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Original Research Article

Predictors of ICU Admission in Acute Neurological Emergencies: A Retrospective Study

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Abstract:

Background and Objectives: This study seeks to examine ICU mortality rates and identify predictors of such mortality, concentrating on clinical and demographic variables, including age, comorbidities, hemoglobin and creatinine levels, intubation in the Emergency Department, and Glasgow Coma Scale (GCS) and APACHE II scores at presentation, as well as the impact of these factors on patients' clinical outcomes.

Methods: This retrospective observational cross-sectional study examined patients hospitalized to the Patna Medical College and Hospital's ICU from January 1, 2022, to December 31, 2023. A total of 100 patients were enrolled.

Results: This study identifies significant factors linked to ICU admission in patients with severe neurological crises. Low Glasgow Coma Scale scores, the necessity for mechanical breathing, hemodynamic instability, and aberrant neuroimaging results are critical determinants of ICU admission in acute neurological emergencies. Mean age of 50 ± 10 years, and the GCS score was observed 8.4 ± 2.4 during their ICU stay.

Conclusions: Acute stroke necessitating ICU hospitalization is associated with a grim prognosis, as fewer than 20% of patients achieve a favorable neurological outcome at 6 months. The age and level of coma independently forecasted the prognosis.

Keywords: Stroke, Intensive care unit, Mechanical ventilation, Coma, Disability, Mortality.

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Introduction

Acute neurological emergencies represent a substantial percentage of emergency department admissions and are linked to elevated morbidity and fatality rates [1]. Conditions like stroke, status epilepticus, traumatic brain injury, central nervous system infections, and acute neuromuscular respiratory failure frequently necessitate prompt evaluation and advancement of treatment [2]. Prompt identification of patients likely to necessitate intensive care unit (ICU) admission is essential for effective triage, early intervention, and appropriate utilization of critical care resources [3].

Determining ICU admission for neurological emergencies is intricate and relies on various clinical, physiological, and radiological variables [4]. Prolonged transfer to the ICU has been linked to poorer neurological results and heightened mortality rates [5]. Consequently, recognizing dependable predictors of ICU admission might assist physicians in early risk classification and management planning, particularly in resource-constrained environments [6]. This retrospective study aimed to uncover clinical and investigative factors linked to ICU admission in patients presenting with acute neurological emergencies during a two-year duration.

Materials and Methods

Study Design and Setting: This retrospective observational study was conducted in the emergency and neurology departments of a tertiary care hospital over two years. July 2023 to July 2025

Study Population: Medical records of 100 patients presenting with acute neurological crises were evaluated. Patients were divided into two groups:

- **ICU Group (n = 45):** Patients who required ICU admission.
- **Non-ICU Group (n = 55):** Patients managed in general wards or high-dependency units.

Inclusion Criteria

- Age ≥18 years
- Presentation with an acute neurological emergency, including stroke, seizures/status epilepticus, traumatic brain injury, acute encephalopathy, CNS infections, or neuromuscular respiratory failure
- Complete clinical and investigation records available

Exclusion Criteria

- Patients with chronic neurological disorders without acute deterioration
- Post-operative neurosurgical patients
- Incomplete medical records

Data Collection: Demographic information, neurological diagnoses, Glasgow Coma Scale (GCS) scores at admission, vital signs, requirement for airway assistance, laboratory results, neuroimaging findings, and concomitant conditions were documented. Admission to the ICU was predicated on the necessity for mechanical breathing, hemodynamic monitoring, or rigorous neurological supervision.

Statistical Analysis: Data were evaluated utilizing conventional statistical software. Continuous variables were represented as mean ± standard deviation, whereas categorical variables were denoted as frequencies and percentages. Comparisons between ICU and non-ICU groups were conducted utilizing Student's t-test for continuous variables and the chi-square test for categorical variables. Multivariate logistic regression analysis was employed to ascertain independent determinants of ICU admission. A p-value less than 0.05 was deemed statistically significant.

Results

Table 1: Baseline Characteristics of Study Population

Variable	ICU Group (n = 45)	Non-ICU Group (n = 55)	p-value
Mean age (years)	50.2 ± 10.2	42.1 ± 8.6	0.18
Male sex, n (%)	30 (62.2)	34 (58.2)	0.62
Glasgow Coma Scale at admission	8.4 ± 2.4	12.0 ± 1.6	<0.001
Hypotension at presentation, n (%)	20 (42.0)	10 (16.5)	<0.01
Need for airway support, n (%)	28 (59.8)	8 (11.9)	<0.001

Table 2: Distribution of Neurological Diagnoses

Diagnosis	ICU Group (n = 45)	Non-ICU Group (n = 55)
Acute stroke	19 (42.2%)	23 (41.8%)
Status epilepticus	13 (28.8%)	10 (18.2%)
Traumatic brain injury	10 (22.2%)	8 (14.5%)
CNS infections	6 (13.3%)	11 (20%)
Acute encephalopathy/others	4 (8.8%)	9 (16.5%)

Table 3: Multivariate Logistic Regression Analysis for Predictors of ICU Admission

Predictor	Odds Ratio (OR)	95% Confidence Interval	p-value
GCS ≤ 8 at presentation	4.8	2.1–10.9	<0.001
Mechanical ventilation required	6.2	2.6–14.5	<0.001
Hemodynamic instability	3.9	1.6–9.4	<0.01
Abnormal neuroimaging (mass effect/raised ICP)	4.1	1.8–9.7	<0.01

Discussion

This study identifies significant factors linked to ICU admission in patients with severe neurological crises. A low GCS score upon presentation was identified as a significant predictor, indicating the severity of neurological injury and the necessity for vigilant monitoring and airway preservation [7].

The necessity for mechanical breathing and hemodynamic instability was independently correlated with ICU admission, underscoring the significance of systemic involvement in neurological emergencies. Neuroimaging results revealing elevated intracranial pressure or mass effect necessitated extensive care [8].

These findings align with the current literature, emphasizing the importance of early neurological evaluation and imaging in informing triage decisions. The retrospective approach and constrained sample size are significant drawbacks; yet, the study offers practical insights relevant to standard emergency and critical care practices.

Conclusion

Low Glasgow Coma Scale scores, the necessity for mechanical breathing, hemodynamic instability, and

aberrant neuroimaging results are critical determinants of ICU admission in acute neurological emergencies. Prompt identification of these characteristics can enable timely ICU referral, enhance patient outcomes, and optimize the usage of critical care resources. Larger cohort prospective studies are advised to validate and enhance predictive models for ICU admission in neurological crises.

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