Advances in Bioresearch
Adv. Biores., Vol 15 (1) January 2024: 378-387

Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
DOI: 10.15515/abr.0976-4585.15.1.378387

Advances in Bioresearch

ORIGINAL ARTICLE

Etiological Analysis, Morbidity and Outcomes of Altered Sensorium in Non-Traumatic Patients

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ABSTRACT
Altered sensorium is a neurological deficit that changes the brain function varying from consciousness to coma and death. This condition requires urgent medical attention. To estimate the causes occurrence and effects of altered sensorium in non-traumatic patients. A prospective observational study was conducted in a tertiary care hospital in inpatient departments of general medicine over 6 months and recorded 110 cases and obtained the results. Out of 110 cases, 51 were males and 59 were females and the average age group of patients diagnosed with altered sensorium belong to the age group of 46-60 years. Neurological factors accounted for the maximum number of cases followed by metabolic factors with stroke being the primary cause. Commonly occurring comorbidities include Diabetes Mellitus and Hypertension. GCS (Glasgow coma scale) scores were found to be moderate in 52% of the cases. 88% of altered mental status (AMS) patients make a full recovery in a matter of 1-2 weeks, which is a result of proper diagnosis and therapy that yielded a favorable outcome and imposing a higher lifestyle quality on the patients. Our study concludes that etiology and severity of altered sensorium vary from different age groups and comorbid conditions. Knowledge of the commonly occurring etiologies along with clinical assessments like CT (Computed Tomography) provide potential for recovery in patients due to improved patient care.
Key words: *Altered sensorium, Glasgow coma scale, altered mental status, neurological factors, computed tomography.*

Received 24.08.2023 Revised 01.10.2023 Accepted 11.12.2023

How to cite this article:
Shaik K A, Sanjana R T, Deepthi D, Nehika M, Narender B, Rama R T. Etiological Analysis, Morbidity and Outcomes of Altered Sensorium in Non-Traumatic Patients. Adv. Biores., Vol 15 (1) January 2024: 378-387.

INTRODUCTION

Sensorium refers to the parts of the brain through which the effects of the surroundings are received processed and interpreted by sensory stimuli [1].

Altered sensorium (synonymous with clouded sensorium, altered mental status (AMS) and altered level of consciousness) is a condition brought on by a wide range of factors and appear clinically as cognitive problems, attention disorders, arousal disorders, and decreased level of consciousness [2,3].

The common causes of an abrupt drop in sensorium can be divided into

- ❖ Neurologic causes
  - o Vascular – strokes (ischemic/ haemorrhagic/ subarachnoid haemorrhage), hypoxic ischemic encephalopathy.
  - o Infections – meningoencephalitis/Autoimmune encephalitis.
  - o Seizures – postictal/ nonconvulsive status epilepticus.
- ❖ Toxic causes
  - o Drugs of abuse, medication overdose (NSAIDs, anti-depressants) polypharmacy, alcohol abuse, envenomation.
- ❖ Environmental causes: Carbon monoxide poisoning, heat stroke, hypothermia or hyperthermia
- ❖ Metabolic causes
- Metabolic encephalopathy
- Hypoxia
- Hypoglycaemia or hyperglycaemia

- Diabetic ketoacidosis
- Sepsis
- Shock
- Hypo/hypernatremia
- Uremic encephalopathy
- Wernicke's encephalopathy [4]

Physical examination

Vital indicators such as blood pressure, respiration rate, temperature, heart rate and rhythm, and pulse oximetry should all be evaluated while performing a focused physical examination. The vital signs could provide important clues as to what is causing the altered sensorium.

- Heart rate: Bradycardia may be present in people who have elevated intracranial pressure (ICP) or those who have consumed sedatives or hypnotics (e.g., barbiturates). Patients with sepsis or psychiatric medication overdose frequently have tachycardia.
- Blood pressure: Hypotension is a common sign of sepsis in patients. Hypotension may also be a symptom of drug overdose (e.g., tricyclic antidepressants, sedative-hypnotics). Conversely, in individuals with elevated ICP, hypertension may be detected a component of the Cushing's reaction.
- Respiratory rate: Bradypnea is a respiratory rate symptom of opioid and sedative-hypnotic overdose. Patients who appear with metabolic acidosis due to any cause, including diabetic ketoacidosis, uremia, alcoholism, drug overdoses, or sepsis, may experience tachypnoea.
- Temperature: A septic etiology for the altered sensorium may be expressed by hyperthermia. Patients with salicylate toxicity or environmental exposure may also experience fever. The usual cause of hypothermia is environmental [5].

Neurological examination

CT (Computed Tomography) of head is commonly performed in the setting of delirium and altered mental status (AMS). the yield of CT of head in hospitalized patients with delirium and/or AMS is useful in determining the causes of aberrant imaging [6].

The condition is deemed severe if the Glasgow coma scale (GCS) rating is between 3 and 8. These patients are unable to follow instructions and are obtunded to coma. They might display decerebrate or embellish posture.

Moderate condition is defined as a GCS rating between 9 and 12. Typically sleepy or obtunded, these individuals can open their eyes and localize painful stimuli upon examination.

If the GCS score is between 13 and 15, the condition is considered mild. These patients can appear confused and are awake, however, they can still speak and follow directions [7,8].

Table 1: Glasgow coma scale (GCS) [9]

Domain	Response	Score
Eye opening	Spontaneous To speech To pain None	4 3 2 1
Best verbal response	Oriented Confused Inappropriate Incomprehensible None	5 4 3 2 1
Best motor response	Obeying Localizing Withdrawal Flexing Extending None	6 5 4 5 3 1

MATERIAL AND METHODS

An observational study was conducted in department of general medicine, Gandhi hospital, Secunderabad, Telangana. This study was approved by Institutional Ethics Committee (CMRCP/IEC/2022-23/08). Non-traumatic patients diagnosed with altered sensorium whose case sheets were fully detailed up until discharge were included in this observational study. It was conducted for a period of 6 months from October 2022 to March 2023. The sample size taken was 110. Pediatric patients, pregnant and lactating women, traumatised patients, outpatient's department patients and cases with incomplete information or without a proper discharge summary were excluded from the study. Dropouts in this study were absconded patients, if the patient dies in the process or if patient left the hospital in between treatment course. The demographic details of the patients like their age, gender, past history and laboratory findings were collected.

RESULTS

Table 2: Patient gender distribution of patients with AMS

Gender	No. of patients	Percentage (%)
Male	51	46
Female	59	54
Total	**110**	**100**

110 cases with altered sensorium were examined in total, as shown in the table above, and 46% of patients were men and 54% were women. Therefore, it has been stated that in our research, females predominate males.

Table 3: Age profile of patients with AMS

Age	No. of patients	Percentage (%)
15-30	7	6.36
31-45	21	19.09
46-60	38	34.54
61-75	35	31.81
76-90	9	8.2

According to the table, a total of 110 patients were evaluated, ranging in age from 15 – 90 years. The majority of patients diagnosed with AS were in the 46–60 age range (n=38, 34.54%), whereas the patients who were least affected were in the youngest age groups i.e., 15–30 age range (n=7, 6.36%).

Table 4: Age based gender distribution of patients with AMS

Patient demographic details	N		Frequency
	Male	Female	
Gender	51	59	46% Male 54% Female
15-30	2	5	6.36
31-45	12	9	19.09
46-60	24	14	34.54
61-75	12	23	31.81
76-90	1	8	8.2
Total	51	59	100%

The above table shows that, in comparison to other age ranges, males in the 46-60 years range and females in the 61–75 years range are most impacted by AMS.

Table 5: Etiological factors of AMS

Etiological factors	No. of cases	Percentage (%)
Neurological factors	54	49.09
Toxic factors	6	5.46
Metabolic factors	45	40.90
Environmental factors	1	0.90
Others	4	3.65

According to the above table, neurological factors account for the greatest percentage of cases of altered sensorium (n=54, 49.09%), followed by metabolic factors (n=45, 40.90%), and environmental causes (n=1, 0.90%).

Table 6: Causes of AMS based on etiological factors

Causes	No. of cases	Percentage (%)
Ischemic stroke	23	20.90
Septic encephalopathy	6	5.45
NSAID drug abuse	2	1.82
Hyponatremia	5	4.54
Metabolic encephalopathy	18	16.36
Meningoencephalitis	12	11
Status epilepticus	1	0.90
Hypoglycemia	10	9.1
Alcohol withdrawal	3	2.72
Uremia	3	2.72
Auto immune encephalitis	3	2.72
Hypovolemic shock	1	0.90
Heat stroke	1	0.90
Seizures	9	8.20
Alcohol intoxication	3	2.72
Hypertension	1	0.90
Infection	6	5.45
Hyperglycemia	1	0.90
Wernicke's encephalopathy	1	0.90
Medication overdose	1	0.90
Total	**110**	**100**

According to the above table, ischemic stroke (n=23, 20.90%) and metabolic encephalopathy (n=18, 16.36%) are the most common causes of individuals presenting with altered sensorium.

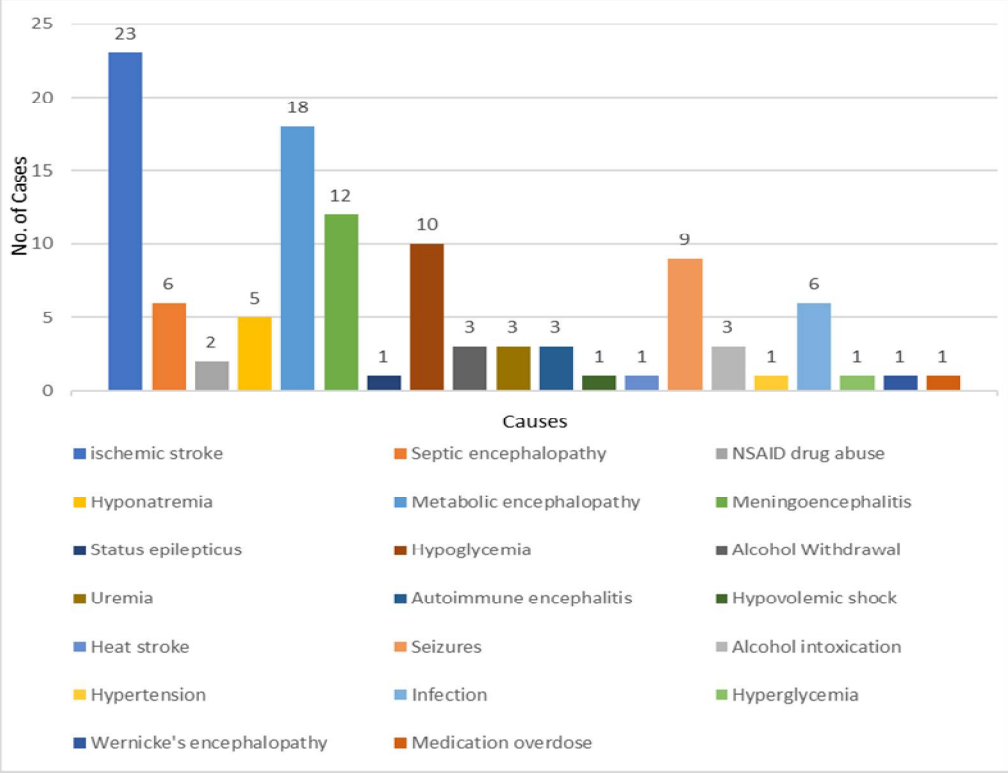

Figure 1: Causes of AMS based on etiological factors

Table 7: Comparison of etiological factors in < 45years and > 45years

Etiological Factors	< 45	> 45
	n=28, 26%	N=82, 74%
Neurological	14 (50%)	40 (48.9%)
Metabolic	13 (46.2%)	33 (40.2%)
Toxic	0	6 (7.3%)
Environmental	0	1 (1.2%)
Others	1 (3.8%)	2 (2.4%)
Total	28	82

It has been found that, AMS patients who were over 45 years old bought considerable illness from neurological, metabolic, and other reasons compared to younger age groups.

Table 8: Distribution of comorbidities of AMS

Comorbidity	No. of cases	Percentage (%)
Hypertension	48	32.4
Hypotension	4	2.7
Diabetes Mellitus	33	22.3
CVD	14	9.5
Acute Kidney Injury	6	4.04
Chronic Kidney Disease	4	2.7
Tuberculosis	7	4.7
Anemia	3	2.02
GI Disorders	7	4.79
Pneumonia	9	6.08
Psychiatric Illness	2	1.35
HIV	3	2.02
Others	8	5.4
Total	148	100

From the above table, it is evident that hypertension (n=48, 32.4%) and diabetes mellitus (n=33, 22.3%) are the two main comorbidities associated with AMS.

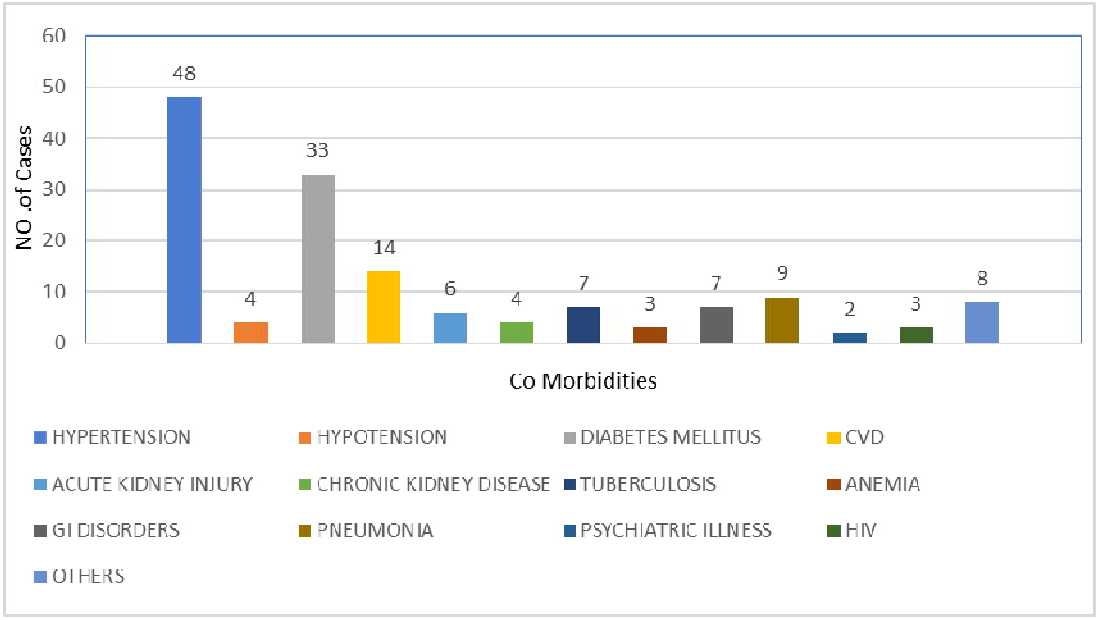

Figure 2: Distribution of comorbidities of AMS

Table 9: Distribution of risk factors of AMS

Risk Factors	No. of cases	Percentage (%)
Hypertension	48	28.07
Diabetes Mellitus	33	19.3
Alcohol Consumption	30	17.54
Chronic Kidney Disease	4	2.34
Smoking	16	9.35
Others	40	23.4
Total	171	100

The above table indicates that the most common risk factor was hypertension (n=48, 28.07%) with altered sensorium, while CKD was the least associated risk factor (n=4, 2.34%).

Table 10: Distribution of severity of AMS as indicated by GCS

Severity	Score	No. of cases	Percentage (%)
Minor	13-15	6	5.45
Moderate	9-12	58	52.73
Severe	3-8	46	41.82

From the above table it is observed that among 110 patients the severity of altered sensorium was moderate in most of the patients. (n=58, 52.73%).

Table 11: Evaluation of AMS with CT of brain

Abnormal	19	17.27%
Normal	10	9.1%
Not done	81	73.63%

Computed tomography (CT), the most significant radiological test for altered sensorium, was conducted in 27% of patients, 17% of whose results were reported to be abnormal, while CT was not performed in 74% of the patients.

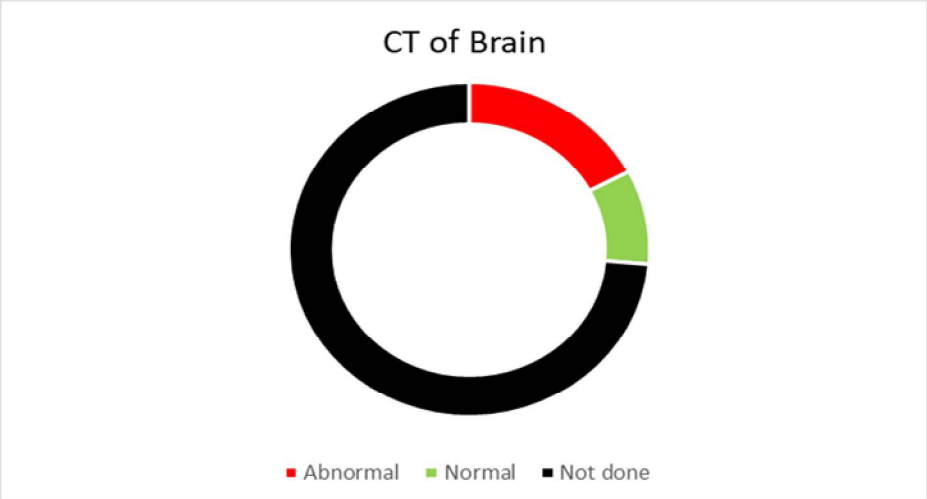

Figure 3: Evaluation of AMS with CT of brain

Table 12: Outcomes

Outcomes	No. of cases	Percentage (%)
Recovered	60	54.56
Partially recovered	17	15.45
Not recovered	32	29.09
Deceased	1	0.9

The above table indicates that 54% of the patients diagnosed with AMS were recovered and 29% of the patients were not recovered during the duration of hospital stay.

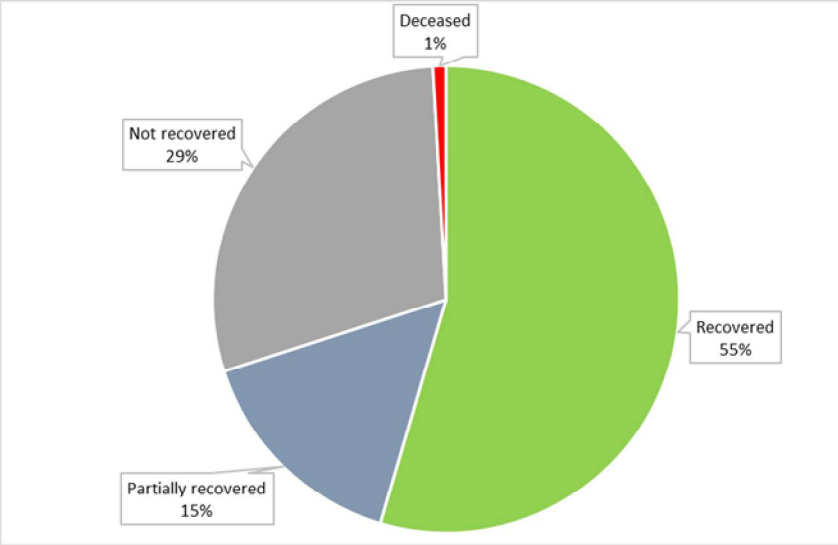

Figure 4: Outcomes

Table 13: Age group vs outcomes

Age	Recovered	Percentage (%)	Partially recovered	Percentage (%)	Not recovered	Percentage (%)	Deceased	Percentage (%)
15-30	4	6.66	0	0	3	9.37	-	-
31-45	13	21.66	4	23.52	4	12.5	-	-
46-60	20	33.33	7	41.18	10	31.25	1	100
61-75	18	30	5	29.42	12	37.51	-	-
76-90	5	8.35	1	5.88	3	9.37	-	-
Total	60	100	17	100	32	100	1	100

Based on the table above, it can be observed that patients between the ages of 46 and 60 had the highest recovery rate (n=20, 33.33%), while those between 61 and 75 did not recover (n=12, 37.51%).

Table 14: Etiological factor vs outcome

Etiological Factor	Recovered	Percentage (%)	Partially recovered	Percentage (%)	Not recovered	Percentage (%)	Deceased
Neurological	32	53.33	9	52.95	12	37.5	-
Toxic	2	3.35	2	11.76	2	6.25	1
Metabolic	21	35	6	35.29	18	56.25	-
Others	4	6.66	-	-	-	-	-
Environmental	1	1.66	-	-	-	-	-
Total	60	100	17	100	32	100	1

From the above table, it can be observed that 53% of individuals with AMS with a neurological etiology recovered, while 56% of individuals with AMS with a metabolic etiology were not.

Table 15: GCS vs outcome

GCS	Recovered	Partially recovered	Not recovered	Deceased
3-8	24	9	13	-
9-12	30	8	19	1
13-15	5	1	0	-

From the above table it is indicated that irrespective of the severity of GCS score maximum number of patients got recovered compared to the number of patients that aren't recovered.

Table 16: Day wise recovery

Days	No. of patients	Percentage (%)
1-7	29	48.34
8-14	24	40
15-21	4	6.66
22-28	3	5
Total	60	100

According to the above table, out of 110 patients, 88% of them recovered within one to two weeks, while 12% took about a month to recover.

DISCUSSION

We have collected a total of 110 patients from the male and female wards of the general medicine department at Gandhi Hospital Secunderabad between September 2022 and February 2023. In 110 cases, women predominated, comprising nearly 54% of the cases compared to men's 46%, which was similar to the study done by Henna Naqash et al. [10].

In our research of general medicine patients who represent various age ranges, it was found that 34% of the population belonged to the 46–60 age range. According to a study conducted by Siba Narayan Jail et al. [11], the majority of patients (32%) belonged to the 60+ age group, which was a significantly older age range than in our study.

Based on the age and gender distribution analysis, it was discovered that altered sensorium mostly affected males in the age range of 46 to 60 years, while females in the age range of 61 to 75 years were more impacted. The patients who were least impacted were between the ages of 15 - 30 and 76-90 years respectively, in both males and females.

According to our study's etiological analysis, neurological factors accounted for the maximum percentage of cases (49%) followed by metabolic causes (40%) and the least number of cases were caused by environmental causes [12], While a diversity of aetiologies for altered sensorium viewed, the majority of patients (20%) had stroke as the primary cause, which is similar to the research done by Sarker PS et al. [13].

In our investigation, metabolic encephalopathy (16%) and meningoencephalitis (10%) were also commonly observed. In a study conducted by Keun Tae Kim et al. [14] infections were the most frequent contributing factor.

According to a comparative analysis between the age groups of <45 years and >45 years, patients who are older than 45 years are more likely to be impacted by neurological, metabolic, and other conditions than younger age groups. Lim Beng Leong et al. [15] study supports this observation.

Commonly occurring comorbidities were pneumonia in 9 patients, cerebrovascular diseases in 14 patients, hypertension in 48 patients, and DM in 33 patients. In our analysis, elevated blood pressure (28%) was the most common risk factor, followed by diabetes mellitus (19%) and alcohol abuse (17%).

The results of the GCS evaluation were recorded, and they were different from what Ayana Harikumar et al. [16] reported. In their study, 19% of patients had a moderate GCS score and 1.5% had a severe score, whereas in the current study, 52% of cases had a moderate GCS score of 9-12, and 41% had a severe score of 3-8. Additionally, a CT examination was done on 27% of the individuals in the research, and 17% of the results were abnormal. When compared to other studies, the ordering rate for CT is typically low. 29% of the patients were not recovered throughout their hospital stay, compared to 54% of the instances that were studied that had full recovery.

It was discovered that in the older age range of 61–75 years 33% of patients were unable to recover, with the recovery rate being highest in slightly younger age groups of 46–60 years.

This results primarily from the fact that older people have weakened immune function and tend to have risk factors and co-morbid conditions.

In our study, it was also shown that neurological cases recovered at a greater rate than metabolic cases, mainly because the latter category had more risk factors. The majority of patients experienced a favorable

outcome regardless of the GCS score, as 24 patients recovered with a severe GCS score of 3–8 (signifying that the sensorium and GCS have improved during hospitalization) and 30 patients recovered with a moderate GCS score of 9–12; in contrast, Failure to recover occurred in 13 individuals with a severe GCS score and 19 patients with a moderate GCS score. 88% of AMS patients made a full recovery in a matter of 1-2 weeks, which is a result of proper diagnosis and therapy that yielded a favorable outcome by minimizing the symptoms of AMS and imposing a higher lifestyle quality on the patients.

CONCLUSION

AMS has a complex etiology that varies across age groups, making it one among the most difficult presentations for a medical practitioner to accurately diagnose. Knowledge and awareness of the often-occurring etiologies enable improved patient care. It was found that neurological causes were the most frequent cause of altered sensorium when one or more co-morbidities were present. Clinical assessments like CT and GCS provide predictive information about the potential of recovery in the patients and with prompt intervention and appropriate management. It was observed that the majority of patients demonstrated a favorable outcome regardless of the morbidity and severity of the condition.

ACKNOWLEDGEMENT

We express our indebtedness and sense of gratitude to the management of CMR College of Pharmacy, Kandlakoya, Medchal, Hyderabad, Telangana, India for providing the necessary equipment for research, praiseworthy inspiration, constant encouragement, facilities, and support.

Authors contribution

All authors contributed to experimental work, data collection, drafting or revising the article, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing interest statement

All authors declare that there is no conflict of interests regarding publication of this paper.

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