

Correlation of Serum Sodium at Admission with the Staging, Neurological Deficits and Imaging Abnormalities in Tuberculous Meningitis

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Introduction

Tuberculous meningitis (TBM) is a major global health problem and is the most severe form of extrapulmonary tuberculosis with high mortality rate. Its reported prevalence varies from 5 to 15% in various cohorts of the population of patients with tuberculosis (Farer et al 1979, Wood et al 1998). Clinically, TBM is a syndrome of subacute lymphocytic meningitis in the majority of patients. In developing countries, TB meningitis is still a disease of childhood with the high incidence in the first three years of life (Tandon PN, Brattier R, Handbook of clinical neurology, Donald PR).

Many complications are associated with tuberculous meningitis like vasculitis infarcts, hydrocephalus, cerebral atrophy, and tuberculomas. There are various cofactors associated with the various complications like CSF ADA levels and hyponatremia. Hyponatremia is seen in almost half of the patients with tuberculous meningitis. Various mechanisms are held responsible for the hyponatremia most common of them is cerebral salt wasting. Previous studies by **Harold e Harrison et al** ⁽¹⁾ shows that in plasma the concentrations of sodium and chloride are reduced without any consistent change in the concentrations of the potassium. It has been seen that the more severe the hyponatremia, the more severe meningitis

and severe the complications also seen associated with that. This study was done so as to see the relationship of the serum sodium levels with the staging of tuberculous meningitis and the neurological deficits along with the neurological imaging abnormalities seen in the scanning.

Materials and Methods

The study was a prospective study, done in the department of medicine and department of neurology from September 2015 to August 2016. The patients who got admitted with clinical picture commensurate with Meningitis in Medicine and Neurology department were assessed on Thwarts Criteria and those found to be likely cases of T.B.M, as per the criteria were included in the study and their serum sodium levels were measured.

Inclusion Criteria

- Those subjects who give informed consent for the study.
- Patients fulfilling the diagnostic criteria of TBM based on the Thwaites criteria.

Exclusion Criteria

- 1. Patients/attendants refusing consent.
- 2. Patients not fulfilling the Thwaites criteria.
- 3. Brain abscess
- 4. Head trauma

Table 1: THWAITES CRITERIA

Parameters		DI
Age	>= 35 years	2
	< 35 years	0
Blood WBC, 10 ³ / ml	>= 15000	4
	< 15000	0
History of illness, days	>= 6 days	-5
	< 6 days	0
CSF total WBC, 10 ³ / ml	>= 900	3
	< 900	0
CSF % neutrophils	>= 75 %	4
	< 75 %	0
DI > 4: TBM		
DI 1-4 : other bacterial meningitis		

Study Design

Patients who presented with history and clinical features suggestive of TBM were included in this study. A criterion suggested by Thwaites et al (2) was used to label these patients to be suffering from TBM. Patients satisfying the criteria thus, labeled as TBM were further evaluated. CSF-ADA values were measured in these patients, and values above 10 IU/L were taken to be positive. The patients were characterized on the basis MODIFIED BRITISH MEDICAL RESEARCH COUNCIL (BMRC) clinical stages for tuberculous meningitis using the Glasgow coma scale. (3,4,5)

These patients were treated for TBM as per the standard protocol, and the morbidity and mortality were assessed at discharge. (6,7,8)

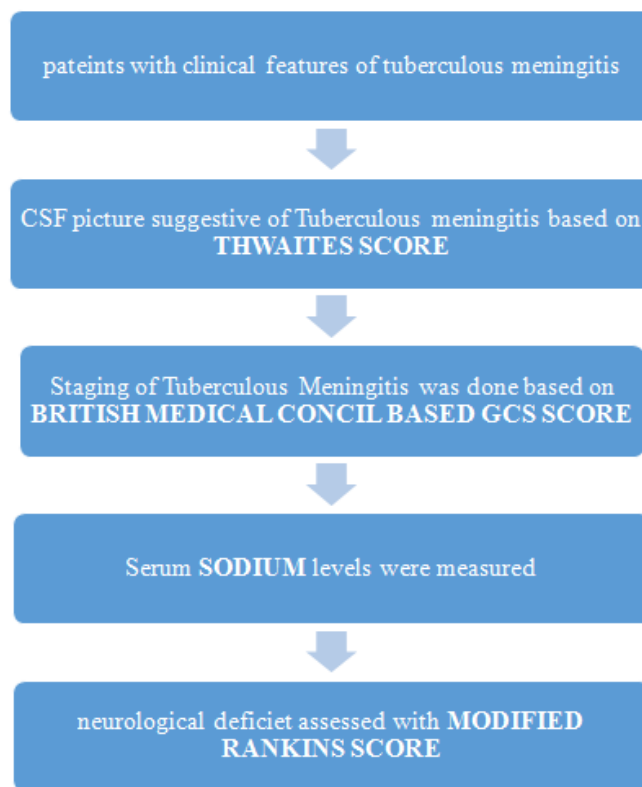


Table 2: MODIFIED RANKINS SCORE

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

Table 3: Modified British Medical Research Council (Bmrc) Clinical Stages For Tuberculous Meningitis Using The Glasgow Coma Scale

GCS	Focal neurological deficits	Grade
15	absent	I
15	present	II
11-14	NA	III
3-10	NA	IV

Results

Table 4: Association between TBM Stage and Serum Na⁺ Levels

	No. of cases	Mean S. Na ⁺	SD	Minimum	Maximum
Stage I & II	24	133.05	8.21	113.70	148.00
Stage III	75	128.86	7.51	105.00	149.00
Total	99	129.88	7.85	105.00	149.00

Table 5: Association Between Serum Na⁺ And Mrs-D Scores.

MRS-D Score	N	Mean Na ⁺	SD	Minimum	Maximum
0	49	133.08	6.06	116.70	149.00
1	21	129.14	8.70	112.00	145.00
2	7	130.43	7.23	118.00	142.00
3	10	126.26	5.61	112	132
4	5	125.68	3.42	120.4	128
Total	92	130.84	7.09	112	149

TABLE 6: S. Na⁺ Correlation with Imaging

Imaging Finding	N	Mean Na ⁺	SD	Minimum	Maximum
Normal	44	134.38	5.60	124.00	149.00
Basal exudates	11	127.76	7.53	113.70	135.00
Diffuse atrophy	4	132.50	5.32	127.00	138.00
Hydrocephalus	19	124.30	8.78	105	145
Left/Right MCA infarct	4	124.48	9.25	111	131
Meningitis	7	124.57	4.72	120	132
Others	8	129.18	6.25	120.40	141.00
Total	97	130.03	7.86	105.00	149.00

Discussion

Serum sodium levels of those in stage I & II were significantly higher as compared to those in stage III but

the result wasn't statistically significant (p=0.022). Mean S. Na⁺ levels were significantly lower in cases with MRS score 3 &4 as compared to that of cases with scores MRS 0 to 2 and result was statistically significant (p=0.009). Mean Na⁺ levels of patients with basal exudates, hydrocephalus, left/right MCA infarct and meningitis were lower as compared to that of patients with normal, other findings and diffuse atrophy and were statistically significant (p<0.001).

Conclusion

Hyponatremia is associated with the severe stage and more complications in the patient of Tuberculous meningitis.

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