Original Article

Assessment of Serum Sodium Status in Patients With Acute Confusional State Admitted in A Tertiary Care Hospital

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ABSTRACT:

Context: *Acute confusional state (ACS) which is a frequent medical emergency among hospitalized patients is often associated with different factors, resulting from different etiologies. Electrolytic imbalance especially disturbance in sodium serum level, is considered one of the manageable factors in the management of ACS.*

Methodology: *This cross-sectional observational study was conducted in the Department of Medicine, Shaheed Suhrawardy Medical College Hospital, Dhaka with a duration of six months. A total of 100 patients with clinically diagnosed ACS were enrolled. Each patient underwent clinical evaluation and various laboratory investigations including serum electrolytes measurement, with their consent. Data were analyzed using SPSS; $p<0.05$ was considered as statistically significant*

Results: *In this study, male patients were predominant (61%) and mean age of the patients was 6.38 years. Cerebrovascular disease was found to be the leading cause of ACS (38%), followed by pneumonia (14%) and meningitis (13%). Serum sodium disturbances were observed in 18% of cases—hyponatremia in 15% and hypernatremia in 3%—while 82% had normal sodium serum levels. Differences between sodium categories were not statistically significant ($p > 0.05$). Most patients (76%) recovered without sequelae; mortality was 6%.*

Conclusion: *ACS is a common medical condition in tertiary level hospital of Bangladesh, where Hyponatremia is a common complication. Patients who develop ACS have high disability, complication rate and longer length of stay than any other patients. Knowing the nature and timing of the disease, together with the identification of high-risk patients are essential to reduce complications and improve outcome.*

Key Words:
Acute confusional state, ACS, electrolyte imbalance, sodium serum level, hyponatremia, hypernatremia

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Introduction:

Acute confusional state (ACS) which is commonly referred as delirium, is an acute or subacute brain dysfunction characterized by impaired attention, fluctuating cognition, and perceptual disturbances. It develops over hours to days and is associated with significant morbidity and mortality. Previous data indicated an incidence rate of ACS of 3-42% among hospitalized patients, with prevalence ranging from 5-44% (1, 2). According to the criteria of DSM-III, ACS is marked by clouding of consciousness with reduced clarity of awareness and impaired attention, by perceptual disturbances

such as misinterpretations, illusions, hallucinations, incoherent speech, sleep-wake cycle disruption, disorientation and memory impairment, and by the acute onset of the symptoms that fluctuate over hours or days (3, 4). The etiology of ACS comprises a diverge range that includes cerebrovascular disease, cerebral malaria, meningitis, encephalitis, acute poisoning, drug therapy, urinary tract infection (UTI), respiratory tract infection (RTI), metabolic syndrome, end-stage renal failure, liver failure, leukemia, lymphoma, and AIDS with concomitant septicemia. ACS can also result from systemic disturbances such as infection, trauma, or surgery. Stress-related activation of the sympathetic nervous system and hypothalamic-pituitary-adrenocortical axis also contributes to ACS. Hyperactive ACS correlates with hepatic failure, opioids, and steroids, while hypoactive ACS is often linked to dehydration. (5-7). Alongside, metabolic disturbances such as sodium imbalance, hypoxia, and glucose abnormalities- remain the most frequent and clinically significant causes of ACS (8-12).

Since, ACS has numerous causes and variable presentations, often leading to diagnostic uncertainty and delayed management, which can result in fatal outcomes. Patients with one or more risk factors require close monitoring for early signs of confusion, as delayed recognition and treatment increase morbidity and mortality. Due to its fluctuating nature, ACS may remain undetected in its early stages despite careful clinical evaluation. Physicians identify only about 35% of cases compared to 90% when specialists use the Confusion Assessment Method (CAM)(4, 13). Hemodynamic instability and electrolyte imbalances are important clinical indicators of ACS. Electrolyte imbalance, particularly changes in serum sodium balance, is a frequent complication in patients ACS (11, 14). Evidence from previous observational studies showed that hyponatremia negatively affects attention and cognitive performance, and these impairments often improve following correction of sodium levels (15, 16). Given the highly variable presentation and multifactorial etiology of ACS, timely diagnosis and management are essential to reduce adverse outcomes (17, 18). However, there is a big gap in researches on this topic in Bangladesh, underscoring the need for more studies to raise awareness of common causes and guide early detection and treatment strategies for medical practitioners at all levels (19).

Hence, bridging the gap, this study aims to assess the serum sodium status in patients presenting with acute confusional state (ACS) admitted to a tertiary care hospital. It also seeks to serum sodium levels, examine overall electrolyte and laboratory profiles, explore the association between ACS and sodium imbalance, and document the clinical characteristics of affected patients.

Methods:

A) Study Design and Setting

This is a cross-sectional hospital-based observational study that was conducted in the Department of Medicine at Shaheed Suhrawardy Medical College Hospital, Dhaka, over a period of six months (Feb 2019- August 2019).

B) Study Population and Sampling

Patients with acute confusional state (ACS) meeting the predefined inclusion criteria were enrolled for the study. Inclusion criteria included a clinical diagnosis of ACS and informed consent from the attendants of the patients. Patients who required immediate ICU/HDU support, those who left the investigations incomplete, and those who were unwilling to provide their consent were excluded from the study. Based on an approximately 175 ACS cases in the preceding six months and assuming a prevalence of 50% at 95% confidence interval, the calculated sample size was 120.However, 100 patients were enrolled due to time constraints using purposive sampling.

C) Data Collection and Variables

Data collection was done using a structured questionnaire that included demographic details i.e., age, sex, occupation, socioeconomic status. It also included clinical history (onset, duration and comorbidities), and associated risk factors (hypertension, diabetes, smoking, obesity). Serum electrolytes level. Serum sodium status was the primary outcome variable whereas other electrolyte levels and clinical manifestations were included in the secondary variables.

D) Data Analysis

Data analysis was performed using the SPSS version 25, 2017. Quantitative variables were calculated and summarized as mean, whereas qualitative variables were expressed as frequencies with percentages. The sodium serum (Na) levels observed in the study, were catego-

rized following the referenced source, as hypernatremia (>145 mmol/L), normal range (135-145 mmol/L), mild hyponatremia (121-134 mmol/L) and severe hyponatremia (<120 mmol/L)(20). Associations were examined using Chi-square and unpaired t-tests as necessary, where $p<0.05$ was considered as statistically significant. Patients symptoms, degree of disability or dependence in the daily activities and clinical outcome had evaluated and measured by modified Rankin Scale (mRS).

E) Quality Assurance and Ethical Considerations

In order to ensure the quality of the data collected, a standardized protocol and pretested questionnaire were used. Study confidentiality was thoroughly maintained. Informed consent was obtained from all the participants or their attendants after explaining the objectives, procedures, and potential risks and benefits of the study. Prior to the collection of data ethical approval was obtained from the Institutional Review Committee.

Table 1: demographic distribution of the patients.

	Number of patients		Total	Mean ± SD
	Male (n= 61)	Female (n= 39)	N=100	
Age (years)				
40-59	30(49.18%)	13(33.3%)	43 (43%)	63.38 ± 11.23
60-79	23(37.70%)	15(38.46%)	38 (38%)	
>80	8(13.11%)	11(28.20%)	19 (19%)	
Residence				
Rural	20(32.7%)	11(28.2%)	31 (31%)	
Urban	34(55.7%)	24(61.5%)	58 (58%)	
Sub-urban/ slum	7(11.4%)	4(10.2%)	11 (11%)	

Table I shows the demographic distribution of the patients. This study included 100 participants with male being predominant than female (61% vs 39). Maximum numbers of patients (43%) were between 40-59 years age group. Mean age of the patient were 63.38 ± 11.23 years. Maximum numbers of male patients; 49.18% (30/61), were in age group of 40-50 years, whereas majority of the female patients; 38.46% (15/39) belonged in the age group of 60-79 years. Large numbers of the participants were from urban area (58%), followed by rural area (31%) and sub-urban/slum area (11%

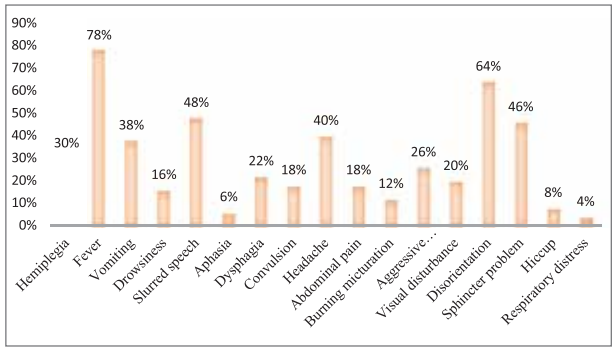

Figure- 1: Column chart showing clinical presentation of the acute confusional state patients.

Figure 1 shows that fever and disorientation was the most common presentations accounting for about 64% of patients. of patients. Fever, slurred speech, and sphincter problem was observed in 78%, 48%, and 46% of cases, respectively.

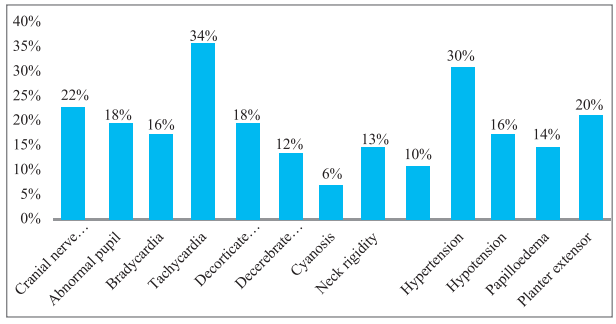

Figure-2 Column chart showing physical signs and symptoms of the acute confusional state patients.

Figure 2 shows the physical signs and symptoms of the acute confusional state patients. Majority of the patients were found having tachycardia (34%), followed by cranial nerve palsy (22%), planter extensor (20%), and hypertension (15%).

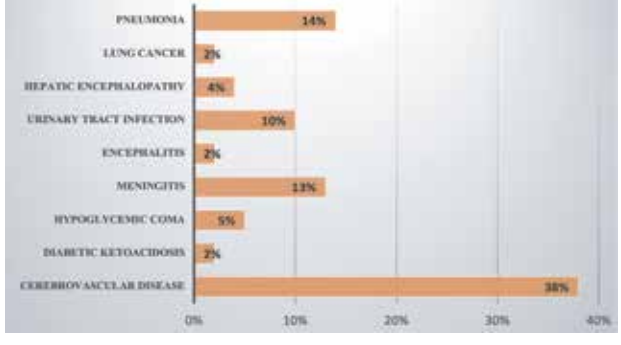

Figure- 3: Bar chart showing etiological distribution of the acute confusional state patients.

Figure 3 shows the etiological distribution of the acute confusional state patients. In our study we found that, 38% of patients had cerebrovascular disease, 14% had pneumonia and 13% had meningitis, which were depicted as the most common causes of acute confusional state. Least common causes found were lung cancer and encephalitis (2%).

Table 2: Medical history and predisposing factors of the acute confusional state patients.

Factors	Number of patients, n (n%)
Hypertension	46 (46%)
Diabetes mellitus	12 (12%)
Old CVD	16 (16%)
CLD	12 (12%)
Smoking	19 (19%)
COPD/Asthma	18 (18%)
Obesity	22 (22%)

Table II shows the medical history and predisposing factors of the acute confusional state patients. In this study, 46% of patients had a history of hypertension, 22% had obesity, 16% had old CVD, and 18% had asthma. Smoking and diabetes were reported in 19% and 12% of the patients, respectively.

Figure-3: Pie chart showing GCS & level of consciousness

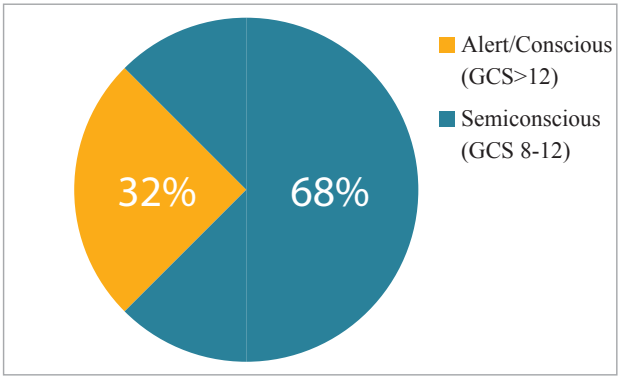

Figure 3 shows GCS and the level of consciousness. At the time of admission thorough physical examination and neurological evaluation, 32% of the cases were alert or conscious, whereas, 68% of the cases were semiconscious.

Table 3: Serum sodium (Na+) levels among the acute confusional state patients

Category according to the Serum sodium (Na+) levels	Serum sodium (Na+) levels	Frequency		Total	p-value
		Male (n= 61) n, (n%)	Female (n= 39) n, (n%)	N=100 n, (n%)	
Hypernatremia	>145 mmol/L	3(4.9%)	0	3 (3%)	
Normal range	135-145 mmol/L	48(78.6%)	34(87.1%)	82 (82%)	0.641
Mild Hyponatremia	121-134 mmol/L	7(11.4%)	4(10.2%)	11 (11%)	
Severe Hyponatremia	<120 mmol/L	3(4.9%)	1(2.5%)	4 (4%)	

Table 3 shows the evaluation of serum sodium (Na+) levels among the acute confusional state patients. Majority of the patients i.e., 82% were within the normal range of 135-145 mmol/L. 11% of the patients reported mild hyponatremia (121-134 mmol/L) whereas 4% patients had severe hyponatremia (<120 mmol/L). Only 3% of the patients exhibited hypernatremia (>145 mmol/L) and the differences between the groups were not statistically significant (p>0.05).

Table 4: Outcome and fate of the acute confusional state patients.

Outcome & fate	Modified Rankin Scale (mRS	Number of Cases
Recovery without sequelae	0 to 2	76 (76%)
Recovery With sequelae	3 to 5	18 (18%)
Death	6	6 (6%)

Table IV shows the outcome and fate of the acute confusional state patients. In our study 76% of the patients had recovery without whereas 18% had recovery with sequelae. Unfortunately, six cases (6%) expired during the hospital stay.

Discussion

Our study evaluated the serum sodium status and clinical characteristics in patients with acute confusional state (ACS) admitted at Shaheed Suhrawardy Medical College Hospital, Dhaka. We found that the majority of the patients were older with male predominance which is consistent with the previous studies showing ACS is more common in the elderly populations (Table 3.1)(20,

21). Clinical presentation was very typical of ACS- fever, disorientation, slurred speech, sphincter disturbance and tachycardia that mirrors the common showcase of ACS, aligning with earlier studies emphasizing on cognitive and behavioral changes as the core features(22, 23). In this study, cerebrovascular disease had emerged as one of the leading causes of the ACS, accounting for about 38% of the cases, followed by pneumonia (14%) and meningitis (13%), a pattern also reflected in previous hospital-based studies (23-27). In our study, hypertension, asthma, obesity and diabetes mellitus has emerged as the most common predisposing factors for ACS (Table 3.2). Similarly previous studies have also reported these factors especially dementia, hypertension and diabetes mellitus as common predisposing factors associated with ACS.(27, 28). Meanwhile stroke related ACS is likely to result from structural and nutritional factors (29). All these observations underscore the multifactorial nature of ACS, where the baseline vulnerabilities (age, comorbidities) interact with different precipitating factors like infection, hypoxia, and medication effects (27, 30).

We observed electrolyte imbalance, focusing especially on sodium disturbances in around 18% of the cases, where 15% was the case of hyponatremia (<135 mmol/L) and 3% was the case of hypernatremia (>145 mmol/L). Even though the differences between the different sodium categories were not found statistically significant, this information remains clinically important. Since both low and high sodium are well-recognized contributors to acute cognitive change, sodium-related osmotic shifts are expected to provoke cerebral function ultimately having effects on attention, sleep-wake cycle, and in critical thinking, reasoning and problem solving (31, 32). Hence, from our data we can reinforce the prioritization of routine monitoring and timely correction of sodium levels, especially focusing on the elderly patients or patients having other risk factors like cardiovascular diseases, pneumonia, meningitis in the management pathway of ACS.

Outcome in our study was generally favorable, with 76% patients recovered without sequelae, while 18% had residual disability. Unfortunately, 6% of the patients faced death during the hospitalization period- primarily due to stroke, pneumonia and meningitis. This is consistent with the known lethality of these conditions when even complicated by ACS highlighting the need for early recognition and intervention of ACS.

This study has some limitations. Since it was a single-center, time limited study with modest sample size, it limits generalizability of the outcome. Larger multicenter studies are needed to explore the intricate links between electrolytic imbalance and ACS severity and also to evaluate different protocols and measures for the prevention and management of ACS.

Incorporating early electrolyte screening and prompt correction, especially in patients with cardiovascular disease, stroke or systemic infection can play a critical role in effective management of ACS. Standardized screening tools, such as the Confusion Assessment Method (CAM) can improve detection of ACS, especially for hypoactive ACS, which is often missed. Preventive strategies should address systematic identification of manageable triggers that include dehydration, infection, inappropriate medication use etc. while ensuring adequate nutritional support.

Conclusion

Acute confusional state (ACS) remains as a common and serious clinical condition especially among hospitalized elderly patients, with cardiovascular disease, infections, and metabolic disturbances as major contributors. Our study highlights that electrolyte imbalance- particularly hyponatremia- was present in notable portion of the ACS cases, emphasizing its role as a manageable factor. Even though differences in sodium levels were not statistically significant, electrolytic imbalance can exacerbate cognitive dysfunction and worsen the outcomes. Hospital prevalence rates and presentation for ACS vary widely because of different patient characteristics, socioeconomical status, hospitalization time, association with multiple comorbid condition and concomitant complication. By implementing structured protocols for early detection and timely intervention in ACS it is possible to minimize complications and greatly improve patient outcomes.

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