Original Research Article

An Epidemiological and Clinical Analysis of Patients Presenting with Delirium in the Emergency Department: A Prospective Single Center Observational Study

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Abstract

Background: Delirium is a state of acute brain dysfunction. It is one of the most common diagnoses encountered in the Emergency Department(ED), but frequently missed or under-evaluated. In developing countries like India, there is extreme paucity of reliable research data of patients presenting with delirium in the ED.**Objectives:** To evaluate the demographics and analyse the risk factors, triggers and clinical features in patients confirmed with delirium, attending the ED.**Methods:** Patients aged ≥18 years, attending the ED, of a tertiary care medical college hospital, from November 2020 to April 2021, were screened with Delirium Triage Screen, then confirmed for delirium by brief Confusion Assessment Method. These patients were classified into psychomotor subtypes on the basis of Richmond Agitation-Sedation Scale and into severity subtypes based on Delirium Rating Scale-revised-98 score. A wide range of demographic, epidemiological and clinical data was compiled and analyzed for statistical significance.**Results:** A total of 1660 patients were included. Almost 30% were young adults (<50 years age), while 61.5% patients were males. Hypoactive delirium was the most common psychomotor subtype. The younger adults and males predominantly showed delirium with less severity while females had more of severe delirium. The commonest risk factor was a recent decrease in food intake. Vomiting was the commonest presenting symptom. Hyponatremia was the commonest laboratory abnormality. **Conclusion**: Recognizing delirium by rapid validated methods and treating it appropriately in time, while working in a busy ED setup, will help in reducing the morbidity and mortality associated with this condition.

Keywords: Delirium, risk factors, symptoms, ED

Introduction

Delirium is defined as an acute confusional state. It is a neuro-psychiatric syndrome, characterized by altered or fluctuating cognition, attention and consciousness.[1] Delirium is associated with higher in-hospital and long-term mortality, faster functional and cognitive decline, prolonged hospital stay, and higher intensive care unit admissions, especially among the elderly group patients.[2] Despite having such potent clinical and prognostic implications, delirium remains a common, complicated, and easily missed condition. Among patients attending the Emergency Department (ED), delirium remains under-recognized, poorly understood and not adequately managed.[3] Emergency Department is the gateway to prompt health management for any patient entering the hospital with a critical ailment and similarly Emergency Physicians are the cornerstone in this modality. Different studies have shown that Emergency Physicians often fail to appreciate or diagnose delirium and its precipitating cause, and this may negatively impact the evaluation and further management of the patient.[4] Delirium is not a discrete event, but a conglomeration of underlying risk factors pressed upon by recent triggers. The risk factors for its occurrence include advancing age, underlying dementia, chronic liver disease, psychiatric illness and others. The various precipitating factors or triggers include stress, pain, dehydration, infections, stroke, metabolic disturbances, and so on.[5] There is limited data concerning with the epidemiology and clinical aspects of patients attending the ED, in low-income and middle-income countries.[6] The research picture regarding delirium is scarce in India, with studies lacking in comprehensiveness and clarity in describing epidemiological and clinical profiles together for the occurrence of delirium.[7] Patients having high risk need only minor precipitating factors to trigger the onset of delirium, while those at low risk may need more or severe triggers.[8] Delirium is a presentation which affects patients related to most of the clinical departments, like internal medicine, general surgery, urology, orthopedics, trauma care and psychiatry. Understanding the prevalence, risk factors, triggers and patient characteristics in the patients attending the ED with delirium, will definitely help the busy Emergency Physician in the timely diagnosis and prompt management of such patients, especially in hospital settings with huge patient load, often seen in developing countries like India.

Our study is one such attempt, to reduce the dearth of research knowledge, in this setting.

Materials & Methods

Study setting: This is an observational non-interventional single centre study conducted at the Emergency Department of a tertiary care medical college hospital in the state of Kerala, in India, over a

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period of 6 months. It was approved by the Institutional Review Board of the hospital, with study reference number IRB/II/25/2020.
The objectives of this study are:

1) To evaluate the demographics of patients confirmed with delirium, attending the ED.
2) To analyse the risk factors, precipitating triggers and symptoms in the patients confirmed with delirium, attending the ED.
3) To assess the abnormalities of laboratory evidences and neuro-imaging in the patients confirmed with delirium, attending the ED.

Participant selection

Patients (aged 18 years and above) attending the ED of a tertiary care medical college hospital in Kerala, due to any ailment, from November 2020 to April 2021, were screened using Delirium Triage Screen (DTS)(done in less than 20 seconds). DTS needs less than 20 seconds to assess and can be done by any medical professional. This screening test effectively rules out delirium, so if DTS is negative, there is no need for additional testing.[9]

DTS works as follows:

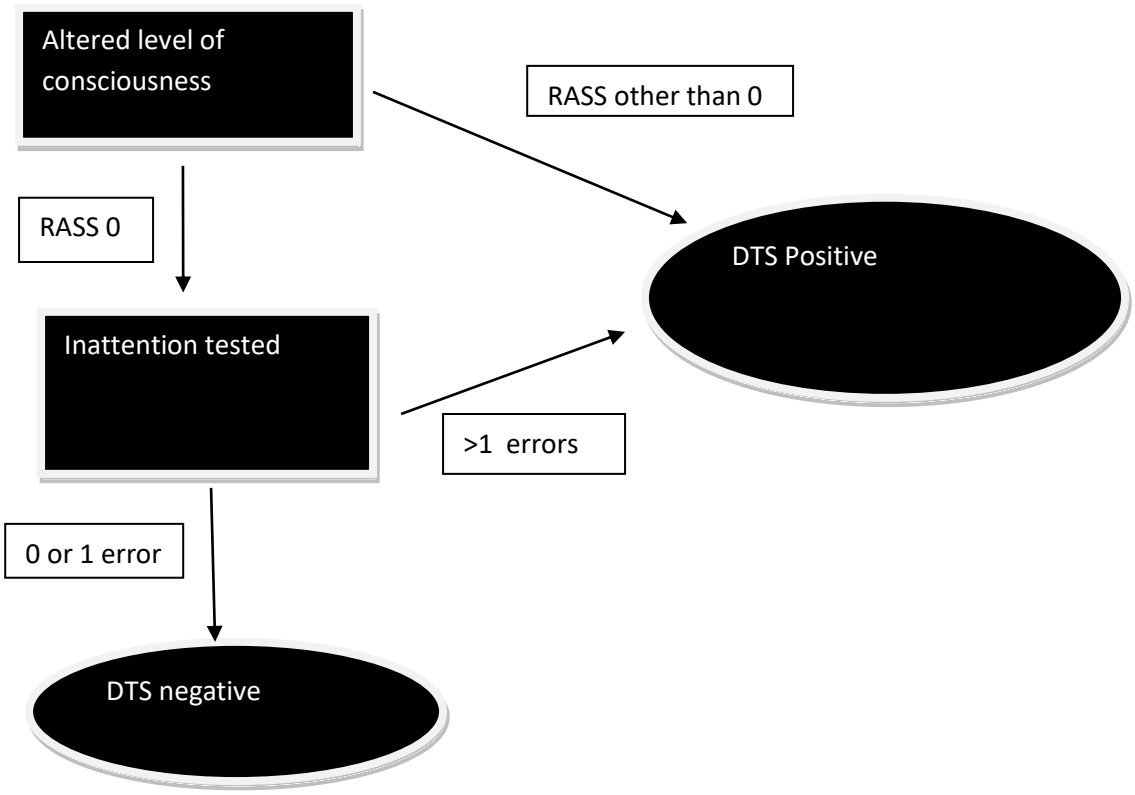

Fig 1: This explains the sequence of testing in Delirium Triage Screen

Altered level of consciousness is assessed objectively with Richmond Agitation-Sedation Scale (RASS). A RASS score of 0 means alert and calm, that means there is no altered level of consciousness. RASS score from +1 to +4 stands for restless, agitated, very agitated and combative, respectively. RASS score from -1 to -5 stands for drowsy, light sedation, moderate sedation, deep sedation and unarousable, respectively. RASS score other than 0 suggests altered level of consciousness, which directly leads to DTS positive result.
If RASS score is 0, then attention deficit is tested by asking some practical question to the patient, like 'Spell the word LUNCH backwards'. If there are at least 2 errors committed by patient, then also DTS is termed as positive.[10]
DTS positive result needs to be specifically assessed for the presence of delirium by a validated formal testing method. In this study, we have taken the brief Confusion Assessment Method (bCAM) for confirming delirium in DTS positive patients. This method is highly specific and reliable, and needs less than 2 minutes for assessment.[11]

bCAM works as follows :
Feature 1 (altered mental status or fluctuating course)
Feature 2 (inattention)
Feature 3 (altered level of consciousness)
Feature 4 (disorganised thinking)

If Feature 1 is absent, then **bCAM is negative (means no delirium).**
If Feature 1 is present, then check for Feature 2.
If Feature 2 is absent(0 or 1 error in attention testing), then bCAM negative.
If Feature 2 is present(more than 1 error), then check for Feature 3.
If Feature 3 is present (based on RASS score other than 0), then **bCAM is positive (means delirium is present).**
If Feature 3 is absent (RASS score is 0), then check for Feature 4.
Feature 4 is tested by asking logical questions like 'Can stone float on water?', 'Show me thumb and index fingers of your left hand'.

If Feature 4 shows no error, that means there is no disorganised thinking and hence bCAM is negative.
If Feature 4 shows any error, then bCAM is positive.
Hence, **a patient was considered to be having delirium if both features 1 (altered mental status or fluctuating course) and feature 2 (inattention) were present and either feature 3 (altered level of consciousness) or feature 4 (disorganized thinking) was present.**These bCAM positive patients form the **inclusion criteria** for this study. An informed consent was obtained from the bystander. Those who refused the consent form and those who were bCAM negative formed the **exclusion criteria**. (Figure 2)

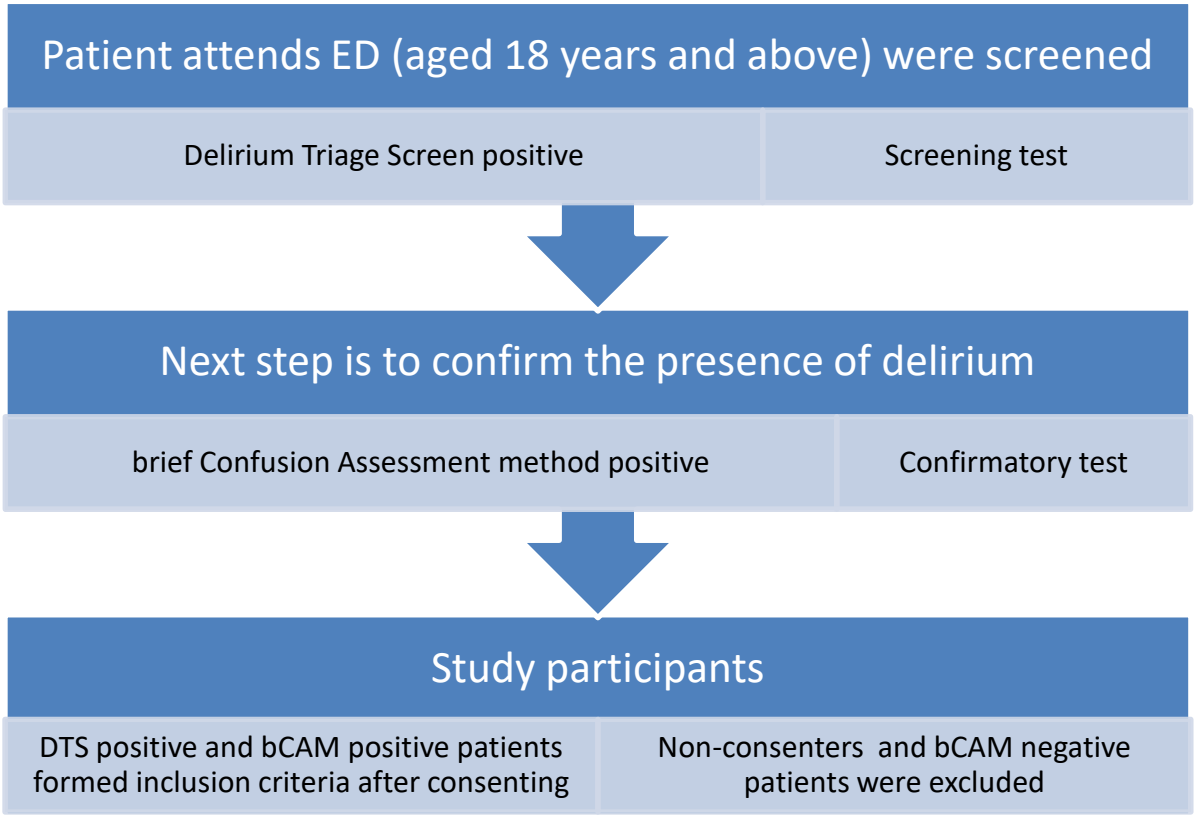

Fig 2: This explains the study design – initial screening with Delirium Triage Screen, then confirmation with brief Confusion Assessment Method.

Study design and Assessment tools:
The patients included in this study were classified into psychomotor subtypes (hyperactive, mixed and hypoactive) based on RASS(Richmond Agitation Sedation Scale).[12]Hyperactive delirium includes RASS scores of +1 to +4 and these patients are termed in **GROUP A**. Hypoactive delirium includes RASS scores of -1 to -5 and these patients are termed in **GROUP C.** Meanwhile, those with mixed or unclassifiable psychomotor activity formed **Group B.**
The severity of delirium in these patients was assessed as severe and less severe based on DRS-R-98 (Delirium Rating Scale – revised - 98) scoring. This scoring method is a 16-item scale, with 13 severity and 3 diagnostic items, and has high reliability, sensitivity, and specificity for detecting and evaluating the severity of delirium. Severity scale scores range from 0 to 39, with higher scores indicating more severe delirium. Delirium typically involves scores above 15 points (Severity scale) and for this study, we divided the patients into two groups, one with less severe delirium (DRS-R-98 score less than 25) and other with severe delirium (DRS-R-98 score more than or equal to 25).[13]
Based on the above classifications of patients, we (the investigators) collected and projected the demographic, epidemiological and clinical data, with the help of a pre-designed systematic pro forma. Data collection and classification were based on all available information obtained from the patients, caregivers, medical staff, and medical records. The rationale of the study was explained to the caregivers in the informed consent.The demographic and epidemiological data included age group (adults less than 50 years, more than or equal to 50 years), gender(male, female), recent social stress episode, alcohol use within last 48 hours, history of dementia (defined as an acquired loss of cognition in multiple cognitive domains sufficiently severe to affect social or occupational function), [14] history of decompensated chronic liver disease (CLD), history of advanced chronic kidney disease (CKD), history of psychiatric illness, history of recent decrease in food intake, history of recent fever, vomiting, diarrhea, breathing difficulty, decreased urine output or urinary retention, recent narcotic abuse and recent trauma(including road traffic accidents, head injuries, any other type of physical trauma). The clinical data to be collected include presence of the following : hyponatremia (serum sodium less than 130 mEq/L), hypercalcemia (serum calcium more than 12 mg/dl), sepsis as defined by life threatening organ dysfunction due to dysregulated host response to infection,[15] symptomatic hypoglycemia (low detected blood glucose, usually at less than 70 mg/dl), altered liver function test (as shown by high bilirubin levels with elevated transaminases), altered renal function test (abnormal

serum urea and creatinine levels), abnormal brain imaging (including infarcts, hemorrhages, traumatic brain injury, brain parenchymal lesions).The above data were correlated and compared based upon the assessment tools used in this study.

Data Analysis

The data obtained was coded, entered in Microsoft Excel sheet and analysed using the software Statistical Package for Social Sciences (SPSS) Version 20. Baseline characteristics of the study participants were explained in terms of frequency, percentage, mean and standard deviation. Association between categorical variables was analyzed using Pearson's chi square test. The level of significance was estimated with 95% confidence intervals and p value < 0.05.

Results

In the study time period (that is, 6 months), out of the 5260 patients screened at the ED with DTS method, 1702 patients turned out to be DTS positive. Out of these, 1660 patients were confirmed for the presence of delirium, using bCAM. None of these patients or their caregivers denied the consent for the study. Hence, 1660 patients confirmed to our inclusion criteria for the study.

The age range was 18-95 years. Mean age was 62.5 years. Of these, 495 patients were in the younger age-group of less than 50 years, while 1165 patients were in the older age-group of equal to or more than 50 years.

Of these, 61.5 % (that is, 1022 patients) were males, while remaining (638 patients) were females.

Of the 1022 male patients, 356 (34.8 %) were in the age-group less than 50 years while 666 were in the age-group equal to or more than 50 years.

Of the 638 female patients, 139 (21.7%) were in the age-group less than 50 years while 499 were in the older age-group.

The total 1660 patients were classified based on the younger and older age-groups and sub-classified into Group A (hyperactive), Group B (mixed) and Group C (hypoactive) based on RASS scoring. (Table 1)

Table 1 : Classification of the study participants into age-groups and gender groups and into psychomotor subtypes

		Group A	Group B	Group C
Age	<50 years	298	6	191
	≥50 years	216	13	936
Gender	Male	337	14	671
	Female	177	5	456

Table 1 shows the classification of the study participants into age-groups and gender groups and into psychomotor subtypes.

In the younger age-group, Group A had 212 males and 86 females, Group B had 6 males and 0 females, while Group C had 138 males and 53 females.In the older age-group, Group A had 125 males and 91 females, Group B had 8 males and 5 females, while Group C had 533 males and 403 females.Hence, Group A had total 514 patients (30.9 %), Group B had only total 19 patients, while Group C had total 1127 patients (67.8 %).All the included patients were then classified into patients with less severe and severe delirium, based on DRS-R-98 scale. (Table 2)

Table 2 : Classification of patients into age-groups, gender groups and severity of delirium groups.

	Less Severe Delirium	Severe Delirium
Age < 50 years	360	135
Age ≥ 50 years	597	568
Gender - Male	655	367
Gender - Female	302	336

Table 2 shows the classification of patients into age-groups, gender groups and severity of delirium groups.

Out of the 655 male patients with less severe delirium, 255 (38.9 %) were in the age-group less than 50 years while 400 belonged to older age-group.

Out of the 302 female patients with less severe delirium, 105 (34.7%) were in the younger age-group while 197 belonged to older age-group.

Out of the 367 male patients with severe delirium, 101 (27.5%) belonged to the younger age-group while 266 belonged to older age-group.

Out of the 336 female patients with severe delirium, 34 (10.1%) belonged to the younger age-group while 302 were in the older age-group.

When analyzed, the above values of both age-groups with the groups having less severe delirium and severe delirium were found to be statistically significant with p value <0.0001.

Also, the above mentioned values of both the gender groups with the groups having less severe delirium and severe delirium were found to be statistically significant with p value < 0.0001.

The next step was to assess the association of various **risk factors for the onset of delirium** with the age-groups as well as with the gender groups. The data collected regarding risk factors from the patients were tabulated as below. (Table 3)

Table 3: Number of patients found to have any of the risk factors

Risk factor for onset of delirium	Total number of patients
Recent physical trauma	617
Narcotic abuse	15
Recent decrease in food intake	953
Alcohol use in last 48 hours	654
Recent social stress	268

Table 3 shows the number of patients found to have any of the risk factors included in the study.

Association of risk factors for the onset of delirium with age-groups and with gender groups is shown below. (Table 4)

Table 4: Statistical significance of patients in the specified age-groups and gender groups

Risk factors	<50 years	≥50 years	P value	Male	Female	P value
Recent physical trauma	317	300	<0.0001*	504	113	<0.0001*
Narcotic abuse	15	0	<0.0001*	15	0	0.0021*
Recent decrease in food intake	66	887	<0.0001*	528	425	<0.0001*
Alcohol use in last 48 hours	259	395	<0.0001*	654	0	<0.0001*
Recent social stress	54	214	0.0002*	99	169	<0.0001*

*statistically significant at 0.05

Table 4 shows the statistical significance of patients in the specified age-groups and gender groups with respect to risk factors assessed in the study .

Subsequently, the association of symptoms preceding the onset of delirium was evaluated for the age-groups and gender groups. The following set of symptoms were noted and tabulated. (Table 5)

Table 5: Number of patients with the specified symptoms

Symptom preceding onset of delirium	Total number of patients
Fever	646
Vomiting	946
Diarrhea	111
Breathing difficulty	255
Decreased urine output or sudden urinary retention	156

Table 5 shows the number of patients with the specified symptoms assessed in the study.

The association of above symptoms with age-groups and gender groups was analyzed as shown below: (Table 6)

Table 6: Statistical significance in the patients based on age-groups and gender groups, in relation to the symptoms assessed in the study

Symptoms	<50 years	≥50 years	P value	Male	Female	P value
Fever	65	581	<0.0001*	339	307	<0.0001*
Vomiting	282	664	1.000	725	221	<0.0001*
Diarrhea	8	103	<0.0001*	41	70	<0.0001*
Breathing difficulty	60	200	0.009*	199	61	<0.0001*
Decreased urine output or sudden urinary retention	49	107	0.646	128	28	<0.0001*

*statistically significant at 0.05

Table 6 shows the statistical significance in the patients based on age-groups and gender groups, in relation to the symptoms assessed in the study.

The data on symptoms preceding the onset of delirium indicates that vomiting was the most common symptom overall (56.9 % of total 1660 patients). (Figure 3)

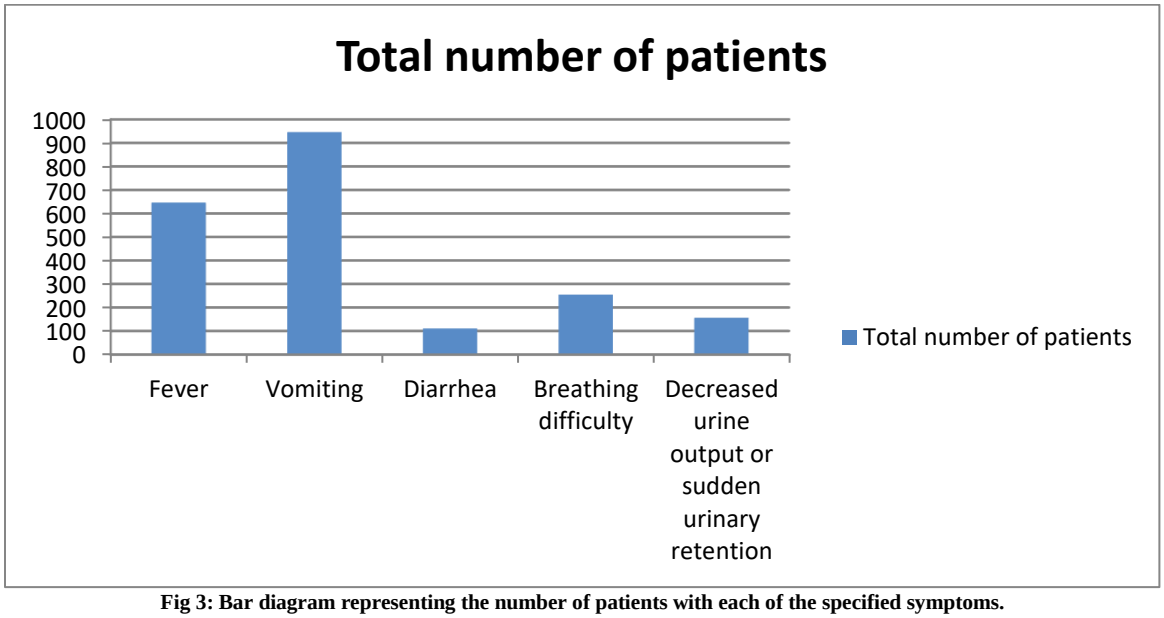

Fig 3: Bar diagram representing the number of patients with each of the specified symptoms.

Vomiting was found to be the commonest presenting symptom in the younger as well as in the older age-groups, and also in the male group (70.9 % of total 1022 patients). In the female group however, the most common symptom was fever (48.1% of total 638 patients).

The next step was to find the association of underlying chronic diseases as a predisposing factor for the occurrence of delirium. The following underlying conditions were noted: (Table 7)

Table 7 : Total number of patients with underlying chronic illnesses

Underlying chronic diseases or conditions	Total number of patients
Dementia	287
Decompensated chronic liver disease	111
Advanced chronic kidney disease	100
Psychiatric illness	112

Table 7 shows the total number of patients with underlying chronic illnesses

The association of the above mentioned underlying chronic conditions was evaluated for the age-groups and gender groups. (Table 8)

Table 8:Statistical association of underlying chronic illnesses with the age-groups and gender groups

Underlying chronic disease	<50 years	≥50 years	P value	Male	Female	P value
Dementia	0	287	<0.0001*	154	133	0.003*
Decompensated chronic liver disease	24	87	0.064	108	3	<0.0001*
Advanced chronic kidney disease	15	85	0.001*	61	39	1.000
Psychiatric illness	29	83	0.392	45	67	<0.0001*

*statistically significant at 0.05

Table 8 shows the statistical association of underlying chronic illnesses with the age-groups and gender groups.

After this, the data regarding laboratory evidence or neuro-imaging supportive as a cause of delirium was collected and tabulated. Of these, hyponatremia was the commonest abnormality with 845 patients (50.9 %) while sepsis was seen in 675 patients (40.6%). Symptomatic hypoglycemia was seen in 241 patients while hypercalcemia was noted in a single patient only. Liver function test and renal function test were found significantly altered in 70 and 132 patients respectively. Abnormal neuro-imaging was seen in 784 patients (47.2%).

Association of the above data for laboratory evidence and neuro-imaging supportive as a cause of delirium was analyzed for the age-groups and gender groups, as follows : (Table 9)

Table 9:Statistical significance for the laboratory or neuro-imaging abnormalities with age-groups and gender groups

Laboratory evidence or Neuro-imaging	<50 years	≥50 years	P value	Male	Female	P value
Hyponatremia	126	719	<0.0001*	456	389	<0.0001*
Hypercalcemia	0	1	1.000	1	0	1.000
Symptomatic hypoglycemia	46	195	<0.0001*	132	109	0.022*
Sepsis	71	604	<0.0001*	348	327	<0.0001*
Significantly altered liver function test	15	55	0.151	68	2	<0.0001*
Significantly altered renal function test	19	113	<0.0001*	70	62	0.044*
Abnormal neuro-imaging	346	438	<0.0001*	592	192	<0.0001*

*statistically significant at 0.05

Table 9 shows the statistical significance for the laboratory or neuro-imaging abnormalities with age-groups and gender groups.

Discussion

This study was conducted at a tertiary care medical college hospital in Kerala state of India, and since the data collection spanned over 6 months, a large cohort of patients with delirium could be assessed and stratified based on validated and objective measures.

The occurrence rate of delirium among patients attending this hospital over the study period was found to be 31.5%, that is, 1660 patients out of 5260 were found to have delirium. This is nearly similar to previous studies which showed occurrence rates ranging from 11% to 42%.[16,17]

Since the minimum age limit for the study of the patients was 18 years, we found a significant number of young adults (less than 50 years) with delirium (29.8%). However the remaining 70.2% comprised of older adults, which is consistent with older age being an established risk factor for the occurrence of delirium.[18]

Of the total 1660 patients, 61.5% were males, and this supports the evidences of multiple studies indicating male gender at higher risk of delirium.[19]

Our study found that hypoactive delirium (Group C) was the most common psychomotor subtype with 67.8% while mixed delirium was seen only in 1.1 % patients. Hypoactive delirium was seen in 936 out of 1165 patients of the older age group, which suggests that elderly patients are at higher risk of hypoactive delirium. This type of delirium is clinically more difficult to diagnose, evaluate and treat.[20]

65.6 % males and 71.4% females belonged to Group C.

The classification of patients based on DRS-R-98 scale showed that the patients with less severe delirium were more in the younger age-group (72.7%) and among males (64%). Although the male gender is traditionally at higher risk for the occurrence of delirium (as mentioned above), we found 52.6% of females having severe delirium while only 35.9% of males had severe delirium. This association was found to be significant statistically.

Among the risk factors for the onset of delirium, we found 57.4% patients to have a recent decrease in food intake. 39.3% patients had alcohol intake within the last 48 hours while recent physical trauma was seen in 37.1% patients. Narcotic abuse was seen in hardly in just 0.9% patients while recent social stress was found to be present in 16.1% patients. 93% of the patients found to have recent decrease in food intake were from the older age-group, thus confirming to established evidence.[21] Narcotic abuse was seen only in 15 males belonging to the younger age-group while alcohol use was seen restricted to the male group only. Recent physical trauma was found

higher in males (81.6%) when compared to females. This might be attributed to the fact that men in this part of the world are more involved in outdoor and driving activities as well as prone to violent interactions compared to women who are less exposed due to household, social and religious limitations.[22,23]

Among the symptoms preceding the onset of delirium, vomiting proved to be the most common symptom, and it was more seen in the male group(76.6%) and older age-group(70.1%). Diarrhea, when found to be preceding delirium, was seen predominantly in the older age-group (92.7%). Fever was seen mainly in the older age group (89.9%). The elderly patients are always at higher risk of delirium, when there are significant concurrent illnesses,[24]as is supported by the above mentioned data, regarding symptoms preceding the onset of delirium. Breathing difficulty was seen in 76.9% in older age group and 76.5% in the male group, probably due to smoking being predominant in males in India[25] and the vulnerability of elderly patients which has already been mentioned earlier. Decreased urine output or sudden urinary retention was seen more in elderly patients and in the male group, probably due to prostatic problems often encountered in elderly males.The evaluation of chronic conditions as a predisposing factor for the occurrence of delirium showed that advanced chronic renal or liver disease was seen in about 6-7% of patients, more predominantly in elderly and male groups. Dementia was noted in 24.6% of the elderly age-group patients. Underlying psychiatric illness was seen in 6.7% patients.

Among the laboratory evidence or neuro-imaging evidence supportive of delirium, hyponatremia was the commonest cause, being much more prominent in the elderly group (85%). Symptomatic hypoglycemia, sepsis, altered liver function test as well as altered renal function test were again seen predominantly in the elderly group. Altered liver function test was almost completely detected in male group(97%) compared to female group, probably related to the high alcohol consumption rate among males in this part of India. Abnormal neuro-imaging was seen in a significant number of patients (47.2%). This underlines the fact that delirium, being an acute brain failure, has to be always evaluated for structural brain pathology, irrespective of the clinical presentation.

Limitations

1) This is a single center study, although the sample size is large.
2) The study was limited to a period of 6 months, hence there is likely to be a selection bias.
3) The study excludes pediatric and adolescent patients less than 18 years, for whom delirium is diagnosed and assessed by separate scales.
4) This study does not assess the effect of medical interventions in the ED which could have corrected or worsened the existing delirium in the patients.
5) Although delirium is a fluctuating condition, the study does not assess this waxing and waning nature, as the time progresses, while admitted to the ED.

Conclusion

Detecting delirium and identifying its risk factors and triggers is extremely crucial for prompt treatment and minimizing morbidity and mortality, in patients attending the ED. The ED is usually a busy area, involving multi-disciplinary approach within a limited span of time, where every minute is critical for the patient. In countries like India, the prevalence of delirium is high, so is the patient load arriving at the ED for medical or surgical attention. Rapid screening and validated confirmation of the diagnosis of delirium is the first vital step, that is, not to miss delirium. Next step is to identify the predisposing risk factors and precipitating triggers, and to take corrective measures. Our study emphasizes on detecting and evaluating these aspects, thus forming the foundation for treatment of delirium. Delirium is one of the most common diagnoses in the ED and is most often correctable, treatable and curable.

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