

Frequency of Hyponatremia in Patients with Tuberculosis Bacterial Meningitis: A Cross Sectional Study

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ABSTRACT

Aim: To determine the frequency of hyponatremia in patients with Tuberculosis Bacterial Meningitis

Study Design: Cross sectional study

Place and duration: This study was conducted at Gambat Institute of Medical Sciences Gambat Khairpur Pakistan from June 2020 to June 2021.

Methodology: The study included 169 patient. Each patient was questioned for their medical history and demographic data and this information was analyzed using the Statistical Package for Social Sciences (SPSS) version 22.0. These simple statistics included the age, height, and weight of the patients. It also factored in their Glasgow Coma Scale, how long their symptoms lasted for, and their serum sodium levels. Data taken for categorical variables was calculated and characterized using mathematical frequencies and percentages. These variables included data such as their gender, their smoking habits, diagnosed or undiagnosed hypertension and other medical phenomena's inflicting the patient such as Type 2 Diabetes Mellitus, hyponatremia, the syndrome of inappropriate antidiuretic hormone, Cerebral salt wasting syndrome and finally the BMRC stage for the patients. The BMRC criteria was set for determining the stage of TBM in each patient, this criterion was created by the British Medical Research Council. Post stratification chi-square test was also taken for this study and only variables with a p-value of ≤ 0.05 were taken to be significant.

Results: The results of our study concluded that 76 (45%) of the tuberculous bacterial meningitis patients suffered from hyponatremia. Patients who suffered from syndrome of inappropriate antidiuretic hormone secretion and cerebral salt wasting syndrome were also recorded which were 13.2% and 26.7% respectively. This study population consisted of 60% males and 40% females where the average age of the patients was from 44 to 48 years. The mean duration of the symptoms was also recorded which displayed that the patient suffered from the disease for a period of three days to almost two weeks and the patients weighed between 68 to 87 kilograms.

Conclusion: The results of our study proved the hypothesis that a great number of patients suffering from tuberculous bacterial meningitis are a victim of hyponatremia. If hyponatremia is not diagnosed and treated using the proper channels and techniques it can lead to grave consequences such as significant neurological conditions and death. It is important to keep track of the sodium levels in patients of tuberculous bacterial meningitis.

Keywords: tuberculous bacterial meningitis, hyponatremia, syndrome of inappropriate antidiuretic hormone secretion, cerebral salt wasting syndrome

INTRODUCTION

Tuberculous meningitis is a disease which carries with it a lot of stigma especially in South Asian countries and to this day remains one of the highest causes of morbidity and mortality in the world. According to the World Health Organization tuberculous meningitis is this second leading infectious cause of death. According to the worldwide health global report of 2020, 10 million people suffered from tuberculous meningitis. A local study has shown that central nervous system (CNS) tuberculosis is a common manifestation among patient suffering from extra-pulmonary tuberculosis. CNS tuberculosis has been characterized as the third most common manifestation of the disease (1). Tuberculous meningitis has been studied as one of the most common manifestations in CNS tuberculosis. It has also been observed that tuberculous meningitis presents one of the highest mortality rates. Patients suffering from tuberculous meningitis has been recorded with hyponatremia as the most common electrolyte irregularities. Hyponatremia is associated with a particularly high morbidity and mortality rate because of the effects of sodium disorders (2). Hyponatremia is extremely difficult to diagnose and its diagnosis and treatment plan consists of potential neurological impairments which is why it is required to consider differential diagnoses before settling on it as a final diagnosis. Patients who have been diagnosed with cerebrovascular insult are one of the most common to be diagnosed with hyponatremia as well. Low sodium levels resulting from a CNS infection can be caused by more than one mechanism where one of the most prevailing mechanisms recorded for the rise of hyponatremia in CNS infection is the SIADH(3). Another

mechanism which has been recorded as the reason for low sodium levels in CNS infection is (CSWS) cerebral salt wasting syndrome.

As portrayed, SIADH is a volume-extended state due to antidiuretic chemical worked with renal water holding. CSWS is portrayed by a contracted successful blood vessel, blood volume ensuing of renal salt squandering. The reasoning for what exactly causes the cerebral salt wasting syndrome has not yet been clearly crafted. (4). The pathogenesis of SIADH is connected to the resetting of the osmoreceptors situated in the nerve center.

A physician needs to be well equipped with the knowledge of the differences present between the SIADH and the CSWS. This is because both of these syndromes are present as a symptom of hyponatremia. This makes the tracking and development of these two conditions extremely pivotal. Both these syndromes require different specialized treatment plans which is why the correct diagnosis of these syndromes is absolutely necessary (5). Most clinicians use the method of fluid restriction as a treatment plan for the SIADH secretion. This is the complete opposite of the treatment plan presented for the cerebral salt wasting syndrome where patients are treated with fluids (6). Previous studies have associated the relationship between tuberculous bacterial meningitis and hyponatremia to be statistically characterized as 44.7%, about 50% of these patients suffered from cerebral salt wasting syndrome and 9% suffered from the SIADH (7).

This study is planned to determine the frequency of hyponatremia in patients with Tuberculosis Bacterial Meningitis

METHODOLOGY

In our study total of 169 patients admitted for diagnosis of tuberculous bacterial meningitis. The study followed a vigorous inclusion criterion which included age range of 18 to 60 years. The study population did not include patients with a history of mental illnesses, heart failure, Post-traumatic stress disorder, asthma, chronic bronchitis and liver disease. Each patient was questioned about their demographic information and the duration of their illness. Each patient gave a blood sample to the researchers upon which different tests were done. The tests were taken to measure the electrolyte levels of each patient and the serum urea, thyroid function tests and the short synacthen test were also done on these samples and the sodium level was also measured for each patient. Each patient admitted with a diagnosis of hyponatremia was categorized under two different syndromes; the CSWS and the SIADH.

The results were recorded with the different variables being kept in the picture as well. These variables included different demographic and other variables such as the patient's age. These variables included data such as their gender, their smoking habits, diagnosed or undiagnosed hypertension and recorded the BMRC stage for the patients. The BMRC criteria was set for determining the stage of TBM each patient is at, this criterion was created by the British Medical Research Council.

The diagnosis of tuberculous meningitis for patients for this study was presented if the patients fulfilled the criteria for a range of different symptoms listed as the following: fever persisting of more than 37 degrees Celsius lasting for more than 6 hours a day per week, dull headache occurring for more than three hours per day, vomiting more than three times a day or contact within 2 years with a Tuberculous meningitis patient. To diagnose a patient with tuberculous meningitis, a laboratory test was performed on cerebrospinal fluid (CSF). The patient tested positive for tuberculous meningitis if the acid-fast bacilli smear turned out to be positive, there was a recorded increase of more than 100 mg/dl in the CSF protein and a recorded decline in glucose concentration in the cerebrospinal fluid.

RESULTS

The study included a study population of 169 patient. The results of our study concluded that 76(45%) of the patients suffered from hyponatremia. Patients who suffered from SIADH and CSWS were also recorded which were 13.2% and 26.7% respectively. Each patient was between 18 to 60 years of old. This study population consisted of 60% males and 40% females where the average age of the patients was from 44 to 48 years of age. The mean duration of the symptoms was also recorded which displayed that the patient suffered from the disease for a period of three days to almost two weeks and the patients weighed between 68 to 87 kilograms. The recorded average for the Glasgow Coma Scale for each patient was between 8.07 to 14.35 and the serum sodium was in a range of 125-135 where the recorded average was 128.65±7.52 mmol/L. The Frequency distribution by age for Patients with tuberculous meningitis is given in table 1:

The distribution analysis showed that out of the study population of 169, 47.6% of the patients (80) had the symptoms for less than a week whereas 52.4% of the patients (89) suffered from symptoms for more than a week (As shown in table 3). The Frequency distribution by BMRC (British Medical Research Council) stage for Patients with Tuberculous meningitis is given in table 2. The study findings also reported that 20 patients were suffering from hypertension and 30 patients were smokers which was 11.8% and 18% respectively.

When the study population of 169 was classified according to patients who did not have hyponatremia, statistics showed that 17 (18.6%) patients of the age group 18-30 years, 23 (32.78%) patients of the age group 30-40 years, 11 (18.22%) patients of the age group 41-50 years, and 32 (31.4 %) patients who were in the age group 51-60 years had hyponatremia (As shown in Table 4).

When the study population of 169 were gender classified according to hyponatremia patients, statistics showed that 36 (52.5%) male patients had hyponatremia and 64 (45%) male patients did not have hyponatremia. 38 Female patients were diagnosed with hyponatremia and 31 Female patients did not have hyponatremia, where the value of p was 0.11 (As shown in Table 5).

When the study population of 169 were classified according to hypertension, statistics showed that 11 (10.5%) patients had hypertension and 58 (88%) patients did not have hypertension. The value of p was 0.54 (As shown in Table 6). When the study population of 169 were classified according to hypertension, statistics showed that patients who smoked, 18% (30) had hyponatremia. Whereas patients who did not smoke, 82% (138) had hyponatremia and 80.2% (81) did not had hyponatremia. P-value was 0.10 as presented in Table 7.

Table 1: Frequency distribution by age for Patients with tuberculous meningitis (n=169)

Age (Years)	%	Number
18-30	29.5	49
31-40	23.4	39
40-50	31.5	53
51-60	15.6	26

Table 2: The Frequency distribution by BMRC stage for Patients with Tuberculous meningitis (n=169)

BRMC Stage	%	Number
Stage 1	18.5	31
Stage 2	65.4	110
Stage 3	16.1	28

Table 3: Descriptive Statistics (n=169)

Variables	Mean ± SD	Minimum - Maximum
Age	47.68±2.81	18-60
Symptom Duration (weeks)	1.3±0.74	0.3-1.9
Serum Sodium (mmol/L)	129.64±7.52	125-135
Glasgow Coma Scale	12.21±3.1	7-14
Weight	76.7±9.87	67-112

Table 4: Hyponatremia according to age (n=169)

Age (Years)	Hyponatremia		Total
	Yes	No	
18-30	25.5%	18.6%	22.05%
30-40	34.5%	32.78%	33.64%
41-50	11.1%	18.22%	14.66%
51-60	28.9 %	31.4 %	30.15%
Total	100%	100%	100%

p- value = 0.15

Table 5: Hyponatremia according to gender (n=169)

Gender	Hyponatremia		Total
	Yes	No	
Male	52.5%	45%	22.05%
Female	47.5%	55%	33.64%
Total	100%	100%	100%

p- value = 0.11

Table 6: Hyponatremia according to hypertension (n=169)

Hypertension	Hyponatremia		Total
	Yes	No	
Yes	10.5%	12%	11.25%
No	89.5%	88%	88.75%
Total	100%	100%	100%

p- value = 0.11

Table 7: Hyponatremia according to Smoking Status (n=169)

Smoking Status	Hyponatremia		Total
	Yes	No	
Yes	18%	79.5%	48.75%
No	82%	20.5%	51.25%
Total	100%	100%	100%

p- value = 0.10

DISCUSSION

The study assessed the serum sodium levels to analyze the frequency of hyponatremia in patients suffering from tuberculous meningitis. A total of 169 patients determined to have tuberculous meningitis were included in the study while keeping in terms with the inclusion criteria. Out of 169 patients with tuberculous meningitis, 45% (76) had hyponatremia. Patients who suffered from SIADH and CSWS were also recorded which were 13.2% and 26.7% respectively. A forthcoming medical clinic-based review including 67 patients with Tuberculous meningitis detailed that 35 (53%) TBM patients had hyponatremia(8).

Results of Tuberculous meningitis related to the span of clinic stay, level of cognizance, neurological test, mechanical ventilation, seriousness of disease, age and other variables. A review noticed that mortality was 11.4% with male populace prevalently involved. Hyponatremia in Tuberculous meningitis cases was large (37%)(9). Separating CSWS from SIADH is of fundamental significance since both present fairly in much the same way (10). Information from our review would conceivably offer new knowledge to clinicians that can affect the comprehension of hyponatremia in tuberculous meningitis and help in the improvement of dynamic administration systems, working on personal satisfaction and patient prosperity (11). Our review has a couple of limits. Our review utilized a more modest sample size of patients. We likewise utilized a moderately brief term of study. Future examinations with bigger populaces and longer span will assist with relieving these impediments.

CONCLUSIONS

The results of our study proved the hypothesis that a great number of patients suffering from tuberculous meningitis are a victim of hyponatremia. If hyponatremia is not diagnosed and treated using the proper channels and techniques it can lead to grave consequences such as significant neurological conditions and death. It is important to keep track of the sodium levels in patients of tuberculous bacterial meningitis.

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