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DELIRIUM AMONG MEDICAL ICU PATIENTS: A PROSPECTIVE STUDY OF INCIDENCE, PSYCHOMOTOR SUBTYPES, ASSOCIATED RISK FACTORS, AND CLINICAL OUTCOMES

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ABSTRACT

Background: To assess the incidence, motor subtypes, associated risk factors, and clinical outcomes of delirium in medical intensive care unit (ICU) patients. **Study Design:** Prospective observational study. **Study Place and Duration:** The study was conducted at Liaquat University Hospital Hyderabad Pakistan from April 2025 to April 2026.

Materials and Methods: Patients were enrolled in the medical ICU who had been there for 24 hours or longer as adults. The Richmond Agitation-Sedation Scale (RASS) and Confusion Assessment Method for the ICU (CAM-ICU) were used to assess delirium twice daily. Motor subtypes were determined by RASS scores. Demographic parameters, comorbidities, APACHE II, SOFA scores, laboratory parameters, intensive care unit interventions, complications, and outcome parameters were documented. Statistical comparisons were performed between delirium and non-delirium groups.

Results: Among 238 patients, 158 (66.4%) developed delirium. Delirious patients were older (66.2 ± 15.1 vs. 53.1 ± 15.8 years, $p<0.001$) and were more likely to have organ dysfunction, mechanical ventilation, vasopressor use, and sepsis. The most prevalent subtype was hypoactive delirium (50.0%), followed by hyperactive delirium (28.5%) and mixed delirium (21.5%). Delirium was associated with increased in-hospital mortality (30.4% vs. 11.3%, $p<0.001$), longer ICU stay (9.8 ± 5.7 vs. 4.3 ± 2.6 days, $p<0.001$), prolonged hospital stays (18.6 ± 9.4 vs. 10.7 ± 6.2 days, $p<0.001$), mechanical ventilation, catheter removal, sepsis, and decubitus ulcers. Patients with hypoactive delirium were found to have the longest durations of stay in the ICU and hospital.

Conclusion: Delirium is a frequent and clinically significant condition in patients admitted to the medical intensive care unit, which is linked to death, longer length of stay, and preventable complications. Appropriate screening and management are critical to optimize outcomes.

Keywords: Delirium; Medical Intensive Care Unit; CAM-ICU; Hypoactive Delirium; Outcomes.

INTRODUCTION

Delirium is an acute and transient change in mental state manifested by poor attention and poor awareness. It can occur within a relatively short time and is frequently accompanied by other cognitive deficits, such as perceptual abnormalities, disorientation, and memory impairment.[1] In critically ill patients, it is a state of acute brain dysfunction resulting from the interaction of multifactorial processes including neuroinflammation, cerebral hypoperfusion, metabolic dysfunction, neurotransmitter imbalance, and disturbances in neuronal connectivity.[1,2] Unlike coma, patients with delirium retain some arousal, although consciousness and cognitive performance may vary. However, routine evaluation with a validated instrument like the Confusion Assessment Method for the ICU (CAM-ICU) combined with the Richmond Agitation-Sedation Scale (RASS) is imperative.[3]

Delirium is a common complication in patients admitted to intensive care units (ICUs). In a systematic review of 183,285 patients in the intensive care unit, the pooled incidence of delirium was 28.8%, and the pooled prevalence was 35.7%. Of the identified subtypes, hypoactive delirium was described as the most common subtype of delirium.[4] However, there are significant variations in occurrence between settings due to factors such as sedation management, illness severity, mechanical ventilation, admission diagnosis, exclusion of patients who are deeply sedated, and screening frequency. Incidence reported from prospective studies in similar populations has been reported as similar, such as 31.4% in medical ICU patients[5] and 31.5% in a mixed-ICU cohort.[6] A recent prospective medical-surgical study of the medical-surgical ICU found delirium in 37.8% and subsyndromal delirium in 33.0%.[7]

Delirium is known to have three clinical motor presentations, namely hyperactive, hypoactive, and mixed. Patients with hyperactive delirium typically display increased psychomotor activity, consisting of emotional lability, restlessness, agitation, and interference with medical devices. Hypoactive delirium, in contrast, is characterized by decreased activity, decreased alertness, delayed responses, and withdrawal from interaction. These patterns alternate in mixed delirium.[1,8] Hypoactive delirium is significant because it is not uncommon and is often under-recognized. It represented 55.7% of medical-ICU cases, while the proportion of cases detected clinically was only 2.04%.[5] A systematic scoping review identified that 50.3% of those who developed delirium had hypoactive delirium, 22.7% had hyperactive delirium, and 27.7% had mixed delirium.[9]

Risk factors are conventionally divided into predisposing and precipitating categories. Predisposing factors to delirium include advanced age, underlying cognitive dysfunction, chronic illnesses, and previous delirium.[7] In medical ICUs, particularly relevant precipitating factors include mechanical ventilation, benzodiazepines or deep sedation, physical restraint, hypoxia, metabolic derangements, infection, and high illness-severity scores.[10] Delirium is linked to aspiration, pressure injuries, accidental removal of the catheter, reintubation, increased ventilation and hospital stay, the mortality rate, as well as cognitive impairments during discharge.[11]

Although extensive research has been carried out, incidence estimates and relationships of subtype to risk, complications, and outcomes remain heterogeneous, especially in medical ICUs. This gap needs to be addressed to enhance risk stratification and early identification of risk factors at the local level. This study aims to estimate the prevalence and motor subtypes of delirium, risk factors and complications associated with delirium, and outcomes of patients admitted to the medical ICU who develop delirium.

MATERIALS AND METHODS

This was a prospective observational study using consecutive sampling, where all adult admissions to the medical ICU during the study period were screened. In the subsequent phase of the study, participants who fulfilled the study criteria were recruited consecutively to achieve the required sample size of 238 individuals. Patients aged 18 or older, who spent at least 24 hours in the medical intensive care unit, and who were able to be assessed (RASS score of −3 or above) were included. The exclusion criteria were a known pre-existing dementia or severe baseline cognitive impairment, major pre-existing neurological or psychiatric diagnosis that could interfere with cognitive functioning, persistent coma (RASS −4 or −5 during the entire stay in the ICU), profound hearing or visual impairment, and refusal to participate in the study.

Delirium was monitored twice a day during the period of patient admission to the intensive care unit (ICU) and at both morning and night checkups until the time of admission to the ICU or patient death. The assessment process started with the measurement of sedation level and agitation level through the RASS scale. Patients with high sedation scores (RASS −4 or −5) were deemed comatose and were not delirium-screened at the time of this assessment. Delirium status was defined using the CAM-ICU scale for patients with RASS scores of −3 to +4. For a positive delirium diagnosis, an acute change in mental status (CAM-ICU feature 1) and inattention (CAM-ICU feature 2) had to be present in addition to altered level of consciousness (feature 3) or disorganized thinking (feature 4). After assessment was completed, participants were divided into a delirium-positive group and a

delirium-negative group based on the CAM-ICU score.

Patients screening positive on the CAM-ICU were further classified into motor subtypes according to the concurrent RASS score. Hyperactive delirium was defined as a RASS score of +1 to +4, and hypoactive delirium was defined as a RASS score of −3 to 0. Mixed delirium was described as a delirium with both hyperactive and hypoactive features throughout the same ICU admission.

Demographic information, comorbidities, admission diagnosis, severity of illness (APACHE-II and SOFA scores), use of sedatives (specifically benzodiazepines) and opioids, mechanical ventilation status, and use of physical restraints and environmental factors were recorded in a structured proforma. Laboratory measurements were obtained and included creatinine, serum creatinine, bilirubin, ALT, and AST at admission and at appropriate times throughout the ICU stay. Information on predisposing and precipitating risk factors was collected systematically from medical records, nursing notes, and direct observation.

Delirium group was compared with non-delirium group. The statistical analysis was carried out using SPSS. Descriptive statistics were presented as mean ± SD or median values for continuous variables, and comparisons between groups were made using Student's t-test. All categorical variables were summarized as numbers and percentages, and the chi-square test evaluated differences among these variables. The results were considered statistically significant at $p < 0.05$.

RESULTS

Among 238 patients admitted to the medical ICU, 158 (66.4%) developed delirium, while 80 (33.6%) remained non-delirious. Patients with delirium were significantly older compared with non-delirious patients (66.2 ± 15.1 vs. 53.1 ± 15.8 years, p<0.001). Smoking history was more frequent among delirium patients (n=56, 35.4%) than non-delirious patients (n=16, 20.0%, p=0.014). Several comorbidities, including diabetes mellitus (n=69, 43.7%, p=0.018), chronic kidney disease (n=32, 20.3%, p=0.011), cardiovascular disease (n=48, 30.4%, p=0.032), previous stroke (n=25, 15.8%, p=0.018), and cognitive impairment (n=15, 9.5%, p=0.021), were significantly associated with delirium. Higher SOFA and APACHE II scores were observed for delirious patients (p<0.001), greater need for mechanical ventilation (n=78, 49.4%, p<0.001) and vasopressors (n=66, 41.8%, p<0.001), and increased sepsis occurrence. Statistical significance was observed between delirium and laboratory abnormalities, including AST, ALT, higher creatinine, bilirubin, and lower albumin levels, were significantly associated with delirium. Medication exposure, particularly sedatives (n=83, 52.5%) and benzodiazepines (n=46, 29.1%), was also more common among delirium patients (Table 1)

Table 1. Comparison of Patient Characteristics between Delirium and Non-Delirium Groups in the Medical ICU Population (N = 238)

Variables	Delirium Group (n=158)	Non-Delirium Group (n=80)	p-value
Demographic Characteristics			
Age (years)	66.2 ± 15.1	53.1 ± 15.8	<0.001
Male sex	96 (60.8)	47 (58.8)	0.77
Female sex	62 (39.2)	33 (41.2)	
Body mass index (kg/m²)	26.1 ± 5.4	26.9 ± 4.8	0.28
Smoking history	56 (35.4)	16 (20.0)	0.014
Alcohol/substance use history	14 (8.9)	4 (5.0)	0.29
Baseline Comorbidities			
Diabetes mellitus	69 (43.7)	22 (27.5)	0.018
Hypertension	81 (51.3)	31 (38.8)	0.07
Chronic kidney disease	32 (20.3)	6 (7.5)	0.011
Chronic liver disease	17 (10.8)	4 (5.0)	0.14
Cardiovascular disease	48 (30.4)	14 (17.5)	0.032
Chronic respiratory disease	34 (21.5)	11 (13.8)	0.15
Previous stroke/cerebrovascular disease	25 (15.8)	4 (5.0)	0.018
Cognitive impairment/dementia	15 (9.5)	1 (1.3)	0.021
Admission and Disease Characteristics			
Sepsis/septic shock	78 (49.4)	18 (22.5)	<0.001
Respiratory failure	50 (31.6)	17 (21.3)	0.09
Cardiovascular admission	18 (11.4)	13 (16.3)	0.31
SOFA score, mean ± SD	8.6 ± 3.7	4.5 ± 2.5	<0.001
APACHE II score, mean ± SD	22.1 ± 7.0	12.1 ± 5.1	<0.001
Laboratory Parameters at ICU Admission (mean ± SD)			
Serum ALT (U/L)	61.8 ± 46.7	40.4 ± 29.8	<0.001
Serum AST (U/L)	71.5 ± 57.2	44.2 ± 32.8	<0.001
Serum albumin (g/dL)	2.9 ± 0.6	3.4 ± 0.5	<0.001
Serum creatinine (mg/dL)	1.8 ± 1.2	1.2 ± 0.8	<0.001
Serum potassium (mmol/L)	4.2 ± 0.8	3.9 ± 0.5	0.008

Serum sodium (mmol/L)	139.4 ± 5.6	137.1 ± 3.8	0.001
Total bilirubin (mg/dL)	2.1 ± 1.7	1.2 ± 0.9	<0.001
ICU Supportive Interventions			
Mechanical ventilation	78 (49.4)	18 (22.5)	<0.001
Non-invasive ventilation	34 (21.5)	10 (12.5)	0.09
Vasopressor requirement	66 (41.8)	15 (18.8)	<0.001
Renal replacement therapy	15 (9.5)	2 (2.5)	0.049
Medication Exposure During ICU Stay			
Any sedative exposure	83 (52.5)	18 (22.5)	<0.001
Benzodiazepine exposure	46 (29.1)	8 (10.0)	0.001
Opioid analgesic exposure	86 (54.4)	30 (37.5)	0.017
Corticosteroid exposure	39 (24.7)	8 (10.0)	0.008

CAM-ICU screening confirmed delirium in 158 patients, of whom the most common motor subtype was hypoactive delirium, observed in 79 patients (50.0%). Hyperactive delirium was identified in 45 patients (28.5%), while mixed delirium was present in 34 patients (21.5%). Hypoactive delirium represented the predominant presentation (Figure 1).

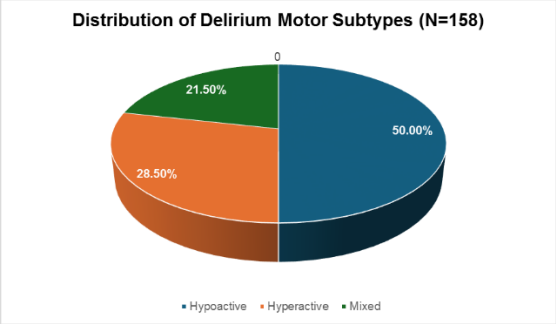

Figure 1. Distribution of delirium motor subtypes among CAM-ICU positive patients

Delirium was significantly associated with adverse clinical outcomes among medical ICU patients. Patients with delirium had significantly higher in-hospital mortality (n=48, 30.4%) compared with non-delirious patients (n=9, 11.3%, p<0.001). A significant relationship was observed between the presence of comorbid conditions and delirium occurrence. Patients in the delirium group had a greater burden of comorbidities compared with those without delirium (137 [86.7%] vs. 56 [70.0%], p = 0.003). Furthermore, patients who developed delirium experienced substantially longer durations of hospitalization and ICU admission. The mean hospital stay was 18.6 ± 9.4 days in the delirium group compared with 10.7 ± 6.2 days in the non-delirium group (p < 0.001), while ICU stay was also extended among delirious patients (9.8 ± 5.7 vs. 4.3 ± 2.6 days, p < 0.001). Mechanical ventilation requirement was significantly higher among delirium patients (n=78, 49.4%, p<0.001). Similarly, delirium was significantly associated with unplanned catheter/line removal (n=34, 21.5%, p=0.002), sepsis during ICU stay (n=78, 49.4%, p<0.001), and development of decubitus ulcers (n=27, 17.1%, p=0.018) (Table 2).

Table 2. Clinical Outcomes and Complications According to Delirium Status (N=238)

Variables	Delirium Group (n=158)	Non-Delirium Group (n=80)	p-value
In-hospital mortality	48 (30.4)	9 (11.3)	<0.001
Presence of comorbidities	137 (86.7)	56 (70.0)	0.003
Mean hospital length of stay (days), mean ± SD	18.6 ± 9.4	10.7 ± 6.2	<0.001
Mean ICU length of stay (days), mean ± SD	9.8 ± 5.7	4.3 ± 2.6	<0.001
Mechanical ventilation	78 (49.4)	18 (22.5)	<0.001
Duration of mechanical ventilation (days), mean ± SD	7.2 ± 4.8	3.1 ± 2.0	<0.001
Unplanned removal of catheters/lines	34 (21.5)	5 (6.3)	0.002
Sepsis during ICU stay	78 (49.4)	18 (22.5)	<0.001
Decubitus ulcers	27 (17.1)	5 (6.3)	0.018

Among delirium subtypes, significant differences were observed in hospital and ICU length of stay. Patients with hypoactive delirium had the longest mean hospital stay (21.3 ± 9.6 days) and ICU stay (10.6 ± 5.8 days), followed by mixed delirium (17.2 ± 8.7 days and 8.6 ± 4.9 days, respectively). Patients with hyperactive delirium demonstrated the shortest hospital (16.4 ± 8.1 days) and ICU stay (7.6 ± 4.5 days) (Table 3).

Table 3. Comparison of Length of Hospitalization and ICU Admission According to Delirium Subtype Classification (n = 158)

Delirium Motor Subtype	Patients, n (%)	Length of Hospitalization (days), mean ± SD	Mean ICU Length of Stay (days), mean ± SD	p-value
Hypoactive delirium	79 (50.0)	21.3 ± 9.6	10.6 ± 5.8	<0.001
Hyperactive delirium	45 (28.5)	17.2 ± 8.7	8.6 ± 4.9	
Mixed delirium	34 (21.5)	16.4 ± 8.1	7.6 ± 4.5	

DISCUSSION

This study aimed to estimate the prevalence of delirium, its psychomotor subtypes, risk factors, and outcomes in medical intensive care unit patients. We found that the incidence of delirium was 66.4% in our participants, significantly higher than the pooled incidence of 28.8% and prevalence of 35.7% reported by Leong et al. in critically ill adults.[4] Our finding also contrasts with incidences of 31.4% reported by Soohinda et al.[5], 31.5% by Alzoubi et al.[6], 37.8% by Dalli et al.[7], and 42.17% by Asmare et al.[12] On the other hand, two studies more closely support our results. He et al. reported delirium in 57.6% of ICU patients[13], and Hughes et al. observed delirium in 71% of patients who developed respiratory failure or shock.[14] The high frequency of delirium in the cohort is compatible with its older age, more severe illness, and more frequent sepsis, ventilation, vasopressor use, and twice-daily CAM-ICU screening.

The most frequent subtype in the present study was hypoactive delirium, which is consistent with the pooled estimate of 50.3% reported by la Cour et al.[9] Its significance is not just limited to frequency. Lethargy, diminished activity, delayed responses, and withdrawal may be confused as signs of fatigue or sedation, which may delay diagnosis. Jäckel et al. reported that a structured screening identified delirium in 46.4% of patients in the ICU. In comparison, clinical diagnosis identified it in 21.7% of patients, with hypoactive delirium being underdiagnosed.[15] There are also important clinical complications associated with hypoactive delirium. Hughes et al. found that each ICU day of hypoactive delirium was associated with more than three times the risk of inpatient death on the next day, independently of other factors, while hyperactive delirium was not significantly associated with inpatient mortality.[14] For hypoactive delirium, Tiwari et al. reported the longest length of stay in the intensive care unit and in the hospital, as well as the highest death rates for each delirium subtype (34.4%). Delirium was also associated with aspiration, pressure ulcers, reintubation, and accidental removal of the catheter in their delirium cohort.[16]

The present study revealed age, smoking, diabetes, chronic kidney disease, cardiovascular disease, previous stroke, and cognitive impairment as factors associated with delirium. These patterns have been confirmed by two studies: He et al. identified age and neurological disease as independent predictors[13], and Lobo-Valbuena et al. reported that delirium tended to cluster in the older, frailer patient with multiple organ failure.[17] However, Soohinda et al. contradicts our age finding as age was not significant in their cohort.[5]

Delirium was significantly linked to increased in-hospital mortality, longer hospital stays, longer ICU stay, and greater mechanical ventilation requirements in our cohort. Results from the present study suggest that ICU delirium is not solely a symptom of acute cognitive dysfunction, but also an important marker of adverse clinical outcomes. Alzoubi et al. showed a strong association between delirium incidence and prolonged ICU and hospital stay and mortality rates.[6] Li et al., however, reported a strong relationship between delirium and length of hospital stay but no independent relationship to short-term mortality after controlling for illness severity, indicating that mortality associations might differ among patient subgroups and by baseline illness severity.[18] This is confirmed by Hughes et al., who found that mortality on the same day as delirium was independently associated with subsequent hospital death.[14]

One of the most important findings in our study was the strong relationship between hypoactive delirium and longer hospital stay. Patients with hypoactive delirium also exhibited a longer clinical course, with longer hospital and ICU length of stay when compared with hyperactive and mixed delirium patients. This is clinically relevant because hypoactive delirium is frequently underdiagnosed due to minimal agitation and behavioral disturbance. Hughes et al demonstrated higher rates of mortality in patients with hypoactive motor delirium than in other motor classifications.[14] Smit et al. found that patients with mixed delirium showed the best association with mortality and poor clinical outcome.[19] These findings demonstrate the need for routine delirium screening in medical ICU patients, especially those with advanced age, sepsis, severe illness, mechanical ventilation, and multiple comorbidities. Delirium-related complications, longer stays in ICU, and mortality may be prevented or minimized with early identification and targeted prevention strategies such as sedation optimization, early mobilization, and pressure injury prevention.

This study has several limitations. First, although prospective daily CAM-ICU assessment improved delirium detection, the single-center medical ICU design may limit generalizability to other ICU populations. Second, long-term outcomes such as cognitive decline, functional status, and quality of life after ICU discharge were not assessed. Finally, subtype-specific complications and mortality were evaluated primarily through observational associations; therefore, causal relationships between delirium and adverse outcomes cannot be confirmed.

CONCLUSION

In the present study, delirium was identified as a frequent and clinically relevant phenomenon in the medical ICU and was associated with lower survival. Patients with delirium had increased hospital and ICU length of stay, need for prolonged mechanical ventilation, greater rates of preventable complications, and increased mortality. Hypoactive

delirium was the most common motor subtype and was also associated with the longest length of hospital stay, suggesting that screening of this motor subtype should be done routinely. Using validated assessment tools and targeted prevention strategies to identify high-risk patients can improve patient outcomes, reduce the burden of critical care in the intensive care unit, and enhance critical care delivery.

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