saving, life maintaining and life sustaining actions. The word emergency is derived from the Latin word 'Urgens' meaning pressing.

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The original term (casualty) meant a seriously injured patient. It was predominantly a military word, a general term for the accidents of service: after a battle the dead, the wounded, and the sick lumped together as "casualties". The term "casual" has its origin from the workhouse "casual" who was not one of the unemployable permanents, but the irregular and unexpected caller who needed temporary help.² The casualty department, as the emergency department was called, was named after the casual patients who did not have a letter of introduction for either admission or for outpatient consultations. Its purpose was to give urgent treatment of a surgical or medical nature. In theory the purpose of the modern Emergency Medicine Department (EMD) is to give urgent surgical, medical or psychiatric treatment which cannot be rendered outside the hospital.

MATERIALS AND METHOD

The current study was conducted in the casualty department of Dr D Y Patil Hospital and Research Centre, Nerul in the month of February 2011. Total 500

patients attended the casualty during this period. Their findings were recorded meticulously and the results were carefully analyzed. The main aim of the study was to study the case mix pattern of emergency cases attending the casualty department by grouping them under various specialties and to analyze the disposition of such patients. Another objective was to determine the pattern of medicolegal cases attending the casualty department. The data was collected from the casualty registers/records and the medical record department. To study the case mix pattern, the patients coming to the casualty were grouped under the broad speciality headings of Medical, Surgical, Orthopaedic, Pediatrics and Others. The last category includes patient who had minor ailment or have come for immunization. The patients attending casualty or emergency medicine department were categorized to study the severity of the emergency as below

- i. Serious and urgent cases where there was danger to life or limb needing necessary treatment as in patient.

- ii. Serious but not urgent, though still requiring admission.
- iii. Moderately severe, where skilled treatment was required initially but subsequently the treatment could be continued as an outpatient.
- iv. Not severe (Casual Attenders).

The results were analyzed using simple statistical calculation like percentage and mean.

Observation and Analysis

The study clearly demonstrates the male prepondance in attending the emergency medicine department in all age groups. With an age range of 1 months to 103 years , the overall mean age of the patients attending casualty was 32.26 years. The peak age group attending the emergency medicine department for males was in the 2nd and 3rd decade while in females the major peak was seen in 3rd decade with second peak in 1st and 4th decade. [Table 1]

Table 1: Age and Sex distribution of patients

Sex	Age (years)								Total
	0+-10	10+ -20	20+ -30	30+ -40	40+ -50	50+ -60	60+ -70	>70	
Male	39	49	102	35	30	27	17	13	312
Female	26	23	55	26	19	20	12	7	188
Total	65	72	157	61	49	47	29	20	500
%	13	14.4	31.4	12.2	9.8	9.4	5.8	4	100

The speciality wise case mix pattern of the patients in descending order is Medicine and allied (45%), Surgery and allied (28%), Orthopedics (14%), Paediatrics (10%) and others (3%). The others group comprises of patients coming to the casualty for the sake of immunization, for minor eye or dental problems, brought dead etc. [Table 2]

Table 2: Speciality wise case mix pattern of patients

Speciality	Total Number of Patients (N)	%
Medicine and Allied	225	45
Surgery and Allied	140	28
Orthopedics	70	14
Paediatrics	50	10
Others	15	3
Total	500	100

The analysis of distribution of patients to different category based upon the severity of the disease or emergency conditions, revealed that out of the total 500 cases only 256 cases (51.2%) required some form

of skilled medical treatment (Category I to III), while 48.8% constituted patients were casual attenders. Of the 51.2% who required medical care, 6.2% belonged to category I (life threatening needing admission), 31% belonged to category II (serious requiring admission) and rest were category III patients 14% (moderately severe requiring treatment but no admission). The study data revealed that almost 50% of patients attending the casualty department belonged to Category IV (casual attenders). [Table 3]

Table 3.: Category wise distribution of patients

Category	Number of Patients (N)	%
Category I	31	6.2
Category II	155	31
Category III	70	14
Category IV	244	48.8
Total	500	100

Category wise distribution of patients based upon the severity of the disease

Category I: Life threatening needing admission.

Category II: Serious requiring admission.

Category III: Moderately severe requiring treatment but not admission.

Category IV: Minor conditions (casual attenders).

Table 4 demonstrates the method of disposition of paediatric patients attending the casualty department. Out of the total 50 patients, 28% were admitted in the

paediatric ward, 12% were admitted in Post Natal Intensive Care Unit (PICU) or Neonatal Intensive Care Unit (NICU), 2% were admitted in D wing (Private ward for affordable patients), 2% patients were send back to the Out Patient Department (OPD) and 56% patients went home after treatment. Thus it can be easily seen from the above data that 56% of the cases were casual attenders while 44% of the cases required skilled medical treatment by either admission in the Intensive Care Unit (ICU) or in the ward.

Table 4: Disposition of patients of Paediatric speciality

	Method of disposition of patients					Total
	Admitted in ward	Admitted in PICU or NICU	Admitted in D wing	Sent to OPD	Went home after treatment	
Number of patients (N)	14	6	1	1	28	50
%	28	12	2	2	56	100

The study discovered that out of total 500 cases, 140 patients belonged to surgical and allied specialities. Out of these cases, 39.28% were admitted in ward, 1.42% were kept in D wing, 5% were referred back to the concerned OPD and 54.28% were send back to

home after minor treatment. None of the patient required admission to the surgical ICU (SICU) or other ICU. Casual attenders formed the major percentage of attendees in these specialities (54.28%). [Table 5]

Table 5: Disposition of patients of Surgical and its allied speciality

	Method of disposition of patients					Total
	Admitted in ward	Admitted in ICU or SICU	Admitted in D wing	Sent to OPD	Went home after treatment	
Number of patients (N)	55	0	2	7	76	140
%	39.28	0	1.42	5	54.28	100

The method of disposition of patients belonging to the Orthopaedic speciality who attended the casualty medicine department revealed that out of total 500 cases, 70 patients belonged to this speciality (14%), out of which 28.57% were admitted in ward, 1.42% were kept in D wing, 4.28% were referred back to the

concerned OPD and 65.71% were send back to home after minor treatment (dressing of the wound, plaster removal, general treatment etc). None of the patient required admission to the surgical ICU (SICU) or other ICU. Here once again the casual attenders formed the largest group attending the casualty (65.71%). [Table 6]

Table 6: Disposition of patients of Orthopaedic speciality

	Method of disposition of patients					Total
	Admitted in ward	Admitted in ICU or SICU	Admitted in D wing	Sent to OPD	Went home after treatment	
Number of patients (N)	20	0	1	3	46	70
%	28.57	0	1.42	4.28	65.71	100

The analysis of patients attending emergency medicine department revealed that maximum number of patients belonged to medicine and allied specialities. Out of total 500 cases, 225 cases i.e. 45% can be attributed to medicine and its allied specialities. Table 7 illustrates that out of 225 patients, 23.11% were

admitted in the wards, 10.22% required admission in ICU or Cardiac Care Unit (CCU), 3.55% were admitted in D wing, and 2.66% were referred to the concerned OPD while 60.44% were treated and send back to home from the casualty.

Table 7: Disposition of patients of Medicine and its allied speciality

	Method of disposition of patients					
	Admitted in ward	Admitted in ICU or SICU	Admitted in D wing	Sent to OPD	Went home after treatment	Total
Number of patients (N)	52	23	8	6	136	225
%	23.11	10.22	3.55	2.66	60.44	100

The percentages of casual attenders in medicine speciality were 60.44%, surgical speciality 54.28%, orthopedic speciality 65.71% and in paediatric department 44%.

The total number of medicolegal cases (MLC) attending the casualty were 84 (16.8%). Further analysis of medicolegal cases disclosed that out of 84 MLC cases, Road Traffic Accident (RTA) constituted 32.14%, fall from height or in the bathroom 42.85%, assault and thermal burns 7.14% each followed by poisoning 5.95 % and others 4.76% respectively. The

others group consists of patients who were brought for treatment in the casualty but were declared dead before admission or they died within a brief period of admission in the casualty. [Table 8 and 9]

Table 8: Type of cases (Medicolegal Vs Non medicolegal)

Type	Number of cases (N)	%
Medicolegal Case (MLC)	84	16.8
Non medicolegal (Non MLC)	416	83.2
Total	500	100

Table 9: Pattern of medicolegal cases

	Type of MLC cases						
	Road Traffic Accident (RTA)	Fall ICU or SICU	Poisoning D wing	Assault OPD	Thermal Burns after treatment	Others	Total
Number of cases	27	36	05	06	06	04	84
%	32.14	42.85	5.95	7.14	7.14	4.76	100

DISCUSSION

Among the cases studied, males outnumbered females in attending the casualty department (62.4% vs 37.6%). The male to female ratio was 1.65:1. The overall age range was from 1 month to 103 years, with an overall mean age being 32.26 years. Male preponderance was observed in all age groups. The above findings coincide with the study done earlier by other researchers.^{1,3}

The analysis of the speciality wise case mix pattern of patients revealed that highest number of patients belonged to Medicine and its allied speciality (45%), followed by Surgery and its allied branches (28%), Orthopedics (14%), Paediatrics (10%) and others (3%) in the descending order. The above findings correlates with that of the study done by S Malhotra and R S Gupta.³ The highest number of patients visiting medicine and its allied branches can be attributed to the fact that most of the ailments and emergencies belonged to the medicine speciality e.g. myocardial infarction, stroke, paralysis, respiratory infections etc. This finding is comparable with the study conducted in Malaysia.⁴

The analysis of patient admitted under the medicine and its allied speciality reveals that 36.88% of cases belonged to category I to III, while those admitted under surgery and its allied branches (belonging to category I to III) compromised of 40.71% of cases, Orthopedics (30%) and Pediatrics (42%) respectively. The percentage of casual attenders in medicine and its allied speciality were 63.12%, Surgery and its allied branches were 59.29%, Orthopedics (70%) and Pediatrics (58%). The study observation clearly demonstrates that the number of casual attenders belonging to category IV were highest in all major and allied speciality. A similar study conducted earlier³ revealed that the casual attenders compromised 60.14% of the patients in the speciality of medicine followed by 40.59% in paediatric medicine with only 5.26% casual attenders in orthopaedics.

The study analysis revealed that out of the total 500 cases, only 256 cases (51.2%) required some form of skilled medical treatment (Category I to III), while 48.8% constituted patients who may be termed as casual attenders. This means that the casual attenders formed almost 50% of the total casualty attendees. Most of the patients require treatment but not

admission. Such patients take a major portion of resources allocated for emergency cases with respect to infrastructure, medical personnel, drugs and medicines etc. This has resulted into failure of the real purpose of casualty department meant for attending casualty victims or emergency cases is not served. Thus the inference can be drawn that resources made available for utilization to treat emergency cases are used to manage trivial cases. The reasons for casual use of the emergency department may be many, some of them being – not everyone has a family physician, or the family doctor was not available, for example, on holidays; the patients feels that the hospital has better facilities for the treatment, or finds the treatment in the casualty cheaper.⁵ The patient may find the hospital more convenient to visit or just wants a second opinion.⁶ More or less similar findings were noted by other researchers.⁷

The survey of total number of patients attending casualty department discovered that the medicolegal cases compromised 16.8% of the total 500 cases while non medicolegal cases were 83.2%. Out of 84 MLC cases, Road Traffic Accident (RTA) constituted 32.14%, fall from height or in the bathroom 42.85%, assault and thermal burns 7.14% each followed by poisoning 5.95 % and others 4.76%. The above finding roughly correlates with the findings observed by another researcher.⁸

CONCLUSION

It can be concluded that almost 50% of the patients attending the casualty department had trivial complaints which did not required much attention. The massive influx of such casual attendees results into increase workload on the staff especially on the junior medical and paramedical staff. However, casual visitors will continue to attend the emergency medicine department making it more difficult to channelize the energy towards management of real or genuine emergency cases. In order to stop such massive influx of casual attenders and to increase the efficiency in dealing with the real emergencies one can propose to start a casualty OPD which will specifically remain open even after the routine OPDs are closed in order to cater to the need of such patients who come with trivial complaints. It can be proposed that henceforth the casualty department should be known as the Accident and Emergency Department whose main responsibility is to treat and manage serious life threatening traumatic and non traumatic emergencies.⁹ It make sense to charge patients (at least above

nominal) especially casual attenders for using emergency room services with the aim of reducing abuse of the free or subsidized emergency care treatment and as a step in reform of health care financing.¹⁰

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Stature Estimation from Hand and Foot Length in Bhopal Region

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ABSTRACT

Ascertaining sex and estimation of stature from incomplete skeletal and decomposing bodies is a recurring theme in physical anthropology and forensic science. This has become useful in recent times due to mass disasters like plane crash, mass suicide, tsunamis, forest fires, earth quakes. The present investigation was conducted to study hand lengths, widths, height, stature ratio and indices for bilateral differences. Data for the study was obtained from 140 students with mean age of 18.95 ± 1.15 years from chirayu medical college and hospital Bhopal. Height of subject, length and width of hand and foot were measured following standard protocols using vernier calliper and measuring tape. In all anthropometric parameters measured or calculated males were significantly ($P < 0.001$) higher. Significant relationships were established between height, hand lengths and width, foot length and width in both sexes. Multiple linear regression analysis of hand and foot lengths generated predictive equations with statistical significant ($P < 0.001$) ability for height prediction.. The results showed a significant correlation between hand length and foot length. Height could be accurately predicted from a combination of right and left hand and foot lengths which will be useful in forensic investigation, medico-legal cases for the identification of body parts as well as in cosmetic surgery.

Keywords: Stature, Height, Hand length, Hand width, Foot length, Foot width

INTRODUCTION

Relationship between different body parts especially the limbs is being used to establish sex and stature (4), which is a prerequisite to identification in forensic investigation. Specifically hand and foot have been used by many investigators to determine sex and estimate stature (7). Although the relationships of hand length and foot length with various body part measurements have been studied, there is no information in the available literature regarding the correlation between hand length and foot length. Parameters that have been employed for this purpose include hand and foot length (8), and foot indices (10). There are many studies undertaken to emphasise the importance of the measuring the hand length as well as foot length. Ashizawa et al. (1997) studied the correlation between foot length and general body size. Levy et al (1978) has shown that there is a symmetry in the length of the feet irrespective of sex or handedness. Amirshaybani et al (2000) found that hand length can be a good predictor of the body surface area independent of the sex of the individual.

The aim of this study is to investigate the relationship in the hand and foot lengths, hand and foot indices, hand and foot-stature ratio and to determine the relationship between hand and foot lengths to stature in a sample of Bhopal population.

MATERIAL AND METHOD

This study was carried out on a cross sectional sample of 140 students without any physical deformities or previous history of trauma to the hand or foot with mean age 18.95 ± 1.15 years of the chirayu medical college and hospital Bhopal. Samples were drawn randomly across the student population, after giving informed consent to participate in the study.

Anthropometric measurements of height, hand length and width and foot length and width were obtained following the description of Krishan and Sharma (10). The foot index was calculated as foot breadth/foot length $\times 100$ as described by Agnihotri et al (4). Hand and foot to stature ratio were calculated by dividing the lengths of the hand and foot by the height of the subject as described by Fessler et al (9).

Hand Length: Each subject was asked to place his/her hand on a white paper with the palm facing upwards keeping the fingers close together with the thumb lying comfortably but not tightly against the radial aspect of the hand and index finger. A tracing of the hand was made with a lead pencil. The tracing proceeded from the radial styloid process to the ulnar

styloid process. A line was drawn joining the two styloid tips. This line is designated as the interstyloid line (Fig. 1). The distance between the midpoint of the interstyloid line and the tip of the middle finger in extension was measured as the length of the hand as described by Amirshaybani et al (2001).

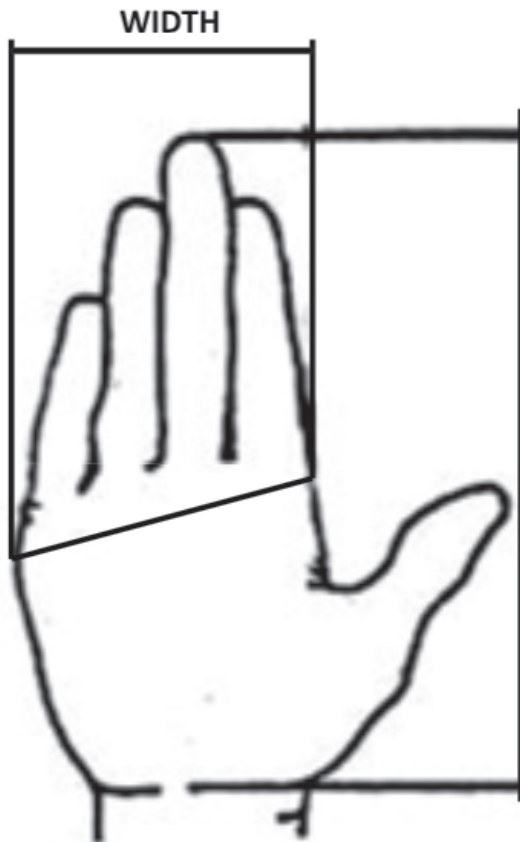


Fig. 1. Measuring hand dimension



Fig. 2. Measuring foot dimension

Foot Length: Each subject was made to stand on a calibrated foot board with his/her back against the wall in such a manner that the posterior most point of the heel will gently touch the wall. A vertical stop was placed against the anterior most point of the foot. The distance between the posterior most point of the heel and anterior most point of toe is measured.

Data are expressed as means \pm standard deviation. Differences in hand and foot length and breadth were determined using Students paired and unpaired t-test relationship between body proportion and in males and females are obtained using Pearson correlation coefficient. Multiple linear regression analysis was used to generate predictive equations of height from hand and foot lengths. Differences were declared significant when $P < 0.05$.

FINDINGS

Parameter		Right Hand (cm.)	Left Hand (cm.)	Right Foot (cm.)	Left Foot (cm.)
Length	Minimum	162	162	212	213
	Maximum	216	218	277	278
	Mean	187.23 \pm 11.36	187.22 \pm 11.54	248.07 \pm 16.51	249.20 \pm 16.48
Width	Minimum	75	73	82	82
	Maximum	115	116	112	112
	Mean	92.53 \pm 9.32	92.59 \pm 9.28	97.73 \pm 8.04	98.19 \pm 7.84
	pValue	Non	significant		

The following relationship is derived from the above data :

1. $H = 8.78 \text{ RHL}$
2. $H = 17.76 \text{ RHW}$
3. $H = 6.6 \text{ RFL}$
4. $H = 16.8 \text{ RFW}$
5. $FL = 1.32 \text{ HL}$

Where (H –Height of person, RHL- Right hand length, RHW – Right hand width,)

CONCLUSION

Even though the hand length and foot length has been studied in relation to various body parameters, the correlation between the hand length and foot length has not been studied. The present study has shown that there is a significant correlation between hand length and foot length ($p < 0.05$). The results, therefore, indicate that if the hand length is known, foot length can be predicted and if the foot length is known, hand length can be predicted and vice versa, Taylor MC et al (1981).

A significant correlation is found between hand length and hand width, foot length and foot width ($p \text{ value} < .05$). Since if hand length is known we can establish the dimension of both hand ,if foot length is known we can establish the dimension of both foot and reconstruct the stature. Similar study was done by Agnihotri et al (2007).

Range for the hand length as well as foot length when one parameter is known. This can be of tremendous use in medico-legal cases especially in the identification of severed body parts. The data can also be of help in plastic and re-constructive surgery.

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Metrical Study of Human Hyoid Bones in Western Maharashtra

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ABSTRACT

A metrical study of 91 human hyoid bones constituting 51 male and 40 female hyoid bones obtained from medicolegal postmortems as well as dissected cadavers from the department of Anatomy was conducted. In our study we have tried to evaluate some of the tested metrical parameters in sexing the hyoid bones.

Univariate statistical tests were applied to the metrical data. Sexual differences between the means of each parameter was statistically highly significant ($P < 0.001$). On the basis of demarking points 0 to 56.8% of hyoid bones could be sexed accurately. The Minimum transverse distance between bases of lesser cornua, width of body in middle, weight of bone and length of greater cornua have been found to be more useful parameters in identifying sex, especially in males.

Keywords: Hyoid bone, Sexual Dimorphism, Western Maharashtra

INTRODUCTION

The osseous skeleton is the only material that remains after the decaying process of the human body. Anthropological study of such skeleton helps in identification of age, sex as well as helps in estimation of stature from the various parameters. Identification of sex is possible in adult bones because certain features like size, shape, muscular markings, ligamentous attachment and weight are well developed after puberty. The regional and racial variations in the metrical parameters of different bones are well established. Stinson (1985) ⁽¹⁾ commented that sexual dimorphism is influenced by genetic, environmental, nutritional as well as functional characters.

Sexing of Skull, Pelvis, Sacrum, Sternum, Clavicle and long bones of the body have been carried out extensively. Among the bones of the axial skeleton hyoid bone is the least studied. Literature on the shape

and dimensions of the human hyoid bone is limited to western population Furmanik et al, 1976⁽²⁾; Koebeke and Saternus, 1979⁽³⁾; Lykaki and Papadopoulos, 1988⁽⁴⁾; and Papadopoulos et al, 1989⁽⁵⁾. In India Ranjit and Pillai (1988)⁽⁶⁾ carried out sexual dimorphism of hyoid bone based on its weight and concluded that a bone above 1193mg in weight belongs to male and less than 1185mg belongs to female. On the basis of these criteria they could identify 86.57% male and 95.65% female bones. The metrical study of hyoid bones in North-west Indians was done by Harjeet and Jit (1996).⁽⁷⁾ They subjected sixteen variables to multivariate discriminant analysis and identified 92.3% male and 95.6% female hyoid bones.

The present study was done in western Maharashtra region to find out the metrical values and the demarking points for the different parameters of hyoid bones in both sexes.

MATERIALS AND METHOD

91 human hyoid bones from different religion and castes were collected from medicolegal postmortems as well as dissected cadavers from the department of Anatomy. The study included 51 male and 40 female bones.

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Each hyoid bone was collected by dissecting neck. Midline incision was taken on neck and the incision was extended from symphysis menti to suprasternal notch. Strap muscles of neck were dissected and were reflected to both sides and the front part of larynx was exposed. Hyoid bone was identified which is present above the thyroid cartilage. It was separated from base of tongue and then it was separated from larynx. Thus the hyoid bone was obtained with partial attachment of muscle fibres and ligaments. The bone was cleaned and kept in a labeled container indicating the serial number and the sex of the bone to avoid mixing of the specimens. It was kept for maceration for 2 weeks and then dried for 1 week. After drying the bone was subjected to measurement. The measurements were taken with the help of vernier calliper and the measurements were recorded in millimeter. All the measurements were taken three times to avoid personal error. The weight of each bone was recorded with standard weighing machine and the weight was recorded in grams.

Following measurements were recorded

- 1) Length of right and left greater cornua:
The length was recorded from middle of junction of greater cornua with body to tip of its tubercle. (Fig a- 1and 2)
- 2) Transverse distance between tubercles of greater cornua. (Fig a-3)
- 3) Distance between internal surfaces of greater cornua at the middle. (Fig a-4)
- 4) Minimum transverse distance between bases of lesser cornua. (Fig a-5)
- 5) Side to side dimension (width) of body in middle. (Fig b-6)
- 6) Distance between upper and lower margins (height) of body in middle. (Fig b-7)
- 7) Vertical distance between middle of anterior surface and transverse line drawn between tubercles of greater cornua. (Fig b-8)
- 8) Weight of bone.

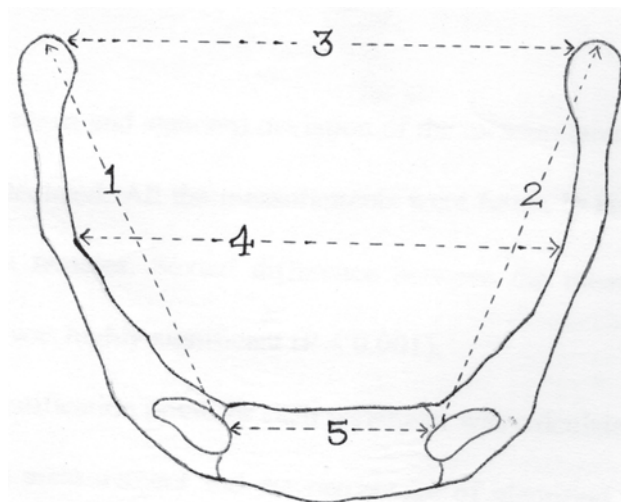


Fig. a

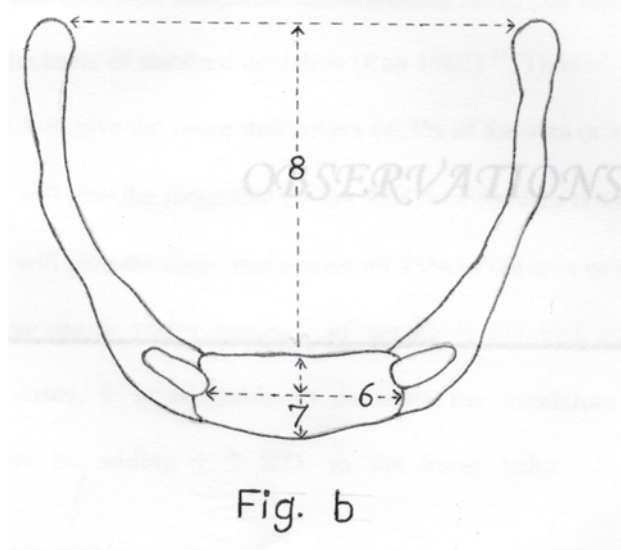


Fig. b

OBSERVATION

Identification point : (IP)

Range, Mean, standard deviation and Identification point of all the measurement and the percentage of all identified bones is given in Table no 1. All the measurements were found to be greater in males than in females. Sexual differences between the mean of every measurement was statistically significant. ($P < 0.001$). The identification point for each parameter was calculated from the range of each measurement and the percentage of identified bones noted. The maximum and minimum limits were calculated by adding $\pm 3S.D$ to the mean value of each measurement. This gives the calculated range. From the Identification points we could identify 74.5% male

bones on the basis of minimum transverse diameter between bases of lesser cornua and 66.6% male bones on the basis of width of body in the middle. Similarly 20% of female bones could be identified on the basis of transverse distance between tubercles of greater cornua.

Demarking point: (DP)

Demarking points were worked out from the calculated range. The percentage of bones identified from each demarking point in both sexes was

estimated. The demarking points identify sex with 100% accuracy. (Singh and Potturi,1978).⁽⁸⁾ If sexing is done on the basis of demarking points the chances of misclassification of sex are minimal. The results obtained after applying demarking points ranged from 0 to 56.8% (Table-2). The minimum transverse distance between bases of lesser cornua(56.8%),width of body in middle(47.05%),weight of bone(27.45%)and length of greater cornua(13.7%) have been found to be more useful parameters in identifying sex especially in males.

Table 1: Range, Mean, Standard Deviation and IP of all the parameters.

Measurement	Sex	Range in mms	Mean ±3SD in mms	IP in mms	% of identified bones
Length of right greater cornua	M	24-41	31.82±3.53	>33	21.56%
	F	20-33	27.15±2.33	<24	2.5%
Length of left greater cornua	M	24-39	30.9±3.45	>33	21.56%
	F	20-33	27.63±2.46	<24	2.5%
Transverse distance between tubercles of greater cornua	M	24-58	36.63±7.2	>48	7.8%
	F	20-48	28.67±6.54	<24	20%
Distance between internal surface of greater cornua at the middle	M	22-43	31.9±4.21	>35	17.6%
	F	20-35	26.46±3.38	<22	5%
Minimum transverse distance between bases of lesser cornua	M	17-26	22.66±2.18	>21	74.5%
	F	16-21	18.97±1.27	<17	2.5%
Width of body in middle	M	18-27	23.19±2.22	>22	66.6%
	F	17-22	19.33±1.40	<18	7.5%
Height of body in middle	M	09-14	11.18±1.35	>12	19.6%
	F	08-12	09.89±1.02	<09	10%
Distance between middle of ant.surface of body and transverse line between tubercles of greater cornua in midline	M	27-42	34.76±3.31	>36	31.3%
	F	22-36	29.46±2.87	<27	12.5%
Weight in gms	M	0.8-2.4	1.49±0.37	>1.4	49.01%
	F	0.7-1.4	1.08±0.21	<0.8	7.5%

Table 2: Percentage of male and female hyoid bones identified after applying demarking point:

Parameter	Sex	Demarking point in mms	% beyond D.P
Length of right greater cornua	M	>34.14	13.7%
	F	<21.23	2.5%
Length of left greater cornua	M	>35.01	7.8%
	F	<20.55	2.5%
Transverse distance between tubercles of greater cornua	M	>48.29	7.8%
	F	<15.03	nil
Distance between internal surface of greater cornua at middle	M	>36.6	9.8%
	F	<19.27	nil
Minimum transverse distance between bases of lesser cornua	M	>22.78	56.8%
	F	<16.12	nil

Table 2: Percentage of male and female hyoid bones identified after applying demarking point: (contd.)

Parameter	Sex	Demarking point in mms	% beyond D.P
Width of body in middle	M	>23.53	47.05%
	F	<16.53	nil
Height of body in middle	M	>12.95	19.6%
	F	<7.13	nil
Distance between middle of ant surface of body and transverse line between tubercles of greater cornua in middle	M	>38.49	15.6%
	F	<24.83	5%
Weight of the bone in grams	M	>1.71	27.45%
	F	<0.38	nil

DISCUSSION

The available literature on the metrical study of hyoid bones is limited. The range, mean and standard deviation of all the measurements were calculated and compared with those of Harjeet and Jit (1996)⁽⁷⁾ (Table 3). Sexual difference between the mean of every measurement was statistically significant ($p < 0.001$). The range and mean of all the measurements was less in the present study as compared to Harjeet and Jit.⁽⁷⁾

- 1) Length of greater cornua: It is observed the length of greater cornua is a good parameter for sexual identification of hyoid bone in comparison with other parameters. Harjeet and Jit (1996)⁷ recorded that greater cornua was equal on both the sides in 45% males and 48% females. It was greater on right side in 33% males and 27% females, while on left side it was greater in 22% males and 25% females. In the present study length of greater cornua was equal in 45% males and 55% females. It was greater on right side in 45% males and 7.5% females while on left side it was greater in 9.8% male and 37.5% females.
- 2) Transverse distance between internal tubercles of greater cornua: Harjeet and Jit (1996)⁷ observed that internal transverse distance between tubercles of greater cornua in males increased from 15.46±1.07mm at birth to 33.50±2.8mm at 17 years. It went on increasing progressively and was 38.7±5.1mm in age group of 41-45 years and thereafter remained unaltered. In females the distance increased from 13.72±0.61mm at birth to 32.5±7.27mm at 17 years and no change took place with further increase in age. In the present study the percentage of identified bones is 7.8% in males and 20% in females (table 1).
- 3) Distance between internal surface of greater cornua at middle: The mean values for the above parameters in the present study for males is 31.9mm±4.21 and for females it is 26.46mm±3.38. Harjeet and Jit (1996)⁷ found mean values of 33.42mm±3.38 in males and 27.65mm±3.08 in females. The percentage of identified bones is 17.6% in males and 5% in females. (Table 1).
- 4) Minimum transverse distance between bases of lesser cornua: In the present study the mean values for males was 22.66mm±2.18 and for females it was 18.97mm±1.27. The percentage of identified bones as 74.5% in males and 2.5% in females. Harjeet and Jit (1996)⁷ observed that the distance between bases of lesser cornua in males increased from 10.93±0.47mm at birth to 24.0±1.0mm at 17 years. It further increased slightly when it was found to be 25.2±3.1mm in age group of 31-35 years but no noticeable change was seen thereafter. In females this distance increased from 11.4±0.85mm at birth to 20.57±1.10mm at 17 years and did not change any further.
- 5) Width and height of body in middle: In the present study the mean width and height of the body in the middle in males was 23.19mm±2.27 and 11.8mm±1.35 respectively. In females the mean width and height of body in middle was 19.33mm±1.40 and 9.89mm±1.02 respectively. Based on these measurements 66.6% male and 7.5% female bones could be identified from width of body and 19.6% male and 10% female bones could be identified from height of body in the middle.

- 6) Distance between middle of anterior surface of body and transverse line between tubercles of greater cornua in midline :The mean values for this measurement was 34.76mm±3.31 in male and 29.46mm±2.87 for females.The percentage of identified bones was 31.3% in males and 12.5% in females.The measurement were slightly less than those observed by Harjeet and Jit(1996)⁽⁷⁾(Table 3)
- 7) Weight of bone: Ranjit and Pillai (1988) ⁽⁶⁾ studied sexual dimorphism of hyoid bone only on the basis of its weight. They concluded that a bone above 1193mg in weight belongs to male and one weighing less than 1185mg is that of female. On

the basis of these criteria they could identify 86.57% male and 95.65% female bones.

Similarly Harjeet and Jit (1996) ⁽⁷⁾ recorded the weights of hyoid bones before and after defatting. The mean weight of hyoid bone in adult male before defatting was 1.84±0.36gms and that of females was 1.19±0.30gms.The mean weight after defatting was 1.200±0.31gms in males and 0.80±0.23gms in females.In the present study the mean weight of hyoid bones in males was 1.49±0.37gms while in females it was 1.08±0.21gms.On the basis of weight alone we could identify 49.01%male and 7.5% female bones.

Table 3: Table showing comparison of the various parameters of the present study with previous study

Parameter	Sex	Previous study (Harjeet and Jit)		Present study	
		Range	Mean ±S.D	Range	Mean
Length of right greater cornua	M	27.0-40.5mm	33.59mm±2.76	24-41mm	31.82mm±3.53
	F	24.0-36.7mm	29.74mm±2.75	20-33mm	27.15mm±2.33
Length of left greater cornua	M	26-41mm	33.90mm±2.84	24-39mm	30.9mm±3.45
	F	24-35mm	29.66mm±2.38	20-30mm	27.63mm±2.46
Transverse distance between tubercles of greater cornua	M	21.6-59.4mm	37.24mm±5.85	24-58mm	36.63mm±7.2
	F	19-43mm	31.82mm±4.76	20-48mm	28.67mm±6.54
Distance between internal surface of greater cornua at the middle	M	26-41mm	33.42mm±3.38	22-43mm	31.9mm±4.21
	F	21.5-36.8mm	27.65mm±3.08	20-35mm	26.46mm±3.38
Minimum transverse distance between bases of lesser cornua	M	20-35mm	24.45mm±2.35	17-26mm	22.66mm±2.18
	F	18.5-24.5mm	20.48mm±2.42	16-21mm	18.97mm±1.27
Width of body in middle	M	18.0-35mm	24.03mm±2.36	18-27mm	23.19mm±2.22
	F	17-24.5mm	20.29mm±1.55	17-22mm	19.33mm±1.40
Height of body in middle	M	8.0-13.9mm	11.04mm±1.10	09-14mm	11.18mm±1.35
	F	6.4-12.3mm	9.47mm±1.08	08-12mm	9.89mm±1.02
Distance between middle of anterior surface of body and transverse line drawn between tubercles of greater cornua in midline	M	31.5-46mm	38.66mm±3.29	27-42mm	34.76mm±3.31
	F	29-41mm	34.05mm±2.82	22-36mm	29.46mm±2.87
Weight of bone	M	1.1-2.7gms	1.84gms±0.36	0.8-2.4gms	1.49gms±0.37
	F	0.6-1.9gms	1.19gms±0.30	0.7-1.4gms	1.08gms±0.21

CONCLUSION

Sex overlap is observed in all the parameters and it may be due to genetic, nutritional and socio-economic differences in the individual or may be due to hypomascularity in males or hyperfemininity in females.

On applying univariate statistical tests to the metrical data obtained, the difference between the means of each parameter was statistically significant.

The demarking points for identification of sex were worked out by using the formula ±3S.D. Minimum transverse distance between bases of lesser cornua ,width of body in middle,weight of bone and length of greater cornua have been found to be more useful parameters especially in males.

Continuance of such studies in a defined geographic area over a period of time will help in

establishing anthropometric standards. Such studies will also help to observe the changing trends in metric measurements if any.

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Epidemiology of Sudden Unexpected Natural Medico-legal Deaths in Central Delhi

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ABSTRACT

Objectives: To study the epidemiological, magnitude, clinical, and pathological characteristics of sudden unexpected non-violent deaths (SUNDS) in central Delhi.

Material & Method: Autopsy based retrospective study of all SUNDs carried out in the Department of Forensic Medicine, Lady Hardinge Medical College, New Delhi. All records were studied in detail; age, sex, time and month of date, cause of death etc.

Results: Total 2773 medico-legal autopsies were conducted from 1st January, 2006 to 31st December 2010. Out of that, 915 (32.99%) cases were of SUNDs. Male and female ratio was 13:1. The maximum 279 (30.49%) sudden deaths were reported in age group 41-50 years followed by 51-60 years i.e. 201 (21.96%). The most common cause of death in all age groups including all identified and unidentified individuals was pulmonary pneumonitis (n=508, 55.76%) followed by tuberculosis (n=175, 19.20%) and CAD (n=144, 15.73%). But in identified individual alone CAD was commonest (n=135, 36.78%) cause of SUNDs and followed by Pulmonary pneumonitis (32.97%). Maximum 122 (13.33%) deaths were reported in September.

Conclusion: Observations suggest that most of the SUNDs were due to preventable causes and meticulous autopsy and study of histopathology and toxicological analysis could be important to ascertain the cause of death.

Keywords: Sudden Unexpected Natural Death (Sunds), Autopsy, Coronary Artery Disease, Pulmonary Pneumonitis, Tuberculosis

INTRODUCTION

Despite tremendous technological advances in health care, the phenomenon of sudden death is still problem. The WHO definition of sudden death according to the International classification of diseases, version 10 (ICD-10) is death, non-violent and not otherwise explained, occurring less than 24 hours from the onset of symptoms¹. The cause of death is often

evident from the post-mortem findings. But in some of the cases the diagnosis is not obvious. All Natural deaths autopsies which were carried out in this study were deemed Medico-Legal because of sudden nature of occurrence and the emergency doctor unable to certify the Cause of death. In many instances, we come across various sudden unexpected deaths; therefore, the cases were booked under Medico Legal category to rule out any foul play and to know the exact cause of death. Our aim to conduct an autopsy based retrospective evaluation of findings of sudden unexpected non-violence natural deaths to find out the incidence and main underlying causes of sudden death in a central District of Delhi where Lady Hardinge Medical College is located.

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MATERIALS AND METHOD

This is autopsies record based retrospective analysis for the period of 5 years from 1st Jan. 2006 to 31st Dec. 2010, in the Department of Forensic Medicine & Toxicology, Lady Hardinge Medical College, New Delhi. In the present study the cases were chosen as per the definition of sudden deaths occurring within 24hr from the onset of signs and symptoms. Deaths from all un-natural causes were excluded. The total 2773 number of medico-legal Autopsies were conducted where 915 were Sudden and unexpected natural deaths. All deaths were studied in detail in relationship with age, sex, cause of death, identified or un-identified individual and month of death.

RESULTS

This is autopsies record based retrospective analysis of the period of 5 years from 1st January 2006 to 31st December 2010, in the Department of Forensic Medicine & Toxicology, Lady Hardinge Medical College, New Delhi. Total 2773 medico-legal autopsies were conducted, out of total 915 (32.99%) cases were of sudden unexpected non-violent natural deaths. it comprises 849 (92.78%) males and remaining 66 (7.21%) females. Male and female ratio was 13:1. The maximum 279 (30.49%) sudden deaths were reported

in age group 41-50 years followed by 51-60 years i.e. 201 (21.96%) deaths. The most common cause of death in all age groups including all identified and unidentified individuals was pulmonary pneumonitis; constituted 508 (55.76%) cases followed by pulmonary tuberculosis (175 cases, 19.20%) and 144 (15.73%) cases of coronary artery diseases. But in un-identified (homeless) individual alone coronary artery diseases was commonest (135 cases, 36.78%) causing of SUNDs. The Pulmonary pneumonitis stands second commonest (32.97%) cause of death in identified population. In this study 16 (1.74%) sudden infant deaths were reported. The maximum 122 (13.33%) deaths were reported in month of September. Total 548 (59.89%) deaths of all SUNDs were of unidentified individual whom identity could not establish. That was the homeless population and prone to infectious deaths especially lung infections including pneumonia and tuberculosis. Remaining 367 (40.10%) deaths were of identified individuals where coronary artery disease was the commonest cause of SUNDs. Total 859 (93.87%), those died on the spot or declared dead on the arrival in the casualty, categorised in brought dead category and later sent to the mortuary to ascertain cause of death and rule out any kind of foul play. Only 56 (6.14%) cases died within 24 hours during the course of treatment after admission in the hospital.

Table No. 1: Distribution of Sudden Non-violent natural deaths during 5 years period (From 1st Jan. 2006 to 31st Dec. 2010).

Cause of death	Male								Female								Grand Total	%
	0-10n yrs	11-20 Yrs	21-30 Yrs	31-40 Yrs	41-50 Yrs	51-60 Yrs	>60 Yrs	Total	0-10 Yrs	11-20 Yrs	21-30 Yrs	31-40 Yrs	41-50 Yrs	51-60 Yrs	>60 Yrs	Total		
Pulmonary pneumonitis	0	12	72	111	147	88	40	470	0	0	8	7	6	10	7	38	508	55.51
Tuberculosis	0	3	24	37	50	37	15	166	0	0	5	0	1	2	1	9	175	19.12
Coronary artery disease	0	0	6	16	49	44	20	135	0	0	1	0	0	5	3	9	144	15.73
Intra-cranial Haemorrhage	0	1	2	6	7	4	1	21	0	0	0	0	1	1	0	2	23	2.51
Cirrhosis of liver	0	0	0	5	13	3	0	21	0	0	0	0	1	0	0	1	16	2.4
Meningitis	0	0	3	2	3	2	0	10	0	0	0	0	0	1	0	1	11	1.2
Infant death	10	0	0	0	0	0	0	10	6	0	0	0	0	0	0	6	12	1.74
Others	0	1	3	6	1	4	1	16	0	0	0	0	0	0	0	0	1	1.74
Total	10	17	110	183	270	182	77	849 (92.78%)	6	0	14	7	9	19	11	66 (7.21%)	915	100

Table No. 2: Age wise distribution of Sudden Non-violent natural deaths

Cause of Death	Age group in years							Total	%
	0-10n yrs	11-20 Yrs	21-30 Yrs	31-40 Yrs	41-50 Yrs	51-60 Yrs	>60 Yrs		
Pulmonary pneumonitis	0	12	80	118	153	98	47	508	55.51
Tuberculosis	0	3	29	37	51	39	16	175	19.12
Coronary artery disease	0	0	7	16	49	49	23	144	15.73
Intra-cranial Haemorrhage	0	1	2	6	8	5	1	23	2.51
Cirrhosis of liver	0	0	0	5	14	3	0	22	2.4
Meningitis	0	0	3	2	3	3	0	11	1.2
Infant death	16	0	0	0	0	0	0	16	1.74
Others	0	1	3	6	1	4	1	16	1.74
Total	16 (1.74%)	17 (1.86%)	124 (13.55%)	190 (20.76%)	279 (30.49%)	201 (21.96%)	88 (9.61%)	915 (100%)	100

Table No. 3: Distribution according to brought dead or died in hospital of Sudden Non-violent natural deaths

Cause of Death	Brought Dead	Died within 24 hrs of admission	Total
Pulmonary pneumonitis	478	30	508
Tuberculosis	171	4	175
Coronary artery disease	139	5	144
Intra-cranial Haemorrhage	14	9	23
Cirrhosis of liver	18	4	22
Meningitis	10	1	11
Infant death	16	0	16
Others	13	3	16
Total	859 (93.87)	56 (6.14%)	915 (100%)

Table No. 4: Monthly Distribution of Sudden Non-violent natural deaths

Month	Total No. of deaths	Percentage
January	88	9.61
February	28	3.06
March	26	2.84
April	20	2.18
May	40	4.37
June	80	8.74
July	102	11.14
August	103	11.25
September	122	13.33
October	99	10.81
November	109	11.91
December	98	10.71
Total	915	100

Table No. 5: Distribution of Sudden Natural deaths in identified and Unidentified/homeless population

Cause of death	Identified	Un-identified	Total
Pulmonary pneumonitis	121	387	508
Tuberculosis	53	122	175
Coronary artery disease	135	9	144
Intracranial haemorrhage	21	2	23
Meningitis	4	7	11
Cirrhosis of liver	17	5	22
Infant deaths	4	12	16
Others	12	4	16
Total	367 (40.10%)	548 (59.89%)	915 (100%)

DISCUSSION

Sudden unexpected death is a major public health problem and a difficult task for forensic expert to find out the real cause of death. Our study shows, 32.99 % of deaths of all medico-legal deaths were sudden unexpected non-violent natural death where at the first hand manner of death was not clear. These finding were concurrent with Krahn et al², in Canada, who reported an incidence of SUNDs 41% and contrast to findings of Zanjad Naresh P et al³ and Gupta Sanjay et al⁴ who reveals 8.92% and 7.64% sudden natural deaths in all medico-legal autopsies respectively, while findings of Escoffery et al⁵ suggests that sudden natural deaths were comprising 51.3% of all medico-legal autopsies, conducted in Jamaica. Udoon et al⁶ recorded; sudden unexpected death in Thailand comprises up to 50-60% of all medico-legal deaths, whereas Nafal HK et al⁷ reports that sudden death were occurred in 18.30% cases. Goraya et al⁸, reported sudden cardiac death occurring in 61% of all cases of death due to coronary heart disease in the United States⁸. Nonetheless, another analysis of national and State-specific sudden cardiac death data in the US found that 63.4% of all cardiac death cases were sudden cardiac death⁹.

Death from natural causes in which the interval between onset of signs and symptoms and death was not more than 24 hours were regarded as sudden deaths^{10,11}. In our study we included only natural sudden deaths and excluded all deaths due to poison, trauma or any other un-natural event. Despite this heterogeneity most of the series showed that the majority of cases of sudden and unexpected deaths were due to coronary artery diseases cardiovascular pathology^{12,13,14} similar results (36.78%) were reported in our study in identified population but its contrast while compare combined in identified and unidentified population. Escoffery et al⁵ reported the most common causes of death were cerebro-vascular accidents (13.6%), pneumonia (9.4%), pulmonary embolism (7.4%), ischemic heart disease (7.0%) and diabetes mellitus (6.1%). Hoon and Balasubramanian¹⁵ reported that LAD was the cause of death in 89% of brought in dead cases and 85% of those who died within 24 hours of arriving at hospital, the present study is also showed 36.72% sudden deaths were due to coronary artery disease in identified individuals

concurrent to Gupta Sanjay et al⁴ and Kumar V et al¹⁶; cardiovascular diseases were the most important cause of sudden natural deaths contributing in 58.73% and 64.9% cases in respective studies. Zanjad Naresh P et al³ also found that the coronary artery disease amounts to almost half of all sudden deaths (42.85%) followed by respiratory causes. Similar findings were reported by Nafal HK et⁷ where cardiovascular diseases was contributing in 59.2% cases, followed by respiratory causes in 24.7%, diabetes mellitus 23.8% and 23.3% liver diseases and 20% infections. Udoon et al⁶ reports, the most common cause of death in all age groups was coronary atherosclerosis as other studies report. Whereas, Anders Siboni et al reported¹⁷ that epilepsy, alcoholics, obstetric/gynaecologic conditions and drug addicts was cause of sudden deaths.

In our study a males (92.78%) were outnumbered of females and this is consistent with other international studies^{8,9,18,19}. Also in study of Udoon et al⁶, male outnumbered of female (69.10%). Sudden deaths occurred in all age groups but the highest (30.49%) number were age group 41-50 years followed by 51-60 years (21.96%). This age distribution of sudden death was also consistent with studies from other countries^{8,20}. Escoffery et al⁵ reported that male and female ratio was 1.2:1, contrast to our study (13:1). Udoon et al⁶ reports, the peak age group was the 46-60 years accounting for 28.2% of cases in consistence of our findings where highest numbers (30.49%) of sudden natural deaths were in 41-50 years age group but contrast to findings of Escoffery et al⁵ where the peak age group was the seventh decade; accounting for 21.9% of cases. Anders Siboni et al reports¹⁷ that out of total autopsies, only 4.06% were sudden deaths and maximum were in between 2-30 years which is in contrast to our study. Zanjad Naresh P et al³ reports that most of the sudden deaths were in the middle age group i.e. 31-50 years and male predominates female with male: female ratio 5.58:1, which is in concurrence to our findings. Similarly in findings of Kumar V et al¹⁶, male and female ratio was 6.78:1. Nafal HK et al⁷ reports that Male and female incidence was 56% and 42.2% respectively and maximum (31.4%) sudden deaths were in age group more than 60 year. The consistence findings were also reported by Gupta Sanjya et al⁴ where most of the cases were found in 31-50 years age group with male predominance was seen.

There were a seasonal variation in natural sudden death among our cases with the highest (13.33%) frequency during month of September, followed by November, August, July (11.91%, 11.25%, 11.14%), This contrasts with the findings of Katz et al²¹ in the Negev Desert region of Israel who found the highest rate in winter (31%) and autumn (25%). Nafal HK et al⁷ reports that highest incidence was reported in April to June (29.6% followed by July-September (25.1%). Hence for the Forensic investigator, to accurately assign the cause and manner of death in SUNDs, must be conduct careful autopsy and explore all aspects and reasons before deciding the cause of death. The opinion and decision of the autopsy surgeon about the manner of death may be crucial in initiating or aborting a investigation.

CONCLUSION

The above observations suggest that most of the sudden unexpected natural deaths were due to preventable causes including infections pulmonary pneumonitis; constituted 508 (55.76%) cases followed by pulmonary tuberculosis (175 cases, 19.20%) and 144 (15.73%) deaths of coronary artery diseases. A meticulous post-mortem examination along with study of histopathology and detailed toxicological analysis could be important to find out the cause of death.

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Statistical Study of Electrocution Deaths at Victoria Hospital, Bangalore

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ABSTRACT

Electricity has become a dangerous but essential part of our lives. One cannot imagine our daily routine without electricity and so are electrocution related deaths. The present study analyses the pattern of age and sex distribution, seasonal variation, place of occurrence, manner of death and causes of death in fatal electrocution cases.

Study was conducted on deaths due to electrocution brought to Victoria hospital mortuary during the period of two years (Nov 2003 to Oct2005). Data will be collected from police inquest and photographic evidence from scene of occurrence.

Total number of 61 cases was studied in two-year period. Most of the victims were male, belonging to working age group. 56% of victims died instantaneously due to shock. 34% of victims died due to complications of flash burns sustained.

Main reasons for electrocution deaths were found to be human negligence, faulty electrical equipments, connections and lack of protective measures.

Keywords: High Voltage Current, Low Voltage Current; Electric Contact Mark, Flash Burns, Shock, Septicemia, Toxemia

INTRODUCTION

Availability of electricity has been the most powerful aspect of introducing economic development and social change throughout the world. The process of moderation, increase in productivity in industry and agriculture and the improvement in the standard of living of the people basically depend up on the adequate supply of electrical energy.

Supply of electricity is of two types.

Alternating Current (AC)

Direct current (DC)¹

Effect of Electrotrauma on human body:

Skin

It is convenient and of practical importance to consider the skin injuries in two groups.

1. Due to low or medium current up to 400v.

Most important indication of electric contact is current mark also called 'Joule burn'.

An electric mark is found at the point of entry of current where the electric energy is converted into thermal energy.

Exit marks are variable in appearance but have most features of entrance marks. There will be more description of tissue and instead of presenting as cracks they are often seen as split.

2. Those due to high-tension circuits.

Exogenous burns

Injury by high tension current is either by direct contact or an indirect result of arcing or flashes. Risk of arcing arises when the person comes close to the high-tension cables. Flash burns may be extensive and severe and may be exaggerated by burns from ignited clothing.

Heart and circulatory system

On brief exposure to low voltage current cardiac action may momentarily stop and start again with after

withdrawal of current. Exposure to current of greater intensity following contact with longer duration leads on to ventricular fibrillation and cardiac arrest.

Nervous system

Loss of consciousness occurs in three fourth of high voltage current and one third of low voltage current. Other manifestation is persistent headache, somnolence, convulsions, which are due to cerebral edema and increased intracranial pressure, paresthesia, feeling of numbness in extremities, total or partial loss of memory usually retrograde involving events prior to accident

Endocrine system

Perspiration, dehydration of skin, pigmentolysis, herpetic eruption, graying and loss of hair, disorder of menstrual cycle, temporary glycosuria, polyuria, loss of weight and thyroid dysfunction.²

Blood Hemopoietic system

Liquid and dark blood, hemolytic anemia, increases in serum bilirubin level.

Lungs

There are pulmonary edema and petechial hemorrhages.

Liver

There is elevation in serum bilirubin and bilirubinuria.

Kidneys

There is electrolyte imbalance, proteinuria, myoglobinuria, reddish brown color urine, myoglobin casts. Renal failure is a common complication of high voltage shock.

Ear

There are hemorrhages in tympanic membrane, middle ear, cochlea, cochlear duct, mastoiditis, sinus thrombosis, hearing defect.

Eye

Two categories of injuries due to Electro thermal effect – results in burns of ocular components Light effect – photopsia, strabismus, ptosis, paralysis of ocular muscles, disturbance in accommodation, scotoma, intraocular hemorrhage, thrombosis, retinal edema, papillitis, atrophy of optic nerve and cataracts.³

In most fatal cases, death is caused by electric energy itself. Rarely electro trauma becomes associated with mechanical injury.

Death following electrocution can result either from

Ventricular fibrillation

Ventricular fibrillation is reversible if duration of contact is short and irreversible if duration is more. Exposure to low voltage current, death as a rule is caused by ventricular fibrillation. Most vulnerable stage of heart condition is at end of systole.

Tetanic Asphyxia

Current passing through chest can induce tetanic contraction of extrinsic muscles of respiration and thus cause death by mechanical asphyxia. These victims are likely to be cyanosed, whereas those who die of ventricular fibrillation are not.

Respiratory arrest

If the route of current passes through respiratory center which happens only when head is involved; there may be paralysis of center and respiratory arrest.

Cerebral Anoxia

Prolonged ventricular fibrillation may cause brain damage due to an inadequate blood supply i.e., cerebral anoxia. Death after short time after electrocution and delayed deaths are due to complications of flash burns.⁴

Circumstances of Electrocution

Accidental electrocution

Most of the electrical injury is accidental. The majority of fatalities are result of accidental contact with low voltage 210 – 250 v, which is from domestic supply. Domestic appliances, which call for special attention, include water boiler, immersion coil, electric coil stove, electric iron, and hair dryer.

Homicidal electrocution

Murder by electrocution is very rare.

Suicidal electrocution

Though uncommon in India, cases of suicidal electrocution are reported in western countries. Although it requires no profound knowledge of electricity and electric wiring to commit suicide and requisite materials are easy to acquire, suicide by electrocution is still uncommon.

Judicial electrocution

The use of electrocution as a means of capital punishment was first introduced in mid 19 century in New York.⁵ A current of 2000volts and 7ampere is passed for one minute through the body. After tetanic spasm and loss of consciousness, the same current is passed for one more minute.

Autoerotic electrocution

Electrical stimulation has become one of the modes of autoerotic practice similar to hanging which may become fatal resulting in death. Victims are usually males, either nude or clothed in female garments – wiring is arranged to include genitalia for stimulations. To date number of cases reported is small.

Iatrogenic electrocution

A number of mishaps, which occurred in course of investigation and treatment of patients with electrical apparatus, are recorded. Electric current is used in electro convulsive therapy, cautery etc; where risk of fatal electrocution is maximum.⁶

Death due to Electrocution has increased among employees working in factories and in electricity related occupation. Domestic electrocution accidents are also on the rise. Hence there is requirement for detailed statistical study of electrocution deaths and there by deriving effective measures to prevent electrocution becoming an occupational hazard as well as domestic accident.

The main objective of the study is

To determine the gender ratio, the age group which is more prone to electrocution, common place of occurrence, seasonal variation, cause and the manner of death in case of electrocution and whether the death was due to negligence or accident or due to faulty electrical appliances. To suggest concrete preventive measures to make house and work place safer so that electrocution deaths could be prevented in future.

The precise total number of electrical accidents is difficult to ascertain, as number of non-fatal accidents are not recorded. The present study is limited to fatal cases of Electrocution.

METHODOLOGY

The methodology involves study of fatal electrocution cases brought for autopsy to Victoria Hospital, Bangalore. Study period is for two years.

Retrograde study involves collection of data from the inquest report, relatives of deceased and police regarding the circumstances of electrocution. Photographic evidences from site of occurrence were collected. Subjects included for the present study includes all age group, sexes, incidents occurring at home and work place. Exclusion criteria are cases where electrocution is indirect cause of death, for example a person after getting electrocuted falls from height and dies due to head injuries and lightning deaths.

RESULTS

A total number of 61 cases were received for autopsy in deaths due to electrocution in a period of two years. Out of which 51 cases were male and remaining 10 cases were female. Maximum number of cases was reported in the age group of 21 to 30 years, i.e.; 23 that includes the working class of people. Least number of cases was reported in extremes of age group. All the cases reported were accidental in nature.

Shock is the cause of death in 34 cases, where death was instantaneous and on spot. 21 cases died due to complications of flash burns sustained, out of which 16 died due to Septicemia and 5 due to Toxemia. Coma was cause of death in 5 cases consequent up on head injury sustained. Shock and hemorrhage was cause of death in 1 case.

Places of occurrence are mainly divided into home, work place and miscellaneous. 36 cases of fatal electrocution were reported at work place, 17 cases at home and 8 cases as miscellaneous.

Seasonal variation of fatal electrocution cases was also studied. Maximum number of cases i.e. 34 was recorded in rainy season. Out of 34 cases, 24 occurred outside house and 10 were domestic and 14 cases were reported in summer and 13 cases in winter.

During the period, not even a single case of lightning was reported. Following changes in skin were observed at gross examination of electric contact mark. Skin is yellowish or light yellow in colour, with the area hardened, pale area at the center, with margins everted surrounded by zone of erythema.

Causes of electrocution were Faulty electrical equipment and connection in 19 cases,

human negligence in 25 cases and lack of protective measures in 17 cases.

Table 1. Gender Distribution in Electrocution Deaths

Sl. No	Sex	No of Cases	Percentage
1	Male	51	84%
2	Female	10	16%
	Total	61	

Table 2. Age Distribution In Electrocution Deaths

Sl. No	Sex	No of Cases	Percentage
1	1 To 10	2	3%
2	11 To 20	14	23%
3	21 To 30	24	39%
4	31 To 40	11	18%
5	41 To 50	7	12%
6	51 To 60	2	3%
7	61 To 70	0	0
8	71 To 80	1	2%

Table 3. Seasonal Variation in Electrocution Deaths

Sl. No	Season	No of Cases	Percentage
1	Summer	14	23%
2	Rainy	34	56%
3	Winter	13	21%

Table 4. Cause of Electrocution Deaths

Sl. No	Cause of Electrocution	No of Cases	Percentage
1	Human Negligence	25	41%
2	Faulty Equipments & Connections	19	31%
3	Lack of Protective Measures	17	28%

Table 5. Place of Occurance in Electrocution Deaths

Sl.No	Place of Occurance	No of Cases	Percentage
1	Work Place	36	59
2	Domestic	17	28
3	Miscellaneous	8	23

DISCUSSION

Number of cases being 61 in a span of 24 months is a significant number compared to earlier studies, where 220 cases were reported in 22 years by R.K. Wright, I.H.Davis of them 217 were classified as accidental, two were suicide and one was homicide⁷. There were 36 cases in 3 years⁸ span of Jan 1992 to Dec 1994 brought to mortuary of GTB hospital attached to University College of Medical Science for autopsy. All cases were males as compared to present study where 84% of victims were male.

Age group most affected is the working class, which suggests that electrocution deaths are occupation related deaths.58% of deaths from high voltage occurred on job as compared to 86% in earlier

studies.⁷ 57% of deaths from low voltage were on job as compared to 45% in earlier studies⁷ 21% of deaths from high voltage occurred at home. 39% of deaths from low voltage occurred at home. Least number of cases was reported in extremes of age group. Electrical accidents involving high voltage form 54 % and Low voltage form 46 % of total electrocution.

56 % died instantaneously due to shock as against 88.9% in Northeast Delhi.⁸

35 % died due to complications of flash burns.

8 % died due to head injury consequent upon fall.

1% died due to shock and hemorrhage.

All the cases were accidental electrocutions unlike observations made by Trubner and Puschel, who studied 245 cases of death of children in bath tub during period of 1971 – 1988, manner of death of 24 children were described out of which 20 were accidental, 2 were homicidal, 1 natural death, and 1 undetermined.⁹

Maximum number of cases was seen in rainy season, which suggests that wet surface plays major role in electrocution as against findings of R.K.Wright and J.H.Davis⁷ where there is predominance of cases in summer.

Causes of electrocution were investigated and found that human negligence was main cause of electrical accidents (41%), faulty electrical equipments and connections contributed to 31 % of accidents and lack of protective measures caused 28 % of electrocution, which agrees with study done at Armed Forces Institute of Pathology¹⁰ where a review of 155 cases with emphasis on human factors in electrocution was investigated to determine role of human factors such as carelessness, intoxication. Blatant carelessness, misuse or improper maintenance of equipment and intoxication were analyzed as contributory factors.¹⁰.

Employees of electrical work even though provided with protective gloves, harness, belts were negligent of not using the same and they should ensure that main line should be devoid of current supply while they are working.

Domestic accidents, which consists 28% of total electrocution, are due to faulty electrical equipments or connections and human negligence. One fourth of domestic accidents occur in bathrooms involving boiler switches and immersion coils. Another important cause observed was contact with live wire

while drying of wet cloths over metal wire (one fourth of total domestic cases) in correlation with Theodore Bernstein study where electrocution deaths seem to occur quite regularly near a tree, on golf course, on a tractor, using telephone, near clothesline, near wire fence¹¹

Houses constructed illegally with close vicinity to high-tension wire lead to electrical hazard with the dwellers. Short circuit with television cable wire has lead to electrical accidents to people who tried to connect the cable wire.

Following suggestions may be helpful in preventing electrical accidents:

- Ensure electrical appliances at home and workplaces are in proper working condition with effective non-leaking connections.
 - All electrical wiring should have proper insulation.
 - All electrical installation should be effectively earthed as per standard earthing practice.
 - Houses or extension of houses should not be built underneath, overhead lines or in proximity of the lines.
 - Tying of wire to electrical pole for drying of cloths should not be allowed.
 - Electrical equipments or switches should not be operated with wet hands.
 - Crisscrossing of television cable wire with live wire should not be done.
 - Electrical employees should be given proper education regarding electrocution.
 - Protective thick rubber gloves should be provided to the workers.
 - Harness should be provided to the electrical employees working at heights.
- Female victims formed 16 % of cases.
 - Electrocution is occupation related death as work place is commonplace of occurrence with working age group constitute bulk of cases.
 - All cases were accidental in nature.
 - 56% of victims died instantaneously due to shock.
 - Maximum number of cases is seen in rainy season.
 - Main cause of electrocution was determined to be human negligence followed by faulty electrical equipments, connections and finally lack of protective measures.
 - Electrocution can be prevented by educating people about the equipments, precaution to be taken while working with electrical equipments, replacing old electrical installations with new one, use of protective measures like gloves and harness to avoid fatal electrocution.

CONCLUSION

- Total number of 61 fatal electrocution cases was reported for autopsy in two years period.
- Male victims formed 84 % of cases.

ETHICAL CLEARANCE

Ethical clearance was obtained from ethical clearance committee of Victoria hospital, Bangalore

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Different Methods of Plastination Techniques and their Applications in Teaching Medical Graduates

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ABSTRACT

Objective: Cost effective preparation of plastinated specimen for teaching and learning.

Material & Method: This study was conducted by using organs collected from abattoirs and fetus received from our hospital.

The specimens were plastinated by four different methods of using ethanol, acetone, GP Resin, RL resin.

Result: The specimens made by different method were durable, odorless, and served the purpose of Teaching. Plastinated snakes helped the students study the scale pattern of snakes and to Learn how to identify poisonous snake from non-poisonous ones.

Conclusion: The use of plastination technique will allow students to understand gross beyond the two Dimensional level. Cost effective methods can be developed using locally available Materials, thus allowing for greater acceptance at all the medical schools.

Keywords: GP Resin, General Purpose resin, RL Resin, Roof Lite Resin, Plastinated Specimens

INTRODUCTION

Formalin has been used as a fixative of choice since its discovery in 1859 by Alexander Butlerov and practical aspects in 1868 by August Wilhelm Von Hoffman, in most of the Medical Colleges¹. The teaching and non-teaching staff members of Anatomy, Forensic as well as first year medical students during their dissection course, are all exposed to formaldehyde, which usually crosses the permissible exposure limit causing irritation of the eyes and upper respiratory tract². “ Traditionally, Medical schools in India have depended on formaldehyde for preserving tissues of histopathological and histological importance. Though it is cheap, easily available and does not require technical expertise, nevertheless, it is a very harmful and extremely toxic when inhaled and has irritant properties when in contact with the skin or eyes³.

Since the discovery of the plastination technique in 1978 by Gunther von Hagens there has been a growing dependence on plastinated specimens in learning Anatomy. These specimens are without odor, are resilient and easy to deal with in the classes⁴ when compared to Formalin which has oncogenic activity and has been associated with different kinds of cancer - nasal, lung, testicular and brain and leukaemia⁶ Though Plastination started in India in 1995 in AIIMS, Delhi⁷ and is also being done in JSS Medical College, Mysore, Yenepoya Medical College, Mangalore, Karnataka, CMC, Vellore the technique is still not known to many, since plastination is not very popular and perfecting the technique takes a great deal of persuasion. Plastinated specimens are being used for teaching Anatomy, Pathology and Forensic Medicine in majority of Medical schools abroad⁸ but in India these are not very popular as they are expensive to make and very few have the technical knowledge and expertise to make such specimens.

OBJECTIVES

1. To prepare dry, odorless, nontoxic, durable, specimens for the study of student's as well as a tool for teaching.
2. To assess the cost effectiveness of the method used.

MATERIALS AND METHOD

This study was carried out in Yenepoya Medical College from 2009 to 2012. In this study we obtained fresh organs from the local abattoir and aborted fetuses received from our hospital. Once the specimens were collected they were cleaned thoroughly with saline, washed and hollow organs like heart were dilated. Fixation was done to prevent autolysis and putrefaction¹. The basic steps of plastination are used from the Heidelberg plastination booklet^{4, 5}.

FIXATION

The specimens were fixed in 5% formalin for a week and then 10% formalin for another week. A 10% solution of formalin serves as a suitable fixative.

DEHYDRATION

Overnight rinsing with running tap water was followed by the Ethyl Alcohol/ Acetone dehydration. First few specimens were dehydrated using Ethyl Alcohol (Fig 1-2). The Remaining specimens were dehydrated in cold acetone (Using Refrigerator). The ratio used was 10:1 (volumes of dehydrating fluid to the volume of tissue). This was kept for 2-3 weeks⁵

DEFATTING – Specimens were placed in acetone at room temperature for a week.

IMPREGNATION

We used 4 different methods to impregnate the specimens with Resin (general purpose resin and RL resin). The specimens were placed in the following solutions.

- a) 100ml Resin, Accelerator (violet colored compound) and catalyst in 1:2 ratio.

For 2weeks, then excess resin was drained and specimens were kept for drying at room temperature.

- b) In resin for one week, then resin and accelerator mixture for another week, the specimens were drained and a coating of catalyst was applied before keeping it for drying.

- c) In resin – accelerator mixture taken in plastic bottles to which a syringe was fixed and vacuum was created manually (5 times a day for a period of 2 weeks). Drying of specimen was done as mentioned above (b).
- d.) Using the above method (c) along with vacuum chamber and pump prepared cost effectively in our lab.

RESULT

The specimens made by different method were durable, odorless, and served the purpose of teaching. The students preferred to learn with plastinated specimens which they could easily handle. Plastinated snakes helped the students study the scale pattern of snakes and to learn how to identify poisonous snake from non-poisonous ones. We have tried to make the specimens cost effective by using locally available resin, using the refrigerator instead of deep freezers, making our own vacuum chamber and rest of the chemicals are what we use daily in the laboratory.

Specimens of spleen, kidney made using first solution of impregnation were flexible, odorless, maintained the morphological features but lost their original color and size.

Specimens of heart made using the second method were durable, odorless but slightly rigid.

Specimens of the fetal heart and lungs showed good results and also maintained the color.

Specimens of snakes made using a vacuum chamber showed all the morphological features clearly, were durable and odorless.

The left over resin, accelerator mixture was used for preparing anatomical models using molds made of plaster of Paris thus reducing wastage of resin.

To prepare good quality plastinated specimen a vacuum chamber and pump is necessary, Which can be prepared cost effective.

The plastinated specimens can be displayed on an artistically made acrylic stand or simply stored in transparent plastic bags.

DISCUSSION

As concentrated formalin does not result in good fixation of specimens, the fixation was done using 10%

Formalin. It is a good fixative, easy to prepare and economical also⁹. Specimens used for plastination are wet which makes dehydration obligatory before forced impregnation can be done¹⁰. Cold acetone or alcohol is usually used to desiccate specimens for plastination. The decrease in size of specimens due to dehydration can be reduced by using cold acetone or increasing the gradation of ethanol¹⁵. It is important to check the concentration of dehydrating fluid every week and if required, the specimen is moved into a new dehydrating solution. Use of warm acetone results in an extreme reduction in the size of the specimen and also causes incomplete dehydration. According to Von Hagen's method the dehydration should be done in cold acetone (-25degree C) in deep freezer⁴.

In our study first we used increasing gradation of ethanol as dehydrating agent, but after finding excessive shrinkage of specimens (fig 1), we switched it with cold acetone¹¹. We had placed the specimen in cold acetone and kept it in a refrigerator, achieving a minimum temperature of -4°C. Plastic container should not be used as acetone is a reactive chemical and dissolves the plastic. Acetone acts as a mediator solvent forming better-quality specimens. Dehydration time is shorter and pre-used acetone (70% - 90%) can be used to initiate dehydration. Two changes of Acetone after a period of 6 days each is done and then the specimens are kept for defatting in fresh acetone at room temperature.



Fig. 1. Spleen

When dehydration and defatting is complete the specimens are subjected to resin impregnation. Importing the Biodur silicone polymer series (S10, S3, S6), to determine if plastination of our museum specimen would be feasible, was expensive¹⁰ and required a lot of time and effort to obtain such.

Therefore we explored locally available Indian silicones to see if one might meet the conditions necessary for plastination. First we used a general purpose resin readily available in the market for our study. The specimens were placed in Resin for 2 weeks, and then it was placed in a mixture of Resin, accelerator and catalyst. Resin (100ml) was mixed with accelerator, a violet colored compound then the catalyst was added to it (accelerator and catalyst are added in the ratio of 1:2) but the specimens turned black when placed in resin and after curing the specimen of spleen (fig 1) showed little shrinkage but was dry, odorless, non-toxic and durable. Similar results were seen with a specimen of the kidney (Fig2).



Fig. 2. Kidney

The reasons for defects in preparation are incompatible temperature, using old, improperly fixed specimens and extensive curing procedure. Common imperfection seen in plastinated specimens is related to changes in the bulk, color, spots on organ's surface¹⁹. Next we tried Roof Lite type silicone which was colorless and transparent, could be cured at room temperature and was flexible after curing. In this method we used acetone instead of ethanol as the dehydrating agent. The specimen was placed in acetone and kept in refrigerator for 2 weeks and then kept at room temperature for 1 – 2 days and then placed in fresh acetone for defatting for a week. Acetone acts as a dehydrating agent (in the cold) and

defatting agent (at room temperature)¹⁵. The specimen was placed in RL Silicone resin for 2 weeks (time duration depends on the size of the specimen). The specimen was drained of excess of polymer¹⁶ and then dried and a coating of hardener was applied to it, specimen thus obtained was dry, odorless, non-toxic and durable but a little rigid (fig 3– heart)



Fig. 3. Heart

Specimen of heart has to be dilated before fixation⁹, to get good result always prefer fresh rather than old formalin fixed specimens. The specimens have to be cleaned thoroughly with dilute fixative or saline to remove blood¹⁰.

The method we used is cost effective as it has been done manually without using deep freezer, acetometer, gas chamber for curing, Biodur silicone (S 10, S 3, S 6)¹⁴. For a specimen of fetal lung (fig 4) we used disposable plastic bottles with syringe fixed on the cap as vacuum chamber. After the impregnation of specimen with resin, the specimen was drained and a coating of hardener was applied. The specimen



Fig. 4. Foetal lung

obtained after curing was dry, odorless, nontoxic and durable.

Forced impregnation is the most important step in plastination for which one needs a vacuum chamber which we made in our lab cost effectively using a steel drum, plastic tubes, a vacuum pump, the specimens of snake were placed in the resin mixture and when vacuum was applied bubbles appeared showing the acetone escaping from the specimen and resin getting slowly impregnated into it. The impregnation is complete when no more bubbles appear. The excess resin was drained out and a coating of hardener was applied to the specimens after wiping with absorbent paper, it was then wrapped in transparent polythene covers and allowed to dry till it became non sticky (fig 5 and 6).



Fig. 5. Rat Snake



Fig. 6. Banded Racer

The adult banded racer resemble spectacled Cobra, Rat snake, and juveniles look like Krait and wolf snake²⁰ The plastinated specimen helped the students to identify the features to differentiate Non- poisonous snake from poisonous ones.

Use of formalin and its side effects can be reduced to a great extent by incorporating the plastinated specimens in the routine teaching schedule in all Medical Colleges in India.

Plastination can be used in Pathology and Forensic Medicine also. In Medico legal cases the specimens need to be carried to the court, it would be easy to handle if such specimens were plastinated. One has to thoroughly practice this technique using specimens from abattoir before dealing with specimens of pathological and Forensic importance.

The left over resin, accelerator mixture was used for preparing anatomical models using molds made of plaster of Paris thus reducing wastage of resin (fig 7 to 9)



Fig. 7. Wax Model of 31 week Embryo



Fig. 8. Mold of Plaster of paris



Fig. 9. Resin cast of Embryo

CONCLUSION

The use of plastination technique will allow students to understand gross beyond the two dimensional level. Cost effective methods can be developed using locally available materials, thus allowing for greater acceptance at all the medical schools.

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Ethical Clearance: This paper is a part of PhD study Titled "Evolution of museum techniques for preservation of wet specimens, their comparison and role in education".

The Ethical clearance was taken.

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Counteracting Bioterrorism: A Challenge to India

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ABSTRACT

Bioterrorism is a potential public health threat to India. The impact of a biological attack to our nation could be devastating. Most biological warfare agents do not produce symptoms for many hours or several days, so Indians exposed to a contagious biological warfare agent could easily spread the agent to thousands before symptoms manifest. The dental profession could potentially play a significant role in the emergency response to a major bioterrorism attack. This article provides a brief overview of the threat from biological weapons, its consequences, clinical presentation of diseases and state of preparedness in India as a response to this potentially catastrophic danger.

Keywords: Bioterrorism, Biological Warfare Agents, Biological Weapons

INTRODUCTION

Biological weapons (BW) are of interest for centuries and have been utilized in numerous battles.¹ Bioterrorism dates back to ancient Roman civilisation, where dead and rotting animals were thrown into wells to poison water supplies.² In 1346, plague broke out in the Tartar army during its siege of Kaffa in Crimea. The attackers hurled the corpses of those who died over the city walls; the epidemic that followed forced the defenders to surrender. Infected people who left Kaffa started the Black Death pandemic throughout the Europe killing 1/3rd of the population.³ In 1700s during the French-Indian War, Britishers gave blankets that were used by smallpox victims to the native Americans, resulting in decimation.⁴

Bioterrorism (BT) is a planned and deliberate use of pathogenic strains of microorganisms such as bacteria, viruses, fungus or their toxins to spread life-

threatening diseases on a mass scale in order to devastate the population of an area.⁵ BW are defined as microorganisms that infect and grow in the target host producing a clinical disease that kills or incapacitates the targeted host. Such microbes may be natural, wild- type strains or may be the result of genetically engineered organisms. These may be the products of microbial metabolism that kill or incapacitate the targeted host. These include biological toxins, as well as substances that interfere with normal behaviour, such as hormones, neuropeptides and cytokines.⁶

Classification of biological agents

Centre for Disease Control (CDC), Atlanta, USA has classified BT diseases/agents (Table: 1) into three broad categories based upon the following criteria's²

- (i) Capability of the agent to be easily disseminated.⁷
- (ii) Ability to be transmitted from person to person.
- (iii) Potential to cause significant morbidity and mortality.
- (iv) Capacity to cause public panic and social disruption.²

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Table 1. Classification of bioterrorism diseases/agents²

<p>Category A : High-priority agents. These include organisms that pose a risk to national security because they can be easily disseminated or transmitted from person to person resulting in high mortality rates and potential for major public health impact, causing public panic and social disruption. It requires special action for public health preparedness.</p>	<p>Category B: These agents are moderately easy to disseminate, resulting in moderate morbidity and low mortality. These require specific enhancements of diagnostic capabilities and enhanced disease surveillance.</p>	<p>Category C: Emerging pathogens engineered for mass dissemination in future because of easy availability, ease of production and dissemination, potential for high morbidity and mortality and major health impact.</p>
<p>A Agents:</p>	<p>B Agents:</p>	<p>C Agents:</p>
<ul style="list-style-type: none"> • Anthrax • Botulism • Plague • Small pox • Tularemia • Viral hemorrhagic fevers [Filoviruses (e.g., Ebola, Marburg) and Arena viruses (e.g., Lassa, Machupo)] 	<ul style="list-style-type: none"> • Brucella • Food Safety Threats (Salmonella species, E Coli O157:H7, Shigella) • Burkholderia mallei • Burkholderia pseudomallei • Q fever -Coxiella burnetii • Viral encephalitis [alphaviruses (e.g., Venezuelan, encephalitis)] • Staphylococcal enterotoxin B • Typhus fever (Rickettsia prowazekii) • Ricin toxin from Ricinus communis (castor beans) 	<ul style="list-style-type: none"> • Nipah virus and Hantavirus

Biological warfare agents are mostly colourless and odourless microorganisms or toxins derived from microorganisms which spread in air as aerosols or in food or drink (Table: 2). These are easily concealed and thus difficult to detect.⁸ BW are sometimes clubbed with the nuclear and chemical weapons for mass destruction. However nuclear and chemical attacks cause maximum damage immediately, biological attacks using BW manifest after sometime.⁹ An attack with a biological agent could remain undetected for days, unlike attacks involving conventional or even chemical weapons, which could be readily detected and limited to specific geographic areas. These biological attacks are usually widely scattered and depends on the type of biological agent used. It might not be identified immediately as a manmade event.¹⁰

Table 2. Mode of administration of biological agents^{2,11}

1	Dispersal systems for inhalational exposure
a	Mail/ packages
b	Commercially available spray device/ crop duster
c	Fire extinguisher
d	Air conditioning systems
e	Smoke generators
f	Street air fresheners

Table 2. Mode of administration of biological agents^{2,11} (contd.)

2	Contamination of food or water supplies
a	Individual consumption items
b	Food chain contamination
3	Injection
a	Contaminated needles
b	Projectiles/contaminated shrapnel
4	Direct contact by infected persons/animals
5	Military munitions

Presently one of the advanced ways of biological warfare is through aerosols. This can be ineffective as the materials often get clogged when spraying or may get destroyed by ultra violet light.^{4,12} They may get washed away due to rain. Another method of distribution is to attach the toxins to a bomb so that they may be released upon explosion, but microbes will most likely be destroyed by the explosion as well.⁴

The recent outbreaks of avian influenza due to H5N1 subtype infected thousands of people and killed 296 (July, 2010) of them raising a suspicion that this

organism could be used as BW.¹³ Using highly pathogenic avian influenza virus (H5N1), both humans and poultry can be targeted. 2006 outbreak, caused great panic throughout the nation. The occurrence of the disease outbreak was not found to be due to terrorist activity.²

The signs and symptoms of some biological agents

Most biological agents do not cause unique clinical signs and symptoms that are immediately recognizable in exposed individuals. To effectively mitigate a bioterrorist attack, all medical and dental practitioners must be familiar with the agents of biologic warfare and their clinical manifestations (Table: 3).¹⁴

Table: 3 Characteristics of selected bioterrorism agents^{4,11,13,14}

Disease / Agent	Mode of transmission	Incubation period	Head and neck manifestations
Anthrax Bacillus anthracis	Airborne transmission	≥2–60 days	Headache, nonproductive cough. In cutaneous anthrax, spores are introduced into the skin. Formation of red macule → papular-vesicular stage → ulceration, with blackened necrotic eschar surrounded by brawny edema. The lesion is painless with regional lymphadenitis Oropharyngeal form - fever, dysphagia, painful lymphadenitis, toxemia, respiratory distress and primary tonsillitis.
Smallpox Variola major virus	Aerosols or by direct contact	7–17 days	Headache, maculopapular rash appears in centrifugal distribution - most dense on face and extremities and also affects oropharyngeal mucosa. Early symptomatic phase → severe febrile illness, nonspecific macular rash (2 to 4 days) → evolution to a vesicular rash → pustular rash (4 to 5 days) → healing scabs, with neighbouring lesions developing synchronously.
Plague Yersinia pestis	Insect vector (flea bites)	1-6 days	Cough productive of bloody watery or purulent sputum.
Tularemia Francisella tularensis	Cutaneous inoculation, inhalation, or ingestion through insect vectors (ticks, biting flies, and mosquitoes)	1-14 days	Headache, sore throat, rhinitis, purulent sputum production, hemoptysis, pharyngitis, cutaneous ulcer and lymphadenopathy.
Botulism Clostridium botulinum	Aerosol	2 hours to 8 days	Blurred vision, dilated pupils, photophobia, dysphonia, dysphagia, severe muscle paralysis, choking and dysarthria.

Biological warfare agents are able to target specific biological systems like cardiovascular, immunological, neurological, gastrointestinal systems and can also produce a wide range of effects including death, incapacitation, or neurological impairment.⁴

Features of the disease suggestive of bioterrorism¹⁵

1. A disease occurring in an area where it is not endemic.
2. An unusual temporal or geographic pattern may suggest that a disease outbreak is not a natural phenomenon.

3. BT will often resemble a point-source outbreak with all cases clustering around a single time period.
4. An unusual age distribution for common diseases.

Problems posed by bioterrorism and warfare

- 1) BT is more likely than ever before and more threatening than explosives or chemicals.¹⁶
- 2) Official actions directed at the threat to the civilian population have been only marginally funded and minimally supported.¹⁷

- 3) Preventing or countering BT will be extremely difficult as techniques for making BW are available on internet. Groups with modest finances and basic training in biology, engineering could develop weapons at little cost.¹⁸
- 4) Detection or interdiction of groups, intending to use BW is next to impossible.¹⁹

Global preparedness and response

The components for a comprehensive public health response to BT identified by the CDC include detection, rapid laboratory diagnosis of biological agents, epidemiologic investigation, communication (between local, state, and federal public health authorities), preparedness planning and readiness assessment.¹¹

BT is an event in a civil setting that is equivalent to an epidemic in a medical scenario. This differentiation results in direct challenge to medical community for clinical diagnosis of infectious agent used in BT. Hence collaboration between medicine and public health, training of personnel, preparation of regional stockpiles of vaccines and drugs, immunization of first responders, rapid test methods, safe immunization methods and specialized hospital centres with specially trained personnel to handle bioterrorist attack victims.¹¹

Civilian exposure to BT agents may result in severe health complications if early diagnosis is unavailable and medical intervention is not provided in sufficient time. These kinds of intentional threats that directly harm the health of a community can be expected in the future, and one way to lessen the impact and minimize risks associated with such assaults is to be fully prepared for them by educating and training health care professionals in BT preparedness and management.²⁰ The American Dental Association believes that dentists can be a resource and should be prepared through targeted education and training to effectively respond and assist during natural and other catastrophic disasters.²¹

State of preparedness in India

Planning, coordination and preparedness are recurrent themes for discussing the threat of BT. A fundamental step toward addressing the threat of BT is comprehensive planning that focuses on local preparedness and response capacity integrating the role of state, regional and federal governments.

Effective planning should be executed for scenarios that may confront, including the announced/silent release of a biological agent or hybrid event like bomb explosion followed by the release of a biological/chemical agent. In addition scenarios like person-to-person transmission or non-communicable infectious diseases should be considered.²²

India should develop a contingency plan to protect against such eventualities by involving organisations like defence, home ministry and scientific institutes/laboratories. Though India has established a National Institute for Disaster Management in 2003, it has no agenda specifically directed for bioterrorism and its mitigation. The first line of defence is establishment of a high containment laboratory (Bio safety level-4) having ultra modern facilities, preferably under the home ministry or science and technology or defence ministry, for quick and precise diagnosis of all the agents presently listed under BW and their storage under safe custody for developing vaccines and antidotes for use in emergency.²

The role of these laboratories is archiving critical biological agents and the performance of other specialized tests, such as culture or molecular identification of highly dangerous viral agents that require bio safety level-4 facilities.¹¹

Presently, there is only one bio-safety level-4 laboratory in India at Bhopal under the Indian Council of Agricultural Research engaged in diagnosis and control of exotic animal diseases.² After September 2001 attack in USA, many samples suspected for anthrax were received in Bhopal laboratory for testing and found to be a hoax. The laboratory tested successfully a recombinant anthrax vaccine in laboratory animals and monkeys for subsequent vaccination of humans. The vaccine is now under field trials with good results. The vaccine can be used for defence personnel, postal department employees and police who are vulnerable.² At present Government of India, under Indian Council of Medical Research and Council of Scientific and Industrial Research has initiated the establishment of two bio-safety level-4 laboratories at Pune and Hyderabad for use in health-related high-risk pathogens. It is high time to develop preparedness for BT to safeguard the country. To establish such facilities, technologies are now available indigenously. Resources can be pooled under one umbrella to concentrate on the subject. If we initiate now it will take 5-10 years to get the desired results.²

Dentist's role in bioterrorism

Dentistry can contribute valuable assets, both in personnel and in facilities, to the preparation for and in the immediate response to a bioterrorist attack and its aftermath.²³

Preparation before an attack

Education should be given to dentist regarding the medical and oral manifestations of diseases that result from a bioterrorist attack. Dental offices may be called on to serve as local "mini hospitals" when local hospital facilities become overwhelmed.²³

Assistance during an attack

In the first few days of a significant bioterrorist attack, the assistance varies according to the needs of the community and the resources available. Dentists can detect characteristic intra oral or cutaneous lesions and inform initial attack to public health authorities. Dentists can also refer suspicious cases to the appropriate specialists for confirmation, treatment or both.²³

Dentists could be called on to prescribe and dispense chemotherapeutic or chemoprophylactic medications for the public. They can augment and assist medical and surgical personnel in providing definitive treatment for victims of bioterrorist attack and can apply their knowledge in reducing the spread of infections between patients and between patients and care givers in mass disasters.²³

After the initial attack

Dentists trained in forensic odontology can work closely with local disaster mortuary operational response teams. Dentists may also provide local surveillance to detect any spreading of disease beyond the original area of attack or re-emergence of infections in the original attack area.²³

CONCLUSION

The threat of BT is real and significant. It is neither in the realm of science fiction nor confined to a particular nation. The increased threat of BT and the risk posed by various microorganisms as BW needs to be evaluated and should be better understood. Planning and training involving all organizations potentially involved in responding from emergency managers to public health officials to hospital administrators and staffs is essential. Expanded public

health laboratory capacity, increased surveillance, health communication and training, with focused public health preparedness resources at the state and local level, are necessary to respond effectively to this unique disaster. Dentistry has assets in personnel and facilities that can be of great value in responding to a major bioterrorist attack. Educational programs for dentists should be developed to prepare them for providing services they may be recruited to perform in an emergency.

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A Study of Palmar Dermatoglyphic Pattern in Patients of Epilepsy

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ABSTRACT

Dermatoglyphic is a scientific study of epidermal ridges and their configuration on the volar skin. Dermatoglyphic variations in epilepsy cases may be suggestive of an external imprint of genetic variation. The present study has been undertaken to find out the existence of any correlation between dermatoglyphics and idiopathic epilepsy. The material consisted of 100 patients (75 males and 25 females) and 100 controls (50 males and 50 females). Dermatoglyphics were obtained by printing method. Parameters studied were a-b, a-d ridge count, palmar angle - 'atd' angle, and total finger ridge count (TFRC). There is no significant difference in 'atd' angle in epileptic patients as compared to control group. Difference in the 'atd' angle between patients and controls was also not found to be significant. In this study a statistically (P value<0.01) reduced a-b ridge count is observed in patients as compared to control. Similarly total finger ridge count is reduced in epileptic patients as compared to controls. Significant differences have not been observed from these dermatoglyphics features for concluding the genetic predisposition of epilepsy.

Keywords: Epilepsy, A-B, A-D Ridge Count, Total Finger Ridge Count, Palmar Angle - 'atd'

INTRODUCTION

Armed with fresh resolve to slake our collective efforts for correlating dermatoglyphic association in epilepsy, we have undertaken yet another pot of sparkling water from the fountain of knowledge. Primary generalised epilepsy is a tendency to have seizures when there is no structural abnormality in the brain¹. The Familial incidence of epilepsy has been reported but a mandelian pattern of inheritance has not been discerned².

According to World Health Organization (WHO), and the International League for Struggle against Epilepsy (ILSE), epilepsy has been defined as a "recurrent paroxysmal disorder of cerebral function

characterized by sudden brief attacks of altered consciousness, motor activity, sensory phenomena, or inappropriate behaviour caused by abnormal excessive discharge of cerebral neurons"³.

The annual incidence of new cases of epilepsy in infancy is 20-70/100,000. The recurrence rate after a first seizure approaches 70% during the first year and more recurrent attacks occur within a month or two of the first seizure⁴.

Dermatoglyphics is the study of pattern of ridges on the skin of fingers, palms, toes, and soles. Dermatoglyphics are of interest in the field of anthropology, criminology, and medicine, including dysmorphology and the study of chromosomal abnormality such as trisomy 21⁵. Abnormalities in the epidermal ridges may result from genetic alterations occurring around the first trimester, during organogenetic period, between 13th-60th days after fertilization⁶.

The present study was undertaken as a humble attempt to further advance the knowledge on the subject with the following aim:-

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1. To Look for any gross Palmar Dermatoglyphic pattern changes in patients with primary generalised epilepsy.
2. Compare Palmar Dermatoglyphic pattern in normals of same age and sex.
3. Total finger ridge count (TFRC) represents the sum of ridge counts of all the ten digits, where only the larger count is used on those digits with more than one ridge count.

MATERIAL AND METHOD

Epileptic patient attending out-patient and in-patient Medicine department at Era Medical college & hospital were selected. The data was collected in a pretested proforma including various parameters meeting the objective of the study. Proper written informed consent was taken from patient. The material consisted of a total of 200 cases of which 100 patients of Epilepsy (mainly of Idiopathic grand mal epilepsy), and 100 Control group were taken up for the study. Control group comprises of Teaching and non teaching staff of Era Medical College matched for gender, and age criterias as that of patients without personal or family history of epilepsy were selected. Patients suffering from other diseases were excluded from the study.

The Palmar imprint of both hands is taken by classic ink method irrespective of predominant handedness (right or left) indicating the opposite dominant hemispheres of brain. The ink roller or applicator with ink is applied to cover the entire palm including the wrist creases, the thenar & hypothenar borders and digits. Then the wrist is placed on a sheet of paper over a foam pad on a flat table and the hand is gently, uniformly & firmly moved forwards to press on the paper. The foam pad is used to fill the concavity of the palm when pressed firmly on the paper. Then each digit is pressed and rolled gently to get their prints.

The following dermatoglyphic variables were analysed for both hands(Fig-1):-

1. a – b and a - d ridge count: Number of ridges between the triradius “a” and triradius “b”, and triradius “d” that were counted with magnifying lens.
2. ‘atd’angle: Angle between the straight lines joining triradii points ‘a’, ‘t’, and ‘d’ were measured.

A triradius is a point where the ridges deviate into three directions. Triradius ‘a’, ‘b’, ‘c’ and ‘d’ are the triradius of the second, third, fourth, and fifth digits respectively. These are located just below the respective digits, between the metcarpo-phalangeal crease of the digits and the bracelet creases. Student ‘t’ test was applied for the study.



Fig. 1. a, b, c, d are triradii location and atd angle



Fig. 2. Different Fingerprint Patterns

TABLE 1. Distribution of a-b & a-d Ridge count in different groups

Group		a-b ridge count				a-d ridge count		
			R	L	R+L	R	L	R+L
Cases n= 100	Patient	M	28	27.89	55.89	58.85	50.72	109.57
	Male	S.D	5.32	4.27	9.5	11.5	10.67	22.17
	n=75				p<0.01			p<0.49
	Patient female	M	28.53	27.5	56.03	52.67	51.84	104.51
	n=25	S.D	5.33	4.16	9.49	12.06	11.87	23.93
						p<0.01		
Control n=100	Normal	M	31.68	32.85	64.53	57.67	58	115.67
	Males	S.D	4.76	4.98	9.74	13.75	11.47	25.22
	n=50				p<0.16			p<0.85
	Normal	M	30.66	29.46	60.12	51.99	52.72	104.71
	Female	S.D	4.3	4.1	8.4	14.74	13.37	28.11
	n=50				p<0.21			p<0.21

TABLE 2. Distribution of Total Finger Ridge count (TFRC) in different groups

Groups			Total Finger Ridge Count(Mean Value)		
			R	L	R+L
Cases N=100	Patient male	M	72.52	70.79	143.31
		S.D	4.89	4.46	9.35
					p<0.001
	Patient female	M	63.23	60.04	123.27
		S.D	4.68	4.08	8.76
					p<0.001
Control N=100	Normal male	M	80.2	78.6	158.8
		S.D	5.77	5.28	11.05
				p<0.21	
	Normal female	M	70.13	68.27	138.4
		S.D	5.12	4.77	9.89
					p<0.16

TABLE 3. Distribution of atd angle

Groups			Mean 'atd' angle		
			R	L	R+L
Cases N=100	Patient Male	M	1.26	40.1	81.36
		S.D	4.23	4.04	8.27
					p<0.21
	Patient female	M	39	40.18	79.18
		S.D	3.92	4.08	8
					p<0.30
Control N=100	Normal Male	M	40.1	40.85	80.95
		S.D	4.04	4.22	8.26
					p<0.68
	Normal female	M	38.65	40.85	79.5
		S.D	3.84	4.22	8.06
					p<0.68

OBSERVATION & DISCUSSION

Epilepsy constitutes the tendency of clambering on to the bandwagon manifestation of the nervous system and the familial incidence of epilepsy has been reported but a mendelian pattern of inheritance has not been discerned. In this study males predominated in epileptic group (75 males and 25 females) and male/female ratio being 3:1, while in a study conducted by Treiman L⁷, the male/female ratio being 1.8:1. In other study conducted by Slatis HM⁸, the reported male/female ratio being 1.6:1.

In epileptic patients there is higher incidence of whorls and the arches and lower incidence of loops on the index finger(II digit) as compared to controls.

In this study a statistically (P value<0.01) reduced a-b ridge count is observed in males patients(56.09±9.16) as compared to normal males(64.53±8.43), and in Female patients(56.03±9.04) as compared to normal females (60.06±8.04). Similar results have been reported by Schmann B⁹, suggesting the existence of a familial predisposition to seizures of various etiologies.

Similarly total finger ridge count is reduced in epileptic patients as compared to controls(P value<0.001), in male patients(143.21) as compared to normal males (158.80), and in females patients (123.27) as compared to normal females (138.40). Similar report have been reported by Schmann B¹⁰, Kharitonov RA¹¹.

No significant changes have been observed in sydney line and simian crease in epileptic patients as compared to control group.

There is no statistically significant difference in 'atd' angle in epileptic patients as compared to control group (P value>0.05).

Among the conventional palmistry parameters of brain disease, prevalence of breaks under the mount of Apollo in brain line of both hands is significant only in female epileptic patients as compared to control. This supports the hypothesis that females need a greater genetic threshold for manifestation of the disease.

The basis of uniqueness of finger ridge lies in embryology; the unique features of the skin are established between approximately 10.5 and 16 weeks estimated gestational age (EGA) due to development noise. This is also period of cytogenesis and neurogenesis of early brain development and could

be of some association with finger ridge pattern and generalized epilepsy.

These dermatoglyphic variations in epilepsy cases may be suggestive of an external imprint of genetic variation. Dermatoglyphic marker of any disease is not an abnormal pattern, it is only a normal pattern found in abnormal frequency or at a place different from the normal.

CONCLUSION

It is not possible to draw any firm conclusion from a study of only a few hundred cases. It is also not expected that in epilepsy which was multifactorial predisposition causes, any definite or invariable dermatoglyphic finding is likely to be present in all or most of the cases. It is only a preliminary study to explore if any dermatoglyphic finding, but still there is strong doubt that whether it could help practically in prediction, diagnosis, treatment and palliative care of epilepsy in convulsive disorders or to take preventive steps to delay or avoid epilepsy in those predisposed to it as revealed by dermatoglyphic marker.

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A Ten Year Study of Pattern of Electrocution Deaths in Bangalore

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ABSTRACT

Deaths due to electrocution constitute an important part of unnatural deaths even though uncommon but most of them are preventable since almost all are accidental deaths. This 10 year study from January 2000- December 2009 at department of Forensic Medicine, M.S. Ramaiah Medical College revealed that a total of 76 cases of electrocution were identified in 10 years averaging 7.6 cases per year and constituting 1.05% of autopsies conducted. The highest incidence was seen in 20-29 yrs age group (44.7%). Males constituted 83% of cases. Construction workers accounted for 32.9% of cases and 28% of individuals were engaged in domestic activities. Maximum number of cases occurred in the afternoon (63.2%). In 32 cases there was a single electric contact wound and the most common site was the hand (49cases). Exit wounds were noted in 10 cases (13.2%) and foot was the commonest site (8cases). In eleven (14.5%) cases the deceased had sustained other associated fatal injuries.

Keywords: Electrocution, Contact Mark, Exit Wound

INTRODUCTION

The human body is a good conductor of electricity because it contains a large amount of water and dissolved salts in the form of blood and other body fluids. This means that an electric current may pass easily through the body, a process known as electrocution, causing various types of tissue damage and even death. The electricity takes the fastest route through the body which is, typically, from one hand to another or from a hand down to the ground¹. Electricity related deaths result from an overwhelming transmission of electrical current to the body². At autopsy, the points of entry and exit of the current may be marked by a burn or a collapsed blister, the latter with a characteristic brown center and pale rim. The hand is the most common entry point for electrocution. One of the reasons that electrocutions can be challenging deaths to identify is that in about one-half of low voltage electrocutions, there are no electrical burns or other autopsy findings to suggest

electrocution³. The pathologist's interpretation may therefore rely much more on the circumstances of the incident rather than on the autopsy findings. The usual mode of death is cardiac arrhythmia leading to ventricular fibrillation and arrest⁴. Deaths caused by electrocution are infrequent, virtually all are accidents with suicides rare and homicides even rarer⁵. Hence most of the deaths could be prevented if proper precautions are taken both at home and workplace. In view of widespread use of electricity for commercial, industrial, public and domestic purposes this study was undertaken to know the age and sex incidence, occupation, presence and sites of contact and exit marks and the other associated fatal injuries.

MATERIAL AND METHOD

This 10 years study was taken up in Department of Forensic Medicine M.S. Ramaiah Medical College. Data was collected from all electrocution deaths amongst autopsies conducted at M.S. Ramaiah Medical

College from January 2000– December 2009, Bangalore and information / history was obtained from police / relatives of deceased regarding the circumstances. In few cases scene of occurrence was visited.

RESULTS

Table 1. Year wise distribution of cases

SI No	Year	Total No of autopsies	Deaths due to electrocution	Percentage %
1	2000	600	6	1
2	2001	635	5	0.7
3	2002	632	11	1.74
4	2003	635	5	0.78
5	2004	695	8	1.15
6	2005	738	7	0.94
7	2006	791	9	1.13
8	2007	811	8	0.98
9	2008	896	8	0.89
10	2009	819	9	0.98
		7252	76	1.05

Table 2. Age and sex of distribution

SL No	Age	Male	Female	Total	Percentage
1	0-9 yrs	0	0	0	0
2	10-19 yrs	5	1	6	7.9
3	20-29 yrs	29	5	34	44.7
4	30-39 yrs	11	1	12	15.8
5	40-49 yrs	14	3	17	22.4
6	50-59 yrs	2	2	4	5.3
7	> 60 yrs	2	1	3	3.9
		63	13	76	100

Table 3. Activity at the time of electrocution

SI No	Activity	No of cases	percentage
1	Domestic	28	36.9
2	Factory work (Non electric)	3	3.9
3	Electrical work	14	18.4
4	Construction work	25	32.9
5	Others	6	7.9
	Total	76	100

Table 4. Time of occurrence

SI No	Time	No of cases	Percentage
1	Morning (6 am to 12 noon)	27	35.5
2	Afternoon (12 noon to 6 pm)	48	63.2
3	Evening (6pm to 12 midnight)	1	1.3
4	Late night (12 midnight to 6 am)	0	0
		76	100

Table 5. Presence and number of electric contact marks

SI No	Electric contact mark	Total	No of electric contact marks	Site of electric contact mark
1	Present	72	1 in 32 cases 2 in 24 cases 3 or more in 16 cases	Hand-49 Forearm-9 Arm-3 Leg-5 Face-3 Others-3
2	Absent	4		
	total	76		

Table 6. Exit wounds – presence and location

SI No	Exit wound	No of cases	Site of exit wound
1	Present	10	Hand-02 Foot-08
2	Absent	66	
	Total	76	

DISCUSSION

A total of 76 cases of electrocution were identified in the 10 years period from Jan 2000 to Dec 2009, averaging 7.6 cases per year and accounted for 1.05% of total autopsies conducted. In a similar study conducted in South Australia 3.2 deaths on an average occurred per year⁶ and in another study in Bulgaria deaths due to electrocution accounted 1.46 per year⁷. The higher incidence of electrical deaths in this part of the country especially in Bangalore could be attributed to the rapid growth and industrialization of the city hence people engaged in constructional activities and working in industries getting electrocuted accidentally.

Barring a case of suicide all cases (98.7%) were due to accidental electrocution, which is in contrast to a study conducted in South Australia where 29% of cases were due to suicides and 2% were due to homicides and accidents constituted 69% of cases⁶.

The higher incidence in 20-29 yrs age group is because of their active involvement in domestic, out door activities, occupation, exposing them for greater risk of electrocution.

Males constituted 83% of cases as in India they are generally working outdoor and few of them being electricians by profession and few handling the electrical appliances, hence facing the high risk of accidental electrocution. But females remain in door and hence most of them sustained electrocution accidentally while handling switches and electrical appliances. The lower incidence in extremes of age can be attributed to their sedentary life style.

Similar observation was made in a study conducted in Bulgaria where males constituted 85.7% and females 14.29% of cases⁷. In another study conducted in South Australia male's constituted 91% and females 9% of cases⁶.



Fig. 1. Patterned electric contact mark over right leg



Fig. 2 a



Fig. 2. (a & b) Photograph showing charring and extensive soft tissue destruction indicating prolonged contact with broad electrical contact source (Focusing light). Note froth at the mouth.



Fig. 3. Crocodile flash burns-Multiple burnt punched out lesion seen in a case of high voltage burns

From the study it can be inferred that 28% of individuals were engaged in domestic activities like using household electric appliances (switches, wires), gardening etc who got accidentally electrocuted due to lack of safety measures taken while installing electrical equipment improper wiring leading to short circuits. Construction workers accounted for 32.9% of cases constituted by laborers, masons, tile polishers, plumbers died because of accidental electrocution due to lack of awareness about the electric points, short circuits, unawareness about the power supply at that point of time. Electricians constituted the 18.4% of cases who while engaged in repair, installation work died due to accidental electrocution. Others in the study include the individuals engaged in activities like walking in public places etc. In two cases the individuals got electrocuted since they were carrying long rods which touched accidentally the overhead high tension wire on roadside.

Maximum number of cases occurred in the afternoon (63.2%) and morning as most of the people are actively into their profession (domestic and non domestic) during this time hence are at risk.

In 32 cases there was a single entry wound in the form of raised blisters, hard brownish raised nodule, deep scorching or a patterned contact mark. The most common site was the hand (49cases). In 4 cases where there was no obvious electric contact mark cause of death was opined as due to electrocution based on internal post mortem findings (petechiae over heart) and HPE findings⁸ (stretching of myocardial fibers along with elongation and wavy appearance of fibers at places and section of kidneys showing congested vessels and foci of hemorrhage) and circumstantial evidence.

Exit marks are variable in appearance; usually appear as splits in the skin or annular raised grey white rings with umbilicated centre at the site of current passage. But sometimes it can cause more damage to tissues. In our study exit wounds in the form of peeling and blistering of skin, burns were noted in 10 cases (13.2%) and foot was the commonest site of exit wound.

In eleven (14.5%) cases the deceased had sustained other fatal injuries in the form of fractures, head injury etc due to associated fall after electrocution and died.

CONCLUSION

A total of 76 cases of electrocution were identified in the 10 years averaging 7.6 cases per year and constituting 1.05% of autopsies conducted. The highest incidence was seen in 20-29 yrs age group (44.7%). Males constituted 83% of cases. Construction workers accounted for 32.9% of cases and 28% of individuals were engaged in domestic activities. Maximum number of cases occurred in the afternoon (63.2%) and morning (35.5%). In 32 cases there was a single entry wound and the most common site was the hand (49cases). Exit wounds were noted in 10 cases (13.2%) and foot was the commonest site (8 cases). In eleven (14.5%) cases the deceased had sustained other associated fatal injuries.

RECOMMENDATIONS

1. SAFETY AT HOME

- a. Electrical equipments or switches should not be operated with wet hands.
- b. Ensure electrical appliances at home are in proper working condition with effective non-leaking connections.
- c. Every electrical installation should be earthed properly.
- d. All electrical wiring should have proper insulation.
- e. Electricians should be given proper education regarding electrocution.

2. SAFE WORK PRACTICES

- a. prevention of electrocution by taking the similar safety measures as mentioned above.
- b. No one who works with electric energy should work alone, and in many instances, a "buddy system" should be established. It may be advisable to have both members of the buddy system trained in CPR. Every individual who works with or around electrical energy should be familiar with emergency procedures. This should include knowing how to de-energize the electrical system before rescuing or beginning resuscitation on a worker who remains in contact with an electrical energy source.

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Epidemiology of Homicide by Sharp Force in Tehran, Iran between 2010 and 2011

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ABSTRACT

Background: Stabbing is the most common method of homicide especially in countries such as Iran. This study was carried out to determine epidemiology of murders caused by sharp force injury in the city of Tehran.

Method: This study was a prospective cross-sectional study. All the victims of homicides caused by sharp force injury between July 2010 and June 2011 in the city of Tehran were included in this study. Questionnaire was used to collect the obtained data through census.

In data analysis, the frequency and standard deviation (SD) were calculated and t-test and Chi-square tests were used for data analysis.

Results: 166 murders were caused by sharp force. The mean age of victims was 33.06±14.11 years old. The mean of the number of wounds on the victim's body was 6.6 ± 2.9.

Motivation for murder was feud in 65 cases (39.6%) and 33 cases (20.1%) had family issues.

Defense wounds were seen in 108 cases (65.9%). 94 cases (65.6%) had 2-9 wounds on their body. The cause of death in 102 cases (61.4%) was injury of a critical organ.

There was a significant relationship between sex and neck lesions (p=0.001).

Mean and SD of the number of wounds was higher in females than males (p= 0.009).

Conclusion: Increased use of knives and other sharp tools in homicides is considered a threat for public health and more legal limitations for use of these devices and their transport seems necessary.

Keywords: Homicide, Epidemiology, Sharp force injury, Tehran, Defense wound

INTRODUCTION

Currently the most common methods of homicides in the world include stabbing, mechanical asphyxia, blunt head injury and shooting ^[1]. According to statistics, almost every minute one person is murdered in the world^[2].

Accidents resulting from the use of sharp objects are the leading cause of deaths from violence ^[2, 3].

Stabbing is the most common method used in cases of homicides in countries such as Iran ^[4] and some European countries ^[5-9] where carrying firearms is forbidden.

In some countries restrictions to carrying stabs and other sharp objects are applied^[10, 11].

In Iran although use of knife and other stabs in a threatening way is illegal, ^[12] but there is no restriction on the purchase and sale of such objects.

Mechanism of deaths from sharp objects include: shock from blood loss, air emboli (when the neck structures involved), asphyxia due to aspiration of

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blood, cardiac tamponade, hemo/pneumothorax, and injury to the brain and spinal cord. Also delayed complications causing death include: symptomatic hypotension after emergent surgery, various complications after surgery like pulmonary emboli, pneumonia, wound infection, recurrence of hemorrhage, ischemic heart disease, and meningitis in skull wounds [13].

Analysis of homicides and their motives reveals different results in different countries and even in different regions of a country [14].

This study was carried out to determine epidemiology of murders caused by sharp force in the city of Tehran between July 2010 and June 2011.

MATERIAL AND METHOD

This study was a prospective cross-sectional study. All the victims from sharp force fatalities in Tehran between July 2010 and June 2011 were included in this study by census method. Data on body examination and autopsy findings, interviews with victim's family, criminal files and hospital records, were recorded in the questionnaire.

Putrid cadavers and mutilated corpses and unidentified bodies due to lack of access to information were excluded from the study.

In data analysis, the frequency and standard deviation were calculated and t-test and Chi-square test were used for data analysis.

RESULTS

166 cases of murder with sharp force were examined in the study. 137 victims (82.5%) were male and 29 (17.5%) were female, 86 (52.4%) victims were married (Table 1).

Mean age of the victims was 33.06 ± 14.11 years old (range 4-87). Mean of number of wounds on the victim's body was 6.6 ± 9.2 (range 2-72).

The total number of autopsies performed in the study period was 10100 and death caused by sharp force comprised 1.64% of all autopsies. 293 homicides were recorded in the study period, with 166 (56.7%) homicides caused by sharp force.

Based on the national census carried out in 2011, population of the city of Tehran was over 12 million thus frequency of murder cases by sharp objects was 1.4 per 100000 populations.

Motivation for murder was feud in 65 cases (39.6%) and family issues in 33 cases (20.1%).

28 victims (16.9%) had a history of drug abuse. Opium abuse was found in 12 victims (7.2% of all victims and 42.9% of those with a history of drug abuse).

In 99 cases (60%) the victim died at the scene. 27 cases (16.5%) had a previous injury scar on the body and 108 cases (65.9%) had defense wounds on their hands.

Perpetrators were victim's friends in 44 cases (26.8%), coworkers in 18 cases (11.0%), anonymous in 59 cases (36.0%) and in 43 cases (26.2%) had family ties to the victim (Table 2).

Injuries localized to four local divisions included head, neck, trunk and limbs. Head injuries were seen in 15 cases (9.0%), neck injuries in 38 cases (22.9%), trunk injuries in 119 cases (71.7%) and extremity injuries were seen in 21 cases (12.7%) respectively.

The wounds on the victim's body were divided into three groups: one wound, 2-9 wounds, and 10 or more wounds. 55 cases (33.1%) of victims have one wound, 94 cases (56.6%) had 2-9 wounds and 17 cases (10.2%) had 10 or more wounds.

The cause of death in 102 cases (61.4%) was injury to a critical organ with injury to the heart in 30 cases (29.4%), neck and cervical vessels in 30 cases (29.4%) and lung in 24 cases (23.5%).

There was a significant relationship between sex and site of wounds in the victim ($p=0.002$) (Table 3).

There was not a significant relationship between the location of the injury and the relationship between perpetrators and victims, the number of wounds and victim's gender, the number of wounds and relationship between perpetrators and victims, and the number of wounds and the victim's level of education ($p>0.05$).

2-9 wounds were seen in 26 cases (78.8%) and in 32 cases (49.2%) of family violence and dispute respectively ($p=0.004$).

There was significant relationship between the relation of perpetrators and victims with victims gender ($p=0.000$), so that 20 cases (69%) of female murder victims were belong to the family group (Table 3).

There was significant relationship between motivation of murder and wounds numbers ($p=0.004$) (Table 4).

The mean and standard deviation of the number of wounds in female victims was higher than male ones (7.55±14.11 compared with 3.8±3.95) (p=0.009).

Table 1. Demographic data in victims of homicide by sharp force

Victim	Frequency (n)	Percentage (%)
Gender		
Male	137	82.5
Female	29	17.5
Total	166	100
Marital Status		
Married	86	52.4
Single	74	45.1
Divorced	3	1.8
Widow	1	0.6
Total	164	100
Nationality		
Iranian	153	92.9
Non-Iranian	13	7.8
Total	166	100
Murder Motivation		
Robbery	17	10.2
Honor	17	10.2
Feud	33	19.9
Dispute	65	39.2
Non-Identified	34	20.5
Total	166	100

Table 2. Site of injury, number of wounds, cause of death and relation between perpetrator and victim.

Victim	Frequency (n)	Percentage (%)
Site of injury*		
Head	151	91.0
Neck	38	22.9
Trunk	119	71.7
Extremities	21	12.7
Number of wounds		
one	55	33.1
2-9	94	56.6
10 and more	17	10.2
Total	166	100
Cause of death		
No critical organ involved	5	3.0
One critical organ involved	102	61.4
Two critical organ involved	51	30.7
Three critical organ involved	6	3.6
Four critical organ involved	2	1.2
Total	166	100
Relation between perpetrator and victim		
Friend	44	26.8
Coworker	18	11.0
Anonymous	59	36.0
Family	43	26.2
Total	164	100

*In some cases more than one site involved

Table 3. Relationship between site of injury and Relation between perpetrator and victim with sex in victims

	Male		Female		Total	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Site of injury*						
Head	13	9.5	2	6.9	15	100
Neck	25	18.2	13	44.8	38	100
Trunk	97	70.8	22	75.9	119	100
Extremities	19	13.9	2	6.9	21	100
Total	154	79.8	39	20.2	193	100
Relation between perpetrator and victim **						
Friend	44	100	0	0	44	100
Coworker	16	94.1	1	5.9	17	100
Anonymous	51	86.4	8	13.6	59	100
Family	23	53.5	20	46.5	43	100
Total	134	82.2	29	17.8	163	100

In some cases more than one site involved

* p=0.002

** p=0.000

Table 4. Relationship between number of wounds and motivation of murder in the victims

	One wound		2-9 wound		10 and more wound		Total	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (n)	Frequency (%)	Percentage (%)	Frequency (n)	Percentage (%)
Motivation of murder *								
Robbery	11	64.7	6	35.3	0	0	17	100
Honor	3	17.6	11	64.7	3	17.6	17	100
Feud	3	9.1	26	78.8	4	12.1	33	100
Dispute	27	41.5	32	49.2	6	9.2	65	100
Non-Identified	10	33.3	17	56.7	3	10	30	100
Total	55	33.5	92	56.1	17	10.4	164	100

* p=0.004

DISCUSSION

Murders due to sharp force comprised 1.64% of all autopsies during this time. According to the population of Tehran frequency of murder cases due to sharp force was 1.4 per 100000 people. These figures compared with other countries such as Sweden [6], France [3], Malaysia [15] and also a study done in the United States in 2002 [16], in proportion to the population had higher figure and somewhat similar to presented data in some European countries such as Scotland [17] (3.44 for every 100 thousand people, compared with 2.3 for every 100 thousand people in this study). But it was lower in comparison to performed study in South Africa which homicides due to sharp forces was 35 cases per 100 thousand people annually [18].

293 homicides were recorded in the study period, 56.7% of them involved the use of sharp force. Similar results were reported in previous studies performed in Scotland (47%) [18], south India (49.4%) [19] and Hong Kong (60%) [20]. While in a study performed in Sri Lanka, sharp force caused 14% of homicides [2]. Sharp force was the second most common cause of homicides in Thailand [21] and Malaysia (25%) [22].

Presence of legal restrictions in some countries regarding transportation, production and import of certain types of knives [5-9] and also higher rates of the use of firearms in homicides in countries that carrying firearms is not illegal [17, 18] should be considered in explaining these differences.

Homicide patterns in different countries and even in different areas of a country are different, for example in the United States the most common method for homicide is using firearms while in South Asian countries like India blunt trauma and sharp force are the most common method of homicide [23, 24]. Based on a previously published study sharp force especially

knife was the most common method of homicide in Iran (53.9%) [4].

In this study, most victims were male; this is in accordance to the results of previous studies in this field [2, 3, 6, 15, 17-20]. This can be due to the high presence of men in social environments and more tension in their relationships.

In this study, 33.1% of victims had one wound on their body; this is similar to the findings of studies in Sweden and (33.9%) the United States (34%) [6, 16]. In other studies this figure was between 25-45% [9, 25].

35.3% of our cases having 10 or more wounds belonged to the "relative group" while this percent in Sweden was 50% [6]. In 78.8% of murders motivated by family issues, 2-9 wounds were seen in the victim. In addition it seems that in cases which perpetrators and the victims belonged to the "relative group" more wounds were found on the victim's body, probably due to emotional charge to the victim. A significant correlation was found between the number of wounds and gender of the victim in our study and mean of the number of wounds was higher in female victims. 69% of female murderers had familial relationship with their victims and the higher number of wound in cases which had relationship to the murderer explains this finding.

In our study 39.6% of murders caused by sharp force occurred in feud, so stricter laws on carrying knives and other sharp weapons may reduce murder rates due to sharp force because a high percentage of fatalities (60%) occurred in the immediate aftermath of conflict among people who had been carrying a knife or other sharp objects.

In this study most victims (60%) died immediately at the scene. In another study in Malaysia 86% of victims were dead when they reached the hospital [22].

In this study, a high percentage of injuries were seen on the trunk (71.7%), which was in accordance to results of similar studies in the United States and France^[3,16]. But in a study conducted in India the most common site of injuries was the head^[19].

The most common cause of death in this study was injury to a critical organ with injury to the heart and great vessels being the leading cause of death. In a study in the United States in 71% of cases heart or great vessels were involved while in India injury to the chest and abdomen was the third leading cause of death in homicide cases^[19].

CONCLUSION

Using sharp objects, especially knives was the most common method for homicide in Tehran. It appears the number of wounds can be considered as a marker of close relationship between murderer and victim. More legal restrictions on carrying knives and other sharp objects in public places and more training in this area to prevent murder caused by knives and other sharp objects is recommended.

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Ethical clearance

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Histopathological Evaluation of Liver Autopsies in a Tertiary Care Hospital: A Case Series

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ABSTRACT

A wide spectrum of Primary as well as secondary diseases can affect liver. With the rare exception of fulminant hepatic failure, liver disease is an insidious process in which clinical detection and symptoms of hepatic decompensation may occur weeks, months or many years after the onset of injury. Liver injury and healing may also occur without even clinical detection. Liver histopathology remains a mainstay in the diagnostic workup of most liver diseases. Liver autopsies are a wonderful learning tool for clinicians as well as pathologists. They help in formulating exact liver disease burden in the population. Present study was conducted between the period of 2008 - 2012 consisting of 154 cases. Fatty change liver (Steatosis) was found to be the most common disease entity followed by hepatitis.

Keywords: Fatty Change (Steatosis), Hepatitis, Cirrhosis

INTRODUCTION

The major primary diseases of the liver are viral hepatitis, alcoholic liver disease, non-alcoholic fatty liver disease (NAFLD) and hepatocellular carcinoma. In United states, the surveillance studies has documented an annual incidence of 72 per 100,000 population of newly diagnosed chronic liver diseases¹. Liver disease accounts for over 27,000 deaths per year in the United states (1.1% of all deaths)². The annual number of deaths attributable to chronic liver disease and cirrhosis is the tenth leading cause of death³. HCV is the most common cause of chronic liver disease affecting nearly 170 million people while cirrhosis is the leading cause of liver related deaths in U.S. The chief worldwide causes of cirrhosis are alcohol abuse, viral hepatitis and NASH. Light microscopic examination of liver tissue remains an essential part of the diagnostic procedure⁴. Autopsy remains an important tool to study in situ disease process, diagnose clinically undetected cases as well as incidental rare diagnoses thus enriching the medical knowledge.

MATERIALS AND METHOD

The present study is a prospective study done between the periods of 2008 – 2012 in which 154 liver autopsies received in the department of pathology were studied. A consent was taken from the ethical committee of the institute prior to the commencement of study. In majority of the cases, a part of liver specimens were received along with other viscera in 10% formalin solution and were examined grossly as well as microscopically.

In each case, the important information regarding age, sex, clinical findings, suspected cause of death and post-mortem findings were obtained from post mortem papers and police papers send routinely along with the viscera.

RESULTS

The study is conducted in the Department of pathology between the period of 2008 – 2012, in which 154 liver autopsies were studied. Out of 154 liver autopsies studied, 40.8 % showed pathology. Congestion being the normal terminal event. A wide spectrum of liver diseases were diagnosed during the study which revealed maximum cases of Fatty change liver (Steatosis) -18.18% followed by hepatitis- 12.9% along with a single case of granulomatous hepatitis- 0.64%, cirrhosis- 6.49%, secondary carcinomatous

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deposits 1.94% and a rare diagnosis of simple cyst-0.64%.

The age wise distribution of the cases in the present study was wide and maximum liver autopsies were received between 2nd- 4th decade with mean age being the 41.2 ± 18.3.

Table 1. Age wise distribution of liver autopsies

Age (years)	Total No. of Cases	Percentage of cases
0-9	05	3.24 %
10-19	05	3.24 %
20-29	35	22.72 %
30-39	29	18.83 %
40-49	37	24.02 %
50-59	14	9.09 %
60-69	15	9.74 %
70-79	08	5.19 %
80-89	05	3.24 %
90-100	01	0.65 %
Total	154	~100%

Maximum liver autopsies were received between 2nd- 4th decade.

Table 2. Distribution of cases according to histopathological diagnosis.

S. No.	Diagnosis	No. of cases	Percentage
1.	Fatty change (Steatosis)	28	18.18%
2.	Hepatitis	20	12.98%
3.	Cirrhosis	10	6.49%
4.	Secondary carcinomatous deposits	03	1.94%
5.	Granulomatous hepatitis	01	0.64%
6.	Simple cyst	01	0.64%
7.	Congestion	15	9.74%
8.	Unremarkable	56	36.36%
9.	Autolysed	20	12.98%
10.	Total	154	~100%

Fatty change liver or Steatosis (18.18%) (Fig.1) was the most common diagnosis and has specific gross findings while diagnosis was made on microscopic examination. After fatty change liver, hepatitis (12.19%) (Fig.1) was the second most common diagnosis. A single case of Granulomatous hepatitis (0.64%) was also made. Next followed the cirrhosis (6.49%) (Fig.2 &3). The diagnosis of cirrhosis was made on gross examination and was confirmed microscopically. Secondary carcinomatous deposits were seen in (1.94%) of liver autopsies.

A rare diagnosis of simple cyst (0.64%) (Fig.4) was an incidental finding. 9.74% of cases showed congestion while in 56 liver autopsies (36.36%), no remarkable pathology was found. 12.9% of liver autopsies showed partial or complete autolytic changes and major cause was lack of use of proper fixative.

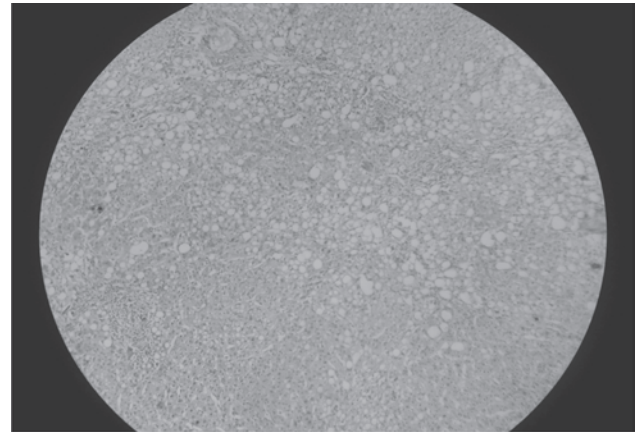


Fig. 1. Sections show steatosis and hepatitis (H&E X100)



Fig. 2. Gross appearance of cirrhosis liver

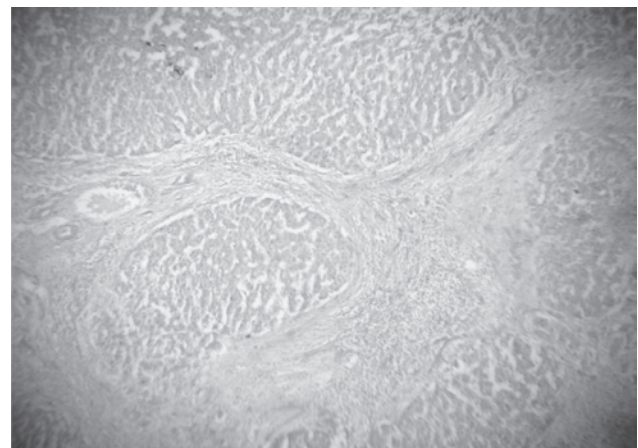


Fig. 3. Sections from liver show cirrhosis (H&E X100)

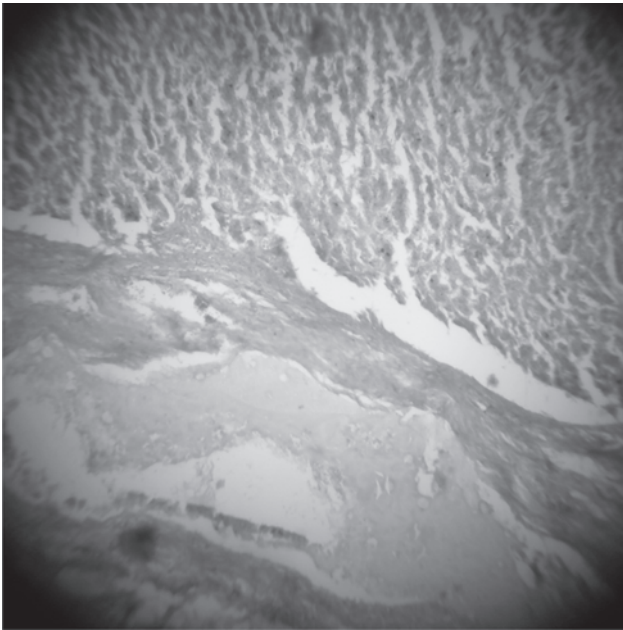


Fig. 4. Sections show liver cyst exhibiting columnar lining (H&E X100)

DISCUSSION

Steatosis of liver is the frequent histologic finding seen in routine autopsies in association with other histologic features or as the only structural abnormality. The prevalence of fatty liver is found to be between 20 to 50% in general population^{5,6}. Various conditions are associated with fatty change in the liver. Alcoholism, obesity, diabetes and hepatitis C infection are the most common causes for fatty liver disease in developed countries⁷⁻⁹.

Amarapurkar A. and Ghansar T. did a 4 year retrospective autopsy study in which a total 1,230 autopsies were screened and amongst them 195 cases showed fatty change liver. Overall prevalence of Steatosis was found to be 15.8%. Alcohol was the commonest risk factor¹⁰. The results were almost comparable to that of present study (18.18%).

After Steatosis, hepatitis (12.19%) was the most common diagnosis which was made on histopathological examination only. This was in discordance with liver autopsy study done by Bal M.S., Singh S.P., et al who found incidence of hepatitis to be 3% only¹¹.

Of the malignant tumors, metastatic are more common than the primary tumors. In the present study,

all the three cases of malignancy were secondary carcinomatous deposits (1.94%).

A rare incidental diagnosis of simple cyst (0.64%) was also made in the present study. The presence of non-parasitic cyst of the liver constitutes an uncommon and relatively benign condition. Hepatic cysts occur more frequently in females and reported in all age groups¹².

CONCLUSION

Autopsy is a magnificent learning tool in the hands of pathologists to study the histopathological spectrum of diseases which help to study the in situ disease process as well as rare incidental diagnoses. The present study comprised of 154 liver autopsies which showed a wide range of liver diseases and Steatosis (18.18%) was the most common diagnosis followed by hepatitis (12.19%), cirrhosis (6.49%), secondary carcinomatous deposits (1.94%) and a single case of granulomatous hepatitis (0.64%) and simple cyst (0.64%).

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Relationship of Stature of an Individual with Second and Fourth Digit Lengths among Medical Students Belonging to Southern Part of India

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ABSTRACT

Objectives: To find the association of Second digit length (2D), Fourth digit length (4D) and their ratio (2D:4D ratio) with stature of an individual.

Materials and Method: 2D and 4D lengths (right hand) of 141 medical students both male and female from IInd MBBS aged between 18 to 21 years were recorded using a digital vernier callipers.

Results: Statistically significant relationship was found between 2D and 4D lengths with stature in both the gender. There was no statistically significant relationship between 2D:4D ratio and stature of an individual.

Conclusion: Second digit lengths and fourth digit lengths serve as important tools of identification for determination of stature of an individual.

Keywords: Second Digit Length (2D), Fourth Digit Length (4D), 2D:4D Ratio, Stature

INTRODUCTION

Estimation of stature from the body parts has been researched all over the world and is an important tool for identification of individuals in commingled remains at various disaster sites. Krishan K et al¹ reported that anthropometric measurements of foot and its segments are valuable in estimation of stature, foot length being more accurate than foot breadth for estimation of stature. Ozaslan A et al² studied the relationship between various dimensions of the leg and stature of an individual and found that various dimensions like thigh length, trochanteric stature, lower leg length, leg length along with foot breadth and foot length can be useful in estimation of stature of an individual. In another study Ozaslan A et al³

studied the relationship between upper arm length, forearm length, hand length and stature of an individual and found that all these were useful for the purpose. Wankhede KP et al⁴ studied the applicability of various facial parameters in determination of stature of an individual and found that percutaneous facial dimensions are not good predictors of accurate stature estimation and can be used when other parameters are not available.

Second and fourth digit lengths (2D, 4D) and the ratio of them (2D:4D) has been studied worldwide for their relationship with gender and various physical and hormonal traits across different ethnicities. It has been found that the 2D:4D ratio of males and females is affected by the intrauterine testosterone and estrogen hormone exposure. The ratio is established in-utero. Lower values of 2D:4D ratio are associated with male traits (eg. taller stature), higher testosterone exposure and lower estrogen exposure. Higher values of 2D:4D ratio are associated with female traits, lower testosterone exposure and higher estrogen exposure^{5,6,7}.

A strong association of stature with 2D, 4D lengths has been found by studies in India, Finland and Nigeria^{8,9,10}.

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The present study is to find the relationship between stature and 2D, 4D lengths. We have also included the correlation of 2D:4D ratio with stature in our population.

MATERIALS AND METHOD

This study is a cross sectional descriptive study conducted at AV Medical College, Puducherry. Study participants were 141 medical UG students both male and female from IInd MBBS aged between 18 to 21 years. Only students who were born and brought up in southern states of India (Pondicherry, Tamil Nadu, Kerala, Karnataka & Andhra Pradesh) were included. Student with skeletal deformities were excluded from the study. Also, students with parents from other states of India and other countries were excluded from the study. Measured variables included 2D length, 4D length and the stature. Digit lengths were measured using digital sliding callipers (with accuracy upto 0.01 mm). The digital lengths were measured from basal crease to tip of the finger of the right hand as the right hand has strong associations with gender and fitness parameters⁹. Stature was measured from the heel to top of the vertex with the subject standing erect on barefoot, looking straight so that the Frankfurt's plane remains horizontal. Statistical analysis was done by correlation and regression using Microsoft Excel, Data analysis software.

RESULTS

Among males, the mean 2D length was 74.27 mm, the mean 4D length was 76.44 mm and the mean stature was 172.1 cm. Among females, the mean 2D length was 67.57 mm, the mean 4D length was 69.57 mm and the mean stature was 157.6 cm (Table No.1).

Table No. 1: Mean 2D length, 4D length & stature in males and females

Sex	Mean 2D length	Mean 4D length	Mean Stature
Male	74.27 mm	76.44 mm	172.1 cm
Female	67.57 mm	69.57 mm	157.6 cm

The correlation co-efficient(r) between second digit length and stature in males was 0.59 and in females was 0.57. Both were statistically significant($r > 0.2$) (Table 2). The correlation co-efficient(r) between fourth digit length and stature in males was 0.45 and in females was 0.52. Both were statistically significant($r > 0.2$) (Table 3).

Table No. 2: Correlation between digit length and stature

Digit	r (Pearson's co-efficient)	
	Male	Female
2D (Right Index finger)	0.59	0.57
4D (Right Ring finger)	0.45	0.52

Table No. 3: Co-efficient of Determination (r^2) for regression equations for reconstruction of stature from digit lengths

Digit	Males (n= 58)		Females (n=83)	
	r^2	S.E.E (cm)	r^2	S.E.E (cm)
2D (Right Index finger)	0.35	5.47	0.21	5.42
4D (Right Ring finger)	0.32	5.59	0.27	5.21

S.E.E – Standard Error of Estimate

Table No.4: Correlation between 2D:4D ratio and stature

Sex	r (Pearson's co-efficient)
Males (n=58)	0.025
Females (n=83)	0.093

The correlation co-efficient(r) between 2D:4D ratio and stature in males was 0.025 and in females was 0.093. Both were statistically not significant ($r < 0.2$) (Table 4).

DISCUSSION

This study showed significant correlation of stature of the individual with 2D, 4D (right hand) lengths in both the gender (Table no. 2 & 3). This is consistent with the study by Krishan K et al¹⁰ in a North Indian adolescent population which shows strong correlation of stature with 2D, 4D lengths. Considering the paucity of such studies in India, more studies should be conducted in different parts of India. By which, a good regression equation can be arrived which may be practically applicable in the determination of stature of an individual from severed remains.

The correlation between 2D:4D ratio (right hand) and stature was not statistically significant in both the gender (Table no.4). This finding is consistent with Ibegbu AO et al, who reported no statistically significant correlation between stature and 2D:4D ratio (right hand) in a Nigerian ethnic tribe¹¹.

SUMMARY

This study shows statistically significant correlation between right 2D, 4D lengths with stature in both the gender. Also, there is no statistically significant

association between 2D:4D ratio (right hand) and gender.

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Conflict of Interest : None

Ethical Clearance

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A Study of Protective effect of Ginger (*Zingiber Officinale*) in Normal and Carbon-Tetrachloride Induced Hepatotoxic Rats in Western U.P. India

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ABSTRACT

The current study has been conducted to investigate the affect of ginger on hepatic antioxidant enzymes system in carbon tetrachloride induced hepatotoxic rats. The first set of animals received only ginger-supplemented diet while the another set were treated with CCl₄ before maintaining them on ginger-based diets. Consumption of the experimental diets by the normal rats produced significant elevation ($p < 0.05$) in the activities of the hepatic aspartate aminotransferase and alanine aminotransferase as well as the concentration of protein and albumin. Administration of CCl₄ to the second set of rats resulted in the alteration of the liver function parameters . However, the significantly reduced ($p < 0.05$) marker enzymes such as AST, ALT, due to CCl₄ treatment were restored towards normalization on consumption of ginger diet. The biochemical parameters like total protein and albumin were also restored towards normal levels. The findings indicate that the ginger is an efficient hepatoprotective and antioxidant agent against CCl₄-induced liver toxicity.

Keywords: *Aminotransferases, Carbon tetrachloride (CCl₄), De novo synthesis Hepatotoxicity, Spices*

INTRODUCTION

Spices are a group of esoteric food adjuncts, which have been in use for thousands of years. By virtue of their pleasing colour, flavour or pungency, they can transform our food into attractive and appetizing meal. In addition to these organoleptic properties, few spices are also known to possess several medicinal properties¹ and are effectively used in the indigenous systems of medicine. In the past three decades, it has been experimentally documented that several common spices can also exert beneficial effects in health and diseases². Examples of these spices include ginger, pepper, turmeric and cardamom. Ginger (*Zingiber officinale*) belongs to Zingiberaceae family. The part of the plant used is rhizome. The plant produces an orchid-like flower with petals that are greenish yellow streaked with purple colour. Ginger is cultivated in areas of abundant rainfall. Even though it is native to

southern Asia, ginger is cultivated in tropical areas such as Jamaica, China, Nigeria and Haiti. It is an important spice crop in India. [3]. Ginger is an indispensable component of curry powder, sauces, ginger bread and ginger flavoured carbonated drinks. It is also used in some products like biscuits, pickles and confectionaries. It is extensively used in preparation of dietaries for its aroma and flavour. Dry ginger is used in the manufacture of oil, oleoresin, essence and processed meat^{4,5}. The polyhalogenated compound CCl₄ is a well-known hepatotoxin and exposure to this chemical is known to result in hepatocellular necrosis in rodents. Depending on the dose of exposure to CCl₄ and prior exposure to other chemicals, extensive liver damage results in total hepatic failure and animal lethality⁹. The liver is an important organ which is actively involved in many metabolic functions and is the frequent target for a number of toxicants⁶. Hepatic damage is associated with distortion of these metabolic functions⁷. Liver disease is still a worldwide health problem. Unfortunately, conventional or synthetic drugs used in the treatment of liver diseases are inadequate and sometimes can have serious side effects⁸. In view of severe undesirable side effects of synthetic agents, there is growing need to utilise abundant plant resources available and to evaluate scientific basis for the medicinal plants that are claimed to possess

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hepatoprotective activity. Consequent upon the wide usage of this plant (ginger) in food preparations, the aim of this study is to evaluate the effect of consumption of ginger-supplemented diet on selected tissues in normal and CCl₄-induced hepatotoxic rats.

MATERIAL AND METHOD

This study was conducted in Departments of Pharmacology and Medicine in collaboration with Department of Biochemistry in Saraswathi Institute of Medical Sciences, Hapur, U.P. India. The present study was started after obtaining ethical clearance from the institutional ethical committee.

Sample preparation

Ginger was grounded and sieved to a particle size of 250 μ m. The rat chow – ginger concentrate (2.5%, 5% and 10%w/w of ginger in rat chow) was prepared by mixing normal chow and ginger which were stored in a desiccators.

Experimental animals

Adult male albino rats of Wistar strain (190 \pm 10 g) were purchased. They were housed (5 per cent) in animal cages under standard conditions of temperature, relative humidity 12 h light and 12 h dark cycle and given food and water ad libitum.

PROTOCOL

The animals were divided into two groups of twenty animals each. Both groups were then subdivided into 4 groups consisting of five animals each. Animals in group 1 were treated as follows for 4 weeks:

Group 1A: received normal rat chow and water (control)

Group 1B: received normal rat chow supplemented with 2.5% ginger

Group 1C: received normal rat chow supplemented with 5% ginger

Group 1D: received normal rat chow supplemented with 10% ginger

Group 2 animals were also assigned into 4 groups and treated as follows for 7 days:

Group 2A: received olive oil and normal rat chow (control)

Group 2B: received CCl₄ as a 50% solution in olive oil (1ml/kg) on the first day and normal rat chow

Group 2C: received CCl₄ and fed on normal rat chow supplemented with 2.5% ginger.

Group 2D: received CCl₄ and fed on normal rat chow supplemented with 5% ginger

Sample collection and preparation

At the end of the experiment, rats were anaesthetized in slight chloroform and blood samples collected into clean, dry heparinised centrifuge tubes by lateral tail vein.

Biochemical studies

The determination of albumin concentration was done using the method described by¹¹ and total protein concentration was estimated using the Biuret method¹². The activities of aminotransferases (ALT and AST) were assayed basically by the method of¹³. All measurements were done using Spectronic 21 digital spectrophotometer (Bausch and Lomb, N.Y.).

Statistical analysis

The statistical analysis was carried out using analysis of variance (ANOVA) followed by Dunnet's 't' test. P values <0.05 were considered as significant¹⁴.

RESULTS

Table 1 shows that hepatic alanine aminotransferase (ALT) and aspartate aminotransferase (AST) of treated animals significantly (p<0.05) increased compared to the control (Table 1). The levels of proteins and albumin in the treated animals also increased significantly (p<0.05) compared to the control group.

Table 1. Activities of aminotransferases and levels of albumin and protein in the liver of Rats fed ginger supplemented diet

Parameters & Unit	Group 1A	Group 1B	Group 1C	Group 1D
AST (U/L)	29.23 \pm 4.37	45.19 \pm 5.39*	53.02 \pm 2.69*	56.58 \pm 4.35*
ALT (U/L)	30.29 \pm 3.17	51.16 \pm 5.48*	56.38 \pm 7.15*	68.16 \pm 5.09*
Albumin (g/L)	2.59 \pm 0.18	3.59 \pm 0.59	8.15 \pm 0.29*	7.69 \pm 0.29*
Total Protein (g/L)	2.79 \pm 0.3840	5.22 \pm 0.28*	7.59 \pm 0.89*	6.79 \pm 0.19*

Values are mean \pm SEM of 5 determinations. Values with different superscripts are significantly different at

P<0.05 (*p < 0.05).

Table 2 shows that treatment of rats with single dose of CCl₄ (0.5 ml/kg body weight) after 7 days led to the development of severe hepatic injury in the rats that were intoxicated with CCl₄ but not treated with ginger based diet (group 2B) compared to the control group and the groups (2C and 2D) that were treated with 2.5% and 5% ginger-based diet respectively. There was a marked and highly significant ($P < 0.05$) decrease in the concentration of the total protein (4.87) in the CCl₄-treated when compared to the control (7.80). However, ginger improved these values in group 2C (7.67) and

2D (8.10) respectively. Albumin concentration also witnessed significant reduction ($p < 0.05$) in the CCl₄-treated rats (1.83) as against the control (3.67), group 2C (3.57) and group 2D (3.40). The activity of AST decreased significantly ($p < 0.05$) in group 2B animals (24.90) when compared to the control (51.77). Attempts were made by the ginger-based diet to restore this activity in group 2C and 2D but were not complete. However, the reduction ($p < 0.05$) in the activity of the ALT in the CCl₄-treated rats (35.00) was totally recovered in the group 2D animals.

Table 2. Effect of ginger-based diet on the hepatic total protein, albumin and some transaminases in CCl₄ treated rats Parameters Group 2A, Group 2B, Group 2C, Group 2D

Parameters & Unit	Group 2A	Group 2B	Group 2C	Group 2D
AST (U/L)	49.39 ± 1.39	25.01 ± 0.89*	39.01 ± 1.28*	41.12 ± 1.23*
ALT (U/L)	78.01 ± 5.09	34.91 ± 2.29*	54.10 ± 2.77*	82.33 ± 2.53
Albumin (g/L)	3.67 ± 0.12	1.83 ± 0.09*	3.61 ± 0.08	3.39 ± 0.19
Total Protein (g/L)	7.68 ± 0.81	4.91 ± 0.58*	7.71 ± 0.51	8.17 ± 0.49

Values are mean ± SEM of 5 determinations. Values with different superscripts are significantly different at

$P < 0.05$ (* $p < 0.05$).

DISCUSSION

Study on normal rats

Measurement of the activities of marker enzymes, like AST and ALT can be used in the assessment of liver function^{15,16}. Aspartate and alanine aminotransferases are normally localized within the cells of the liver, heart, kidney, muscles and other organs. The enzymes are of major importance in assessing and monitoring liver cytolysis¹⁷. Their presence in the serum may give information on organ dysfunction¹⁸. The general increase in the activity of liver AST and ALT (Table 1) following the consumption of ginger diet could be due to de novo synthesis of the enzyme molecules or an adaptation by the liver to the presence of the ginger leading to activity higher than the control¹⁹. Due to the fact that the results obtained for the albumin and liver protein concentrations followed the same trend (Table 1), it thus implicates the same mechanism by which the extract exerts its effect on these three parameters. This shows that the consumption of the ginger diet by the rats may be increasing the rate of protein synthesis leading to the higher concentration of albumin and protein in the liver.

Study on CCl₄-induced hepatotoxic rats

It is well established that CCl₄ induces

hepatotoxicity by metabolic activation; therefore it selectively causes toxicity in liver cells maintaining semi-normal metabolic function²⁰. CCl₄ is bio-transformed by the cytochrome P450 system in the endoplasmic reticulum to produce trichloromethyl free radical ($\bullet\text{CCl}_3$). Trichloromethyl free radical when combined with cellular lipids and proteins in the presence of oxygen form trichloromethyl peroxy radical, which may attack lipids on the membrane of endoplasmic reticulum faster than trichloromethyl free radical. Thus, trichloromethyl peroxy free radical leads to elicit lipid peroxidation, the destruction of Ca²⁺ homeostasis, and finally, results in cell death²¹. The efficacy of any hepatoprotective drug is essentially dependent on its capacity of either reducing the harmful effects or maintaining the normal physiologic function which has been disturbed by hepatotoxic agents. Hypoalbuminemia and decline in total protein (TP) content can be deemed as a useful index of severity of hepatocellular damage. The lowered levels of TP and Albumin recorded in the liver of CCl₄-treated rats reveal the severity of hepatopathy²². In the present study, TP and Albumin concentrations were very low in rats treated with CCl₄. When liver cell plasma membrane is damaged, a variety of enzymes normally located in the cytosol are released into the blood stream. The reduced activities of ALT and AST observed in CCl₄-treated rats in this study

corresponded to the extensive liver damage induced by toxin. The tendency of these enzymes to return towards a near normal level in groups 2C and 2D is a clear manifestation of antihepatotoxic effect of ginger. Carbon-tetrachloride induced adverse changes were evident from decreased hepatic antioxidant enzyme activities. In the present study, upon ginger supplementation the above enzymes were restored to normal in the liver. In conclusion, the ginger-supplemented diet afforded protection against CCl₄ induced liver damage. Possible mechanism that may be responsible for the protection of CCl₄ induced liver damage by ginger may be due to its free radical scavenging activity thereby intercepting those radicals involved in CCl₄ metabolism by microsomal enzymes. Thus, from the foregoing findings, it shows that ginger is safe for consumption at the doses tested and offers protection to CCl₄-induced liver damage. This protective role may be due to the mineral and antioxidant chemicals present in it.

CONCLUSION

The aim of this study was to investigate the effect of ginger on carbon tetrachloride (CCl₄)-induced hepatotoxic rats. The results of this study suggest that the consumption of ginger-based diet maintains the integrity of the liver and protects it against damage caused by carbon-tetrachloride induced hepatotoxicity.

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Comparative Study of Angles between Coronal, Sagittal and Lambdoid Sutures of North and South Indian Human Crania

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ABSTRACT

1189 non-pathological dried adult crania were studied from north and South India. The angles were measured by protractor after tracing on butter paper. In the study of sexual dimorphism the angle between sagittal and lambdoid suture was significant ($P < 0.05$) on left side and the angle between two limbs of lambdoid suture was significant ($P < 0.01$). In the regional comparison of Male crania of NI with male crania of SI. (1) The angle between coronal suture shown significant P value ($P < 0.01$). (2) Angle between sagittal and lambdoid suture left side was highly significant in P value ($P < 0.01$). (3) The angle between two limbs of lambdoid suture shown significant P value ($P < 0.01$).

In the regional study of female crania of SI and NI was compared (a) Shown highly significant P value ($P < 0.01$) in angle of coronal suture. (b) Angle between sagittal and lambdoid suture on left side shows significant P value ($P < 0.03$). (c) Angle between two limbs of lambdoid suture of female crania of north and SI shown significant P value ($P < 0.01$). (a) The logistic regression equation study of angle between two limbs of lambdoid suture with cranial index classified 73.8% of crania of NI and 67% in SI. (b) In the regional comparison of male crania of NI and SI classified 71.7% and female crania of NI and SI classified 75.1%. This study could not be compared with previous studies as no data is available in English literature but these findings are quite helpful to the anatomist, anthropologist and medico-legal expert.

Keywords: Bregma, Lambda, Butter paper, Protractor, Sketch Pen, NI = North India, SI = South India

INTRODUCTION

The angles are formed in the junction of frontal, parietal and occipital bones but carry out different important functions like facilitate passage through birth canal, in infancy these angles prevent the separation of bones and till adulthood accommodate the expanding brain by shearing the mechanical stress⁽¹⁾.

It becomes a challenge to medico-legal expert to name the sex and race of region when calvarias are

brought to him because morph-metrical values of dermal bones and their joints are quite uncertain⁽²⁾. More over sutural joints and their angles are governed by developing bones⁽³⁾. Hence attempt is made to study the sexual, regional (racial) to find out the variations in degrees of angles.

MATERIAL AND METHOD

Total 1189 crania of known sex were studied comprising of NI and SI. The study was carried out by multistage sampling status i.e. by lottery method in which four states are chosen from SI and four states from NI for comparison i.e. four colleges are selected from every state. Hence total colleges are 32.

The coronal sagittal and lambdoid sutures are traced by black sketch pen. Transparent butter papers fixed on it with the help of rubber band and sutures and sutural angles are traced by micro tipped pen.

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The angles traced on butter paper are measured by protractor.

Statistical analysis was done by Z test for comparison. Logistic regression equation study is carried out by SPSS 2007 software.

OBSERVATION OR RESULTS

Table No. 1 shows the angle formed between sagittal and lambdoid suture SI male and female crania on left side shows significant P value ($P < 0.01$). SI female crania left side was $90.67^{\circ} \pm 1.71$ male crania was $91.60^{\circ} \pm 0.5$.

Table No. 2 shows sexual dimorphism of angle between two limbs of lambdoid suture in the NI & SI crania the female of NI crania had mean value of $123.09^{\circ} \pm 1.67$ and male crania mean value was $120.57^{\circ} \pm 0.5$ and difference was statistically highly significant ($P < 0.01$).

Table No. 3 shows in the regional study of male crania of NI and SI is compared. The angle of coronal suture the mean value of SI male crania was $136.44^{\circ} \pm 0.57$ and female crania was $141.18^{\circ} \pm 1.09$ and the difference was highly significant ($P < 0.01$).

Table No. 4 shows comparative study of the angle between sagittal and lambdoid suture on left side value of SI male crania was $90.67^{\circ} \pm 0.5$ and NI Male crania was $91.67^{\circ} \pm 1.39$ and the difference was significant ($P < 0.03$).

Table No. 5 shows comparative study of angle between two halves of lambdoid suture in male crania of south and NI. The SI cranial mean value was $115.4^{\circ} \pm 1.87$ and NI male cranial was $120.57^{\circ} \pm 2.33$ the difference was highly significant ($P < 0.01$).

Table No. 6 shows comparative study of angle of coronal suture of female crania of south and NI. The mean value of SI female crania was $139.39^{\circ} \pm 1.49$ and north male crania was $142.92^{\circ} \pm 2.13$ and the difference was highly significant ($P < 0.01$).

Table No. 7 shows comparative study of angle between sagittal and lambdoid suture of female crania of south and NI. The mean value angle between sagittal lambdoid of south female crania on left side was $90.67^{\circ} \pm 1.71$ and north female crania was $91.67^{\circ} \pm 1.19$ difference was significant.

Table No 8 shows comparative study of angle between two limbs of lambdoid suture in female

crania. The mean value of SI female crania was $116.19^{\circ} \pm 2.51$ and NI female was $123.38^{\circ} \pm 1.67$ and the difference was highly significant ($P < 0.01$).

Table No. 9 Shows logistic regression equation of sexual dimorphism of NI Degree of Angle between two limbs of lambdoid suture of correct classification of NI crania was 73.8% and in SI crania it was 67%.

Table No. 10 Shows logistic regression equation of regional comparison of Male cranial lambdoid suture angle of NI and SI crania can be classified up to 71.7% while female crania of North and SI can be classified up to 75.1%.

DISCUSSION AND SUMMARY

The angle between sagittal and lambdoid suture on the left side. The mean value of SI female was $90.67^{\circ} \pm 1.71$ and male was $91.60^{\circ} \pm 0.5$ and the difference was significant ($P < 0.05$) (Table No.1).

This significant P Value could be due to altered sutural position by deviation of bone growth⁽⁴⁾.

In NI crania the angle between two limbs of lambdoid suture was wider in female than male $123.09^{\circ} \pm 1.67$ and $120.57^{\circ} \pm 0.5$. Respectively which were statistically significant ($P < 0.01$) (Table No. 2) (Fig. 1 & 2 of North and SI).

In present study female crania of NI had shown more occipital flattening than male crania. It could be due to nutritional and environmental factors because bone is a dynamic tissue that responds throughout life to variety of environmental stimuli and biomechanical stress. Hence significance of lambdoid angle in NI crania was to cope with environmental stimuli and causal factor to overcome biomechanical stress. More degree of lambdoid angle in female crania was observed by many workers^{(5) (6)}.

The mean angle of coronal suture of NI male crania was $141.15^{\circ} \pm 1.09$ and in SI male crania was $136.44^{\circ} \pm 0.57$ and the differences was statistically highly significant ($P < 0.01$) but the angle between coronal and sagittal suture was statistically insignificant on both sides (in the Table No.3).

The synchondrosis of basiocciput was situated in such a position so as to influence both coronal and lambdoid sutures, thereby permitting the growth of cranial vault in antero posterior direction to give complete space for growing brain hence these sutures regulate the length and breadth of the cranial vault at

the expenses of these angles⁽⁷⁾.

The mean value of angle on left side in SI male crania was 90.67 ± 0.53 and NI male crania was 91.67 ± 1.39 and the difference was highly significant ($P < 0.01$) (as given in the Table No.4).

The variation on left side of sagittal suture of NI male crania could be under more stretch of muscular forces than SI male crania because "sutural morphology is the response to extrinsic factor"⁽⁸⁾.

The mean angle in SI male crania was found to be 115.4 ± 1.87 while mean angle in NI male crania was found to be 120.57 ± 2.33 . The difference was highly significant ($P < 0.01$) (as shown in the Table No. 5). It shown wider lambdoid sutural angle in NI male crania. The reason could be NI male crania was under more stress (external or internal) than SI male crania because intra cranial stress intracranial volume intra cranial pressure decide the morphology of sutures⁽⁹⁾.

Female crania of SI and NI the angle of coronal suture is compared Table.6, mean value of coronal suture angle the mean of SI female crania was 139.39 ± 1.49 and NI female crania was 142.49 ± 2.13 .

The probable reason for significant P value for angle of coronal suture could be more Bregmatic inclination⁽¹⁰⁾ or Bregma was placed at higher level. This indicates that, NI female crania have more Bregmatic inclination as compared to SI female crania. This significant finding could not be compared with previous studies as no data was found in English literature

Similarly the angle between sagittal and lambdoid suture of female crania on left side also showed significant value. (Table No.7). Where the mean value of SI female crania was 90.67 ± 1.71 while in NI female crania the mean value was 91.67 ± 1.19 and the difference was highly significant ($P < 0.03$).

The mean angle of SI female cranial lambdoid angle was 116.0 ± 2.51 while mean value for NI female cranial lambdoid angle was 123.38 ± 1.67 and the difference was statistically highly significant ($P < 0.01$) Table 8.

Degree of Bregma is lesser than degree of lambdoid angle because parietal bone grows slower than occipital bone .As basisphenoid and basiocciput were the most precocious extending and wide NI angle posteriorly. The sphenoid was the last bone to reach the maturity. This growth pattern expresses somatic growth is faster than neural development to adapt erect posture in the Homo sapiens. Apart from this logistic regression equation of sexual dimorphism of NI lambdoid angle classifies 73.8% and SI lambdoid angle regression equation classified up to 67% of the crania (Table No. 9). In the regional comparison of male cranial lambdoid sutural angle of North and SI crania classified up to 71.7% while Female cranial lambdoid sutural angle of North and SI crania classified up to 75.1%(Table 10). This is an entire new parameter to classify the crania sexually and regionally because Books and Literatures are always cannot be relied upon.

These above mentioned significant inferences suggest that, geographical diversity plays vital role in the craniometry than genetic factors moreover nutritional factors, dietary habits also play contributory roles. These findings could not be compared with the previous studies as no data was found in English literature.

These variations could be due to racial history because anthropologist believed that every race of mankind migrated to India for survival in olden Days⁽¹¹⁾Hence these variations might be representing their ancestors.

CONCLUSION

In the present study of angles between cranial sutures the significant values of the sexual dimorphism and regional comparison provide an entire new parameter for anthropologist, anatomist and medico-legal expert though these cranial sutures are temporary joints and obliterate at certain age but these significant values warrant for further embryological, genetics, nutritional and environmental studies to throw more light upon these values.

Table No. 1. Sexual Dimorphism of angle between sagittal and lambdoid suture (in degrees) of NI & SI.

Name of the place	Side	Mean	Standard deviation	No. of Crania Studied	95% Confidence Interval	P Value	Conclusion
SIFemale	Left	90.6783	5.24	143	(89.81,91.52)	$P < 0.01$	Significant
SIMale	Left	91.6035	5.12	285	(91.34,91.86)		

Table No. 2. Sexual Dimorphism of angle between the two Limbs of lambdoid suture in the NI & SI Crania (in degrees)

Place	Mean Value	Standard deviation	No. of Crania Studied	95% Confidence Interval	P Value	Conclusion
North India F	123.0916	7.21	251	(122.75,123.42)	P<0.01	Highly Significant
North India M	120.5725	7.69	510	(120.32,120.81)		

F: Female M: Male

Table No. 3. Study of angle between Coronal suture, and coronal and sagittal suture in Male crania of NI & SI

Male crania		SI (N=285)			NI (N=510)			Pvalue	Conclusion
		Mean	SD	95% Confidence Interval	Mean	SD	95% Confidence Interval		
Angle of Coronal Suture	A c s	136.44	6.16	(135.72,137.15)	141.15	6.27	(140.60,141.69)	P<0.01	Highly Significant

ACS= Angle formed in coronal suture,

Table No. 4. Comparative Study of Angle between Sagittal and lambdoid suture in Male Crania of NI & SI

Male crania			SI (N=285)			NI (N=510)			Pvalue	Conclusion
			Mean	SD	95% Confidence Interval	Mean	SD	95% Confidence Interval		
a)	Angle between Sagittal and Lambdoid suture	Left	90.67	5.24	(90.40,90.93)	91.67	5.14	(91.47,92.86)	P<0.03	Significant

Table No. 5. Comparative Study of angle between lambdoid suture in Male Crania of NI & SI

Male crania		SI (N=285)			NI (N=510)			Pvalue	Conclusion
		Mean	SD	95% Confidence	Mean	SD	95% Confidence		
a)	Angle of Coronal Suture & Angle between Sagittal Suture	115.4	64.68	(114.47,116.34)	120.57	59.26	(119.90,121.23)	P<0.01	Highly Significant

Table No. 6. Comparative Study of angle of coronal suture and angle between coronal sagittal suture in "Female Crania" of NI & SI

Male crania		SI (N=285)			NI (N=510)			Pvalue	Conclusion
		Mean	SD	95% Confidence	Mean	SD	95% Confidence		
Angle of Coronal Suture Significant	ACS	139.39	26.83	(138.54,140.23)	142.49	21.00	(141.92,143.05)	P<0.01	Highly

ACS= Angle formed in coronal suture,

Table No. 7. Comparative Study of angle between Sagittal and lambdoid suture in "female crania" of NI and SI

Female crania		SI (N=143)			NI (N=251)			Pvalue	Conclusion
		Mean	SD	95% Confidence	Mean	SD	95% Confidence		
Angle between Sagittal & Lambdoid Suture	Left	90.67	5.24	(89.81,91.52)	91.67	5.15	(91.07,92.26)	P<0.03	Significant

Table No 8. Comparative Study of angle between lambdoid suture in "female crania" of NI & SI

Female crania		SI (N=285)			NI (N=510)			Pvalue	Conclusion
		Mean	SD	95% Confidence	Mean	SD	95% Confidence		
a)	Angle of lambdoid suture	116.19	7.63	(114.93,117.44)	123.38	6.78	(122.54,124.21)	P<0.01	Highly Significant

Table No. 9. Logistic regression of sexual dimorphism of NI cranial angle between two limbs of lambdoid suture $Y = b^1 \cdot x^1 + b^2 \cdot x^2 + c$

A

Group (I+1)	Cranial Index (x^1)	Angle of Lambdoid suture (x^2)	Constant (c)	% of correct classification
Coefficient (b)	-0.622	-0.046	50.586	73.8

B

South India

Group (I+1)	Cranial Index (x^1)	Angle of Lambdoid suture (x^2)	Constant (c)	% of correct classification
Coefficient (b)	-0.659	-0.002	47.683	67

Table No 10. Logistic regression of regional comparison of Male crania of North and SI angle between two limbs of lambdoid suture $Y = b^1 \cdot x^1 + b^2 \cdot x^2 + c$

A

Group (I+1)	Cranial Index (x^1)	Angle of Lambdoid suture (x^2)	Constant (c)	% of correct classification
Coefficient (b)	-0.133	-0.077	-1.134	71.7

B

Female Crania of SI & NI

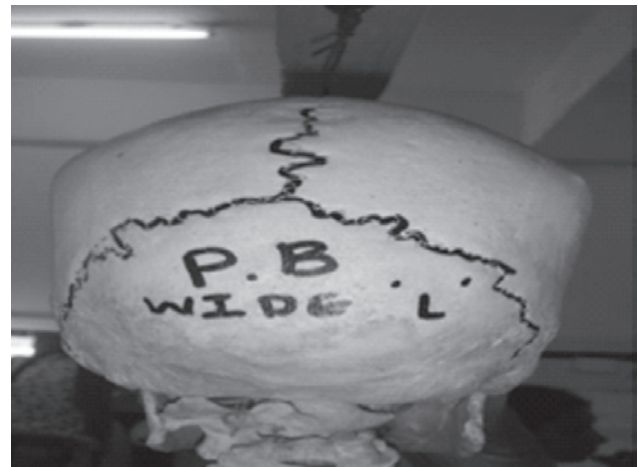
Group (I+1)	Cranial Index (x^1)	Angle of Lambdoid suture (x^2)	Constant (c)	% of correct classification
Coefficient (b)	-0.135	-0.143	-26.080	75.1



Photograph showing the narrow lambdoid angle in North India male crania



Photograph showing in cadence of Narrow lambdoid angle in South India male crania



Photograph showing Wide Lambdoid Angle in North Indian female crania



Photograph showing Wide lambdoid angle in North Indian female crania

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Toxic effects of Carbaryl on the Vasculature of Liver in Adult Albino Rat, *Rattus norvegicus*

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ABSTRACT

The excessive use of pesticides and insecticides on agricultural crops, poultry, livestock, home and garden pest control has become one of the major health concerns as humans are exposed to these environment pollutants constantly. Carbaryl, a 1-Naphthyl N-methyl carbamate insecticide has been one of the most commonly and extensively used insecticide in the recent years due to its broad spectrum activity and short residual life on treated crops. However, studies have revealed their presence in the food and fruit products available in the market. Since liver plays an important role in the first pass metabolism of carbaryl, which has seen to cause various disturbances in the liver enzymes, the present work was conducted to study the morphological and morphometric changes in the vasculature of the liver produced by the insecticide carbaryl. Inbred adult Wistar albino rats (150-200gm) were injected with 200mg/kg body weight of carbaryl intraperitoneally, five days a week for thirty days. Controls were maintained. The animals were group housed with ad libitum access to food and water. The animals were sacrificed within twenty four hours of the last injection, liver was processed and sections (7 μ) cut and stained. Microscopic examination revealed a statistically significant dilatation of the hepatic vasculature along with various histomorphological changes in the liver parenchyma.

Keywords: Carbaryl, Carbamates, Hepatocytes, Hepatic vasculature, Liver

INTRODUCTION

Carbaryl is a synthetic colorless, odorless white crystal, chemically 1-naphthyl N-methyl carbamate insecticide, commercially sold with the brand name Sevin. It is a cholinesterase inhibitor and classified as a likely human carcinogen by the U.S Environmental Protection Agency (EPA)¹⁵. Carbaryl has been one of the most commonly and extensively used insecticide in the recent years being most widely used in commercial agriculture on crops, citrus fruits, apple and grape cultures, poultry, livestock, and home garden pest control. It is a matter of concern that many of the pesticide residues have been detected in the food and fruit products that are available in the market which we consume daily. Carbaryl was the most frequently (58.6%) detected N-methyl carbamate in the juice samples studied (Rawn et al, 2004)⁷. Humans are exposed either directly or indirectly to this pesticide causing various toxicities (M. Sittig, 1985; US Environmental Protection Agency, 1984)^{3,15}. Occupational hazards like increase in the incidence of sperm shape abnormality and decreased sperm motility has been documented by Wyrobeck et al (1981)¹⁶ and Meeker et al (2004)⁵. Congenital

malformations and teratogenesis were observed in chicken embryos and beagle dogs (Marliac et al, 1965; Smalley et al, 1968; Robens, 1969)^{4,10,6}. Necrotic changes in testes and ovaries (Sternberg and Otovan, 1971)¹² have been observed. Inflammatory infiltrations in the heart and the lungs have been reported by Toœ-Luty et al (2001)¹⁴, while D.Bigot Lassere et al (2003)¹ observed tumors in the heterozygous P53 knockout mice after oral administration of carbaryl. Sharma (1999)⁸ recorded an increase in the activities of transaminases and acid phosphatases, while Tripathi and Singh (2003)¹³, reported a significant inhibition of the liver enzymes. Both the enzyme studies suggested a possibility of hepatocellular damage.

Since liver plays a significant role in the metabolism of carbaryl, the present experimental study was undertaken to study the effect of this pesticide on the hepatic vasculature.

MATERIALS AND METHOD

Inbred adult Wistar albino rats (150-200gm) were taken from the animal house of University College of Medical Sciences & G.T.B Hospital after clearance from

the Ethical Committee and were divided into two groups. Group-I served as the experiment and Group-II as the control. The animals were group housed with ad libitum access to food and water. The body weights of the animals were recorded before the onset of the experiment and prior to their sacrifice. Group-I rats received 200mg/kg body weight of carbaryl intraperitoneally, five days a week for thirty days. The control animals received equal quantity of the vehicle by the same route. The animals were sacrificed within twenty four hours of the last injection by perfusion with formal saline. The liver was dissected out and processed. Sections (7µ) were cut and stained with haematoxylin and eosin stain. Liver was examined grossly and under light microscopy for histomorphological changes. Histomorphometry of the hepatic vasculature was done, data tabulated and statistically analyzed.

OBSERVATION AND RESULTS

On gross examination, the liver in experimental rat was found to be encapsulated. At sites, areas of fatty tissue adherence and numerous spots of sub-capsular hemorrhage were seen. Microscopically, these hemorrhagic areas showed large blood filled spaces which replaced the normal liver parenchyma. The hemorrhagic blood was seen to extend into the neighboring dilated sinusoids (Fig1.). The central veins, sinusoids, vessels at the portal triads as well as the bile canaliculi between the hepatocytes appeared dilated (Fig3. & Fig4.). There was sub-endothelial edema of the blood vessels (Fig4.). In the experimental

rats, the mean long diameter of the central veins was found to be 119.22±47.99 microns and the mean short diameters was found to be 70.67±30.55 microns, whereas in the controls it was found to be 73.72±31.61 and 52.10±22.49 microns, respectively (Table1.). There was a statistical significant increase (P<0.001) in the mean diameters of the central vein in the experimental rat (Table1.). The sinusoids in the experimental animals had a mean long diameter of 93.37±39.80 microns whereas in the control rats it was 81.27±39.71microns (Table2.). The mean maximum and minimum short diameter was 13.82±4.58 and 6.15±2.52 microns in the experimental rats and 8.07±2.43 and 3.25±1.27 microns, respectively in the controls (Table2.). The mean diameters of the sinusoids in the experimental rats were significantly increased (P<0.001) as compared to that of the control (Table2.). The hepatocytes appeared shrunken with a highly eosinophilic cytoplasm and a pyknotic nucleus, surrounded with a clear halo which is known as councilman body. Few hepatocytes appeared swollen and empty with lightly stained nucleus and indistinct cell boundaries called ballooning of cells (Fig3 & 4). There were aggregations of inflammatory cells such as macrophages and lymphocytes surrounding the blood vessels (Fig4.). The liver hepatocytic plates appeared disheveled and in most areas the hepatocytes appeared to be singly placed (Fig 3 & 4). Some of the hepatocytes away from the blood vessels showed an increased cytoplasmic basophilia and a large euchromatic nucleus with a prominent nucleolus, while a few were binucleated (Fig 4). The kupffer cells also appeared swollen and distended.

Table 1: Comparison of the parameters of central veins in experimental and control rats.

Parameters	Groups	Mean	SD (µ)*	p-value (on way ANOVA)	Significance (Tukey's test at 5% level)
Long	Experimental	119.22	47.99	<0.001*	Difference between the experimental and control group was statistically significant.
Diameter	Control	73.72	31.61	<0.001*	
Short	Experimental	70.67	30.55	<0.001*	
Diameter	Control	52.10	22.49	<0.001*	

µ* micron

<0.001* statistically significant.

Table 2: Mean diameter (microns) of the sinusoids in the experimental and control rats:

Groups	Long diameter (µ)*	Short Diameter (µ)*	
		Maximum	Minimum
Experimental	93.37±39.80	13.82±4.58	6.15±2.52
Control	81.27±39.71	8.07±2.43	3.25±1.27
p-value	<0.001**	<0.001**	<0.001**

µ* micron

<0.001** statistically significant.

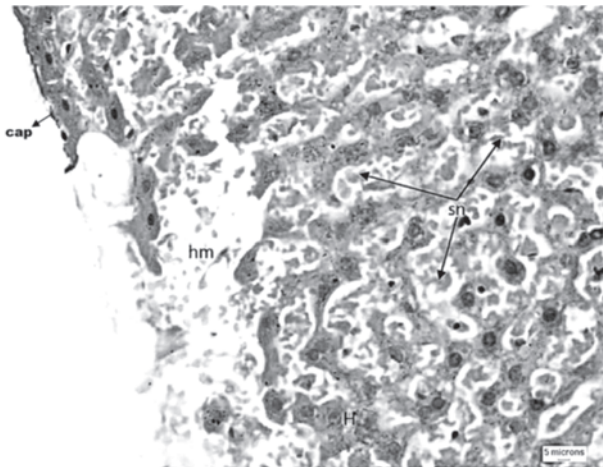


Fig1. Photomicrograph of the transverse section of the experimental rat liver showing liver capsule(cap), areas of sub-capsular hemorrhage(hm) and the extension of hemorrhagic blood into the neighboring sinusoids(sn) which appear dilated. Note the liver parenchyma has been replaced by the hematoma. (H & E 200X).

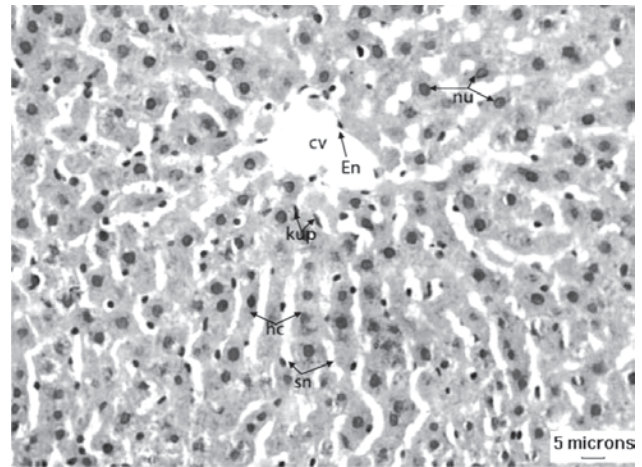


Fig2. Photomicrograph of the transverse section of the control rat liver showing the central vein(cv), lined by endothelium(En) and surrounded by hepatocytic cords(hc) and sinusoids(sn) which appear to be radiating from the central vein. The hepatocytes with their nuclei(nu) and the kupffer cells(kup) can also be seen. (H & E 200X).

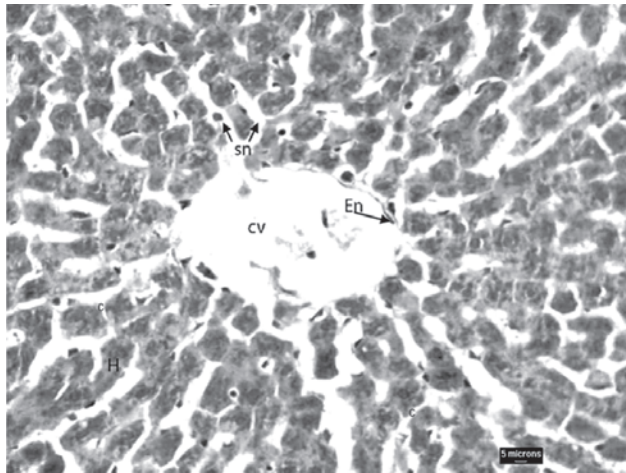


Fig3. Photomicrograph of the transverse section of the experimental rat liver showing dilatation of the sinusoids(sn), bile canaliculi(c) and central vein(cv) which is lined with endothelium(En), with disheveled pattern of the surrounding hepatocytic cords(H) which appeared more darkly stained compared to that of the control at same magnification. (H & E 200X).

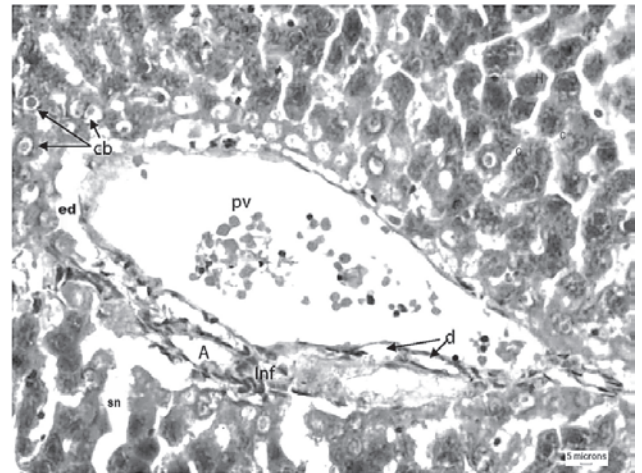


Fig4. Photomicrograph of the transverse section of the experimental rat liver showing a dilated branch of the portal vein(pv) with sub-endothelial edema (ed) and surrounded by degenerated hepatocytes known as councilman bodies (cb) and inflammatory infiltrate(Inf). Branches of hepatic artery(A) and bile ductules(d) can also be seen. The sinusoids(sn) and bile canaliculi(c) appear dilated. (H & E 200X).

DISCUSSION

In the present study, carbaryl was seen to cause numerous spots of sub-capsular hemorrhage which had replaced the normal parenchymal tissue. This could probably be due to vascular destruction caused by the insecticide carbaryl, which led to the formation of hematoma in the liver parenchyma. Histomorphometry revealed a statistically significant dilatation of the central veins and the sinusoids along with dilatation of the blood vessels in the portal triads, probably suggestive of an occlusive vasculopathy. This could be due to destruction and degenerative changes

of the vascular epithelium leading to vascular obstruction. There was sub-endothelial tissue oedema of the central veins and portal veins and collection of inflammatory cells around the portal triads, which is indicative of inflammatory reaction post exposure to carbaryl. Similar findings were observed by Smalley et al (1969)¹¹ who noted oedema and rupture of myelinated tracts in cerebellum, brainstem and upper spinal cord on carbaryl administration in pigs. Meanwhile, Toø-Luty et al (2001)¹⁴ demonstrated swelling of the endothelium of the capillary blood vessels and inflammatory infiltrations in the lungs and

heart of male rats on dermal application of carbaryl.

The central veins and the portal triads surrounded by degenerating hepatocytes known as councilman bodies and hepatocytes that appeared swollen and empty with lightly stained nucleus and indistinct cellular boundaries, are probably indicative of ongoing hepatocellular degeneration. Degenerative changes caused by the insecticide carbaryl were observed in the stratum spinosum of epidermis and in the purkinje cells of the cerebellum (Toœ-Luty et al, 2001)¹⁴, in myocytes (Smalley et al, 1969)¹¹, and in testes and ovaries (Sternberg and Otovan, 1971)¹².

The bile cannalculi between the hepatocytes also appeared dilated due to which the hepatocytes were seen to be singly placed. This dilatation of the cannalculi could probably be either due to increased secretion of bile owing to inflammatory reaction of the liver or due to obstruction of the bile outflow, suggestive of cholestasis. The hepatocytic cords appeared disheveled and those hepatocytes away from the blood vessels showed an increased cytoplasmic basophilia with a large euchromatic nucleus, probably suggestive of an increase in the cellular activity. Toœ-Luty et al (2001)¹⁴ also observed an increase in the amounts of smooth endoplasmic reticulum in the hepatocytes and swelling of mitochondria in cardiomyocytes, postulating a possibility of the metabolism of carbaryl in these cells. Hepatocytes were binucleated at places, which may be a regenerative attempt by the degenerating cells. Similar findings were documented by Smalley et al (1969)¹¹. Various biochemical studies have revealed a disturbance in the carbohydrate and protein metabolism in the liver following carbaryl exposure, possibly leading to a hepatocellular damage (Kagan et al, 1970; Sharma, 1999; Singh et al, 2004)^{2,8,9}.

CONCLUSION

From the present study, it is concluded that carbaryl caused statistically significant dilatation of the vasculature of the liver probably suggestive of an occlusive vasculopathy with areas of sub-capsular hematoma formation. The dilatation of the bile cannalculi between the hepatocytes is suggestive of cholestasis and evidence of increased cellular metabolism co-existing with foci of hepatocellular degeneration and inflammatory infiltrations around the portal triads probably suggests carbaryl toxicity on liver.

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Intravascular Haemolysis due to Glucose -6- Phosphate Dehydrogenase Deficiency in a Patient with Aluminum Phosphide Poisoning

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ABSTRACT

Aluminum phosphide (AIP) poisoning and glucose-6-phosphate dehydrogenase (G6PD) deficiency are two common clinical problems in Iran. However, hemolysis associated with AIP poisoning is extremely rare. We report a 24-year-old G6PD deficient patient with AIP poisoning presenting with intravascular hemolysis.

Keywords: G6PD Deficiency, Aluminum Phosphide, Hemolysis

INTRODUCTION

Aluminum phosphide (AIP), known as rice tablet in Iran, is commonly available as an insecticide. It is highly toxic, cheap, and easily available as a potent mole pesticide and has emerged as a major cause of suicidal death in some Asian countries such as India and Sri Lanka¹⁻⁴.

After contact with water, phosphine gas (PH₃) is released. This is especially important in acidic pH. Phosphine gas disrupts mitochondrial function by blocking cytochrome-C oxidase. In addition to energy failure in cells, generation of free radicals increases and results in lipid peroxidation. Ingestions over 500 mg are often fatal. This is while the product is sold in 3-gram tablets. Phosphides have a rotten fish odor, although the resultant phosphine gas may have a garlic odor. They rapidly (generally within 30 minutes of ingestion) produce toxicity and death may follow in less than 6 hours. They are also potent gastric irritants and generally cause profuse vomiting and abdominal pain as their first symptoms^{4,7}.

Respiratory signs and symptoms include tachypnea, hyperpnea, dyspnea, pulmonary edema, and chest tightness that may progress to acute lung injury over days. Tachycardia, hypotension, refractory shock, acute renal failure, metabolic acidosis, and dysrhythmias may also develop. Phosphine-induced dysrhythmias include atrial fibrillation and flutter, heart block, ventricular tachycardia, and fibrillation. Signs of central nervous system toxicity include coma, seizures, and delirium. Other uncommon features include disseminated intravascular coagulation (DIC) and hepatic necrosis^{2,7}. We report a 24-year-old G6PD deficient patient with AIP poisoning presenting with intravascular hemolysis.

CASE REPORT

A 24-year-old male who was the known case of G6PD deficiency was referred to our center two days after intentional ingestion of one tablet of AIP. On presentation to the first center (in which his AIP poisoning had been managed), he had gastrointestinal upset, frequent episodes of vomiting, thirst, and metabolic acidosis (pH=7.29, PCO₂=30, and HCO₃=16). The patient was conservatively managed by gastric washing with potassium permanganate (1/10000) and fluid therapy, administration of sodium bicarbonate, magnesium sulphate, and N-acetyl-cysteine. Two days after that, he referred to Loghman Hakim hospital (The main referral hospital for poisoned patients located in

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Tehran)⁸ with the chief complaint of icter that had initiated 12 hours earlier. He denied ingestion of any other drugs or fava beans and contact with any other toxins. On physical examination, the patient was fully conscious, febrile, and icteric. His vital signs were as follow: blood pressure= 110/70 mm Hg, respiratory rate = 22/min, and pulse rate =100/min. His urine had changed to dark brown. Physical examination was unremarkable in other systems except for a mild suprapubic tenderness with abdominal pain. Laboratory tests on admission showed normal electrolytes, normal PT and PTT, negative Coombs' test and normal urinary tract and hepatobiliary system ultrasonography. Electrocardiography only showed sinus tachycardia.

In the initial complete blood count (CBC), while blood cell and platelet counts were normal, hemoglobin was 9.3 gr/dl, and hematocrite was 29.3. Alanine transaminase, aspartate transaminase, and total and direct bilirubin were 50 IU/L, 134 IU/L, 12.5 mg/dL, and 0.5 mg/dL, respectively, and hemoglobinuria (4+) was detected in urine analysis. His hemoglobin dropped to 3.9 gr/dl and therefore, two units of packed cell was transfused. By the next day, the urine was cleared showing only 1 to 2 red blood cells per high power field. CBC, electrolytes and kidney function tests were normal. His urine culture was negative. He improved clinically and was discharged 6 days later in good condition and completely symptom-free. The informed consent was given from patient for publishing the data after discharge.

DISCUSSION

Glucose 6-phosphate dehydrogenase deficiency is the most common enzymatic disorder of red blood cells in humans⁹. Patients with this problem are usually asymptomatic in the steady state; however, sudden destruction of erythrocytes can be triggered by various medications, toxins (such as methylene blue and naphthalene [mothballs, henna]), poisons (such as arsen), infections, fava beans, and metabolic abnormalities (such as diabetic ketoacidosis)¹⁰. These all may cause anemia, hematuria, and hemoglobinuria.

Hematologic complications of AIP poisoning are not common². Phosphide acts by liberating phosphine gas (an oxidant) and causes haemolysis; however, this is a very rare condition seen in only a few cases in the literature¹¹. AIP has been reported to produce intravascular hemolysis in one patient with

concomitant G-6-PD deficiency in India¹². Microangiopathic hemolytic anemia and methemoglobinemia have been reported with AIP poisoning and hemolysis and methemoglobinemia may complicate the course of phosphine poisoning^{13,14}. Aggarwal et al. reported the occurrence of intravascular hemolysis following ALP poisoning in a patient with normal G6PD levels¹⁵. Phosphine and arsine are chemically very similar and therefore it is not surprising to encounter hemolysis in cases of G6PD exposed to either of them¹². It seems that the other mechanism of action of PH₃-induced hemolysis is induction of free radicals by phosphine. In the present case, oxidative stress may have had a primary role in the induction of intravascular hemolysis.

CONCLUSION

This case illustrates the potential of AIP poisoning to trigger hemolysis in patients with G6PD deficiency. Although haemolysis is a rare presentation in AIP poisoning, detection of associated G6PD deficiency is imperative and contact with this chemical in G6PD deficient patients should be avoided.

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Conflict of Interest

The authors report no declarations of interest. The authors alone are responsible for the content and writing of this paper.

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Correlation of Clinical and Ct Scan Findings in Relation to Mortality in Deceased Victims Diagnosed with Extradural Hematoma

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ABSTRACT

Extradural hematomas occur frequently as an intracranial finding in trauma to the head. The mortality and morbidity in head injury cases are assessed by factors like progressive deterioration of consciousness, patient age less than 80 years, Glasgow coma scale (GCS) of 5-11, lack of severe coagulopathy or presence of systemic disease; and CT findings like increased edema, compression on brain stem, shift effect hematoma location on non-dominant hemisphere. Very few attempts have been undertaken to study the dimensions and the effects of hematomas in the CT scans and to relate the findings in autopsy. This study was undertaken to analyze the epidemiological and pathological factors of extradural hematoma as well as to correlate the radiological findings in death cases to arrive at the factors influencing the mortality. Thickness and diameter of the hematoma and their relation to mass effect, ventricular shift and midline shift, and incidence of ventricular changes and herniation was studied.

Keywords: Extradural Hematomas, Thickness and Diameter, Mass Effect, Ventricular Shift and Midline Shift

INTRODUCTION

Extradural hematomas (EDH) are a frequent clinical and radiological finding and comprises of 1-3 percent cases of trauma to the head¹. The presence of extradural hematoma calls for thorough clinical work up with radiological investigations including computed tomography (CT) scan and Magnetic resonance imaging (MRI) of head. Although MRI is sensitive for EDH, because of its limited availability in the rural and peripheral institutions CT is the investigation of choice. It is a common practice for the CT and MRI reports to document the length, breadth and thickness of the hematoma. Volumetric measurements by MRI and its documentation become important for the clinicians to make a decision on the need for surgery. Hematoma volume $>30\text{cm}^3$ at cerebral and diameter greater than 3 cm at cerebellar region is a definite surgical indication criterion².

Conventionally the mortality and morbidity in head injury cases are assessed by factors like progressive deterioration of consciousness, increased edema on CT, development of obstructive hydrocephalus, compression on brain stem, shift effect, patient age less than 80 years, Glasgow coma scale (GCS) of 5-11, lack of severe coagulopathy or presence of systemic disease, hematoma location on non-dominant hemisphere². The 30-day mortality rate of intracerebral hemorrhage (ICH) is approximately 44%, with almost half of the patients dying within the first 48 hours³. The purpose of this study was to evaluate the clinical and CT findings in relation to mortality, dimensions of the hematoma and its relation to the intracranial complications like mass effect, midline shift and ventricular changes.

MATERIAL AND METHOD

This prospective study was undertaken in a total of 120 deceased victims who were hospitalized with a history of blunt force trauma to the head. Cases were selected where CT scan reports showed a definite presence and description of the epidural hematoma. The patients presented to the emergency department between June 2005 to June 2011 with history of road traffic accident, fall and assault constituted the sample. The patients were investigated with head CT scans. Data with respect to time interval between trauma and presentation to emergency department, history of loss of consciousness, Glasgow coma scale, history of alcohol consumption, and time of the occurrence of the event were noted. Autopsies were conducted following the standard protocol.

RESULTS

A total of 1457 cases of head injury due to blunt force impact presented to the emergency department from June 2005 to June 2011. Out of these 1457 cases, 120 (108 male and 12 female) had epidural hematoma and succumbed before they could reach higher center for surgical evacuation. The cases were subjected to radiological investigation including CT scans. There were 108 males (90.2%) and 12 females (9.2%). The male to female ratio was 9:1. The age groups of the patients were as shown in the chart-1 below. The highest incidence of fatality was seen in the 31-40 years age group. Of these 120 cases, 92 (76.47%) were as a result of road traffic accident, 21 (17.64%) were due to fall and 7 (5.88%) were due to assault.

Of these 120 cases, 52 (43.1%) cases presented to the emergency department within 6 hours of trauma, 38 (31.3%) presented within 12 hours and 31 (25.49%) presented between 12-18 hours after trauma. In 70% of the cases, the cases had to transit long distances from the peripheral parts in the village to get medical attention. The rest of the cases succumbed due to associated injuries despite emergency management and early medical care like intubation and management of hemorrhagic blood loss by restoration of blood volume. In 56 cases (46.66%) patients were found to have consumed alcohol and majority of these patients were involved in motor vehicular accidents and as drivers. Glasgow coma score was less than 6 in 111 (92.15%) and 8 in two cases and 10 in 7 cases. Lucid interval was observed in 5 cases.

CT scans analyzed in the deceased victims described cephalhematoma in 87 cases (72.54%) and

in 7 cases (5.88%) the scalp contusions were bilateral. Five cases showed scalp lacerations. The maximum thickness of the scalp contusion noted was 25 mm in the occipital and parietal scalp. The location and distribution of the extradural hematomas were as shown in the chart-2 below. In 118 (98.03%) cases the hematomas were associated with skull fractures and the location of the hematomas immediately below or adjacent to the skull fracture. In 111 (92.15%) cases, the fracture was single, fissured and linear type and in 9 (7.8%) cases there were multiple fissured fractures extending into the base of the cranium into the cranial fossae. The dimensions of the extradural hematoma with respect to diameter, and thickness were noted. The CT scans were further analyzed with findings of midline shift, ventricular shift, and mass effect. Findings like hemorrhage in the paranasal sinus and mastoid air cells were also noted. In one case, basal ganglia showed calcifications, and in one case there were old infarcts revealed in the basal ganglia. In 6 cases, there were associated hemomastoid seen and in 7 cases hemosinus was noted. Hemomastoid was seen in temporal impact and hemosinus was seen in frontal impact predominantly. EDH was present along with subdural hemorrhage in 43% of the cases.

The mean thickness of hematoma was 2.92 cm with a standard deviation of 2.24 cm as noted in Chart-1. Minimum thickness was 0.4 cm and maximum thickness was 8.5 cm. The mean diameter of the hematoma was 3.68 cm with a standard deviation of 1.96 cm. The mean of midline shift was 13.58 cm with a standard deviation of 53.18 cm.

Frequency distribution of mass effect, ventricular shift and midline shift were studied as represented in Chart-2. There was mild mass effect in 22.5% of the cases, ventricular shift in 22.5% of the cases and brain herniation in 20% of the cases. Table 1 shows the study of interrelationship between thickness and diameter of the hematoma with the mass effect, midline shift and brain herniation. The multivariate analysis of the data has shown that the thickness of the hematoma had significant relationship with the midline shift and ventricular displacement at 0.05 levels, while the diameter of the hematoma had a significant relationship with the mass effect and ventricular displacement at 0.05 levels. In terms of morbidity and mortality, it is observed that the thickness of extradural hematoma has a strong bearing as compared to the other dimensions.

Table 1: Interrelationship between dimensions of the extradural hematomas and midline shift.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Thickness (cms)	120	0.40	8.50	2.9226	2.23700
Diameter(cms)	120	1.00	8.80	3.6800	1.96095
Midline shift	120	0	280	13.58	53.183

Table 2: Frequency distribution of mass effect, ventricular shift and midline shift in extradural hemorrhage.

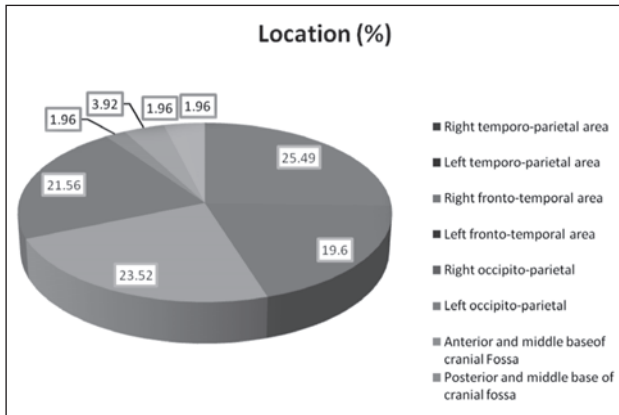
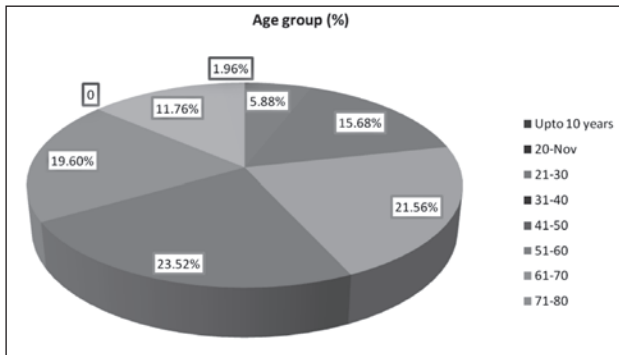
Parameters	Frequency	Percent
Mass effect	27	22.5
Ventricular displacement	27	22.5
Herniation	24	20

Table 3: Multivariate analysis of mass effect, ventricular shift and midline shift in relation to dimensions of the extradural hematoma.

Tests of Between-Subjects Effects							
Source	Dependent Variable		Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	dimension1	Mass effect	18.703 ^a	34	.550	21.041	.000
		Midline shift	336586.704 ^b	34	9899.609	7.800E31	.000
		Ventricles	20.925 ^b	34	.615	1.153E31	.000
		Herniation	19.200 ^b	34	.565	5.756E30	.000
Intercept	dimension1	Mass effect	2.548	1	2.548	97.474	.000
		Midline shift	17739.681	1	17739.681	1.398E32	.000
		Ventricles	4.833	1	4.833	9.055E31	.000
		herniation	3.452	1	3.452	3.518E31	.000
Thickness (cms)	dimension1	Mass effect	.000	6	.000	.000	1.000
		Midline shift	11.589	6	1.931	1.522E28	.000
		Ventricles	2.589	6	.432	8.085E30	.000
		herniation	.000	6	.000	.000	1.000
Diameter(cms)	dimension1	Mass effect	3.750	8	.469	17.930	.000
		Midline shift	.000	8	.000	.000	1.000
		Ventricles	.500	8	.063	1.171E30	.000
		herniation	.000	8	.000	.000	1.000
Thickness (cms)* Diameter(cms)	dimension1	Mass effect	.000	0	.	.	.
		Midline shift	.000	0	.	.	.
		Ventricles	.000	0	.	.	.
		herniation	.000	0	.	.	.
Error	dimension1	Mass effect	2.222	85	.026		
		Midline shift	1.079E-26	85	1.269E-28		
		Ventricles	4.537E-30	85	5.338E-32		
		herniation	8.339E-30	85	9.810E-32		
Total	dimension1	Mass effect	27.000	120			
		Midline shift	358711.240	120			
		Ventricles	27.000	120			
		herniation	24.000	120			
Corrected Total	dimension1	Mass effect	20.925	119			
		Midline shift	336586.704	119			
		Ventricles	20.925	119			
		herniation	19.200	119			

a. R Squared = .894 (Adjusted R Squared = .851)

b. R Squared = 1.000 (Adjusted R Squared = 1.000)



DISCUSSION

Extradural hematomas indicate surgical emergency and require early surgical evacuation. Out of 1457 cases, we noticed 120 cases of deaths associated with extradural hematomas 36 cases died due to hematoma per se and the other cases died due to associated internal organ and peripheral injuries. In our study 92% cases of extradural hematomas were as a result of accidents followed by 17.64% cases due to falls. This finding was in concurrence with the studies by Cordobes et al⁴, Mc.Kissock et al⁵, Seeling et al⁶. Fall was the major cause of EDH as noted in studies conducted by Ozken et al⁷, Ersahin et al⁸, Baykaner K et al⁹. Majority of the cases involved were males and predominantly in the age group of 31-40 years.

EDH is almost always associated with skull fractures immediately adjacent to the site of the hematoma. In 118 cases in our series, the hematoma was associated with fracture and majority of them were linear undisplaced fractures at the temporal and parietal skull. The presence of the skull fracture along with the hematoma along with intracranial changes like mass effect, sulcal effacement, midline shift and ventricular shift apparently increase the mortality. EDH is located most commonly on the parieto-temporal surface (45.09%) and frontotemporal (45.08%), occipitoparietal (5.88%), occipital and basal

(3.92%) surface, and overlapped in the rest of the cases. The study of the scalp contusions corresponded to the site of the impact in almost all the cases.

GCS of d" 6, presence of multiple injuries, more than 1.5 liter of blood loss, associated comorbidities, and preexisting diseases all contribute to the increased mortality in cases of extradural hematomas. In our series, it was found that the delay in the presentation to the emergency department was a major concerning factor and in those cases presented early to the emergency department, the decision to shift the patient to a higher center was delayed and the delayed transit time to provide early neurosurgical care decreased the chances of recovery.

The study on relationship between the size of the EDH and the intracranial complications leading to pressure effect suggests that the factors like mass effect, midline shift and ventricular changes are more significantly related to the thickness of the hematoma and less significantly related to the diameter. Among these fatal cases, it was observed that the midline shift of more than 16 mm was sufficient enough to produce greater morbidity without any association of other visceral injuries or blood loss. Midline shift of 19mm to 30 mm would produce serious complications and is unfavorable to the prognosis.

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DECLARATION

The authors hereby declare that there is no conflict of interest in preparation of the manuscript, the study was self funded, and ethical clearance was obtained.

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Biochemical Alterations on Exposure of Imidacloprid and Curzate on Fresh Water Fish *Oreochromis Mossambicus* and *Labeo Rohita*

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ABSTRACT

Imidacloprid (IMI) is a nicotinoid insecticide that belongs to a group of insecticides referred to as the chloronicotinyl group and Curzate M8 (CZ) (72%) is a mixture of two fungicides viz. Cymoxanil (8%) and mancozeb (64%). Teleost were exposed to sub-lethal concentration (LC50/ 10 and LC50/ 20) of IMI and CZ for 21 days to assess the alterations in the level of some biochemical parameters in tissues. Significant alterations in all the biochemical parameters were found to be dose dependent. Increased activity of ALT, AST, ALP and GDH of tissues indicate liver damage. Thus from the present studies it can be concluded that curzate and Imidacloprid are potentially toxic to freshwater Teleosts, *Oreochromis mossambicus* and *Labeo rohita*.

Keywords: *Imidacloprid, Curzate, AST, ALT, ALP, GDH and Teleost*

INTRODUCTION

Environment pollution by agro-chemicals has become one of the most important problems in the world¹. The pesticide contamination of aquatic system has attracted the attention of researcher all over the world² and has increased in the last decades due to extensive use of them in agriculture. Fishes are more frequently exposed to these pesticides because it is believed that regardless of where the pollution occurs, it eventually end up in the aquatic environment³. The insecticide IMI referred to as neonicotinoids⁴. It acts as an agonist of the postsynaptic nicotinic acetylcholine receptors⁵, disrupting the normal neural processes and is used mainly to control sucking insects in crops⁶. IMI is a potential groundwater and surface water contaminant, because it can leach and runoff from soil and crops⁷. Until now, the toxicity of IMI to aquatic invertebrates has been assessed but very few monitoring studies of this insecticide have been performed in fresh water aquatic environments. Toxicological data showed that IMI has been proved to be moderately toxic to fish⁸. Toxic responses of IMI has been studied on fresh water fish^{9,10}. CZ a mixture of Cymoxanil and mancozeb, has got systemic action

and is moderately toxic. Cymoxanil and Mancozeb at individual level have proved to be toxic to fish^{11, 12}. However, the toxicity data on the mixture are lacking.

Biochemical alterations in response to pesticides are considered to be rapidly responding endpoints and thus most biochemical biomarkers in the laboratory studies are assessed after acute exposure to chemicals. Changes in the biochemical profile indicate alterations in metabolism of the organism resulting from the effect of the pesticide and they make it possible to study the mechanisms of the effects of these pesticides¹³. In the view of paucity of information available on IMI and CZ toxicity, the present work was under taken on fresh water teleosts, *O. mossambicus* and *L. rohita*.

MATERIALS AND METHOD

Freshwater teleosts, *O. mossambicus* and *L. rohita* of similar size in length and weight (12 ± 2 cm; 25 ± 1.9 g) and (25 ± 3 cm; 110 ± 5 g) respectively were brought from a local pond of Baroda district. Animals were transported to laboratory in large aerated plastic container and were acclimatized in glass aquaria containing 50 liter of well aerated dechlorinated tap

water for ten days. During an acclimation period of 10 days, the fish were kept under natural photoperiod and fed two times a day with commercial pelleted diet. The acclimatized healthy fishes of both sexes were selected randomly for the studies.

Based on the result of the 48 h LC₅₀ of *O.mossambicus* for IMI (0.7319 mg/L) and CZ (39.84 mg/L) and that of *L.rohita* for IMI (0.840 mg/L) and CZ (51.048 mg/L), 30 fishes were divided in 3 groups, 10 fish for each group:

- Group 1 served as control without any treatment of Agro-chemicals.
- Group 2 were treated with low dose of IMI and CZ (LC 50 / 10).
- Group 3 were treated with high dose of IMI and CZ (LC 50 / 20) for a period of 21 days.

At the end of the experiment (21 days) the fish were carefully netted to minimize stress, and weighed. Prior to sacrificing the fish, about 1 - 2ml of blood was collected from the caudal peduncle using separate heparinized disposable syringes. The blood was stored in -4°C in deep freezer prior to analysis. Fishes were sacrificed by pithing. Tissues such as liver, kidney, gills and muscle were carefully removed, wiped thoroughly, using blotting paper to remove blood and other body fluids. Then they were washed in chilled PBS and again blotted dry. After noting the total weight of the tissues, the desired amount of the tissues were

weighed and used. Estimation of Alanine aminotransferase (ALT) and Aspartate aminotransferase (AST) were done by the method of Mohun and Cook, (1957). Alkaline phosphatase (ALP) was estimated following the method of king and king, (1954), and that of Glutamate dehydrogenase (GDH) was estimated by the method of Plummer, (1995). The statistical analysis was carried out using the software Graph pad prism 5 package. For determining the significant difference between different treatments in biochemical parameters, Two-way ANOVA followed by Tukey's test for multiple comparisons between different concentration of IMI and CZ was done. Significance level was set at 0.05 in all tests.

RESULTS

Two-factor ANOVA followed by Tukey's test showed that there was significant elevation in ALT activity in all the tissue of both teleosts on exposure of IMI and CZ compared to control (Table: 1).

AST and ALT activity was found to be significantly elevated in tissues such as liver, kidney and muscle of both the treated groups compared to control in both the fishes (Table 2). Variation in ALP activity in all tissues in *O.mossambicus* and *L.rohita* exposed to IMI and CZ compared to control (Table: 3). GDH activity showed statistically significant increase in all the tissue of *L.rohita* and *O.ossambicus* on IMI and CZ exposure at low dose as well as high dose compared to control (Table 4).

Table: 1 Effect of IMI and CZ on ALT activity (mean ± SEM) in *O.mossambicus* and *L.rohita*.

ALT							
O.mossambicus	Tissues	IMI			CZ M8		
		C	LD	HD	C	LD	HD
O.mossambicus	Gills	1.180 ±0.042	2.660 ±0.040***	2.240 ±0.300***	1.180 ±0.042	2.150 ±0.031***	1.970 ±0.072***
	Liver	3.850 ±0.040	8.790 ±0.020***	12.240 ±0.242***	3.850 ±0.040	6.980 ±0.291***	9.170 ±0.076***
	Kidney	2.740 ±0.054	5.270 ±0.035***	7.480 ±0.322***	2.740 ±0.054	4.450 ±0.215***	5.970 ±0.112***
	Muscle	2.660 ±0.035	3.840 ±0.063***	3.170 ±0.438	2.660 ±0.035	3.090 ±0.040**	2.890 ±0.081
L.rohita	Gills	2.260 ±0.08	4.890 ±1.25**	6.97 ±1.25**	2.26 ±0.08	3.13 ±0.04	4.45 ±0.57***
	Liver	15.35 ±2.09	20.98 ±0.87**	24.89 ±0.48**	15.35 ±2.09	17.17 ±1.38**	19.83 ±0.97***
	Kidney	2.570 ±1.15	5.910 ±0.97***	11.71 ±0.79	2.57 ±1.15	4.89 ±1.07***	6.01 ±1.06***
	Muscle	3.980 ±0.42	6.130 ±0.79**	10.33 ±0.12**	3.98 ±0.42	5.01 ±0.30	6.17 ±0.23***

- Values are expressed as μmoles of pyruvate liberated / h/ mg protein.
- Each value represents the mean ± SEM of six separate experiments.
- Significant level indicated by * (P<0.05); ** (P<0.01); *** (P<0.001)

Table: 2 Effect of IMI and CZ on AST activity (mean ± SEM) in O.mossambicus and L.rohita.

ALT							
O.mossambicus	IMI			CZ M8			
	Tissues	C	LD	HD	C	LD	HD
O.mossambicus	Gills	1.260 ± 0.094	1.140 ± 0.264	1.310 ± 0.156	1.260 ± 0.094	1.220 ± 0.025***	1.460 ± 0.007
	Liver	3.680 ± 0.089	8.760 ± 0.058***	10.240 ± 0.282***	3.681 ± 0.089	6.870 ± 0.081***	9.140 ± 0.015***
	Kidney	2.750 ± 0.040	6.280 ± 0.039***	7.440 ± 0.259***	2.749 ± 0.040	4.650 ± 0.054***	6.150 ± 0.008***
	Muscle	2.500 ± 0.027	3.800 ± 0.030***	3.080 ± 0.429*	2.500 ± 0.027	2.870 ± 0.028	2.590 ± 0.029***
L.rohita	Gills	3.920 ± 0.08	8.090 ± 1.25	17.99 ± 1.25	3.92 ± 0.08	4.13 ± 0.04	6.81 ± 0.57
	Liver	12.65 ± 2.09	19.10 ± 0.87*	27.38 ± 0.87***	12.65 ± 2.09	14.21 ± 1.38**	20.87 ± 0.97***
	Kidney	17.72 ± 1.15	22.30 ± 0.97	28.13 ± 0.97***	17.72 ± 1.15	19.83 ± 1.07***	21.48 ± 1.06***
	Muscle	5.870 ± 0.42	28.13 ± 0.79	11.38 ± 0.79***	5.87 ± 0.42	7.98 ± 0.30***	9.37 ± 0.23***

- Values are expressed as µmoles of pyruvate liberated / h/ mg protein.
- Each value represents the mean ± SEM of six separate experiments.
- Significant level indicated by * (P<0.05); ** (P<0.01); *** (P<0.001)

Table: 3 Effect of IMI and CZ on alkaline phosphatase activity (mean ± SEM) in O.mossambicus and L.rohita..

ALP							
O.mossambicus	IMI			CZ M8			
	Tissues	C	LD	HD	C	LD	HD
O.mossambicus	Gills	3.190 ± 0.026	8.600 ± 0.011***	11.880 ± 0.443***	3.190 ± 0.026	4.080 ± 0.020	7.530 ± 0.401***
	Liver	7.420 ± 0.007	10.420 ± 0.029***	12.878 ± 0.020***	7.420 ± 0.007	8.990 ± 0.020***	9.798 ± 0.389***
	Kidney	4.980 ± 0.021	7.130 ± 0.010***	9.578 ± 0.872***	4.980 ± 0.021	5.980 ± 0.006*	8.120 ± 0.487***
	Muscle	2.720 ± 0.031	7.680 ± 0.027***	9.980 ± 0.496***	2.720 ± 0.031	6.270 ± 0.008***	9.670 ± 0.432***
L.rohita	Gills	43.78 ± 0.451	76.71 ± 0.003**	102.71 ± 0.038***	43.78 ± 0.451	61.81 ± 0.020***	82.78 ± 0.035***
	Liver	98.88 ± 0.443	131.91 ± 0.002**	158.31 ± 0.025***	98.88 ± 0.443	118.73 ± 0.022***	128.48 ± 0.463***
	Kidney	39.87 ± 0.001	56.11 ± 0.001*	82.17 ± 0.015**	39.87 ± 0.001	47.31 ± 0.038***	58.12 ± 0.008***
	Muscle	87.91 ± 0.005	121.87 ± 0.015***	108.31 ± 0.044***	87.91 ± 0.005	99.78 ± 0.033***	101.81 ± 0.005***

- Values are expressed as mg of phenol liberated / min / mg protein.
- Each value represents the mean ± SEM of six separate experiments.
- Significant level indicated by * (P<0.05); ** (P<0.01); *** (P<0.001)

Table: 4 Effect of IMI and CZ on Glutamate dehydrogenase activity (mean ± SEM) in O.mossambicus and L.rohita.

GDH							
O.mossambicus	IMI			CZ M8			
	Tissues	C	LD	HD	C	LD	HD
O.mossambicus	Gills	0.060 ± 0.01	0.074 ± 0.026	0.092 ± 0.027	0.06 ± 0.01	0.063 ± 0.008	0.084 ± 0.008*
	Liver	0.086 ± 0.02	0.097 ± 0.008	0.126 ± 0.026*	0.086 ± 0.02	0.093 ± 0.012	0.112 ± 0.014*
	Kidney	0.062 ± 0.012	0.049 ± 0.007	0.076 ± 0.021	0.062 ± 0.01	0.054 ± 0.008	0.068 ± 0.012
	Muscle	0.05 ± 0.007	0.024 ± 0.007	0.033 ± 0.030	0.05 ± 0.01	0.032 ± 0.013	0.042 ± 0.013
L.rohita	Gills	0.080 ± 0.003	0.120 ± 0.040	0.190 ± 0.003	0.080 ± 0.003	0.100 ± 0.036*	0.130 ± 0.040**
	Liver	0.180 ± 0.002	0.260 ± 0.027	0.380 ± 0.002***	0.180 ± 0.002	0.210 ± 0.022**	0.280 ± 0.014***
	Kidney	0.090 ± 0.001	0.130 ± 0.004	0.180 ± 0.044*	0.090 ± 0.001	0.110 ± 0.004**	0.150 ± 0.003**
	Muscle	0.100 ± 0.005	0.150 ± 0.019	0.230 ± 0.010**	0.100 ± 0.005	0.110 ± 0.010*	0.180 ± 0.005**

- Values are expressed as mg of phenol liberated / min / mg protein.
- Each value represents the mean ± SEM of six separate experiments.

Significant level indicated by * (P<0.05); ** (P<0.01); *** (P<0.001)

DISCUSSION

The changes in the biochemical constituents in the gills, muscle, kidney and liver of the fish exposed to sub-lethal concentration of IMI and CZ at different dose were observed in the present study (Table 1, 2, 3 and 4).

Aminotransferases are widely acknowledged for their significance in protein metabolism by virtue of their ability to regulate both synthesis and degradation of amino acids. Changes in their activities are often associated with changes in many other metabolic functions and thus represent widespread alterations in the organisms physiological state. Aminotransferases such as ALT and AST catalyse the reaction of transamination of alanine, glutamic and aspartic acids. Changes in AST and ALT enzyme activity in fish have been used frequently as indicators of toxicant and contamination of aquatic ecosystem¹⁴. Various scientists have reported the alterations in ALT and AST on exposure of pesticides^{15,16}. In the present study, ALT and AST were found to be significantly elevated in all the tissues of fishes exposed to IMI and CZ in a dose dependent manner (Table 1 and 2). As proposed by Vardharajan, (2010)¹⁷, the primary energy currency in fish is amino acids. Elevated activity of transferases is possibly a result of a response to stress induced by pesticides to generate keto acids like α -ketoglutarate and Oxaloacetate for contributing to gluconeogenesis and/or energy production necessary to meet the access energy demand.

ALP is a one of the important markers for liver and kidney. A dose dependent response was observed in all tissues (Table 3). A significant increase in enzyme activity in liver might be due to a stress induced over activity of hepatobiliary cells, involved in detoxification mechanism. Further, increased ALP activity also may be due to pathological processes such as liver impairment and kidney disfunction¹⁸. Thus in the present study, increase in the levels of ALP reflects liver damage, whereas an elevation in ALP activity may be indicative of renal and liver damage¹⁹.

GDH, a mitochondrial enzyme, catalyses the oxidative deamination of glutamate, providing α -ketoglutarate to the kreb's cycle²⁰. GDH in extra hepatic tissues can be utilized for channelling of ammonia released during proteolysis for its detoxification into urea in the liver hence, activities of GDH along with AST and ALT are considered as sensitive indicators of stress²¹. An increase was observed in activity of GDH

in all the tissues of the fish exposed to IMI and CZ (Table 4), suggestive of active transdeamination of amino acids for the incorporation of keto acids into the TCA cycle to release necessary energy required for the synthesis of new protein²². Significant elevation in activity of GDH indicates the association of oligomers in response to toxic stress, leading to oxidative deamination and ammonia production. The high levels of ammonia produce is not eliminated but is salvaged through GDH activity which is utilize for aminoacid synthesis through transaminases²³. Our results are in agreement with that of Nelson and Cox (2005)²⁴.

Thus from the present studies it can be summarised that biochemical alterations of the fishes exposed to two different agrochemicals led to elevation in AST, ALT, ALP and GDH in different tissues of fishes as a response to the stress induced by agrochemicals to meet the energy demand.

Conflict of Interest: Nil

Source of Funding: University scholarship

Ethical clearance: Not mandatory for edible fish

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In Vitro effects of Cadmium Chloride on Steroid Profiles of Post-Vitellogenic Ovary in the Catfish *Heteropneustes Fossilis*

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ABSTRACT

Cadmium (Cd) is a known endocrine disruptor with the ability to affect the production of hormones involved in the regulation of reproductive processes. The purpose of this study was to evaluate invitro effects of cadmium chloride (CdCl₂) exposure on steroid levels in post-vitellogenic follicles of catfish ovary. Pieces of ovarian tissues (500mg) were incubated in culture medium in the presence or absence (control) of CdCl₂ (0,0.01,0.1,1,3 and 10µg/ml) for 12 or 24hr. Estradiol-17 (E₂) and testosterone were measured by ELISA. Other steroids like progestins (progesterone -P₄; 17-OH-progesterone -17-P and 17,20 -dihydroxyprogesterone -17,20 -DP) and corticosteroids (cortisol, 21-deoxycortisol, corticosterone and deoxycorticosterone) were quantified by High Performance Liquid Chromatography. The results show that Cd produced biphasic effects on E₂, T, P₄, 17,20 -DP, cortisol, deoxycorticosterone, and 21-deoxycortisol, stimulatory at lower concentrations and inhibitory at higher concentrations. In contrast, 17-P and corticosterone were inhibited in a dose-dependent manner. Thus, Cd can influence ovarian steroidogenesis adversely, affecting gametogenesis and ovulation resulting in the decline of fish population.

Keywords: Cadmium, Ovary, Invitro Steroid Levels, Endocrine Disruptors, Catfish

INTRODUCTION

Amongst vertebrates, fish are the most at risk of endocrine disruption since their aquatic habitat receives the greatest input of natural and anthropogenic pollutants. The use of fish as bioindicators of metal pollution and the suitability of fish for human consumption from a toxicological view have been documented⁽¹⁾. The accumulation of toxic metals to hazardous levels in aquatic biota has become a problem of increasing concern. Heavy metals such as copper (Cu), iron (Fe) and zinc (Zn) in trace amounts are essential for fish metabolism, whereas others, such as mercury (Hg), cadmium (Cd), arsenic (As) and lead (Pb), have no known beneficial role in biological systems⁽²⁾. Fish are, therefore, considered the most suitable animal model for the endocrine disruption related research. Endocrine disrupting compounds (EDCs) can obstruct reproduction of domestic and wild animals by acting at different levels of the reproductive system, causing structural and functional alterations. Metal-induced endocrine disruptions have been documented for various vertebrate groups. In recent years, considerably greater evidence has been

accumulated for heavy metals like Hg, Cd and Pb in mammalian and fish models^(3,4). Metals such as Cd have been shown to stimulate or inhibit gonadal steroid production in fish, depending on the dose and sex⁽⁵⁾. At the gonadal level, steroid hormones are very important and play essential roles in maintaining reproductive functions⁽⁵⁾. In mammals, it has been suggested that Cd acts at multiple sites in the intracellular signalling pathway of testosterone synthesis⁽⁶⁾. Cd was found to influence the activity of many enzymes including those which participate in the process of ovarian steroidogenesis^(7,8).

The purpose of the present study was to investigate the direct *invitro* effects of Cd on ovarian steroidogenesis. The results show that Cd elicited varied effects depending on the concentrations and duration of the incubations.

MATERIALS AND METHOD

Animal collection and acclimatization

Adult female *Heteropneustes fossilis* (50-60g) approximately of one year old were purchased from

local fish markets in prespawning (June) phase of the annual reproductive cycle⁽⁹⁾. The fish were acclimatized in flow-through aquarium tanks under normal photoperiod and ambient temperature (13L:11D, 28±2°C) for 48hr before sampling. The experiments were performed in accordance with local/national guidelines for experimentation in animals.

CHEMICALS

Cadmium chloride (CdCl₂, 98.9% purity) was purchased from E-Merck, Mumbai, India. Estradiol-17β (E₂) and testosterone (T) ELISA kits (Diametra, Italy) were purchased from local suppliers. Diethyl ether and other chemicals were of analytical/HPLC grade and purchased from E-Merck, Mumbai, India.

Preparation of incubation medium

The incubation medium was prepared as described by Goswami and Sundararaj⁽¹⁰⁾ with minor modifications as described by Mishra and Joy⁽¹¹⁾.

Incubation of ovarian pieces with different concentrations of Cd

The experiments were conducted in the prespawning (June) phase. The ovary pieces containing post-vitellogenic follicles were incubated with different concentrations of CdCl₂ (0, 1ng, 0.1mg, 1mg, 3mg and 10 µg/ml) at 22°C for 12 or 24hr in triplicate. The medium was changed after every 4hr to maintain the pH (checked in parallel incubations in medium containing a pinch of phenol red) and collected group-wise. After completion of the incubation, the medium was collected and processed for steroid extraction. Control groups (plain medium) were set up in parallel.

Steroid extraction and Assay

The tissues were homogenized with an ultrasonic homogenizer (XI-2000 Microson, Misonics, USA) at 0°C for 5-10sec, steroid extraction and estimation of estradiol-17β and testosterone was performed by ELISA⁽¹²⁾.

Progestin and Corticosteroid Assay

Progestins (progesterone, 17-hydroxyprogesterone, and 17,20β dihydroxyprogesterone) and corticosteroids (cortisol, 21-deoxycortisol,

corticosterone and deoxycorticosterone) were quantified by High Performance Liquid Chromatography⁽¹¹⁾.

Statistical analysis

The data were expressed as means ± SEM (n=5) and analyzed by one way analysis of variance (ANOVA), followed by Tukey's test (P<0.05).

RESULTS

In vitro effects of different concentrations of Cd on E₂ and T

The incubation of ovarian pieces showed an overall significant effect on E₂ and T levels at 12 and 24hr (Fig. 1A, B). At 12hr, E₂ was stimulated in all the groups except the 1ng group and at 24hr, the steroid level was increased in all the groups except the 0.1µg group (P<0.05, Tukey's test). Cd produced biphasic effects on testosterone level in a dose and duration dependent manner. At 12hr incubation, the steroid level was stimulated only in the 1ng group and was inhibited in the higher dose groups except the 0.1µg groups. At 24hr testosterone level was stimulated in the 1ng, 0.1µg and 1mg groups but the magnitude of the stimulation decreased with the increase in the concentrations. The 3 and 10µg concentrations inhibited the steroid level.

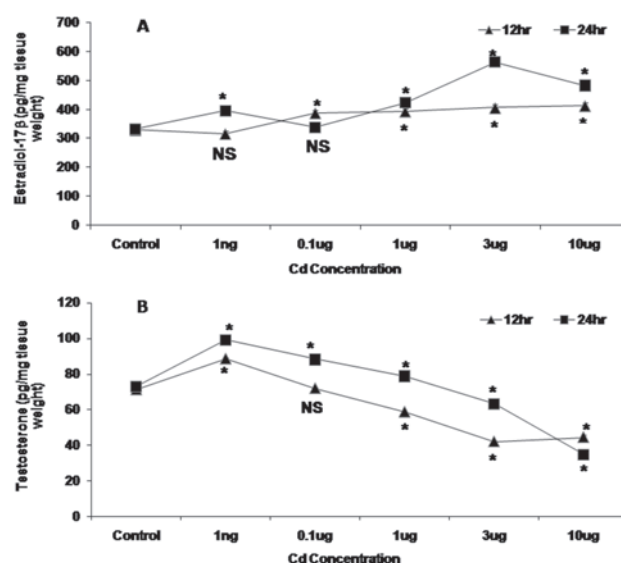


Fig. 1. Effects of incubation of postvitellogenic follicles with cadmium chloride for 12 or 24hr on Estradiol-17β (E₂; A) and Testosterone (T; B) secretion in catfish *Heteropneustes fossilis*. Data were expressed as Mean±SEM (n=5). Data were analysed by one way ANOVA, followed by Tukey's test (P<0.05). Asterisks show significant difference from the control groups.

In vitro effects of different concentrations of Cd on progestins

The incubation of ovarian pieces produced overall significant changes on progestin (progesterone, 17-hydroxyprogesterone, and 17,20β-dihydroxyprogesterone) levels at both 12 and 24hr (Fig. 2A, B, C). The progesterone level was stimulated in the 1ng concentration (at 12hr incubation only) and in all other concentrations and incubations, the steroid level was inhibited in a dose and time dependent manner (P<0.05, Tukey’s test). At 12hr incubation, the 17-OHP level was stimulated in both 1ng and 0.1µg concentration groups. In all other concentration groups, the steroid level was inhibited. The inhibition was stronger at 24hr. 17,20b-DP level was stimulated significantly at all concentrations at 12hr in a biphasic manner, the response being maximal in the 1µg group. At 24hr, the steroid level was inhibited in a dose-dependent manner.

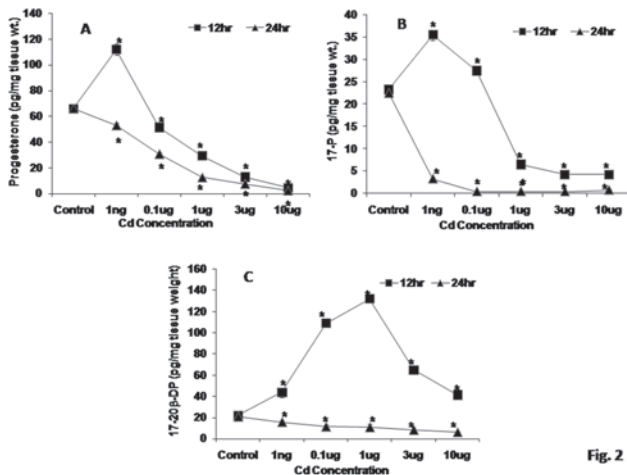


Fig. 2

Fig. 2. Effects of incubation of postvitellogenic follicles with cadmium chloride for 12 or 24hr on progesterone (P₄; A), 17-OH-progesterone (17-P: B) and 17, 20b-DP (C) secretion in catfish *Heteropneustes fossilis*. Data were expressed as Mean±SEM (n=5). Data were analysed by one way ANOVA, followed by Tukey’s test (P<0.05). Asterisks show significant difference from the control groups.

In vitro effects of different concentrations of Cd on corticosteroids

The incubation of ovarian pieces produced overall significant changes on corticosteroid (cortisol, corticosterone, deoxycorticosterone and 21-deoxycortisol) levels at both 12 and 24hr (Fig. 3A, B, C, D). Cortisol showed biphasic changes with 1ng, 0.1µg and 1µg groups stimulating and 3 and 10µg groups decreasing the levels at both 12 and 24hr. The stimulatory response was higher at 12hr and the

inhibitory response at 24hr. The Cd exposure inhibited corticosterone levels significantly at both 12 and 24hr in a dose-dependent manner. Deoxycorticosterone elicited a biphasic response, stimulatory in 1ng and 0.1µg (24hr) groups and inhibitory at higher concentrations. 21-deoxycortisol also elicited a biphasic effect; 1ng, 0.1µg and 1µg concentrations stimulated (except 1ng at 24hr), and 3µg and 10µg inhibited the steroid level. The stimulatory /inhibitory trend was higher at the 24hr exposure.

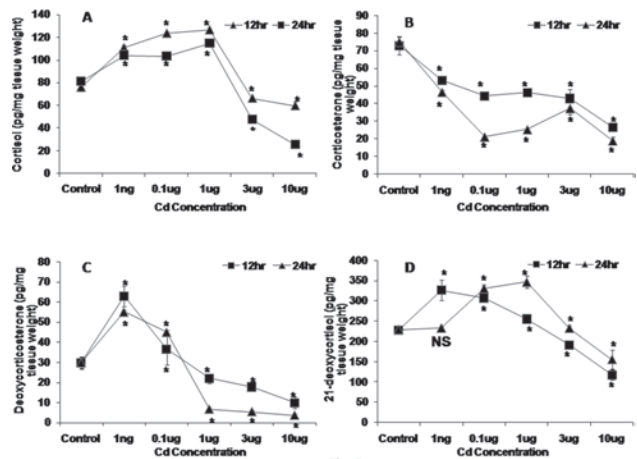


Fig. 3

Fig. 3. Effects of incubation of postvitellogenic follicles with cadmium chloride for 12 or 24hr on cortisol (A), corticosterone (B), deoxycorticosterone (C) and 21-deoxycortisol (D) secretion in catfish *Heteropneustes fossilis*. Data were expressed as Mean±SEM (n=5). Data were analysed by one way ANOVA, followed by Tukey’s test (P<0.05). Asterisks show significant difference from the control groups.

Discussion and conclusion

It is widely recognized that Cd is a major EDC and affect various aspects of reproduction in animals. Gonadal steroid hormones are the terminal or subterminal regulators of gametogenesis, maturation and spawning. Sequential and balanced hormone secretion is essential for maintenance of these functions. The present *invitro* study shows that Cd exposure interrupted follicular steroidogenesis at multiple sites. In teleosts, E₂ is the major regulator of vitellogenesis, a complex and elaborate process responsible for the growth of the follicle and the yolk so deposited are used during early embryonic development. The data show that Cd stimulated E₂ production in a concentration and time dependent manner. This is in agreement with the report that Cd stimulated both plasma concentration and *invitro* secretion of E₂ and vitellogenesis in the Atlantic croaker^(13,14).

Cd appears to interfere with the steroidogenic patterns at multiple sites⁽¹⁴⁾. Cd produced biphasic effect on testicular steroidogenesis in rainbow trout at short term (2hr) exposure, it stimulated 11-KT production but at 18hr incubation, it was inhibited by CdCl₂⁽¹⁵⁾. 20 β -HSD activity which catalyzes the conversion of 17-P to 17,20 β -DP was inhibited when sexually immature juvenile african catfish were fed diet containing Cd⁽¹⁶⁾. Cd is a non-specific blocker of Ca⁺⁺ channels. As Ca⁺⁺-calmodulin is important for follicular steroidogenesis, the binding of Cd and Pb to the Ca⁺⁺ binding sites in calmodulin can affect hormone secretion^(17,18). Cd may inhibit the activity of many steroidogenic enzymes and ovarian maturation in common carp⁽⁷⁾. In frog, Cd was found to inhibit pituitary homogenate-induced oocyte maturation and ovulation⁽¹⁹⁾.

The actions of Cd on steroid biosynthesis may be complex, with multiple stimulatory/inhibitory actions such as those on plasma membrane, adenylyl cyclase or endogenous mitochondrial cholesterol utilization through effects on calcium ion interactions, membrane proteins (e.g. P450scc) or lipids⁽²⁰⁾. Cd could mimic the effects of E₂ in estrogen responsive breast cancer cell lines⁽²¹⁾. Thus, the estrogenic actions of Cd, such as on vitellogenesis may be due to E₂ receptor activation. The present data show that Cd exposure disrupted the progesterone pathway. P₄ and 17-P were significantly inhibited except in the 12hr exposure of 1ng (P₄) and 1 and 0.1 μ g (17-P) groups. The higher concentrations had a deleterious effect especially in the 24hr exposure groups. In contrast, the response on 17,20 β -DP was quite different and biphasic. At short exposure time (12hr), Cd stimulated the steroid production response; the response was maximal at the 1 μ g concentration and declined thereafter. However, at 24hr, the metal elicited an inhibitory effect in a concentration-dependent manner. The mechanisms underlying varied effects of Cd on P₄, 17-P and 17, 20 β -DP is not clear at present and the enzyme involved in the conversion may be important targets of the metal.

In our earlier study with lead exposure, a similar pattern was noticed⁽¹²⁾, suggesting that metals may act similarly at various steroidogenic steps. The biphasic action of Cd on the MIS may interfere with oocyte final maturation. In Prussian carp, Cd at lower concentrations (20, 100 and 200 μ M) stimulated spontaneous oocyte maturation similar to carp pituitary extract or 17, 20 β -DP stimulation⁽²²⁾. The spontaneous stimulation might be due to the activation of the progestin or corticosteroid pathway or both. Ca²⁺

is an activator of LH-stimulated 20 β -HSD activity responsible for 17,20 β -DP production⁽²³⁾.

The present data show that the catfish ovarian follicles are a major source of corticosteroids, in addition to the interrenal tissue, the adrenocortical homologue has been reported earlier⁽¹¹⁾. The Cd exposure led to biphasic effects on cortisol, deoxycorticosterone (DOC) and 21-deoxycortisol levels. The lower concentrations stimulated the steroids with greater response at short exposure (12hr) for cortisol (1ng, 0.1 μ g and 1 μ g groups) and DOC and 21-deoxycortisol (1ng groups). At higher concentrations (3 and 10 μ g), both were inhibited by Cd at 12 and 24hr. In contrast, exposure to lead produced a biphasic effect on follicular cortisol and inhibitory effect on other corticosteroids⁽¹²⁾.

Although the brain-pituitary-adrenal (BPA) axis was not examined for Cd toxicity, the results imply that the BPA axis may also be affected by the metal. Lacroix and Hontela⁽²⁴⁾ reported that Cd interfered with the signalling pathway of cortisol synthesis at a step prior to the formation of pregnenolone and vulnerability of the interrenal tissue varied with species. Cortisol is the main stress hormone having both glucocorticoid and mineralocorticoid actions. The stimulatory response may be due to stress. The inhibitory response may be due to the impairment of the steroid secretion. The adverse effect of Cd on follicular corticosteroids may influence follicular functions. In teleosts, cortisol or DOC are implicated in oocyte final maturation. The stimulatory effect of low Cd may be beneficial for maturational activity⁽²⁵⁾. The results of our investigations indicate that cadmium adversely affects severely steroid hormone secretion thereby affecting all hormone induced activity of the ovary.

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Conflict of Interest

There is no interest of conflict among authors.

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Unusual Finding in Ante Mortem Partial Hanging: A Case Report

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ABSTRACT

Partial hanging is generally associated with prominent eye and facial changes and less prominent ligature mark. We are reporting a case of partial hanging in a 26 years old male showing unusual findings. Although he was found hanged in sitting position, then also deceased body had prominent ligature marks and absence of facial and eye changes.

Keywords: Partial hanging, Forensic Pathology, Forensic Medicine

INTRODUCTION

26 years old man was found hanged in sitting position with double loop of ligature material made up of black wire in situ. His room was closed from inside and ligature material was tied to door handle. He was taken to Lok Nayak Hospital, Delhi, India for medico-legal post-mortem examination.

On autopsy examination, deceased was moderately built and nourished. Salivary stain was present at left angle of mouth. Tongue was protruded with blackish discoloration. Post mortem lividity was present over lower back, buttocks and upper part of both thighs. Semen discharge was present at glans penis.

Ligature material (black wire) was in situ (Figure 1), it was cut away from the knot and both ends were secured with thread. Ligature material was encircling neck in the form of double loop with fixed type knot present over left side of neck.

Ligature mark in the form of pressure abrasion 30 cm long (Figure 2), reddish brown parchment like present completely encircling the neck, going upward, present at the level of thyroid, in midline is 7 cm below extended chin, 9.8 cm above sternal notch, at right side of neck 5.4 cm below mastoid process, at left side of neck 6.2 cm below mastoid process, at back of the neck just below hair line. Grooved mark of ligature knot, 2.5 cm x 1.8 cm present over left side of neck 6.4 cm below and behind left mastoid process. Width of ligature mark varies between 0.5 cm and 0.9 cm.

Another ligature mark in form of pressure abrasion (Figure 2), 15 cm long, reddish brown parchment like present over front and both side of neck starting over

left side of neck 3.8 cm from midline and 4.2 cm below lower margin of mandible, going upward and toward right ending at right angle of mandible. In midline it is 5.5 cm below chin and over right side of neck just below right angle of mandible. Thickness of mark varies between 0.4 cm and 0.6 cm.

Abrasion 3.2 cm x 1.4 cm, reddish; present over left lateral malleolus may be due to friction against floor.

Internal examination (Figure 3) revealed white glistening subcutaneous tissue beneath ligature marks. Effusion of blood present in strap muscles beneath ligature mark over right side. Internal organs are congested and oedematous. Cause of death was given asphyxia as a result of ante mortem hanging.



Fig. 1. Showing ligature material in situ

DISCUSSION

Suicide is second to only accidental death as the leading cause of mortality in young men across the world¹. The term Partial Hanging is used for such cases in which the bodies are partially suspended, or for those in which bodies are in a sitting, kneeling, reclining, prone or any other posture. In hanging from a low point of suspension (Partial Hanging), a comparatively little force, about 4.5 kg is enough to occlude blood vessels of the neck². Classical external injuries of asphyxial death (congestion of the face and petechial haemorrhages) are more common in cases of partial suspension than in complete suspension.

Clément R, etc. publication showed that incidence of petechiae was higher among incomplete hanging victims compared with cases of complete suspension and that the incidence of petechiae varied inversely with the height of the victims³.

Huh GY, etc publication showed that, subconjunctival petechiae were found in 33.6% of all cases, mostly seen in incomplete, atypical hanging. However, about 30% of incomplete, atypical hanging showed no definite subconjunctival petechiae. The patterns of location of ligature mark, type of knot, and position were somewhat different between positive and negative cases of subconjunctival petechiae in incomplete, atypical hanging⁴.

In partial hanging weight of the head is enough to occlude venous circulation but vertebral arteries will continue to supply blood to brain and facial regions, so pressure of capillaries will increase that will lead to minute haemorrhages in brain, conjunctiva and face⁵.

Typical finding in partial hanging is congestion of face and petechial haemorrhages over conjunctiva, brain and face. In partial hanging suspending force is not whole body weight, so ligature mark typically will be less prominent with absence of haemorrhages beneath ligature marks.

In our case report, deceased did not show any congestion or petechial haemorrhages over face and conjunctiva (Figure 4). His neck region had 2 prominent ligature marks due to double loop of ligature material. On internal dissection, subcutaneous tissue and strap muscles, beneath ligature marks shown effusion of blood. So finding in our case is unusual for partial hanging.

Diagnosis of ante mortem hanging includes (i) presence of ante mortem ligature mark with vital



Fig. 2. Showing Prominent ligature marks



Fig. 3. Showing effusion of blood beneath ligature marks



Fig. 4. Showing absence of petechiae or congestion over face

reaction (ii) *Le facies sympathique*: Eyes on one side where the knot presses the cervical sympathetic trunk remains open with dilated pupil. It is an important sign of ante mortem hanging (iii) Saliva dribbling mark from angle of mouth. (iv) Ecchymosis of larynx or epiglottis (v) Extent of fracture of thyroid cartilage and hyoid bone (vi) Rupture of intima of carotid vessels (vii) Emission of seminal fluid is quite common in ante mortem hanging⁶. In our case salivary dribbling, semen discharge and effusion of blood beneath ligature mark was present deceased body.

CONCLUSION

Partial hanging may present with unusual finding if ligature material will be wire and encircled around neck tightly with fixed knot. Pressure exerted by wire will be much more in comparison to soft material per unit area and this may explain these unusual findings.

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Profile of Fatal Electrocutation in Visakhapatnam Region

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ABSTRACT

It is a prospective study of fatal electrocution cases brought for post mortem examination at the Department of Forensic Medicine & Toxicology, Andhra Medical College, Visakhapatnam, Andhra Pradesh. Fatal electrocution cases accounted 1.68% of all total cases of autopsies done at our centre during the study period. Majority of the victims were male belonging to the age group of 21-30 years. Incidence was more during the summer and monsoon seasons. Most of the victims were from the unskilled or skilled category. Majority of the cases were accidental in nature and spot death.

Keywords: Fatal electrocution, Electric shock, High Tension, Low Tension

INTRODUCTION

In this modern era of electronics electrical injuries are becoming a big challenge in the emergency wards with a high morbidity and mortality rate. In most of the incidents fatal electrocution occurred at home or in work place and they are mostly accidental in nature. It is commonly encountered amongst the unskilled and skilled people. If there is a little awareness about the use of good quality electrical home appliances, proper electrical fitting, etc. amongst the common people and work safety measurement amongst the skilled people, then we can reduce the incidence of death from electrocution.

MATERIAL & METHOD

It is a prospective study of fatal electrocution cases brought for medico legal autopsy during the period of September 2007 through August 2009 at the Department of Forensic Medicine & Toxicology, Andhra Medical College, Visakhapatnam, Andhra Pradesh. For the present epidemiological study we

selected 54 cases (Out of the total 3214 medico legal cases reported at the centre during the study period) of fatal electrocution where death occurred at the site.

For each & every case we collected all the relevant information from the police inquest papers, relatives, friends, eye witness, etc. The findings were tabulated for easy study and comparison with previous studies.

OBSERVATION

Out of the total 3214 cases of autopsy conducted during the present study period, there were 54 cases, (1.68%) of electrocution (Table No.1).

Table 1: Cases Distribution According to Study Period

Year	Total autopsies	Electrocution Cases	%
2007-2008 (Sept-Aug)	1577	20	1.27
2008-2009 (Sept-Aug)	1637	34	2.08
Total	3214	54	1.68

Male victims outnumbered the female victims. Sex wise distribution of cases is shown in Table No.2.

Table 2: Cases Distribution According to Sex of Victim

Year	Male	%	Female	%
2007-08 (Sept-Aug)	17	85	3	15
2008-09 (Sept-Aug)	29	85.3	5	14.7
Total	46	85.2	8	14.8

Majority of the victims were young adults in the age range of 21-30 years, 17 cases, 31.5% of the total

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fatal electrocution cases. Age wise distribution of cases is shown in the Table No.3.

Table 3: Cases Distribution According to Age of Victim

Age group	No. of Cases	%
0-10	0	0
11-20	12	22.3
21-30	17	31.5
31-40	13	24
41-50	7	13
51-60	4	7
61-70	1	1.85
Total	54	100

Summer & monsoon seasons had witnessed maximum number of cases. The least number of cases was recorded during the winter season (as shown in Table No. 4).

Table 4: Cases Distribution According To Season

Season	Cases	%
Summer (Mar-Jun)	22	40.7
Monsoon (Jul-Oct)	21	38.9
Winter (Nov-Feb)	11	20.3
Total	54	100

Majority of victims were unskilled type although skilled victims were also not immune to fatal electrocution. It is shown in the Table No.5.

Table 5: Cases Distribution According to Skills

Skilled	%	Unskilled	%	Semi skilled	%
2	10	14	70	4	20
8	23.5	22	64.7	4	11.8

Fatal electrocution was more or less equally common both in low and high tension electricity (as shown in Table No.6).

Table 6: Cases Distribution according to Voltage

Year	No. of Cases	Low Tension	%	High Tension	%
2007-08 (Sept-Aug)	20	11	55	9	45
2008-09 (Sept-Aug)	34	14	41.1	20	58.9

Majority of the incidents happened at home, 29 cases, 53.7%. In 10 cases, 18.52% the cases happened in industrial places (as shown in Table No.7).

Table 7: Cases Distribution According To Place.

Year	Total cases	Domestic	%	Industrial	%	Others	%
2007-08 (Sept-Aug)	20	8	40	7	35	5	25
2008-09 (Sept-Aug)	34	21	61.7	3	8.82	10	29.4

DISCUSSION

During the study period there were total 3214 cases of autopsy out of which 54 cases, (1.68%) were of fatal electrocution. It is observed that the incidence of fatal electrocution was more in the second period of study.

Most of the victims were male seen in 46 cases, 85.2%. Females were involved in 8 cases, 14.8%. Similar findings of male victim dominance were also reported by Shaha KK, Joe AE¹, Dixit P et. al² and Sheikhzadi A et. al³.

Increasing incidence of electrocution was noted in the age groups ranging from 11-20 years, 21-30 years and 31-40 years. The maximum number of cases was seen in the age group of 21-30 years, 17 cases, 31.5%. The study conducted by Shaha KK and Joe AA¹ also reported that most of the victims were from the age group of 21-30 years. Our present study is also consistent with the study conducted by Gupta BD et. al⁴ if we combine all the cases falling in the age group 11-50 years together.

More number of cases was reported during the summer and monsoon seasons probably due to increase in use of electricity and electrical appliances for cultivation. Moisture and wetness will also increase of the risk of fatal electrocution as there is decrease body resistance and increase in electric conduction⁵. Moreover cyclones are common during these seasons and wetness also plays an important role in electrocution. Similar type of findings was also observed by Gupta BD et. al⁴.

We categorized victims based on their chosen profession like electrician/electrical engineer/electricity technician into three groups of (1) Skilled (trained electricians), (2) Unskilled (without any training any training) and (3) Semiskilled (with in

adequate knowledge and incomplete training). Majority of the victims were from the unskilled & skilled categories. In case of skilled category the reason for increased incidence could be due to lack of safety at work places or ignorance. Amongst the unskilled category the reason could be due to improper house hold wire fitting, old wire & broken switch, etc. Moreover there is increase use of electrical home appliances day by day. Our present findings are consistent with those finding reported by Gupta BD et. al⁴ and Rautji R et. Al⁶. All cases of domestic fatal electrocution were accidental in nature.

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A Study of Mortality among Children by Poisoning in North India

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INTRODUCTION

It is worth to paying attention to the term 'poison' by simple logic; a poison is a substance which produces toxicity. Deaths due to poisoning have been known since time immemorial and continue to be a major problem all over the world. Although its type and the associated morbidity and mortality vary from country to country or even place to place in the same country. Poisoning in children is a global health problem. Introduction of new drugs and chemicals coupled with rapid industrial growth have widened the spectrum of toxic products to which the children may get exposed.

Although the pediatric poisoning is not very uncommon in this part of the country, yet there exist inadequate data regarding the pediatric fatalities due to poisons in this part of the country and the present study tries to address this problem.

The objective of the present study was to determine the various aspects of poisoning fatalities in children, like demographic data, manner of death, diurnal, and

seasonal variation. The present study attempts to gather epidemiological information so as to formulate recommendations that could probably help to prevent or reduce these deaths.

MATERIALS AND METHOD

The present study is a retrospective research which comprises 245 pediatric victims (less than 18 years of age) of poisoning deaths from the medico legal autopsies done at the Department of Forensic Medicine and Toxicology, King George's Medical University UP, Lucknow, India over a span of 1 year (June 2011 to May 2012). The mortuary of the King George's Medical University, under the Department of Forensic Medicine and Toxicology, conducts the medico legal autopsies referred from Lucknow police station and also those referred from adjoining police stations of Lucknow and nearby districts. Data was obtained from the autopsy files, police inquest reports & hospital case records.

RESULTS

A total of 4756 medico legal autopsies were conducted during the study period. Among them 1168 were deaths due to poisoning about of which 245 victims were under the age of 18 years. Age group 13-18 years were commonly involved (Fig-1). Male victims outnumbered females (Fig-2). About 70% of the decedents allegedly died due to suicidal poisoning (Fig-3). Consumption of poison was more during day

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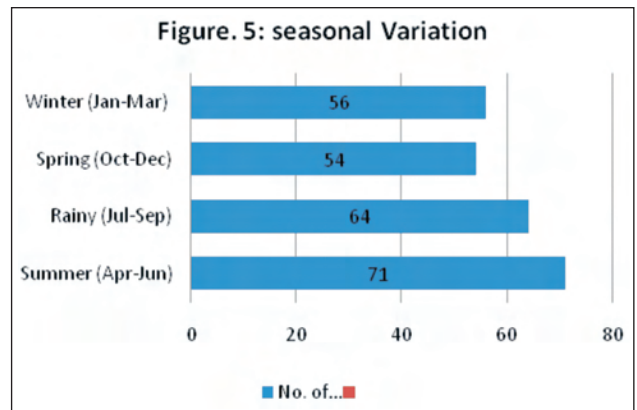
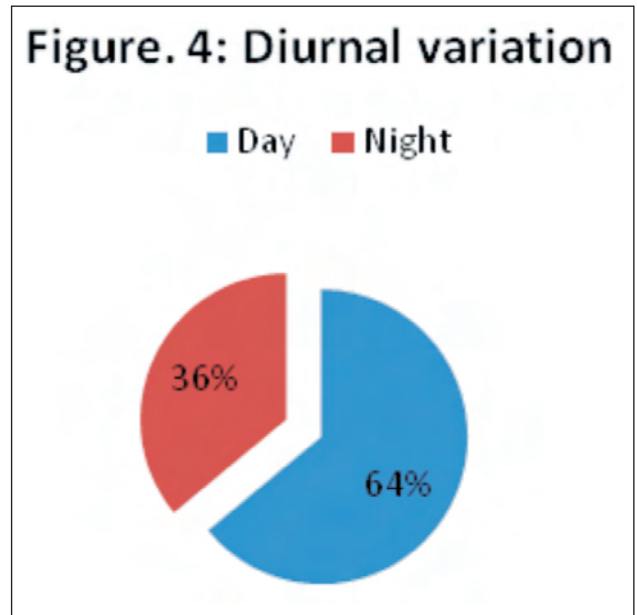
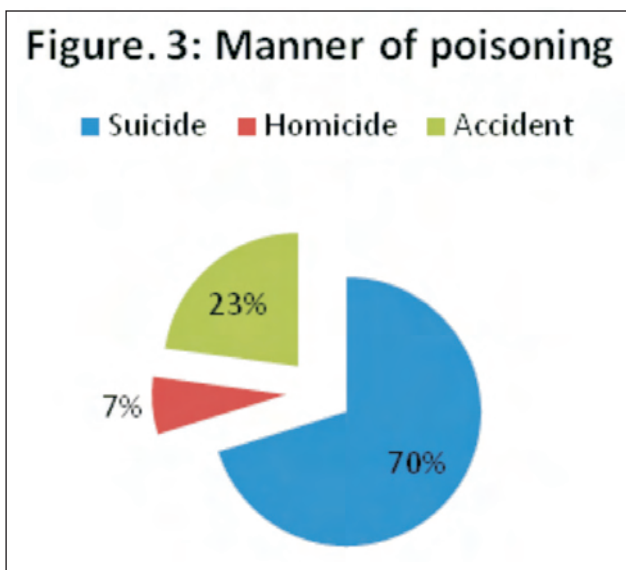
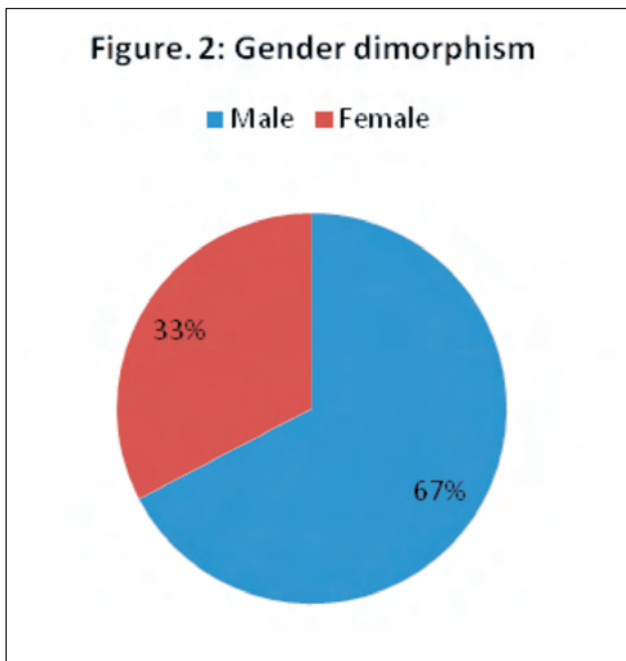
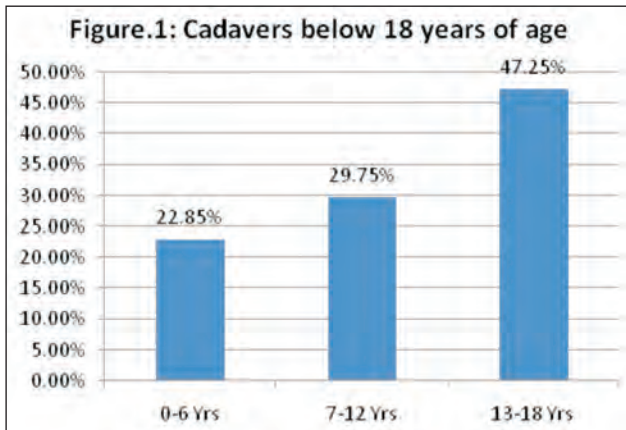
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time (Fig-4). About one third of the victims 71 (28.97%) consumed poison during summer months (Fig-5).

DISCUSSION

Pediatric poisoning although amenable for prevention is a growing concern in the clinical practice. Unlike in adults the accidental poisoning is more common in children. Small children may accidentally swallow poisonous substances or a parent/another person may deliberately poison a child and on occasions a child may deliberately ingest a poison in a fit of rage or anger.

Present study observed that deaths due to pediatric poisoning formed 5.15% of all unnatural deaths for which autopsy were done at the morgue of King George's Medical University Lucknow. Childhood poisoning constituted 1-2 % of total deaths in other works.^{1,2} Most common age group to be affected was

13-18 years. Data from Jordan indicates more involvement of children under the age of 6 years.³ Children less than 5 years old were at the highest risk for poison related fatalities in our study.⁴ Data from South Carolina¹ observed a bimodal age distribution having two peaks, one in the teenage group (15-17 years) and other in preschool group (9 months to 4 years). However data from England and Wales suggest more common involvement of 0-9 years.⁶

There was a male preponderance in the present series of cases under study which is concurring from other works.^{1,3,6} Suicidal poisoning was noted in overwhelming majority of the cases under study. Two cases of accidental and a case of homicidal poisoning were noted. Self poisoning was more common in one of the study.³ However other reports indicates accidental poisoning was more common in less than 11 years and self poisoning in children over 11 years of age.⁵ Consumption of poisoning was more during the day time when compared to night. It is probably because during the daytime the person would be awake and stress would be at its peak, there could be a tendency to terminate one's own life with readily available substances like poison. About 30% of the victims consumed poison during the summer months. Spring had more poisoning events followed by summer in one of the reported work.³

CONCLUSION

In a developing country like India, where agriculture is the main source of income of the majority, loss of crops due to pests cannot be ignored. Hence instead of banning a particular insecticide, some measures for their safe usage and disposal could be adopted like; proper labeling, imparting awareness

programmes to the general public about the hazards of pesticides and their safe and proper handling.

Extending psychiatric services to the community which may help in identifying the high risk children who are likely to commit deliberate self harm. Parental education and intensified child supervision are the indicated measures of prevention for unintentional poisoning. The use of child-resistant packaging and the secure storage of household substances are the basis of preventing unintentional exposures. Poison prevention efforts should also address the appropriate role of the poison information centre.

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Descriptive Study of Skull Fracture and its Associated Features at Tertiary Care Hospital, Northern India

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ABSTRACT

Head injury is a morbid state and commonly results during the road traffic accident. Identification of studied pattern helps to understand the potential fatal head injury.

Objective: to describe the nature and pattern of skull fractures among deceased due to injury at tertiary care hospital of North India.

Study design: descriptive Study.

Method and Procedures: Autopsy.

Results: Head injury with skull fracture found to be associated with road traffic accident (92.8%) among total 87 deceased. The base skull fracture was common (44.0%), followed by base and vault (31.0%). The ratio of unilateral to bilateral involvement of skull vault in fracture was 2.40:1. Intracranial hemorrhage was the most frequent associated with the fracture.

Conclusion: Most of the cases of head injury is due to vehicular accidents and proved to be fatal for life, the safety measures, for both the drivers and the passengers of the respective vehicles should be addressed.

Keywords: Head Injury, Skull Fracture, Hemorrhage

INTRODUCTION

Head Injury is defined by the National Advisory Neurological Diseases and Stroke Council (NANDSC) as a morbid state, resulting from gross or subtle structural changes in the scalp, skull, and/or the contents of the skull, produced by mechanical forces. Majority of fatalities in trauma cases occurs due to head injury^[1]. Unintentional injuries contribute 66.0% of all injury deaths and 70.0% of injury Disability Adjusted Life Years (DALYs). Road traffic injuries (RTI) contribute a large among unintentional injuries in low middle income countries. Young people from 15-29 year accounted highest portion of RTI. It is a modern epidemic with rising vehicles density, high velocity technology, along with congestion of roads and traffic rules violation. India has just 1% of the total vehicles in the world but it contributes to 6% of the global Road

Traffic Cases^[2]. Estimates suggest that New Delhi has the highest number of road side accidents in India^[3].

Unintentional head injury varies with extremes of outcome from good recovery to death. The lethality of injury depends on amount of strike force, skull properties at the point of the contact, thickness of scalp, amount of hair and thickness and elasticity of individual skull, etc.^[4] It is observed that the victim is more vulnerable in frontal collision, side collision and if hit by heavy motor vehicle. Head injury is also caused by the assault as a common reason and pattern of injuries depends upon type of weapon^[5]. Clinical features of head injury are; Loss of consciousness or headache, nausea and vomiting, ear bleed, vertigo, papilloedema. Likelihood of skull fracture is directly associated with severity of injury and vault is involved three times more often than the base. Sub dural

hematoma (SDH) was the most common intracranial lesion resulting from head injury. Contusions and lacerations of the brain often seen in vehicular accidents and fall from height cases. These may occur with or without external injury to the scalp and fracture of the skull [6].

Preoccupation with knowledge of skull area involvement followed by type of injury helps in triage and patient care management. Present study rationalizes the institute injury surveillance towards facility preparedness in managing the patients with injury with the objective to analyze the pattern of skull fractures among all patients with head injury reported to tertiary care hospital of North India, June 2007 to May 2008.

MATERIAL AND METHOD

This study was undertaken in the Government Medical College and Hospital (GMCH), and Government Multispecialty Hospital (GMSH) Chandigarh with prior ethical approval from Institution Ethics Committee (IEC) from both the institutes. Information was collected on pretested structured questionnaire from the police and accompanying relatives/friends to gather information regarding the age, sex, socioeconomic status, *pucca* (Hard with gravel and charcoal tar) or *kuccha* (Loose ground without gravel and charcoal tar) road, the type of weapon in case of assault and height from where the person fell. The pattern of skull fracture i.e. type of skull fracture, region and bones of skull involved, any accompanying underlying brain injuries, was noted along with injuries to other parts of the body. The clinical records of the deceased were collected before and compare after the autopsy findings of those cases that received treatment at study hospitals but eventually succumbed to their injuries/complication.

RESULTS

Total of 84 deceased including 7 crush injuries with skull fracture were studied. All the deceased had more than one type of fracture and associated finding. Quarter of victims died before reaching the hospital. Head injury with skull fracture found to be associated with road traffic accident (78; 92.8%), fall from height (3; 3.6%), assault (2; 2.4%) and railway accident (1; 1.2%). Age of the victims varied from 2-75 years with large number (27.9%) from age group 21-30 years and 31-40 years (23.8%). Males were involved more (81.0%) with male to female ratio being 4.2:1. Total 60 victims

were able to be studied for socio-economic status; more belonged to middle (53.4%) than lower (28.3%) and higher (18.3%) status. Rest could not be studied as victims were unknown. Significantly ($p < 0.05$) majority of victims belonged to urban area (64; 76.20%) than rural area.

Based upon clinical investigation and autopsy, the base skull fracture alone was common (44.0%), followed by base with vault (31.0%). Vault alone was involved in 25.0% cases. In all type of victims the most common type of fracture present was linear fracture. Temporal region was the commonest (35.9%) region involved in fracture followed by parietal (29.5%) and frontal (34.6%) region. Skull fracture unilaterally present among maximum (70.6%) victims. The ratio of unilateral to bilateral involvement of skull vault in fracture was 2.40:1. The middle cranial fossa was the commonest region involved (52.2%) followed by posterior cranial (25.4%) and anterior cranial fossa (22.4%). Subdural (43.1%), subarachnoid (31.9%) and extradural (19.4%) haemorrhage was associated with skull fracture. Edema (11), laceration (7), midline shift (6) and necrosis (5) were other intracranial observations.

Of the 78 cases of road traffic accidents (RTA), half (51.3%) were two wheeler occupants and 82.5% of whom were the drivers. The next major group of victims were the pedestrian (37.2%) followed by the bicycle riders (6.6%). Only 3 (7.5%) were reported to be wearing helmet among motorized two wheeler riders. Car was the most common offending vehicle (43.4%) followed by bus (21.1%) and trucks (11.8%). Information regarding the offending vehicle was not available in 15.4% cases. Majority of RTA victims were reported to have been hit either from side (33.3%) or from behind (33.1%). Head on collision was reported in 15.4% cases, while 7.7% cases of vehicular accident occurred due to skidding of motorcycle.

Accident on *pucca* (94.9%) found to be significantly higher ($p < 0.05$) than *kuccha* road (5.1%). Maximum number of RTA occurred between 15:00-18:00 (23.8%), 09:00-12:00 (22.5%), 12:00-15:00 (13.7%), and 24:00-03:00 (11.3%) hours. Thirty five victims (41.7%) died within 6 hours of the incident, of which 25 (71.4%) died within 1 hours of the incident. Forty seven (56%) victims died within 24 hours of the incident.

DISCUSSION

As a part of body head is one of the most accessible and vulnerable to injury. Continued and facility based

injury surveillance helps in understanding the effects of trauma to the head and facility preparedness in trauma care. Vehicle usage is related with age and gender of the population. As reported in other studies^[7] the present study observed peak injury incidence the age group 21-40 years (51.2%) as reported in other studies. Male involvement found to higher (81%) as predisposed to vehicular mobility and reported from other evidences^[8,9]. Work timings associated with high traffic congestion on the road found to be associated as in present study majority of the incidents occur morning and evening hours as reported earlier in India^[7,9]. Almost all (94.9%) of the accidents were reported to be occurred on the metallic road.

Severity of injury and transportation mechanism to health facility is important for the patient management and survival. In present study about half (47.1%) of the victims died on the spot within 6 hours and out of them 71.4% died within 1 hour of accident. Laceration alone (21.4%) and laceration with contusion (21.4%) was found to be common scalp injury as with other study^[8, 10] however contusion and scalp haematoma^[11] was observed as common scalp injury. Present and other evidence^[12] observed fracture base of skull a commonest (44.0%), vault alone (25.0%) and involvement of both vault and base of skull was found in 30.95% cases. In our study temporal bone was involved the most as reported in another studies^[4, 13].

Linear fractures were most common observed fracture in the present study. It was observed among 30.4%^[14] in other study. Fissure fracture was also found common^[15]. Followed with fracture subdural haemorrhage was found in 43.1% of cases in the present study hence it was observed as 22.7%^[10] and 52.63%^[7] in another studies. A study^[16] found subarachnoid haemorrhage as high as 66.9%, whereas present study found only in 31.9% of victims and by extradural haemorrhage (31, 19.4%). Laceration was present in 7 cases. Intracerebral haemorrhage was seen in 9 cases.

Present study found 51.3% and other 48.0%^[15] reported two wheeler riders and 92.5% were not had helmets while driving. Car was the most common (43.4%) offending vehicle followed by bus (21.1%) in the present study. Majority got hit from side (33.3%) and behind (33.1%) at the time of accident.

As the maximum number of cases of head injury is due to vehicular accidents and proved to be fatal for life, the safety measures, for both the drivers and the

passengers of the respective vehicles should be addressed. Awareness of safety rules should spread through the society by judicious use of multimedia facilities available to us in the modern era. Speed limit for different type of vehicles should be implemented strictly. Helmet use for two wheeler motorized vehicle should be made mandatory. Special emphasis is given to peak timing of road congestion. Local hospital based injury surveillance system is to be established to understand the type of fatal injury for patient triage and management.

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Conflict of Interest: None.

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A Study on HIV/AIDS Infection amongst Commercial Sex Workers

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ABSTRACT

Presently, the Human Immunodeficiency virus (HIV) pandemic still remains as the leading cause of deaths in terms of sexually transmitted diseases (STD). According to UNAIDS (2008), 33.4 million people worldwide are currently living with HIV; among them 31.3 million people are adults. Deaths due to HIV were 2.0 million (1). HIV infection is now almost equally distributed between men and women. Deaths in women have also increased, accounting for an estimated 46% of adult deaths (2). The vast majority of people living with HIV/AIDS are not aware that they are carrying the virus (3) India has the largest number of people living with HIV/AIDS. It has also been declared that at end of 2010 women account for 50% of all adults living with HIV worldwide(4).

A significant increase in prevalence of HIV infection has been observed in female sex workers and patients attending STD clinics (5-6). Commercial Sex Workers (CSW) form one of the high risk groups for HIV and STD infections. The prevalence of HIV due to sexual transmission is now the main mode of transmission and has purported in all strata of community irrespective of urban and rural. Hence, it is quite necessary to assess the magnitude of HIV infection among CSW in the rural area of socio economically backward district of Bijapur.

Objectives:

- To assess the magnitude of HIV/AIDS infection among sex workers visiting the STD clinic.
- Socio demographic profile of CSWs

Material and Method

Study Area: STD clinics run by NGOs in the villages of Bijapur Taluka. All the villages covered by selected NGOs were included in the study.

Participants: All the female commercial sex workers registered with selected NGOs were included in the study.

Study Design: Cross sectional study.

Sample size: 600 CSWs

Result: Overall Prevalence of HIV was found to be 9% among 600 studied commercial sex workers (CSWs). The study subjects of younger age group i.e. 15-30 years and age more than 45 years had higher risk of having disease. Statistically association was found between HIV/AIDS and CSWs who were working in open area (field), Time of sex, doing profession in odd time and started sex selling less than one year, entertaining more than 5 partners per day and selling sex more than 15 days per month. So, they have more risk of acquiring HIV Infection.

Keywords: Commercial Sex workers, NGO, HIV/AIDS, Magnitude

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INTRODUCTION

India has been experiencing the most serious Public health challenge posed by HIV epidemic since its first detection in 1986. The problem of HIV is seen to be increasing continuously from beginning till date. India has a sharp increase in the number of HIV infections

from a few thousands in early 1980's to an estimated 3.8-4.6 million children and adults living with HIV/AIDS in 2002. Sentinel surveillance data indicated that the number of HIV cases is increasing continuously throughout the country, with a major route of transmission being the heterosexual contacts (>86%)⁷

Presently, the HIV pandemic still remains as the leading cause of deaths in terms of sexually transmitted diseases. Virtually 40 million people worldwide are currently living with HIV, out of which 95% live in less developed countries⁸ HIV infection is now almost equally distributed between men and women. 17.6 million women aged 45-49 years living with HIV/AIDS and estimated 46% of adult deaths in women due to HIV infection in 2001. Since the first report of this infection in female sex workers in Chennai in 1986, a significant increase in prevalence of HIV infection has been observed in female sex workers (FSWs) and patients attending STD clinics. Prevalence of HIV due to sexual transmission is now the main mode of transmission. In India heterosexual transmission of HIV infection accounts for more than 83%,⁹ But the vast majority of people living with HIV/AIDS infection are not aware that they are carrying the virus.¹⁰

Commercial sex workers (CSWs) act as a major vehicle of HIV infection through sexual contacts. This is an efficacious mode of transmission of HIV infection. That is why the HIV infection rate is very sensitive to a change in rate of multi partner sexual activity in the population. Hence, controlling this rate should have very big impact in lowering HIV infection rates in the population.

As HIV infection is alarmingly increasing in most major metropolitan cities of India It is important to study the HIV infection rates in India. In view of the threat posed by HIV/AIDS, there is a need to get an in-depth understanding of the sexual behavior and magnitude of the population.

OBJECTIVES

- To assess the magnitude of HIV/AIDS infection among sex workers visiting the STD clinic.
- Socio demographic profile of CSWs.

MATERIALS AND METHOD

600 FSWs from different villages of Bijapur taluka (Karnataka state, India) were included in the study. The study conducted during April 2010 to June 2010. There are many STD clinics running by NGOs in Biapur District. Using simple random sampling (By Lottery method), one NGO was selected for our study. 600 registered FSWs who were willingly to participate in the study were included after explaining the study purpose. After informed consent, participants answered a structured questionnaire, which included data on selected sociodemographic and behavioral characteristics.

Statistical Analysis

SPSS version 16 was used to analyze the data. Association between HIV/AIDS and selected features of FSWs were examined using univariate analysis. Odds ratio with 95% Confidence limit was used to measure the magnitude of the association between HIV and sociodemographic and behavioral factors.

RESULTS

Table No. 1 General Information of CSWS

Variables	Number of CSWS	Percentage
1 Age (Years)		
15-20	5	1
20-25	46	8
25-30	175	29
30-35	147	25
35-40	124	20
40-45	57	09
45-50	46	08
2 Marital status		
Married	146	24
Unmarried	50	08
Divorcee/living separately	278	46
Widow	126	21
3 Education		
Illiterate	570	95
1 st -4 th std	13	2
5 th -7 th std	7	1
8 th -10 th std	10	2
4 Income (Rs)		
≤5000	134	22
>5000	466	78

Table No. 1 General Information of CSWS (Contd.)

Variables	Number of CSWS	Percentage
5 Religion		
Hindu	563	94
Muslim	37	6
6 Type of family		
Nuclear	538	90
Joint	62	10
7 No. of children		
0	64	11
1	136	23
2	176	29
3	133	22
4	75	12
≥5	16	3
8 HIV infected		
Yes	53	9
No	547	91
9 Duration of disease		
4-6 months	6	1
1-2 years	32	5
2-5 years	33	6
≥5 years	529	88
10 Time of sex		
Morning	37	6
Afternoon	79	13
Evening	184	31
Late night	272	45
Multiple time	28	5
11 No of days of sex/month		
<15 days	252	42
≥15 days	348	58

Among 600 participants, according to age, 175(29%) belonged to age group of 25-30 years, followed by 147(25%) in the age group of 30-35 years. Rest included 46(8%) in the age group 40-50 years. Most of the subjects were married but remain separated from their husbands i.e 278 (46%). Rest were married 50(8%) and widowers 126(21%). Educationally, 570(95%) were illiterate followed by 30(5%) were educated up to 10th standard. About 466 (78%) had their monthly income more than Rs 5000 and 134 (22%) had their income per month less than Rs 5000.

The interviewed subjects responded to the questions such as duration of sex work, 49(8%) had duration of 5 or more than 5 years and maximum number of subjects 284 (47%) had sex work 1-2 years. Only 6 (1%) had less than one year. The prevalence of HIV infection is more (i.e.6%) in CSWs those who had sex for 5 or more than 5 years. 452(75%) CSWs entertain 1-3 clients daily, 15(3%)entertain more than 5 clients daily.272 (45%) used to do their profession in the late night, followed by 184(31%) in the evening and 79 (13%) in the afternoon and 28(5%) both in morning and night. 348 (58%) FSWs used to work more than 15 days per month. 175(29%) FSW reported that they entertain their clients outside i.e. in hotel, Dhaba and at night club for higher income and 80 (13%) in home.

TABLE 2. IIUnivariate analysis of HIV prevalence by sexual characteristics and sexual behavior practices among CSWS.

Characteristics	NO.	HIVPositive	OR	95% CI	P VALUE
1 Age(Years)					
15-30	231	25 (11%)	1.253	0.7386-2.472	0.4092
30-45	328	24 @ (7%)	1		
>45	46	4 (9%)	1.206	0.3088-3.649	0.7635
2 Education					
Illiterate	570	50 (9%)	0.937	0.2745-3.201	0.7562
Literate	30	3 (10%)			
3 Income(Rs)/mth					
≤ 5000	134	13 (10%)	1.128	0.5844-2.178	0.7313
>5000	466	40 (9%)			
4 Religion					
Hindu	563	50 (9%)	1.105	0.3274-3.726	1.00
Muslim	37	03 (8%)			
5 Marital status					
Married	146	14 (10%)	1.134	0.5971-2.15	0.7374
Unmarried, Divorcewidowers	456	39 (9%)			

TABLE 2. IIUnivariate analysis of HIV prevalence by sexual characteristics and sexual behavior practices among CSWS. (Contd)

Characteristics	NO.	HIVPositive	OR	95% CI	P VALUE
6 Type of family					
Joint	62	09 (15%)	1.675	0.7741-3.624	0.1784
Nuclear	538	44 (8%)			
7 Time of sex					
Morning	37	03 (8%)	1.1055	0.2986-3.725	1.00
Afternoon	79	03 (4%)	0.4718	0.137-1.625	0.3128
Evening	184	23 (13%)	1.707	0.9149-3.187	0.1061
Late night	272	21 @ (8%)	1		
Multiple time	28	3 (11%)	1.434	0.3996-5.149	0.4788
8 No. of days of sex/month					
<15	348	32 (9%)	1.114	0.6261-1.982	0.7718
≥15	252	21 (8%)			
9 No. of clients/day					
1-3	452	44 @ (10%)	1		
3-5	265	08 (3%)	0.2886	0.1337-0.6231	0.0008*
>5	15	01 (7%)	0.6628	0.0850-5.160	1.00
10 Place of sex					
Home	80	17 @ (21%)	1		
Hotel Dhaba, Night clubs, Hotels	175	35 (20%)	0.9255	0.4830-1.777	0.8674
Field	04	1 (25%)	1.235	0.1206-12.649	1.00
Multiple places	11	0	0.1578	0.00884-2.814	0.473
11 Duration of sex(year)					
<1	6	1 (17%)	2.070	0.2312-18.489	0.434
1-2	284	26 (9%)	1.043	0.579-1.878	1.00
3-5	261	23 @ (9%)	1		
≥5	49	3 (6%)	0.6749	0.1945-2.341	0.7789

Note: With * highly significant association without * no significant association

The study subjects of younger age group of 15-30 years and age more than 45 years had higher risk of acquiring disease (OR- 1.353 95% CI 0.7386-2.472 & OR= 1.206, 95% CI = 0.398-3.649). Similarly low level of income (OR- 1.128 95% CI = 0.5844 – 2.178), Marital status (OR= 1.134 95% CI – 0.5971-2.15), Religion (OR – 1.105 95% CI- 0.3274-3.726) and Type of family (OR= 1.675 95% CI – 0.774-3.624) were statistically associated with HIV infection.

CSWs, who were working in open area (field) had more risk of HIV infection as compared to those who were working in home and hotels (OR=1.235 95% CI= 0.1206 – 12.649) and some risk factors i.e. Time of sex by Univariate analysis showed the association with HIV positivity i.e. CSWs those who were working in the morning, working in the evening and both morning and evening had more risk as compared to those who were working in the late night. Current study revealed that Duration of sex is associated with HIV, i.e. CSW those who started sex selling less than one year had

more risk of having disease (OR=2.07 95% CI=0.2312-18.489). It was also found that there was an association between HIV infection and sex for more than 15 days per month (OR= 1.114 95% CI= 0.6261-1.482). (Table – II).

DISCUSSION

Since 1986, the prevalence of HIV infection in female sex workers and patients attending clinics for sexually transmitted diseases in India has continued to raise¹¹⁻¹². In the current study, overall HIV seroprevalence in FSWs was 8.83 =9%. It is varied in different studies carried out in Maharashtra i.e. in Pune 55% and in Mumbai 47%.¹³⁻¹⁴

Prevalence of HIV infection among CSWs in Pune has increased from 6% in 1989¹⁵ to over 45% in 1993-94¹⁶, whereas it was decreased (13.2%) in Kolkata, as per study conducted by D.Pal et al.¹⁷ Some studies conducted in Northern India and South India showed

that the prevalence of HIV infection in North India has been reported to be low¹⁸ and a rising trend has been reported in South India¹⁹.

FSWs with low income commencing sex work at early age have been associated with HIV. The similar finding was found in the study conducted at Vietnam by N V Thuangl et al²⁰.

In the present study, the overall HIV prevalence was 9% and result suggested that there are important differences both in HIV prevalence and in the risk factors for HIV infection according to venue where sex work occurs and duration of sex work. FSWs working on the field (25%) having more risk as compared to FSWs working in home, lodge and night clubs (20%). Similar results observed in the study conducted by Haibo Wang et.al. in China. They observed that HIV infections significantly more among FSWs working in street (17%) as compared to lower risk venues clubs, hostels (5.7%).²¹ Prevalence of HIV is higher among FSWs those who have started sex work less than one year (17%) as compared to those who had more than one year.

We found that the FSWs of younger age group, low level of income, marital status, religion, type of family and working in the odd time (morning and evening) had more risk of having HIV infection. But number of partners per day entertained by them had lower risk of having infection, when compared with other study conducted in West Bengal by K.Sarkar.⁷ Statistically no association was found with the risk factors like literacy status, income, number of partners entertaining and duration of profession.

The FSWs with low income, more than 5 partners per day and more than 15 days sex per month may reflect poverty and the financial need to sell sex. These FSWs may not be able to access STD and HIV Prevention programmers easily because of pressure of work

CONCLUSIONS

These data provide a comprehensive analysis of prevalence of HIV infection at high risk in India. The risk factors associated with HIV infection strongly suggest that the HIV epidemic is similar to that seen in other parts of the world. The socio-demographic behavioral factors from this study had to be considered in developing preventive measures and as well as targeting preventive measures.

Recommendations

The increase in prevalence of HIV infection in these high risk groups suggests an urgent need for comprehensive and national efforts to control sexually transmitted diseases and to provide intensive education on HIV and AIDS and changing high risk behavior.

Mobile clinics and outreach programmes are likely to offer these women a more user friendly service than the traditional STD clinic model.

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Sex Determination from Femoral Fragments - Discriminant Function Analysis in Contemporary South Indian Population

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ABSTRACT

Diagnosis of sex from skeleton or individual bone is vital to archaeological and forensic applications. The aim of this study is to examine the applicability of the measurements taken from the femur fragments to assess sex, and to contribute to establishing discriminant function equations for medico legal applications. In a sample of 120 femora, seven variables were measured and subjected to discriminant function analysis. All the measurements are found to be individually sexually dimorphic. Univariate and multivariate functions were computed and their accuracy were evaluated.

Keywords: Forensic Anthropometry, Sex Determination, Femur Fragments, South Indian Population, Discriminant Function Analysis

INTRODUCTION

Sex determination from skeletal remains, which forms an important component in the identification procedure, sometimes becomes a difficult task for the forensic anthropologist, especially without skull and pelvis. The task becomes more intricate if the recovered remains are in fragmented state. Several novel methods whereby criminals obliterate the identity of their victims by dismemberment require simple standards for sex determination from the available bones of the skeleton.

Forensic experts generally employ "morphological" or "classical" or "visual" technique, where the pelvic girdle and cranium are usually the first choice for information for sex estimation¹. The second technique for sex estimation is a "morphometric" or "statistical" method. In this method, besides pelvis and cranium examinations, most of the long bones, either individually or in combination, have been subjected to statistical and morphological analysis for determining sex. Metric analysis has become the most preferred technique because of its objectivity and reproducibility. It has additional advantage in enabling to identify the sex from fragmentary or incomplete bones as well.

Various studies have been conducted on several postcranial elements such as the humerus^{2,3}, patella⁴, tibia^{5,6}, metacarpals⁷, foot⁸ and even the ribs⁹. Among the postcranial indicators, the femur is the most studied of all bones¹⁰. Studies on the femur such as either or both the epiphysis^{11, 12, 13}, the mid-shaft circumference^{14,15} and the entire femur^{16,17,18,19,20} have already proven the sex discriminating potential of femur in different populations with diverse results.

As the magnitude of sex-related differences depends on the particular regional population, skeletal biologists have long recognized that each population requires its own specific standards for accurate determination of sex, and this requires the study of sexual dimorphism in a more localized way to establish specific osteometric standards for different regions in India.

The first goal of this study is to evaluate the application of femur fragmentary measurements in sex determination on contemporary South Indian population sample. The second goal is to create sex-discriminating standards and to state the degree of accuracy of the method in this population, and thus their utility in forensic contexts.

MATERIALS & METHOD

Materials

The study material consists of 120 adult femora (60 male & 60 female), which were collected from the unidentified, unclaimed bodies, coming for routine medico legal postmortem examination to the Institute of Forensic Medicine, Chennai during the period from 1st August 2009 to 31st July 2010.

Femora were removed by giving lateral skin incision in the thigh extending from hip joint to knee joint. The capsules and the ligaments of hip joint and knee joints were incised. The soft tissues were removed by treating the femur with antiformalin solution. By

convention, the left side femora in the skeletons were measured, although the right side femora were substituted when the left was abnormal or missing. The femora selected showed no fracture at the femoral necks, no pathological disorders, no surgical procedures, intact closed epiphysis at femoral heads and were of known sexes.

METHOD

The maximum femoral length was measured using osteometric board and the other measurements were taken using Electronic digital vernier sliding caliper with accuracy of 0.001" (.02mm).

Definition of fragments:

FRAGMENT	DESCRIPTION
FML- maximum length of femur	linear distance between the most superior part of the head of the femur and the most inferior part of the medial condyle.
VHD- Vertical diameter of head	linear distance between the highest and lowest points of the head in the equatorial plane
VHA- upper breadth of femur	linear measurement between the most medial point on the fovea capitis to the most lateral point of the greater trochanter
VND- Vertical neck diameter	minimum diameter on the neck of the femur in a plane perpendicular to head neck axis
BCB- Bicondylar Breadth	most lateral and posterior projection of the lateral condyle, to the most medial and posterior projection of the medial condyle
MCL- Medial condyle length	linear distance between the most anterior and the most posterior points on the medial condyle.
LCL- Lateral condyle length	linear distance on the lateral condyle measured in an anteroposterior direction.

Statistical analysis

All statistical computing was carried out using SPSS version 18.0. Standard descriptive statistics were calculated and t-test was applied (two tailed) for that. Univariate and multivariate discriminant functions were analyzed. All measurements were entered as the predictors (independents) and sex was selected as the grouping variable. These were run without the stepwise procedure to prevent variables being excluded in the function. Consequently, standardized coefficients, structured coefficients, unstandardised (raw) coefficients, group centroids and predicted group memberships are calculated for each variable and functions with multiple variates. The Wilks' lambda shows the percent contribution of each measurement, and determines the order of variables to enter the function. Lambda ranges between 0 and 1. The values close to 0 indicate that the group means are different,

and values close to 1 indicate that the group means are not different. The standardized coefficient "indicates the contribution of a variable to the discriminant score relative to other variables"²⁰. For example, if the standardized coefficient for upper breadth of femur (VHA) is 0.462 it contributes 46.2% of the difference between the sexes in that function.

To calculate the discriminant score from a function,

$$Y = (\text{dimension1} \times \text{unstandardised or raw coeff1}) + (\text{dimension n} \times \text{unstand.or raw coeffn}) + (\text{constant})^{16}$$

As the group centroids are the same value but in opposite directions, the sectioning point was set at zero (Table 3, 4, 5 and 6). If the discriminant score is above the sectioning point the specimen is male and below, female. Cross-validation was performed to test the accuracy rate of the original sample. Results:

Table -1 (a) Descriptive statistics in male:

Male Measurements	Minimumcm	Maximumcm	Meancm	Std. Deviation
FML	41.2	47.8	44.9	1.5
VHD	4.2	5.11	4.6	0.2
VND	2.76	3.9	3.2	0.3
VHA	8.54	10.55	9.5	0.5
BCB	6.23	8.27	7.2	0.5
FDL	7.34	8.47	8.0	0.3
LCL	5.28	7.35	6.2	0.5

Table -1 (b) Descriptive statistics in female:

Female Measurements	MinimumCm	Maximumcm	Meancm	Std. Deviation
FML	36.4	42.6	39.5	1.4
VHD	3.35	4.2	3.8	0.2
VND	2.19	2.95	2.6	0.2
VHA	7	8.76	7.9	0.5
BCB	5.3	7.01	6.1	0.3
FDL	5.91	7.14	6.6	0.3
LCL	4.9	6.27	5.4	0.3
MCL	4.67	5.77	5.2	0.3

According to the present study, the femoral head diameter on an average is 44.9 mm and 39.5 mm in males and females respectively. This finding reiterates

the fact that the average male skeleton is longer than the average female.

Table 2 Univariate discrimination function score equations:

	Raw coefficient	Constant	Sectioning point	Eigen value	Canonical Correlation	Wilks lambda
VHD	4.481	-18.793	0	3.346	0.877	0.230
FML	0.691	-29.171	0	3.478	0.881	0.278
VND	3.653	-10.666	0	1.427	0.767	0.412
VHA	1.973	-17.248	0	2.579	0.849	0.279
BCB	2.435	-16.267	0	1.868	0.807	0.349
LCL	2.572	-14.973	0	1.194	0.738	0.456
MCL	2.407	-13.788	0	1.950	0.813	0.339

Table-3 Percentage of correct group membership

	Male %	Female %	Combined%	group centroids
(F1) VHD	100100*	98.398.3*	99.299.2*	Male:1.814Female:-1.814
(F2)FML	9595*	9595*	9595*	Male:1.849Female:-1.849
(F3)VND	83.383.3*	96.796.7*	9090*	Male:1.185Female:-1.185
(F4)VHA	9595*	9595*	95.895.0*	Male:1.592Female:-1.592
(F5)BCB	9090*	98.398.3*	94.294.2*	Male:1.355Female:-1.355
(F6)LCL	83.383.3*	91.790*	87.586.7*	Male:1.084Female:-1.084
(F7)MCL	88.386.7*	98.398.3*	93.392.5*	Male:1.385Female:-1.385

*Cross validated accuracy

Table 4. Multivariate discrimination function score equations:

Variable	Raw coefficient	Standard coefficient	Structure coefficient	Group centroid	Sectioning point	Accuracy Male%	Accuracy Female%	Accuracy Combined
(F8)VHD	3.704		0.927	M:1.957F:-1.957	0	10098.3*	98.396.7*	99.297.5*
VND	-1.635	-0.448	0.605					
VHA	0.911	0.462	0.814					
BCB	0.615	0.253	0.692					
LCL	-0.943	-0.367	0.605					
MCL	0.536	0.223	0.708					
CONSTANT	-20.408							
(F9)VHD	3.980	0.888	0.993	M:1.827F:-1.827	0	98.398.3*	100100*	99.299.2*
BCB	0.388	0.159	0.742					
CONSTANT	-19.285							

Direct analysis revealed vertical head diameter as the best single discriminating variable (99.2 %) The cross validated accuracy of sex determination ranged from 95% to 99.2%.

In functions (F 8, 9, 10), VHD showed the highest correlation to that function. VHA upper breadth of

femur is the second best variable with good correlation the functions 8 only next to VHD. Considering the possibility of any one of the femoral end being recovered in medicolegal situations, we formulated the functions for proximal fragments and distal fragments independently table-5&6). Only medicolegally significant combinations of variables are included.

Table 5. Functions from proximal fragments

Variable	Raw coefficient	Standard coefficient	Structure coefficient	Group centroid	Sectioning point	Accuracy Male%	Accuracy Female%	Accuracy Combined
(F10)VHD	3.975	0.887	0.960	Male:1.889Female:-1.889	0	100100*	98.398.3*	99.299.2*
VND	-1.211	-0.332	0.843					
VHAConstant:	0.833-20.421	0.422	0.627					

Table 6. Functions from distal fragments

Variable	Raw coefficient	Standard coefficient	Structure coefficient	Group centroid	Sectioning point	Accuracy Male%	Accuracy Female%	Accuracy Combined
(F11)LCL	-0.315	-0.122	0.732	Male:1.480Female:-1.480		88.388.3*	98.398.3*	93.393.3*
MCL	1.595	0.663	0.936					
BCB	1.249	0.513	0.916					
Constant:	-15.646							

DISCUSSION

Due to the vast differences in the body size of various populations, it is obvious that standard formulae cannot be transposed from one population to another. Thus each population should have population specific data for methods based on measurements, to optimize the accuracy of identification. Numerous studies using a variety of measurements of the femur have therefore been conducted from all over the world, with varying degrees of accuracy^{21, 22}. The discriminant function analysis is one of the most commonly used mathematical approach. In addition, logistic regression analysis are preferred.

Each of the seven variables measured on the femora of the South Indian sample showed statistically significant sex differences between males and females, showing that these variables are sexually dimorphic in this population group, which reiterates that the average male skeleton is longer than the average female, although the magnitude of difference varies from population to population. Therefore, the discriminant equations that were derived from each of them may be used for sex determination.

Results of the univariate prediction(F1-7) values showed that sex differentiation could be done by femur measurements with accuracy between 87.5 and 99.2%, with female accuracies slightly higher than the males

except F1.(table 2 & 3) The discriminant analysis study of Purkait and Chandra reported that single measurements could assign sex with 71 to 93.5% accuracy[20]. Taylor and DiBennardo test for sex assessment on femurs of American Whites with 82% of accuracy²³.

The degree of sexual dimorphism ranges from VHD, FML, VHA, BCB, MCL, VND, and LCL. The present findings agree with previous studies of long bones in several populations that head diameter provides the greatest separation of the sexes. In general, the proximal fragments discriminate against the sex better than the distal fragments (table-3, 5 & 6).

While considering the distal end, bicondylar breadth function (F5) showed better accuracy than the other distal fragments. It is also shown that the linear dimensions in the femur are less discriminating than the head diameter and breadth dimension.

When multiple fragments are used, the accuracy ranges between 95.0 to 99.2 (table -4). Only those combinations which are logical and medicolegally significant are considered. It is interesting to note that the univariate function with VHD (99.2%) has better predictive accuracy than other multivariate functions (93.3%-99.2%), which concludes that the vertical diameter of the head is the best single dimorphic dimension of the femoral fragments. Results indicated that head diameter and bicondylar breadth are the optimal combination of all the fragments for sex diagnosis with 99.2% accurate classification. One significant finding is that the sex-prediction accuracies obtained in the present study are higher than those obtained in most of the previous studies on different populations. The high accuracy rates may be due to the high sexual dimorphism shown by the samples and smaller sample size as well.

More detailed studies with a larger sample size, may have to be done considering the present study as a pilot study.

while discriminant functions were equated for proximal and distal fragments separately (table-5&7),it has also been reaffirmed that the proximal epiphyseal fragments of the femur (94.2 % to 99.2 %) tend to show more sexual dimorphism present than the distal epiphyseal fragments of the femur (93.3 %to 94.3%), which in contrast to the results reported by Steyn and Iscan in South African white population within six femur measurements¹⁷.

Considering all of these findings, it was concluded that the measurement of the femoral fragments is a relatively reliable method for sex assessment in anthropological studies and forensic applications of this region. The present study also demonstrates that the usage of discriminant formulas developed by combination of femur fragmentary measurements and to update the osteometric standards in determining sex. Principally, the discriminant functions obtained for the femoral ends are of much practical use in forensic and archaeological contexts using fragmented femora.

CONCLUSION

All the seven variables measured on the femora in this study are individually sexually dimorphic, and their individual and combined discriminant function score equations can be used for sex determination in fragmented remains. High accuracies obtained from various combinations of these variables confirm the usefulness of the femoral fragments for sex determination in this population group. The results obtained in this study have yielded strong evidences that osteometric assessments are very sensitive to population variation. It also emphasizes the need for population specific standards in sex determination by femur, which is of imperative consideration in medicolegal matters.

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Comparative Study of Incidence of Parietal Foramina in North and South Indian Human Crania

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ABSTRACT

1189, non-pathological dried crania from north and south Indian were studied. The incidence of parietal foramen was highest in south Indian male(113.9%) and female(112.2%) crania. While incidence of parietal foramen in North India (104%) and female(90.46%) crania. Moreover measurement was taken from parietal foramen to bregma by measuring tape. The mean value of south Indian male crania was 91.42cms \pm 0.23(SD = 2.02) and female mean value was 86.50cm \pm 0.27 (SD = 1.68) with highly significant P value (P<0.050 similarly mean value of north Indian male crania was 89.85cms \pm 0.6 (SD=1.88) and mean value of female crania was 87.12 cms \pm 0.23 (SD=1.90) with highly significant P value (P < 0.01). the logistic regression equation for classification of sexual dimorphism of north Indian crania was 70.8% and south Indian crania was 66.5%. while, in the regional classification of male crania of North and South India was 69.9% and female crania of north and south India was 66.4%

As there is no parameter for calvaria to find out sexual dimorphism and regional classification, hence this study will certainly help the medico legal experts, anatomists and anthropologists.

Keywords: Emissary Vein, Bregma, Measuring tape, Calvaria., PF = Parietal Foramen

INTRODUCTION

As per parietal foramen transmits emissary vein of the scalp to the superior sagittal sinus. The incidence of parietal foramen is a normal phenomenon, moreover due to variation of position of lambda the exact position could not be measured because position of lambda is quite fluctuating to stabilize the inion to give globular shape to the crania for normal development of the brain⁽¹⁾. Hence attempt is made to measure the distance between parietal foramen and bregma, apart from studying the incidence of parietal foramen.

MATERIAL AND METHOD

- Total 1189 non-pathological dried adult crania from North India and South India studied by MSSM (Lottery method). 4 states of North India and 4 states of south India, 4 colleges from every state(32 Colleges).The Distance between PF and Bregma is Measured by Tailor's Tape (Measuring Tape).
- Z test is applied for comparison between two samples.

- Logistic regression equation for correct classification of sexual dimorphism and regional difference in both sexes, by 2007 SPSS method.

The cosmopolitan cities avoided, even Maharashtra is also avoided by presuming that North India is mainly occupied by Aryan race and south India is mainly occupied by Dravidian race and Maharashtra and Cosmopolitan cities are mixture of both races.

Crania available	No. of Colleges(4)	Total No. of Crania
Uttar Pradesh	389+75+22+40	526
Rajasthan	031+29+22+14	096
Haryana	021+14+09+08	052
Punjab	030+20+19+18	087
Andhra Pradesh	036+29+20+18	103
Karnataka	047+39+24+24	134
Kerala	030+21+17+10	078
Tamil Nadu	048+41+17+07	113
Grand Total		1189

(Eleven Hundred Eighty Nine Only)

S.R.S Method comes under Multistage Sampling Status (M.S.S)

OBSERVATION OR RESULTS

Table No 1

Percentage Incidence of Parietal foramen in the crania of North and South India in both sexes, and more incidences were found in South Indian Male (113.9%) and female (112.2%).

Table No 2

- A) Incidence of PF in Male Crania in North & South India.
- B) Incidence of PF in Female Crania in North & South India.

Table No 3

The present study was compared with previous workers of abroad, but present study shows higher incidence than previous workers like NI male 104.0, NI female 90.43, while S.I male 113.9 and S. I female 112.2

Table No: 4

Sexual Dimorphism of distance between parietal foramina & Bregma in the crania of north and south. Shows highly significant ($P < 0.01$) in both north and south Indian crania.

Table No. 5

Sexual dimorphism by Logistic Regression Equation between. P.F & Bregma.

($Y = b^1x^1 + b^2x^2 + c$). Sexual dimorphism of North India shows 70.8% while South Indian crania shows 66.5%

Table No. 6

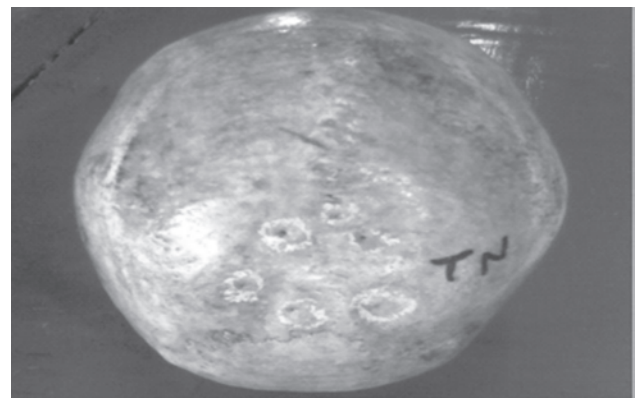
Regional comparison by Logistic Regression Equation ($Y = b^1x^1 + b^2x^2 + c$). Regional of north Indian male crania with South Indian male crania shows 69.9 correct classifications while that of south Indian female with north Indian female crania shows 66.4% of correct classification.

DISCUSSION AND SUMMARY

In the present study the incidence of PF are more in south Indian male crania (11.37%) and female crania(112.2%) North Indian Male crania (104%) and Female crania (90.46%) (Table 1). Incidence of PF in male crania was also observed in Australian crania the

ratio was 10: 6⁽⁸⁾. It could be due to massive chewing stress in males than females because masticatory stress leads to prominent sagittal crest in male crania than females ⁽⁹⁾.

The present study also compared with the previous workers of abroad (Table 2), but the incidence of PF of present study is quite higher, could be because of dietary habits which are based on ecological differences. Ecological and nutritional factors certainly co-related to degree of strain of crania⁽¹⁰⁾ hence six PF observed in single crania of Tamil Nadu and five PF of Punjab crania in the present study (Fig. 1&2). Multiple PF were also observed about 2.5% in Normal Crania of Canada⁽⁵⁾. It could be due to delayed ossification ⁽²⁾.



Photograph showing incidence of six parietal foramina in South Indian female crania

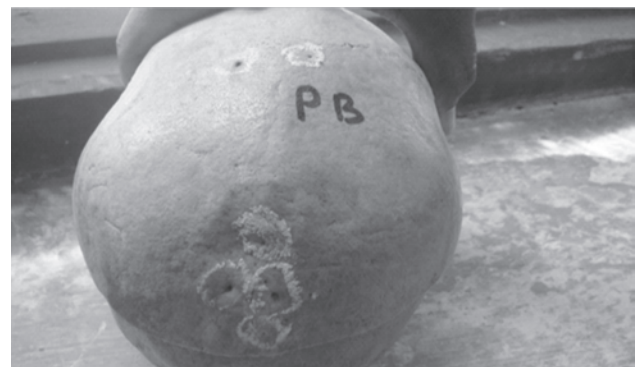


Fig. 2. Photograph showing five parietal foramina out of which two are near bregma and three are near lambda of North Indian female crania

It is also believed that, migration of temporalis muscle on either side could pull the sagittal suture, hence to overcome the stress there could be deploy of more emissary veins transmit through PF by arresting the bone growth⁽¹¹⁾. Moreover variations in the incidence of PF could be as compensatory role to maintain the normal hemodynamic pressure for

normal development of the brain. As brain is a clearly a focus for important and stage setting for selective pressure to adopt erect posture hence there could be absence of PF in some crania irrespective of sex, because emissary veins might have sought any alternate pathway for normal development of the brain⁽¹²⁾.

In fetal life there is a sub sagittal suture of puzzi in the regions of parietal foramen. During parturition this sub- Sagittal suture of puzzi overlaps and obliterates in later life and persists as a PF in the same crania in response to the function need⁽¹³⁾. It is also believed that incidence of PF is the result of incomplete fusion of posterior fontenalle⁽¹⁴⁾. It is suggested that, emissary vein alters the stress since it is valveless. Hence the incidence of PF to alter, redirect and shear the compressive and tensile stress of crania. As calvaria is pluripotent and autonomous to respond for external and internal stimuli.

In the present study, the distance between PF to bregma is studied in both sexes of north and south India (Table 3). Distance is more in south Indian male crania 94.42mm ±0.5 with significant (P< 0.01). These significant values could not be compared with any previous studies as no other data or references are

available in English literature. The values are studied with logistic regression equation for sexual dimorphism of North and South India and percentage of correct classification of North India was 70.8% while that South Indian crania was 66.5% (Table 4). The regional classification of male crania of North and South India was 69.9% and female crania North and South India was 66.4%(Table 5). The study of logistic regression equation encompasses the classification of whole Indian crania accurately.

CONCLUSION

The study of incidence of PF and distance between PF and bregma provide entirely a new parameter for sexual and regional classification because there is no any anthropological parameter to identify sex and regional classification of calvaria.

These regional values of north and south India may be useful to compare Indian crania with abroad because morphometric values of crania are uncertain. Overall accuracy of global crania varies between 77 to 87%. Hence these values of variations in regional study certainly indicate that, India is a multi racial country because “when India was in glory Europe was in dark”.

Table N. 1. Name of the Place

	Female			Male		
	No. of Parietal Foramina	No. of Skulls studied	Percentage	No. of Parietal Foramina	No. of Skulls studied	Percentage
North India	227	251	90.43	532	510	104
South India	163	143	112.9	320	285	113.2

Percentage Incidence of Parietal foramen in the crania of North and South India in both sexes.

Incidence of parietal foramina is more in both male and female crania of south India. ‘P’ value could not be calculated as incidence value is above 100

Table No. 2 (A). Incidence of Parietal Foramina in Male Crania

Male Crania			
Region	No. of Skulls studied	Incidence of Parietal foramina	% Incidence of Parietal foramina in Male
South India	285	320	113
North India	510	532	104

Table No 2 (B). Incidence of Parietal Foramina in Female Crania

Female Crania		
	South India	North India
No of Skulls Studied	143	251
Incidence of Parietal foramina	163(112%)	227(90.4%)

Table No. 3. Comparative Study of Incidence of Parietal foramina with previous workers

Name of the worker	No. of Crania Studied	Percentage Incidence
GREIG. D. M (1892) Egypt	670	70.29
TODD. T. W & LYON D. W(1925), Negroes	150	61.0
CAVE. A. J.E , (1928) Maori (Modern Egypt)	250	67.0
BOYD. G.I (1930) , Canada	1478	69.5
STALL WORTHY (1960), Newzealand	310	75.5
YO -HO- HONG (2010) , Taiwan	126	42.8
Present Study (India), 2009-10	Total -1189 NI Male - 510 NI Female - 251 SI Male - 285 SI Female- 143	104.0 90.43 113.2 112.9

Table No. 4. Sexual Dimorphism of distance between parietal foramina & Bregma in the crania of north and south India

Name of the Place	Mean Value	Standard Deviation	No. of Crania studied	95% Confidence Interval	'P' Value	Conclusion
N. Indian Female	87.1256	1.90	251	(86.88, 87.35)	P <0.01	Highly Significant
N. Indian Male	89.85294	1.88	510	(89.68, 90.1)		
S. IndianFemale	86.5035	1.68	143	(86.22, 86.77)	P <0.01	Highly Significant
N. Indian Male	94.4215	2.02	285	(91.18, 91.65)		

F: Female M: Male

'P' values are highly significant in the study of distance between parietal foramina and bregma for both regions. Confidence interval values are also quite variable

Table No. 5. Sexual dimorphism by Logistic Regression Equation betn. P.F & Bregma

$$Y = b^1x^1 + b^2..... + c$$

(A) N I Male – 510, N I. Female – 251

Dist. btn. P. F to Bregma (X)	Constant (C)- 4.417	Percentage of Correct Classification
Logistic Regression Coeff (b)	0.597	70.8

(B) S I Male –285, S I. Female – 143

Dist. btn. P. F to Bregma (X)	Constant (C)- 3.434	Percentage of Correct Classification
Logistic Regression Coeff (b)	0.460	66.5

Table No. 6. Regional comparison by Logistic Regression Equation

$$Y = b^1x^1 + b^2..... + c$$

(A) N I Male – 510, N I.Female – 285

Dist. btn. P. F to Bregma (X)	Constant (C)- 1.354	Percentage of Correct Classification
Logistic Regression Coeff (b)	0.057	69.9

(B) S I Male –285, S I. Female – 143

Dist. btn. P. F to Bregma (X)	Constant (C)- 3.944	Percentage of Correct Classification
Logistic Regression Coeff (b)	0.374	66.4

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Significance of Head Length in Estimation of Stature in Healthy Individuals of Central India

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ABSTRACT

Introduction: The estimation of height from head length has attracted many earlier workers to derive a formula but no significant formula has yet been derived. Also there is scanty data pertaining to regional variations in the published literature. Height, like other phenotypic traits, is determined by a combination of genetic and environmental factors. It is sexually dimorphic and statistically more or less normally distributed. Length and circumference of skull is thought to be a useful parameter to estimate stature of an individual.

Objectives: This study was carried out to evaluate the relationship between personal stature and head length among a group of male and female Central Indian adults and to derive a regression formula between the head length and height of an individual.

Materials and Method: The subjects consist of 391 medical students from various colleges in central Indian population (Vidarbha region of Maharashtra) ranging between 18 to 22 years of age of similar socio economic status. The length of head and the height of the subject were measured with using standard anthropometric instruments in anatomical position. Measurements were taken at fixed time to avoid diurnal variation and were carried out by a single person to eliminate the personal factor. The result obtained was analyzed and attempt was made to derive a formula between head length and the total height of an individual.

Results: The differences of the head length between the genders were found to be highly significant. A positive correlation between height and head length was observed in both sexes and it was statistically significant. Regression equation for stature estimation was formulated using the head lengths for both sexes.

Conclusion: The results indicate that head length provides an accurate and reliable means in estimating the stature of an unknown individual. The regression formula derived in this study will be useful for anatomists, archeologists, anthropologists and forensic scientists.

Keywords: Anthropometry, Head length, Total height, identity of individual

INTRODUCTION

Growth is a vital process which is assessed by measuring the height of a person. To assess the height

of individual from measurement of different body parts of body has always been of particular interest to anatomists and anthropologists. In forensic medicine the estimation of height from head length could serve as important evidence in court and may act as a helping aid for the Forensic experts to reveal the identity of an individual especially when only parts of the deceased body are available.

It has been estimated in the past¹ head length (Nasion to inion) is 1/8th of total height of an

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individual. A regression equation was derived between head length and height in Agra population². A more recent study³ estimated the personal height from length of head in Gujarati students of the age group 17 to 22 years. Although the estimation of height from head length has been investigated by various workers but there is scarcity of data reported from the central part of our country.

AIMS AND OBJECTIVES

Since most of the researchers are of the opinion that means of stature reconstruction are both population and sex specific and the most accurate estimates of stature for an unknown individual can only be derived from a sample of population of the same sex, race, age, geographical area and time period to which the unknown is thought to belong. Bearing in mind all these concepts, the present study was undertaken. The study also aimed to evaluate the sexual differences in the correlation. The equations of regression were derived using the data obtained.

MATERIAL AND METHOD

The subjects consist of 391(165 males and 226 females) medical students from various colleges of Vidarbha region of Maharashtra ranging between 18 to 22 years of age of similar socio economic status. The length of head and the height of the subject were measured with using standard anthropometric instruments in anatomical position. Measurements were taken at fixed time (2 to 5 pm) to avoid diurnal variation and were carried out by a single person to eliminate the personal factor. A prior permission from institutional ethics committee was taken. A written informed consent was taken by subjects.

Head Length: It was measured by spreading Caliper from glabella to inion⁴ (shown in fig. I)

Height of Individual: It is measured by the wooden height measuring instruments marked in centimeters. The subject was asked to stand barefooted in Anatomical erect position. The sliding head plate is brought into firm contact with the vertex of the subject⁵. (Shown in fig. II)



Fig. 1. Figure showing measurement of Head length.



Fig. II. Figure showing measurement of total height of an individual.

RESULTS

With the aid of measuring instruments the measurements were done. The statistical analysis was performed using computer programming (EPI 6). The data for personal height and head length for both the sexes are shown in Table I. The correlation coefficient for head length was evaluated as for males and for females. Using this correlation coefficient regression

equation for calculating height from head length has been derived which is shown in table II.

On basis of regression equation the estimated height was calculated and then root mean square deviation was calculated by observed value and estimated height. The root mean square deviation was obtained as for males, for females and when both males and females were combined.

Table I. Showing range, mean and SD of height and head length for males and females.

Parameter	Sex	Range in c.m.	Mean	SD
Height of Subject (in cm)	Male	153.4 – 189.2	170.12	6.99
	Female	140.8 – 174.0	156.15	11.10
Head length (in cm)	Male	13.3 – 23.0	19.28	1.49
	Female	16.2 – 29.8	18.64	1.58

Table II. Showing regression equation for head length of males, females and combine (both male & female)

Sex	No. of Subjects	Regression Equation
Male	165	$y = 1.050x + 149.861$
Female	226	$y = 0.0287x + 156.687$
Combined	391	$y = 1.265x + 138.125$

Where y is height of an individual and x is head length.

DISCUSSION

In the present study we have observed the correlation of height (in anatomical position) with head length amongst medical students of central India. Medical students were chosen for the easy availability of the subjects.

In previous one such study³ derived a regression equation between head-length and height in Agra population (U.P.). Their correlation coefficient between head -length and height was +0.2048.

Similar study¹ has estimated the personal height from length of head in Gujarati students of the age group 17 to 22 years and reported the correlation Co-efficient between height and head length as + 0.53.

The correlation coefficient obtained in the present study was + 0.224 for males and + 0.004 for females. The correlation coefficient for both male and female (combined) was + 0.168.

Correlation coefficient between stature and head length was found to be statistically significant and positive indicating a strong relationship between the two parameters. Regression equation for stature estimation was formulated using head length and checked for their accuracy by comparing the estimated

stature and the actual stature. The results indicate that head length provides an accurate and reliable means in reconstructing the stature of an unknown individual.

The average height for each sex within a population is significantly different, with adult males on average being taller than adult females. It is stated that the gender difference in height may be attributed to sex chromosomal differences. Adult height between ethnic groups often differs significantly. This may be due to genetic differences, to childhood lifestyle differences or to both.

Some researchers thought length and circumference of skull to be useful parameters to estimate stature from skull^{6,7,8}. From their study it was thought that a single dimension say for example length or circumference can estimate stature of an unidentified person with small standard error of about 6.5cm. Thus significant and positive correlation has been shown to exist between stature and measurements of head length. Taken together the evidence suggests that the relationship between head length and stature is of practical use in medico legal, anthropology and archeological studies when such evidence provides the investigator the only opportunity to gauge that aspect of an individual's physical description.

CONCLUSION

The results indicate that head length provides an accurate and reliable means in estimating the stature of an unknown individual. The regression formula derived in this study will be useful for anatomists, archeologists, anthropologists and forensic scientists.

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An Autopsy Study about Cause of Death in Fatal Road Traffic Accident Victims in New Delhi, India

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ABSTRACT

This study was conducted in Maulana Azad Medical college, New Delhi Mortuary among the 102 post mortem cases of road traffic accident victims over the period of three years from 2008-2011. Objective of this study was to find out cause of death in fatal road traffic accident. Most common cause of death was cranio-cerebral damage, followed by haemorrhage and shock.

Keywords: Road Traffic Accident, Cranio-cerebral Damage, Haemorrhage and Shock, Post Mortem

INTRODUCTION

Accident is an event occurring suddenly, unexpectedly, and inadvertently under unforeseen circumstances. In spite of recent advancement of technology and medical sciences, death and deformity following road traffic accidents is yet to be controlled successfully, rather incidence of road traffic accident increasing at alarming rate in developing countries because of rapid urbanisation, poor road, poor safety measure and overcrowded road. Most of the injuries and fatalities worldwide are caused by road traffic accident. Road traffic accidents are leading cause of death globally among 15 to 19 years old while for those in the 10 to 14 and 20 to 24 years age brackets they are second leading cause of death¹. In 2009 1.27 lakh people in India lost their lives in road mishaps². Road traffic accident represents 45 to 50 % causes of head injuries and young adult were the most common victim³. Ten per cent of all new admission in emergency OPD came with head injuries due to Road traffic accident⁴. During post mortem observations it has been observed that head injuries are the commonest cause of death among fatal road traffic accident victims^{5,6}.

MATERIALS AND METHOD

This study was conducted in Maulana Azad Medical college, New Delhi Mortuary among the 102 post mortem cases of road traffic accident victims over the period of three years from 2008 to 2011. Cause of death was noted in every post mortem case.

OBSERVATION

A total of 102 cases were studied. Out of 102 cases cranio-cerebral damage was cause of death in 72 cases in the form of intracranial haemorrhages, skull fractures and parenchymal injuries. Haemorrhage and shock was accountable for 16 deaths in present study. Combined effect of cranio-cerebral damage, haemorrhage and shock were responsible for cause of death in 6 cases. Spino vertebrael damage, Septicemia and fat embolism were less common cause of death.

Table 1. Showing cause of death in fatal road traffic accident victims and their percentages

Cause of death	Number of cases	Percentage
Cranio-cerebral damage	72	70.59
Haemorrhage & shock	16	15.69
Combined effect of, Haemorrhage, shock and Cranio-cerebral damage	06	5.88
Spino-vertebrael damage	01	0.10
Septicaemia	06	5.88
Fat embolism	01	0.10
Total	102	100

DISCUSSION

In road traffic accidents, head injury is the most common cause of mortality followed by Thoraco-abdominal and musculo-skeletal injuries in that order^{7,8,9}. In present study head injuries were accountable for about 80 % of total death, followed by haemorrhage and shock accountable for about 16 %

of cases. So in present study head injuries are the most common cause of death, which is consistent with existing literatures. Septicemia was cause of death in about 6% cases mainly in the cases of more than 2 days survival. A study conducted by Moharamzad Y et al. showed¹⁰ that most common cause of death was central nervous system injury (146 cases, 58.1%). The other causes were skull base fractures (10%), internal bleeding (8%), lower limb hemorrhage (8%), skull vault fractures (4%), cervical spinal cord injury (3.6%), airway compromise (3.2%), and multifactor cases (5.1%), respectively. So in Moharamzad Y et al study also most common cause of death was craniocerebral injuries. A study conducted by Singh YN. Showed¹¹ that infection, gangrene, crush syndrome, surgical operation, supradadded natural disease, thrombosis and embolism were responsible for 37.50% cases of death. In our study craniocerebral injuries were accountable for 70.59 % of the cases of death, in rest of the cases cause of death was haemorrhage and shock, septicaemia, fat embolism, spinovertebrael damage.

CONCLUSION

Head injuries were leading cause of death in the present study consistent with other researcher findings. Protective measures like helmet and seatbelt will decrease head injuries and overall mortality in road traffic accidents. So rule of compulsory helmet bearing and seat belt should be followed strictly as these measures will decrease mortality in road traffic accidents. In the present study, Haemorrhage and shock were cause of death mainly in the thoraco-abdominal and musculoskeletal injury. In the present study, fat embolism and spino-vetebrael damage were very rare cause of death. This may be due to both of them may be contributory but not main cause of death.

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Incidence and Pattern of Acute Poisoning among Children Aged 1 Month to 18 Years : An Experience from Jammu

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ABSTRACT

Introduction: Acute poisoning is one of the commonest pediatric emergencies and an important cause of mortality.

Objectives: To study the magnitude and demographic profile of acute poisoning among hospitalized children (1Month-18 years of age) in Jammu, India.

Materials & method: All the children between one month and eighteen years of age, admitted to Pediatric wards of SMGS Hospital, Government Medical College, Jammu, India, over a period of one year as a case of acute poisoning were included in the study. The information obtained from Subjects / Parents / Guardians and examination of subjects was recorded on a pretested proforma and analyzed.

Results: A total of 245 (1.76% of total admissions) children were admitted with acute poisoning during the study period. Male - Female ratio was 1.58:1. Majority 243(99.18%) patients were of oral poisoning and maximum were in the age group of more than one to five years (71.42%). Majority 219(89.39%) patients of acute poisoning were accidental. Suicidal attempts constituted 2.45% and 1.22% cases were of homicidal nature. Majority (41.63%) of poisoning cases were due to accidental ingestion of household products followed by drugs ingestion (23.67%), food poisoning (16.33%) and agricultural/industrial products ingestion (9.8% cases). Maximum 187(76.33%) patients of acute poisoning recovered whereas 3 patients (1.22%) died.

Conclusion: Acute poisoning in children is usually accidental with favorable outcome. Deaths do occur depending upon the nature of poisoning and the stage at which patient seeks medical care. Poisoning can be prevented by increasing public awareness, counseling and correct guidance to the parents.

Keywords: Poisoning, Organophosphates, Kerosene oil

INTRODUCTION

Acute poisoning is one of the commonest pediatric emergencies and an important cause of mortality¹. Most cases of poisoning are acute². Acute exposure is a single contact that lasts for seconds, minutes or hours,

or several exposures over about a day or less³. Innumerable deaths in children due to accidental poisoning occur all over the world which is of serious concern since the lives of these toddlers can be saved in most cases by proper guidance to the parents, suitable propaganda and modification of local habits and environmental conditions.

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Knowledge of the general pattern of poisoning in a particular region would help in early diagnosis and treatment which in turn results in reduction of morbidity and mortality. In view of the paucity of reports from Jammu and Kashmir and possible

regional differences, it was considered worthwhile to analyze the cases of acute poisoning admitted to Pediatrics Department of S.M.G.S. Hospital, Government Medical College, Jammu, to ascertain the pattern of commonly encountered poisoning and suggest control measures to minimize such catastrophies.

AIMS & OBJECTIVES

To study the magnitude of problem of acute poisoning among children (1Month-18years of age) being admitted to the hospital.

MATERIAL AND METHOD

The present study was conducted prospectively over a period of one year from 1st November, 2006 to 31st October, 2007 in the Postgraduate Department of Pediatrics, Shri Maharaja Gulab Singh Hospital, Government Medical College, Jammu.

All the children between the age group of one month to eighteen years admitted to Paediatric wards as a case of acute poisoning were the study participants.

This included all children presenting with

1. Definite history of acute poisoning by any substance through any of the following routes:-
(i) Oral (Ingestional), (ii) Parental (I/V or I/M), (iii) Inhalational, (iv) Dermal and (v) Ocular
2. Signs and Symptoms seen commonly with a particular poison but without a definite history of poisoning (i.e. Suspected Poisoning).

The Study Participant / Parents / Guardian were subjected to detailed questioning after explaining the purpose of study. Then the patient was subjected to complete physical examination. Diagnosis was made mainly from the history. Necessary blood examination, chemical analysis, radiological tests, electrocardiogram and other relevant investigations were done as and when required.

Regarding selection of Food poisoning cases for inclusion in the study, we excluded solitary cases to avoid over diagnosis. Only those cases where two or more patients apparently well before consumption of a particular food item were included in the study.

OBSERVATIONS

Present study included 245 patients who were admitted as a case of acute poisoning over a period of one year. Males were 150 (61.22%) and females 95(38.78%) constituting Male-Female ratio of 1.58:1. Majority 243(99.18%) patients were of oral poisoning, 1 case was of inhalation poisoning and in 1 suspected case of poisoning route was not known.

Maximum cases of acute poisoning were seen in the age group of more than one to five years (71.42%) and least 2.04 % in above 15 years age group (Table 1).

Table 1. Age wise distribution of cases

Age	No. of Males	No. of Females	Total	%age
1month-1year	18	4	22	9%
>1-5 yrs	107	68	175	71.42%
>5-10 yrs	14	11	25	10.20%
>10-15 yrs	9	9	18	7.34%
>15 yrs	2	3	5	2.04%
Total	150	95	245	100%

Majority 219(89.39%) patients of acute poisoning were accidental. Suicidal attempts constituted 2.45% and 1.22% cases were of homicidal nature (Fig.1).

Mode of Poisoning

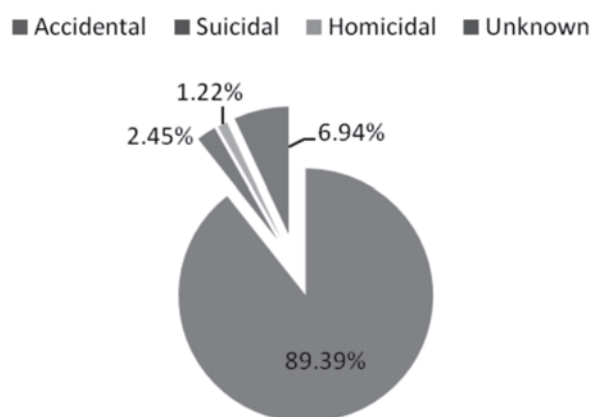


Fig. 1. Mode of Poisoning

Maximum 187(76.33%) patients of acute poisoning recovered whereas 3 patients (1.22%) died. Rest 55(22.45%) either absconded or lost to follow up.

Majority (41.63%) of poisoning cases were due to accidental ingestion of household products followed by drug ingestion (23.67%), food poisoning (16.33%) and agricultural/industrial products ingestion (9.8%

cases). Least 3.26% cases were of plants poisoning (Table 2).

Table 2. Types of acute poisoning

Category of Poisons	No. of Patients	
	(n)	(%)
Household products	102	41.63%
Drugs	58	23.67%
Food poisoning	40	16.33%
Agricultural / Industrial products	24	9.80%
Plants	8	3.26%
Unknown	13	5.31%
Total	245	100.00%

Among household products maximum 32(31.37%) cases were of Kerosene and pesticides poisoning. Pesticides included Pyrethroids (Mosquito coils, Mosquito repellent oil, Laxman rekha), Rodenticides, Organophosphates and Carbamates (Baygon spray). Other household products included phenyl 9(8.82%), Detergent & corrosives 8(7.84%), Thermometer mercury/Parad (Common grain preservative) 5(4.9%), naphthalene 3(2.94%) and 2 cases each of alcohol, battery water and dettol and 1 case each of camphor, air freshener, boric acid, silica gel, ayurvedic massage oil, cigarette piece and deodorant spray.

Drugs were the 2nd commonest cause of poisoning constituting 58(23.67%) cases. Out of which, 11(18.97%) patients had ingested anticonvulsant drugs (Phenytoin, Clonazepam, Phenobarbitone and valproate), 6(10.34%) sedatives/tranquillizers (alprazolam, diazepam and lorazepam), 6(10.34%) anti cough/cold syrups, 5(8.62%) antipyretics/analgesics, 4(6.9%) cyproheptadine, 2(3.75%) each antiscabies lotion, lactocalamine lotion, loperamide and salbutamol and 1(1.72%) each of atorvastatin, ayurvedic drug, enalapril, iron tablets, ketoconazole shampoo, metoclopramide, steroids and tincture benzoin. In 10(17.24%) cases nature of drug was not known.

Agricultural/Industrial products were responsible for 24(9.80%) cases of poisoning which included 6(25%) cases each of organophosphates and diesel followed by 5(20.83%) cases of aluminium phosphide, 2 (8.33%) each of fertilizers and other insecticides and 1(4.17%) each of Machine oil and Turpentine oil.

Poisoning due to plants was seen in 8(3.26%) cases which comprised of 3 cases of wild fruit ingestion, 2 cases each of mushroom and datura poisoning and one case of opium poisoning.

Average time taken by the patient to reach the hospital was 3.84 hours (Range: 0.25 hour to 72 hours) and 72 (29.38%) patients had no symptoms at the time admission.

DISCUSSION

The present study was conducted on 245 patients of acute poisoning admitted in department of Pediatrics, S.M.G.S. Hospital, government Medical College, Jammu over a period of one year from 1st November, 2006 to 31st October, 2007 in the age group of one month to 18 years.

There is no nationwide statistics on morbidity and mortality due to poisoning in children in our country though incidence of poisoning as reported by various studies in different hospitals of different regions varied from 0.23% to 11.9%. We observed that the patients of acute poisoning accounted for 1.76 % of total 13,918 admissions (excluding neonates) in the pediatric wards of our hospital during the study period. Our hospital is the major referral hospital for pediatric patients in Jammu division. Most of the poisoning cases report either directly or are referred by other hospitals. Difference in incidence in poisoning in various hospitals was also due to different age groups taken in studies and some studies had excluded food poisoning cases.

In agreement with most other studies male-female ratio in the present study was observed to be 1.58:1^{4,5,6}. Males dominated in all the age groups except in adolescents >15 years age, where females were more. Predominance of males may also be due to male preference in our society. Male children are brought to the hospital at the earliest even in doubtful cases.

In the present study maximum cases of acute poisoning were seen in the age group of more than one to five years (71.42%) and least 2.04 % in above 15 years age group which is similar to the findings of various other studies^{5,7,8,9}. High incidence of poisoning in children >1-5 years age is possibly due to their developmental stage and exploratory nature. By the age of 4 years, the incidence of accidental poisoning begins to decline as the older child tends to select things that taste good for the purpose of ingestion.

Similar to the observations made by many other studies majority (89.39%) of acute poisoning cases were accidental^{5,10,11}.

Six cases (2.45%) were of suicidal attempt all of whom were above 12 years of age^{12,13}. Majority 4(66.67%) of these patients were females similar to the observations of Lalwani S et al¹⁴. All these patients with suicidal attempt were mentally normal and cause of suicidal poisoning was conflict with parents in 3, conflict with siblings in 2 and poor performance in examinations in 1 case.

Among three (1.22%) homicidal cases (all females), reason in 2 cases was poverty (mother gave poison to her two daughters) and in one adolescent girl, the cause was eve teasing.

In the present study, commonest poisoning was due to ingestion of household products which was observed in 102(41.63%) cases similar to the findings of Singh S, Singhi S et al¹⁰. Among household products, maximum 32 (13.06% of overall poisoning) cases were of kerosene ingestion. Although commonest it was less as compared to other older Indian studies^{6,10,15,16,17,18,19}. This decreasing trend of kerosene poisoning may be due to the reason that people have shifted from kerosene to other better available alternative like LPG as cooking medium.

Mosquito coils, mosquito repellent oil, Laxman rekha, Odomos cream, Rat poison, Organophosphate compounds, Baygon Spray, etc. were among the ingested insecticides, which are commonly available at home.

In the present study, drugs constituted 23.67% cases of poisoning which included anticonvulsant drugs (Phenytoin, Clonazepam, Phenobarbitone and valproate) and sedatives/ tranquillizers (alprazolam, diazepam and lorazepam). One of the family members was on these drugs and has kept the drugs within the reach of children. Most of other drugs (anti cough/ cold syrups, antipyretic analgesics, cyproheptadine, anti-scabies lotion etc) were bought from local chemist shops without proper prescription of Doctors.

In the present study, food poisoning occurred in 40 cases (16.33%). Kumar V and Buhariwalla RJ et al reported food poisoning in 12% and 6.6% cases respectively^{6,15}.

We observed that poisoning due to plants occurred only in 8 (3.26%) cases which is in agreement with few other studies^{5,6,17}.

Similar to the observations of various other Indian studies mortality was 1.22% in the present study.

Majority of the patients (76.33 %) recovered, 14.70% patients absconded and 7.75% could not come for follow up. Two patients died out of 9 cases of organophosphate poisoning constituting 22.22% mortality and out of 32 cases of kerosene oil poisoning one (3.1%) patient died^{1,10,15}.

This study reveals that most of the acute poisonings in children are unintentional and pattern of poisoning has a lot of geographical variations in India. Although the clinical outcome of such cases is usually favourable, deaths do occur depending upon the nature of poisoning and the stage at which patient seeks medical care. Poisoning can be prevented by increasing public awareness, counseling and correct guidance to the parents and in case of poisoning seeking early medical advice reduce morbidity and mortality.

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Detection of Sildenafil Analogues in Coffee Powder by Liquid Chromatography Tandem Mass Spectrometer (LC-MS/MS)

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ABSTRACT

The active ingredient in Viagra is Sildenafil which is used for the treatment of impotency or erectile dysfunction. Sildenafil has become one of the most commonly prescribed pharmaceutical drugs to cure sexual deficiency. In recent years, the use of this drug had been widely expended towards consumption for negative activities. Local authorities and media have reported the abuse of this drug such as taken in drinks, beverages or sweets. That was adulterated. To avoid detection, this erectile dysfunction drug was modified chemically and therefore known as Sildenafil Analogues. These analogues have slight difference in chemical structure, but they have almost the same effect as the original drug. In this study, five (5) local brands of coffee powder suspected to be adulterated with Sildenafil were analyzed. All the coffee samples were extracted with methanol and identified using LC-MS/MS. Each sample was qualitatively analyzed followed by confirmation analysis using two Multiple Reaction Monitoring (MRM) transitions selection, parent and daughter ions for Sildenafil Analogues. The expected chemical structure for parent and daughter ions in this study was also proposed.

Keywords: Sildenafil, Sildenafil Analogues, Coffee, LC-MS/MS

INTRODUCTION

Sildenafil is a drug that is taken orally for the treatment of impotency or erectile dysfunction. It enhances the erectile response to sexual stimulation. During the sexual stimulation, it acts as a selective enzyme inhibitor causing relaxation for smooth muscle and increase blood flow to the erectile tissue of the penis ^[1]. Sildenafil has been shown to be an effective cure for men including the elderly and those with high blood pressure, diabetes, coronary artery disease, depression spinal cord injury and prostate problems^[2].

Prescribed user normally does not encounter problems, however in some cases of abuse, users might

encounter headaches, flushing, dizziness, indigestion, and vision disturbances including effects on color vision. In some severe cases, abuser will experience a more serious effect such as heart problem or failure and might lead to fatality ^[3].

In recent years, there are products, introduced in the market, which was adulterated with Sildenafil citrate, not to cure impotency but more for negative activities. In Malaysia, the local authorities and media have reported on Sildenafil found in food sample especially in drinks or beverages. To avoid being detected, this erectile dysfunction drug was structurally modified, which is now known as Sildenafil Analogues ^[4]. In August 2011, the Ministry of Health had reported that 40 beverages including coffee products sold locally in the market contained Sildenafil, Tadalafil and Verdalafil. Tadalafil and Verdalafil are some of the newly introduced Sildenafil Analogues.

Analogues are a drugs that differ structurally in minor ways from its parent compound ^[5]. These minor differences in molecular structurel, eventhough not

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significant, can result in importance changes on its action^[6]. The use of analogues to replace existing drugs are either for more potent action, cause fewer side effect, or for better absorption after oral administration

According to the Chemistry Department of Malaysia, there are still sildenafil analogues in black market that are yet to be detected. Therefore, in this study, LC MS/MS is introduced and a new method to detect Sildenafil Analogues present in coffee powder was developed. This new method hopefully will help the local authorities to enforce and minimize the abuse of this drug.

METHODOLOGY

Equipment

The LC-MS/MS analysis was performed using a Waters 2690 Alliance LC module, equipped with Micromass Quantro Ultima Tandem Mass Chromatography (MRM) used one precursor ion/two product ions transition per compound.

Sample Preparation

Test samples were randomly obtained from local markets. All 5 brands of coffee powder were weighted 0.1 g each. Drugs were extracted from samples using methanol (5mL) by ultrasonic shaking at room temperature for 10 minute. Then, the solutions were centrifuged at 2000rpm for 5 minute. The extract was then filtered into vials and injected to LC-MSMS analysis.

Analysis Condition of LC-MS/MS

The LC-MS/MS was performed out on a Chromolith Monolithic RP-18 Column (Merck), 3.00 x 100mm using 0.1% acetic acid in 10mM CH₃CO₂NH₄/acetonitrile (60:40) as mobile phase. The flow rate was 0.25 mL/min, the injector volume was 10µl, the degasser was normal and the running time was 15 min.

The analytical condition of tandem mass was positive ion electrospray (ESI +ve) modes, capillary voltage: 3.00kV, cone voltage: 42V, collision gas: argon at a cell pressure of 3.6x10⁻³mbar, source temperature: 120°C and desolvation temperature: 350°C.

RESULT AND DISCUSSION

The LCMS/MS instrument was operated in positive ion ESI with ms/ms transitions monitored during one time segments in Multiple Reaction Monitoring (MRM) mode. Each compound was qualitative and confirmed using two MRM transitions selection and tuning of transition. The analyte depends on cone voltage and collision energy, and were performed using infusion and mixing of individual standard solution with methanol. Finally, the assignment of sildenafil analogues in samples were done by mass to atomic ratio (m/z) respectively; 453/311 (Carbodenafil), 461/151 (N-DesethylVardenafil), 483/127 (HydroxyAcetildenafil), 467/1119 (Acetildenafil), 505/298 (ThiodymethylSildenafil), 438/297 (PiperiAcetildenafil) and 453/296 (N-DesmethylAcetildenafil).

Table 1 shows the compilation of results obtained from five samples of coffee mixtures analyzed using LC-MS/MS. Only 3 samples show positive qualitative identification of sildenafil analogues in this analysis.

Table 1: Compilation of result obtained from 5 brands of coffee powder and had been compared for 7 standard solutions (1ppm).

Sample (1ppm)	Samples				
	S 1	S 2	S 3	S 4	S 5
Carbodenafil	"	x	x	x	x
Hydroxyacetildenafil	x	x	"	x	x
Acetildenafil	x	"	x	x	x
N-DesethylVardenafil	x	x	"	x	x
Piperiacetildenafil	x	x	x	x	x
Thiodymethyl sildenafil	x	x	"	x	x
N-Desmethylacetildenafil	x	x	x	x	x

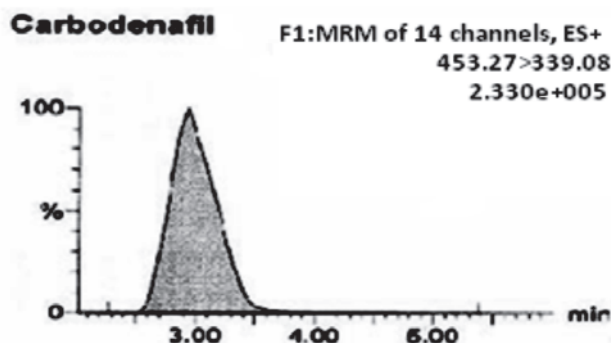
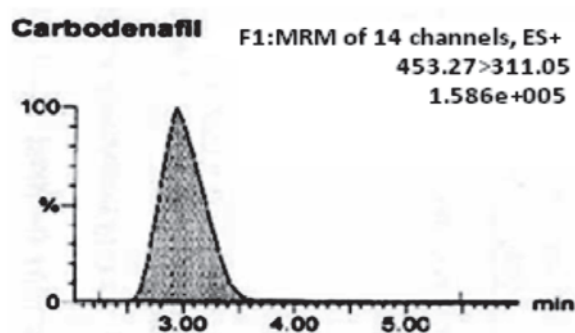


Fig. 1. Positive result of sample 1 for Carbodenafil.

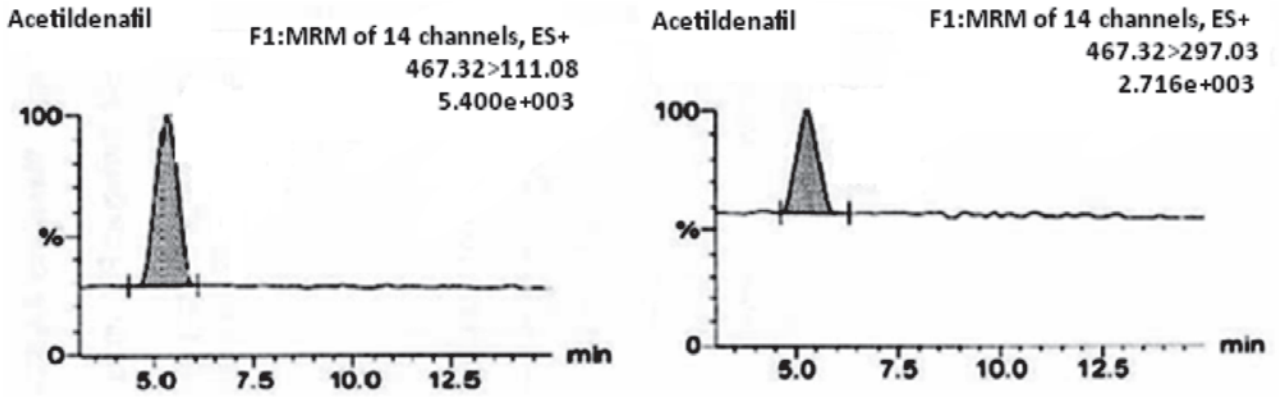


Fig. 2. Positive result of sample 2 for Acetildenafil.

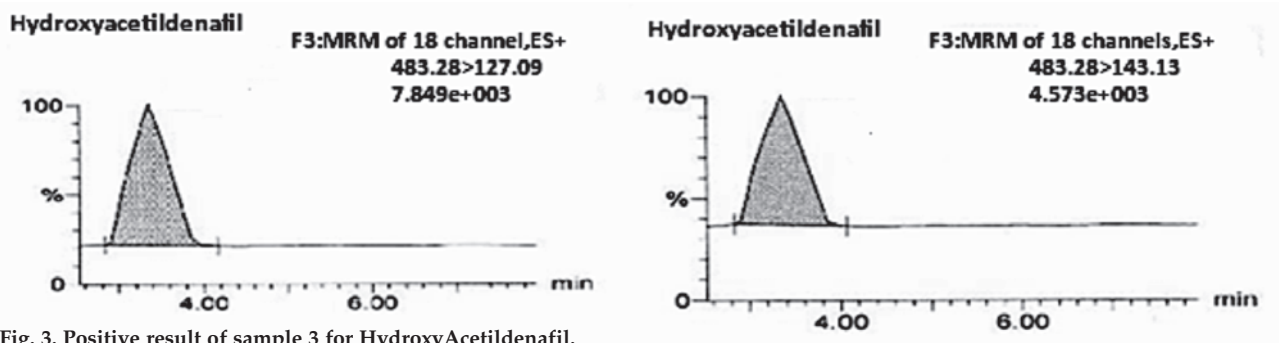


Fig. 3. Positive result of sample 3 for HydroxyAcetildenafil.

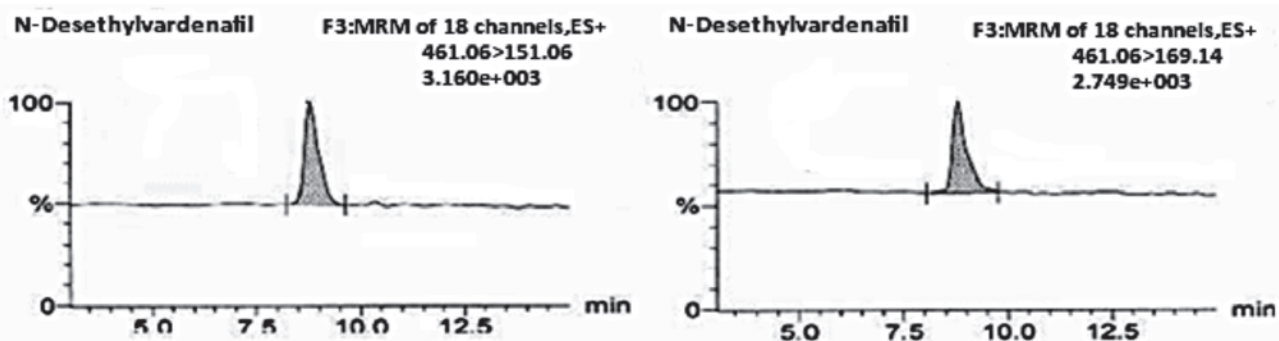


Fig. 4. Positive result of sample 3 for N-DesethylVardenafil.

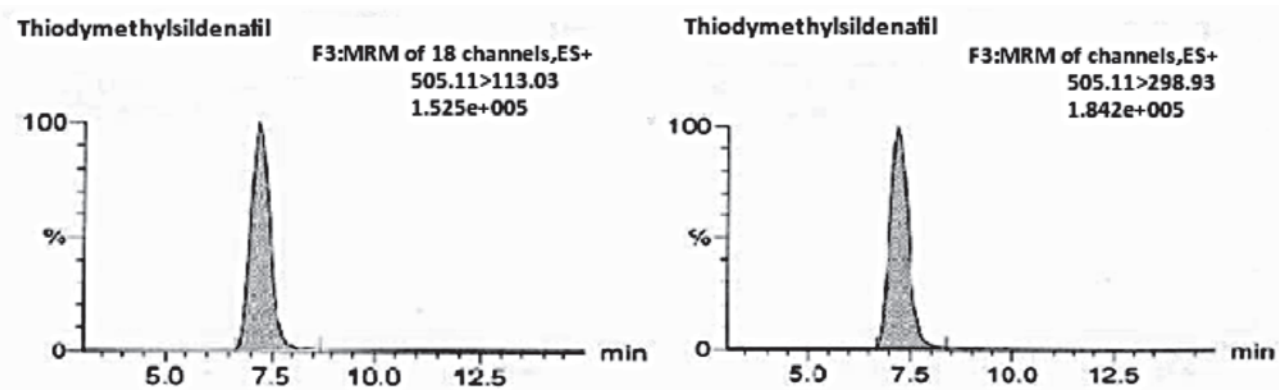


Fig. 5. Positive result of sample 3 for Thiodymethylsildenafil.

Figure 1 to 5 show the peak of samples for each Sildenafil analogues tested. Each sample was qualitatively analyzed and was confirmed using two MRM transitions selection, parent and daughter of

Sildenafil analogues. The proposed fragmentation structures of for Carbodenafil, Acetildenafil, HydroxyAcetildenafil, and N-DesethylVardenafil are as shown by Figure 6.

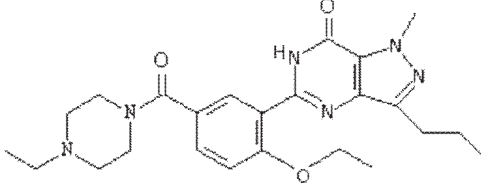
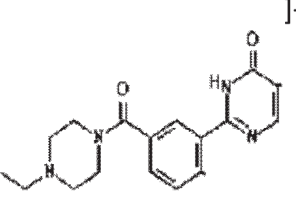
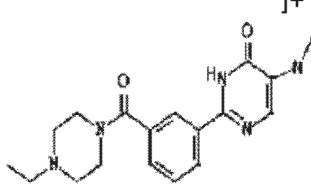
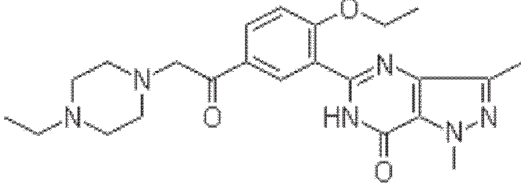
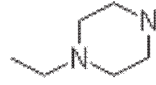
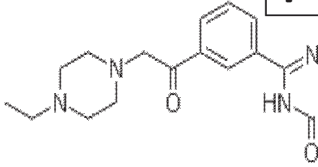
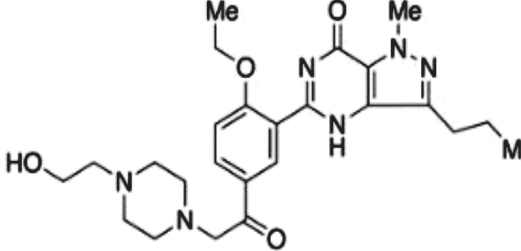
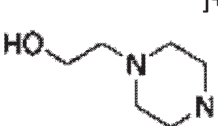
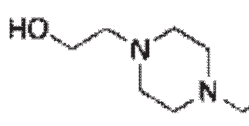
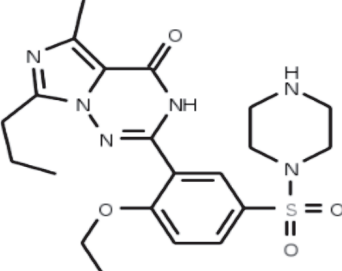
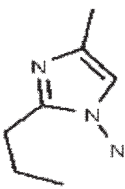
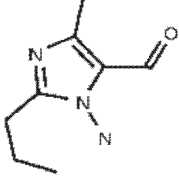
 <p>Carbodenafil (Parent ion m/z 452.56)</p>	 <p>Daughter ion m/z 311</p>	 <p>Daughter ion m/z 339</p>
 <p>Acetildenafil (Parent ion m/z 466.58)</p>	 <p>Daughter ion m/z 111</p>	 <p>Daughter ion m/z 297</p>
 <p>HydroxyAcetildenafil (Parent ion m/z 482.58)</p>	 <p>Daughter ion m/z 127</p>	 <p>Daughter ion m/z 143</p>
 <p>N-DesethylVardenafil (Parent ion m/z 460.55)</p>	 <p>Daughter ion m/z 151</p>	 <p>Daughter ion m/z 169</p>

Fig.6. Proposed fragmentation structures of for positive result of Carbodenafil, Acetildenafil, HydroxyAcetildenafil, and N-DesethylVardenafil

CONCLUSION

In this study, LC-MS/MS was used to identify Sildenafil analogues that are suspected adulterated in coffee. The developed method was successful to screen Sildenafil analogues marketed to enhance sexual activity. It is hoped that this would increase the awareness to society about the doped coffee powders. The development of an effective method for screening and detection of Sildenafil hopefully can help the enforcement agencies to inspect products in the market and might reduce the illegal activities and therefore reduce the danger of Sildenafil analogues might bring.

ACKNOWLEDGEMENT

Special thanks to Department of Chemistry, Johor branch to make this project a success.

Conflict of Interest

There is an arising issue which is abusing of Sildenafil where many products were being introduced into the market has been added with Sildenafil analogues in order to help men encounter their problem of having sex either they having erectile dysfunction or not. The success of this research will be useful to help Ministry of Health, Ministry of Domestic Trade and Consumer Affairs and the consumer society to overcome this unhealthy problem. Beside that, it would give the information and right for consumer not to buy prohibited and poisoned food products.

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Death Profile in Elderly - a Study in District Hospital Tumkur, South India

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ABSTRACT

The aim of this study was to determine the cause and manner of death in the elderly people. The elderly people are ones, who are aged 60 years and above, form 7.4% 1 of the total population, are the most neglected people in the society. Data were collected from district hospital Tumkur. The total number of autopsies performed at district hospital, Tumkur over a five-year period, between the years 2006 to 2010. Of the 2288 cases 173 deaths were seen in elderly people. Of this 46 deaths were due to natural cause and 127 deaths were due to unnatural causes. Accidental deaths were more than the suicidal or homicidal deaths. Cardiovascular diseases and accidents were the major cause in natural and unnatural deaths respectively. Deaths were seen more in males than females.

Keywords: Elderly People, Autopsy, District hospital, Accidental, Natural Disease

INTRODUCTION

The elderly were treated with respect by the young in a family and in society in olden days. As the time changed respect towards elder people has reduced and most of the times left to take care of themselves even though they are dependent on younger generation of the family for food, living and health, as they will not be earning or have energy to work. Better health care and improved standards of living, control of infectious, communicable and non communicable diseases has prolonged their life and have increased their population. Hence felt as burden to society. Death is inevitable once old age begins and natural death is the norm. But for their susceptible nature, they became easy victims of crime (robbery, property grabbing) and deaths by unnatural modes also increased among them along with natural cause. Hence an attempt is made to study the death profile in elderly people based on the autopsies conducted at district hospital, Tumkur.

MATERIALS AND METHOD

The autopsies conducted at the District General Hospital Tumkur between the years 2006 – 2010 were considered for this study. Of this, 173 (7.56%) deaths were seen in older people. The data was collected from police inquest, postmortem report, and forensic science lab and histopathology report to determine the sex, cause and manner of death.

OBSERVATION & RESULTS

Table No. 1. Sex wise distribution of cause of death

Sex	Natural	Unnatural
Male	29	87
Female	17	40
Total	46	127

Table No. 2. Manner of death

Manner of Death	Male	Female
Accidental	56 (32.36%)	24 (13.87%)
Suicidal	28 (16.18%)	13 (7.51%)
Homicidal	03 (1.73%)	03 (1.73%)
Natural	29 (16.76%)	17 (9.82%)
Total	116 (67.05%)	57 (32.94%)

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During the period of study a total of 2288 autopsies were conducted, of this 173 (7.56%) deaths were in older people. 46 (26.58%) deaths were due natural causes and 127 (73.41%) deaths were due to unnatural

causes. Among the natural causes, deaths were more due to cardiac arrest (MI) 16 (34.78%), tuberculosis 15 (32.60%) followed by congestive cardiac failure 6 (13.04%), stroke 3(6.52%), cancer 3(6.52%) and epilepsy 1 (2.17%).

Among the unnatural deaths 127 (73.41%), accidental deaths 80 (62.91%) were more followed by suicidal 41(32.28%) and homicidal deaths 6 (4.72%). Road traffic accidents deaths 55 (68.75%) were more followed by other forms 25 (31.25%) of accidental deaths.

Among the suicidal 41(32.28%) forms of death, asphyxial deaths 29 (70.73%) were more followed by poisoning deaths 12(29.26%). Hanging 15(51.72%) and drowning 14 (48.27%) accounted for the asphyxial deaths. In the poisoning deaths, organophosphorous poison accounted for 8(66.66%) deaths followed by aluminum phosphide 3(25%) and carbamates 1(8.33%).

Death were more in males 116 (67.05%) then the females 57 (32.94%). In the 46 natural deaths, males accounted for 29 (63.04%) and in females 17 (36.95%). In the 127 unnatural deaths, males accounted for 87 (68.50%) and females 40 (31.49%).

DISCUSSION

The medico-legal autopsies conducted on the elderly people were 173 (7.56%), which was similar to study in Nigeria² where it was 7.2%. The deaths were due unnatural causes 127 (73.41%) and were due to natural causes 46 (26.58%). The unnatural deaths were more than natural death which was similar to study by others^{3,4}. Sex wise deaths were seen more in males 116 (67.05%) than females 57 (32.94%) which was similar in other study^{3,4}.

The accidental deaths 80(62.91%), were more among unnatural deaths. Of the accidental deaths, road traffic accidents 55 (68.75%) were most followed by the other forms 25(31.25%) like snake bite, fall, burns etc. Our study was similar to a study done in Nigeria where, road traffic accident is most common accidental deaths². The road accidents were mostly due to highway roads passing along the villages with drivers driving rashly, poor road condition, poor visibility due to poor vision in the aged people and absence of lights on the roads and inability of the old people to move quickly while crossing on the roads. In the study by Essam M et al⁴, homicidal death were most common of unnatural death followed by accidental and suicidal death. In study by Haakon H

et al⁵, drowning in males and road traffic accident death in females were most commonest cause of unnatural deaths.

In our study, the suicidal deaths accounted for 41(32.28%) of which asphyxial deaths were 29(70.73%), followed by poisoning deaths 12(29.26%). Hanging 15(51.72%) and drowning 14 (48.27%) accounted for the asphyxial deaths. In the poisoning deaths, organophosphorous poison accounted for 8(66.66%) deaths followed by aluminum phosphide 3(25%) and carbamates 1 (8.33%). In study by Haakon H et al⁵, hanging in males, drug overdose and drowning in females were most commonest cause of suicidal deaths. Behera C et al⁶ in his study found hanging followed by poisoning were two major methods of committing suicide. In our study, organophosphorous poisoning is the commonest method of poisoning followed by aluminum phosphide and carbamates.

In study by Arun M et al⁷ organophosphorous poisoning the most preferred method, which is similar to our study. Essam M et al⁴ in his study found carbamates poisoning was most commonest poisoning followed by organophosphorous poisoning.

The homicidal deaths accounted for 6 (4.72%) of the unnatural deaths. The main motive for homicides was property disputes. The weapons used were blunt and sharp weapons.

The natural deaths accounted for 46 (26.58%) deaths, of which cardiac arrest (MI) 18(39.13%), tuberculosis 15 (32.60%) were most followed by congestive cardiac failure 8 (17.39%), stroke 3(6.52%), and epilepsy 2 (4.34%). In a study by Gross et al⁸ bronchopneumonia, congestive cardiac failure and metastatic carcinoma was more common. In other studies^{9, 10} bronchopneumonia and carcinoma of GI and lung were commonest cause of death. In study by Kilma MP et al¹¹ infections and cardiac disorders each accounted for one third of all deaths. But in our study showed myocardial infarction and tuberculosis were most common cause of natural death.

CONCLUSION

The death is inevitable as the old age arrives which cannot be stopped, but can be prolonged and suicidal deaths can be avoided by providing the elderly people love and affection instead of showing them that they are burden to family, establishing old age homes to take care of elderly people who are homeless or whom have no one to take care off, provision of proper, timely

and free healthcare with necessary follow-ups for the elderly patients.

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Romberg Syndrome and Medical Negligence: A Rare Case

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ABSTRACT

Romberg syndrome is a rare neurocutaneous disorder characterized by progressive atrophy or shrinkage and degeneration of tissues beneath the skin usually on one side of face. One such case was reported to the FMT Department where a 27 year old female was suffering from such a disease. The peculiarity here is that, her disfigurement was enhanced after Plastic Surgery. A case of negligence has been filed in the Honourable High Court of Odisha.

Keywords: *Progressive Atrophy, Disfigurement*

INTRODUCTION

Romberg syndrome known as progressive hemi facial atrophy results in progressive shrinkage and degeneration of tissues beneath the skin usually on one side of the face but may be bilateral in 5% to 10% of cases⁽¹⁾.

The tissues involved include the skin, tongue, gingiva, soft palate, the cartilage of the nose, ear, subcutaneous fat, laryngeal muscle and bone.

Its onset occurs mostly before puberty⁽¹⁾ but occasionally begin in middle or later years. Although both sex may be affected but has a higher prevalence in females⁽²⁾. The prevalence rate is estimated to be at least 1 per 700,000 general populations⁽³⁾.

The syndrome may be a variant of localized scleroderma. A few familial instances are suggestive of autosomal dominant inheritance. In addition to the connective tissue disease, the condition is often accompanied by significant neurological, ocular and oral sign and symptoms whose range and severity are highly variable.

The first mention of this condition was made by Parry⁽⁴⁾ whose medical writing were published posthumously in 1825. The disorder was again described by Romberg⁽⁵⁾ in 1846. In 1871 descriptive title "Progressive hemi facial atrophy" was coined by German neurologist Albert Eulenburg⁽⁶⁾. In 1963 Roger⁽⁷⁾ was able to review 772 such cases. A definitive review was given by Lewkonja and Lowry⁽⁸⁾ in 1983.

Incidence of various presentations⁽²⁾ of the Syndrome :

In 20% of cases hair and skin overlying affected areas may become hyper pigmented or hypo pigmented with patches of unpigmented skin. In upto 20% of cases the disease may involve the ipsilateral or contra lateral neck, trunk, arm or leg. The cartilage of the nose, ear and larynx may be involved. The disease affects both sides of the face in 5-10% of the cases. Where the atrophy meets normal tissue on the other side of the face , it may produce a "line". Around 25% of patients with facial hemiatrophy have a more definite vertical or diagonal "line" on their forehead as a result of cutaneous sclerosis (rather than atrophy of the deeper tissue)⁽⁹⁾. Roughly 45% of cases are also associated with trigeminal neuralgia and /or migraine. 10% may develop a seizure disorder. 50% of cases may develop dental abnormalities like delayed eruption dental root exposure or resorption of dental roots on the affected side. 35% have difficulty to open mouth. 25% show atrophy of one side of upper lip and tongue. Ophthalmic involvement is common ; the most frequent abnormality is progressive endophthalmos with subsequent changes in the palpebral fissure⁽¹⁰⁾. Enophthalmos, ptosis, miosis and conjunctival redness may occur in affected side.

The disease may progress for several years before eventually going to remission (abruptly ceasing) but deformity exists.

MATERIALS & METHOD

A 27 year old female diagnosed to suffer from Romberg's syndrome sustained disfiguration on her face. She underwent plastic surgery after which instead of any improvement her disfiguration was further enhanced at her temple region of her face.

The case was operated in a private hospital with very high cost. As they were poor family they had to sell their landed property to bear the cost. The end result of operation was unsatisfactory because the deformity was enhanced than before. The family became disappointed and being desperate and they file a case in local police station for the negligence on the part of the doctor. But the police station did not hear any objection filed by the girl.

On direction of the Honourable High Court she was sent to FMT Dept, S.C.B. Medical College, Cuttack with reference from Markat nagar PS to clarify the following points.

- (i) Whether the preoperative disfiguration has been enhanced by the surgical procedure adopted for correction of the preoperative disfiguration.
- (ii) If it is enhanced whether it is grievous hurt or not.



Fig. 1. Present case shows the photographs before surgery

FINDINGS

In this case a planned surgery was done by the doctor but unfortunately it was a failure and deformity increased so a case was filed for negligence.

Medicolegal Examination

1. Partial atrophy of facial muscles of the right side causing facial deformity.
2. Atrophy of right side nasal cartilage.
3. Ptosis of right side lower eyelid.
4. Scar tissues on right side forehead, with a depression extending upto right tragus and also faint scar tissue below the right malar prominence.

As this case was treated to correct the deformity with good faith and no question of assault arises. Hence final opinion was that it was not a grievous hurt.

DISCUSSION

There is no definitive treatment for this condition but an attempt to use restorative plastic surgery which includes fat or silicone implants, flap/pedicle grafts, or bone implants can be done to improve facial disfigurement⁽³⁾. Regarding the treatment of such condition the affected individual may benefit from microsurgical reconstructive surgery to restore a more normal contour to the face.

It involves the transfer of an island Parascapular fasciocutaneous flap or a free flap from the groin, rectus abdominis muscle or latissimus dorsi muscle to the face. Severe deformities may require additional procedures, such as pedicled temporal fascia flaps, cartilage grafts, bone grafts orthognathic surgery and bone distraction⁽⁷⁾.

Major risk of surgery is losing the tissue if the blood vessels clot off, preventing the donor and recipient tissue from becoming integrated. In such rare case, the transplant can be repeated using another part of the body as the donor⁽¹¹⁾.

The timing of surgical intervention is controversial. Some surgeons prefer to wait until the disease has run its course and been stable for at least two years while others recommend early intervention. Dr. John W. Siebert of Newyork City⁽¹¹⁾ has operated about 100 people with cutaneous scleroderma and Romberg's disease. He prefers an early intervention so that we can change the biology of the surrounding tissues by bringing in well vascular- rized healthy tissue. We can possibly prevent some of the secondary changes from the scleroderma like changes in the skin colour and damage to the bone. The treatment modalities mentioned , resolve just momentarily the good

appearance, where as all the structure projected in the cosmetic surgery is lost with time, due to gravity action , and the patient usually requires new intervention⁽³⁾. The treatment options include cosmetic surgical reconstruction and possibly the use of immunosuppressants. The latter have been used in some situations with good results. An interdisciplinary approach is usually required ⁽¹²⁻¹⁵⁾.

CONCLUSION

Reconstructive surgery is required in different disease conditions resulting in deformities, specifically face viz. leprosy, polio, Romberg disease, paralysis and Paraplegia. In such case doctor should follow steps to prevent litigation following surgery.

1. Informed consent is very essential before doing any surgery.
2. Doctor should take care to see that deformity should not increase. Minimal surgical intervention with proper informed consent will save from litigation. Expertise and experience is highly required.

As per the Supreme Court verdict, 2005 a case of negligence by the doctor is to be proved by a board of doctors comprising of different specialities and it cannot be proved by a single doctor. Hence the police officer was advised to request the appropriate authority to form a board of expert to get the final opinion.

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A Rare Finding of Red Tears in Eyes (Haemolacria) in a Case of Death due to Electrocution: A Case Report

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ABSTRACT

Objective: To report a rare finding of red tears in eyes in a case of death by electrocution due to electric current.

Material and Method: This case was brought to mortuary of Late Baliram Kashyap Memorial Government Medical College, Jagdalpur, Bastar, Chhattisgarh, for post-mortem examination with history of electrocution.

Result: The conventional practice of suspecting organophosphorous compound poisoning, tumour or injury gets a differential diagnosis. This is rarely noted finding, particularly in cases of electrocution due to electric current.

Conclusion: Red tears not merely indicate toxicity, trauma and tumour but may also suggest electrocution.

Keywords: Red tears, Haemolacria, Electrocution

INTRODUCTION

In practice of forensic medicine autopsy surgeons come across many deaths by electrocution due to electric current. Meticulous examination shows the routine wounds and findings of electrocution. Electrocutions involving humans may be due to low voltages (<1000 V), high voltage (>1000 V), or to lightning.

The autopsy assessment of possible electrocution is complicated by the non-specificity and subtlety of lesions. Victims may have classical electrical burns of the skin or may have uncommon associated finding as in this case i.e. red tears in eyes or haemolacria. Blood stained tears or haemolacria is an extremely rare condition.

Earlier haemolacria, though rare, has been reported in direct trauma, toxicity (organophosphorous compounds) and tumours of lacrimal apparatus. In present case, all these probabilities were ruled out at autopsy, and thus electrocution remains the only probable cause.

CASE REPORT

A body was brought for autopsy, to the mortuary of Department of Forensic Medicine, Late Baliram Kashyap Memorial Government Medical College, Jagdalpur, a tribal town in Bastar district of Chhattisgarh. As per police inquest and requisition, the 27 years old robust and seemingly healthy person was accidentally electrocuted by electric wire while he was working at home in presence of his family members. The wire was in direct contact with electricity pole wire. He immediately lost consciousness after flash burns. The relatives brought him to casualty department of this hospital. He was declared brought dead by the casualty medical officer, and advised post-mortem examination.

External examination: Post-mortem examination was started about six hours after death. At autopsy, a

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young male deceased had a lungi around waist and underwear inside. The person had moderate built and body was cold. Rigor mortis was well marked in the whole body. Purple postmortem lividity was fixed in posterior aspect of body. No signs of decomposition were seen on the body.

Eyes were closed and cornea was hazy. Conjunctivae were congested and bloody red fluid was observed to have flown from medial canthus of both the eyes over the bulbar conjunctivae and lateral canthi to the temporal region on both sides (Fig. 2). On careful examination the origin of red tears was found to be lacrimal puncti. On cleaning the existing tears and pressing the lachrymal gland region traces of red tears reappeared. No evidence of any injury was seen in and around eyes or head, face and neck region. Frothy mucoid fluid was oozing out of nostrils. Thin froth was oozing from mouth.



Fig. 1. Face and flash burns over chest.



Fig. 2. Haemolacria with frothing from mouth and nostrils.

Upper limbs were semi-flexed and lower limbs were straight. Multiple antemortem flash burn injuries were seen over anterior, upper half of the trunk, sparing neck and shoulder region (Fig.1). Multiple antemortem electric entry wounds were observed over left wrist, palm and fingers (Fig. 3 & 4). An imprint of the conductor in thenar region of left palm measured 6 mm. in breadth (Fig. 3). Some of the joule burns were blackened. Even after careful examination, no exit wound was found over body.



Fig. 3. Electric entry wounds over left



Fig. 4. Multiple electric entry wounds palm and wrist over fingers

Internal examination: Meninges and brain were congested. Heart was congested and was having fluid blood within. Both lungs were congested and oedematous. Abdominal viscera were congested. No gross evidence of any other injury or disease was seen.

Person was certified to have died by electrocution due to electric current.

Further details from family members of the deceased revealed no prior incidence of shedding red tears by the deceased himself or any family member. The deceased or family member didn't have any features suggestive of chronic illness or bleeding tendency. The deceased didn't have any complaint related to eyes or vision, nor was he exposed to any pesticide in recent past.

DISCUSSION

In cases of electrocution due to high voltage current findings like bleeding from nostrils has been reported in literature. The reason proposed are, congestion or tears of lining mucosa of respiratory tract or air sinuses. The haemolacria has been reported to have caused due to retrograde epistaxis⁷, conjunctival lacerations, malignant melanoma of the conjunctiva⁴, malignant tumors of the lacrimal sac¹, Osler-Weber-Rendu disease (hereditary haemorrhagic telangiectasia)⁴, severe anaemia⁴, jaundice⁴, vascular tumours⁴, chlorpropham poisoning⁹, organophosphorous compound poisoning^{2,3}, orbital varix⁴, giant papillary conjunctivitis⁴, haemophilia⁴ and other coagulopathies⁴. In some clinical cases no cause of unilateral haemolacria could be ascertained even after extensive work up⁶. Some of the above conditions commonly present unilaterally but in present case, the tearing was bilateral. The other probabilities were ruled out by gross examination and history.

The probable explanations for this haemolacria in this case are- 1. In deaths due to high voltage electric current petechial haemorrhages or ecchymoses may appear in organs along the path of the current due to vascular lacerations. 2. The rapid dilatation of pre capillary vessels with intimal tears and paralysis of blood vessels in lacrimal glands leading to congestion and increased permeability resulting in effusion of blood.

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Comparative Study of Incidence of Wormian (Sutural) Bones in North and South Indian Population

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ABSTRACT

1189 Non-Pathological dried adult crania from north and south Indian states (NI & SI) are studied and observed that Incidence of sutural bones (SB) were more in female crania of all 3 sutures i.e. coronal, sagittal & lambdoid. A) In NI cranial study coronal suture of female crania had 8.76% of SB but in males crania it was 6.47%. In sagittal suture 18.72% SB while in male crania had 17.45%. Moreover in lambdoid suture also 168.72% was observed in female crania while male crania had 122.12%. Similarly b) in SI crania also exhibit more incidence of SB in female crania all three sutures - coronal suture of female crania had 8.39% while male crania had 7.7%. In sagittal suture of female crania had 13.2% while male crania had 9.47% moreover lambdoid suture of female crania of SI had 220.09% and male crania had 171.22%. c) during regional study of male crania of NI were compared with SI crania - of male crania of coronal suture of NI had incidence of SB were 6.47% while SI had 7.71% SB, but SB at sagittal suture were more in NI crania 17.45, while SI crania of suture had 9.47% which was statistically highly significant ($P < 0.01$) similarly lambdoid suture of NI crania had 122.35% and SI crania had 171.21, during comparison of regional study of female crania of NI and SI. In coronal suture of SI female had 8.39% and NI female had 8.76% similarly sagittal suture also had 18.55% of SB in NI female while SI female had 13.28%, but lambdoid suture of SI female had 206.94% and NI female crania had 168%. These findings are helpful to the anatomist, anthropologists and medico-legal expert to differentiate sexual dimorphism and comparison of India as whole or regionally. Above all to the clinician, who may confuse the incidence of SB as fractures.

Keywords: Sutural Bone, North India, South India, Nutritional, Environmental

INTRODUCTION

Sutural bones (SB) are also called "Wormian" bones not because of their worm like appearance but the Wormian bones are named after 'ole worm' (1588-1654) an earlier Scottish anatomist who was pioneer to study SB. They were called Wormian bones by his nephew Thomas Breathline⁽¹⁾. SB is usually present in the lambdoid suture and fused fontanelle areas. Hence the presence might be to fill the gap between membrane and cartilaginous areas during ossifications to allow the normal growth of the brain⁽²⁾.

MATERIAL AND METHOD

NI four states viz UP, Rajasthan, Haryana, and Punjab. Four States from SI namely Karnataka, Tamil Nadu, Kerala, AP, Four Colleges from each states are studied as S.R.S (Simple Random Sampling) Method. SRS Method crania under multistage sampling status (MSS).

Crania available	No of colleges	Total No of Crania
UP	389+75+22+40	526
RAJASTHAN	031+29+22+14	96
HARYANA	021+14+09+08	52
PANJAB	030+20+19+18	87
ANDRA PRADESH	036+29+20+18	103
KARNATAKA	047+39+24+24	134
KERELA	030+21+17+10	78
TAMIL NADU	048+41+17+07	113
	TOTAL	1189

It is presumed that NI are mainly Aryans and SI are mainly Dravidians⁽³⁾. Hence Maharashtra, Goa, Gujarat states are avoided as they are in central Indian States Moreover Cosmopolitan Cities like Delhi, Bangalore, Chennai, Hyderabad are avoided as there could be mixing of races The studied sutures are coronal, sagittal and lambdoid. Each suture is divided into three equal segments like Segment I, Segment II, Segment III (From right left) but in sagittal sutural

(anterior to posterior) and incidence of SB are also divided into 3 segments along with sutures.

Observation or Results

Table-No 1 (a) Sexual dimorphism of incidence of SB in coronal suture of NI crania has more incidence of SB in female crania (8.76%) than male crania (6.47%)

Table No.1 (b) Sexual dimorphism of incidence of SB in coronal suture of SI crania has more incidence of SB in female crania (8.39%) than male crania (7.7%)

Table No.1(c) Sexual dimorphism of incidence of SB in sagittal suture of NI crania has more incidence of SB in female crania (18.72%) than male crania (17.45%)

Table No.1 (d) Sexual dimorphism of incidence of SB in sagittal suture of SI crania has more incidence of SB in female crania (13.2%) than male crania (9.47%)

Table No.1 (e) Sexual dimorphism of incidence of SB in lambdoid suture of NI crania has more incidence of SB in female crania (168.1%) than male crania (122.32%)

Table No.1 (f) Sexual dimorphism of incidence of SB in lambdoid suture of SI crania has more incidence of SB in female crania (220.09%) than male crania (171.22%)

Table No. 2. (a) Regional comparison of Incidence of SB sagittal suture in male crania of NI and SI shows highly significant ($P < 0.01$) but P value of lambdoid suture cannot be calculated as they are more than 100 (b) In segmental study 3rd segment of Sagittal suture, 2nd & 3rd segment of lambdoid suture shows highly significant ($P < 0.01$).

Table No. 3. Regional comparison of Incidence of SB in female crania of NI & SI. SB at coronal suture and sagittal suture shows insignificant values but SB at lambdoid suture cannot be calculated as they are more than 100. (b) IInd segment of sagittal suture SB & 2nd, 3rd segment of lambdoid suture shows highly significant value ($P < 0.01$).

Discussion & Summary

In the present study (Table 1a, b, c, d, e, and f) has shown the sexual dimorphism. The more incidences were observed in female crania especially in segment I & segment III of the all three sutures. More incidence of SB in female crania was also observed by anatomist previously.^{(4) (5) (6)}

It is believed that, spheno-occipital syndesmosis which has bilateral epiphyseal cartilage which fuses earlier in female than male crania. Hence there could be more incidences of SB in female crania to provide space for developing crania.⁽⁷⁾ Weather incidence of suture bones is genetic or environmental factors remains controversial on the other hand large number of SB is observed in hydrocephalus. Hence incidence could be due to pressure or stress influenced by metabolic activity⁽⁸⁾.

SB is treated as fragmentation of bones from single center of ossification⁽⁹⁾ because they increase the capacity of skull regardless of any cause⁽¹⁰⁾. Hence it can be hypothesized that, incidence of SB is not under genetic control but is a secondary characteristic brought about by ontogenetic stress.

SB are also observed in fetal skulls⁽¹¹⁾. It is also observed SB present in fetal skulls with congenital anomalies.⁽¹²⁾ In the present comparative study of male crania of NI and SI (Table No 2a) Incidence of SB at sagittal suture NI crania was 17.45% and South Indian Crania was 9.47%. The difference was statistically highly significant ($P < 0.01$)

Incidence of SB was highest at lambdoid suture compared to other two sutures in both regions. The incidence was 122.35% in NI Male crania and 171.22% in SI male crania. However the significance level could not be calculated because parameter exceeds hundred.

In the segmental study of Male crania of both Regions (Table 2b) IIIrd segment of Sagittal suture shows NI 35.97% and SI 12.76% shows significant P values ($P < 0.01$). Similarly segment II of lambdoid suture SI (96.97%) and NI (92.5%) and the difference was statistically highly significant ($P < 0.01$) and Incidence at segment III was 81.92% in SI Male Crania and 56.58% in NI male crania the difference was statistically highly significant ($P < 0.01$).

More incidence observed in lambdoid suture in both regions could be due to the fact that, lambdoid suture is under stress due to dual ossification, partly in membrane partly in cartilage and SB are⁽¹³⁾ developed as a response to the stress hence differentiated as true SB and false SB depending upon the degree of stress⁽¹⁴⁾. These findings could not be compared with previous studies as data was available in English literature.

Comparative study of Incidence of sutural bones in female Crania (Table No.3 a, b) At lambdoid suture

it was 168.12% in north India and 206.94% in SI. However we could not calculate the significance because parameter increase above hundred.

In segmental study (Table 3b) SB at sagittal suture in segment 2nd SI Female had 11.76% & NI Female 3.63% which shown significant (P < 0.05). SB at the lambdoid suture at segment II was 88.24% in SI Female While 92.72% in NI female and the difference was statistically significant (P<0.05), similarly in segment III also percentage incidence was 84.47% in South Indian Female Crania and 68.75% in NI female crania and the difference was statistically highly significant (P<0.01). Fig. 1 shows sutural bones along the entire length of the lambdoid suture in NI lambdoid crania and three SB in third segment of sagittal suture. Fig.2 shows nine SB at lambdoid suture in SI female crania.

These significant values of sexual dimorphism, regional comparison of male crania in SI & NI, regional comparison of female crania of NI and SI Could not be compared with previous studies as no data is available in English literature. But it is interesting to note that single female crania of saccopastore(Italian) had sixteen wormian bones, possibly a world record⁽¹⁵⁾.

The variations in the different values between north and South India could be traced back to the racial history. It is believed that, Negritos from Africa found in SI, Pro-Australia people found in NI and Indo-Aryans found in North and central part of India⁽¹⁶⁾ it is observed that all the races migrated and settled in India for the survival purpose in olden days⁽¹⁷⁾ therefore all this variations represent their ancestors.

CONCLUSION

It is studied that female crania had more incidence of SB than male crania In the regional studies Incidence of SB in sagittal suture is more in male crania of NI than SI male crania but Incidence of SB in lambdoid suture of SI Male crania was more than NI Male. In the Female cranial study of regional comparison, Female crania of SI had more incidences of SB than NI female crania in lambdoid suture but more SB observed in the NI Female Crania of Coronal & sagittal suture. This idiopathic variation incidence could be due to environmental, genetic, racial or nutritional status or variation in dietary habits. These significant finding has given a new parameter to differentiate sexual dimorphism of crania and Male crania of NI from SI and Female Crania of NI from SI. It is useful for anatomist, anthropologist and medico-legal expert. But it warrants further radiological study in crania of living subject to throw more light upon metabolic study of mesodermal derivatives.

Table No. 1(a) Percentage Incidence of SB in coronal suture in male and female crania of NI.

Sex	No. of SB	Location SegI, SegII, SegIII	%	Total crania studied
		SegI-08	36.36%	251
Female	22	Seg II-2	9.09%	8.76%
		Seg III-12	54.55%	
		Seg I -15	45.45%	
Male	33	Seg-II -3	9.10%	510
		Seg-III-15	45.45%	6.47%

Table No 1(b) Percentage Incidence of SB in coronal suture in male and female crania of SI.

Sex	No. of SB	Location SegI, SegII, SegIII	%	Total crania studied
Female	12	Seg I-09	75%	143 (8.39%)
		Seg II-01	8.33%	
		Seg III-02	16.67%	
Male	22	Seg I -10	45.45%	285(7.7%)
		Seg II	—	
		Seg -III-12	54.55%	

Table No. 1(c) Percentage Incidence of SB in Sagittal suture in male and female crania of NI.

Sex	No. of SB	Location SegI, SegII, SegIII	%	Total crania studied
Female	47	Seg I-06	12.77%	25118.72%
		Seg II-02	4.25%	
		Seg III-39	82.98%	
Male	89	Seg I -04	4.5%	510 17.45%
		Seg II-05	5.61%	
		Seg -III-80	89.89%	

Table No - 1 (d) Percentage Incidences of SB in Sagittal suture in male and female crania of SI.

Sex	No. of SB	Location SegI, SegII, SegIII	%	Total crania studied
Female	19	Seg I-00	-	14313.2%
		Seg II-05	26.31%	
		Seg III-14	73.69%	
Male	27	Seg I -00	-	2859.47%
		Seg II-03	11.11%	
		Seg -III-24	88.89%	

Table No- 1 (e) Percentage Incidence of SB at lambdoid suture in male and female crania of NI.

Sex	No. of SB	Location SegI, SegII, SegIII	%	Total crania studied
Female	422	SegI-193	45.74%	251168.12%
		Seg II-151	35.78%	
		Seg III-78	18.48%	
Male	624	Seg I -420	67.31%	510 122.32%
		SegII-75	12.01%	
		Seg-III-129	20.68%	

Table No 1 (f) Percentage Incidence of SB at lambdoid suture in male and female crania of SI.

Sex	No. of SB	Location SegI, SegII, SegIII	%	Total crania observed
Female	316	Seg- I-162	51.26%	143220.09%
		Seg- II-45	14.24%	
		Seg-III-109	34.50%	
Male	488	Seg-I -238	48.77%	285 171.22%
		Seg-II-96	19.67%	
		Seg—III-154	31.55%	

Table No 2(A) Incidence of SB in “male crania” of NI & SI

Place of work	SB at coronal suture	SB at sagittal suture	SB at Lambdoid suture
NI	6.47%	17.45%	122.35%
SI	7.71%	9.47%	171.22%
P Value	P>0.05	P<0.01	-
Result	Insignificant	Highly Significant	-

Table No- 2(B) Comparative Segmental Study in Coronal, Sagittal and Lambdoid SB in male crania of SI and NI

510 = North Indian Male Crania
285 = South Indian Male Crania

Sr.NO.	Male Crania	Segment-I		Segment-II		Segment-III	
		South	North	South	North	South	North
a)	SB at coronal suture	12(4.8%) (P> 0.05) NS	15(3.41%) -	0 (P> 0.05) NS	3(3.75%) (P> 0.05) NS	10(5.32%)	17(7.45%)
b)	SB at sagittal suture	0 -	4(0.91%) (P> 0.05) NS	3(3.03%) (P< 0.01) HS	3(3.75%)	24(12.76%)	82(35.97%)
c)	SB at lambdoid suture	238(95.2%) (P> 0.05) NS	420(95.68%) (P< 0.01) HS	96(96.97%) (P< 0.01) HS	74(92.5%)	154(81.92%)	129(56.58%)
	Total	250	439	99	80	188	228

HS =Highly Significant ; NS = Not Significant.

Table No 3(A) Percentage Incidence of SB in “female crania” SI & NI

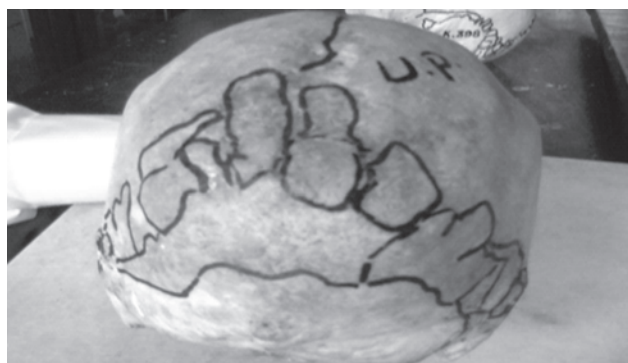
Place of Work	SB at Coronal Suture	SB at Sagittal Suture	SB at Lambdoid Suture
NI	8.76%	18.55%	168.12%
SI	8.39%	13.28%	206.94%
P Value	p>0.05	p>0.05	-
Result	Insignificant	Insignificant	-

Table No. 3(B) Comparative Study of SB in Female crania of SI & NI.

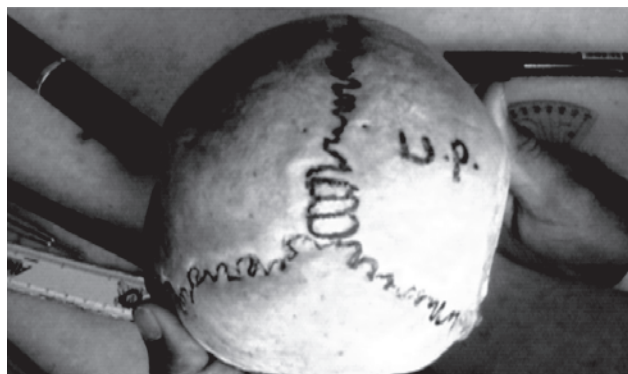
Female Crania	Segment-I		Segment-II		Segment-III	
	South	North	South	North	South	North
a) S B at coronal suture	9(5.26%) (P> 0.05) Not Significant	8(3.92%)	0 -	2(3.63%)	3(2.91%) (P> 0.05) Not Significant	11(9.82%)
b) S B at sagittal suture	0 -	3(1.47%)	6(11.76%) (P> 0.05) Not Significant	2(3.63%)	13(12.62%) (P> 0.05) Not Significant	24(21.42%)
c) SB at Lambdoid suture	162(94.74%) (P> 0.05) Not Significant	193(94.61%)	45(88.24%) (P> 0.05) Not Significant	51(92.72%)	87(84.47%) (P> 0.05) Not Significant	77(68.75%)
Number	171	204	51	55	103	112



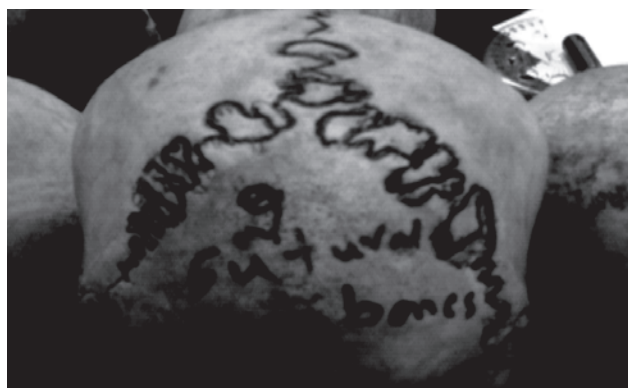
Photograph showing incidence of sutural bone in III segment of sagittal suture & lambdoid suture of South Indian female crania



Photograph showing incidence of sutural bones along the entire lambdoid suture of North Indian female crania



Photograph showing incidence of three sutural bones at III segment of sagittal suture in South Indian female crania



Photograph showing incidence of nine sutural bones at lambdoid suture in female crania of South India

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A Comparative Study of Pattern of Medico-Legal Cases at two Tertiary Care Hospitals in Karnataka

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ABSTRACT

In the past two decades, India has witnessed rapid urbanization, motorization, industrialization and migration of people resulting in socio demographic, epidemiological, technological and media transition and development.

In spite of recent advancement of technology in the field of medical sciences, death and deformities due to all causes, are yet to be controlled successfully; rather incidences of road traffic accidents has been increasing at an alarming rate in our country and also throughout the world³.

Drawing a public attention and awareness towards casualties is important to prevent unnatural deaths; this possibly could reduce the incidence of such cases. This is a retrospective study of pattern of medico legal cases conducted and compared at two tertiary care hospitals at different places in Karnataka namely Sri Siddhartha Medical College Hospital, Tumkur and Harsha Hospital, Nelamangala, Bangalore rural district to understand the magnitude & pattern of medico-legal cases in these regions of the state.

In this study conducted at these tertiary care hospitals revealed that road traffic accidents constituted 840 (64.6 %) & 1136 (75.3%) cases respectively being majority of medico-legal cases, followed by poisoning 110 (8.4%) & 149 (9.84%) cases respectively and assault cases 134 (10.3%) & 74 (4.9%) cases respectively.

Male predominance is quite evident. The affected age group is 21-30 years with 397 (30.5%) & 664 (44%) cases respectively followed by 31-40 years 291 (22.6%) & 335 (22.18%) cases respectively indicating young were exposed to such casualties.

Violence is a significant public health problem and assault or homicide is severest form of violence, depriving a human being of his fundamental right to live.

Keywords: RTA, Poisoning, Assault, Fall From Height, Medico- Legal Case

INTRODUCTION

Medico-legal cases are integral part of medical practice. A medico-legal case is a case of injury or illness where the attending doctor, after eliciting history and examining the patient, thinks that some investigation by law enforcement agencies is essential to establish and fix responsibility for the case in accordance with the law of land¹.

Injury is defined under section 44 IPC as “any harm whatever illegally caused to any person, in body, mind, reputation or property”².

In spite of recent advancement of technology in the field of medical sciences, death and deformities due to all causes, are yet to be controlled successfully; rather incidences of road traffic accidents has been increasing at an alarming rate in our country and also throughout the world³.

By the year 2020 it is estimated that in countries like India, mortality from injury will be more than those from communicable diseases. Despite this documentation, injuries are still not well recognized as major public health problem in this country⁴.

Road traffic injuries account for 2.1% of global mortality. The developing countries bear a large share of burden and account for about 85% of the deaths as a result of road traffic accidents⁵. India accounts for about 10% of road accident fatalities worldwide⁶.

The present comparative study of pattern of medicolegal cases is an attempt to address this deficit in this zone by providing epidemiological analysis of medico-legal cases. The accidental causes from major part of this study, more attention has been given to their evaluation and prevention.

MATERIAL AND METHOD

The study is comparative retrospective analysis of pattern of medicolegal cases admitted in emergency department at two hospitals i.e, Sri Siddhartha Medical

College Hospital, Tumkur and Harsha Hospital, Nelamangala, Bangalore rural district during 1st January 2008 to 30th November 2011 and 1st Jan 2009 to 31st March 2012 respectively. Both the hospitals are situated beside two different National highways namely NH 206 with a rural background and close to Tumkur city and NH 4 very close to Bangalore city respectively. The collected data were analyzed and compared with other studies.

OBJECTIVES

1. To analyze pattern of medicolegal cases.
2. To draw public attention and awareness towards traumatic casualties.
3. To suggest preventive measures so as to reduce incidence of such casualties.

OBSERVATIONS AND RESULTS:

Table No. 1: Gender wise distribution.

Hospital	Sri Siddhartha Medical College Hospital		Harsha Hospital	
	No. of cases	percentage	No of cases	percentage
Sex				
Male	1024	78.76%	1219	80.72%
Female	276	21.24%	291	19.28%
Total	1300	100%	1510	100%

Table No. 2: Age wise distribution.

Hospital	Sri Siddhartha Medical College Hospital		Harsha Hospital	
	No. of cases	percentage	No. of cases	percentage
Age in years				
0-10	65	5%	45	3%
11-20	170	13%	141	9.4%
21-30	397	30.5%	664	44%
31-40	291	22.6%	335	22.18%
41-50	174	13.5%	178	11.67%
51-60	111	8.5%	91	6.1%
61-70	58	4.4%	40	2.60%
71-80	28	2%	16	1.05%
>80	6	0.5%	0	-
Total	1300	100%	1510	100%

Table No 3: Pattern of distribution of cases.

Hospital		Sri Siddhartha Medical College Hospital				Harsha Hospital			
Sl. No	Type of cases	Male	Female	Total	Percentage	Male	Female	Total	Percentage
1	RTA	693	147	840	64.6%	929	207	1136	75.3%
2	Poisoning	61	49	110	8.4%	97	52	149	9.84%
3.	Assault	98	36	134	10.3%	66	8	74	4.9%
4	Snake bite	15	2	17	1.3%	11	5	16	1.06%
5	Animal injuries	8	1	9	0.6%	0	0	0	-
6	Railway accidents	2	0	2	0.14%	0	0	0	-

Table No 3: Pattern of distribution of cases. (Contd.)

Hospital		Sri Siddhartha Medical College Hospital				Harsha Hospital			
Sl. No H/o Fall	Type of cases	Male 1	Female 42	Total 3.2%	Percentage 43	Male 7	Female 50	Total 3.23%	Percentage ⁷
8	Brought dead	54	20	74	5.6%	24	4	28	1.82%
9	Burns	4	7	11	0.8%	1	3	4	0.26%
10	Industrial accidents	17	3	20	1.5%	33	1	34	2.2%
11	Hanging	3	6	9	0.6%	9	2	11	0.73%
12	Electrical injuries	14	2	16	1.2%	4	0	4	0.26%
13	Insect bite	9	1	10	0.7%	0	0	0	-
14	Self inflicted injuries	4	1	5	0.38%	0	2	2	0.2%
15	Alcohol case	1	0	1	0.07%	2	0	2	0.2%
	Total	1024	276	1300	100%	1219	291	1510	100%

DISCUSSION

In the present study 1300 and 1510 medico-legal cases respectively were admitted in emergency department of Sri Siddhartha Medical College Hospital, Tumkur and Harsha Hospital Nelamangala, Bangalore rural. Road traffic accidents comprised of maximum number of cases 840 (64.6 %) and 1136 (75.3%) cases respectively followed by poisoning cases 110 (8.4 %) and 149 (9.84%) cases respectively and assault 134 (10.3%) & 74 (4.9%) cases respectively. In this present study RTA cases in Harsha hospital is more than the other hospital which can be attributed because NH4 is a Bangalore Mumbai highway with overflow of traffic round the clock. The study in Harsha Hospital indicates road traffic accidents cases form major part followed by poisoning cases which is similar to a study done by Garg V and Verma SK⁷.

There is overwhelming majority of the male victims 693 (82.5%) and 929 (81.77%) respectively, consistent with studies by World Health Organization, Institute of Road Traffic Education, Garg V, Salgado, Sachdev P, Friedman and others⁵⁻¹⁰. It is due to greater exposure on roads, alcohol consumption, ignorance.

The most common age group affected was 21-30 years with 397 (30.5%) and 664 (44%) cases respectively followed by 31-40 years with 291 (22.6%) & 335 (22.18%) cases respectively. This is consistent with the studies by Salgado, Sachdev P, Dogra TD, Friedman and others⁸⁻¹⁰ except 31- 40 years. Males between 10 to 39 years of age are most likely to be victims¹¹. A study by Agnihotri, Joshi and Tsmilshina indicates commonest age group was 16-30 years and most common cause was road traffic accident followed by acts of violence¹². It is consistent with our study in Sri Siddhartha Medical College Hospital, Tumkur. This age group is the most active phase of life, physically and socially and hence outnumbers the other age groups.

In this study of poisoning cases 61 (55.45%) out of 110 and 97 (65.10%) out of 149 cases respectively were

males. Maximum poisoning cases were seen among the young adults in the age group of 21-30 years in both sexes with male preponderance. Poisoning due to Organophosphorus compounds was the commonest followed by Organochlorines and this study is consistent with study by Vishwajeet Pawar and others¹³.

Deaths due to falls from height are common in urban settings. Many people live or work in high-rise buildings, factories, construction sites. In this study of fall from height cases 41 (97.6%) out of 42 and 43(86%) out of 50 cases respectively were males indicating risk works are done by males as described by Turk and others¹⁴.

Snake bite, an important cause of death in rural patients in developing countries. More than 2,00,000 cases of snake bite are reported in India each year and 35,000–50,000 of them are fatal¹⁵. Snake bite is continuing to be a major medical concern in India. In this study 17(1.3%) and 16(1.06%) cases respectively of the total medicolegal cases were snake bite cases which is an alarming sign. World Health Organization survey reports that 1.2–2.4 deaths occur per 100,000 victims with a mortality level of 25,000 per annum¹⁶.

Assault is a major social problem. This is due to rapidly increasing population, urbanization, poverty, unemployment, rivalry, illiteracy, prevalent economic, social and political environment, insurgency, terrorism, drug addiction, easy availability of weapon. In this

study 98 (73.1%) out of 134 and 66 (89.2%) out of 74 cases respectively were males and majority of cases were in the age group of 21-30 years followed by 31-40 years indicating aggressive and antisocial behavior in males and is similar with the study done by Gupta. S and Prajapathi P¹⁷.

In this study brought dead cases constituted 74 (5.6%) out of 1300 and 28 (1.2%) out of 1510 cases respectively. The study conducted by Gupta BD and others at Jamnagar indicated 10.7% cases were brought dead¹⁸. The difference in incidence in this study can be attributed to geographical differences, awareness among the public.

Man has invented fire since times immortal. The use of fire has not only added to his comforts but also added to his miseries by increasing risk of burns. Morbidity and mortality due to burn injuries is higher in developing countries due to lack of awareness among people and lack of availability of health care services¹⁹. In this study 11 (0.8%) and 4 (0.26%) cases respectively of total medicolegal cases were burns cases.

In this study 16 (1.2%) out of 1300 and 4 (0.26%) out of 1510 cases respectively were electrical injury cases.

Ignorance, safety and security lapses are resulting in accidents and disaster in industries. In this study 20 (1.5%) and 34 (2.2%) cases respectively of total medicolegal cases were industrial injury cases with male preponderance and consistent with the study of Sivaprakash P and Sakthivel.M²⁰.

CONCLUSION

The comparative study of pattern of medicolegal cases done at Sri Siddhartha Medical College Hospital, Tumkur and Harsha Hospital, Nelamangala, Bangalore rural respectively shows that road traffic accidents, poisoning and assault cases were maximum when compared to other cases. This is continue to be a growing menace, incurring heavy loss of valuable man power and human resources in the form of death and disability along with a corresponding drain of potential economic growth.

Negligence, ignorance of traffic rules, alcohol consumption, lack of interest by law enforcement agencies result in increase in mortality and morbidity due to road traffic accidents.

Easy availability of pesticides and insecticides, lack of education about the effects of poison, poverty, failures in life drives the person for consumption of poison. So regularizing the sale and use of pesticides by government and storing and supervising the use of pesticides by farmers reduce the incidence of poisoning cases.

Violence has become one of the major threats to the modern society and is increasing at an alarming rate all over the world including India. Young offenders are becoming increasingly violent and this is a cause for concern, as they are tomorrow's generation. The law enforcement authority and to the judiciary necessitates that the assailant be promptly identified, apprehended and punished.

Main reasons for electrocution were found to be human negligence, faulty electrical equipments and connections and lack of protective measures. The basic principles of injury prevention of any type are education, engineering, uniform enforcement of law and order, pre-hospital care and evaluation. Proper education, training for safety standards and behavior modification are interlinked and are required to be implemented in the community to prevent all kinds of injuries including domestic violence.

In our opinion, the above considerations certainly are result oriented and will be extremely helpful to manage the health of all communities. Prevention, acute and long-term care, and rehabilitation are the major challenges faced today. We define it by indicating the importance and implications in the study from time to time.

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Electrocution or Assault- A Case Report

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ABSTRACT

On 22 Jan 2006, the sub divisional magistrate ordered for an exhumation of a sensitive case. First autopsy was already done one month before by a medical officer. His report was confusing, not conclusive, and was vague. There was dispute in the death of an elderly man. The family members were suspecting that it was a murder. But the doctor's report in the opinion to the cause of death said "The death is due to electrocution, and is also possible due to hit over abdomen and scrotum". Hence exhumation was ordered.

Keywords: Incomplete Autopsy, Exhumation, 2nd Autopsy, Electrocution, Murder, Post Mortem Changes

INTRODUCTION

The autopsy surgeon is probably more conscious of his secluded thoughts about death than are most men engaged in peaceful occupations. Even contributing to a great deal through schedule of conducting autopsies, his thinking remains attuned to life, for through his hands the dead do serve the living..

Since the inception of formal autopsies, recognition of their worth has been widely acclaimed but at the same time they have been progressively more ill-supported. The support for autopsy, fiscally, professionally, has remained dismally low. This is amply reflected from the latest observations of the National Human Rights Commission, which felt that the facilities in many mortuaries were abysmal and there was acute dearth of trained and qualified staff ¹.

The post mortem examination is a legal requirement when the cause of death is not known. The cause of death is defined as disease or injury which results in death. The manner of death explains how the cause of death came into being. The manner death may be natural or unnatural. When a person dies because of some disease, the manner of death is natural. If he dies because of some injury, the manner of death is unnatural, which may be homicidal, suicidal

or accidental. The mode of death is the process which cause of death is the physiologic process which causes death like asphyxia, coma, and syncope².

The post mortem examination should be complete and thorough. All great cavities and organs should be examined thoroughly. A partial post mortem is not allowed.

Opinion regarding the cause of death is provided after careful consideration of all the findings. The opinion should be brief, clear, and honest. It should be based on scientific facts and terms like probably, nearly etc should be avoided while expressing opinion regarding cause of death. All bruises should be incised to confirm infiltration of blood beneath the skin so as to confirm their status as ante mortem or not ².

Brief history of the case

An elderly adult male, died in his agricultural field in the night, when he went to guard the crop. The scene of death as per the photo, revealed that the person was holding a torch in his left hand, right hand holding the barbed fence. The ground was wet with water. This indicates that the person went in the night to guard the agricultural crop.

“It was usual practice, by all the farmers to electrify the barbed fencing to scare the wild animals, elephants, and pigs etc to protect their crops”. Illegally they were doing it, without the consent of the power department.

Nobody noticed the body till the next morning, and then in the afternoon everybody came to know about the death. There was *discoloration of the abdominal wall* and *swelling of the scrotum*. This caused a strong suspicion in the minds of the family members. They thought that the color change and scrotal swelling were due to assault. In addition there was rivalry with neighboring land owners, over the caste differences. The deceased was belonging to the scheduled caste. So there was *enmity between upper and lower castes*. Family members of the deceased gave the “police complaint” against the “other land owners”, that they have murdered the person. Fearing the police arrest, all the accused fled the village.

Police conducted the inquest and the post mortem was conducted by the local medical officer in the next morning.

The doctor after conducting the autopsy opined that “death was due to electrocution and is also possible due to hit over the abdomen and scrotum.”

Autopsy report made the police in confused state. People of the deceased side started protesting against police for their inaction against the accused. All the accused had already fled the village for more than two weeks. Police were searching and arresting the people, who claimed they were innocent. So the matter became state news. Hence the second post mortem with exhumation was ordered



Fig. 1. Photo During Life



Fig. 2. Scene of Death



Fig. 3. Discoloration of abdomen with scrotal swelling

Second post mortem examination; Before going for exhumation, the concerned documents were collected from the police which included, the 1st PM report, photos, police inquest report, etc.

After observing all the necessary formalities, the body was dug out, washed, and post mortem was conducted. Salient features of the case were-

- The body was decomposed, epidermis was peeled off.
- Skull was intact (not opened in the first pm examination).
- External genitalia, abdominal wall, all the limbs (both upper and lower limbs), back – all were incised and found no evidence of contusions anywhere.
- No evidence of any ante mortem injury including fractures was detected.
- All the internal organs were discolored, softened.
- Abdominal viscera were collected for chemical analysis, which came negative afterwards.

Exhumation



Fig. 4. Intact skull contents even after 1st autopsy



Fig. 5. Showing No Contusions



Fig. 6. No contusions on serial incisions

DISCUSSION

In India, there is provision for a complete post mortem examination. Every cavity of the body should be examined. Even if the cause of death is evident, other areas and organ of the body to be examined to find out any contributory cause of death. Complete autopsy is necessary to corroborate the evidence of the eye witnesses and the investigations done by investigating office since a poor autopsy can lead to miscarriage of justice³.

Color change is the first external sign of putrefaction in a dead body. The greenish discoloration of the abdomen over the right iliac fossa due to the presence of caecum that lies superficially and close to abdominal wall. The color change appears in 12 to 18 hours in summer and 18 to 24 hours in winter³.

The discoloration of the abdomen and scrotal swelling were due to decomposition changes. This resulted in suspicion that they were due to assault.

All bruises should be incised to confirm infiltration of blood beneath the skin so as to confirm their status as ante-mortem or not³.

Findings in deaths due to low or medium tension currents; Fatal electrocution can occur with no visible skin mark and the doctor have to reach the diagnosis by excluding of all other possible causes and by attending to circumstances of death¹.

Second autopsy ;Before performing the second autopsy the doctor should obtain all the available documents relating to the case especially the first autopsy report, photographs of the scene of death, of the body taken during first autopsy, hospital records, police investigation reports etc and if possible the first autopsy pathologist should be called to correlate all the findings.

The findings should be documented in great detail, whether findings are confirmatory or contradictory from the result of first autopsy. It is possible that valuable may be obtained. Even if no new information is obtained from the second autopsy, it will help in putting an end to rumors or suspicions⁴.

Based on the absence of ante mortem injuries on the body the fast track court in Chamarajnagar, Karnataka, dismissed the charges of murder recently.

CONCLUSION

The post mortem changes will mimic injuries. These are to be distinguished from ante mortem injuries. Wherever there is suspicion the bruises are to be incised to confirm their status as ante mortem or not. In electrocution cases there need not be skin marks in all the cases especially when the ground is wet.

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Reconstruction of Femur Length from its Fragments

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ABSTRACT

The accurate estimation of stature helps to establish an individual's identity in medicolegal issues relating to skeletal remains examination. Stature is estimated using combined dimensions of bones responsible for living height or using regression equations based on complete long bone length measurements. In some instances like a mass disasters, these methods cannot be applied as complete long bones are not available. The aim of the present study is to derive linear regression formulae for estimating stature of adult Indian population from the fragmentary remains of femur. The study includes 50 male femurs and 50 female femurs of south Indian origin dissected from cadavers. Linear regression equations for various morphometric parameters of proximal and distal end of femur is derived to estimate length of femur and hence to estimate the stature of an individual.

Keywords: Stature, Femur Length, Regression Equation

INTRODUCTION

Identification of an individual is the main objective of forensic investigations. Stature is considered to be one of the criteria for personal identification. Cadavers that are sent to Forensic Medicine departments are not always intact. Sometimes due to air crashes, natural disasters, explosions and other incidents, only the skeletal remains or body parts of the corpse are available for identification. Sometimes bones are crushed and only small pieces of them such as the proximal or distal ends of the bones are available. In such instances it is difficult to calculate stature from bones but it still becomes more difficult to estimate the stature from fragments of bones. Previous studies show that various populations are different in size and skeletal symmetry in different races and geographical regions. If we could obtain a significant relationship between these parts and the bone length, we could predict the approximate length of the bone and consequently the approximate stature of the person.

OBJECTIVE

The objective of the present study is to estimate the

length of Femur from anthropometric measurements of their fragments in south Indian population. This is important in forensic investigations and in archaeological studies particularly when the fragmentary portions are examined.

MATERIALS AND METHOD

The study is undertaken in the Department of Forensic Medicine and Toxicology, with help and support from the Department of Anatomy. One hundred pieces of adult right sided femora (50 male and 50 female), dried and fully ossified, from the Department of Forensic Medicine and the Department of Anatomy will be studied. The Pathological bones are not included in the study. It is assumed that the bones were of ethnic Indians of adult age mostly belonging to the southern parts of India. The length of the femur was measured using an osteometric board, other parameters such as maximum head diameter, breadth of both the epiphysis, inter trochanteric distance, vertical diameter of neck of femur was measured using sliding vernier callipers.

Table 1. Various femoral parameters measured

Parameters	Abbreviation	Measurement
Vertical diameter of head	VHD	Distance between the highest and lowest point of the head along equatorial plane
Vertical diameter of neck	VND	Distance between highest and lowest point of neck perpendicular to axis of the neck
Breadth of upper end femur	BUF	Distance between most superior point of fovea capitis to the most inferior point of greater trochanter
Anterior neck length	ANL	Distance between anterior inter trochanteric ridge to mid point of articular line of head of femur
Posterior neck length	PNL	Distance between posterior inter trochanteric ridge to mid point of articular line of head of femur
Inter trochanteric distance	ITD	Maximum distance between the trochanters
Epicondylar breadth	ECB	Distance between medial and lateral epicondyles of femur
Medial condylar length	MCL	Distance between most anterior and most posterior points on the medial condyle
Lateral condylar length	LCL	Distance between most anterior and most posterior points on lateral condyle

RESULTS

All the measurements showed positive degree of correlation

Table 2. Correlation of measurements of fragments of femur with length of femur

Variable	Femoral length(males)	Femoral length(females)
VHD	0.81**	0.525**
VDN	0.514**	0.506**
BUF	0.521**	0.574**
ANL	0.198 ^{NS}	0.195 ^{NS}
PNL	0.33*	0.455*
ITD	0.321*	0.290 ^{NS}
ECB	0.661**	0.705**
MCL	0.507**	0.513**
LCL	0.578**	0.644**

** - highly significant correlation

* - Moderately significant correlation

^{NS} No significant correlation

Table 2 shows correlation of measurements of fragments of femur with maximum length of femur. All the variables showed positive correlation with length of femur. VDH showed highest degree of correlation and VND showed lowest degree of correlation in males. In females ECB shows highest degree of correlation and VND showed lowest degree of correlation. ANL, PNL and ITD showed no significant correlation.

Table 3 Shows Regression analysis from individual independent variable.

Regression Equation (males)	Regression Equation (females)
35.85+(2.094)VDH**	25.325+(3.907)VDH**
35.34+(3.081)VDN**	27.608+(4.597)VDN**
33.33+(1.31)BUF**	22.097+(2.351)BUF**
44.077+(0.295)ANL ^{NS}	37.209+(0.915)ANL ^{NS}
44.72+(0.107)PNL ^{NS}	33.389+(2.063)PNL*
41.43+(0.533)ITD ^{NS}	36.514+(0.595)ITD ^{NS}
21.91+(3.052)ECB**	30.368+(1.451)ECB**
26.17+(3.111)MCL**	25.045+(2.933)MCL**
34.377+(1.806)LCL**	29.43+(1.326)LCL**

** - highly significant correlation

* - Moderately significant correlation

^{NS} No significant correlation

Linear regression analysis

Table 3 shows bivariate regression analysis for estimation of maximum length of femur from femoral fragments. The linear regression analysis between femoral length and femoral fragments in both the sexes was found significant for a majority of variables except for ANL, ITD and PNL in males and ANL and ITD in females. The highest correlation for an individual measurement was obtained for VDH and ECB in males and for females highest correlation was obtained for ECB and LCL

Table 4. Regression equation to determine femur length using proximal end of femur

Males
$34.85+2.96(\text{DN})+0.370(\text{VDH})^{**}$
$32.549+2.79(\text{DN})+0.13(\text{VDH})+0.35(\text{BUF})^{**}$
$31.93-0.41(\text{VDH})+2.94(\text{DN})+0.56(\text{BUF})+0.47(\text{ANL})-0.27(\text{PNL})^*$
$31.746+0.196(\text{ITD})-0.48(\text{VDH})+2.904(\text{DN})+0.486(\text{BUF})+0.523(\text{ANL})-0.346(\text{PNL})^{\text{NS}}$
Females
$22.653+1.959(\text{DN})+3.215(\text{VDH})^{**}$
$19.52+1.564(\text{BUF})+1.339(\text{VDH})+1.317(\text{DN})^{**}$
$19.792+0.564(\text{PNL})+0.265(\text{ANL})+1.116(\text{BUF})+1.445(\text{VDH})+1.367(\text{DN})^*$
$20.256+0.595(\text{PNL})+0.219(\text{ANL})+1.160(\text{BUF})+1.475(\text{VDH})+1.264(\text{DN})-0.102(\text{ITD})^{\text{NS}}$

Table 5 - Regression equation to determine femur length using proximal end of femur

Males
$17.169-0.626(\text{LCL})+2.724(\text{MCL})+2.045(\text{ECB})^*$
Females
$32.105+1.189(\text{ECB})+5.451(\text{MCL})-5.546(\text{LCL})^*$

Multiple regression analysis.

The degree of correlation between length of femur and various combinations of measurements of upper end and lower end of femur for males and females is given in tables 4 and 5. The equations are arranged in descending order of correlation. In both genders VDH, VDN and BUF showed highest correlation in combination for upper epiphysis whereas ECB alone showed better correlation than combination in lower epiphysis

DISCUSSION

Stature is often an important piece of information when creating a biological profile for personal identification of an unknown individual. As evident from previous studies, femur is the most accurate single bone for stature estimation probably because it contribute most to the living height ¹. Estimation of stature requires full length of long bones which is not available in some instances as mentioned in introduction. Hence in such instances length of femur may be estimated based on its fragments and later employ them in stature estimation formulae to get reasonably accurate results.²Muller made the first attempt in estimating the maximum length of a long bone from measurements of its sections. Steele and McKern studied on femur to delineate it into sections as suggested by Muller. Simmons et al reported difficulty in reproducing the measurements as suggested by Steele and McKern.³ Studies by

M.Chandran² and Bidmos³ have shown significant correlations between femoral fragments and maximum length of femur.

Femoral fragments measured on dry bones in this study have an overall low correlation with the length of femur compared to the study by M.Chandran and Bidmos. Correlation between femoral fragments and femoral length ranged from 0.811 to 0.618 in M.Chandran's study and 0.781 and 0.400 in Bidmos study compared to 0.815 and 0.455 in the present study. There are several possible reasons for the difference between the results of these studies. It can be due to difference in the method used to measure the variables, inter observer bias, difference in sample size, difference in mean age of the sample, ethnical difference, ancestry etc. Inter observer error has the potential to increase the variation in data. To reduce this inter observer error, the measurements were taken by two individuals and mean of the values are taken in the present study. Sample characteristics like age may also be the reason for the difference in the results as loss of stature is said to begin around 30 years of age. The mean age in Bidmos study was 58 and 62 years for males and females respectively, whereas in the present study age of the sample is not known.

In the present study VDH and ECB in males and ECB and LCL in females showed better correlation with femur length. Whereas in M Chandran's study FDL and MCL had best correlation with femoral length.

CONCLUSION

This paper has presented analysis of some metric data from proximal and distal end of femur for correlation with maximum length of femur. Our study has positive correlation for majority of variables. Hence when fragments of femur are available to estimate stature, maximum length of femur can be calculated with a reasonable accuracy with metric evaluation of these fragments and hence stature can be estimated. The primary message in the present study is that different geographic regions require their own stature estimation criteria and the criteria derived from studies from other geographic regions cannot be applied to them. Ethnical variations require further population specific studies of estimation of stature from fragmentary remains of femur.

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Study of Patterns of Homicidal Death during Post Mortem Examination Conducted in V.S. General Hospital

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ABSTRACT

Background: Homicide is killing of human being by another human being, which is one of the oldest crimes in human civilization. It started from the murder of Abel by the hands of Cane. Violence is a significant public health problem and homicide is severest form of violence, depriving a human being of his fundamental right to live. Homicide is prevalent widely almost all over the world. Nowadays, the increasing incidence of homicide is worldwide and it is manner of great concern.

Methods: This study was conducted at Dept. Of Forensic Medicine and Toxicology, Smt. N. H. L. Municipal Medical College, Ellisbridge, Ahmedabad. The present study was conducted over period of July 2009 to November 2011. Out of which 50 were considered as homicidal death after going through inquest papers and indoor case papers.

Results: Homicidal deaths constituted of 50/2639 (1.86%) all autopsies. Ratio of male to female victim was 1.94:1. Near half of victims were of age 21-40 years (48%). Head injury constituted the most common cause of death (34%) and near half of homicides (46%) caused by sharp and pointed weapons. The head, neck and face sustained the highest numbers of injuries 28 (56%) followed by thorax 12 (24%) and abdomen 10 (20%). Majority of cases were occurred during summer season (40%) very closely followed by winter (30%) and monsoon (30%). More than half (58%) of the cases occurred during night hours 15 (30%) and evening hours 14 (28%). 31 (62%) cases were with known motives among which personal dispute plays a major role.

Conclusion: In this study, young age victims constituted the dominant group. Sharp weapons were commonly employed in this region for homicide. Proper counselling for developing positive attitude and controlling the aggression in youth have to be promoted at large by the government.

Keywords: Death, Homicide, Post-mortem

AIMS AND OBJECTIVES

1. To study homicidal deaths rate during post-mortem examination conducted at V.S. General Hospital.

2. To study the vulnerable groups of victim with its relation to homicidal death, considering following criteria: Age, Sex, Religion, Seasonal variation, Time.
3. To study the types of weapons use commonly.
4. To study the relation between types of weapon and types of injuries.
5. To take steps towards development of interventions to reduce the impact of homicidal crimes.

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INTRODUCTION

Homicide is killing of human being by another human being.¹ It started from the murder of Abel by the hands of Cane. Violence is a significant public health problem and homicide is severest form of violence, depriving a human being of his fundamental right to live. Homicide is prevalent widely almost all over the world.² Nowadays, the increasing incidence of homicide is worldwide and it is manner of great concern. Study of pattern of homicide in any civil society is the first step towards development of intervention to reduce the impact of homicidal crimes and is a useful indicator of the social stresses in a community and may also provide useful information for law enforcement strategies.

MATERIAL AND METHOD

This prospective study was conducted at the department of forensic medicine and toxicology, Smt. N. H. L. Municipal Medical College, Ellisbridge, Ahmedabad to know the pattern of the homicides, taking it as the first step in the prevention of crime. Total numbers of autopsies conducted were 2639 during period of July 2009 to November 2011. Out of which 50 were considered as homicidal death after going through police papers, inquest papers and indoor case papers, especially in burns cases submitted along with deceased. In case of burns, manner of death could not be concluded perfectly. So especially the cases in which history is altered due to some reasons during stay in hospital were excluded. The composite research series was divided year wise groups. The study was carried out as per the proforma enclosed. All collected data were put into master chart, which was prepared and then fed into laptop in database system and analysis was done and tables prepared with help of Microsoft excel.

OBSERVATIONS AND DISCUSSION

Total 2639 post mortem examinations are conducted during July 2009 to November 2011. Out of which, total 50 homicidal cases are recorded with incidence of homicide is 1.86%, and it is much lower than those observed by other authors.^{3,4}

Out of which 33 (66%) were males and 17 (34%) were female. So the ratio of male: female is 1.94:1. Similar findings were also observed in study of other author.⁵ Out of which 38 (76%) were Hindus including 25 (66%) male and 13 (34%) female and 9 (18%) were Muslims including 6 (67%) male and 3 (33%) female and 3(6%) were unknown males.

Most number of cases recorded in age group of 21-30 years are 13 (26%) and in age group of 31-40 years are 11 (22%). Similar trend has also been observed by other author.⁵

Maximum numbers of homicidal cases were recorded during summer. In this condition we can see the homicidal deaths recorded during the summer is 46%, winter is 31% and monsoon is 23%. It means that significantly high number of cases recorded during summer. This is according to the fact that bad weather makes people miserable. It has been reported that the highest incidence of homicide occurred in summer more than in winter.⁶

Majority of homicide cases were committed during evening and night time (58%) which is well supported by other authors⁷ It could be due to the fact that homicide being heinous crime, it is well planned and the assailant tries to execute it without being witnessed by others and easy escape during night time. It is observed that 31 (62%) cases have involvement of some motive for homicidal act. In 19 (38%) cases motive could not be known.

Maximum cases include injury to head, neck and chest. These regions are more fatal then other regions. The head and chest as primary target areas for homicide is also reported by other authors⁸ and is consistent with the knowledge that vital organs (brain, neck structures, heart and lungs) are situated here.

Commonest weapon are sharp cutting and pointed weapons followed by hard and blunt weapons. Firearms were the most common weapons of homicide in the United States. Our findings are consistence with study of other author.⁶ Interestingly, we find only one firearm injury case.

In is well observed that brain is the organ which is most commonly involved in homicidal cases. It does not mean that brain is commonly damaged organ but it means that injury sustained to brain is most commonly fatal.

In present study, head injury is commonest cause of homicidal death in males, while burns is commonest cause of homicidal death in females. Whereas Subhramanyam in his studies have reported shock and hemorrhage to be the most frequent cause of death.⁹ Adelson reported hemorrhage alone was not the cause of death in a significant majority.¹⁰

SUMMARY AND CONCLUSION:

Ahmedabad is a metro city. People living in Ahmedabad belong to different religions and different cultures. I included Hindus and Muslims chiefly in my study. Increased population and decreased employment opportunities is making life stressful and hard. People of different communities come in contact with each other, and many people are living in slums and economical backward and congested areas. Due to increased stress and complications of life, young generations move towards addiction of different substance, chiefly alcohol. In this study, after looking at observations many things have become clear, though this study was only sample covering of a very small portions of an iceberg.

Total homicidal cases recorded are 50 which is 1.89% of total postmortem examinations conducted (2639). Male:female ratio is 1.94:1.

Highest number of cases found in age group of 21-30 years and followed by age group of age 31-40 years. So most number of cases are from age 21 years to 40 years. So, most vulnerable persons belong to younger population between 21 years to 40 years. Significant involvement of lower age group indicates unemployment and lack of education and might be due to many mental and physical stresses. In India younger population have burden of all financial and family responsibilities. This age group comes in contact and has to deal with different type of people.

Maximum number of cases occurred in months of summer. In Ahmedabad, during summer season environmental temperature is quite intolerable, up to 46°C. Bad weather makes people miserable. So, more quarrels noticed in summer. This might be having some influence of increase in number of homicidal cases in months of summer.

Most crimes occurred during evening and night hours in this study. This may be due to the factor that crime is always planned. It may be concluded that the incidence of homicide were commonly done in the dark hours of evening and night at outdoor places without any notice to victim as well as any attempt to concealment of crime.

Among the motives an old dictum, "wealth, woman and land" were the root causes of the interaction leading to homicide. In this study, 62% are with known motives among which personal dispute plays major role. In 19 cases (38%) due to incomplete

information from police, case papers and inquest the motive remains inconclusive.

The head, neck and face sustained the highest number of injuries. Due to involvement of brain and important structures in neck, these injuries become more fatal. The commonly involved organ found among the body is brain due to the same reason. Most commonly used weapon is sharp and pointed, being commonly available to common man like knives, dhariya, chopper, etc. But most commonly injuries sustained are being contusion and laceration caused by commonly available weapons like lathi, pipe, etc. This is because of used blunt weapon primarily and used blunt weapon with other sharp weapon or injuries sustained during quarrel. Firearm is not commonly available in India so death due to firearm is far less common in India, particularly in Gujarat. One case of firearm injury was recorded in this study. As discussed earlier, the most common fatal injuries are found on head, face and neck, leads to most common cause of death "head injury".

To prevent such killing there should be combined efforts from all sections from society. Following steps should be of help in its prevention. Appropriate steps for control of the extremism, all round socio-economic development of the area, proper employment facility for the youth, social stability and creation of proper political environment, strong and effective measures to control the unlicensed arms, proper protective gear for the police and defence personals, education of both elders and young adults about the hazards posed by possession and irrational use of firearm either for offence or defence, in view of the need to control and decrease illegal trafficking of firearms, the United Nations crime prevention and justice commission recently passed a resolution encouraging all countries to strengthen their domestic gun control.

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Fatal Blunt Abdominal Trauma Involving Superior Mesenteric Vessels and Left Psoas Muscle

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ABSTRACT

For Blunt Injuries of Abdomen majority of the cases i.e. 78.18% were of accidental, 18.18% were homicidal and 3.6% suicidal in nature. Immediate cause of death was shock and hemorrhage. Visceral injuries of the abdomen following blunt trauma present a great medico-legal problem to the forensic experts. We had a case of road traffic accident with fatal blunt abdominal trauma which had no external injuries. Rupture of superior mesenteric vessels, injuries to left psoas muscle, spleen, both kidneys and fracture of left hemi pelvis present internally. We also observed 1500ml of blood in the peritoneal cavity. Death is imminent in such fatal cases. Availability of first aid, transportation, tertiary trauma care facilities, availability of diagnostic procedures, intensity with which medical care is offered contribute to the survival of the accident victim. The main significance of blunt trauma abdomen is delay and difficulty in diagnosis, especially when there is minimal signs and symptoms to warrant an exploratory laparotomy. Early detection and emergency surgical intervention when necessary are critical in improving the outcome of treatment.

Keywords: RTA; BAT; Precautions

INTRODUCTION

The rapid pace of industrialization coupled with an increase in the number of automobiles and vehicular accidents is giving us an increased incidence of blunt abdominal trauma (BAT) which is the 3rd commonest form of trauma(8). Blunt abdominal trauma (BAT) makes up 75% of all blunt trauma and is the most common example of this injury. The majority occurs in motor vehicle accidents. Injury to the intra-abdominal structures can be classified into 2 primary mechanisms— due to compression forces and deceleration forces. Internal abdominal injury may not be associated with external injuries(7). We are reporting a case of blunt abdominal trauma involving superior mesenteric vessels and their branches and left psoas muscle, leading to hemorrhagic shock and death.

CASE REPORT

A 30 year old male brought to casualty, BTGH with h/o road traffic accident involving a passenger jeep and a bus. There was a h/o loss of consciousness for 2 to 3 min after the accident and there was a delay for 4 hours before he was shifted to casualty. He was conscious and well oriented and complained of pain in abdomen, pain in left arm and left hip. On examination his BP was low, tachycardia, tachypnoea were present. Abdominal examination showed distension of lower abdomen with diffuse tenderness and guarding. Bowel sounds were absent. He was diagnosed clinically as blunt trauma of abdomen with fracture of left humerus and posterior dislocation of Left hip (PDH). No X-rays were taken. CT scan of brain was normal. USG abdomen revealed bulky left psoas muscle with intrasubstance heterogeneity and fibrillar separation with minimal to moderate free fluid in the peritoneal cavity. As blood was not arranged, surgery was postponed. The patient deteriorated and was declared dead 9 hours after admission.

AUTOPSY FINDINGS

A deceased middle aged male moderately built and

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nourished. Rigor mortis was present in both upper and lower limbs. Postmortem staining was seen on the back. Dried blood stains were seen in the nostrils. Multiple contusions present over the scalp in the occipital region, posterior wall of chest on its inner aspect and in the left groin and upper thigh. Fracture left humerus was observed on taking deep incision in the upper arm. On opening the abdomen, there was diffuse mesenteric hematoma with rupture of superior mesenteric artery about 2cm below its origin from front of abdominal aorta. Jejunal and ileal vessels were torn. Mesenteric hematoma (Fig-1) of size 20x10cms present in its jejunal and ileal region. 1500ml of clotted blood present in the peritoneal cavity.

Left psoas muscle (Fig-2) was bulky and contused and intrasubstance hematoma of size 15x10cms present. On reflecting the left psoas muscle at its insertion, revealed fracture of left hemi pelvis involving superior and inferior rami of pubis and Ilium. Right psoas muscle was normal. Both kidneys showed sub capsular hematoma. Splenic capsule was torn. The cause of death was hemorrhagic shock due to rupture of superior mesenteric artery and its branches.

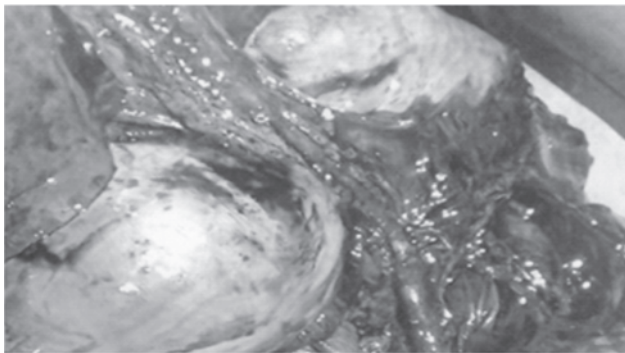


Fig. 1

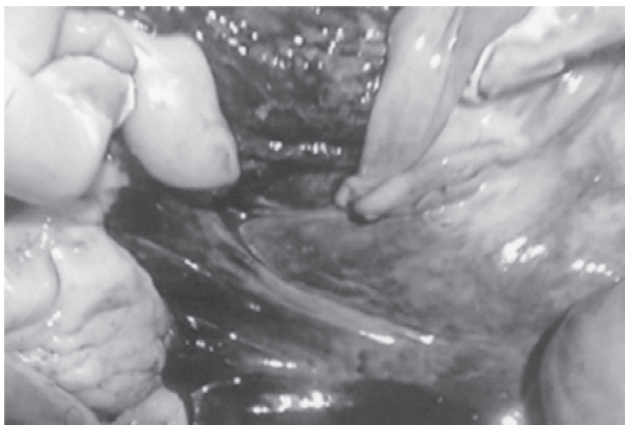


Fig. 2. Time since death was 12 to 16 hours prior to autopsy.

DISCUSSION / CONCLUSION

Sudden acceleration and deceleration of the head during head injury, resulting in immediate loss of consciousness, was due to partial or complete paralysis of cerebral function (concussion), followed by amnesia. Usually spontaneous recovery occurs (3). Mesenteric vessels bruised and lacerated as they are crushed against prominent lumbar vertebrae, when a blunt force is being applied (1). Rupture of superior mesenteric vessels resulted in severe hemorrhage as it was evident in autopsy. No blood transfusions and no surgical interventions were done as the attenders were unwilling. Rapid loss of 1/3rd of blood volume causes death due to irreversible hypovolemic shock (3). Various compensatory mechanisms are explained for hemorrhagic shock. i.e. Arterial baroreceptors are stretched to a lesser degree and increase in sympathetic output occurs due to decrease in blood volume and venous return to heart. This leads to decrease in pulse pressure and decreased rate of discharge from the baroreceptors, resulting in reflex tachycardia and vasoconstriction. Vasoconstriction is generalised except for brain and heart. Venoconstriction maintains filling pressure of heart. Haemorrhage is a potent stimulus for adrenal medullary secretion. It mainly stimulates reticular activation system. Haemorrhage stimulates chemoreceptors in carotid and aortic bodies due to anemia, stagnant hypoxia and acidosis which is the main cause of respiratory stimulation in shock. Excitation of vasomotor centre in medulla increases vasoconstrictor discharges. Restoration of ECF volume and blood pressure by increase in plasma renin activity and formation of angiotensin ii (4).

Psoas muscle (Fig-3) is a long muscle situated on either side of lumbar vertebral column and pelvic brim. Branches of lumbar arteries, renal arteries, common iliac arteries supply this muscle on either side (5). Rupture of these vessels lead to the typical formation of hematoma of left psoas. s

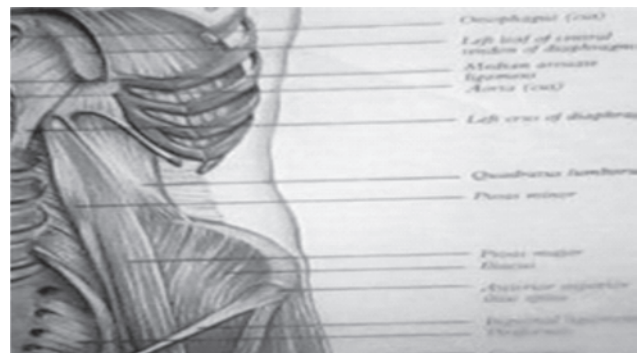


Fig. 3

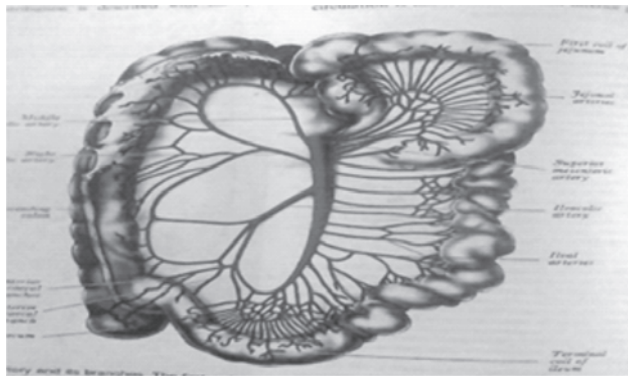


Fig. 4

Mesentery (fig-4) is a broad, fan shaped fold connects coils of jejunum and ileum to the posterior abdominal wall. It has two layers of peritoneum and encloses ilial and jejunal vessels in it. Its intestinal border measures about 6m in length(5), with severe blunt trauma to abdomen, internal organs and mesentery of small intestine often contused or torn(2). Mesenteric tear mostly occurs due to tangential blow to abdomen leading to traction on the mesenteric membrane(2). Death could occur solely from injury to mesentery if one of the large vessels is lacerated(2).

CONCLUSION

We conclude that internal abdominal injury mostly occurs in the absence of external injury. A multipronged approach towards early diagnosis and vigorous management should be adopted to reduce the morbidity and mortality in patients with blunt abdominal trauma. Urgent medical and surgical intervention benefits by increase in survival rate. Thus the doctor should remain alert to the development of signs and symptoms after blunt trauma to the abdomen in vehicular accident otherwise he may be charged of negligence. We recommend setting up of mobile trauma care units which can offer first aid at the site of incident and thereby aiding safer transportation of the victim to the tertiary centre. Accident care units should be set up in every PHCs. Immediate restoration of blood volume by blood transfusion and fluids would save many cases. Reduction of fractures and dislocations, diagnosis and

timely exploration of various body cavities to seize bleeding can add to survival.

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Rare Variant of Truncus Arteriosus with Intact Ventricular Septum and Hypoplastic Left Heart - A Case Report

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ABSTRACT

Persistent Truncus Arteriosus is a relatively uncommon heart malformation involving the ventriculoarterial connection in which a single outlet is present. The malformation is variable in its components. In this report we describe an unusual variant in which the common trunk arose exclusively from the right ventricle, the ventricular septum was intact and left heart was hypoplastic.

Keywords: Persistent Truncus Arteriosus (PTA), Hypoplastic Left Heart

INTRODUCTION

Persistent truncus arteriosus is a single arterial trunk that leaves the heart through a single valve and gives rise to the coronary, systemic and pulmonary arteries ⁽¹⁾. It is a rare congenital anomaly accounting for 0.8 in 10,000 births ⁽²⁾. It is usually accompanied by other intracardiac malformations, but the association with hypoplastic left heart is uncommon.

CASE REPORT

A live term (37+2 wks) male neonate born to G1 mother by vaginal delivery at a tertiary care hospital. At birth the child was normal with fair activity. No pallor, cyanosis or other abnormal findings were present on examination. Later the child developed poor feeding, lethargy, gasping and central cyanosis at 17 hrs of life and was shifted to the nursery. On examination intercostal and subcostal recession was present. A murmur was heard at left lower parasternal area. Liver was palpable 2cm below right costal margin. The child was intubated and put on ventilatory support. Later the child expired within few hours. No echocardiogram was done. Chest X ray showed cardiomegaly with cardiothoracic ratio of 70%.

On autopsy no external or extracardiac congenital anomaly was identified. The examination of heart showed a large heart weighing 40gms (normal wt for age 8.4±5.6gms)⁽³⁾. Right atrium was enlarged and was approximately 2.5 times the size of left atrium i.e. left atrium was rudimentary (Fig i).

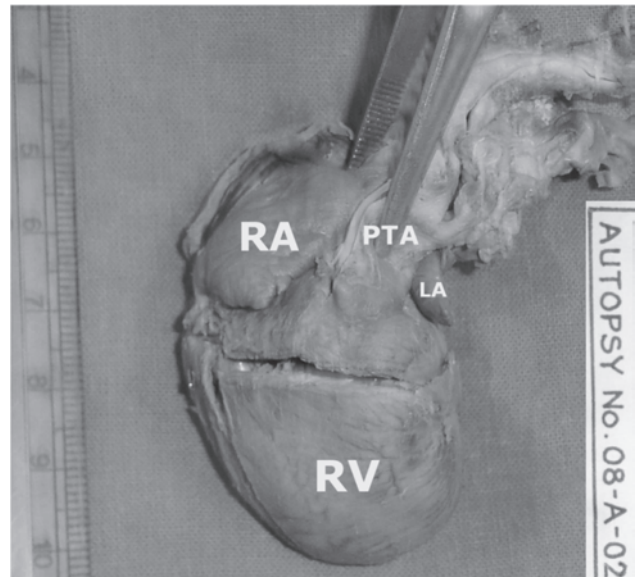


Fig. 1. External appearance of heart. Right atrium (RA) is enlarged and approximately 2.5 times the size of left atrium (LA) i.e. left atrium is rudimentary. A trunk (Persistent Truncus Arteriosus <PTA>) is seen arising from right ventricle (RV)

Inferior (IVC) and superior vena cava were identifiable. All four pulmonary veins were seen opening into the left atrium. No atrioventricular (AV) connection was present in left heart. Left and right atrium communicated via patent foramen ovale. Right ventricle was enlarged, hypertrophied and formed almost whole of the area below AV sulcus with rudimentary left ventricle seen as a thin slit like cavity (Fig ii). There was no ventricular septal defect. A common trunk arising exclusively from right

ventricle and guarded by three leaflet single valve was identified (Fig iii) .The trunk gave rise to both coronaries, two pulmonary arteries, and continued as arch of aorta.

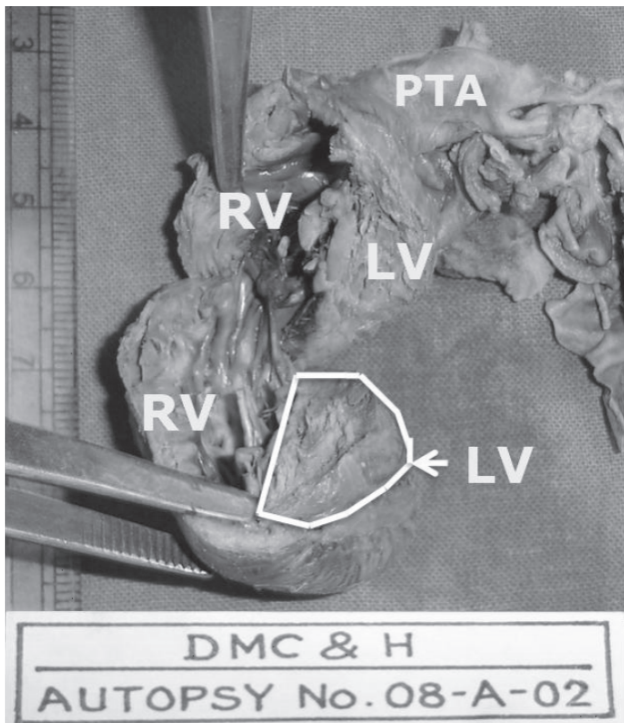


Fig. 2. Right ventricle (RV) is large, hypertrophied and forms almost whole of the area below Atrioventricular sulcus with rudimentary left ventricle (LV) seen as a thin slit like cavity.

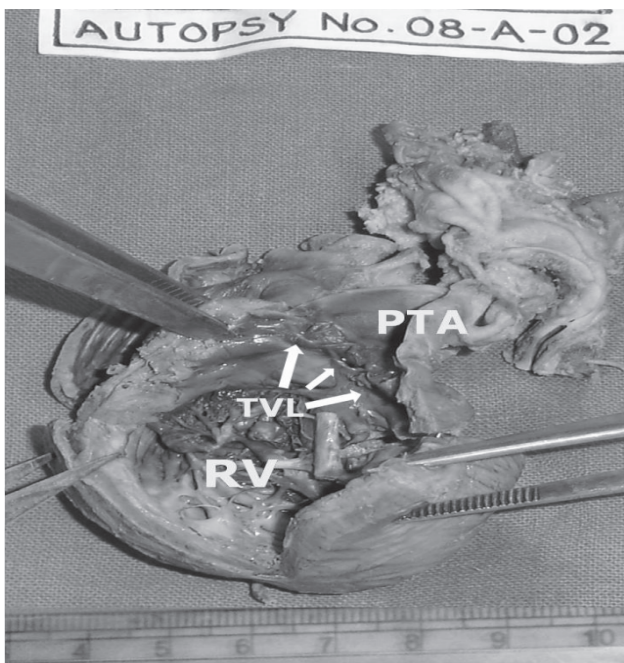


Fig. 3. A common trunk (Persistent Truncus Arteriosus <PTA>) arising exclusively from right ventricle (RV) and guarded by three leaflet (Truncal Valve Leaflets <TVL>) single valve.

DISCUSSION

Neural crest cells, migrating from edges of the neural folds in the hindbrain region, contribute to endocardial cushion formation .Abnormal migration, proliferation or differentiation of these cells result in congenital malformations, as in PTA where insults to these cells result in cardiac defects involving the outflow tract ⁽²⁾. This outflow tract defect results from incomplete or failed septation of the embryonic truncus arteriosus, hence the term persistent truncus arteriosus (PTA). The total absence of the aorticopulmonary septum of the truncus and infundibular septum of bulbus cordis causes this malformation. The conventional cases are characterized by: i) presence of single valve as the only exit from heart ii) a subarterial ventricular septal defect and iii) absence or deficiency of aorticopulmonary septum ⁽⁴⁾. The present case is unusual as it does not confirm to conventional type of PTA. However the definition of PTA as a solitary trunk guarded by a common arterial valve and directly supplying the coronary, pulmonary and systemic circulations would include this unusual variant ⁽¹⁾.

The unusual features which we would like to highlight in our case are: 1) origin of the common trunk entirely from right ventricle 2) absence of ventricle septal defect and 3) hypoplastic left heart.

Origin of the common trunk entirely from right ventricle: PTA is seen as a common trunk that typically straddles a defect in the outlet portion of interventricular septum .By overriding the ventricular septum, PTA has a biventricular origin in 68% to 83% of cases .The origin of the trunk entirely from right ventricle, as in the present case, is found only in 11% to 29% of patients with PTA.^(5,6)

Absence of ventricle septal defect: Ventricle septal defect in PTA is generally large and results from either absence or deficiency of infundibular septum. Very rarely the ventricle septal defect may be small or even absent. It seems that though most instances of PTA have both infundibular and aorticopulmonary septal defects as part of the complex, in rare instances, one of these associated defects may be absent ⁽⁷⁾ . In the case described by Carr, Bharati, Kusnoor and Lev (1979) the aorticopulmonary septum was absent ,while the septation of the bulbus was normal and hence an interventricular communication did not exist.⁽⁷⁾ In contrast in other cases there was normal aorticopulmonary septum and defect in infundibula

⁽⁸⁾ .Hence PTA with intact interventricular septum is known but is very rare.

Associated hypoplastic left heart: The term describes a diminutive left ventricle with underdevelopment of left sided valves, aorta and left atrium ⁽⁹⁾. In patients with hypoplastic left heart there is supply of both pulmonary, systemic and coronaries from right ventricle via ductus arteriosus. The relative flow to these circulations depends on the relative resistance of the vascular beds. In this case the supply to pulmonary, systemic and coronaries was from right ventricle through PTA hence no ductus arteriosus was present .PTA is commonly associated with other congenital cardiovascular malformations but associated hypoplastic left heart is unusual with few case reports stating this association^(10,11) .

There was a patent foramen ovale that connected left and right atrium, thus functioning as the only outlet for left atrium.

The common trunk was guarded by three leaflet single valve .The single valve is a pointer towards deficient aorticopulmonary septum hence leading to PTA .The valve ,as described in a literature review, can be tricuspid in 69% (commonest), quadricuspid in 21%, bicuspid in 9% , and unicuspid in 1%⁽¹²⁾ . The common trunk gave rise to two pulmonaries on its posterior aspect which fits into type II PTA according to Collett and Edwards classification for PTA ⁽⁵⁾.

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In-Vitro Cytotoxic Study of *Moullava Spicata* (Dalz.) Nicolson Leaf Extract

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ABSTRACT

Objectives: The aim of present study is to evaluate cytotoxic and genotoxic activity of *Moullava spicata* (Dalz.) Nicolson.

Materials and Method: The aqueous extract of this plant subjected to genotoxic and cytotoxic study using yeast viability test, hemolytic assay and *Allium* test.

Result: The extract showed dose dependent effect on yeast viability and hemolysis of erythrocytes. The *Allium* test showed significant reduction of root length ($p > 0.01$) and number ($p > 0.001$) indicated cytotoxic effect of plant extract. Microscopic observations showed cytotoxic effects such as ghost cell, membrane damage or rupture, apoptotic bodies and the extent damage was increased significantly after 96 hours treatment.

Conclusion: The study showed that the leaf extract of the *M. spicata* contains various biologically active compounds and possess cytotoxic effects.

Keywords: *Moullava spicata* (Dalz.) Nicolson; *Allium* test; Hemolysis; Cytotoxicity

INTRODUCTION

Plants are the source of different constituents which are directly or indirectly used in traditional medicine since many years. Many modern drugs have natural product origin. As their active ingredients and chemical structure discovered major share goes to plant constituents, which directly or indirectly derived from the plants ¹.

However it has been reported that many plants used as food or in traditional medicine have mutagenic, cytotoxic and genotoxic effects ^{2,3,4}. These

are giving awareness for randomly utilizing traditional medicinal plant. Studies also showed long term exposure to traditional medicines contain plant product is associated with increase in the rates of morbidity and mortality. Sinha, K.C; etal (1984) and Upadhyay S.N; etal (1990) reported antifertility effect in *Neem* ^{5,6}.

Moullava spicata (Dalzell) Nicolson is belonging to the family Fabaceae (Sub family: Caesalpinaceae) is an endemic, endangered medicinal plant of Western Ghats ⁷. Traditionally leaves of this plant used to treat chicken pox and lactating women. Root and bark of this plant are used to heal diabetic wound ⁸, pneumonia and skin diseases ⁹. Though many reports available on the medicinal properties of this plant, no systematic study has done on its toxicity.

This is the first report focused on cytotoxic effect of the plant. The aim of present study is to evaluate cytotoxic and genotoxic activity of the *M. spicata*.

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MATERIALS AND METHOD:

The leaves of *M. spicata* were collected from the place Chanthala, Kollamogaru village (Sullia talluk, Dakshina Kannada district) located in Western Ghats region during the month of February 2012.

Preparation of aqueous extract: The leaves were washed with tap water and deionized water. Then leaves were dried in room temperature for a week, powdered and stored at 4°C until use. For preparation of extract 250g of dried powder was added to 500ml of deionized water and kept in incubation to at 65°C for 24 hours with continues agitation. Extract was filtered using muslin cloth and then Whatman No.1 filter paper. Filtrate was concentrated to 100ml and consider as a stock (100%).

Qualitative Analysis Phytochemicals: The extract was tested for the presence of phytochemicals like saponins, phenolic compounds, flavonoids, glycosides, tannin, steroids and terpenoids according to the method described by Harborne and Harborne (1988); Brindha P; etal (1977)^{10,11}.

Yeast viability study: was studied by viable count method using methylene blue stain, described by Mills (1941). Four concentrations (1%, 2%, 4% and 8%) of the leaf extract were prepared from the stock using phosphate buffer. 200µl of each concentration of this extract was taken in eppendorf tube along with 50 µl of 1% yeast suspension. 200µl deionized water was maintained as control. This was incubated at 37°C for 30 minutes in an incubator shaker. Then stained with 0.2% methylene blue and number of viability of the yeast cell was determined by using haemocytometer. 576.1±20.1 cells were analyzed in each of the slide and percentage of the viable cells was determined (n=2)¹².

Determination of cytotoxicity by Hemolysis assay: This assay was performed as per the method described by Malagoli (2007), Attia M.M.A; et al (2011) and Latha L.Y; etal (2007) with slight modification. The erythrocytes were collected from the peripheral blood and then washed three times with 0.85% NaCl saline solution. After each washing cells were centrifuged 150g for 5 minutes, supernatant was discarded. Finally 2% erythrocyte suspension was prepared using 0.85% sodium chloride saline^{13,14,15}.

Four concentrations (1%, 2%, 4% and 8%) of leaf extracts were prepared in phosphate buffer. 200µl of these extract were taken in separate test tubes and volume was made up to 2000µl using buffer saline. Tubes were containing distilled water served as control. To this 200µl of erythrocyte were added. After 30 minutes of incubation at 37°C liberated hemoglobin was estimated at 405 nm and percentage of hemolysis was determined (n=2). The percentage of hemolysis was calculated using the formula,

$$H\% = \frac{A_t}{A_a} \times 100$$

A_t = Absorbance before hemolysis; A_a = Absorbance after hemolysis

Allium test: The Genotoxicity of *M. spicata* leaf extract was tested as per the method of Sehgal R; etal (2006) and Akeem A; etal (2011) with slight modifications. The onion bulbs were commercially obtained from Madikeri town, Karnataka. The bulbs were divided into four groups (5 each). Two groups were maintained as control and another two as test. Bulbs were grown in dark in moist condition until the root had grown to approximately 0.2-0.5cm in length. Then the base of each bulbs were immersed in the extract at 5%, 10%, 20%, 40% concentrations and number of the roots were counted and length of the roots were measured for 96 hours^{16,17}.

The slide preparation for microscopic observation was followed the method described by Sharma and Sharma (1980). After 48 and 96 hours of treatment, roots were used for microscopic observation. Roots were stained with standard acetocarmine and slides were observed under microscope. Of 400 cells were analyzed by examining the chromosomal aberration and cell death (n=2)¹⁸.

RESULT AND DISCUSSION

The phytochemical analysis of *M. spicata* aqueous extract revealed the presence of saponins, phenolic compounds, flavonoids, glycosides, tannins and terpenoids except steroids as listed in table 1. Phytochemicals exhibit different biological and pharmacological activity including cytotoxic or genotoxic or cytoprotective or antigenotoxic effects⁴.

Table.1: Phytochemical analysis of the *M. spicata* aqueous extract. [- not detected; + detected; ++ detected (medium); +++ detected (high range)].

Name of the test	Aqueous extract
Saponins	++
Phenolic compounds	+++
Flavonoids	+++
Glycosides	+
Carbohydrates	+++
Steroids	-
Tannins	++
Terpenoids	+

We used Baker's yeast for cell viability study. Aqueous extract of *M. spicata* showed significant ($p>0.001$) inhibition to cell viability. The dose dependent decreasing of percentage of viability was observed. *Saccharomyces cereviceae* is used widely as a model organism for studying toxic compounds such as genotoxicity and Cytotoxicity¹⁹. However cellular viability following DNA damage has been used in field of genotoxicity, toxicology, carcinogenesis and cancer therapy.

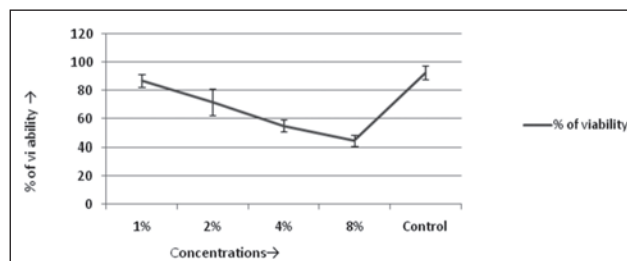


Figure 1: Yeast viable cell count showing reduction of percentage of the viability. $P>0.0016$

Hemolysis assay is an extremely sensitive method for cytotoxic studies with wide range of phytochemicals²⁰. We observed significant hemolytic activity of the aqueous extract. The hemolysis was high at higher concentration of the extract tested. Recent report showed plant with flavonoids rich and phenolic compounds have cytotoxic properties^{21,22}. In addition phytochemical analysis showed detectable amount of flavonoids and phenolic contents in extract.

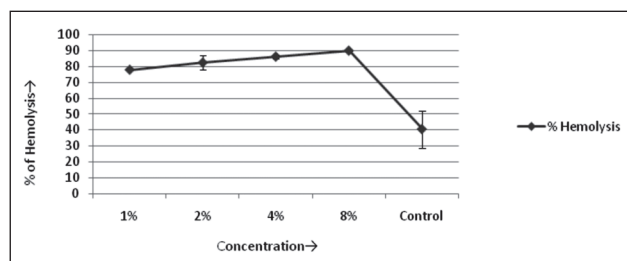


Figure 2: Percentage of hemolysis in different concentrations of extract. $P>0.001$

The effect of *M. spicata* leaf extract on root number and root length are shown in table no.3. The concentration dependent decrease of root number and root length was observed. The roots treated with concentration 10%, 20% and 40% appeared slight brown in colour. This reduction of root number and root length indicates root growth inhibition²³. The root morphology of the control was normal but colour changes of the roots were observed in higher concentrations of the extract. Fiskesjo (1993) reported colour change of the root is due to cell death and leads to cytotoxicity²⁴.

Table No. 2: Reduction of root Length and Number.

Test	98 hours Treatments		
	Concentrations	Numbers of roots	Length of roots (cm)
	5%	18.50±3.5	3.505±0.5
	10%	18±1.4	2.950±0.07
	20%	12±1.4	1.380±0.1
	40%	9.50±0.7	1.050±0.2
Control	Water	20±1.4	3.180±0.3
		P >0.01	P >0.001

The microscopic observation of root cell exposed to plant extract showed chromosomal and cellular damages such as double nucleus, membrane rupture or damage, ghost cells, apoptotic bodies. The extract showed concentration dependent increase of cellular abnormalities. However compared to 46 and 96 hours of treatment, slides which observed at 96 hours showed high significant number of cellular damages. However except double nucleus other chromosomal aberrations are not found in any concentration of the aqueous extract. The formation of double nucleus is due to the prevention of cytokines or cell plate formation²⁵. At present study the higher number of the membrane damage, ghost cell formation and apoptotic bodies was observed. Ghost cells are the dead cells, nucleus and cytoplasmic structures are not stainable but outline remain visible. Celik and Aslanturk have been reported *Inula viscosa* leaf extract showed various number of ghost cell frequency leading the cell death. The leaf extracts cause nucleus damage and prevention of cytoplasmic structure leading to ghost cell formation. The higher concentration of stress, toxins, chemical, heavy metals caused cell death in plants but commonly stress condition cause cell death⁴.

Table No. 3: Effect aqueous extract on cell abnormalities and double nucleus formation of *Allium cepa*. *non significance; Double Nucleus (DN); Membrane Rupture (MR); Ghost Cells (GC); Apoptotic Bodies (AB)

Leaf extract	48hours						96hours				
	No. of cells	DN	MR	GC	A B	Average No. of CA	DN	MR	GC	AB	Average No. of CA
5%	400	-	1.50±0.7	0.0	0.50±0.7	0.0	-	7.50±0.7	9.0±2.8	1.50±0.7	0.25±0.0
10%	400	-	10.50±2.1	5.50±3.5	3.0±1.4	0.25±0.3	0.50±0.7	9.50±0.7	15.0±2.8	6.000±1.4	0.48±0.3
20%	400	-	10.50±0.7	10.0±4.2	9.0±2.8	0.25±0.3		14.50±4.9	21.50±3.5	14.00±1.4	2.11±0.1
40%	400	-	12.0±2.8	13.5±6.3	14.0±4.2	0.75±0.3	1.50±0.7	19.50±3.5	36.0±9.8	19.0±2.8	2.52±0.3
Control	400	-	0.50±0.7	0	1.5±2.1	0.00	-	1.500±0.7	1.50±2.1	2.50±3.5	00
		-	P>0.002	P > 0.05	P >0.01	P>0.2*	P>0.07*	P>0.0086	P>0.007	P> 0.0020	P>0.0003

CONCLUSION

The present study revealed that aqueous extract of the *M. spicata* containing various biologically active compounds which have capacity of cytotoxicity. However the more results are needed in other test system including animal model, Cell lines for detecting biological and biochemical effects.

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Conflict of Interest: None

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Ethical Clearance: Na

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Denture Marking: A Valuable Aid in Forensic Identification

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ABSTRACT

The importance of rapid identification of the victims in mass disasters is essential for legal and humanitarian reasons. When the individual is edentulous, where almost all valuable identification components of oral cavity are lost, the positive identification can be achieved through marked dentures. This paper emphasizes the importance of denture marking and reviews the different denture marking methods.

Keywords: Denture Marking, Denture Identification, Denture Labeling

INTRODUCTION

United Nations Universal Declaration of Human Rights states that "Everyone has the right to recognition everywhere as a person before the law".¹The need for the identity is paramount after the death of the individual. The legal events consequent upon death are complex and have far reaching implications. There are also humanitarian and cultural factors, such as the performance of religious rites in association with the disposal of bodies. Following major disasters such as earthquakes, fires, floods or aviation disasters, a definitive and early identification of the dead and injured becomes of the utmost importance.² Delay in the correct identification causes hardship and distress for the relatives and dependents, therefore any procedure that can provide confirmatory information about an individual must be encouraged.³

The identification of the deceased can either be done by non-scientific or scientific methods. Visual recognition including facial features, scars, tattoos, deformities, clothes, personal documents or jewellery are the most frequently used non-scientific methods. When all these parameters fail to identify a body as in case of 100% burns, putrefaction, bodies recovered from water or in case of severely traumatized patients, identification is done using the scientific methods like comparison of fingerprint patterns, medical and dental evidence and analysis of Deoxyribonucleic Acid (DNA).¹In edentulous individuals denture marking is

a very successful method of identification in forensic investigation. This paper describes the importance of denture marking and reviews the different types of marking systems documented in the literature.

IMPORTANCE OF DENTURE MARKING

Teeth are of great value for forensic identification purposes because they are one of the most resilient structures in the human body and can survive most conditions of nature that may destroy or change other body tissues.⁴ Along with teeth, restorations, fixed prostheses and palatal rugae pattern aids in identification. But when the individual is edentulous, the identification becomes challenging as most of the key features are lost. In such conditions the identification becomes easy, if the dentures were marked with patient's name or unique code. The dentures generally remain undamaged owing to the protection afforded them by the soft tissues of the oral cavity.⁵ Even if the dentures are found at the site of mass disaster and not in the deceased person's mouth, a reliable identification can be done by comparing the palatal rugae of the deceased and of the denture and by checking fit of denture. The other benefits of denture marking include locating the misplaced dentures in hospitalized patients, patients in long-term care facilities or in dental laboratories. Thus marking of the dentures is recommended by most of the forensic odontologist and international dental associations.

TYPES OF DENTURE MARKING

Depending on the location of the mark, the methods have been divided as surface marking and inclusion methods. In surface marking methods, the marks are located on the denture's surface and are easy, inexpensive but are not wear resistant. They include engraving the cast, scribing the denture with a dental bur or an electric engraver, placement of an ink tattoo or writing on the denture surface etc. In inclusion methods the marks are put inside the denture and are permanent, but it could weaken the denture, are more expensive and technique sensitive.⁶ It includes inclusion of paper strip, metal strip, photographs, barcodes and data matrix codes, microchips etc. The denture marking methods are also divided as prefabrication and post fabrication methods depending upon the stage at which the denture marking is done.

REQUIREMENTS FOR DENTURE MARKINGS

The standard requirements for denture markers as outlined by the British Council on Prosthetic Services and laboratory Relations are as⁷:

1. The strength of the prosthesis must not be jeopardized.
2. It must be efficient, easy and inexpensive to apply.
3. The marking must be visible and durable.
4. The identification must withstand humidity and fire.
5. The identification mark should be esthetically acceptable.
6. The identification mark must be biologically inert.
7. The identification mark should be permanent and resistant to everyday cleansing and withstand the cleansing and disinfecting agents.

Moreover, it should be easy to retrieve after an accident, and survive elevated temperatures. The recommended areas for denture marking are the posterior regions of the lingual flange and palate.⁶

Different Methods of Denture Markings with Advantages and Disadvantages

Lose (1958) described a method in which the patient's name was typed on a piece of onion skin

paper and inserted in the denture at the time of fabrication. This technique was simple to perform, non time consuming and effective but was not fire resistant.⁵

Jerman (1970) advised placement of the metal strip in the impression surface during the packing stage of the denture. This method was fire resistant and esthetics was not affected as the strip was placed in the impression surface. The only disadvantage was that limited information could be incorporated and relining was difficult.⁸

Turner et al, (1976) suggested scribing an identification mark directly on the working cast before processing the denture. This negative mark cut into cast produce a positive embossed mark on the fitting surface of denture. Though simple, this method led to irritation on patient's mucosal tissue, lead to candidial infection and also continued tissue irritation may lead to malignancy.⁹

Fiske et al, (1986) mentioned a permanent method, which involved cutting a channel in the denture and either marking the base or inserting a marked strip. The channel was then refilled with autopolymerising acrylic resin. This method is simple but the legibility deteriorates as a result of interaction between acrylic resin monomer and some inks.¹⁰

Chalian et al, (1986) suggested a use of "T" shaped clear acrylic resin bar. A typed label was attached print facing inward against the flat section of bar. The bar would then be either incorporated into wax denture prior to flasking or fitted into suitably prepared recess in the finished denture. Finally the leg of the "T" could be ground away and remaining surface polished to produce a clear window displaying the label. This method was less porous and more colour resistant, but was time consuming and not fireproof.¹¹

Heath J.R.(1987) described a simple method of writing on the surface of denture using a spirit based pen before covering the identification mark with a clear denture base polymer dissolved in chloroform. This technique was simple, inexpensive but had poor abrasion resistance and the chloroform used was carcinogenic.¹²

Stevenson (1987) described a method in which a scalpel was used to scribe a serial number on the distobuccal flange of denture. This mark was then high

lightened with a graphite pencil. This method was simple to perform, but was a crude, unaesthetic and had poor resistance to plaque and fire.¹³

Toolson and Taylor (1989) wrote or typed the label onto the heat shrink plastic strips before being placed to an oven at 250-325°C for 30 seconds. The shrunk strip was then placed into a recess made in the denture and covered with auto polymerizing resin. These labels were compact and esthetically pleasing but were not fire proof.¹⁴

Oliver (1989) used a fine fiber tipped pen to mark the label on the partly polymerized denture resin strips that unite to the base after curing. It had the advantage of being compatible with base material but the disadvantages were it was time consuming and technique sensitive.¹⁵

Lamb (1992) described a simple method of using 4 to 5 mm wide clear autopolymerising acrylic resin sheets roughened on one side. The patient's identification marks were written backwards on the roughened side using a fine fiber-tipped pen. The marked label was placed with ink-side down in the chosen place during packing & processed. This method was simple but was not fire resistant.¹⁶

Ling (1993) suggested a white typing correcting paper to form the characters instead of conventional ink. The advantage was the white characters were easily visible against pink background; however it also had the disadvantage of being non fire proof.¹⁷

Berry et al, (1995) suggested a post fabrication method, in which a specially designed depth limiting bur was used to cut a 4mm wide by 1mm recess into polished surface of the denture, a laser printed label usually onion skin label was then placed into the recess before being covered with a layer of self cure acrylic resin.¹⁸

Coss and Wolfaardt (1995) mentioned the use of labeling machine to print a label on 9 mm or 12 mm tape. The label was inserted in the lingual flange of mandibular denture or posterolaterally in the palate of maxillary denture and autopolymerising acrylic resin was placed over the label. This was simple method but was not fire resistant.¹⁹

Ibrahim (1996) used labels printed on 35mm photographic slides via the use of computer graphic package. The processed slide was cut to the correct size before being placed into a space 1mm in depth

before being covered by clear auto polymerizing resin. The resiliency of this film to fire was greater than the previous labels, but distortion of this film occurred relatively at lower temperatures.²⁰

Milward et al (1997) suggested the use of bar and data matrix codes for the purpose of denture identification. The label containing bar codes and the data matrix codes were placed into the recess and covered by clear acrylic resin. This method was simple and the code contains more data but it required equipment to read and moreover the opacity and curvature of denture makes the reading difficult.²¹ (fig-1)

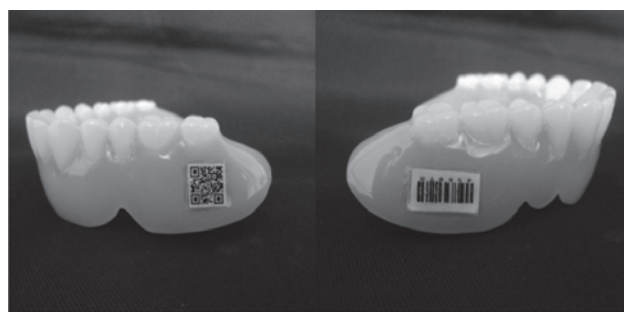


Fig. 1. Inclusion of data matrix code & barcode

Ling (1998) took computer print of the label and photocopied on a transparency film with a reduction in size. The photocopied characters were then coated with cyanoacrylic acid in order to protect it from the solvent effect of denture base monomer prior to incorporating the label into denture during packing stage. It had the advantages like more amount of information can be incorporated, better esthetic but the disadvantage was not being fire proof.²²

Ling (2003) described a method of employing a high power copper vapor laser in order to maximize the amount of data that can be written onto a metallic label. Using such a device font size of a microscopic level can be produced and hence allowing far greater amounts of data to be recorded, however the initial cost of setting this machine was very high, and the warm up time of the laser prior to its operation was much.²³

Millet and Jeannin (2004) implanted a radiofrequency identification transponder into a complete denture. It consisted of a data carrier known as a tag or transponder, and an electronic handheld reader. The reader receives the coded signal returned by the transponder and converts it into readable data. This technique had advantages like easy to locate,

identify and track people. However it was not fire proof, hand held readers may not exist in every hospital and relining may be difficult.²⁴

Matsumura et al (2007) described the fabrication of embossing tape containing the country code, Japanese prefectural code and abbreviation of the dental clinic and placing it on the framework. The casting produced the embossed letters and the plate was identifiable through gingival colored acrylic base. In this method the mark was undegradable and able to identify the nationality of the patient but technique was time consuming.²⁵

Fumi Takahashi et al,(2008) suggested a method which uses image editing computer software to reverse the letters of the label. The reverse mark was printed on paper. The methyl methacrylate monomer was applied on the area of the denture where mark would be located and the paper was pressed on monomer. After this bonding agent was applied on the label. This method was a simple, resistant to routine denture cleansing activity and strength of the dentures was not affected.²⁶ (fig-2)

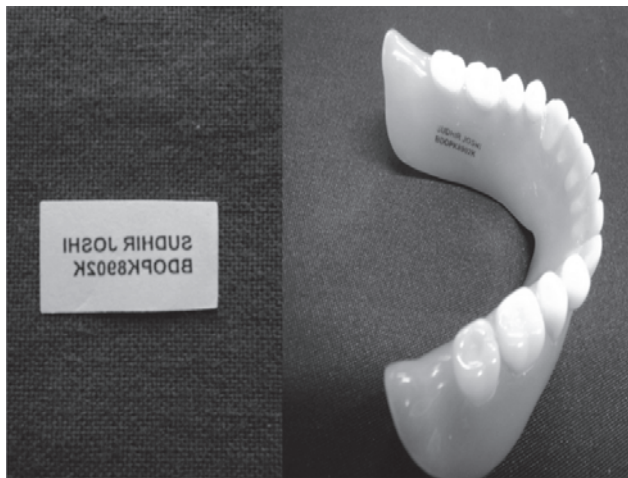


Fig. 2. Surface marking on denture using reverse printing technique

Mona Sayed El-Gohary et al, (2009) described a method in which, the patients details were typed on the lead foil and placed on the posterolateral area of the palate during packing stage. If radiograph is taken of the label, the patient's details will appear clearly. This label was durable, non expensive, survive elevated temperature, doesn't affect the strength of the denture due to its malleability and easy to retrieve after an accident.²⁷ (fig-3)

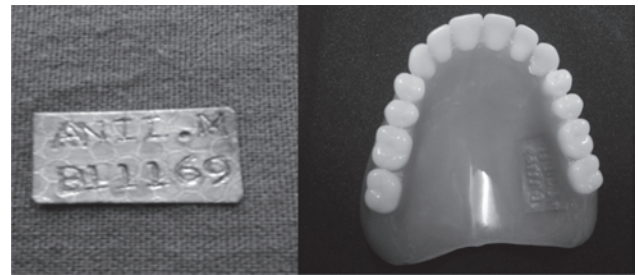


Fig. 3. Inclusion of lead foil

Anehosour G V (2010) suggested the use of the patient's photograph embedded in clear acrylic denture base. This method is particularly useful in the countries with low literacy rate where a photograph is the easiest method of identification. However thermal test revealed that the photographic marker was only resistant to around 200-300°C.²⁸ (fig-4)

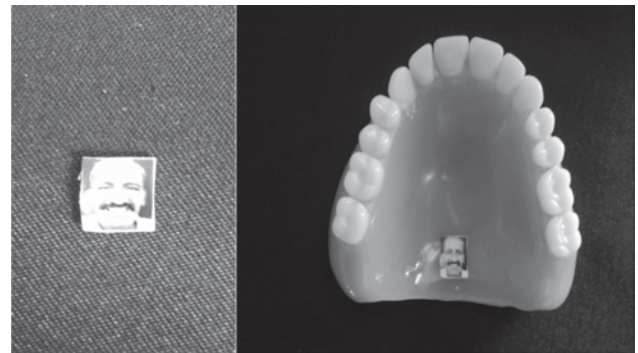


Fig. 4. Inclusion of photograph

Colvenkar (2010) suggested an innovative method of using the lenticular card for the purpose of identification. The lenticular lens is used to produce images with an illusion of depth or the ability to change or move as the image is viewed from different angles. This method stores large amount of data in small space and does not require special equipment to read it and is cost effective. Its durability and waterproofing is remarkable. But disadvantages it may not withstand fire.²⁹ (fig-5)

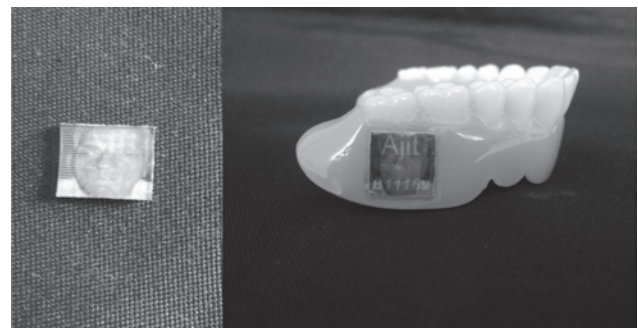


Fig. 5. Inclusion of Lenticular card

These are the various methods that have been proposed for denture marking in the literature. It is important to use a method that is a simple, practical, affordable and universally acceptable.

CONCLUSION

In edentulous individual the forensic identification is challenging but positive identification can be done, if the dentures are marked. The importance of denture marking should be emphasized by all law-enforcing authorities and should be promoted among all dentists, towards making it a compulsory routine dental procedure throughout the world.

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Pattern of Injuries among Deceased Reported at Hospitals in Chandigarh, India

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ABSTRACT

Brain tissue injury and the intracranial hemorrhage due to skull fracture are the known conditions among accident victims that potentially threaten the human life. Location and type of injury/hemorrhage for brain determines the state of health or death.

Objective: To study the type and pattern of skull fracture, intracranial hemorrhage and brain tissue injury among accident deceased at hospitals, Chandigarh, India.

Study design: Hospital based cross-sectional study.

Method and Procedures: Post-mortem of the deceased.

Results: Road traffic injury (RTI) was observed among 78 of total 87 studied deceased. Head injury with skull fracture found to be associated with road traffic accident (92.8%) among total 87 deceased. Linear fracture involving frontal and parietal bone of skull was common (36.7%). Intracranial hemorrhage (Subdural; 43.1%: Extradural; 31.9%: Subarachnoid; 19.4%: Intracerebral; 5.6%), contusion and edema were commonly associated observations.

Conclusion: Intracranial hemorrhage is most common associated finding and possible reason for death among deceased due to head injury, being RTI is most common cause for head injury.

Keywords: Road Traffic Injury, Skull Fracture, Hemorrhage

INTRODUCTION

Various aspects of head injury were being studied throughout the world. Head injuries are most frequently caused by traffic accidents, assaults, falls, during birth, etc. In populous and developing countries Road Traffic Injuries (RTIs) are most common unintentional cause for head injury.¹ Male of early and productive group was found to be affected more than the others.^{1,2} RTIs are considered to be a by-product of urbanization. Various countries have observed increase in the numbers of vehicles, high velocity technology, along with other contributing factors like congestion of roads and non adherence to road safety rules and regulations. RTIs are preventable events taking place as a result of collision of automobile with a pedestrian, another automobile or with non-

automobile on the road, causing injuries or death of the individual.

Majority of fatalities in trauma cases occurs due to head injury.³ It can be the most threatening condition for life depending upon the type and extent of intracranial injury. Lesions may vary from injury limited to scalp and extending to skull fractures, intracranial lesions, etc. The occurrence, degree of deformation and the extent of the fractures are not only related to the amount of strike force but also to the properties of the skull at the point of the contact, including thickness of scalp, amount of hair and thickness and elasticity of individual skull, etc.⁴ The victim is more vulnerable in frontal collision, side collision and when hit by heavy motor vehicle. Further the fractures sustained may be described as severe,

multiple of crushing type and may involve the entire skull.⁵ Local level surveillance system to monitor to study the pattern of head injury and its determinants need to be carried out. Therefore, the present study was carried in two leading catering hospitals of the modern city, Chandigarh.

MATERIAL AND METHOD

Post-mortem of all cases of head injury with the evidence of skull fractures admitted to the department of Surgery during the period from 1st June 2007 to 31st May 2008 and those resulting in deaths was done. It was undertaken in the Government Medical College and Hospital (GMCH), and Government Multispecialty Hospital (GMSH) Chandigarh with prior ethical approval from Institution Ethics Committee (IEC). Cases referred to other centers without proper radiological investigations like X-ray, computed tomography (CT), and magnetic resonance imaging (MRI) in GMCH was excluded from the study. The clinical records of the deceased were collected before and compared after the post-mortem findings of those cases that received treatment at study hospitals but eventually succumbed to their injuries/complication.

Information was collected on pretested structured questionnaire from the police and accompanying relatives/friends to gather information regarding the age, sex, socioeconomic status, type of road, the type of weapon in case of assault and height from where the person fell. The pattern of skull fracture i.e. type of skull fracture, region and bones of skull involved along with accompanying underlying brain injuries, were noted along with injuries to other parts of the body.

RESULTS

Total of 84 deceased including 7 crush injuries with skull fracture were studied. Of these, 63 were admitted to emergency department and 21 were brought dead. Total 78 cases (92.8%) were of RTIs, followed by fall from height 3 (3.6%), 2 (2.4%) of assault and 1 (1.2%) of railway accident. Most (80.9%) deceased were males and of 21 to 40 years of age. Most of deceased belonged to middle (53.4%), followed by lower (28.3%) and upper (18.3%) socioeconomic status. Significantly ($p < 0.05$) majority of victims belonged to urban area (64; 76.20%) than rural area.

Of 63 victims admitted to the emergency department, 60 had undergone for CT scan of head,

and skull fractures were detected in 80.9% studied subjects. In addition, X-ray examination of head was also done in 56 victims and skull fractures was detected in 42.9% of subjects. The most common fracture detected on CT and X-Ray examination was of linear type.

Scalp injury was observed among 80 studied subjects. The commonest type scalp injury was laceration (42.8%), followed by the combination of abrasion, laceration and contusions (21.4%), abrasion alone was present in 11 (13.1%), while black eye was observed in 6 (7.1%) individuals. When studied for fracture, base skull fracture alone was common (44.0%), followed by base with vault (31.0%). Vault alone was involved in 25.0% cases. Skull vault was involved in 78 and linear fracture was observed in 50 (36.0%: temporal; 32.0%: frontal; and 32.0% parietal) study subjects. Base was involved in 67 and middle cranial fossa fracture was found among 50.7% of subjects. Both in vault and base of skull, linear fracture was common type of fracture. About 70.6% of vault and 60.0% of base fractures were unilateral only. Subdural (43.1%) haemorrhage was most commonly associated feature followed by subarachnoid (31.9%), extradural (19.4%) and intracerebral (5.6%) haemorrhage. Apart from haemorrhage edema (11), laceration (7), midline shift (6) and necrosis (5) were other associated intracranial observations.

Twenty four (28.6%) victims had associated chest injuries. Of these, abrasions of chest was observed in 6 subjects followed by contusion and ribs fracture in 5 subjects each. Laceration of the lung was observed in 1 subject only. Upper limb injury, 76 (90.5%) was found to be more associated with skull fractures than the lower limb injuries ($p < 0.05$). Abrasion was most common injury of the limbs and fracture was observed among 6 study subjects.

Of the 78 cases of RTIs, 57.7% were two wheeler occupants and 82.5% of them were driving the vehicle at the time of accident. Linear fracture was common among the two vehicle drivers. The next major group of victims was the pedestrian (37.2%). Only 3 (7.5%) were reported to be wearing helmet among motorized two wheeler riders. Car was the most common offending vehicle (43.4%) followed by bus (21.1%) and trucks (11.8%). Information regarding the offending vehicle was not available in 15.4% cases. Majority of RTI victims were reported to have been hit either from side (33.3%) or from behind (33.1%). Head on collision was reported in 15.4% cases, while 7.7% cases of

vehicular accident occurred due to skidding of motorcycle.

Accident on hard surface road (94.9%) found to be significantly higher ($p < 0.05$) than loose surface road (5.1%). Maximum number of RTA occurred between 15:00-18:00 (23.8%), 09:00-12:00 (22.5%), 12:00-15:00 (13.7%), and 24:00-03:00 (11.3%) hours. In the present study, the survival period of victims varied from spot death to about 3 weeks. Thirty five victims (41.7%) died within 6 hours of the incident, of which 25 (71.4%) died within 1 hours of the incident. Forty seven (56%) victims died within 24 hours of the incident.

Only three cases had injury due to fall from height of age ranging from 21 to 42 years. Fall height varied approximately from 20 to 30 feet. Two were brought dead and one died within 4 hours of admission. Two cases had crush injury of skull involving majority of bones of vertex and base of skull. Brain substance and meninges were lacerated and all types of intracranial haemorrhage were associated.

DISCUSSION

RTI is common group of condition among unintentional injuries. Trauma to head leads to various type injuries which may vary from no external injury to skull fracture and haemorrhage. Haemorrhage and brain tissue injury is most common immediate cause of death in victims. Gender and age group along with socio-economic status associates with vehicle usage as so with RTIs. In present study observed peak injury incidence the age group 21-40 years (51.2%). Another studies^{2, 6, 7} 20-30 years as affected group and study⁸ even found the early age group of 26 to 30 year. Study found that highest fatality rates were in the age group 15-44 years.¹ As observed in present study male were involved the most as observed in other studies.^{1, 2, 7, 9} Vehicle usage was common among male and so were mostly exposed to injuries. Apart from gender and age, timing of trauma especially for RTIs describes the road traffic congestion and most common risk factor for the injury. Present study observed majority of the incidents occurred in morning and evening hours. Other studies reported similar as observed in present study.^{10, 11}

When studied for type of injury, scalp is first to be involved at the time of trauma, as in present study laceration is most common type of scalp injury as observed by other study¹², on contrary contusion⁶ and scalp hematoma¹³ was commonly reported injuries in other studies. Along with scalp, skull is a potential

place of injury as observed, and in present study linear fracture was most common type of fracture in both vault and base of the skull. Other study also reported such fractures in their study.^{6, 7} As in present study, other studies as well, observed temporal fracture as the commonly involved bone.^{4, 6, 14} Base skull fracture was a common fracture in the present study. Other studies as well showed base skull fracture in 46.0%¹⁵, in 36.0%¹⁶, and 34.0%¹⁰ of studied subjects. As in present study, studies reported middle cranial fossa was most commonly involved region in base skull fracture.^{15, 16, 10}

When studied for type of fracture, linear was commonest followed by comminuted. Other studies found linear and depressed⁵, linear and basilar¹⁵, fissure and comminuted fractures^{10, 12} as commonest skull fractures. Along with fracture hemorrhage and brain tissue injury is the most common associated finding and immediate cause of death. In present study subdural haemorrhage was most common intracranial haemorrhage, and brain laceration and intracerebral haemorrhage was observed in 7 and 9 cases respectively. Subdural haemorrhage was also commonly associate find reported in other studies.^{10-12, 16}

Majority of the injury were RTIs as observed in other studies.^{11, 17} Severity of injury and transportation mechanism to health facility is important for the patient management and survival. In present study about half (47.1%) of the victims died on the spot within 6 hours and out of them 71.4% died within 1 hour of accident. Most of the deceased were two-wheeler riders in present study as observed by other authors^{10, 11, 16} and other study observed pedestrians as common victims.^{6, 18} In present study found 51.3% and other 48.0%¹⁰ were two wheeler riders and mostly did not wore helmets while driving. Car was the most common (43.4%) offending vehicle followed by bus (21.1%) in the present study. In present study and other study¹⁹ most of the impacts occurred from the side (57%) of vehicle. Car was the most common offending vehicle in the present study.

Accident can be expected as we study the every accident and analyze the risk factors of the accidents. Type of accident depends upon the geography as RTIs, and has high probably with dense road network with high vehicle density. Fall can be expected among children and old persons. As RTIs are most common cause of unintentional injury and causing death due to head injury and blood loss. Head injury poses threat

to the life based due to brain tissue injury and intracranial haemorrhage. Probability of death can be estimated by studying the scalp injury, skull fracture and type of haemorrhage. Present study and other study showed that the basilar skull fracture with subdural haemorrhage commonly associated finding -even in radiological investigations- among deceased and can increase the probability of death, if associated. The safety measures by abiding to road safety for both the vehicle occupants and pedestrians is most cost effective strategy for averting morbidity and mortality due to RTIs and should be addressed. Centre specific injury surveillance system is to be established to monitor the trend of injuries and their risk factors. Continuous sharing of the analyzed information will help to redesign the public health policy for road safety and injury prevention.

Conflict of Interest Statement: None.

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Retrospective Epidemiological Study of Fatal Road Traffic Accidents at Mortuary of North Bengal Medical College During 2009-2011

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ABSTRACT

In our country motor vehicle accidents rank on the top among all fatal accidents. An accident represents a major epidemic of noncommunicable disease in the present century. A total of 5806 medico-legal autopsies were conducted in the mortuary of North Bengal Medical College, Darjeeling, during three year study period, out of which 1685 (29.02%) cases were due to fatal road traffic accidents (RTA). Female were less involved than men with ratio of 1:6, The principal age group involved in fatal RTA was 21-40 years, 57.32%, and least involved were extremes of ages i.e. below 10 years, 3.62%, and above 60 years, 2.67%. The majority of fatal RTA were due to heavy vehicles (trucks, buses etc), 41.12% of cases followed by light vehicles (car, Jeep, van, taxi etc) 32.40%. Brain was found to be injured in a majority of cases followed by liver and lungs. The victims mostly died of head injuries alone followed by thoraco-abdominal injuries in combination with head injuries. Only 64.09% of victims could be hospitalized and rest of them (35.89%) either succumbed on the spot or died on way to hospital

Keywords: RTA (Road Traffic Accidents), RTIs (Road Traffic Injuries)

INTRODUCTION

The definition of road traffic fatality varies in different countries and is defined as 'any person killed immediately or dying within 30 days as a result of an injury or accident'. With the expansion in road network, motorization and urbanization in the country, the number of road accidents have surged. According to WHO, RTIs are the sixth leading cause of death in India with a greater share of hospitalizations, deaths, disabilities and socioeconomic losses in young and middle-age populations. WHO report claims that all these accidents are primarily due to bad infrastructure and rash driving. As road traffic accidents take the lives of nearly 1.3 million every year, and injure 20-50 million more in the world, India, along with China, is listed among countries with the highest number of deaths. The United Nations has rightly proclaimed 2011-20 as the decade of action on road safety and have called upon all member countries to prepare a decadal action plan for implementation in their respective countries so that the present rising trend of road accidents stabilizes and is reversed by the year 2020^[1]

MATERIALS AND METHOD

The present study comprised of 1685 RTA cases which were brought into the mortuary of the department of forensic medicine, North Bengal medical college, Siliguri, West Bengal, for the medicolegal autopsy during the period from Jan. 1st, 2009 to Dec.31st, 2011 were taken into consideration. Road traffic accident (RTA) provides some 29% or more of the average forensic autopsy load to North Bengal region. The epidemiological features pertaining to victim e.g. age, sex, time of accident, type of vehicle involved in the accident and injuries caused to the victims, place of death of victim and cause of death of RTA victim were noted. Police papers like inquest report and dead body chalan were studied and police officers were asked to provide necessary information as far as practicable for the study. A detailed proforma for the purpose of recording history and epidemiological data was prepared for the purpose of filling observations of the present study.

OBSERVATION & RESULTS

Table 1. Data shows a growing percentage of RTA cases in medicolegal autopsies performed yearly.

Table 1. Year wise number of autopsies and RTA victims:

Year	Number of autopsies	Number of RTA victims	Percentage
2009	1846	475	25.73
2010	1970	558	28.32
2011	1990	652	32.76

Table-2. Female were less involved than men with ratio of 1:6.

Table 2. Sex wise distribution of RTA cases:

Year	Male	Female	Percentage of male	Percentage of female
2009	417	58	87.78	12.21
2010	472	86	84.58	15.41
2011	544	108	83.43	16.56

Table-3. Majority of victims belong to the 21 to 40 yrs of age- 57.32%

Table 3. Age wise distribution of RTA victims:

Age in Yrs.	2009	2010	2011	Total	Percentage
0-10	25	13	23	61	3.62
11-20	31	41	32	104	6.17
21-30	156	173	190	519	30.80
31-40	113	157	177	447	26.52
41-50	82	87	124	293	17.38
51-60	58	65	93	216	12.81
>60	10	22	13	45	2.67

Table 4. Majority of the vehicles involved in the RTA were heavy vehicles (trucks, oil tanker, motor buses) 41.12%, followed by light-vehicles (taxi, car, jeep, van etc) 32.40%, other vehicles (tampos, rickshaw) were involved in 2.43% of cases. RTA due to unknown vehicles was 1.83%

Table 4. Types of vehicle involved in RTA:

Types of vehicle	2009	2010	2011	Total	Percentage
2-wheeler	120	109	145	374	22.19
3-wheeler	11	18	12	41	2.43
4-wheeler	159	177	210	546	32.40
Heavy vehicle	176	246	271	693	41.12
Undetermined	09	08	14	31	1.83

Table-5. Incidence of RTA were maximum within 6 PM to 12 midnight (35.54%) followed by 6AM to 12 Noon (26.29%)

Table 5. Time of accident:

Time	2009	2010	2011	Total	Percentage
12 midnight – 6 AM	65	68	76	209	12.40
6 AM – 12 Noon	115	154	174	443	26.29
12 Noon-6 PM	127	145	162	434	25.75
6PM -12 Midnight	168	191	240	599	35.54

Table-6. Majority of deaths due to RTA occurs during Hospital stay (64.09%) followed by spot deaths (25.69%)

Table 6. Place of death of RTA victim:

Place of death	2009	2010	2011	Total	Percentage
Spot	122	136	175	433	25.69
On the way to Hospital	48	51	73	172	10.20
AT Hospital	305	371	404	1080	64.09

Table-7. Most common cause of deaths due to RTA was due to immediate effects (46.35%) followed by remote causes (40.71%)

Table 7. Cause of death of RTA victims:

Cause of death	2009	2010	2011	Total	Percentage
Instantaneous	68	72	78	218	12.93
Immediate	211	254	316	781	46.35
Remote	196	232	258	686	40.71

Table-8. In present study 65.81% victims had primary Head injury, 27.24% had involvement of chest associated with abdominal injury and in 7.06% victims had injury of other body parts.

Table 8. Site of injury

Site of injury	2009	2010	2011	Total	Percentage
Head injury	305	372	432	1109	65.81
Abdomino-thoracic injury	136	148	175	459	27.24
Other body parts	34	38	47	119	7.06

DISCUSSION

Road traffic injuries are one of the leading causes of death in the world. world wide the number of people killed in road traffic crashes each year is estimated at almost 1.2 million, while the number of injured could be as high as 50 million. In India over 80,000 person die in traffic crashes annually, over 1.2 million are injured seriously and about 30,000 disabled permanently.

The present study carried out in North Bengal region of West Bengal state, India revealed that during three-year study period 1685 fatal RTA have occurred accounting for 29% of total medicolegal autopsies. This has reflected major public health problem. Singh and Dhatarwal have also reported a incidence 29.8% i.e. 450 fatal road traffic accidents out of 1510 total medicolegal autopsies conducted^[2].

Nilamber Jha in a study of RTA at JIPMER reported that out of a total of 544 RTAs there were 26 fatalities^[3]

Our findings that males out numbered females in the ratio of 6:1 can be explained by the fact that males lead a more active life and keep themselves most of the time outdoors to earn bread and butter for families

besides they are more involved in activities such as driving and traveling. On the contrary, females mostly keep themselves indoor mostly due to cultural background, lack of industries and low potential for employment rate owing to poor literacy, along with the tendency that some male members mostly accompany females and extra precautions are taken on roads. These are reasons for their less mortality in RTA. Our findings are in general agreement with reports of WHO(1976)IN the States of USA, Tyagi A.K.et al(1986) and kumar et al(1999).. Moreover, excess male mortality increases the number of widows and orphans and exposes them to a higher risk of economic difficulties^[4]

In the present study, highest incidence of RTA fatalities have been observed in the age group of 21-40years (57.32%) and lowest incidence in the children below 10 years (3.62%) and persons above 60 years of age (2.67%). This may be due to the fact that persons of 21-40 years are group lead more active life and keep themselves outdoors most of the time. Besides they have a universal habit of taking risks like boarding a moving vehicle, traveling on footboard of vehicle, crossing the roads carelessly and risky speed driving

etc. Similarly, lesser involvement of children below 10 years may be for they are accompanied by some member of the family while on road. Our findings are in close accordance with Chandra J(1979), Pillay V.V.(1992) and Kumar A et al(1999)^{[5][6]} & Gupta S et al and Menon A and Nagesh KR reported that the least affected group were those above 70 years (2% and 1% respectively) which is consistent with this study (2.67%)^{[7][8]}

Heavy vehicles (trucks, oil tanker, lorries, bus etc) have been found to be mostly responsible for 41.12% of cases followed by light vehicles (car,

jeep, van, taxies) 32.40% of fatal RTA. This can be attributed to their high speed, presence of single space roads, driver's fatigue, drinking alcohol etc.. Our findings are in close accordance with Voret F(1993), Lan G et al(1998), and Dhattarwal S.K.(2004)^[9]

In the present study, it is found that highest incidence of RTA occurs within 6PM to 12 Midnight (35.54%) followed by 6AM to 12 Noon(26.29%). This indicates the more outdoor work of peoples during these hours.

In the present study, 25.68% died on the spot, this reflected severity of crash. 64.09 % victims died during hospital stay .This highlights the need of establishment of specialized trauma centres in big cities so that prompt specific treatment can be offered to the RTA victims. Our study have also shown that 172 victims (10.20%) have died a way to hospital this itself speak for the need of prompt and safe transportation of the victims with facilities of general management and resuscitation on way to hospital.

In the present study, highest incidence of death after accidents was due to immediate causes like haemorrhage, reflex vagal stimulation, shock or injury to vitals organs at hospital or on the way to hospital. Infections, gangrene, crush syndromes and surgical operations were responsible for deaths of 40.71% victims.

Regarding distribution of injuries amongst RTA victims, it has been observed that multiple injuries involving different parts of the body are more commonly seen. Head injury constitutes about 65.81% cases of death from RTA and abdomino-thoracic

injuries is responsible in 27.24% cases. our findings are in close accordance with the findings of Eke N et al who observed 543 head injuries in 1601 casualties, whereas Singh & Dhattarwal had noted an incidence of 77.6% head injuries in their stud^[9] This establishes that head injury is most common in fatal RTAs. Head injury alone or in combination with thoraco-abdominal injuries is the major causes of death.

CONCLUSION

Our study revealed that young adult age group (21-40) comprised a substantial number of deaths due to RTA. However to a large extent road traffic accidents are preventable and can be influenced through a rational national policy on road safety, stricter licensing policy especially for heavy vehicle, and a greater awareness of different kinds of road-users about traffic rules and use of protective gears like safety belts and motorcycle helmets. Of course, construction of well planned road systems, safe vehicle design implementation of road safety measures ,establishment of well equipped trauma care centers with trained staffs and curbing intoxication and drug abuse amongst drivers are the need of hour to check the rising graph of fatal road traffic accidents .

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Ethical clearance – Ethical clearance was obtained from Ethical committee, North Bengal Medical College, Darjeeling

Conflict of interest – our primary interest of the study is to know the incidence of RTA in our locality and secondary interest is to use this data for the improvement of our professional research work.

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A Study of Burns Cases, Microbiological Profile in Burn Wounds and Cause of Death among Burn Victims in Bijapu

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ABSTRACT

Objective: This study was to study burn cases, microbiological profile of burn wounds, manner and cause of death among burn victims.

Materials and Method: This study was undertaken at Al-Ameen Medical College hospital and District Hospital, Bijapur between 1.1.2008 to 31.12.2008.

Result: Total 89 Cases of injuries due to dry heat were examined. Out of the total 31(34.83%) were Males and 58(65.17%) were Females. Maximum cases 34(38.20%) belonged to the age group of 21-30 years followed by 19(21.35%) belonging to 11-20 years of age group. Among 89 cases studied 42(47.19%) victims were married females while 22(24.72%) were married males, remaining 25(28.09%) were unmarried. In this study 66(74.16%) cases were accidental, 19(21.35%) cases were suicidal and 4(4.49%) were homicidal. Kerosene was the most common causative agent accounting for burns among 72(80.90%) cases. Pseudomonas aeruginosa was the common microorganism isolated among burns cases followed by Staphylococcus aureus, Klebsiella species, Escherichia coli, Proteus species. 41 autopsies were done on the bodies of fatal burn victims reporting Septicemia as the most common cause of death, followed by shock.

Conclusion: Planning the burn ward separately, restriction in the misuse of antibiotics, supportive measures in the form of good nutrition and physiotherapy will increase the survival rate in burn cases.

Keywords: Burns, Manner of Death, Microorganisms, Causative Agent, Cause of Death

INTRODUCTION

Heat is a source of energy, without which existence of human life is not possible, careless in handling, if misused intentionally life will be endangered. In India suicidal burns are a common mode adopted to get rid of the stress, especially by married females due to

dowry harassment - Bride Burning. Unlike in developed countries, the prognosis of a burn victim is very poor in India. The reasons are many; this study was an attempt to make the things better for the burn victims as the dictum "Prevention is better than cure" most appropriate for burns than for any other ailment.

The present study was undertaken

1. To know the age and sex of victims involved.
2. To know the marital status of the burn victims.
3. To study the extent and degree of burns.
4. To know the causative agent and manner of burn injuries.

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5. To know the common microorganisms isolated in burns cases.
6. To know the autopsy findings in relation to cause of death.

Microbiology Al-Ameen medical college, Bijapur. The treatment given was recorded and followed up. In case of death police were informed. Autopsy was conducted at Al-Ameen Medical College or District hospital, Bijapur.

MATERIAL AND METHOD

All the cases of injuries due to dry heat which were admitted, treated and autopsied in the District Hospital, Bijapur and Al-Ameen Medical college hospital, Bijapur from 1.1.2008 to 31.12.2008 were studied. The detailed history and circumstances in which the patient sustained burn injuries due to dry heat was taken, extent and degree of burns were assessed. The swabs were collected from the burnt areas within 48 hours and after 48 hours for culture and sensitivity which was done at department of

OBSERVATIONS AND RESULTS

Table 1: Showing Number of Burn cases in relation to sex.

Sex	Number	Percentage
Male	31	34.83%
Female	58	65.17%

The present study demonstrated preponderance of female 58(65.17%) victims over male 31(34.83%) victims [Table 1].

Table 2: Distribution of cases Age-Sex Wise.

Sl.no	Age	MaleNumber	Percentage	FemaleNumber	Percentage	TotalNumber	Percentage
1	Less than 10yrs	4	44.44%	5	55.56%	9	1.11%
2	11-20yrs	5	26.32%	14	73.68%	19	21.35%
3	21-30yrs	7	20.59%	27	79.41%	34	38.20%
4	31-40yrs	6	42.86%	8	57.14%	14	15.73%
5	41-50yrs	4	80%	1	20%	5	5.62%
6	51-60yrs	3	75%	1	25%	4	4.49%
7	More than 60yrs	2	50%	2	50%	4	4.49%

Age group 21-30 years was most commonly affected 34(38.20%) followed by 19(21.35%) among 11-20 years of age group [Table2].

Table 3: Cases according to Marital Status.

Marital Status	Sex	Total	Percentage
Married(n=64)	FemaleMale	4222	47.19%24.72%
Unmarried(n=25)	FemaleMale	169	17.97%10.11%

Married females 42(47.19%) most common victims of present study followed by married males 22(24.72%) [Table 3].

Table 4: Showing percentage of Burns sustained in relation to Sex and Fatality.

Sl.no	Percentage of Burns	MaleNumber	Died	FemaleNumber	Died	TotalNumber	Percentage
1	<10%	2	0	3	0	0	-
2	11-20%	6	0	2	0	0	-
3	21-30%	6	0	7	0	0	-
4	31-40%	3	0	5	2	2	4.88%
5	41-50%	2	2	2	0	2	4.88%
6	51-60%	1	0	8	5	5	12.19%
7	61-70%	3	2	6	2	4	9.76%
8	71-80%	1	1	1	0	1	2.44%
9	81-90%	1	1	2	2	3	7.31%
10	91-100%	6	1	22	20	24	58.54%

Out of total 89 victims of dry heat death occurred in 41(46.07%) cases [Table 4].

Table 5: Showing Number of Burn cases in relation to the causative agent.

Sl.no	Causative agent	NumberMale	Female	Total	Percentage
1	Kerosene	23	49	72	80.90%
2	L.P.G	1	5	6	6.74%
3	Petrol	1	0	1	1.12%
4	Diesel	1	0	1	1.12%
5	Others	5	4	9	10.11%

Kerosene was the most common causative agent in 72(80.90%) of the total cases [Table 5].

Table 6: Cases according to Manner of Death.

Sl.no	Manner of death	No of cases	Percentage
1	Accidental	66	74.16%
2	Suicidal	19	21.35%
3	Homicidal	4	4.49%

In this study 66(74.16%) were accidental, 19(21.35%) were suicidal and 4(4.49%) were homicidal [Table 6].

Table 7: Types of Organisms cultured from Burn Wounds.

Sl.no	Organisms	< 48 hrsNumber	Percentage	>48hrsNumber	Percentage
1	<i>Pseudomonas aeruginosa</i>	16	30.76%	36	40.44%
2	<i>Staphylococcus aureus</i>	7	13.46%	27	30.33%
3	<i>Klebsiella species</i>	-	-	8	8.98%
4	<i>Escherichia coli</i>	-	-	3	3.37%
5	<i>Proteus species</i>	-	-	1	1.12%
6	No growth	29	55.76%	14	15.73%

Our study shows *Pseudomonas aeruginosa* as the causative microorganisms in burn cases followed by *Staphylococcus aureus*, *Klebsiella species*, *Escherichia coli* and *Proteus species* [Table 7]. Out of 41 deaths occurred, Septicemia was the most common cause of death 20(48.78%) and 19(46.34%) due to shock.

DISCUSSION

The present study demonstrated preponderance of female 58(65.17%) victims over male 31(34.83%) victims same is also reported by other researchers.^{1,2,3,4,5,6} Probably due to cooking on open fire, explosion of pressure stoves, instability of small stoves, use of open fires to keep warm in winter. These findings are similar to as quoted by K.Park.⁷ Out of total 89 cases maximum cases 34(38.20%) belong to the age group of 21-30 years, among them 27(79.41%) were females while 7(20.59%) were males. The reason for female predominance is probably due to lack of education, dowry related, working near fire and unemployment.^{1,2,3,4,5} among 89 cases studied 42(47.19%) victims were married females while 22(24.72%) cases were married males. This is similar to observations made in other studies.^{2,8} Out of 89 cases, death occurred in 41(46.07%), 10 males and 31 females.⁹ It was commonly observed

that the duration of survival among the fatal cases was more if the percentage of burns was less than 70% and more the percentage (81-100%) of burns lesser the duration of survival. Kerosene was the most common causative agent in 72(80.90%) of the total cases probably because of the easy access, use as a fuel in the kitchen, other causative agents were L.P.G, Petrol, Diesel etc. These findings are almost similar to the study findings made by N.P.Zanjad and H.V.Godbole.¹⁰ Most common manner of death was accidental 66(74.16%) cases accounting for more than 2/3rd of total cases, 19(21.35%) were suicidal and 4(4.49%) were homicidal. These findings are almost consistent with the study findings by others.^{10,11} Total 89 swabs were collected after 48 hours, the culture showed growth of *Pseudomonas aeruginosa* in 36(40.44%), *Staphylococcus aureus* in 27(30.33%), *Klebsiella species* in 8(8.98%), *Escherichia coli* in 3(3.37%), *Proteus mirabilis* in 1(1.12%) and 14(15.73%) samples showed no growth. This is consistent with other studies.^{12,13,14,15,16,17,18} Out of 41 deaths occurred, septicemia was the most common cause of death 20(48.78%).^{10,19} the extent of burns in these cases ranging from 30-60%. The fatal cases with more than 60% burns died due to shock 19(46.34%). The move towards earlier mobilization of the patient reduces this as per the study.²⁰

CONCLUSION

Among autopsied, maximum deaths were caused due to Septicemia, it can be reduced by maintaining sterile environment, aseptic precautions, early excision of the burnt tissue and covering the area with split skin grafts and appropriate antibiotic coverage. Shock was the second most important cause of death. Can be prevented to some extent if hypovolemia is effectively treated by plasma expanders, blood transfusion on emergency basis. Planning the burn ward separately and at a distance from the general hospital premises can be one of the effective measures in controlling secondary infection. Restriction in the misuse of antibiotics on the empirical basis, establishment of proper infection control measures and supportive measures like psychological support, physiotherapy and protein rich diet will help lower the incidence of infection and hence will increase the survival rate in burns cases.

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Reliability of Foramen Magnum Length & Breadth and Mastoid Length in Identification of Gender of North Chennai Region

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ABSTRACT

Identification of the sex from the skeletal remains is the prime work of forensic experts. The present study is carried out to determine the sex of the skull bone from foramen magnum length, breadth and mastoid length. One hundred adult human skull bones of known sex (50 male and 50 female) available in the Department of Anatomy and Forensic Medicine & Toxicology, Madha Medical College and Hospital, Chennai are used for the present study. Among all the three variables statistically analyzed, the most reliable parameter is foremena magnum length which helps to sort out 38% of male skulls and 06% of female skulls i.e. overall 22% of skull bones can be sorted out with this parameter alone. This parameter is also found to be statistically significant.

Keywords: Foramen magnum, length, breadth, mastoid length and Gender

INTRODUCTION

Identification of sex of the deceased from skeletal remains is in practice since long ago, as it becomes important expert evidence in the court of law. In medico-legal cases forensic experts are often asked for their expert opinion regarding species, age, sex, race, stature and probable cause of death from skeletal remains. Bones form important evidence in establishing identity of deceased in medico-legal cases. The determination of sex of the deceased is prime step in skeletal analysis. As the studies on sexual dimorphism of skull were very few, present study is an attempt to enhance the accuracy of sexing skull. This will be helpful in anthropometric and medico-legal studies. Similar works were conducted earlier by Harihara¹ (1959) who worked on Japanese skull, Giles and Elliot² (1963) who worked on American crania and Hong Wei Song³ (1992) studied on Chinese skull. Results of these studies have shown wide range of variations in standards of morphological and morphometric sex differences. These variations occur because the skeletal growth is mostly influenced by factors like race, heredity, climate, environment, nutrition, etc., which are likely to change from region

to region, hence, it is essential to carry out such studies in different regions.

MATERIALS AND METHOD

One hundred adult human skull bones of known sex available in the Department of Anatomy and Forensic Medicine, Madha medical college, Chennai are used for the present study.

Out of 100 skull bones, 50 are of males and 50 are of females. All the skull bones are dry, free of damage or deformity and were completely ossified.

Following instruments are used for the measurements of various parameters of hip bone:

- 1) Sliding Vernier caliper
- 2) Chalk
- 3) Marker pencil

Sufficient care is taken to avoid manual error and all measurements are taken personally. From each skull following parameters are measured. The points used for various measurements are as follows:

1. Foramina magnum length (FML): Foramina magnum length is the distance between basion and opisthion. It was recorded with the help of sliding vernier caliper.
 - a. Basion: Basion is the most anterior point on anterior margin of foramina magnum.
 - b. Opisthion: Opisthion is the most posterior point on the posterior margin of the foramina magnum.
2. Foramina magnum breadth (FMB): Maximum breadth of foramina magnum was measured at broadest part of foramina magnum with the help of sliding vernier caliper.
3. Mastoid length (ML): Mastoid length is the distance between highest point on the upper border of external auditory meatus to the tip of mastoid process. It was measured perpendicular to Frankfurt plane with the help of sliding vernier caliper. The upper arm of sliding vernier caliper was aligned with upper border of external auditory meatus and the distance to the tip of mastoid process was measured.

The values of range, mean, standard deviation, calculated range (mean±3SD), Demarking points (D.P.) and Identification points (I.P.) were obtained. For each parameter with male range of a – b and female range of c – d, values ‘a’ and ‘d’ were the identification points for females and males respectively. Any parameter reading less than ‘a’ was regarded as female skull and greater than ‘d’ was regarded as male skull and in case where female range is more than male then ‘b’ and ‘c’ were identification points for female and male respectively. Similarly Demarking Points was calculated from calculated range i.e., Mean ± 3 S.D (a = minimum value in male range, b = maximum value in male range, c = minimum value in female range and d = maximum value in female range). Subsequently ‘t’ test was applied.

OBSERVATIONS

One hundred skull bones (50 males and 50 females) are studied in the present study. In all the skull bones Foramen magnum length, breadth and mastoid length are measured. As the first part of study parameter is analyzed statistically and mean, standard deviation, range, calculated range (mean±3 SD), Demarking points and Identification point are obtained. Percentage of the skull bones identified by demarking point, percentage of skull bones identified by

identification point is calculated. Then ‘t’ test is applied.

Table 01: Statistical analysis of Foramina magnum length of skull

Details of measurement	Male (mm)	Female (mm)
Mean	33.46	29.62
SD	5.04	2.01
Range	26-43	24-34
Identification point (IP)	>34 mm	<26 mm
Percentage of bones identified by IP	38%	06%
Standard error	0.71	0.28
Calculated range (Mean±3SD)	18.33-48.59	23.59-35.65
Demarking point (DP)	>35.65	<18.33
Percentage of skull sexed correctly by DP	34%	0%

‘t’ test: P<0.001 (Highly significant)

The mean foramina magnum length of male skull was 33.46 mm ranging between 26-43 mm. The mean foramina magnum length of female skull was 29.62 mm with the values ranging between 24-34 mm. The identification point of male skull was >34 mm and of female skull was <26 mm and percentage of skull identified by I.P alone was 38% of males and 06% of females. The SD for male and female were 5.04 and 2.01 respectively. The calculated range of mean±3SD in males and females was 18.33-48.56 mm and 23.59-35.65 mm respectively. The demarking point for males was >35.65 mm and for female it was <18.33 mm. The percentage of skull identified by DP alone was 34% for males and 0% for female. ‘t’ test was highly significant with p<0.001.

Table 02: Statistical analysis of Foramina Magnum Breadth (FMB) of Skull

Details of measurement	Male (mm)	Female (mm)
Mean	29.86	27.64
SD	2.09	2.35
Range	25-36	23-33
Identification point (IP)	>33mm	<25mm
Percentage of bones identified by IP	02%	08%
Standard error	0.30	0.33
Calculated range (Mean±3SD)	23.59-36.13	20.58-34.70
Demarking point (DP)	>34.70	<23.59
Percentage of skull sexed correctly by DP	02%	02%

‘t’ test: P<0.001 (Highly significant)

The mean foramina magnum breadth of male skull was 29.86 mm ranging between 25-36 mm. The mean

foramina magnum breadth of female skull was 27.64 mm with the values ranging between 23-33 mm. The identification point of male skull was >33 mm and of female skull was <25 mm and percentage of skull identified by I.P alone was 02% of males and 08% of females. The SD for male and female were 2.09 and 2.35 respectively. The calculated range of mean±3SD in males and females was 23.59-36.13 mm and 20.58-34.70 mm respectively. The demarking point for males was >34.70 mm and for females it was <23.59 mm and the percentage of skull identified by DP alone was 2% of both male and females. 't' test was highly significant with p<0.001.

Table 03: Statistical analysis of Mastoid length (ML) of skull

Details of measurement	Male (mm)	Female (mm)
Mean	26.64	24.7
SD	2.74	2.66
Range	20-34	20-33
Identification point (IP)	>33 mm	<20 mm
Percentage of bones identified by IP	2%	0%
Standard error	0.39	0.38
Calculated range (Mean±3SD)	18.42-34.86	16.72-32.68
Demarking point (DP)	>32.68	<18.42
Percentage of skull sexed correctly by DP	2%	0%

't' test: P<0.001 (Highly significant)

Table 04: Showing Comparison of Foramina Magnum Length

Studies	Male				Female				SS
	N	M	R	SD	N	M	R	SD	P
Keen ⁴ (1950)	50	36.3	30-44	2.9	50	34.8	30-40	2.4	—
Hong Wei Song et al ³ (1992)	30	34.1	—	2.6	30	32.1	—	2.1	<0.001
Deshmukh & Deverthi ⁵ (2003)	40	34	26-40	3.09	34	34	30-38	2.05	>0.05
Present study (2011)	50	33.46	26.43	5.04	50	29.62	24-34	2.01	<0.001

Where N – no of skull, M – Mean, SD – Standard deviation, R – Range, SS – Statistical significant, scale in mm.

Foramina magnum Breadth

Present study determined I.P. for male skull as >33

The mean mastoid length of male skull was 26.64 mm ranging between 20-34 mm. The mean mastoid length of female skull was 24.7 mm with the values ranging between 20-33 mm. The identification point of male skull was >33 mm and of female skull was <20 mm and percentage of skull identified by I.P alone was 02% of males and 0% of female. The SD for male and female were 2.74 and 2.66 respectively. The calculated range of mean±3SD in males and females was 18.42-34.86 mm and 16.72-32.68 mm respectively. The demarking point for males was >32.68 mm and for female it was 18.42 mm. The percentage of skull identified by DP alone was 2% for males and 0% for female. 't' test was highly significant with p<0.001.

DISCUSSION

Foramina magnum Length:

Present study determined I.P. for male skull as >34 mm and that for female skull as <26 mm. Similarly D.P. for males as >35.65 mm and for female as <18.33 mm.

The findings of present study was similar with Hong Wei Song³ (1992) on Chinese skulls as shown in table no.4

mm and that for female skull as <25 mm. Similarly D.P. for males as >34.70 mm and for female as <23.59 mm.

The findings of present study are similar with Hong Wei Song (1992) on Chinese skulls

Table 05: Showing Comparison of Foramina Magnum Breadth

Studies	Male			Female			SS
	N	M	SD	N	M	SD	P
Hong Wei Song et al ³ (1992)	30	27.5	2.4	30	25.8	1.8	<0.001
Deshmukh & Deverthi ⁵ (2003)	40	29	1.97	34	28	2.09	>0.05
Present study (2011)	50	29.86	2.09	50	27.64	2.35	<0.001

Where N – no of skull, M – Mean, SD – Standard deviation, SS – Statistical significant, scale in mm.

mm and that for female skull as <20 mm. Similarly D.P. for males as >32.68 mm and for female as <18.42 mm.

MASTOID LENGTH

Present study determined I.P. for male skull as >33

Findings of present studies were similar with previous workers as shown in table no.06.

Table 06: Showing Comparison of Mastoid Length

Studies		Male	Female	SS								
		N	M	R	SD	DP	N	M	R	SD	DP	P
Keen ⁴ (1950)		50	29.3	21-27	3.6	—	50	26.5	19.3	3.1	—	—
Giles & Elliot ² (1963)	White	75	28.06	2	2.67	—	75	25.21	—	2.74	—	<0.05
	Negro	75	30.32	2	2.75	—	75	26.34	—	2.65	—	
Bagde ⁶ (1981)		70	31.8	25.3	2.8	>32	30	27.8	23-32	2.24	<25	<0.001
Maryna Steyn & Yasar Iscan ⁷ (1998)		43	34	—	3.39	—	46	30.9	—	3.9	—	<0.001
Deshmukh & Deverthi ⁵ (2003)		40	29	22-36	3.16	>39	34	27	21-36	4.02	<19	<0.05
Present study (2011)		50	26.64	20-34	2.74	>32.68	50	24.7	20-33	2.66	<18.42	<0.001

CONCLUSION

With parameter like foremena magnum length, 34% of male skulls and 0% of female skull.i.e., overall 17% of skulls can be sorted out using demarking point and similarly using identification point, 38% of male skulls and 06% of female skulls i.e., overall 22% of skull can be sorted out and this parameter is statistically highly significant. Likewise, with foramena magnum breadth, 02% of male skulls and 02% female skulls i.e., overall 02% of skulls can be sorted out using demarking point and 02% of male skulls and 08% of female skulls i.e., overall 05% of skulls can be sorted out using identification points and this parameter too is statistically highly significant. With parameter, mastoid length 02% of male skulls and 0% of female skull i.e., overall 01% of skull can be sorted out with demarking point and 02% of male skulls and 0% of female skulls i.e., overall 01% of skull can be sorted out with identification point and like other parameters, this is also statistically highly significant.

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Detection and Characterization of Children's Soft Toy for Phthalate Esters

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ABSTRACT

On November 19, 2009, the European Union regulated three phthalates esters; Benzyl Butyl Phthalate (BBP), DiButyl Phthalate (DBP), and DiEthylHexyl Phthalate (DEHP) to a limit of less than 0.1% in all imported toys and articles. However, the U.S regulation strongly prohibited BBP, DBP and DEHP and at any concentrations more than 0.1%. These regulations thus indicate how serious phthalate esters and their effect on health. In the current study, five (5) imported samples of soft toys were obtained from local markets and analyzed for six (6) types of phthalate esters of BBP, DBP, DEHP, Di-n-Octyl Phthalate (DnOP), DiIsoNonyl Phthalate (DINP) and DiIsoDecyl Phthalate (DIDP) respectively. The method used was established by Consumer Product Safety Commission (CPSC) Malaysia while characterization performed by Fourier Transform Infrared (FT-IR) spectroscopy, Thin Layer Chromatography (TLC), Thermogravimetric Analysis (TGA) and Gas Chromatography-Mass Spectrometry (GC-MS). This study found all the samples to contain high percentage of DEHP while two (2) contained acceptable levels of DBP. Other phthalate esters were however not detected or below the detection limit of GC-MS.

Keywords: Phthalate Esters, Soft Toy, Safety Regulation, Health Effects

INTRODUCTION

Phthalate esters (PAES) are the most common chemical widely used to modify the physical properties of plastics products to increase flexibility, transparency, softness, durability and longevity^{1,2}. It also provides plasticity to otherwise rigid materials such as polyvinyl chloride and other polymers. Phthalates thus are widely used in toys, childcare items and other household products.

Chemically there is no bond between phthalates and the polymeric material, thus phthalates are expected to leach out to the surrounding. The main concern is the migration of phthalates to human especially children. Infants have a tendency of mouthing toys and leaching of phthalates via saliva is one of the routes of administration into children^{3,4}.

On December 14, 2005 The European regulations specifically limit three phthalates – DiEthylHexyl Phthalate (DEHP), DiButyl Phthalate (DBP), and Benzyl Butyl Phthalate (BBP) – to a level of less than 0.1 % in all toys and articles designed to be put in a child's mouth. This regulation also limits DiIsoNonyl Phthalate (DINP), DiIsoDecyl Phthalate (DIDP), and Di-n-Octyl Phthalate (DnOP) to less than 0.1 % in articles that are designed to be quenched or put in a child's mouth⁵. The U.S. regulations are slightly different – DEHP, DBP, and BBP, have been permanently prohibited at concentration of more than 0.1% in "children's toys" or "child care articles." Three additional phthalates – DINP, DIDP, and DnOP – have been conditionally prohibited at a concentration of more than 0.1 %, in "children's toys" or "child care articles"^{6,7}.

Existing method for the detection of phthalates requires large volume of hazardous solvents, time consuming, costly and labor intensive. Hence, this study will develop a new simple and reliable test method with regards to the measurement of the

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content and identification of six regulated PAES in toys and children products in order to fulfill the regulations requirements for exporting Malaysian rubber toys products in the EU and USA. The developed is expected to be fully implemented by Malaysian Rubber Board (MRB) as a standard regulation for exporting toys products from rubber.

MATERIALS AND METHOD

The analysis involved analyzing five types of imported rubber toys that has been purchased from the market to measure the phthalates esters and the polymer type in the toys. The compounds of interest in this study are, Dibutyl phthalate ($C_{16}H_{22}O_4$, DBP), Diethylhexyl phthalate ($C_{24}H_{38}O_4$, DEHP), Benzyl butyl phthalate ($C_{19}H_{20}O_4$, BBP), Di-n-octyl phthalate ($C_{24}H_{38}O_4$, DnOP), Diisononyl phthalate ($C_{26}H_{42}O_4$, DINP) and Diisodecyl phthalate ($C_{28}H_{46}O_4$, DIDP) respectively. Benzyl benzoate ($C_{14}H_{20}O_2$, BB) was used as internal standard (IS). β -sitosterol were used as authentic standard in TLC analysis. All standard were analytical grade or higher and was obtained from AccuStandard. The reagents used in this study are Methanol, Nitric Acid, Tetrahydrofuran (THF), n-Hexane, Acetone, Petroleum ether, Diethyl ether phosphomolybdic acid and Cyclohexane purchased from Merck, Germany. All reagents used were of GC grade or higher unless stated otherwise.

Determination of the Polymer Type

Samples were soxhlet extracted using acetone for 16 hours. The extracted was subjected to Fourier Transform Infrared (FTIR) and Thermogravimetric

Analyzer to determine the polymer type. The polymer absorption band and the polymer type was identified and classified.

Extraction of Phthalate Esters

Sample was prepared in the laboratory using method established by Consumer Product Safety Commission (CPSC) Malaysia, which used tetrahydrofuran solvents as extraction medium. Prior to analysis, each component part was cut into small pieces (no dimension larger than 2 mm), or milled/ground into a representative powder. 0.05 ± 0.005 g of the sample was dissolved completely in THF. For sample larger than 0.05g, 10mL of THF was added for every 0.1g of sample. The sample was shook, and stirred for at least 30 minutes to allow dissolution. Any PVC polymer occurred was subjected to precipitation with 10mL of n-hexane for every 5mL of THF used. The sample was continuously shaken. This step was remained for 5 minutes in order for the polymer to settle (longer times may be necessary to minimize clogging of filters in subsequent step). A mixture of THF/n-hexane solution was filtered through a 0.45 μ m PTFE filter. 0.3 ml of the THF/hexane solution was combined with 0.2 ml of internal standard (BB, $150 \mu\text{gml}^{-1}$) in a GC vial, and was diluted to 1.5 ml with cyclohexane. The sample was subjected to Gas Chromatography-Mass Spectrometry (GC-MS).

GC-MS Analysis

Table 2.1 shows parameter used in GC-MS analysis of phthalates. Phthalate analysis was performed on Agilent model series 6890 with a 5975C Mass Spectrometer Detector.

Table 2.1: GC-MS Operating Procedures and Quality Control Measures

Parameter	
Column	DB-5MS; 30 m x 0.25 mm ID x 0.25 μ m
Flow Mode	1 ml/min, constant flow (He gas)
Inlet Mode	20:1 Split or Splitless
Injection Amount	1 μ l
Inlet Temperature	290° C
Solvent Delay	5 min
Initial Oven Temp, Hold Time	50° C, 1 min
Ramp 1	30° C/min, 280° C
Ramp 2	15° C/min, 310° C
Final Hold Time	4 min or longer

OBSERVATION AND RESULTS

A. Analysis of Thermal Stability using Thermogravimetric Analyzer (TGA)

In this study a preliminary analysis was done and no $\hat{\alpha}$ -sitosterol was detected indicating the absence of natural rubber in the samples. The toys were then characterized accordingly. Materials that exhibit weight loss or gain due to decomposition, oxidation, or dehydration of PVC were investigated. Results showed that thermal degradation of PVC proceeds in two steps. First, elimination of Hydrogen Chloride (HCl) at 262°C leads to formation of polyene sequences with then rearrange and decompose to aromatic and aliphatic hydrocarbons at 472°C ⁹.

TGA results showed a second rapid loss of weight observed between 350-480°C. This was due to material decomposition of the dehydrochlorinated product of PVC. Final weight loss was observed starting from 500°C. It corresponded to carbonization of the dehydrochlorinated residue. Corresponding to the HCl loss, unsaturation formation resulting in discolouration of the polymer was observed. Hence, S-shaped curves were observed on all the samples. This is similar to report by Druesdow and Gibbs which reflected the activation of weak links in the polymer ⁹.

From the results, it was found that only slightly different in the percentage weight loss for each toys sample were obtained by TGA analysis. Toys samples 1, 2, 3, 4 and 5 had weight loss percentage of 87.32%, 89.87%, 91.94%, 90.53% and 87.88% respectively.

B. Identification of polymer type using FTIR

Identification of the polymer material was carried out using FTIR before the quantification of PAES was initiated. PVC spectrum confirmed the usage of synthetic rubber in the present study of toys samples.

Result from FTIR shows that similar significance peak was present for all samples. FTIR absorbance spectra of the samples obtained were similar to each other. The doublet peak corresponds exclusively to the plasticizer and served as the best indicator for phthalate groups. The bands corresponding to the carbonyl and ester group, as well as those corresponding to the aromatic and aliphatic C-H bonds can also be observed in the spectrum ¹¹. Spectrum of the plasticizer shows the typical doublet of the phthalates at 1580 and 1600 cm^{-1} ^{11,10}. The doublet peaks of phthalates are present at 1601.29 and 1579.66 cm^{-1} .

Further investigation showed the IR absorption spectra of PVC plasticized with phthalates exhibit a strong band at 1710-1750 cm^{-1} range due to the ester carbonyl groups (-O-C(=O)-) of the phthalate ¹². The absorption of carbonyl band occurs at 1721.66 cm^{-1} . This band however had undergone significant changes. The decrease in the intensity of this band is accompanied by a simultaneous broadening, indicating the conversion of phthalate, and simultaneous formation of bands of new groups or compounds that contain differently substituted keto- groups. The existence of the ester carbonyl peak at 1722 cm^{-1} signalizes the attachment of phthalate fragments to the polymer and showed indication of an indirect effect involving chemical reactions of reactive species formed by the photolysis of the plasticizer with PVC ¹². Instead, the methylene asymmetric stretch peaks at 2,925 cm^{-1} with a methine C-H stretch peaking at 2,958 cm^{-1} . The methylene scissors deformation split at 1,435 cm^{-1} and 1426 cm^{-1} . PVC is sometimes heavily plasticized with phthalates or phosphate and its infrared spectrum can be obscured until the plasticizer had been extracted.

C. Analysis of Phthalates Esters via GC-MS

Peaks for interfering ions in excess of 25% of the base peak are absent; the relative responses of the qualifier ions to the quantifying ion are within an acceptable range of 10%. The most abundant ion formed in the mass spectrometer is called the base peak. In the mass spectra of phthalates the base peak is indicated m/z value 149, for this determination this is referred to as the target ion for quantification ^{13,14}.

Typical chromatograms for internal standards and 6 Phthalate esters standard solution in cyclohexane were collected. The elution order in retention time is BB, DBP, BBP, DEHP, DnOP, DINP and DIDP. It clearly shows that the analytical method proposed in this work completely separates all the analyte within 14 minutes of GC-MS analysis. The confirmation of presence was monitored by the following qualifier ions are m/z 206 (BBP), m/z 223 (DBP), m/z 279 (DEHP and DnOP), m/z 293 (DINP) and m/z 307 (DIDP) ¹⁰. Internal calibration standard was prepared by spiking Benzyl benzoate (BB) with known amount concentration of 20ppm. The calibration curves for all of the phthalate esters were linear in the investigated concentration range, coefficient of correlation more than 0.9983.

From previous study, the fragmentation pattern of DEHP, two hydrogen atoms are transferred from the

parent ion to the m/z 279 fragment. This ion is two mass units heavier than the cleaved fragment would be if unmodified¹⁵. Prior work has documented that the molecular ion peak for phthalate compounds is

usually weak and not always present in the mass spectra, but the $(M-R)^+$ and $(M-OR)^+$ (R =alkyl group) fragments can be secondary form of identification¹⁶.

Table 3.3: Phthalate esters content in toy samples

Sample	Phthalate esters content %, w/w					
	DBP(%)	DnOP(%)	BBP(%)	DEHP(%)	DINP(%)	DIDP(%)
1	ND	ND	ND	0.65±0.02	ND	ND
2	0.06±0.01	ND	ND	0.76±0.02	ND	ND
3	ND	ND	ND	0.68±0.02	ND	ND
4	0.05±0.01	ND	ND	0.56±0.02	ND	ND
5	ND	ND	ND	0.09±0.02	ND	ND

The total areas of each analytes were processed from the ion abundance of the quantifying ion followed by confirmation using the qualifier ions summarized in Table 3.2. All of the analyses were repeated three times with the error of analysis of each samples calculated as shown in table 3.3. From table 3.3, the phthalates identified and their contents in the investigated products are described. Investigation of phthalates in five toys sample showed high percentage content of DEHP ranging 0.09% up to 0.76%. Only small amounts of other phthalates, DBP, with maximum of 0.05% were found in these products. Other phthalates were not detected either not present or beyond the detection limit of GC-MS used. Four (4) out of 5 toys samples failed to fulfill the regulations as prescribed by EU or US respectively.

CONCLUSION:

In this study, none of the soft toys analyzed were found made from natural rubber. High concentration of DEHP was detected in all the samples, and 4 out of 5 failed to fulfill neither the EU nor US regulations limits. This method is found to be simple, and reliable for detection of phthalates esters in children's toys.

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Conflict of Interest: None

Ethical Clearance: None needed.

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Study of Variations in the Diameter (Caliber) of Right Hepatic Vein in Male Cadaveric Livers of South Indian Population

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ABSTRACT

The diameter of right hepatic vein is measured from the 25 Male cadaveric livers by Vernier Caliper. A) Diametric Mean Value of right hepatic vein near Inferior Venacava is $1.88 \text{ cm} \pm 0.23$ (SD = 0.57), b) Diametric mean value of the right hepatic vein terminating at inferior venacava was 0.98 ± 0.3 (SD = 0.82). c) Diametric mean value at the depth of 2cm in inferior venacava is $2.25 \text{ cm} \pm 0.8$ (SD = 0.19). d) Diametric mean value of tributaries of right hepatic vein is $3.1 \text{ cm} \pm 0.43$ (SD = 1.77). This diametric (caliberic) study will certainly enable the surgeon for planned surgeries and minimize the risk of complication during the resection and transplantation of liver because right hepatic vein present in the right portal scissura in most of the livers. Moreover these diametric study will have clinical and radiological importance as increased diameter was observed in non-alcoholic fatty liver (1) and in portal hypertension in Budd-Chiari Syndrome (2).

Keywords: (IVC) Inferior Venacava, Vernier Caliper, Cadaveric liver, Resection of lobes, Transplantation

INTRODUCTION

As liver is the busiest port in the lake of life because it is highest metabolic centre of the body, hence no one can live without "liver"

Hepatic Veins are formed by the union of Central Vein of the lobule. There are three hepatic veins which enter the inferior venacava below the diaphragm. These veins lie between the liver lobules and cross the portal triads. There are therefore no truly vascular planes in the liver. The middle hepatic vein enters Inferior venacava separately or more commonly joins left hepatic vein to form short common trunk. Hepatic veins have destitute of valves but a fibrous muscular loop around opening at inferior venacava is present which regulates the constriction and relaxation of the

hepatic vein⁽³⁾. Hepatic veins are so thin that, they are easily compressed by lymph nodes due to increased exudation. This produces a post sinusoidal obstruction with increased sinusoidal pressure. This leads to portal hypertension in ascites⁽⁴⁾.

The right hepatic vein drains major part of blood from liver, which receives blood from liver, which receives blood from spleen and Pancreas also⁽⁵⁾. The right hepatic vein has more surgical importance because 60% of cases right hepatic vein can be ligated easily from outside the liver but safer to control hepatic vein from within substance of inferior venacava. The important cause of death in hepatic vein injuries apart from hemorrhage is as air embolism which usually occurs at the time of laparotomy.⁽⁶⁾ Hence attempt is made to study the diameter of right hepatic vein at various levels so that, ligation can be made properly to avoid injuries to hepatic veins more over diameter of hepatic veins has radiological importance to diagnose pathology of liver.

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MATERIAL & METHOD

15 cadaveric livers preserved in formalin in the dissection theatre of JJM Medical College,

Davangere(Karnataka), and 10 from SS Institute of Medical Sciences and Research Centre, Davangere(Karnataka), total 25 Cadaveric livers are dissected and measured with help of Vernier Calipers and observations are noted.

OBSERVATIONS (RESULTS) OR FINDINGS

Table No.1 – Study of diameter of Right Hepatic vein near inferior venacava in adult male cadavers – The mean value is 1.88cm \pm 0.23 (SD = 0.57).

Table 1. Study of diameter of Right Hepatic vein proximal to Inferior Venacava

No of Cadaver	Diameter in cmsMean Value	SD	Confidence Interval value
25	1.88	0.57	1.66 – 2.11

Table No. 2 - Study of diameter of Right Hepatic vein on its termination into inferior venacava – The mean value is 0.98cm \pm 0.3 (SD = 0.82).

Table 2. Study of diameter of Right Hepatic vein on its termination at Inferior Venacava

No of Cadaver	Diameter in cmsMean Value	SD	Confidence Interval value
25	0.98	0.82	0.95 – 1.02

Table No. 3 - Study of dept of Right Hepatic vein at its termination in inferior venacava at 2 cm. – The mean value is 2.25cm \pm 0.8 (SD = 0.19).

Table 3. Study of depth of Right Hepatic vein on its termination at Inferior Venacava

No of Cadaver	Diameter in cmsMean Value	SD	Confidence Interval value
25	2.25	0.19	2.17 – 2.33

Table No. 4 - Study of diameter of tributaries of Right Hepatic vein – The mean value is 3.1 \pm 0.43 (SD = 1.07).

Table 4. Study of diameter of the tributaries of Right Hepatic vein.

No of Cadaver	Diameter in cmsMean Value	SD	Confidence Interval value
25	3.1	1.07	2.67 – 3.57

DISCUSSION

In the present study the diameter (caliber) of Right Hepatic vein near the inferior venacava, the mean value is 1.88cm \pm 0.3 (SD = 0.57) (Table - 1). This value is more or less in agreement with German Cadaveric liver study, the mean value of Right Hepatic vein near

Inferior venacava is 1.5 cm and accessory of tributaries diametric mean value was 0.6cm ⁽⁷⁾.

The diametric mean value of Right Hepatic vein at its termination in Inferior venacava was 0.98 cm \pm 0.3 (SD = 0.8) observed in the present study (Table-2). The same value is also observed in Chinese study their mean value was more than 0.50cm in 72% of liver⁽⁸⁾.

In the present study the diametric value of right Hepatic vein at the depth of 2 cm in Inferior venacava is 2.25cm \pm 0.8 (SD = 0.19)(Table-3). These value were also similar in radiological study of Turkish population, they were ranged between 2-3 cm ⁽⁹⁾.

In the present study the diametric mean value of tributaries of right Hepatic vein is 3.1cm \pm 0.43 (SD = 1.07) (Table-4). These values could not be compared with any previous studies as there was no English literature available. The probable reason could be that people within the same population are diverse due to different genetic makeup⁽¹⁰⁾. Of course veins have larger lumen related to the fact that, to transport the blood in given time to the same volume of the blood as the arterial system and the rate of flow is much slower hence variations of accessory veins are quite common to meet the requirement of hemodynamic pressure, but the relationship between cardiac physiology and liver physiology is bridged by hepatic veins. The knowledge of diametric study of right Hepatic vein is must for potential donors prior to the right lobe transplantation because variations in right Hepatic veins and its tributaries might prevent the operation or make it more complicated⁽¹¹⁾, because sudden decrease in diameter of right Hepatic vein and Inferior venacava alarm the worst prognosis during the surgery ⁽¹²⁾

SUMMARY AND CONCLUSION

The diametric value of Right hepatic vein (a) near Inferior venacava, (b) at the termination of Inferior venacava (c) at the 2 cm depth of Inferior venacava, and (d) tributaries of right Hepatic vein. This study will certainly help the surgeons for resection of lobes and transplantation of liver and radiological procedures because during pathological conditions due to enlargement of potential spaces of liver like space of dissaie and space of mal, there will be enlargement of these vessels also. It has diagnostic value in oncological and other clinical studies.

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Study of Patterns of Cranio-Cerebral Injuries in Deaths due to Fatal Vehicular Accidents

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ABSTRACT

In the present study 128 cases of head injury victims in fatal vehicular accidents autopsied are included. In vehicular accidents, among 128 cases studied who died due to fatal cranio-cerebral injuries, males were the commonest victims, 21-40 years was the common age group. Temporal and frontal bones were the commonest sites of fracture. Subdural hemorrhage was the commonest among the intracranial hemorrhages

Keywords: *Cranio-cerebral; Injuries, Vehicular Accidents*

INTRODUCTION

Head is that part of the body which is frequently injured as a result of accident and criminal violence. Head injury is one of the serious fatal injuries. So it is true to say that "no form of cranio cerebral injury is too trivial to be ignored or too serious to be despaired of". The medico legal importance of examination of road traffic injury case is to reconstruct traffic accident. Such examination will also help to detect "hit and run" cases. Proper examination and evaluation of such traffic injuries will help us while facing the cross examination and also to guide the courts towards reconstruction of the whole accident¹. India is one of the fast developing countries. It is mainly an agricultural country as compared to other industrialized nations. But now due to rapid industrialization and increase in fast traffic, injuries of the head have got increasing importance, especially in the urban and industrialized areas².

MATERIAL AND METHOD

The study included 128 cases of cranio-cerebral injury victims with history of fatal vehicular accidents autopsied over a period of three years (2009-2012) in a District hospital. Various epidemiological characteristics of the cases and medico legal reports were gathered from police records, records section of the hospital or by the direct interrogation of the police officer, relatives, friends of the deceased accompanying

the dead body. Data was also collected from postmortem examination report of the cases, inquest reports, and investigation reports wherever applicable were included.

RESULTS

Table 1. Age and sex wise distribution of cases

Age range (years)	Male	Female	Total	Percentage
0 – 10	2	1	3	2.35
11 – 20	14	2	16	12.50
21 – 30	30	2	32	25.00
31 – 40	35	3	38	29.68
41 – 50	18	1	19	14.87
51 – 60	8	5	13	10.15
61 – 70	5	2	7	5.46
Total	112 (87.5%)	16 (12.5%)	128	100.00

The age of the victims varied from 1-70 years. The peak incidence was observed in the age group of 31-40 years comprising 29.68% of cases. It was also observed that 25% belonged to the age group 21-30 years. Thus, 54.68% of the cases comprised of age group of 21-40 years in the study. Individuals in the age group of 0-10 years were the least affected 2.34% followed by older people i.e., 60 years and above in 5.46% of total cases. Males comprised a majority and constituted 112 (87.5%) compared to females who were only 16 (12.5%). The male to female ratio in the study was 7:1 (male=112; females=16).

Table 2: Time of injury

Time of injury	No. of cases	Percentage
12.00 midnight to 6.00 am	16	12.50
6.00 am to 12.00 noon	32	25.00
12.00 noon to 6.00 pm	41	32.00
6.00 pm to 12.00 midnight	34	26.50
Time not known	5	4.00
Total	128	100.00

From the above table, it is evident that maximum number of fatal head injury cases occurred in between 6.00 AM to 6.00 PM i.e., 57.5% and the remaining in between 6.00 PM and 6.00 AM i.e., 38.5%. In 4% cases, no authentic information as regards to the time of occurrence was available.

Preponderance of head injury cases during day time can be explained by the fact that active physical work is undertaken mainly during day time.

Table 3: Location of fracture skull, vault and base

Location	No. of cases	Percentage
Fracture of vault of skull	47	47.50
Basal fracture	1	1.00
Fracture of vault of skull and basal	51	51.50
Total	99	100.00

Among 128 cases, there was no fracture in 29 cases. The above table shows 51.5% cases showed fractures of vault and base, whereas 47% cases showed fractures of the vault only. In 1% cases basal solitary fracture of skull was observed.

Table 4: Percentage of type of fracture of skull

Type of fracture	Total	Percentage
Linear	52	52.53
Linear + Suture separation	02	2.02
Comminuted	18	18.18
Depressed comminuted	09	9.09
Depressed	17	17.17
Depressed + Suture separation	01	1.01
Pond	00	0.00
Total	99	100.00

From above table, it is obvious that in fatal cases of head injury linear fracture of skull is the commonest i.e. 52.53%. In 18.18 cases there was comminuted fracture while in 17.17% cases depressed fracture and in 9.09% cases depressed comminuted fracture. Sutural fracture separation associated with linear fracture in 2.02% cases and sutural fracture separation with depressed fracture in 1.01% cases. While there were no cases of pond fracture.

Table 5: Type and percentage of intracranial hemorrhage

Type of hemorrhage	Total	Percentage
Extradural hemorrhage	5	6.67
Subdural hemorrhage	30	40.00
Subarachnoid hemorrhage	7	9.33
Intracerebral hemorrhage	2	2.67
Subdural hemorrhage + subarachnoid hemorrhage	23	30.67
Extradural + subdural + subarachnoid hemorrhage	1	1.33
Subdural hemorrhage + intracerebral hemorrhage	2	2.67
Intraventricular hemorrhage + subdural hemorrhage	1	1.33
Intraventricular + Intracerebral hemorrhage	1	1.33
Extradural + Intercerebral	1	1.33
Subarachnoid hemorrhage + intracerebral hemorrhage	1	1.33
Extradural + subarachnoid hemorrhage	1	1.33
Total	75	100.00

From the above table, it is obvious that if type of hemorrhage is considered in isolation, then cases having subdural hemorrhage were the highest in number (40%) followed by cases of subarachnoid hemorrhage (9.93%), extradural hemorrhage (6.67%) and intracerebral hemorrhage (2.67%). If combinations of hemorrhages are taken into account, then also combination of subdural hemorrhage with subarachnoid hemorrhage was on the first place (30.67%), followed by various other combinations.

Table 6: Types of injuries to brain matter in fatal cases of head injuries

Injury to brain matter	No. of cases	Percentage
Contusion	56	61.54
Laceration	24	26.37
Contusion + laceration	11	12.09
Total	91	100.00

From the above table, it is seen that contusion of brain matter is often seen in fatal head injury cases (61.54%) followed by laceration (26.37%) and combination of contusion and laceration (12.09%).

DISCUSSION

In the present Study of Cranio-cerebral Injuries in Deaths Due to Fatal Vehicular Accidents 128 cases were studied.

The total number of cases studied are 128, out of which 87.5% were males and 12.5% were females with

a sex ratio 7:1. In a study of acute injuries of head, the sex ratio was 5:1³. As shown in Table-1, high preponderance of male in fatal head injury may be because males are bread earners, for which they go out of homes and major bulk of activities and assignment are carried by them as compared to females.

Head injury can occur at any age. In the present study, the maximum number of cases are (29.68%) in the age group of 31-40 years and if a broader age group of 21-40 years is considered then the percentage of head injury cases in this age group comes to 54.68%.

Janine Jagger et al⁴ in a study found that maximum occurrence of head injury for 20-29 years age group and then decline progressively. Katz Douglas⁵ in a study of 243 cases found that incidence to be the highest in 20-30 years age group as 47%.

In the present study of 128 cases, maximum number of persons sustained fatal head injury between 6.00 AM to 6.00 PM i.e., 57% and the remaining in between 6.00 PM to 6.00 AM i.e., 38.5% (Table-2). Similar observations are found in the study done by Janine et al⁴. Katie Gilbert, Mark McCarthy⁶ (1984) found that most fatal accidents occurred in day light.

In the present study, 77.5% cases had fracture skull, of which 51.50% had fracture of vault and base, whereas 47.5% cases showed fracture of vault only. 1% cases solitary basal fracture of skull was observed (Table-3). In a study of 20 cases of fatal injury by Devadiga & Jain³, 12 of these had fracture of vault as well as of the base of skull. Of the remaining cases, 8 had fracture of vault and 6 had basal fracture of skull.

In fatal cases of head injury, linear fracture of skull was commonest i.e., 52.52. In 18.18% cases there were comminuted fracture, 17.17% cases depressed fracture, 9.09% cases depressed comminuted fracture. Sutural fracture separation associated with linear fracture in 2.02% cases and sutural fracture separation with depressed fracture in 1.01% while there was no case of pond fracture in our study (Table-4). The findings of the present study, are also in accordance with the findings of a study at the Institute of Neurology, Madras⁷.

Intracranial haemorrhage was observed in 75 out of 128 cases of fatal head injury. If the isolated type of haemorrhage is considered then cases having subdural haemorrhage were maximum in number (40%) followed by subarachnoid haemorrhage 9.33%,

extradural haemorrhage 6.67% and intracerebral haemorrhage 2.67% (Table-5).

Walpole Levin⁸ in a study showed that in fatal head injury cases, subdural haemorrhage occurred in 60% cases and extradural haemorrhage in 50% cases. Reddy⁹ found that 25% of the haemorrhages were extradural, 53.5% subdural & 28% Subarachnoid. Devadiga & Jain³ found that 13.9% were extradural haemorrhages, 72.3% subdural & 30.5% subarachnoid. Our observations are in correlation with the above findings.

In the present study, occurrence of contusion of brain was 62.14% followed by laceration 26.55% and combination of contusion and laceration 10.77% (Table-6).

Blackwood et al¹⁰ found that contusions of the brain are extremely common in fatal head injury. Sharma et al¹¹ concluded that cerebral contusion was the commonest finding in head injury. Our observations are similar in correlation with the above documented series.

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Deaths due to Poisoning at District Hospital - A Retrospective Study

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ABSTRACT

Deaths due to poisoning are more in developing countries and methods of poisoning varies from one place to other. Hence to know the pattern of poisoning, a retrospective study was done at a district hospital, Raichur (Karnataka) between the years 2009 - 2012. During this period 302 cases of poisoning deaths were autopsied. These poisoning cases were studied to know age and sex distribution of the victims, commonest type of poisons used and manner of poisoning. In this study, majority 220 (72.85%) of the cases were due to organophosphorus compound, followed by snake bite 30 (9.93%), aluminium phosphide 21 (6.95%) and others respectively.

Keywords: *Poisoning, Unnatural Death, Organophosphorous Compound, Snake Bite*

INTRODUCTION

Unnatural deaths due to poisoning are one of the second common cause following road traffic accidents. Deaths due to poisoning may be suicidal, homicidal or accidental in nature. The commonest cause for poisoning in India and other developing countries is insecticides; the reason for this is agriculture and poverty. The method of poisoning depends on the various factors like, socioeconomic status, religious, cultural influences and easy availability of poison. It also varies from country to country and from one place to the other.

MATERIALS AND METHOD

The medico legal autopsies conducted at mortuary of district hospital, Raichur between the years 2009 – 2012 were considered for the present retrospective study. The data were collected from hospital case records, police inquest forms, post-mortem and

forensic science laboratory reports. The decomposed and unidentified bodies were excluded from the study.

RESULTS

In this study following results were found. Total number of deaths due to poisoning was 302 cases. Table No.1 shows age and sex wise distribution of poisoning deaths. Among the 302 deaths 211 (69.87%) were seen in males and 91 (30.13%) were seen in females with a ratio of 2.3:1. The incidence was more in the age groups of 21 – 30 years 120 (39.74%) followed by 31 – 40 years 70 (23.19%) and 41 – 50 years 50 (16.56%). In case of males, incidence was more in age group 21 – 30 years, followed by 31 – 40 years but in females the incidence was more in 21 – 30 years followed by 11 – 20 years.

Table No.1: Age and sex wise distribution of poisoning deaths

Age	Male	Female	Total	Percentage
0 -10 yrs	4	1	5	1.66%
11 - 20 yrs	12	28	40	13.25%
21 – 30 yrs	85	35	120	39.74%
31 – 40 yrs	53	17	70	23.19%
41 – 50 yrs	35	15	50	16.56%
51 – 60 yrs	7	3	10	3.31%
61 – 70 yrs	4	2	6	1.99%
> 71 yrs	1	0	1	0.30%
Total	211	91	302	100%

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Table No.2: Type of poisons

Poison	Male	Female	Total	percentage
Organophosphorous	162	58	220	72.85%
Snake bite	19	11	30	9.93%
Aluminium phosphide	10	11	21	6.95%
Organochlorine	10	8	18	5.96%
Alcohol	7	0	7	2.32%
Carbamates	1	1	2	0.66%
Pyrethroids	0	1	1	0.33%
Miscellaneous	2	1	3	1.00%
Total	211	91	302	100%

Table No. 3: Manner of Death

Manner of Death	Male	Female	Total	Percentage
Suicidal	183	74	257	85.10%
Accidental	24	14	38	12.60%
Homicidal	4	3	7	2.30%
Total	211	91	302	100%

DISCUSSION

Among unnatural deaths, poisoning is one of the causes of death worldwide. During the study it was found that occurrence of poisoning was more in males 211 (69.87%) than females 91 (30.13%) in the ratio of 2.3:1^{1,2}. The incidence was more in 21 – 30 years age group³ followed by 31 – 40 years and 41 – 50 years.

The common type of poisoning was with organophosphorous compound⁴ followed by poisoning due to snake bite, aluminium phosphide^{5,6}, organochlorine compound and others. But in a study pesticides poisoning was followed by carbon monoxide and drugs^{7,8}. In this study, there were only 2 cases of drug poisoning.

In this study, it was found that suicidal poisoning 257 (85.10%) was more than the incidence of accidental 38 (12.60%) or homicidal poisoning 7 (2.30%). The suicidal poisoning occurred more in males 183 (60.60%) than females 74 (24.50%). The suicidal poisoning was more than accidental or homicidal poisoning in this and other study⁹. The accidental poisoning was more due to snake bite 30 (9.93%) than other poisons in this study. The incidence of homicidal poisoning was low 7 (2.30%) and among this, incidence was more in children than adults.

CONCLUSION

To reduce deaths from self-poisoning, it requires intervention to reduce this harmful behaviour by detecting cause, by providing psychiatric counselling and provide quick medical help in management of

acute poisoning. The more stringent legislation and enforcement regarding the sale and distribution of the toxic substance is needed and substitution of the pesticide with safer agents is necessary. Enforcement of regulations and safety education to prevent pesticide poisoning should be carried out by the government.

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Comprehensive Study of Two Wheeler Road Traffic Accident Deaths in Hyderabad (Andhra Pradesh) Region

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ABSTRACT

Background: Road traffic injuries are the eighth leading cause of death globally, and the leading cause of death for young people aged 15-29. More than a million people die each year on the world's roads, and the cost of dealing with the consequences of these road traffic crashes runs to billions of dollars. Current trends suggest that by 2030 road traffic deaths will become the fifth leading cause of death unless urgent action is taken.

Objective: In road traffic accident fatalities, deaths are mainly due to head injuries, especially in case of two wheelers. An attempt is made in this study to make a scientific observation of these motor vehicle accidents with special reference to two wheelers, in the city of Hyderabad. A general reference is made towards the use of helmets in preventing head injuries.

Methodology: A comprehensive study of pattern of injuries sustained by the victims of road traffic accidents involving two-wheeler reported to Osmania General Hospital, Hyderabad during a period of 2010-11.

Results: The total number of autopsies conducted in the year 2010 are 4,636 which constitute roughly about 27.54 % and in the year 2011 are 4,530 which constitutes 28.69 %, RTAs showing a marginal increase of 100 cases per year. Two-wheeler rider fatalities are taken up as they themselves are constituting roughly about 39% in the year 2010 and 41% in the year 2011 of total number of road traffic accidents. Males are more prone to death by RTAs (83.78%) as compare to females (16.21%), making an M: F ratio of 5:1. Incidences of RTA are more in third (24.06%) and fourth decade (18.99%) as compared to both extremes of life.

Keywords: RTA, Two Wheelers, Injuries, Mortality

INTRODUCTION

Road Traffic Accident deaths are a human tragedy, a family shattered or disabled for life. Fatalities on the roads have become the number one cause of accidental deaths, not only in India but throughout the world. Approximately 1.24 million people die every year on the world's roads, and another 20 to 50 million sustain

nonfatal injuries as a result of road traffic crashes^{1,2}. In India, 11% of deaths due to non communicable diseases are due to injuries and 78% of injury deaths are due to road traffic accidents. They are the leading cause of mortality for young adults of less than 45 years and a major burden of disease across all age groups³. The incidences of road accidents in the city of Hyderabad are increasing year after year. Due to the fast pace of modernization, basic needs including the requirement of a vehicle for transportation are increasing rapidly and resulting in an epidemic situation of injury everywhere including developing countries¹. Road traffic injuries are increasing, notably in low- and middle-income countries, where rates are twice those in high-income countries^{2,3}. This is partly attributable to the rapid rate of motorization in many developing

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countries that has occurred without a concomitant investment in road safety strategies and land use planning. Indeed, current trends suggest that road traffic injuries will become the fifth leading cause of death by 2030, with the disparity between high- and low-income countries further accentuated². The magnitude of automobile injuries and resulting mortality and morbidity are creating many a problem not only to the doctors, police and other law enforcing agencies in the investigation and management of these cases, but also to the victims for the disability and suffering and to the nation as a whole for the loss of human resources. The road accidents are major part of daily work for medico legal expert in our cities. In Osmania medical college, 30% of total medico legal autopsies are on road accident fatalities. Even without quoting a lot of depressing statistics on road accidents, it is obvious that a motor cycle is more dangerous than a motor car. In our country the statistical data regarding road accidents is meager as there had been no controlled studies made on these aspects. In accidental fatalities the death is mainly due to head Injuries and spinal injuries especially in case of two wheelers. An attempt is made in this study to make a scientific observation of these motor vehicle accidents with special reference to two wheelers, in the City of Hyderabad. A general reference is made towards the use of helmets in preventing head injuries.

MATERIAL METHOD

A comprehensive study of pattern of injuries sustained by the victims of road traffic accidents involving two-wheelers reported to Osmania general hospital, Hyderabad during the year Jan 2010 to Dec 2011 has been made. A detailed information and data were collected from medical record section and National Information Centre.

RESULTS

In the year 2010 is 4636 and in the year 2011 4530, autopsies were conducted. In the present study two-wheeler rider fatalities are taken up as they themselves are constituting roughly about 39% in the year 2010 and 41% in the year 2011 of total number of road traffic accidents. Males are more prone to death by RTAs (83.78%) as compare to females (16.21%), making an M: F ratio of 5:1. Incidences of RTA are more in third (24.06%) and fourth decade (18.99%) as compared

to both extremes of life. The peak timings of two-wheeler accidents were either morning hours of 8-12

or evening hours between 4-8 pm. Incidence of deaths due to RTAs are maximum (40%) in two wheeler riders followed by pedestrians in 21% cases. Four wheelers were involved in 16% cases and bicyclists in only 5% cases. In two wheeler accidents most of the victims (97) were not wearing any protective helmets at the time of incidence while in only 3% cases the victims died due to multiple injuries even though they wore protective helmets. Head and face injuries are frequently seen in all types of injuries. In RTIs, this type of injuries was seen in two thirds of patients, Fractures and dislocations in upper and lower limbs are 17% to 38% among different injury causes. Injury to chest and abdominal organs are documented in 23% of patients. In 65% cases the head injury was so severe that the victims could not survive even for 12 hours after the incidence and most of them died either on the spot or on the way or immediately after they got admitted in the hospital. Only 21% could survive up to 2-7 days and 14% could survive more than 7 days following the intervention of particular treatment or appropriate surgery.

Table1: Number of RTA Deaths

Years	No of Accidents	No of injured	No of Deaths
2010	1377	1549	498
2011	1285	1540	507

Table2: Number of Two Wheer Accident Deaths

Years	No of autopsies	No of RTAD	% RTAD
2010	4636	1277	27.54
2011	4530	1300	28.69

Table3: Age and Sex wise distribution of RTAs

Age Group (In Years)	Male	Female	Total Cases
0 – 15	21	37	58
16 – 29	348	51	399
30 – 45	266	48	314
46 – 60	192	23	215
61 & Above	15	04	19
Total	842	163	1005

Table4: Relation of Accident With type of Vehicle

Motor Vehicle	Number of cases (%)	
Two Wheeler	1005	(40)
Four Wheeler	412	(16)
Pedestrian	567	(21)
Bicycle	129	(05)
Un Specific	464	(18)
Total	2577	(100)

DISCUSSION

Road traffic accidents are the leading cause of serious injuries with associated head trauma especially in youth and middle age^{4, 5, 6, 7}. Despite tremendous progress in all fields of life, RTA continues to be the major cause of morbidity and mortality in India. The road traffic accidents related deaths constitutes about 25 to 30% of the total number of autopsies conducted per year which itself indicates the importance of unnatural mortality and medico legal significance of these cases (Table 1). In two wheeler accidents we noticed that most of the victims who died because of fatal head injury where those who did not wear helmets, which shows that the safety helmet can be the life saving during the accident involving two wheelers (Table 2)^{9,11}. Male predominance continues similar to the findings of the studies done by others in previous years (Table 3)^{4,6,7,8}. This can also be explained by the fact that during this age, people especially males are more mobile, go out for work and take risks, while elderly people, females and children usually stay at home. In our study the common cause of RTA was two wheelers and pedestrian accidents in comparison to four wheelers and bicycles accidents which shows that the four wheelers are comparatively safer than two wheelers (Table 4)^{3,5,8,12}. We found that two third of the victims of RTA's died either on the spot or within 24 hours of the incidence, and the rest could survive for a couple of days to a maximum of two weeks after getting some medical or surgical interventions, similar to other studies^{3,8}.

CONCLUSION

In two-wheeler fatalities 30% mortality are seen at the spot itself. So nothing can be done to reduce the mortality at this level. About 70% of the fatalities have the opportunity of getting Medical care. Hence an improved Medical care has better reflection by lowering the mortality. It has been found to be the commonest cause of death in this age group. Males predominate over females. These accidents occur more frequently in certain age groups, at certain times of day and at certain localities. Some people are more prone to accidents than others. Alcohol, unawareness of traffic discipline and carelessness increase the susceptibility.

The two wheeler accident deaths are high because of lack of preventive measures such as speed control,

helmets in motor cyclists and seatbelts in automobiles and poorly controlled traffic conditions, poor road conditions.

SUGGESTIONS

1. Strict implementation of wearing of helmets while riding two wheelers on roads.
2. Maintaining traffic rules and regulations while riding.
3. Maintaining proper roads by the government.
4. Taking all safety measures while riding such as control of speed, cell phone use and drunken Riding.

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Role of Odontology in Forensic Medicine: An Update

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ABSTRACT

The role of dental characteristics to identify deceased individuals is well recognized since late nineteenth century. This application of dental science for the identification of the deceased had originally been driven by external agencies, for instance police; coroner's and courts instead of the dental community. However once the value of forensic odontology was recognized by dentists, it has evolved into a specialty within. Today forensic odontology is considered specialized and reliable method for identification of the deceased, particularly in disaster situations.

Keywords: Odontology, Identification, Age Estimation

INTRODUCTION

Forensic Odontology, or forensic dentistry, was defined by Keiser-Neilson in 1970 as the branch of forensic medicine which in the interest of justice, deals with the proper handling and examination of dental evidence and proper evaluation and presentation of the dental findings.¹

There are three major areas of activity embracing current forensic odontology namely:

- 1) Examination and evaluation of injuries to teeth, jaws, and oral tissues resulting from various causes.
- 2) Examination of bite marks for identification of a suspect.
- 3) Examination of dental remains from unknown persons or bodies for identification of the latter.²

HISTORY

The use of dentition as an evidence is not recent. There are historical reports of identification by recognizing specific dental features as early as 49th century. Forensic Odontology, as a science, appeared in 1897 when Dr. Oscar Amoedo wrote his doctoral thesis entitled "L'Art Dentaire en Medecine Legale" describing the utility of dentistry in forensic medicine with particular emphasis on identification.³

Teeth in the determination of human identity

The most common role of the forensic dentist is identification of deceased individuals.⁴ Dental identification is required in two main situations. Most frequently examination is for a comparative identification used to establish that the remains of a decedent and a person represented by ante mortem dental records are the same individual. In situations where ante mortem records are not available, and no clues to the possible identity exist, a postmortem dental profile is completed by the forensic dentist suggesting characteristics of the individual likely to narrow the search for the ante mortem materials.⁵

Comparative dental identification

The dentition is significant in the human identification process primarily because teeth and the jaw structures resist even the most severe environmental conditions and trauma, particularly the teeth, because of the inherent durability of enamel and cementum. As a result, aside from fingerprint analysis, one of the most legally reliable forms of identification of human remains is by comparison of dental structures with dental records especially in situation where the fingerprints may not be available due to putrefaction or damage due to other physical agents to which the body is exposed. Among other distinctive characteristics for ante mortem and postmortem comparisons are maxillary sinus patterns, bone trabeculation patterns, and orbital outlines.

The following categories and terminology for body identification are suggested for use in communicating the results of a forensic odontology identification investigation.

Positive identification: The ante mortem and postmortem data match in sufficient detail to establish that they are from the same individual. In addition, there are no irreconcilable discrepancies.

Possible identification: The ante mortem and postmortem data have consistent features, but, due to the quality of either the postmortem remains or the ante mortem evidence, it is not possible to positively establish dental identification.

Insufficient evidence: The available information is insufficient to form the basis for a conclusion.

Exclusion: The ante mortem and postmortem data are clearly inconsistent. However, it should be understood that identification by exclusion is a valid technique in certain circumstances.⁶

Postmortem dental profiling

In cases where dental records are not available, Forensic Odontology can still contribute to establishing the identity by creating a profile of how the deceased person was during life. This includes any unusual oral habits, type of diet, socio-economic status, ancestral background, and sex but most importantly the age of the person at time of death. Dental aging is based on the chronology of formation and eruption of teeth. This helps in determining the age for persons up to 15 years-old in a fairly accurate manner. After 15 years of age, dental aging relies on modifications that take place during life, such as attrition, cementum formation and root transparency. Despite being extensively studied, results of aging of this latter group remain less than optimal because those age-related modifications can be influenced by various factors, such as diet and dental pathosis.⁷

The information from postmortem dental profiling process will enable a more focused search for antemortem records. The determination of sex and ancestry can be assessed from skull shape and form. Generally, from skull appearance, forensic dentists can determine race within the three major groups: Caucasoid, Mongoloid and Negroid. Additional characteristics, such as cusps of Carabelli, shovel-shaped incisors and multi-cusped premolars, can also assist in determination of ancestry.⁸ Sex determination is usually based on cranial appearance, as no sex

differences are apparent in the morphology of teeth. Microscopic examination of teeth can confirm sex by the presence or absence of Y-chromatin and DNA analysis can also reveal sex of an individual.^{9,10}

The presence of erosion can suggest alcohol or substance abuse, an eating disorder or even hiatus hernia while stains can indicate smoking, tetracycline use or betel nut chewing.¹¹⁻²⁰ Unusual wear patterns may result from pipe stems, cigarette holders, hairpins, carpet tacks or previous orthodontic treatment.^{21,22} The quality, quantity and presence or absence of dental treatment may give an indication of socio-economic status or likely country of residence.²³ If the postmortem profile does not elicit the tentative identity of the deceased it may be necessary to reconstruct the individual's appearance during life. This is the responsibility of forensic artists who use the dental profile to help with the facial reproduction.

DNA in dental identifications

The resilient nature of the dental hard tissues to environmental assaults ensure that teeth represent an excellent source of DNA material.²⁴ When conventional dental identification methods fail, this biological material can provide the necessary link to prove identity. With the advent of the polymerase chain reaction, a technique that allows amplification of DNA at pre-selected specific sites, this source of evidence is becoming increasingly popular with investigators. Comparison of DNA from the teeth of an unidentified individual can be made to a known ante mortem sample like stored blood, hairbrush, clothing, cervical smear or to a parent or sibling. A recent study has found out that mitochondrial DNA can be sourced from dentine powder obtained via cryogenic grinding, and also via dentine in the case of root-filled tooth.²⁵⁻²⁷

Dental identification in mass disasters

The most descriptive definition for a mass disaster or mass casualty incident would be: "Any situation, man-made or natural, which overtaxes the normal emergency resources available within a community."²⁸ Forensic Odontologists have contributed to the resolution of many mass disasters. The 2004 Indian ocean tsunami is probably the most eminent example on the success of Forensic Odontologists in identifying large number of victims in short time. Nearly half of the victims in Thailand were identified by dental characteristics method alone, and Forensic Odontologists contributed to the identification of the remaining half by assisting the fingerprint, DNA and

physical characteristics teams.²⁹The dental structures and dental restorations may be the only parts of the body not destroyed, and they can be used even though they may be scattered over a wide area, such as occurs in aircraft accidents, terrorist attacks, partial incineration, fragmentation, and severe decomposition.³⁰ It is important to note that there is no minimum number of concordant points that are required for a positive identification which is different from the analysis of fingerprint.³¹ In some cases, a single tooth can be used for identification if it contains sufficient identifying or unique features. Equally, a full mouth series of radiographs may not reveal sufficient detail to render a positive identification.³² The certainty of identification conclusion lies with the forensic odontologist, who must be prepared to justify his conclusions in court.³³

Age estimation

Estimation of age is one of the main tasks of a forensic practitioner, especially in third world countries, where many births take place in rural settings without the benefit of the expert supervision of a trained obstetrician. There are a number of medico-legal reasons for determining the age of an individual. Dental structures can provide useful indicators to the individual's chronological age. The age of children can be determined by the analysis of tooth development and subsequent comparison to development charts, usually to an accuracy of approximately 1.6 years.³⁴

An interesting fact to keep in mind is that the total number of teeth in a child's mouth only changes when the superadded teeth (the molars) erupt. The permanent molars erupt in a fairly regular mathematical rhythm of approximately 6, 12, and 18–24 years. Thus the total number of teeth would change only at these ages.³⁵

Newer techniques like aspartic acid racemisation³⁶ and translucent dentine. have been proposed and proved to be highly accurate in adult age assessment.^{37,38}

Bite mark analysis

Another area that utilizes identifying characteristics of the teeth, although on a more functional level, is bitemark analysis. It is the most complex and controversial area of forensic odontology. The American Board of Forensic Odontology (ABFO) has approved guidelines for the collection of evidence from bite mark victims and suspected bitters.³⁹ The

techniques for obtaining bite mark evidence from human skin for example, various forms of photography, dental casts, clear overlays, computer enhancement, electron microscopy, and swabbing for serology or DNA generally are well established and relatively noncontroversial.

- Photograph

Orientation and close up photographs should be obtained with and without the presence of a scale placed adjacent to the bite mark. The scale must be positioned within the same plane as the bite mark and should include linear and circular reference to aid in eliminating possible distortion. The film resolution should be of high quality with proper color balance. Serial photographs are recommended in living victim.

- Salivary Swabbing

Saliva swabs should be collected in circumstances in which the bite site area has not been altered from the time when the bite was inflicted.

- Impressions

Impressions of the bite site area should be taken when there is sufficient surface detail which may yield beneficial information. The material used must meet the American Dental Association specifications and suitable support should be included for proper support and reproducibility of the body site contour.

- Tissue Samples

Tissue samples should be retained if it appears it may yield useful information

When collecting dental evidence, a description of the bite mark in regards to demographics, location, shape, size, color, type of injury and any other information needs to be recorded.⁴⁰⁻⁴²

Domestic violence and child abuse

The World Health Organization (WHO) has declared that violence is a major and growing public health problem across the world.⁴³ The WHO further distinguishes four types of violence; physical, sexual, psychological and neglect. All forms of violence can manifest in the oro-facial region, and hence should be of concern to dentists. Prevalence of physical violence, as a cause of maxillofacial injuries, ranges from 3.3% to 41% in various countries.⁴⁴ This wide range is

probably due to different reporting thresholds in different communities. Injuries due to abuse can manifest in the oro-facial region in various forms, including fractured anterior teeth, fractured alveolar bone, lacerations of the labial and buccal mucosae, lacerations to the frenum and bruises to the lips, face and neck.

CONCLUSION

In its most literal sense, forensic odontology is the application of the art and science of dental medicine to the resolution of matters pertaining to the law. Some of the diverse facets of this unique discipline can range from the identification of human remains to mass disaster management; from the assessment of bite mark and patterned skin injuries to the use of dental materials in the examination of evidence.

Dental practitioners should be aware of the forensic application of dentistry. Dental records that are used to provide patients with optimal dental service could also be very beneficial to legal authorities during an identification process.

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Estimation of Post Mortem Interval by Means of Changes in the Eye-vitreous Humour Potassium Levels

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ABSTRACT

The present study was carried out in Shri. Vasantrya Naik Government Medical College, Yavatmal. The dead bodies brought to the mortuary were used as material for collection of vitreous humour sample from the eyes of deceased. The vitreous analytes have been investigated to establish their relationship with PMI or time since death. A significant linear relationship, at various degrees, was seen to exist between PMI and vitreous potassium

Keywords: Potassium, Vitreous Humour, Post Mortem Interval

INTRODUCTION

Time since death is a question of day to day challenge faced by teams of investigators during their course of investigations. The physical signs require a definite experience and are subject to variations in interpretations from person to person, hence are extremely subjective in nature. It was a quest for us to arrive at an objective method for determination of time since death which would be objective and simple, cheap and easily available, undeterred by external influencing factors, providing a reliable method of estimation of time since death. Vitreous humour of eye being relatively stable, less susceptible than other body fluids to rapid chemical changes and contamination, easily accessible; thus it is suitable to estimate postmortem interval. (PMI)

In the present study, vitreous analytes have been investigated to establish their relationship with PMI or time since death. A significant linear relationship, at various degrees, was seen to exist between PMI and vitreous potassium.

MATERIALS AND METHOD

The study was carried out in Shri. Vasantrya Naik Government Medical College, Yavatmal. The dead bodies brought to the mortuary at Shri. Vasantrya Naik Government Medical College, Yavatmal were used as material for collection of vitreous humour sample from the eyes of deceased. The information regarding exact time of death was gathered from police inquest report,

dead body challan, clinical details from hospital records; correlated and checked from relatives, friends and attendants of the deceased. Cases where exact time of death was not known were not included in this study. Vitreous humor samples were collected from the eyes of 152 deceased during January 2006 to May 2007 from the autopsies conducted in mortuary at Shri. Vasantrya Naik Government Medical College, Yavatmal. 96 subjects in all were males and 56 were females in the age group of 07 to 80 years (Mean \pm SD, 35.38 years \pm 14.37 years) and the known postmortem interval ranges from 1.6 hours to 39.2 hours (Mean \pm SD, 13.01 \pm 7.22 hours). After sample removal detail postmortem examination carried out and the general relevant findings were documented in the proforma with details of livor mortis, rigor mortis, external and internal sign of decomposition. The vitreous samples drawn from the eyes of deceased at the beginning of postmortem examination of dead body to the mortuary, (Only the clean and clear samples were taken, samples having any particulate matter discarded). All the information about the deceased i.e. age, sex, address, cause of death, exact time of death, time of each sampling, temperature recorded. Vitreous humour was collected at autopsy from the posterior chamber of the eye, slowly and gradually avoiding tearing of loose fragments of tissues by needle aspiration through a puncture made 5-6 mm away from the limbus (sclero-corneal junction) using 10 ml sterile syringe and 20 gauge needle and poured in a rubber stoppered vial. Pre-sterilized syringe will be used and rubber stoppered glass vials

washed with deionised double distilled water and dried in hot air oven and will be used for sampling. Liquid paraffin gel will be injected in the posterior chamber of eye for cosmetic purposes. The samples after collection in a rubber stoppered vial, will be labeled and transported to the biochemistry laboratory for analysis. The vitreous samples will be centrifuged at 3000 rpm for 10 minutes; all the biochemical analysis will be carried out immediately post-extraction. The sample were analyzed for potassium. The analysis was carried out on the same day as collection using a BECKMAN COULTER LX20 AUTOMATED ANALYZER.

OBSERVATIONS AND DISCUSSION

The samples were taken from both eyes at same time and evaluated separately, no significant difference was observed. In the present study, observations were made up to 40 hours (Mean ± SD, 13.01 ± 7.24) postmortem period. During the studied postmortem period, vitreous potassium represented a fairly linear rise with increasing PMI. The rate of rise of potassium

was 0.2998 mmol/L per hour. This linear rise of vitreous potassium was consistent in the PMI upto 40 hours. These results are in accordance with previous reports in literature on the behavior of vitreous potassium in the postmortem period.^{1,2,3,4,5.}

The vitreous potassium concentrations were used as the dependent variable to calculate the estimated PMI. The resulting linear regression equation in the form of $y = ax + b$ (where 'y' is vitreous potassium concentration; 'x' is actual PMI in hours; 'a' is the slope of regression line and 'b' is the intercept of the regression line) was:

$$y = 0.2994 x + 4.3985.$$

Corresponding formulae to estimate the PMI in the form of: $PMI = \beta^0 + \beta^1$ [Mean of the individual biochemical constituent concentration] (where β^0 is the estimated regression coefficient when no other variable is included in the model and β^1 is the estimated regression coefficient for vitreous potassium) was:

$$\text{Estimated PMI} = 3.34 (\text{Potassium}) - 14.9023$$

TABLE 1

S.N.	Name of study	Year	Linear regression equ.	Cases	PMI
1	Sturner ⁸	1963	$Y = 0.14 x + 5.6$	54	104 hrs.
2	Hansson et al	1966	$Y = 0.17 x + 8.0$	108	120 hrs.
3	Coe ¹	1969	$Y = 0.332 x + 4.99$	88	6 hrs.
4	Coe ²	1969	$Y = 0.1625 x + 6.19$	57	6-24 hrs.
5	Adjutantis et al ¹⁰	1972	$Y = 0.55 x + 3.14$	120	12 hrs.
6	Stephens et al ⁵	1987	$Y = 0.248 x + 6.342$	1427	35 hrs.
7	Madea et al ⁶	1989	$Y = 0.19 x + 5.88$	170	120 hrs.
8	Munoz et al ⁹	2001	$Y = 0.22 x + 5.35$	164	41 hrs.
9	Present Study	2007	$Y = 0.2994 x + 4.399$	152	40 hrs.

Comparison of statistical parameters of paired differences between actual and estimated post mortem

interval using vitreous potassium formulae of various studies

TABLE-2

NO.	Study Using K+	n	Slope	Mean	S.D.	S.E. mean
1	STURNER ⁸	152	0.14	20.52839	15.20762	1.233504
2	MADEA ⁶	152	0.19	13.02792	11.20337	0.908716
3	JAMES ⁷	152	0.23	17.72768	9.20125	0.746322
4	MUNOZ ⁹	152	0.22	13.011	7.2405	0.5873
5	PRESENT	152	0.2994	12.99339	7.113929	0.577017

Based on the regression equation obtained from the data in this study, a new formula, $PMI (\text{hours}) = 3.34 (\text{Potassium}) - 14.9023$, is proposed. In this study, the

PMI range used in deriving the regression equation was 1.6 to 39.2 hours with a mean of approximately 13.01 hours.

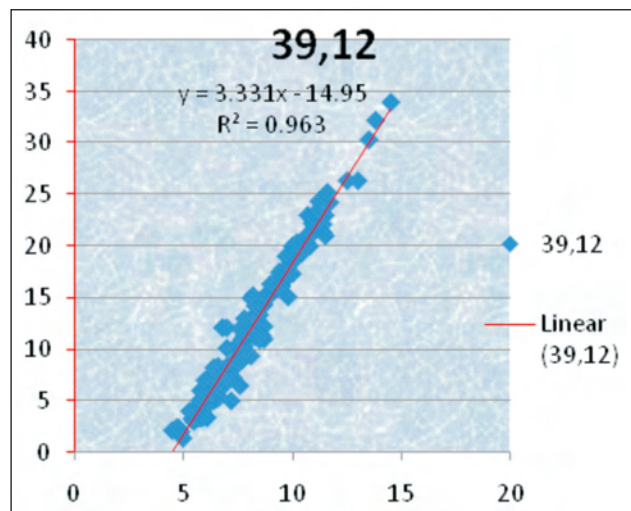
Table 3. Potassium Levels and Time Since Death

K+Y	PMI ACTHR,MI	K+Y	PMI ACTHR,MI	K+Y	PMI ACTHR,MI	K+Y	PMI ACTHR,MI
15.9	39.12	10.9	22.24	8.7	15.12	8.1	15
7	8.12	10.8	21.00	8.5	12.48	4.8	2.36
7.8	10.36	7.6	6.48	9.2	16.24	6.4	8.24
8.2	12.24	10.6	20.36	7.9	11.24	13	26.36
5.8	3.36	7.9	11.12	7.2	8.36	8.5	11
8.3	13.24	7.2	5.00	6	4.48	11.4	21.36
11	22.00	10.1	19.00	7.8	10.00	8.7	11
7.4	9.00	11.7	24.24	5.9	3.36	11.4	22.12
14.5	34.00	8.8	15.12	7.8	13.00	8.5	11.36
9.9	18.24	8	12.24	10.7	23.00	7.9	12
9.4	17.48	9.3	16.00	7.7	11.00	6.1	3.36
5.7	3.36	8.8	15.24	7.3	7.24	6.6	6
9.5	16.36	6.3	5.36	5.8	4.00	4.7	2.36
8.2	12.48	6.4	5.00	9.3	16.12	7.8	11.36
6.5	6.12	6.6	5.48	8.2	12.36	9.7	19
10.2	19.24	8.4	12.48	11.5	23.00	5.3	4
5.9	4.00	7	12.12	9.9	18.36	4.5	2.12
8.1	12.00	9.5	17.24	11.1	23.36	8.3	14.24
7.8	11.00	6.8	7.00	6.8	6.36	7.4	10.24
7.4	8.36	11.2	23.00	6.1	6.00	5.8	5
10.4	19.24	8.1	13.00	13.8	32.24	5	1.36
6.2	5.36	5.7	4.48	10.5	20.36	11.5	21
8.7	14.36	6.6	5.24	6.6	8.36	8.5	11
5.5	3.00	5.8	5.12	9	16.36	7	7
11.3	23.00	13.5	30.36	8.5	13.36	7.7	9
10.2	20.36	10.2	19.36	10.5	20.24	7.7	9
8.6	11.36	8.7	12.24	10.8	20.00	9.8	17.24
6.8	7.36	5.6	3.36	10.7	21.00	6.2	7.36
10.4	20.00	6	6.24	9.8	15.12	7	10.12
8.9	15.12	6.9	7.00	7.6	12.00	5.8	5
10	20.00	9.7	17.36	6.6	7.00	6.3	7.12
9.3	16.36	8.1	12.48	6.6	6.36	8.2	15.24
6.6	6.48	6	5.12	9.6	17.00	5.8	6
10	17.36	8.5	14.00	9.5	16.12	11.6	25.24
10.1	19.24	7	8.36	8.1	9.36	6	7
10.3	20.00	6.3	5.48	11.2	24.36		
5.4	3.24	4.9	2.00	6.8	12.12		
9.8	17.36	6.4	7.00	12.5	26.36		
10.7	21.12	8.4	12.24	8.3	11.24		

The slope of the regression line for postmortem vitreous potassium rise with increasing PMI obtained in the present study is 0.2994 mmol/L per hour with a zero hour 'y' intercept of 4.399 mmol/L. The slope and the intercepts observed for the vitreous potassium in the present study is comparable to that reported for vitreous potassium rise in literature. The variation in experimental methods and the sample characteristics may account for the small differences noted with the slopes of various other studies.

The slope of 0.2994 mmol/L is steeper than that reported earlier by Sturmer (1963), Madea (1989), James et al. (1997) the authors of the popular studies who have devised formulae for estimation of PMI based on these regression slopes. The regression slope for potassium obtained in the present study is in close agreement to the slope of 0.248 mmol/L per hour and 0.22 mmol/L per hour as obtained in a study by Stephen et al. (1987) and Munoz et al.(2001) respectively. It is essential that the slope of regression

line be relatively steeper because flatter slopes tend to overestimate the time since death based on the obtained regression line and equation.



CONCLUSION AND SUMMARY

The principal objectives of the present study were to evaluate the utility of vitreous humor biochemistry in estimating time since death. The present study re-establishes and confirms a significant role for vitreous potassium in estimating PMI. Using the study results, PMI estimation based on the proposed regression formula i.e. "RAVIDEO equation"- (Estimated PMI = 3.34 (Potassium) - 14.9023) for vitreous potassium can be done with great accuracy within range of ± 1.1309 hours.

We, however, propose to combine other parameters also for more accurate estimation of time since death for achieving more precision.

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