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Intracranial tuberculomata: A computerized tomographic evaluation

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Abstract

Tuberculosis is a global pandemic accounting for 9.2 million new cases and approximately 2 million deaths annually. Tuberculomata of the brain are a common feature of Intracranial tuberculosis. In the past the diagnosis was based on the evidence of active tuberculosis, elsewhere in the body, characteristic Cerebrospinal fluid (CSF) findings, a biopsy of necropsy. CSF findings would be equivocal in the absence of meningeal involvement. In India, its incidence is 12 to 30% of all intra-cranial space occupying lesions. The material consisted of 1000 patients who were admitted during the two year period, presenting with clinical features of headache vomiting, or focal/generalized seizures. These patients belonged to the acute medical care unit and pediatric Medical Units of a tertiary care hospiatl in South India. This study is a retrospective one and only those cases who had their Computerized Tomography (CT) scan of head and brain done were included. A total of 276 patients with definite CT findings of tuberculoma were analyzed for their age, and sex incidence, numbers, size and site of correlated with the clinical presenting features, duration of illness, CT morphology. A definite pattern of CT morphology of tuberculomata was seen, small sized lesions were the commonest 61 % , medium size lesions 30 % large size lesions 9 % . Shape: Ring and disc lesions 79 % irregular ball like nodular lesions 21 %. Number: Single lesions were the most frequent 86 % though multiple lesions were encountered in 14 % cases of our study. Site: Supratentorial involvement we noted in 96 % of patients and only 4 % infratentorial involvement was seen. The commonest site of supratentorial involvement of brain by tuberculoma was the parietal lobes. The advent of CT has definitely helped in the early diagnosis of intracranial tuberculomata. It is cost effective and currently available even at the district headquarter level, and is therefore effective in isolating tuberculomata cases from other intracranial space occupying lesions by its typical CT morphology unsuspected cases are coming to light who and are amenable to medical treatment if diagnosed at the earliest by the help of CT.

Keywords: Tuberculomata, CT scan, Seizures, Intensive care unit (ICU).

Introduction

Tuberculosis is a global pandemic accounting for 9.2 million new cases and approximately 2 million deaths annually.[1] Tuberculomata of the brain are a common feature of Intracranial tuberculosis. In the past the diagnosis was based on the evidence of active tuberculosis, elsewhere in the body, characteristic CSF findings, a biopsy of necropsy. CSF findings would be equivocal in the absence of meningeal involvement.[2] In India, its incidence is 12 to 30% of all intra-cranial space occupying lesions.[3] The treatment is advocated based on clinical and C.T. features alone, as MRI is not universally available.

While pulmonary tuberculosis is the commonest form world – over, tuberculosis of the CNS is one of the most dangerous forms. In spite of the most development of antimicrobial agents , the morbidity and mortality of the infection is still disturbing high. Among the principal reasons of this failure of therapy are the delay in recognizing the nature of the disease process and failure to localize the lesion.[4] The present study was done with the following objectives-

1) To study the incidence of tuberculoma of brain, during the two year period of May 2002 to May 2004.

2) To assess the CT findings in relation to age and sex incidence.

3) To study the CT image morphology of tuberculoma in terms of their size , shape, number and sites of distribution.

4) To compare our results with those available in the literature.

Material and Methods

The material consisted of 1000 patients who were admitted during the two year period, presenting with clinical features of headache vomiting, or focal/generalized seizures. These patients belonged to the acute medical care unit and peadiatric Medical Units of a tertiary care hospiatl in South India. This study is a retrospective one and only those cases who had their CT scan of head and brain done were included.

Patients admitted with history of headache, vomiting or seizures were assessed by detailed history taking and physical examination as shown in the proforma. Fundoscopy was done to asses for raised intracranial tension if any. Appropriate biochemical and haemotological investigations were done including an X - rayskull, and chest before sending the patient for computerized tomography (CT) scan of head and brain. A period of 3 days (72 hours) was allowed to elapse before referring the patient for CT Scan of head and brain, during which period antiedema and anti epileptic therepy were instituted.

Diagnosis of tuberculoma of brain was based on history and clinical examination. The anatomical level of the lesion was correlated with clinical features and localizing signs wherever available. The diagnosis of tuberculoma of brain was made on characteristic CT morphology. In plain CT there may be hyperdense or isodense lesions, with intense edema around on the lesions. In CECT there may be ring, disc enchancement of the same lesion.

Results and Discussion

For the 82 patients who had their CT scans done after referral from the Acute Medical care unit and paediatric medical units, with the symptoms of focal/ generalized seizures and suggested raised intracranial tension, detailed clinical histories were obtained and a through clinical examination especially of central nervous system were performed as shown in the proforma case sheets. Out of 310 patients subjected to CT Scans of head and brain, only 276 patiens showed definitive evidence of intra cranial tuberculoma in various forms, numbers and locations.

In the remaining 34 patients. CT scans were normal in 20 patients, 14 patients showed abnormalities such as: cysticercosis in 10 patients, and small brain abscess in 4 patients. The 276 patients with definite CT findings of tuberculoma were analyzed for their age, and sex incidence, numbers, size and site of correlated with the clinical presenting features, duration of illness, CT morphology.

The advent of CT scan has revolutionized the diagnosis and management of tuberculoma, we are now able to identify the tuberculoma by its typical CT appearances. Although several other mass lesions closely resemble tuberculoma on CT the differential diagnosis to be considered are pyogenic abscess, neoplasm, and cysticercosis.[5]

Age and sex incidence

Bhagwati S.N quote that more than half of their tuberculoma cases occurred in children, 75% of their total cases were below the age of 25 years.[6] In the present study the incidence is similar in that 44 % cases were in children and 79% of our total cases occurred in the age group of 1 to 30 years. The male to female ratio in our study was 2:1 which is comparable to male preponderance reported by Arvind C *et al*[2], in which the male to female ratio was 3:2 (Table 1).

Table 1: Age and sex distribution of clinically diagnosed cases of tuberculoma

Age	Male	Female	Total	Percentage
1 - 5 years	12	6	18	5.8%
6 - 10 years	48	15	63	20.3%
11 - 15 years	30	32	62	20.0%
16 - 20 years	36	15	51	16.5%
21 - 30 years	30	24	54	17.4%
31 - 40 years	22	9	31	10.0%
41 - 50 years	18	1	19	6.1%
More than 21 years	10	2	12	3.9%
Total	206	104	310	100.0%

Clinical symptomatology

In the present study an attempt was made to correlate clinical and CT findings in patients with seizures, headache, gaint disturbance or hemiparesis (Table 2).

Seizures: Retrospective symptom analysis revealed that 72% of patients with tuberculoma in our series presented with seizures (focal/generalized) as the most frequent symptom. History of seizures were present in 60% of patients in Arvind C *et al*[2] series, and 56% in the series by Bhagavathi S . N. *et al*[6] and as low as 38% in Jayakumar P.N *et al*[7] series.

Headache & Vomiting: The next frequent symptoms were headache/vomiting in 62% of patients and there was papilloedema in 60% of patients in our series, which is similar to that of Jaya Kumar P.N. *et al*[7] series.

Gait Disturbance: Gait disturbance was present in only 2% of patients and speech disturbance was also a rarer symptom in our series (2%), although Jaya Kumar P.N. *et al*[7] reported a high incidence of 35% gait and speech disturbance. This is because their study consisted of post operative (selective) surgical series which included higher number of "infratentorial: lesions.

Hemiparesis: In our series hemiparesis occurred in 7.3% of patients, though in the series of Jaya Kumar P.N. *et al*[7], they report an incidence of hemiparesis as high as 33%. This is because their series contained patients with larger lesions in motor areas of the brain which needed surgery.

Table 2: Clinical features of CT evaluated 276 cases of tuberculoma

Clinical Features	Total Patients	Percentage
Headache Vomiting	170	62%
Seizures	200	72%
Hemiparesis	20	7%
Gait Disturbance	8	3%
Speech Disturbance	5	2%
Papilloedma	166	60%

Duration of illness

The youngest patient in our series was 10 months old and the oldest patient was aged 72 years. In our series the duration of illness was for less than 3 months in 65% patients, for less than 1 year 30% of patients and for more than 1 year in 5% of patients (Table 3). Butin the series of Jaya Kumar P.N. *et al*[7] 38% of patients presented with less than 3 months duration of illness, and 17% of patients presented with more than 1 year duration of illness. Further they mentioned that with shorter duration of illness (less

than 6 months), when compared to those with supratentorial lesions of more than 1 year duration.

Table 3 : Duration of illness of 276 CT diagnosed cases of tuberculoma

Duration of Illness	Patients	Percentage
Less than 3 months	178	65%
3 months to 6 months	56	20%
6 months to 1 year	28	10%
More than 1 year	14	5%
Total	276	100%

Plain CT study

1) Number of lesions

Single lesions were the most frequent in our study 86%, as compared to 78% reported by Arvind c *et al*[2] study. The incidence of multiple lesions was 22% in our study, as copmpared to that of 14% in Arvind C *et al*[2] series. In multiple lesions the larger perifocal edema makes tuberculoma distinct from metastases. But the geographical region, the age of the patient and the absence of a primary site easily rule out metastases according to Bharghava S. and Tandon P.N.[4]

2) Size of lesion

In our series the small lesions of sizes less than 2 cm were the most common 169 cases (61%); next frequent were medium sized lesions of 2 to 3 cm diameter 82 cases (30%) . The least frequent were the large lesions of the size of more than 3 cm diameter. In our series the smallest size lesion noted was 0.85 cm and largest size lesion was 3.30 cm (Table 4). In the series of Bharghava S. Tandin P.N. they report a largest size lesion of 1.5 cm in their series and the smallest lesion of 2 mm diameter.[4]

Table 4: Size of tuberculomas on CT scan

Size of Lesions	Total	Percentage
Large size lesions > 3 cms	25	9%
Medium size lesions 2 cms to 3 cms	82	30%
Small size lesions < 2 cms	169	61%
Total	276	100%

3) Density of lesion

On plain CT Scan in our series hyperdense ring lesions (CT Value >45 HU) were the commonest 59%, while the isodense lesions (CT value 35 HU), formed 41%. But Jaya Kumar P.N. *et al*[7] report an incidence of 37% hyperdense lesions, an abnormally high incidence of 54% of isodense lesions and a low incidence of hypodense lesions 5% figures are varying between the two studies because our series is one containing more than five times the number of their patients.

4) Shape of the lesions

Regarding the shape of tuberculoma, ring lesions were the most frequent forming 79%, nodular and disc lesions forming 21% in our series (Table 5). These figures are similar, when compared to Jaya Kumar P.N. *et al*[7] series in which ring lesions formed 82% and disc lesions formed 17% of cases. According to Bhargava S and Tandon P.N. *et al*[4] small discrete disc like lesions (single or multiple) were the commonest form of tubercular foci seen in CT scan. These represent early stages of parenchymal involvement and suggest immaturity of tuberculoma foci. The individual foci were small and scattered over both hemispheres supra and infra tentorially and the accompanying adema was massive.

Table 5: Number and shape of tuberculomas on plain CT scan

Shape of Lesions	Patients	Percentage	Number of Lesions	Patients	Percentage
Ring	218	79%	Single	238	86.3%
Nodular	50	18%	Multiple Isolated	28	10.1%
Disc	8	3%	Multiple Coalascent	10	3.6%
Total	276	100%	Total	276	100%

Hydrocephalus was noted in 5 patients (20%) in this series

5) Coalescence of lesions

Coalescence of the ring lesions were noted in 4 % of cases in our study, where as Bhargava S. Tandon P.N. *et al*[4] reported 8% of such cases in their study. Further Bharghava S *et al*[4] quoted that coalsaced lesions were present in mature tuberculomas and they were a conglomeration of multiple ringsor discs resulting in the irregular contour. Thus is can be inferred that our series contained a lesser number of mature tuberculomata patient.

According to Bharghava S Tandon P.N. the large single irregular ball like lesions are due to conglomeration of multiple discs and rings.[4] Irregular contour of the mass was the hall mark of conglomeration of small immature tubercles into more identifiable tuberculomatous mass, surrounded by a rim of collagen tissue, which in turn was surrounded by massive edema.

Contrast Enhanced Computed Tomorgraphy (CECT)

CECT was performed on 252 patientsin our series which revealed enhancements of various intensities and shapes (Table 6). Mild ring enhancement was seen in 43% of cases, dense ring enhancement was present in 37% of cases, ring enhancement with eccentric nodule was present in 1% of the pacases, disc shaped enhancement was noted in 8% of cases, irregular nodular (ball) shaped enhancement was present in 8% of cases.

Table 6: Types of enhancements of tuberculomas on CECT in 252 patients

Type of Enhancement	No. of Patients with CECT	Percentage
Mild Ring Enhancement	109	43.0%
Dense Ring Enhancement	94	37.0%
Ring with Eccentric Nodule	3	1.8%
Discoid Enhancement	21	8.3%
Irregular Nodular Enhancement	19	7.5%
Target Sign	6	2.4%
Total	252	100%

In 24 patients CECT was not performed after plain CT.

Target sign (ring enhancement with central calcification) was present in 2% of cases in our series, whereas in the series by Jaya kumar P N *et al*[7] they have not come across a single case of Target sign though they quote Vandyke[8] and Welchman[9] as saying that Target sign was pathogomic of tuberculomata of brain. In P.N. Jaya kumar *et al*[7] series there was enhancement of tuberculoma lesion in 98% of their cases as against 99% enhancement in our series.

According to Bharghava S. tendon P.N. *et al*[4] CECT is imperative for the correct image analysis, and that only on contrast enhancement it can be confirmed whether there was a single irregular mass made up of multiple discs and rings extending irregularly in all directions, or there were multiple small disc and rings scattered bilaterally or if there was no mass at all but only edema is seen.

Perilesional Edema

Perilesional edema was a constant fearure in all cases of tuberculoma in our series just as reported by Jaya Kumar P.N. *et al*[7] . According to Bharghava S Tandon P.N. *et al*[4] there was massive edema seen with immature tuberculoma, but minimal or no edema was seen with mature tuberculomata.

Conclusion

The advent of CT has definitely helped in the early diagnosis of intracranial tuberculomata. It is cost effective and currently available even at the district headquarter level, and is therefore effective in isolating tuberculomata cases from other intracranial space occupying lesions by its typical CT morphology unsuspected cases are coming to light who and are amenable to medical treatment if diagnosed at the earliest by the help of CT.

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