

Analysis of Trauma in Skeletal Remains

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Abstract:

In the forensic field, the study of the skeletal remains is an important task for the anthropologists to solve the mystery of an individual. In their investigation, they work on the skeletal remains and give their opinion on the identification of individuals through the age, race, sex and stature, cause of death as well as manner of death. For the determination of these features, the trauma analysis is very crucial part in anthropology. Trauma is the injury on the tissue due to external force. It may occur before death called antemortem trauma, at the time of death called perimortem trauma or after death called postmortem trauma. After observing the fractures or trauma, the anthropologist find out whether it is the antemortem, perimortem or postmortem based on the healing process and vital biochemical reaction which occur during the life. These traumatic injuries also reveal the type of weapon which was used to create these injuries. In this paper, we reviewed on the analysis of trauma in skeletal analysis and it also discussed some techniques such as CT scan, MDCT, and SEM etc. which are used to visualize the traumatic injuries.

Keywords: *Ante mortem Trauma, Peri mortem Trauma, Postmortem Trauma, Techniques*

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Introduction

An important information is delivered by the skeleton which helps anthropologist and archeologist in the investigation. In the investigation of fossils (paleontology), traumatology is most interesting aspect. By the help of traumatic injuries present on the ancient human remains, we are able to analyze the lifestyle of the ancient people. This type of injuries are common to the anthropologists because the injuries occurred in the lifetime are remain preserved in bones after death.

In the analysis of paleotrauma, the determination of lesion types gives evidence regarding the intergroup conflict or warfare, interpersonal violence, and daily activities. The main aim of trauma analysis is to interpret the social, cultural and environmental causes which lead to the trauma and also determine the relation between the age or sex and trauma, between temporal and geographical patterning, and trauma (Licata and Armocida, 2015).

The relation among the dry skeleton pathology (disease or trauma) and forensic anthropology has been proved a vital tool in the human rights violations investigation mentioned in Latin America from the 1970 to 1990s. After many studies, many approvals for skeletal trauma are considered:

1. The experts must avoid rumors
2. The whole body or skeleton should be observed in detail.
3. All present lesion or trauma should be recorded and detailed as per the topography.
4. The variability of trauma or injuries should be taken into account based on the age, sex, previous health etc. (Schmitt, Cunha and Pinheiro, 199).

Principle of Trauma Analysis

The main principle of the trauma and other alteration in the skeletal remains is to find the answers of the important questions in which the circumstance of the death and the personal identification of an individual exist. The alteration refers to the changes to bones' physical properties while trauma is defined as the disruption of tissues physically through the outside forces. It also reveal the time of trauma, mechanism of trauma and also the type of weapons, used for making the trauma. According to some researchers

and scientists, the postmortem alteration is not measured as trauma because after death the living tissues are not disrupted (Christensen, Passalacqua and Bartelink, 341). Actually, trauma is an injury or wound to the living person due to the force or mechanism extrinsic to the body. The trauma may occur accidentally or intentionally. In the conventional way, the trauma is the force and its interpretation is relied on the fractures' characteristics.

The trauma mechanism is divided into many categories; blunt force, high velocity projectile, sharp force, thermal, and other categories. In the types of force/ trauma, blunt force trauma is caused by the blunt object like club, ground, and piece of furniture. While the sharp force trauma give penetrating injury like stabbing, chopping, slashing and incising wounds cause by sharp objects. Cranial fracture or trauma are generally caused by blunt forces. These traumas are localized depressed fractures that heal very slowly. As the bone also have the elastic property like skin and tissues, try to gain their original position. The bone elasticity is very less as compare to the skin and other tissue due to which the fracture take place easily and maintain a gap with each other. In spite of healing the fracture of bone, sometime the impression made by the weapon left in the skull throughout the life, even after death. Gunshot wound is also a type of blunt force trauma in which very powerful force act on the small focal area. Hence, many reaction of bone tissue occur with the gunshot as present in the above injury (Klepinger, 102, 109).



Figure 1 – Cranial Fractures

According the many studies, it is estimated that most of the injuries are caused by accident and some other

are due to surgical practices in which weapons are used. The proper description of injury or lesion is the first and most important step in the analysis of trauma. The mechanism of the injury defines the trauma either it is direct or indirect. So, the understanding of mechanism of injury is the vital for knowing the cause of trauma.

According to predominate characteristic, injuries are classified and by which the trauma present on the skeletal remains are analyzed and interpreted. These predominate characteristic are:

1. Ossification of soft tissues
2. Externally induced abnormal shape or edges of the bone
3. Dislocation of joint and tooth in socket
4. Fracture or breakage in the continuity in bone or tooth (Lovell and Grauer, 2018)

Forensic pathologists work on the soft tissue injuries to determine its type as an ante mortem or postmortem which based on the degree of the vital reactions and bleeding. There are three types of trauma; Ante mortem, Peri mortem and Postmortem trauma. The trauma or injury which occurs during the life of the person is called ante mortem trauma. It can be distinguished from others as showing the sign of healing. The trauma which occur at the time of death or around the time of death which may or may not be the cause of the death, is known as peri mortem trauma and last one is postmortem trauma that occur after death due the disturbance with the body. There are many factors which disturb the dead body or human skeleton. In these factors, suspect's activity, animal activity and also by the archeologist during the excavation can harm the skeletal remains.

Differences between Antemortem, Perimortem and Postmortem

Anthropological discussion is not only talk about the case of finding the skeletal remains but also investigate the recent deaths. Through this investigation, anthropologists are able to give their opinion on the length of postmortem period as well as the cause of death. In their investigation, they examine the injuries present on the skeleton and determine the relative time at which it was produced. They also try to find of mechanism which is responsible for it formation. There are many difference between the antemortem, perimortem and postmortem trauma.

The ante mortem injuries on bones show the sign of healing which make different from others. While the difference between the peri mortem and postmortem injuries is a challenging factor mainly depends on the subtle attributes of bone tissue. In the ante mortem trauma, when skin is present over the bones. The blood is pumped out in the soft tissues around the broken part of the bones or arteries, show the microscopic image of red blood cells which should not be seen. In the same way, the other biochemical marker responsible for the inflammation, are released and proceed the vital reaction. While post mortem does not show any this type of effect on surrounding tissues.

In case of dry bone, the anthropologists only check that the fracture is fresh or not. In the peri mortem fracture fresh green branch breaks which shows the turgidity and elasticity of young branch, while in the post mortem fracture only show the pattern as dry ond branch which is clean and neat cut.

Peri mortem can relate to the ante mortem trauma because it may occur day or even weeks before death but the process of healing is not yet perceived and after the death (postmortem- months or year after death) where the feature of skin like elasticity is not lost due to decomposition.

The word ‘post mortem damage’, is also known as taphonomic alteration, refers to the injury to the bone occurs after the removing of green or elastic properties of the body. This process occurs due to the taphonomic factors discussed above (Schotsmans, 354).

Table – Features of Fractures in Fresh or Dry Bone

Fracture Features	Fresh Bone Characteristics	Dry Bone Characteristics
Outline	Radial Pattern Circling Diaphysis	Perpendicular/horizontal fracture surface
Surface's color	Homogeneous color with external bone	Heterogeneous color with external bone
Surface	Smooth	Rough

Angle of fracture	Obtuse and acute angles	Right angles
Other	Loading point present	Loading point absent
Other	Fracture front never crosscut epiphyseal ends	Fractures front can crosscut epiphyseal ends

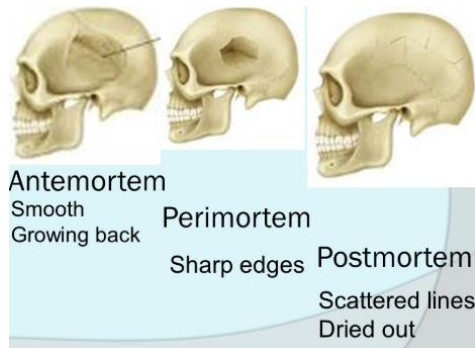


Figure 2 – Differences between the Antemortem, Perimortem and Postmortem

Techniques used in Analysis of Fracture or Trauma

The determination of fracture present in the skeletal remains are done by different techniques

1. CT Scan (Computed Tomography)
2. MDCT (Multi Detector Computed Tomography)
3. SEM (Scanning Electron microscope)

These techniques can examine the position of fracture as they scan the whole body thoroughly and

give the result. They also provide the idea what type of trauma is present by which the investigator or the pathologists can determine the cause of death. Some fractures reveal the history of incident occurred with an individual.

In the scanning electron microscope, the fibrin networks are seen at the fractured sites which show that the fractures were made in ante mortem period and distinguish perimortem or antemortem from postmortem (Deouit *et al*, 2014).

In the CT scan and MDCT technique which are used in virtual autopsy, are slice the body in different part for the analysis and X-ray is done which show the small alteration in the body parts including the bones, tissue, etc.

Conclusion

Trauma to skeleton, is also known as bone injury or bone fracture which caused by some external forces. This paper discussed about the trauma analysis of skeletal remains and concluded that the anthropologists can differentiate antemortem, perimortem and postmortem on the basis of the biochemical markers’ reaction occur in the body only in the period of life, not after death. It also gave an idea to use these techniques like CT scan, MDCT and scanning electron microscope which are used to analyze the traumatic injuries present on the skeletal remains are very efficient and effective. We can says that after the analysis that the trauma analysis is very crucial aspect for the anthropologist to find the cause and manner of death of an individual. It also work in the mass disaster, mass fatality, and other incidents.



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