Study of etiology, clinical profile, and outcome of altered sensorium patients admitted in a tertiary care hospital

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ABSTRACT

Background: Altered sensorium is one of the most common presentations in patients coming to the emergency room. It includes decreased level of consciousness, attention disorder, arousal disorder, and cognitive disorder. The causes of altered sensorium can be varied, some of which are cerebrovascular diseases, alcoholism, cerebral trauma, hypoglycemia, epilepsy, drug intoxication, and neuroinfection. 4–10% of the patients presenting to the emergency department may have altered mental status. The outcome is dependent on early identification and effective treatment using investigations and imaging technologies, and it might range from full recovery to permanent damage to death. **Aims and Objectives:** (1) To study clinical profile and etiology in altered sensorium patients. (2) To assess outcomes in altered sensorium patients. **Materials and Methods:** In this prospective cross-sectional study, clinical examination and investigations are done and data are collected using pro forma for patients fulfilling the inclusion criteria. In this study, all altered sensorium patients were evaluated by detailed history, clinical examination, Glasgow Coma Scale (GCS), laboratory investigations, computed tomography brain, and other investigations. All patients were followed up till discharge or death of the patient in the hospital. **Results:** There were 270 patients who presented with encephalopathy, 184 (68%) were males. The majority of these patients 60 (22.2%) were in the age group of 51–60 years old. The most common cause is neurological in 109 (40.3%) patients, metabolic in 64 (24%) patients, and sepsis in 50 (19%) patients. Ischemic stroke 83 (76%) is the most common neurological cause. Hepatic encephalopathy was the most common cause of metabolic encephalopathy present in 21 (32%) patients. Pneumonia was the most common infection. There were 114 (42.2%) deaths. Septic encephalopathy is the most common cause of mortality. Early presentation to the hospital, higher GCS, and conscious level at presentation were good prognostic markers of outcome in patients, while septic encephalopathy was found to have the worst prognosis. **Conclusion:** The common etiologies of encephalopathy are neurological followed by metabolic and sepsis. Early presentation to the emergency room within 6 h of symptom onset, higher GCS, neurological and metabolic causes are associated with a good prognosis. The mortality rate was 42.2%. Septic encephalopathy is the most common cause of death with pneumonia being the most common source of infection.

Key words: Altered sensorium; Etiology; Clinical profile; Outcome

INTRODUCTION

Altered sensorium is one of the most common presentations in patients coming to the emergency room. It includes a decreased level of consciousness, attention disorder, arousal disorder, and cognitive disorder. The causes of altered sensorium can be varied, some of which are cerebrovascular diseases, alcoholism, cerebral trauma, hypoglycemia, epilepsy, drug intoxication, and neuroinfection.[1] 4–10% of the patients presenting to the

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Table 1: Duration of illness

Duration	Frequency	Discharge	Death	Discharge percentage
Below 6 h	127	92	35	72.4
6–24 h	81	43	38	53
24–48 h	44	15	29	34
48 h and above	18	6	12	33

Table 2: Distribution of patients based on etiology

Neurodiagnosis	Total (n=270) (%)
Ischemic stroke	83 (30.7)
Metabolic encephalopathy	64 (23.7)
Septic encephalopathy	50 (18.5)
Hemorrhagic stroke	23 (8.5)
Neuroinfection	23 (8.5)
Poisoning/toxins	13 (4.8)
Multifactorial	7 (2.5)
Seizure disorder	4 (1.4)
Cerebral venous thrombosis, n (%)	3 (1.1)

emergency department may have altered mental status (AMS).[2]

Encephalopathy is an acute confusional state accompanied by an altered level of consciousness. Encephalopathy is a syndrome of global brain dysfunction with different clinical presentations, causes, and outcomes.[3] AMS may be due to disruption of the ascending reticular activating system or due to impairment in bilateral cortices.[4]

Even though AMS is common in emergency department, the exact etiology is unknown. Patients often present differently, thus, making AMS diagnosis and treatment challenging to the physicians.[5] The outcome is dependent on early identification and effective treatment using investigations and imaging technologies, and it might range from full recovery to permanent damage to death.[5]

Aims and objectives
1. To study the clinical profile and etiology in altered sensorium patients
2. To assess outcomes in altered sensorium patients.

MATERIALS AND METHODS

It is a cross-sectional study done during February 2021–August 2022.

Sample size
Based on a previous study by John et al.,[4] sample size can be calculated as follows,

$Z2$ = standard table value for 95% confidence interval. P=38.6 q=100-p=61.4 d=relative precision = 15% of 38.6 = 5.8 ; n

$=(1.96)2 * (38.6*61.4) (5.8)2 = 3.8416*2370/33.6=9104.592 /38.6=270.5$; sample size 270.

Inclusion criteria
1. Age ≥18 years
2. Patients whose caregivers are willing to give consent
3. Patients presenting with altered sensorium to a medical emergency
4. Patients admitted to the intensive care unit with altered sensorium.

Exclusion criteria
1. Patients whose caregivers are not willing to give informed consent
2. Age <18 years
3. Head injury patients
4. Psychiatric patients
5. Post-operative patients.

Methodology
This study is a hospital-based cross-sectional study that was conducted from February 2021 to August 2022. A total of 270 patients fulfilling the inclusion criteria were enrolled in the study after obtaining informed consent (Annexure-1).

A detailed history taken and clinical examination was performed and data were collected using a pro forma.

Relevant investigations were done to find the cause of the altered sensorium. All patients were followed till discharge or death of the patient in the hospital.

Statistical analysis
The Statistical Package for the Social Sciences version 20 (IBM SPASS statistics [IBM corp. Armonk, NY, USA released 2011]) will be used to perform the statistical analysis. Data will be entered in the Excel spreadsheet.

Descriptive statistics of the explanatory and outcome variables will be calculated by mean, standard deviation frequency, and proportions for quantitative variables.

For all statistical tests, a P<0.05 will be taken to indicate a significant difference. Any other necessary tests found appropriate will be dealt with at the time of analysis based on data distribution.

RESULTS

The current study involved 270 patients with altered sensorium from hospitals attached to Bangalore Medical College and Research Institute. The outcome of the patients was studied as either discharge or death of the patients. Among 270 patients, the maximum patients of 156 (57.7%) were discharged whereas 114 (42.2%) died (Table 3).

The mean age of the patients was 54.66±16.41 with minimum and maximum age being 18 years and 90 years, respectively. 19 (7%), 36 (13%), 59 (21%), 60 (22%), 52 (19%), 31 (11%), and 13 (4.8%) patients belonged to the age group of 18–30 years, 31–40 years, 41–50 years, 51–60 years, 61–70 years, 71–80 years, and >80 years, respectively (Figure 1).

Neurodeficit is the most common presenting complaint present in 115 (42.5%) patients. The presenting complaints other than AMS are vomiting in 50 (18.5%) patients, fever in 30 (11%) patients, headache in 27 (10%) patients, abdominal pain in 23 (8%) patients, abdominal distension in 17 (6%) patients, breathlessness in 16 (5.9%) patients, convulsions in 14 (5.1%) patients, pedal edema in 9 (3.3%) patients, and jaundice in 8 (2.9%) patients (Figure 2).

There are 127 (47%) patients presented within 6 h, 81 (30%) patients presented to the emergency room between 6 and 24 h, 44 (16.6%) patients presented after 24 h and before 48 h, and 18 (7%) patients presented after 48 h. The discharge percentage is highest at 73% when patients present to the emergency room within 6 h of onset of illness. As the duration increased, mortality rate also increased (Table 1).

89 (32.9%), 119 (44%), 16 (5.9%), 11 (4%), and 17 (6.2%) patients had diabetes mellitus, chronic kidney disease, hypertension, ischemic heart disease, and others as comorbidities.

Neurodiagnosis of patients revealed that 83 (30.7%), 64 (23.7%), 50 (18.5%), 23 (8.5%), 23 (8.5%), 13 (4.8%), 7 (2.5%), 4 (1.4%), and 3 (1.1%) patients had an ischemic stroke, metabolic encephalopathy, septic encephalopathy, hemorrhagic stroke, neuro infection, poisoning/toxins, multifactorial, seizure disorder, and cerebral venous thrombosis, respectively (Figure 3 and Tables 2 and 4).

Among the studied cases, cerebrovascular accidents stand as the most common followed by others. Cerebral infarcts and hemorrhage dominate among cerebrovascular accidents. Next common are the metabolic causes among which the most common is hepatic coma.

Among cerebrovascular accidents, most common is ischemic stroke (76.1%) followed by hemorrhagic stroke (21.1%).

Among metabolic encephalopathy, most common cause is hepatic encephalopathy (32.8%) followed by hypoglycemic and uremic encephalopathy (20.3%). Septic encephalopathy is seen in 50 (18.5%) patients. The various infections causing encephalopathy are pneumonia in 30 (60%), urinary tract infection (UTI) in 14 (28%), skin and soft tissue in 6 (12%), gastrointestinal infection, lung abscess, pelvic inflammatory disease, and catheter-related bloodstream infections in one patient each. Bronchopneumonia patients' sputum culture showed *Klebsiella* in five patients, *Acinetobacter baumannii* in two patients, and common commensal in six patients. Of eight among 14 urosepsis patients showed *Escherichia coli* in urine culture (Figure 4).

Twenty-three patients have neuro infection out of which bacterial meningitis is the most common (10 patients) followed by viral meningitis in eight patients, tubercular meningitis in four patients, and one has cryptococcal meningitis.

Among 13 individuals under poisoning/toxin intake list, alcohol intoxication is seen in 5(38.4%) patients followed by Organophosphate compound consumption in 3(23%) patients, 1 patient each of amlodipine poisoning, barbiturate poisoning, antipsychotic, cypermethrin poisoning and rat powder consumptions.

Table 3: Distribution of patients based on neurodiagnosis-overall and comparison based on outcome

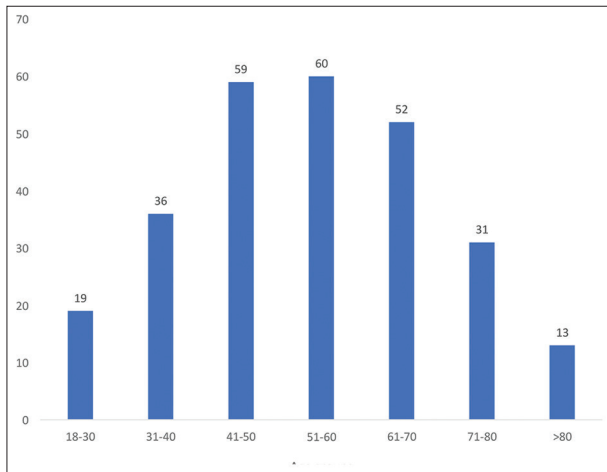| Neurodiagnosis	Total (n=270)	Discharge (n=156)	Death (n=114)	P-value
Ischemic stroke	83	70	13	
Metabolic encephalopathy	64	30	34	<0.001
Septic encephalopathy	50	13	37	
Hemorrhagic stroke	23	12	11	
Neuroinfection	23	20	3	
Poisoning/toxins	13	8	5	
Multifactorial	7	1	6	
Seizure disorder	4	1	3	

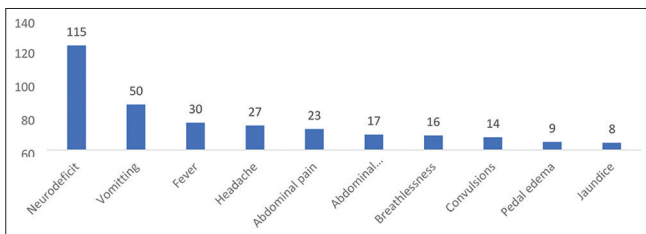Figure 1: Distribution based on age groups

Figure 2: Graph showing common presenting complaints
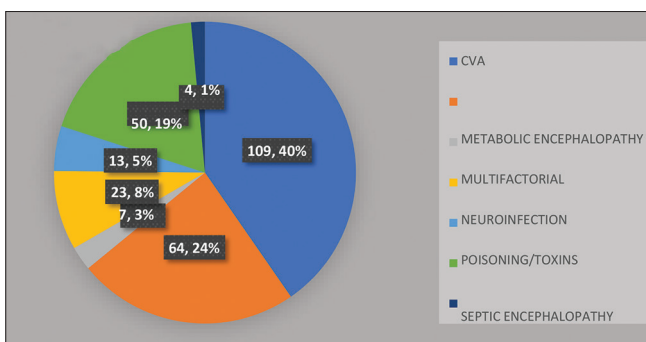

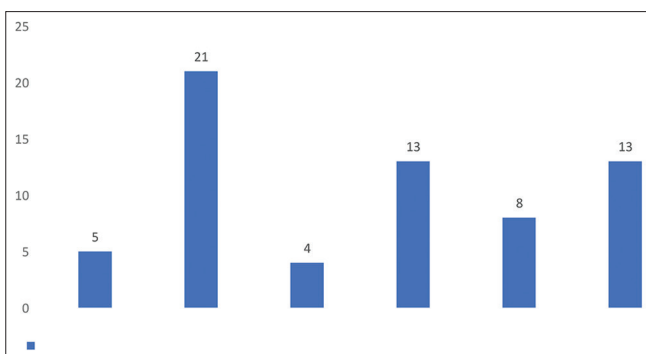Figure 3: Distribution of total patients based on the etiology

Figure 4: Distribution of metabolic encephalopathy patients

In this study, there were 114 deaths of which 37 (32.4%), 34 (29.8%), 13 (11.4%), 11 (9.6%), 6 (5.2%), 5 (4.3%),
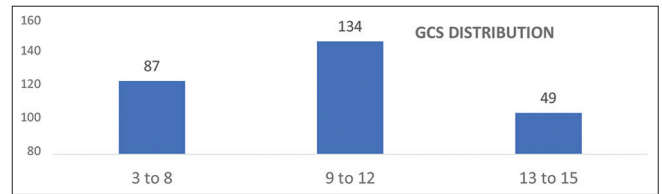

Figure 5: Distribution of patients based on the Glasgow Coma Scale

3 (2.6%), 3 (2.6%), and 2 (1.7%) are due to septic encephalopathy, metabolic encephalopathy, ischemic stroke, hemorrhagic stroke, multifactorial, poisoning/toxins, neuro infection, seizure disorder, and cerebral venous thrombosis, respectively (Figure 3).

The most common cause of death was septic encephalopathy of which 15 patients had bronchopneumonia, six patients had aspiration pneumonia, eight patients had urosepsis, three patients had bed sores, and two patients had diabetic foot as the source of sepsis. Most of the patients with cerebral infarcts were discharged with moderate disability.

Those who died had massive infarcts usually with midline shift. Among cerebrovascular accidents, patients most common cause of death are ischemic stroke followed by hemorrhagic stroke.

Among patients with metabolic causes, hepatic coma (44%) was the most common cause of mortality followed by uremic encephalopathy (Figure 4). Patients with hypoglycemia, hyponatremia, and ketotic coma showed better survival.

61.5% of patients with drug overdosage and poisoning showed good recovery – two patients with alcohol intoxication, one with barbiturate poisoning, one with op compound poisoning, and one with amlodipine poisoning died.

Two out of three cerebral venous thrombosis patients died. One is a young female with deep vein thrombosis and risk factors could not be identified. The risk factor for other patients was alcohol.

Among 270 patients, 134 patients are in the Glasgow Coma Scale (GCS) 9–12 category, 87 patients in 3–8, and 49 patients in 13–15 category. Mortality was high (60.68%) in 3–8 category and low (10%) in 13–15 category (Figure 5).

DISCUSSION

Patients come to the emergency room for varied reasons. One of the most common presentations is AMS. AMS is associated with considerable mortality and morbidity,[4,5] The

	CO$_2$ Narcosis	Hepatic encephalopathy	Hypernatremic encephalopathy	Hypoglycemic encephalopathy	Hyponatremic encephalopathy	Uremic encephalopathy
Total	5	21	4	13	8	13

Table 4: Blood investigations

Investigation parameter	Total (Mean±SD)	Discharge (Mean±SD)	Death (Mean±SD)	P-value
Total leukocyte count	11127±5342.12	10684±5540.76	13160±5082.3	0.541
Platelet count (10³/µL)	2.56±0.81	2.46±2.48	2.25±1.13	0.312
Hemoglobin (g/dL)	11.52±2.6	13.48±2.24	11.34±3.17	<0.001
Urea (mg/dL)	52.34±52.79	46.8±45.23	68.18±62.14	0.002
Creatinine (mg/dL)	1.48±1.45	1.15±1.24	1.64±1.73	<0.001
Sodium (mmoL/dL)	134.9±7.84	135.6±8.56	136.1±7.41	0.849
Potassium (mmoL/dL)	4.19±0.86	4.15±0.80	4.22±0.96	0.928
Chloride (mmoL/dL)	99.32±6.56	99.48±6.15	98.93±7.23	0.571
Total bilirubin (µmoL/L) - median (IQR)	0.80 (0.50–1.31)	0.70 (0.50–1.13)	1.10 (0.60–2.40)	0.001
Direct bilirubin (µmoL/L) - median (IQR)	0.40 (0.20–0.76)	0.30 (0.19–0.50)	0.62 (0.20–1.40)	0.001
Total protein (g/dL)	6.24±1.16	6.34±1.05	5.90±1.26	0.001
Albumin (g/dL)	3.25±0.84	3.38±0.78	2.90±0.87	0.001
Globulin (g/dL)	3.15±0.75	3.10±0.67	3.04±0.85	0.469
Alkaline phosphatase (U/L)	66.00 (32.50–100.50)	45.00 (23.00–78.0)	96.0 (56.0–136.0)	0.001
Aspartate aminotransferase (U/L)-median (IQR)	28.00 (18.00–45.00)	23.00 (18.00–46.00)	34.00 (19.00-64.25)	0.001
Alanine aminotransferase (U/L)-median (IQR)	21.00 (9.55–38.75)	15.50 (7.00–32.50)	29.00 (17.75–64.00)	0.001
Random blood sugar (mg/dL)	143.1±94.30	149.6±101.30	126.3±79.91	0.069
INR	1.09±0.41	1.00±0.39	1.22±0.42	<0.0001
HBsAg				
Negative, n (%)	267 (98.89)	153 (98.07%)	114 (100.00)	0.278
Positive, n (%)	3 (1.11)	3 (1.93)	0 (0)	
HCV				
Negative, n (%)	270 (100.00)	156 (100.00)	114 (100.00)	NA
Positive, n (%)	0 (0)	0 (0)	0 (0)	

SD: Standard deviation, IQR: Interquartile range

majority of deaths are due to reversible and preventable causes such as infections, strokes, and metabolic disorders.[6,7]

Early detection and treatment of the underlying condition, as well as anticipating and correcting any complications before they arrive, have been demonstrated to reduce mortality.[8] In the current study, the study of etiology, clinical profile, and outcome of altered sensorium are analyzed.

In the present study, a total of 270 patients with altered sensorium were studied according to the pro forma detailed in the methodology. The mean age of the patients was 54.8±16.41. There was no statistically significant difference in the distribution of patients based on age groups. Among 270 patients, 156 (57.7%) were discharged whereas 114 (42.2%) patients died. In a study conducted by it was reported that the age group 60 years and above had the most patients with altered sensorium (n=797, or 41.2%), followed by the age group 41–60 years (22.5%) and the patients were on average 51 years old.

The most common presenting symptom along with is a neurodeficit in 115 (42.5%) patients. Other presenting symptoms are vomiting in 50 (18.5%) patients, fever in 30 (11%) patients, headache in 27 (10%) patients, abdominal pain in 23(8%) patients, abdominal distension in 17 (6%) patients, breathlessness in 16 (5.9%) patients, convulsions in 14 (5.1%) patients, pedal edema in 9 (3.3%) patients, and jaundice in 8 (2.9%) patients. In a study by the most common presenting complaints were vomiting, headache, behavioral changes, seizures, and alcohol/substance abuse. Out of 270 patients, 127 (47%) patients presented within 6 h, 81 (30%) patients presented to the emergency room between 6 and 24 h, 44 (16.6%) patients presented after 24 h and before 48 h, and 18 (7%) patients presented after 48 h. Mortality increases as the duration of seeking medical attention increases. In a study by John et al., 2020,[4] better outcome is seen in patients (87%) presenting to the emergency room within 6 h. In our study, it was observed that there was no statistical difference in the neurodiagnosis distribution between patients with outcome death and discharge. In our study, the most common cause of altered mental state was a cerebral vascular accident 109 (40%). Out of 109 cerebrovascular accidents, ischemic stroke is 83, hemorrhagic stroke is 23, and three are cerebral venous thrombosis. Abnormalities on neuroimaging were present in 116/190 (61%) patients with 75/116 patients showing acute cerebral or cerebellar infarction, 19/116 patients showing intracranial hemorrhage, 14 patients showing

chronic lacunar infarct, and four patients showing signs of meningitis. Xiao et al., 2012[35] also noticed that 63% had negative neuroimaging. This stresses the importance of good clinical examination and judicious use of neuroimaging in patients with encephalopathy. Metabolic encephalopathy 64 (23.7%) is the second most common cause of altered mental state. Among 64 (23.7%) patients with metabolic encephalopathy, hepatic encephalopathy was the most common present in 21 (32%) patients.

Septic encephalopathy is seen in 50 (18.5%) patients. The various infections causing encephalopathy are pneumonia in 30 (60%), UTI in 14 (28%), skin and soft tissue in 6 (12%), gastrointestinal infection, lung abscess, pelvic inflammatory disease, and catheter-related bloodstream infections in one patient each. Bronchopneumonia patients' sputum culture showed *Klebsiella* in five patients, *A. baumannii* in two patients, and common commensal in six patients. Eight among 14 urosepsis patients showed *E. coli* in urine culture.

Other causes of AMS observed in our study are neuroinfection in 23 (8.5%), poisoning/toxin in 13 (4.8%), multifactorial in 7 (2.5%), seizure disorder in 4 (1.4%), and cerebral venous thrombosis in 3 (1%) patients. Twenty-three patients have neuroinfection out of which bacterial meningitis is the most common (10 patients) followed by viral meningitis in eight patients, tubercular meningitis in four patients, and one has cryptococcal meningitis among 13 poisoning/toxin alcohol intoxication seen in 5 (38.4%) patients followed by op compound consumption in 3 (23%) patients. In a study by John et al., 2020,[4] the most common cause of AMS is neurological in 97 (38.65%), infection/sepsis in 92 (36.5%) patients, and metabolic in 84 (33.47%) patients. Hyponatremia was the most common cause of metabolic encephalopathy present in 38 (45.24%) patients followed by hypoglycemic in 25 (29.76%) patients. Pneumonia was the most common cause of infection in 41 (44.57%) patients. In a study by Sarin et al., 2016,[37] in patients with non-traumatic coma, 45% had a cerebrovascular accident and central nervous system infection was present in 55% of patients.

Among 270 patients, 134 patients were in GCS of 9–12 category, 87 patients in 3–8 category, and 49 patients in 13–15 category. Mortality is high (60 patients, 68.9%) in 3–8 category followed by 9–12 category 49 (36.5%). Discharge is maximum in 13–15 catogory 44 (89.7%). In a study by mortality is 44% in patients with GCS of <6.

There are 114 (42.2%) patients who expired during their hospital stay which was higher than the mortality in a study by John et al., 2020[4] (19.12%). Of 114 death, 78 (68.4%) patients are male and 36 (31.5%) patients are female which are similar to a study conducted by John et al., 2020[4] where 34 (70.83%) patients are male. The mortality was highest 26 (22.8%) 0 in 51–60-year age group followed by 61–70 years (24.21%). Seventy-eight percent mortality was seen in the age group more than 40 years. In a study by Jose et al.,[52] mortality is highest in 41–50 years (42.8%). The most common cause of death in patients with encephalopathy is sepsis, that is, 37 (32.4%) patients of whom 21 have pneumonia, eight have urosepsis, three have bedsores, and two have diabetic foot as the source of infection. Metabolic encephalopathy was the cause of death observed in 34 (29.8%) patients of which 15 patients had hepatic encephalopathy and six patients had uremic encephalopathy. Cerebrovascular accident as the cause of death seen in 26 patients (22.8%) in which ischemic stroke is seen in 13 patients, hemorrhagic stroke in 11 patients, and cerebral venous thrombosis in two patients. Multifactorial causes seen in six patients (5.2%). Five patients are died due to poisoning and toxin of whom alcohol intoxication seen in two patients, one each due to amlodipine tablet poisoning, op compound poisoning, and barbiturate poisoning. Seizure disorder and neuroinfection as the cause of death were seen in 3 (2.6%) patients each. A study by found the possible cause of mortality in elderly patients presenting with encephalopathy to be neurological in 68% of patients followed by infections in 20% of patients. A study by also showed mortality rates to be high in patients with cerebrovascular accident (44%). In our study, 156 (57.7%) patients were discharged in which 106 (67.9%) patients were males and 50 (32%) patients were female. Of 156 patients discharged, 70 (44.8%) patients had cerebrovascular accidents. Most of the patients with cerebral infarcts were discharged with moderate disability. 30 (19.2%) patients with metabolic encephalopathy were discharged of which the majority of patients have hypoglycemia and hyponatremia as the cause of encephalopathy. In a study by Jose et al.,[9] better outcomes were seen in metabolic encephalopathy (67%) and poisoning (97%).

Limitations of the study
Assessment of gcs was a subjective parameter.

CONCLUSION

- Cerebrovascular accident is the most common cause of AMS
- Better outcomes were observed when the patient had a shorter duration of encephalopathy (<6 h), a higher conscious level at admission, or who had a GCS score between 13 and 15 at presentation
- Septic encephalopathy is the most common cause of death among AMS patients with pneumonia being the most common source of infection.

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