CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES
SJIF Impact Factor: 7.187
http://doi.org/10.5281/zenodo.4452414

Avalable online at: http://www.iajps.com *Research Article*

STUDY TO DETERMINE THE INCIDENCE OF HYPONATREMIA IN COMMUNITY ACQUIRED TUBERCULAR AND BACTERIAL MENINGITIS

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Article Received: November 2020 **Accepted:** December 2020 **Published:** January 2021

Abstract:

Introduction: *Bacterial and tuberculous meningitis is a life-threatening disease. Hyponatremia in bacterial and tuberculous meningitis is a known complication with unknown actual incidence and clinical significance. This study was conducted to determine how common hyponatremia occurs in community-acquired bacterial and tuberculous meningitis to assess its severity, see a pattern of symptoms, and monitor levels of consciousness.*

Material and methods: *It was a descriptive cross-sectional study conducted on 30 admitted patients with clinically diagnosed bacterial and tuberculous meningitis at the Medicine Units of Allied Hospital, Faisalabad for one-year duration from August 2019 to August 2020. The level of electrolytes in the serum and the level of consciousness on admission were recorded in all patients.*

Results: *Twenty-nine patients (96.7%) with meningitis developed hyponatremia, serum sodium concentration ranged from 115–138 mmol / l; mean sodium level is 128.57 ± 5.56 SD mmol / l. Serum sodium concentration was mild (> 125-135 mmol / l) in 20 (66.7%) patients with meningitis and moderate (110-125 mmol / L) in 9 (30%) and severe (<110 mmol / L) in 1 (3.3%) patient. GCS ranged from 8 to 14, mean 11.56 ± 1.40 SD on day 1. In tuberculous meningitis (n = 8) and bacterial meningitis (n = 22), the serum sodium concentration was 128.63 ± 7.44 and 128.55 ± 4.93, while the mean GCS was 11, 38 ± 2.13 and 11.95 ± 1.40 on the day of admission, respectively.*

Conclusion: *Although the true incidence, severity, and clinical significance of hyponatremia in bacterial meningitis are unknown, its presence may influence outcomes in these patients depending on severity. So, knowing its prevalence and severity will guide doctors in making decisions about its treatment.*

Key words: *hyponatremia, meningitis, adults*

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Please cite this article in press Ashna Javed et al, ***Study To Determine The Incidence Of Hyponatremia In Community Acquired Tubercular And Bacterial Meningitis.,*** *Indo Am. J. P. Sci, 2021; 08(1).*

INTRODUCTION:

Bacterial meningitis is an acute purulent infection in the subarachnoid space. Acute bacterial meningitis remains the leading cause of death and long-term neurological sequelae worldwide [1-2]. The organisms most frequently responsible for community acquired bacterial meningitis are Streptococcus pneumoniae (50%), Neisseria meningitides (25%), group B streptococci (10%) and Listeria monocytogens (10%) Hemophilus influenza type b (<10%). Tuberculosis affects the central nervous system (CNS) in approximately 10% of patients, with tuberculous meningitis (TBM) as the most common form. Hyponatremia in adults with community-acquired bacterial meningitis has been reported as a complication, although its actual incidence and clinical significance are unknown [3-4]. Patients with bacterial meningitis are at increased risk of developing acute hyponatremia, although most cases are mild. Hyponatremia reported in up to a third of patients with intracranial disease and has often been associated with TB meningitis. Hyponatremia is not documented as septic or viral meningitis, which is usually self-limiting and has a very low mortality [5-6]. The exact mechanism of hyponatremia in bacterial meningitis is unknown, but it is thought to be due to brain salt depletion, syndrome of inappropriate antidiuretic hormone secretion, or exacerbation by aggressive fluid resuscitation.4 Many studies in recent years have shown that that hyponatremia in many patients with intracranial disease may in fact be caused by loss of brain salt, in which renal sodium loss leads to hyponatremia and extracellular fluid depletion [7-8]. The purpose of this study was therefore to investigate how common hyponatremia occurs in and tuberculous meningitis to assess its severity, see a pattern of symptoms in such patients, and observe the level of consciousness.

MATERIALS AND METHODS:

It was a descriptive cross-sectional study. The study was conducted on 30 hospitalized patients with clinically diagnosed bacterial and tuberculous meningitis (22 bacterial and 8 tuberculous) at the Medicine Units of Allied Hospital, Faisalabad for one-year duration from August 2019 to August 2020. The initial study population was 42. Twelve patients were excluded from the study because they did not meet the inclusion criteria. Patients with encephalopathy due to metabolic and endocrine causes and other causes were excluded from the study. Ten patients were taken with MCWH and 20 patients with DMCH. Information from all these patients was collected from a case sheet, symptoms and signs on admission, blood and cerebrospinal fluid (CSF) results, radiographs, and admission complications were noted. On admission, the level of electrolytes in the serum was checked. Hyponatremia was defined as a serum sodium concentration below 135 mmol / L (mild> 125-135, moderate 110-125, severe <110 mmol / L). Informed consent was obtained from the patient or patient caregiver to participate in the study. SPSS was used for data management and statistical analysis.

RESULT:

A total of 30 patients were enrolled in this study. Of these, 18 were male and 12 females, with a ratio of 1: 0.67. The mean age was 29 ± 15.27 SD years. All 30 (100%) patients had headache, impaired consciousness, fever. The duration of the fever ranged from 7 to 60 days; the mean duration was 16.43 ± 10.07 SD days. Among patients, 2 (6.7%) had a history of seizure.

Table I

Clinical signs of patients with meningitis with hyponatraemia (N=30)

Clinical signs	Present	Absent
Neck rigidity	29 (96.7%)	1 (3.3%)
Kernig's sign	29 (96.7%)	1 (3.3%)
Brudginski's sign	2 (6.7%)	28 (93.3%)
Plantar extensor response	4 (13.3%)	26 (86.7%)
Papilloedema	6 (20%)	24 (80%)

Most patients had neck stiffness and Kernig's symptom (96.7%). Hyponatremia occurred in 29 (96.7%) patients (Fig. 1).

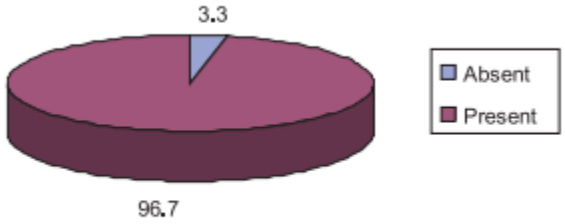

Fig.-1: *Percentage of Hyponatraemia in Meningitis*

Table II

Severity of hyponatraemia in patients with meningitis (N=30)

Severity	Percentage of patients
Severe (<110 mmol/L)	1 (3.3%)
Moderate (110-125mmol/L)	9 (30.0%)
Mild (>125-135mmol/L)	20 (66.7%)

Most patients had mild hyponatremia (66.7%). The mean concentration of potassium, chloride and bicarbonate in the serum was 4.01 ± 0.53 SD mmol / L 94.41 ± 16.87 SD mmol / L and 23.69 ± 2.40 SD mmol / L. and bacterial meningitis, the mean GCS was 11 and the mean serum sodium level was 128.

Table III

Serum sodium and corresponding GCS on the day of admission

Diagnosis	GCS (mean±SD)	Serum sodium (mmol/l)
Meningitis (N=30)	11.56±1.40	128.57±5.56
TB Meningitis (n=8)	11.38±2.13	128.63±7.44
Bacterial (n=22)	11.95±1.40	128.55±4.93

The CSF examination showed that the mean cell count was 207 ± 521.13 SD / cmm. The mean level of glucose in the cerebrospinal fluid was 51.76 ± 16.24 SD mg / dl. The mean concentration of CSF protein was 1.17 ± 0.43 SD g / L. (Table IV) CSF Gram staining was positive in 6 (20%). Among the positive cases, two Gram-negative cocci were found in 4 patients, and Gram-positive cocci in 2 patients. Cerebrospinal fluid culture was positive in 2 (6.7%). Both breeding reports were positive for Neisseria meningitides.

Table IV

Indexes of CSF inflammation

CSF	Mean	Std. Deviation	Minimum	Maximum
Cell count(cmm)	207.20	±521.13	4.00	2800.00
Glucose (mg/dl)	51.76	±16.24	30.00	89.00
Protein (g/L)	1.17	±0.43	0.37	2.04

DISCUSSION:

The study was carried out on 30 patients admitted to the hospital with clinically diagnosed bacterial and tuberculous meningitis (22 bacterial and 8 tuberculous) at the Medicine department. The initial study population was 42 people. Twelve patients were excluded from the study for not meeting the inclusion criteria, refused to sign a consent form, could not afford the study. The present study was conducted to establish the frequency of hyponatremia in adults associated with community-acquired bacterial and tuberculous meningitis, the severity of hyponatremia in these patients, the observation of meningitis symptoms and the level of consciousness of these patients. In this study, the age of the patients ranged from 14 to 75 years, the mean age was 29 ± 15.27 SD years. Of the 30 patients with meningitis, 18 (60%) were male and 12 (40%) were female. Durand ML et al. Observed that the age of the patients ranged from 16 to 88. Among patients, GCS ranged from 8 to 14, mean 11.56 ± 1.40 SD on day 1. In the study by Van de beek et al. Score below 10 in Glasgow Coma Scale occurred in 313 out of 696 episodes (45%). Brouwer MC observed that 157/208 (76%) of the meningitis cases had a GCS score of <14.3. Hyponatremia in adults with acquired bacterial meningitis is associated with a longer duration of symptoms, a lower number of white blood cells in the cerebrospinal fluid, and a lower level of protein in the cerebrospinal fluid. This is most likely because hyponatremia takes time to develop and is therefore more common in patients with a less severe degree of inflammation. The CSF results in our study showed that the mean cell number was 207 ± 521.13 SD / cmm[9-11]. The mean concentration of CSF protein was 1.17 ± 0.43 SD g / l. The study found an exceptionally high rate of hyponatremia in adults with L. monocytogenes meningitis (73%). Comparatively high rates of hyponatremia have also been reported in group A tuberculous and streptococcal meningitis. Hyponatremia has been reported in up to one third of patients with intracranial disease and was often associated with tuberculous meningitis, often complicated by hydrocephalus. CSF staining in our study was positive in 6 (20%). Among the positive cases, two Gram-negative cocci were found in 4 patients, and Gram-positive cocci in 2 patients. Cerebrospinal fluid culture was positive in 2 (6.7%). Both breeding reports were positive for Neisseria meningitides. The etiological mechanism of hyponatremia in bacterial meningitis is unclear[11]. This may be due to syndrome of inappropriate antidiuretic hormone secretion, cerebral salt loss (CSW) syndrome, or aggressive fluid resuscitation. Hyponatremia associated with tuberculous meningitis has three main differential diagnoses: adrenal insufficiency, inappropriate antidiuretic hormone secretion, and loss of brain salt. In a few small studies, patients with tuberculosis-induced hyponatremia have shown different responses to water load, ranging from persistent antidiuresis to normal diuresis. Although tuberculosis is believed to cause the syndrome of inappropriate antidiuretic hormone secretion (SIADH), circulating vasopressin has only been documented in a few cases[12-14]. SIADH is a volume condition due to water retention in the kidney mediated by the antidiuretic hormone. CSW is characterized by a decreased effective arterial blood volume due to renal salt loss. Accurate diagnosis is important because treatment for each condition is completely different. Vigorous salt replacement is required in patients with CSW, while for patients with SIADH, fluid restriction is the treatment of choice. Our study could not assess the etiology, which is a significant limitation of this study. Patients with bacterial and tuberculous meningitis are at increased risk of developing acute hyponatremia, which may affect outcomes and treatment. Knowledge of this relationship will enable the treating clinician to be aware of the extent of the severity of hyponatremia in such conditions[15]. Knowing the pattern and severity of hyponatremia in meningitis can influence the treatment strategy and thus help reduce an adverse outcome. Finally, the study requires further research on this ground with a large sample size.

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