Incidence, Risk Factors And Short-Term Outcomes Of ICU Delirium At MOI Teaching And Referral Hospital: A Prospective Cohort Study

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ABSTRACT

Background: Delirium, a common manifestation of acute brain dysfunction in critically ill patients (incidence ranging from 20-80%), is frequently induced by modifiable risk factors that emerge following ICU admission. Its presence correlates with extended ICU length of stay, elevated morbidity and mortality rates, unplanned device removal, and persistent cognitive deficits. Prophylactic strategies, encompassing both pharmacological agents and non-pharmacological approaches, have the potential to improve patient outcomes.
Objectives: This study aimed to determine the incidence of delirium, identify associated risk factors, and assess short-term outcomes in critically ill patients admitted to the ICU at Moi Teaching and Referral Hospital.
Methods: A prospective cohort study was undertaken in the Moi Teaching and Referral Hospital. A sample of 384 patients was recruited via systematic sampling, subsequent to obtaining informed consent from their relatives and verification of inclusion criteria. Data collection was conducted over a period of 22 months. Patients were monitored with twice-daily assessments of the level of consciousness and delirium, utilizing the RASS (Richmond's Agitation Assessment Scale) and CAM-ICU (**C**onfusion Assessment Method for the Intensive Care Unit), throughout their ICU admission. Data was analyzed using STATA version 13. Categorical variables were summarized using frequencies and percentages. Associations between variables was evaluated using two-sided Chi-square tests and logistic regression.
Results: Delirium was observed in 23.4% of the patient cohort (95% CI 19.5-27.9%), with typical onset occurring on the third day after admission. The majority of delirium cases (84.4%) were classified as mild to moderate in severity. Bivariate analysis revealed statistically significant risk factors associated with the development of delirium ($p < 0.05$). Multiorgan dysfunction ($p < 0.001$), disturbances in urea, creatinine, and electrolyte levels ($p < 0.001$), history of alcohol consumption ($p = 0.04$) and use of mechanical ventilation ($p = 0.025$) were statistically significant. On multivariate analysis, administration of sedative medications ($p < 0.001$, OR 2.67 CI 1.53-4.57), insulin therapy ($p < 0.005$ OR 2.63 CI 1.53-4.6), application of physical restraints ($p < 0.001$ OR 7.56 CI 4.13-13.85), and a history of tobacco use ($p = 0.021$ OR 2.3 CI1.23-4.60) were significant. Short-term outcomes were significantly impacted, with increased length of hospital stay (mean 9.5 days, $p < 0.001$), extended duration of mechanical ventilation ($p < 0.001$), development of ICU-acquired organ failure ($p < 0.001$), and instances of unintended device removal ($p < 0.001$).
Conclusions: Delirium in the ICU is common and multifactorial, the risk factors for delirium were sedative use, insulin therapy, use of physical restraints, and tobacco use. The short-term outcomes were longer hospital stay, longer mechanical ventilation, premature device removal and ICU acquired organ failure.

Recommendations: Intensive care units should minimize modifiable risk factors by judiciously using sedatives, limiting physical restraints, and enhancing electrolyte and glycemic management to optimize patient outcomes.

Keywords: Delirium; Intensive Care Unit; Risk Factors; Mechanical Ventilation; Critical Care; Kenya

I. INTRODUCTION

Delirium, a common manifestation of acute brain dysfunction in critically ill patients, (1, 2, and 3) is associated with elevated morbidity rates, prolonged hospitalization, and increased healthcare costs.(4) Inadequate diagnosis of delirium remains a significant challenge, particularly in settings with limited resources, despite its clinical relevance. (4)

ICU delirium is a multifaceted condition arising from the interaction of predisposing patient vulnerabilities and acute precipitating factors within the intensive care environment. Patient-specific vulnerabilities may encompass pre-existing cognitive deficits, advanced age, or underlying medical comorbidities. (6, 7) Acute factors contributing to delirium onset in the ICU frequently include the primary critical illness, pharmacological interventions, and environmental stressors characteristic of the ICU, such as noise levels, sleep disruption, and unfamiliar surroundings.

This study was conducted to ascertain the incidence, risk factors, and short-term outcomes of delirium among patients in the intensive care unit at Moi Teaching and Referral Hospital. The investigation addresses a gap in knowledge regarding the burden and determinants of delirium in this sub-Saharan African context, where such data are scarce.

II. METHODS

Study Design and Setting

We conducted a prospective cohort study in the 18-bed adult intensive care unit (ICU) at Moi Teaching and Referral Hospital (MTRH), a tertiary referral center in Eldoret, Kenya. The ICU admits approximately 76 patients per month and provides multidisciplinary care for medical, surgical, and trauma patients. We included adult patients (≥18 years) admitted to the ICU who remained in the unit for at least 24 hours. Patients were excluded if they died within 24 hours of admission, had a documented history of delirium or dementia, were transferred from another ICU, or remained persistently comatose (Richmond Agitation-Sedation Scale [RASS] score < −2) throughout observation.

Sample Size and Sampling

The sample size was calculated using Fisher's formula, assuming a delirium incidence of 51% based on prior regional data, a 95% confidence level, and a precision of 5%, yielding a required sample of 384 patients. Systematic sampling was employed. Based on an estimated annual ICU admission of 712 patients, a sampling interval of 2 was calculated. After a random starting point, every second eligible patient was enrolled until the target sample size was achieved.

Data Collection Procedures

After obtaining informed consent from patients' legal representatives, baseline data were collected 24 hours after ICU admission. Patients were subsequently followed throughout their ICU stay until discharge or death. Sedation was assessed twice daily using the Richmond Agitation-Sedation Scale (RASS). Patients with RASS scores ≥ −2 underwent delirium assessment using the Confusion Assessment Method for the ICU (CAM-ICU). Delirium assessments were conducted twice daily by trained research assistants. To accommodate patients with difficulty in letter recognition, a validated numerical adaptation of the CAM-ICU attention test was used.

Variables

The primary outcome was the incidence of delirium during ICU admission. Independent variables included:

Predisposing factors: Age, sex, comorbidities, alcohol use, smoking history, and baseline clinical characteristics

Precipitating factors: Primary diagnosis, mechanical ventilation, medications, laboratory abnormalities, and use of physical restraints. Secondary outcomes included ICU mortality, duration of mechanical ventilation, and discharge disposition.

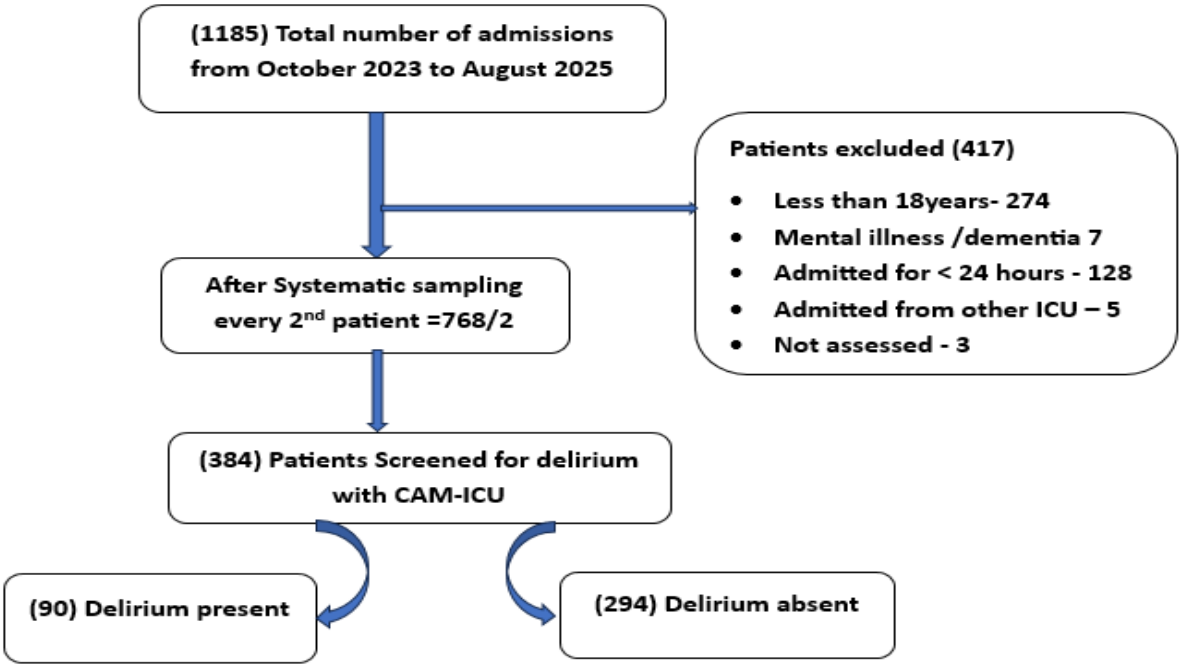
Data Analysis

Data were analyzed using STATA version 13. Categorical variables were summarized as frequencies and percentages, while continuous variables were summarized using means (standard deviations) or medians (interquartile ranges), depending on distribution. Associations between delirium and categorical variables were assessed using Chi-square or Fisher's exact tests as appropriate. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to estimate the strength of associations between risk factors and delirium. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Research and Ethics Committee (IREC), Moi University/MTRH, and the National Commission for Science, Technology and Innovation (NACOSTI). Informed consent was obtained from patients' legal representatives. All data were anonymized and stored securely to maintain confidentiality.

III. RESULTS Figure 1.1: Schemer



Baseline Characteristics

Patient age in this study exhibited substantial heterogeneity, ranging from 18 to 94 years. The mean age of participants was 46 years (SD = 19.4). The study population was predominantly male representing 53.4% of the study population. In terms of educational attainment, 35.9% of participants had completed tertiary education. Regarding employment status, 22.4% of participants were actively employed, while 45% were unemployed at the time of data collection.

Table 1: Baseline Characteristics

Variable	Value
Age, mean (SD)	46.0 (19.4)
Male sex, n (%)	205 (53.4)
Female sex, n (%)	179 (46.6)

Baseline Characteristics of Study Participants (N = 384)

Incidence of Delirium

The incidence proportion of delirium was 23.4% (95% CI 19.5 – 27.9) of which occurred averagely on the third (3rd) day after admission ranging from 1 to 18 days and majority 84.4% were graded as having mild to moderate delirium.

Table 2: Incidence of Delirium

Variable	Value

Delirium, n (%)	90 (23.4)
Time to onset, median (IQR	3.0 (2.0–4.0)
Severity	
Mild–moderate, n (%)	76 (84.4)
Severe, n (%)	14 (15.6)

Incidence and Characteristics of Delirium

Risk Factors to Development of Delirium

Bivariable analyses identified statistically significant associations ($p < 0.05$) between delirium onset and several clinical variables. Specifically, multiorgan dysfunction, Sedative administration, insulin use, mechanical ventilation, abnormal renal function test parameters, application of physical restraints, alcohol intake and smoking history.

Table 4.4: Association between risk factors and development of delirium

	Delirium		
Variables	**No**	**Yes**	**p-value**
Intracranial lesion			0.33
No	146 (74.5%)	50 (25.5%)	
Yes	148 (78.7%)	40 (21.3%)	
Comorbidities			0.16
No	159 (79.5%)	41 (20.5%)	
Yes	135 (73.4%)	49 (26.6%)	
Multiorgan dysfunction			<0.001
Absent	247 (80.2%)	61 (19.8%)	
Present	47 (61.8%)	29 (38.2%)	
Sedative			<0.001
No	178 (84.8%)	32 (15.2%)	
Yes	116 (66.7%)	58 (33.3%)	
Steroids			0.12
No	174 (79.5%)	45 (20.5%)	
Yes	120 (72.7%)	45 (27.3%)	
Antibiotics			0.58
No	36 (73.5%)	13 (26.5%)	
Yes	258 (77.0%)	77 (23.0%)	
Antipsychotics			0.34
No	291 (76.4%)	90 (23.6%)	
Yes	3 (100.0%)	0 (0.0%)	
Antihypertensives			0.98
No	180 (76.6%)	55 (23.4%)	
Yes	114 (76.5%)	35 (23.5%)	
Insulin			0.005
No	276 (78.4%)	76 (21.6%)	
Yes	18 (56.3%)	14 (43.8%)	
Patient on mechanical ventilation			0.025
No	76 (85.4%)	13 (14.6%)	
Yes	218 (73.9%)	77 (26.1%)	
Urea			<0.001
Normal	221 (82.2%)	48 (17.8%)	
Abnormal	73 (63.5%)	42 (36.5%)	
Creatine			<0.001
Normal	210 (82.4%)	45 (17.6%)	
Abnormal	84 (65.1%)	45 (34.9%)	
Sodium			<0.001

Normal	206 (83.7%)	40 (16.3%)	
Abnormal	88 (63.8%)	50 (36.2%)	
Potassium			0.007
Normal	196 (81.0%)	46 (19.0%)	
Abnormal	98 (69.0%)	44 (31.0%)	
Physical restraint			<0.001
No	263 (84.8%)	47 (15.2%)	
Yes	31 (41.9%)	43 (58.1%)	
Alcohol intake			0.004
No	211 (80.8%)	50 (19.2%)	
Yes	83 (67.5%)	40 (32.5%)	
Tobacco intake			0.021
No	250 (78.9%)	67 (21.1%)	
Yes	44 (65.7%)	23 (34.3%)	

Risk factors associated with development of delirium

A multivariable logistic regression was done to determine risk factors that were independently associated with development of delirium. Only five variables (Physical restraints, sedative, insulin, tobacco intake, and abnormal sodium levels) were found to be independently associated with development of delirium.

Table 3: Multivariable Analysis

Variable	aOR	95% CI	p-value
Physical restraint	7.56	4.13 – 13.85	<0.001
Sedative use	2.67	1.53 – 4.66	0.001
Insulin therapy	2.62	1.06 – 6.44	0.036
Tobacco use	2.38	1.23 – 4.60	0.010
Abnormal sodium	3.06	1.76 – 5.34	<0.001

Independent Risk Factors for Delirium

Table 4: Short-Term Outcomes

	Delirium		p-value
Variables	**No**	**Yes**	
Length of ICU stay			<0.001
Median (IQR)	4.0 (3.0-7.0)	9.5 (4.0-20.0)	
Range	2 – 38	0 – 36	
Duration of mechanical ventilation			<0.001
Median (IQR)	2.0 (1.0-6.0)	6.5 (2.0-17.0)	
Range	0 – 30	0 – 27	
ICU Acquired organ failure			<0.001
No	276 (93.9%)	51 (56.7%)	
Yes	18 (6.1%)	39 (43.3%)	
Device removal			<0.001
No	285 (96.9%)	50 (55.6%)	
Yes	9 (3.1%)	40 (44.4%)	
Discharge destination			0.18
General ward	208 (70.7%)	59 (65.6%)	

CCU	26 (8.8%)	5 (5.6%)
Death	60 (20.4%)	26 (28.9%)

Association between development of delirium and short-term outcomes

IV. DISCUSSION

Incidence of Delirium

The incidence of delirium in this study (23.4%) is consistent with previously reported rates ranging between 13% and 78%, and closely aligns with pooled estimates of approximately 22% from meta-analyses.(1,2,3) This suggests that the burden of delirium in this ICU population is comparable to global data despite differences in setting and resources. Higher rates reported in other studies are often associated with older populations, inclusion of cognitively impaired patients, or more severely ill cohorts such as those with sepsis or respiratory failure. (4) The finding that delirium developed early, with a median onset of 3 days, is consistent with prior studies and highlights the importance of early and routine delirium screening in ICU patients. (12)

Sedative use was significantly associated with delirium, in keeping with existing literature, particularly regarding benzodiazepines. (6) Sedatives may disrupt sleep architecture, alter neurotransmitter balance, and contribute to cognitive dysfunction. The lack of standardized sedation protocols in this setting may have amplified this effect.

Insulin therapy was also associated with delirium, likely reflecting the effects of glycemic variability and hypoglycemia on cerebral metabolism. Corroborating this observation, other studies established that hypoglycemic episodes were independently associated with an elevated risk of mortality in several major interventional clinical trials. (7) This finding underscores the importance of careful glycemic control in critically ill patients.

Physical restraint was the strongest independent predictor of delirium. This was in concurrence with a systematic review which found physical restrain to be associated with delirium. (8) While restraints are commonly used to prevent device removal, their use may exacerbate agitation, impair orientation, and contribute to delirium. However, reverse causality is possible, as restraints may also be applied in response to early delirium symptoms.

Tobacco use was independently associated with delirium. This risk may be particularly relevant when individuals with a history of habitual cigarette use prior to hospitalization experience enforced nicotine abstinence during their hospital stay. (9) It is important to note that the literature concerning the potential association between nicotine intake and delirium remains inconclusive and lacks broad consensus.

Other factors such as multiorgan dysfunction, mechanical ventilation, and abnormal renal parameters were significant in unadjusted analyses but did not retain significance after adjustment, suggesting confounding by severity of illness.

Short-Term Outcomes

Delirium was associated with significantly worse short-term outcomes. Patients with delirium had longer ICU stays and required prolonged mechanical ventilation, consistent with findings from prior studies. (11, 12). Delirium prolongs ICU stays via cognitive issues,

less care engagement, and more complications. Longer ventilation can result from poor weaning cooperation and more sedation needs. Delirium was also strongly associated with ICU-acquired organ failure and unplanned device removal. (10) These findings highlight the clinical and safety implications of delirium, particularly in resource-limited settings.

Although mortality was higher among patients with delirium, this difference was not statistically significant. This may reflect limited power to detect mortality differences or the influence of other confounding factors. Larger studies are needed to better characterize this relationship.

V. CONCLUSION

Delirium is a common complication among ICU patients at MTRH, affecting nearly one in four patients and contributing to adverse clinical outcomes. Several modifiable risk factors were identified, including sedation practices, electrolyte imbalance, and use of physical restraints. Implementation of structured delirium prevention and monitoring strategies may improve patient outcomes in this setting.

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