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Original Research Article

Outcomes of patients presenting with central nervous system tuberculosis at a tertiary care center in India

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ABSTRACT

Background: Tuberculosis (TB) is a major public health problem in India. Ten percent of all patients with TB have CNS involvement. Delayed diagnosis of this disease is associated with increased mortality. This study assesses the socio-demographic profile as well as outcomes in patients with various forms of CNS TB.
Methods: A prospective observational study conducted at V.S. Hospital, Ahmedabad, between December-2016 and February-2018. Each patient was assessed from admission to 3- month follow up. The diagnosis of tuberculous meningitis (TBM) and tuberculoma was done as per the Ahuja and Rajashekhar criteria, respectively. Neurological status and functional outcome were graded based on modified Rankin score (mRS).
Results: Our study had 56 patients with a mean age of 35.01±11.46 years. We observed that increasing age was associated with higher mRS (p=0.002). Fever was the most common symptom in patients with TBM (96. 15%), unlike seizures (100%) in patients with tuberculomas with or without TBM. Patients with either isolated TBM or tuberculoma had improvement in outcomes. On multivariate analysis, it was found that CN palsy (HR=0.38, p=0.003), duration of illness (HR=0.35, p=0.005) and age (HR=0.33, p=0.008) were the most significant predictor of worse outcomes.
Conclusions: Identification and evaluation of focal signs like seizures and focal neurological deficits along with certain non-focal signs like headache and fever should raise high level of suspicion for TB in tropical regions at the primary care levels for early diagnosis and treatment.

Keywords: CNS tuberculosis, Tubercular meningitis, Tuberculoma, Tuberculosis

INTRODUCTION

Tuberculosis (Tb) is a major public health problem not only in India but the entire world. In immune competent individuals, CNS tuberculosis constitutes 1% of all cases of tuberculosis and 6% of extra pulmonary tuberculosis.[1] The incidence of CNS Tb increases with increased incidence of Tb infection. Ten percent of all patients with tuberculosis are estimated to have CNS involvement.[2] CNS TB usually results from hematogenous spread.

However, it can result from direct rupture or extension of a subpial or subependymal focus (Rich focus). Granulomatous inflammatory reaction in CNS may involve the meninges, brain, spinal cord, and the bones covering the brain and spinal cord. It may manifest in a variety of forms including parenchymal and leptomeningeal tuberculomas, abscesses, cerebritis, vasculitis, infarction, meningitis, and osteomyelitis.[3] The relative rarity and protean nature of its symptoms makes tuberculosis of the CNS a formidable diagnostic challenge.

Inflammation of the meninges that surround the brain due to a mycobacterium tuberculosis infection is referred to as TBM. It accounts for 70- 80 % of neurological Tb cases.[4,5] The three pathologic features of tuberculous meningitis are inflammatory meningeal exudates, vasculitis of the arteries traversing this exudate (mainly small and medium-sized vessels) and disturbance of CSF flow.[6] The diagnosis of TBM was established as per Ahuja et al criteria, which include the following diagnostic methods: (a) clinical (b) CSF examination (c) radiological (d) evidence of extra-neural tuberculosis.[7]

Current WHO guidelines for treatment of TBM are based on those developed to treat pulmonary TB and suggest treatment with 2 months of rifampicin (RMP), isoniazid (INH), pyrazinamide (PZE) and ethambutol (ETB) followed by up to 10 months of RMP and INH for all patients.8 Adjunctive glucocorticoid therapy is beneficial in adults with tuberculous meningitis.[9] Glucocorticoid regimen followed is either dexamethasone or prednisone.

Aim and objectives

Aim of this study was to assess the in-hospital outcome based on modified ranking scale (mRS) in patients with various forms of neurological TB who receive the daily anti-tubercular treatment (ATT) as per WHO guidelines.[8]

Objectives were 1) to study the socio-demographic, clinical, laboratory profile and radiological spectrum of CNS tuberculosis 2) to study in-hospital outcome using mRS of patients with CNS Tuberculosis and predictors of outcome 3) to assess the severity of CNS tuberculosis in patients using the mRS 4) to study 3-month treatment outcomes in patients with various forms of CNS tuberculosis being treated with the daily ATT as per WHO guidelines using the mRS.

METHODS

This was a prospective observational study conducted at Sheth V.S. Hospital, a tertiary care hospital in Ahmedabad, Gujarat between December 2015, and February 2018. We collected data from 56 patients that were newly diagnosed with CNS TB.

Inclusion criteria

Inclusion criteria were all immuno-competent patients diagnosed with CNS TB based on neuroimaging and laboratory findings; patients above 18 years of age; patients who gave informed consent.

Exclusion criteria

Exclusion criteria were patients with potts spine and TB myelitis; presence of secondary immunodeficiency states, such as HIV infection and malignancy; pregnancy and lactation; patients lost to follow up.

Patients presenting to the Emergency room that were suspected to have CNS TB were admitted to the inpatient ward. After taking an informed written consent, their socio-demographic and vital data were recorded. Essential laboratory and radiological testing were done.

Diagnostic criteria

We diagnosed Tb and TBM based on Rajashekhar and Ahuja criteria respectively.[7]

Clinical evaluation and investigations

Demographic variables, co-morbidities, nutritional status, and neurological status were recorded on admission and thereafter at specified time; the neurological status was evaluated on admission and categorized based on British MRC scale in patients with suspected TBM (Table 2). All patients were evaluated based on haematological and standard biochemical profile, chest X Ray, ultrasound abdomen, and neuroimaging. Lumbar puncture was only performed in patients with suspicion of TBM. The CSF was examined for total cell count, lymphocyte count, typical cells, protein and sugar. CSF was then sent for AFB and gram staining. CSF CB NAAT was sent for all patients. Repeat CSF examination was carried out when clinically indicated; at the time of initial evaluation, plain CT of the brain was done in all patients with suspected neurological TB; plain and gadolinium enhanced MRI of the brain were also done. All patients were neurologically assessed based on mRS (Table 1) on admission, at discharge and at 3-month follow up. Some patients with uncontrolled seizures, fever, and increasing CNS deficit underwent repeat imaging and CSF examination.

Treatment and follow-up

All patients were categorised into groups A, B and C based on diagnosis: TBM, TBM and Tuberculoma, Tuberculoma, respectively.

Regular follow up was done up to 3 months after discharge. Neurological status and functional outcome were recorded and graded based on mRS, on discharge and follow up. Imaging and other appropriate investigations were repeated when clinically indicated.

Follow up imaging was done for patients with isolated tuberculoma and TBM+tuberculoma at the 3rd month.

All patients with CNS TB were treated according to WHO guidelines for a total duration of 2 months (intensive phase) and re-evaluated.[8] On improvement they were transitioned to two-drug regimen (continuation phase).

In patients with TBM, intravenous dexamethasone was administered followed by gradual tapering of oral prednisolone (60 mg/day) for 2 to 3 weeks. Thereafter, prednisolone was gradually tapered off over the next 2 to 3 weeks until stopped. In patients with intracranial tuberculomas, oral prednisolone was administered for 3 weeks.

Table 1: Modified rankin scoring.

Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability: unable to carry out all previous activities but able to look after own affairs without assistance
3	Moderate disability: requiring some help, but able to walk without assistance
4	Moderately severe disability: unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability: bedridden, incontinent and requiring constant nursing care and attention
6	Dead

This table describes the mRS, which was used to measure outcomes in all the three group, on admission, at discharge and at 3-month follow up.

Table 2: Modified rankin scoring.

1.	Stage 1	Fully conscious, no paresis
2.	Stage 2	Decreased level of consciousness, no paresis
3.	Stage 3	Deeply comatose with or without dense neurological deficit

This table describes the stages of BMRC scale. The stage was used to measure the prognosis and outcomes in patients of all the three groups.

Outcomes were defined based on mRS. The scores can be scaled as following- good: 0-4, bad: 5, death: 6

Statistical analysis was carried out using the SPSS software version 20. Descriptive analysis was performed using chi-square test. Pearson's test was done to evaluate co-relation between two variables. Multivariate analysis was done using linear regression analysis.

RESULTS

Out of total 56 patients, 26 patients had TBM, 13 had TBM with tuberculosis and 17 had Tuberculoma.

Age and gender distribution

A total of 56 patients between the ages of 18 to 65 were enrolled in this study. The mean age was 35±11 years. We observed that increasing age was associated with higher mRS. (Pearson's correlation factor 0.398, p=0.002). There were 27 (48%) females in our study. (Table 3).

Clinical features

Fever was the most common presenting symptom in group A. Seizures were present in all patients with tuberculomas (groups B and C). Focal neurological deficit in the form of hemiparesis or hemiplegia was seen in 53% from Group B compared to only 23% in Group A and 17.5 % in Group C. All patients of Group C had seizures followed by headache, Fever, focal neurological deficits and choreoathethoid movements at an incidence of 100%, 59%, 76.5%,17.5% and 5.9% respectively. (Figure 1)

BMRC clinical staging of illness

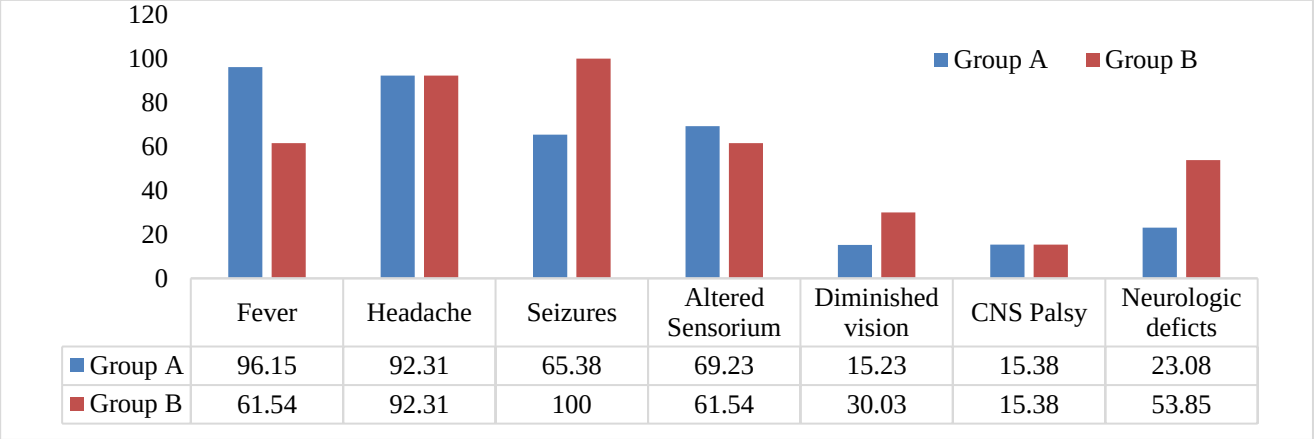
All patients from group A and B were staged based on BMRC scale. Most patients presented at stages 2 (33%) and 3 (48%) (Figure 2).

We observed that most patients in group B presented at advanced stages of the disease. Only 7.69% patients presented in stage 1 compared to 26.9% patients in Group A (Figure 2).

Table 3: Gender distribution of patients in the study.

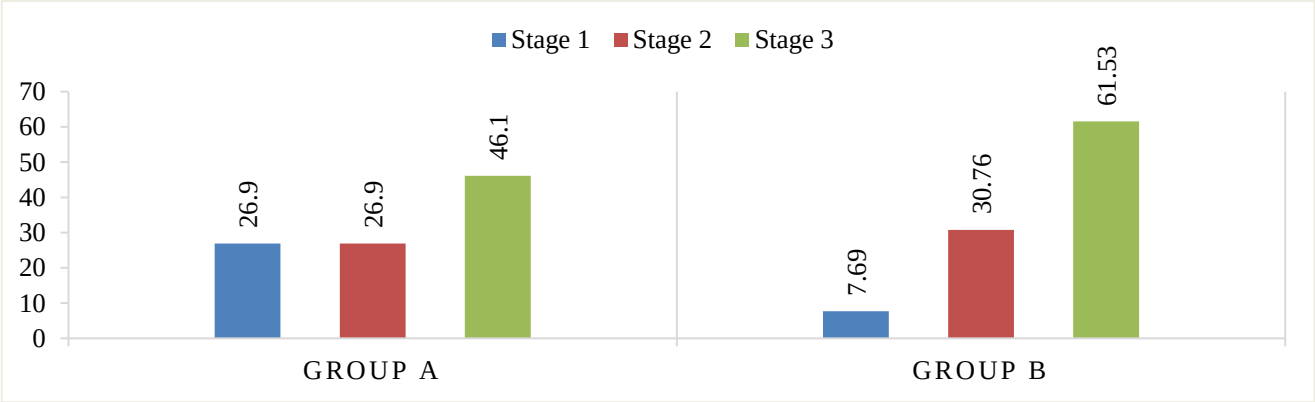
Age group (in years)	Male		Female		Total		Rankin score at admission
	Number	Percent	Number	Percentage	Number	Percent	
<30	11	37.9%	12	44.4%	23	41%	3.13
30-39	6	20.7%	7	25.9%	13	23.2%	3.14
≥40	12	41.4%	8	29.6%	20	35.7%	3.25
Total	29	52%	27	48%	56	100%	

The mean age was 35 +/- 11 years. Increasing age was associated with higher mRS. (Pearson's correlation factor 0.398, p=0.002).



This figure illustrates the presenting symptoms in Group A and Group B: Headache being most common in Group A and Seizures being most common presenting symptom in Group B.

Figure 1: Presenting symptoms in group A and group B (TBM with or without Tuberculoma).



This figure illustrates the BMRC stages of patients in Groups: A, B and C at presentation.

Figure 2: Comparison of BMRC staging of groups A and B.

Duration of the symptoms

Out of 56 patients, 41 (73.21%) had a prolonged duration of illness (2 weeks to 3 months) and were being treated by a primary care physician. On multivariate analysis a long duration of illness was associated with poor outcomes (HR of 0.35 and p=0.005).

CSF analysis

CSF analysis was done in group A and B and the results were compared and evaluated. 71% of patients who presented in stage 2 and stage 3 of illness had moderate to severe elevation of proteins, of which 23.07% had mild elevation (<100 mg/dl), 43% had moderate elevation (101–500) and 25.6 % had severe elevation (500-1500). 43% showed normal sugar levels and 57% of patients had <2/3rds serum sugar level.

Out of 56 patients, only 16 patient's CSF detected mycobacterium tuberculosis on CSF TBNAAT and Rifampicin resistance was not detected on either. CSF ADA were done only in 12 patients out of which it was sensitive among 8 patients. In none of the patients we were able to document AFB in the CSF.

In group A and B proteins ranged from 79-1500 mg/dl and the mean proteins was 287mg/dl in group A and 393.6 mg/dl in group B. In group A and B, total cell count ranged from 6–145/cu.mm with mean total cell count of 56.12/cu.mm in group A and 75.32/cu.mm in group B, lymphocyte count ranged from 5-118/cu.mm with mean lymphocyte count of 44.8/cu.mm in group A and 62.07/cu.mm in group B (Table 4).

Imaging

On imaging the most common finding was meningeal enhancement, 65% in Group A and 61% in group B. All the patients in group B and C showed granulomas. Infarcts were mostly seen in group B patients (46%) ($\chi 2$=3.692, p=0.05). Solitary lesion (63%) appears to be more common than multiple lesions (39%) in our study. Most patients with tuberculoma with or without TBM (group B and C) (n=30) had supratentorial (97%) location of lesion in with parietal lobe (56%) being the most common site seen in 17 patients (Table 5, 6).

71% of patients who presented in stage 2 and stage 3 of illness had moderate to severe elevation of proteins, of which 23.07% had mild elevation (<100 mg/dl), 43% had moderate elevation (101–500) and 25.6 % had severe elevation (500-1500).

Table 4: CSF findings in Group A and Group B.

CSF parameters	Group A (n=26)	Group B (n=13)
	N (%)	N (%)
Proteins		
79-100	10 (38.4)	2 (15)
100-500	9 (35)	8 (61)
500-1500	7 (26.6)	3 (24)
Lymphocytes cell count		
5-50	18 (69)	4 (30)
50-100	8 (31)	7 (53)
100-118	-	2(17)
Total cell count		
6-50	11 (42)	2 (15)
50-100	14 (54)	8 (61)
100-145	1 (4)	3 (24)

Table 5: Imaging findings in group A and group B.

S. no.	Imaging	Meningeal enhancement	Basal exudates	Infarcts	Hydrocephalus
1.	Group A	65%	34%	19%	58%
2.	Group B	61%	38%	46%	38%

On imaging the most common finding was meningeal enhancement, 65% in Group A and 61% in Group B.

Table 6: Lesions in group B and C.

S. no.	Imaging findings	Group B (%)	Group C (%)	Total (%)
1.	Solitary lesion	5 (38.4)	14 (82.3)	19 (63.3)
2.	Multiple lesion	8 (61.6)	3 (17.7)	11 (36.6)

Solitary lesion (63%) appears to be more common than multiple lesions (39%) in our study.

Concurrence of pulmonary tuberculosis

Out of 56 patients 14 had active pulmonary tuberculosis infection based on Chest X-ray results. Amongst all groups, group C had higher incidence of co-infection (29%). Pulmonary TB was associated with poor outcome (p=0.009).

Outcomes

On admission: Out of 56 patients most had a mRS of 4 (29%). Group B had the highest mean of modified Rankin score (4.23±0.72). The lowest mean for mRS was observed in Group C (1.29±1.3) (Table 7).

In hospital: Even during in-hospital group B displayed the highest mean score (3.69±1.62) and group C displayed the lowest (0.81±1.04). There were 3 deaths in group B and 2 deaths in group A (Table 7).

Month follow up: The highest mean was maintained by Group B on 3-month follow up (3.33±1.92) (Table 7).

Improvement scale for groups A, B and C from admission to 3 months follow up

We compared the mRS of group A patients from admission to discharge. The mean difference was found to be 0.85±0.88 and p<0.001 indicating significant improvement. There was also a significant improvement between modified Rankin score at discharge and follow-up, with a mean difference of 0.81±0.80 and p=0.001 (Table 8).

On comparing mRS between admission to discharge in Group B, the mean difference was found to be 0.70±1.26 and p=0.069. There was no significant difference (p=0.982) between mRS at discharge and follow-up. We can attribute this to higher mortality in this group (23%)

as compared to other groups and the severity of disease (Table 8).

On comparing mRS from admission to discharge in Group C, the mean difference was found to be 0.59±0.62, p<0.001 denoting a significant improvement. There was a significant improvement between mRS at discharge and follow-up as well. The mean difference was found to be 0.53±0.80 p=0.015 (Table 8).

We can see that there is significant functional improvement in patients belonging to groups A and C, both at the end of hospital stay and at 3-month follow up but not in group B (Table 8). Patients diagnosed with isolated tuberculoma had a better outcome (100%) than groups A (84%) and B (54.9%). Highest mortality was seen in group B (Table 9).

Table 7: Modified Rankin score (mRS) in different groups.

mRS	On admission			In-hospital			3-month follow up		
	Groups								
	A	B	C	A	B	C	A	B	C
0-1	2	-	12	8	1	13	11	3	14
2-3	6	2	3	5	6	4	8	2	1
4	8	5	2	9	2	0	3	2	-
5	10	6	-	2	1	0	1	2	-
6	-	-	-	2	3	0	2	3	-
Mean	3.85±1.25	4.23±0.72	1.29±1.31	2.84±1.89	3.69±1.62	0.812±1.04	1.95±1.82	3.33±1.92	0.4±0.63

This table shows the modified Rankin Scale of all the groups (Group A, Group B, Group C) on admission, at discharge and after a 3-month Follow up. The mean mRS was 4. Group B had the highest mean mRS at all the three instances.

Table 8: Comparison of improvement in outcomes of groups A, B and C patients from admission to follow up.

Groups	S. no.	Comparisons	Mean	Mean improvement	P value
A	1	Modified Rankin score on admission	3.77	0.85±0.88	<0.001
		Modified Rankin score- hospital outcome on discharge	2.92		
	2	Modified Rankin score-hospital outcome	2.92	0.81±0.80	<0.001
		Modified Rankin score on 3-month follow up	2.12		
B	3	Modified Rankin score on admission	4.31	0.70±1.26	0.069
		Modified Rankin score- hospital outcome on discharge	3.62		
	4	Modified Rankin score-on discharge	3.62	0.02±1.08	0.982
		Modified Rankin score on 3-month follow up	3.60		
C	5	Modified Rankin score on admission	1.35	0.59±0.62	<0.001
		Modified Rankin score- hospital outcome on discharge	0.76		
	6	Modified Rankin score-on discharge	0.76	0.53±0.80	0.015
		Modified Rankin score on 3-month follow up	0.24		

This table determines the improvement of mean mRS in all the three groups A, B and C by comparing the mean mRS at admission with mean mRS at discharge and mean mRS at discharge with mean mRS at 3-month follow up within each group.

Multivariate analysis

We carried out multivariate analysis to find out the association of different factors with general outcome of patients. We included following variables: age, fever, headache, altered sensorium, seizures, limb weakness, meningeal signs, pulmonary TB, duration of illness and cranial nerve palsy in linear regression model. Above mentioned variables explained 34.1% (R square value) of variance occurring in general outcomes.

Also, it was found that CN palsy (HR=0.38, p=0.003), duration of illness (HR=0.35, p=0.005) and age (HR=0.33, p=0.008) were the most significant predictor of worse outcomes as per linear regression analysis in all the 3 groups. Certain variables like diminished vision (HR=0.57, p<0.001), limb weakness (HR=0.42, p=0.001), pulmonary TB (HR=0.28, p=0.009) and hydrocephalus (HR=0.26, p=0.038) were observed to have statistical significance in linear regression analysis in groups A and B. In our study the sixth cranial nerve was the most affected cranial nerve.

Table 9: Comparison of improvement outcomes in all groups from admission to follow up.

	Group A (%)	Group B (%)	Group C (%)
Good	23 (84)	7 (54.9)	17 (100)
Bad	1 (4)	2(14.4)	-
Death	2(8)	3(23)	-

This table indicates that the outcomes in Group B (TBM + tuberculoma) is worse as compared to isolated TBM or isolated tuberculoma.

DISCUSSION

Fifty-six patients with newly diagnosed CNS tuberculosis were registered and followed up. They ranged between 18 to 65 years of age, with the majority lying in the 20 to 29 group. Increasing age was associated with a poor outcome (p=0.006). Similar to WHO reports, we had almost equal distribution among both sexes.[9] In our study 67 % of patients had TBM (with or without associated tuberculoma).

All our patients diagnosed as highly probable cases of TBM had fever and headache as their initial presenting symptoms. Study by Thwaites et al also observed similar trends in which these patients only had very mild and few symptoms on earlier presentation.[10] Most patients with early TBM suffered from only headache without any localized symptoms. Therefore, increased surveillance of suspicious cases in endemic areas is crucial. There is lack of awareness regarding CNS TB in the primary care rural centres.[11] In a study of 48 adults with TBM in France, a delay of 3 days between presentation and initiation of anti-tuberculous therapy was associated with increased risk of death.[12] It is found that one of the most important determinants of outcome and prognosis in these cases is the neurological stage of the disease at which treatment has been started. Mortality and morbidity remain low if ATT and corticosteroids are initiated before the patient progresses beyond stage I, while in stage III the mortality is almost 50% and those who recover may have some form of neurological deficit.[13,14]

In our study all patients that were diagnosed with a tuberculoma had seizures as one of the presenting complaints. Various studies have shown similar findings. Maduranth et al and Arseni et al have reported seizures to be the predominant manifestation in around 90% and 85% of their patients with tuberculoma respectively. In a study of MRI findings on childhood epilepsy, Gulati et al reported tuberculoma as the the most common finding.[15-17]

Hemiparesis and hemiplegia were seen in 23% patients from group A and in 53% from group B in our study. 15-57% of TBM patients were found to have cerebral infarcts, mainly during stage three of the illness.[18,19] According to a study published by Hsieh and colleagues, 75% of the infarcts in the “TB zone” were supplied by the medial lenticulostriate and thalamo-perforating arteries, whereas infarcts in the “ischaemic zone” supplied by the lateral lenticulostriate, anterior choroidal and thalamo-geniculate arteries were seen only in 11% of the patients.[20] TB vasculitis is seen in severe TBM (stage II to III). We checked limb weakness as a predictor of poor outcome by multivariate analysis and the factor was found significant (p=0.001). In our study the sixth cranial nerve was most affected. We checked cranial nerve palsy as a predictor of poor outcome by multivariate analysis and the factor was found to be significant (p=0.003).

The spectrum of vision impairment ranged from legal blindness to functional impairment of vision. In our study we found that vision impairment was a significant predictor of poor outcome Sinha et al reported that 27% of TBM patients had decreased vision due to optochiasmaticarachanoiditis (OCA).[21] Aaron et al reported 14% patients with OCA.[22] Choreoathetoid movements were a presenting symptom of tuberculoma in 5% patients. Alarcon et al have also documented choreoathetoid movement to be the presenting manifestation of tuberculoma.[23]

Total 71% of patients who presented in stage 2 and stage 3 of illness had moderate to severe elevation of proteins. This shows that those who presented in advanced stages had higher levels of CSF proteins which was similar to earlier studies.[24,25] There was no correlation between the severity of the illness and the CSF sugar levels in our study. In contrary Hosoglo showed a correlation between severity of the illness and CSF sugar levels.[24] The CSF analysis in our study resulted in an average of total count :<200/cu.mm, lymphocytes counts>80% total white cells and CSF protein>80 mg/dl, while these values ranged from<750–1000/cu.mm, 10% to>70% of total white cells and 80 mg/dl to 100 mg/dl for CSF protein, respectively in other studies.[26-28] Seventy six percent of the patients showed tuberculous range of lymphocytic pleocytosis and elevated total counts in group A and B. In our study we were not able to document the microorganism in the biological fluid.

Definitive diagnosis of tuberculous meningitis depends upon the detection of the tubercle bacilli in the CSF, either by smear examination or by bacterial culture. It has been claimed that if large volumes of CSF are carefully examined the organism can be found in over 90% of centrifuged CSF specimens.[5] CSF CB-NAAT was sent in all patients and it was sensitive in 41% in our study compared to 38%, 53%, 66% in Armand et al, Moure et al and, Vadwai et al respectively. Rifampicin resistance was not seen in any patients.[29-31] CSF adenosine deaminase (ADA) was sent in 12 patients and was sensitive in 8 patients. Standardized cut-offs of ADA values for the diagnosis of TBM have not been established, and the values used in various studies ranged from>5.0 to>15 IU/liter. High CSF ADA activity has been reported from patients with lymphomas, malaria, brucellosis, pyogenic meningitis, cryptococcal meningitis, and cerebral lymphomas.[32,33] CSF ADA activity is not recommended as a routine diagnostic test for CNS tuberculosis.[34]

A study done by Goyal et al observed that meningeal enhancement was seen in approximately 60% of patients with TBM.[25] We also saw similar finding in our study, with 65% TBM patients showing meningeal

enhancement. Few studies have shown that Hydrocephalus is the most common CT findings.[24] Study by Swash et al revealed that hydrocephalus was the single most common abnormality in 52% to 80% of patients with tuberculous meningitis.[12] In our study hydrocephalus was the second most common finding (51%). Cerebral infarction occurs in 15–57% of tuberculous meningitis patients, mainly during stage III of the illness.

On measuring outcomes, we observed that patients with isolated TBM (84%) or tuberculomas (100%) mostly had better outcomes. Patients with both TBM and tuberculoma on the other hand had a higher percentage of patients with poor outcome (14.4%) and the highest mortality (23%). There are conflicting reports in literature with some suggesting prognosis to be similar in TBM with and without tuberculoma while others showing poorer outcome in patients with tuberculoma.[25,35] In our study patients with tuberculoma had much better outcome than patients with TBM with or without tuberculoma. It is also found in one of the study that prognostic factors correlating with poor performance to ATT are age, raised intracranial pressure, hydrocephalus, infection with multi-resistant mycobacterial strains, infection with HIV whereas in our study cranial nerve palsy, higher age and higher duration of illness showed poor outcomes.[14] The mortality rate in our study (18.6%) which showed similarity to previous studies who had used the daily ATT regimen(17 to 43%).[36-38]

Limitations

Our study is an observational study with patients having Tb only. We did not have control subjects in our study for comparison of our outcomes. As our hospital caters to lower socio-economic background population of western part of India, findings might be different in other socio-demographic background of the country. Due to the economic background as well as lack of electronic medical record system, we did not have full accurate past medical as well as family history of all patients and therefore effects of other co-morbidities were not evaluated for outcomes. Also, we did not have accurate information about past vaccination in these patients. Pulmonary Tb was diagnosed based on chest x-ray. Even though CT scan test has higher accuracy in diagnosing pulmonary Tb. Due to socio-economic profile of our patients as well as no change in management of CNS Tb, CT Chest was not done in all of our patients. Despite the limitations as mentioned above, this study gives us detailed information of a unique population of CNS Tuberculosis patients in the western part of India. It will serve as a base-line for further studies with higher sample size, and matched case-control study design.

CONCLUSION

CNS Tuberculosis has varied presentations. In our study, higher age, duration of illness, and cranial nerve palsy were associated with worse outcome. Seizures and focal neurological deficits were more commonly seen in patients with tuberculomas. Headache and seizures were common non-focal presenting symptoms. Patients having both TBM and tuberculomas at admission had a worse prognosis compared to others. Identification and evaluation of focal signs like seizures and focal neurological deficits along with certain non-focal signs like headache and fever should raise high level of suspicion for TB. We need to increase awareness of CNS TB in at the primary care rural centers in tropical regions of the world. This will help in early diagnosis and treatment.

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