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ORIGINAL ARTICLE

REVIEW OF THE CLINICAL, COMPUTERIZED TOMOGRAPHY SCAN AND/OR MAGNETIC RESONANCE IMAGING FINDINGS OF INTRACRANIAL TUBERCULOMA IN AN ETHIOPIAN TEACHING HOSPITAL

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ABSTRACT

Background: *Ethiopia is one of the countries that has high burden of all forms of tuberculosis and there is no published report on computerized tomography scan and/or magnetic resonance imaging of intracranial tuberculomas. Objective : to review the clinical, computerized tomography and/or magnetic resonance imaging features of intracranial tuberculoma*

Methods: *A retrospective review of patient's medical records of patients operated for intracranial mass that had computerized tomography and/or magnetic resonance imaging brain scans and had histopathological diagnoses, at Tikur Anbessa Specialized Hospital between January 2009 and June 2013.*

Results: *Of 222 operated cases of intracranial mass subjected to histopathological test 29 (14.6%) were found to have tuberculomas, 28 (14.1%) had caseous necrosis and one was a tuberculous abscess, in 25 cases imaging was available for review and were included in the study . There were 15 males and 10 females with age range being 2 to 65 years and with the Median age being 13 years. Twenty patients had computerized tomography and five patients had magnetic resonance imaging. Seizure 15/25 (60%) and headache 11/25 (44%) were the commonest presentation. Solitary or confluent large lesions were seen in 12/25 (48%) of patients. 14/25 (56%) of the lesions had their size between 2 cm and 5 cm. Majority of the lesions 15/25 (60%) were in the frontal and parietal lobes. The lesions were isodense on CT in 18/25 (72%) of the pre-contrast studies and 21/25 (84%) showed ring or rim enhancement after intravenous administration of the contrast medium.*

Conclusion: *Tuberculoma, more frequently, presented with non-specific clinical findings and chronic seizure disorder and comonly occurred in young patients and often seen infratentorialy. It is often complicated with hydrocephalus in the pediatric age group. Computerized tomography scan and/or magnetic resonance imaging features are not different from reports from other countries.*

Key Words: *Intracranial Tuberculoma, computerized tomography, magnetic resonance imaging, Ethiopia*

INTRODUCTION

Central nervous system (CNS) tuberculosis is the most important form of extra-pulmonary tuberculosis that caries serious consequences and accounts for 10% of all cases of tuberculosis (1). Despite effective anti-tuberculous therapy, it associated with high case fatality rates and neurological deficits. The pandemic of acquired immunodeficiency syndrome (AIDS) has resulted in an increased incidence of CNS tuberculosis (TB) worldwide (2)

According to the Ethiopian Federal Ministry of Health's report based on health facility data, tuberculosis is the leading cause of morbidity, the third cause of hospital admission, and the second cause of death in Ethiopia, only surpassed by malaria. Ethiopia ranks seventh among the 22 countries with high TB burden, and third only to South Africa and Nigeria in Africa, with an estimated incidence of all forms of TB at 378/100,000 in 2009 (3). Even though tuberculosis is very common in Ethiopia, introduction of cross-sectional imaging, computerized tomography Scan (CT scan) and magnetic resonance imaging (MRI), is very recent and not widely available during

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the study period, there is no radiological descriptive study done on histopathologically proven tuberculoma of the brain. Therefore this study aimed to identify the commonly affected age group, clinical presentation, common brain location and CT/MRI appearance of tuberculoma, observations that will assist in making decisions on early medical treatment, avoid unnecessary surgery, and associated morbidity and mortality.

MATERIALS AND METHODS

A retrospective review of imaging, CT and/or MRI when available, and medical record of patients who had hitopathological diagnosis of Tuberculoma between January 2009 and June 2013 in Tikur Anbessa Hospital, teaching, a tertiary referral hospital, was made.. Ethical clearance was obtained from the Department of Neurosurgery and Radiology Department Ethics Committee. Clinical presentations and demographic data of patients were filled into a pre-prepared data entry format. Hard and/or soft copy images, when available for patients who had it done outside the teaching hospitals were re-read by senior consultant neuroradiologiest. The size, number, locations and CT and or MRI desnsity and signal patterns, respectively, of the lesion were entered into the data format.

Surgical Procedures: Surgical decompression, nine suboccipital craniotomy/craniectomy, 15 supratentorial craniotomies and one burrhole were performed to remove posterior fossa, supratentorial massess. Iindications for surgery were signs of mass effect with impending herniation and, neurologic detrrioration or deficit in 14 cases, old masses with thick capsule not responding to anti tubercuous therapy in two, and uncontrolled seizure in four, and uncertainty of diagnosis in five patients. Total removal was done when the lesion was solitary and big with significant mass effect; and a biopsy was taken when the lesions were multiple, and the most neurosurgicaly accessible lesion was biopsied.

Hematoxillin/eiosin stained histological sections were made for diagnosis of tuberculosis. Ziel Neelson stain for detection of acid fast bacilli and culture were not done because of resource limitation. Collected data was edited and entered into the computer and descriptive analysis made using SPSS statistical software.

RESULTS

Demographic and clinical: During the study period specimens of 222 operated cases of intra cranial mass were submitted to the department of pathology and out of these 199 had definitive diagnosis of which 29 cases were found to be tuberculomas 28(14.1%) most of which had caseous necrosis and one was a tuberculous abscess. Out of 29 cases 25 of the patients had imaging available for review and were included in the study and out of these 15/25 (60%) were male and 10/25 (40%) patients were female. Twenty percent of the patients were pediatric and below five years of age and 18/25 (72%) of the patients were young adults between the age of 16-35 years, two of the patients were pregnant mothers. The age range is from 2 to 65 years with the mean and median age of presentation 18 and 13 years respectively (Table1)

Table 1: age and sex destribution of patients with CNS tuberculoma, January 2009-June 2013, Tikur Anbessa Specialized Hospital, Ethiopia

	Description	N (%)
Sex	Male	15(60)
	Female	10(40)
	Total	25 (100)
Age in years	<5	5(20)
	5-18	9(36)
	19-29	6(24)
	30-45	3(12)
	>45	2(8)
	Total	25 (100)
	Median	13

The main clinical presentations (Table 2.) described at admission were seizure recorded in 15/25 (60%) patients, visual disturbance 9/25 (36%), headache 11/25 (44%), focal neurological defecit 6/25 (24%), change in mentation and gait disturbance in 3/25 (12%). The duration of symptoms before diagnosis ranged one month to eight years, with the mean duration of presentation 11 months.

Table 2: Clinical presentation of patients with central nervous system tuberculoma, January 2009 - June 2013, Tikur Anbessa Specialized Hospital, Ethiopia

Clinical presentation	Number and perecentage frequency
Seizure	15 (60)
Headache	11 (44)
Visual disturbance	9 (36)
Focal neurological deficet	6 (24)
Change in mentation	3 (12)
Gait abnormality (ataxia)	3 (12)
Total	25 (100%)

Concomitant and chest x-ray suggestive of pulmonary TB was found in 28% of the patients, 2/25 (8%) had previous history of TB, and 4/25 (16%) has contact with active TB patient.

Radiological findings: Hard copies and soft copies, when available, were reviewed and 20 patients had CT scans and five patients had an MRI (Table 3). CT demonstrated 18/25 (72%) iso-dense, 4/25 (16%) hypo-dense lesions and calcification was seen in 7/25 (28%) of the cases. Solitary lesion were common finding (Figure 1) accounting for 12/25 (48%), 5/25 (20%) had more than five lesions (Figure 2). Fifty-six percent of the tuberculomas had sizes ranging between 2 cm and 5 cm (Figure 3). Overall, post contrast enhancement was seen in the majority of the lesions except in two which have dense calcification. Twenty-one patients of 25 (84%) demonstrated ring enhancement, 3/25 (12%) solid enhancement, 5/25 (20%) had target lesion. None of the lesion showed heterogeneous enhancement or appearance. Pathological basal meningeal enhancement was seen in 10/25 (40%) of the patient and three of them had basal exudative meningitis. Twelve patients of 25 (48%) had hydrocephalus, and hydrocephalus was more common in the pediatric age group (Figure 4).

Table 3: Pre- and post-contrast computerized tomography scans appearance of patients with central nervous system tuberculoma, January 2009 - June 2013. Tikur Anbessa Specialized Hospital, Ethiopia

CT Appearance	**Density**	**Number (%) (n=25)**
Pre-contrast density	Iso-dense	18 (72)
	Hypo-dense	4 (16)
	Calcification	7 (28)
Post contrast	Ring enhancement	21 (84)
	Target lesion	5 (20)
	Solid enhancement	3 (12)
	No enhancement	2 (8)
MRI	Signal	Number (n= 25)
	T1W hyperintense	1
	T1W isointense	4
	T2W hypointense	2
	T2W intermediate/ isointens	3
	T1W contrast enhancement	4
location	Supra tentoral	16 (64%)
	location	9 (36%)
	Bihemispheric cerebral	8 (32%)
	meningial enhancement	10 (40%)

The majority of the lesions were supratentorial, frontal and parietal, some of which showing also transcallosal spread (Figure 5) mimicking lymphoma or Glioblastoma multiformis and accounted for 59 % of cases. Nine lesions (36%) were infratentorial, rare sites of location included brain stem (Figure 6), and basal ganglia. Most of the patients who had infratentorial lesion were children (out of nine, eight were below 18 years of age). Peri-lesional edema and mass effect was observed in 90 % of the patients. MRI was available for only five patients. Signal intensity was intermediate in four on T1W images and 1 patient showed slightly hyper-intense lesion. On T2W non-contrast enhanced sequence two of the patient had hypointense nodular signal at the center (figure 2) and three had intermediate signal. On post contrast T1W rim enhancement was noticed in three. Solid enhancement was seen in one patient and no enhancement was seen in another one patient.

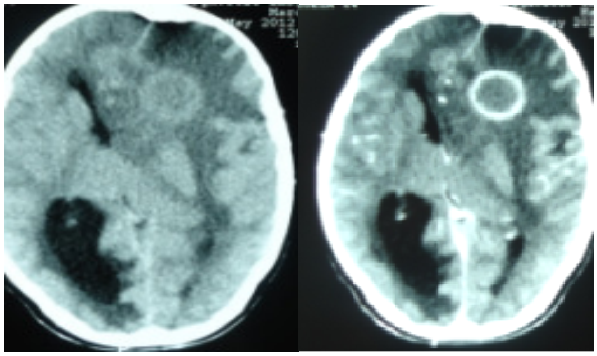

Figure 1. A 14 years male patient presented with visual loss of 1month duration. On pre-contrast CT (left axial image), there is iso-dense frontal mass with hyperdense margin, significant mass effect perilesional edema & obstructive hydrocephalus. Post contrast images (right image) showed smooth ring enhancement.

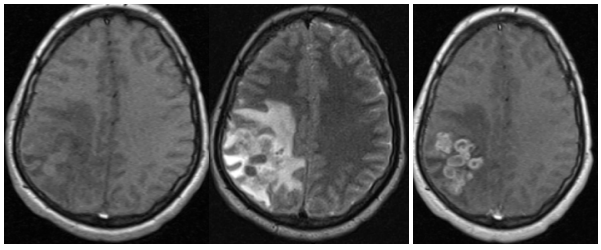

Figure 2. A 26 years old male presented with visual loss of seven months. MRI of the brain showed intermediate intensity on T1W (left) image, Hypo-intense on T2W image (middle image) with perilesional edema. Conglomerate ring enhancing multiple lesions (right image) with significant peri-lesional edema are noted on T1W post contrast image.

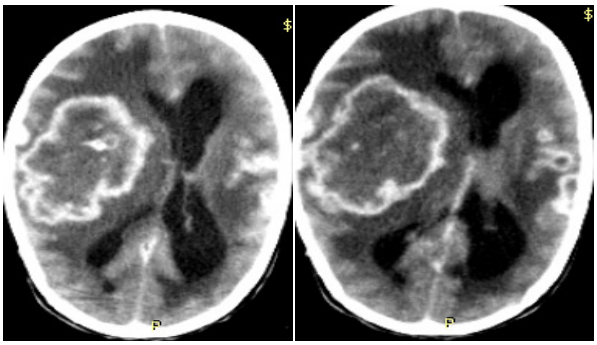

Figure 3. A 8yrs old male child presented with visual loss and seizure and CT scan of the brain showed ring enhancing bilateral partial lobes lesions, bigger on the right, with adjacent satellite lesion and sylvian fissure enhancement suggesting meningial involvement as well.

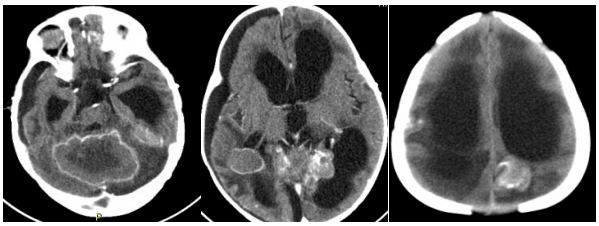

Figure 4. A 2 year old male child presented with seizure, visual loss and change in mentation . CT showed calcified and ring enhancing right parieto-occipital and midline cerebellar and left posterior hemisphere calcified mass (left image) with obstructive hydrocephalus. Right frontoparietal sub dural hygroma was also noted as a complication of VP shunt seen on the left and middle images.

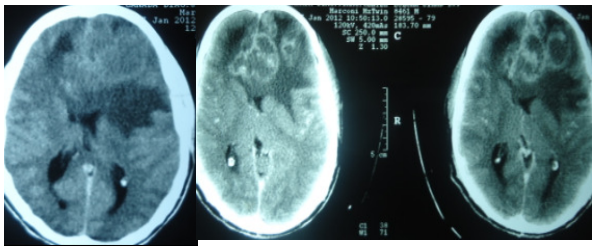

Figure 5. A 20 yrs male with of seizure disorder and visual loss of seven months duration. Axial CT pre (Left image) and post contrast images (middle and far right images) shows frontal & trans-callosal ring enhancing mass with adjacent falx meningial enhancment and significant perilesional vasogenic edema & mass effect.

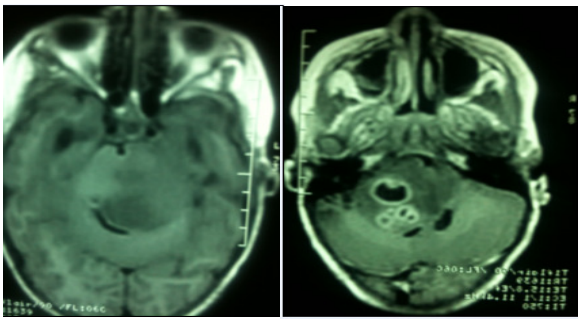

Figure 6. A 4year old presented with gait disturbance. T1W pre contrast showed edema & mass effect on 4th ventricle(left axial image) and axial T1W post contrast study (right axial image) shows conglomerate ring enhancing lesions at the pons and right middle cerebellar peduncle.

DISCUSSION

Intra cranial tuberculomas are space occupying granulomatus mass lesions that result from hematogeneous spread from distant focus of tuberculous infection commonly from the lung. Tuberculomas account for 5-8% of operated Intra cranial masses in endemic and resource limited countries (4) and which is more higher in our series (14%). Tuberculomas origionate as conglomerate of small tubercles that joint to form a mature tuberculoma simulating as any other space occupying CNS mass lesion that may vary in size between 2 cm-10 cm(1), which is less in our series ranging between 2-5cm and accounting for 56% of the tuberculomas.

According to the original description by Rich, a two stage development of CNS tuberculosis - first tuberculous lesion (Rich's focus) develop in the brain during the stage of bacteremia or shortly afterward and later the rupture or growth of one or more of these lesions results in the development of CNS tuberculosis (5). The initial Rich focus may occur in the meninges, the subpial or subependymal surface of the brain, and may remain dormant for many years(5). The diagnosis of Tuberculoma is histopathological, and clinical and radiological diagnosis, although there are non-specific looking for other laboratory findings like cerebrospinal fluid (CSF) analysis and history of past tuberculosis and current chest screening are helpful and prior history of tuberculosis infection is present in 50% of children and in 10% of adults (6,7). In our series, concomittant chest x-ray finding suggestive of pulmonary TB was seen in xx/xx (28%) of the patients, 2/25 (8%) had past history of pulmonary TB treatment and 4/25 (16%) had past history of contact with TB patients. Although CNS involvement is seen in all age groups in our series a predilections for younger age group where 14/25 (56%) of the patients were below the age of 19 years and their median age being 13, which is a little bit lower compared to the reported frequency of 60-70% cases in younger than 20 years (8). and only 2/25 (8%) of the patients were above 45 years, Clinical findings of Tuberculomas are non-specific and are different depending on the size and the location of the pathology, our patients presented with non specific signs and symptoms such as seizure (60%) and headache (40%), visual disturbance (36%), focal neurological deficits (24%) and few of them presented with change of mentation and ataxia. Bihemispheric and transcallosal lesions were seen in 8/25 (32%) and 2/25 (8%) of the patients respectively.

The transcallosal lesion may mimick lymphoma and Glioblastoma multiformis and bihemispheric location may pause the differential diagnosis of metastasis. Other associated findings like meningial enhancement and hydrocephalus (48%) were seen in our study subjects and most of them were below young adults (<18) and pediatric age which is similar to Indian reports (9,10).

The imaging features (CT, MRI) particularly that of its MRI feature is much more specific and sensitive in picking meningeal involvement is been shown to correlate with the histology and n maturity of the tuberculoma, wether the granuloma is having caseous or non casous central necrosis or abscess formations and wether its surrounding capsule contains fibroblasts, epitheloid cells, Langhans giant cells and lymphocytes (11,12) and tuberculoma has been shown to be usually isointense relative to grey matter on both T1W and T2W weighted images and appear as a conglomerated ring-enhancing mass on gadolinium enhanced T1 weighted images and layers of different signal intensities and the shortcoming of our study is that despite most of the histopathology report were caseouss necrosis it lacks direct and one to one correlation of the histology with that of the imaging which could have been coordinated between the pathologist and radiologists in the prior design of the study.

Nevertheless the non-specific findings of smooth ring and solid enhancement with perilesional edema, smaller satellite and target and conglomerated lesions and associated meningial enhancement were seen in both CT and MRI, and on MRI T2W hypointense rim and central hyperintensty, T1W isointense rim,

CT hyperdensity and isodensity and calcification were seen in agreement to the description of most of the radiological and particularly MRI histologically correlated and non correlated cross-sectional studies (13-15) with due consideration of sampling errors and coexisting different pathologies, which could be a potential bias to the study.

Conclusion and recommendation: Tuberculoma is common in our set up and accounts for significant proportion of operated space occupying CNS lesions and commonly seen in young and pediatric patients, and though the imaging features are non-specific additional findings of meningeal involvement and past or present history of TB, the endemicity of the TB, young age of the patient and conglomerated and multiple lesions are invaluable coexisting findings for the differential diagnosis. Imaging and histopathology correlated prospective well designed study is recommended so that timely diagnosis by the radiologists and treating physicians could be made for prompt early medical treatment and avoid unnecessary neurosurgical intervention unless and otherwise complicated. Surgical intervention for intracranial tuberculomas is generally not recommended because prolonged pharmacologic therapy combined with corticosteroides is usually effective in treating these lesions,. However, surgery may be warranted if immediate decompression is necessary for patients with raised intracranial pressure secondary to the lesion or if biopsy is required for definitive diagnosis. In the current study, indications for surgery were similar to the reports made in low-income countries (16,17)

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