

A Prospective Observational Study of Clinical Profile and Outcomes of Patients Undergoing Emergency Endotracheal Intubation in the Emergency Department

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Abstract

Objective: Emergency endotracheal intubation (ETI), a critical life-saving intervention in the emergency department (ED) is associated with significant complications and mortality. We aimed to evaluate clinical profile, procedural characteristics, complications, and outcomes of patients undergoing emergency endotracheal intubation in a tertiary care emergency department. **Methods:** This prospective observational study was conducted on 200 patients requiring ETI in the Department of Emergency Medicine. Demographic details, clinical presentation, indications for intubation, number of intubation attempts, immediate and late complications and final outcomes were recorded. Patients were followed until discharge or death. **Results:** The mean age was between 21–60 years, with a male predominance (69.5%). Medical causes accounted for 78.5% of intubations, while trauma constituted 21.5%. The most common indication for intubation was altered sensorium (68%). A GCS ≤ 5 was observed in 59% of cases at presentation. First-pass intubation success was achieved in 95% of cases. The most frequent immediate complication was hypoxia. Patients with severe neurological impairment and prolonged ICU stay had higher mortality. **Conclusion:** Emergency physician performing endotracheal intubation is associated with high first-pass success. Pre-intubation neurological status and number of intubation attempts are key predictors of patient outcomes. Structured airway assessment and adherence to standardized intubation protocols can reduce complications and improve survival.

Keywords: Emergency Endotracheal intubation, Airway management, Glasgow Coma Scale, Mortality, Emergency Department.

Introduction

Emergency airway management is a cornerstone of resuscitative care, and endotracheal intubation (ETI) remains the definitive method for securing the airway in critically ill patients presenting to the emergency department (ED). Timely airway control is essential to ensure adequate oxygenation, ventilation, and protection against aspiration, particularly in patients with respiratory failure, altered sensorium, trauma, or cardiac arrest ^[1,2].

Unlike elective intubations performed in the operating room, emergency endotracheal intubation is often undertaken in uncontrolled environments with limited time for preparation, incomplete clinical information, and physiologically unstable

patients. These factors significantly increase the risk of complications such as hypoxemia, hypotension, aspiration, esophageal intubation, and cardiac arrest ^[3-5]. Previous studies have reported complication rates ranging from 10% to 30%, with a higher incidence associated with multiple intubation attempts and difficult airway anatomy ^[6].

Rapid Sequence Intubation (RSI) has emerged as the preferred technique for emergency airway management, as it improves first-pass success rates and reduces procedure-related complications when performed by trained emergency physicians ^[7,8]. Despite this, variability exists in airway assessment, device selection, pharmacological agents used, and post-intubation care

across emergency departments, particularly in resource-limited settings [9].

Data from Indian emergency departments regarding the clinical profile, procedural characteristics, and outcomes of patients undergoing emergency endotracheal intubation remain limited. Understanding local epidemiology, indications, success rates, complications, and outcomes is essential to improve airway management protocols and patient safety. Therefore, this prospective observational study was conducted to evaluate the clinical profile, intubation practices, complications, and outcomes of patients requiring emergency endotracheal intubation in a tertiary care emergency department.

Methods

1. **Study Area:** Emergency Medicine Department, Civil Hospital, Asarwa, Ahmedabad, Gujarat- 380016
2. **Study Population:** All patients presenting to the emergency department who required emergency endotracheal intubation as a part of their acute management were considered for inclusion in the study.
3. **Sample Size:** A total of 200 patients were enrolled in the study. The sample size was determined based on previous studies evaluating emergency endotracheal intubation outcomes and complication rates, assuming a confidence level of 95% and adequate power to detect clinically significant associations.
4. **Study Design:** This was a prospective observational study.
5. **Study Variables:** Data were collected prospectively using a structured case record form. The following variables were recorded:
 - Demographic details (age, sex)
 - Clinical presentation and indication for intubation
 - Pre-intubation physiological parameters including Glasgow Coma Scale (GCS) and oxygen saturation (SpO₂)
 - Airway assessment parameters using the LEMON approach and Modified Cormack-Lehane grading
 - Method of intubation (rapid sequence intubation or crash intubation)
 - Device used for intubation
 - Number of intubation attempts
 - Immediate complications such as hypoxia, aspiration, arrhythmias, or airway trauma
6. **Study Period:** The study was carried out over a period of 18 months, from September 2023 to April 2025.
7. **Subject Selection:**

Inclusion Criteria

- Patients aged ≥ 12 years
- Patients requiring emergency endotracheal intubation for indications such as respiratory failure, altered sensorium, cardiac arrest, trauma, or airway protection
- Intubation performed in the emergency department by the emergency medicine team
- Informed consent obtained from the patient's legally authorized representative, where applicable

Exclusion Criteria

- Elective or planned intubations
- Patients intubated outside the emergency department or referred from other centers with an endotracheal tube in situ

- Patients with incomplete clinical data or lost to follow-up
- Refusal of consent by patient or legal guardian

Period of follow up: All patients were managed according to standard emergency and intensive care protocols. Patients were followed up throughout their hospital stay, and outcomes including duration of ICU stay, need for tracheostomy, and in-hospital mortality were documented.

Outcome Measures

- Primary Outcome: Final clinical outcome (discharge, tracheostomy, or death)
- Secondary Outcomes:
 - Number of intubation attempts
 - Immediate and late complications
 - Duration of ICU stay

Statistical Analysis Plan: Data were entered into Microsoft Excel and analyzed using SPSS software. Descriptive statistics were used to epitomize demographic and clinical variables. Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as mean \pm standard deviation. Associations between clinical variables and outcomes were analyzed using the Chi-square test or Fisher's exact test as appropriate. A p-value < 0.05 was considered statistically significant.

Algorithm of research project

Patients requiring emergency endotracheal intubation presenting to the Emergency Department were enrolled in the study after obtaining written informed consent from the patient or the closest available attendant.

A detailed clinical history was obtained with reference to presenting complaints, indication for intubation, comorbid conditions, and relevant past medical history, followed by thorough general and systemic examination.

Pre-intubation clinical parameters including Glasgow Coma Scale (GCS), oxygen saturation (SpO₂), and vital signs were recorded at the time of presentation to the emergency department.

Airway assessment was performed using standard clinical tools such as the LEMON approach and Modified Cormack-Lehane grading, and the method of intubation (rapid sequence intubation or crash intubation) was decided based on clinical status.

Emergency endotracheal intubation was performed by the emergency medicine team as per standard institutional protocols, and procedural details including device used and number of attempts were documented.

Patients were subsequently managed according to standard emergency and intensive care protocols and were followed up until discharge from hospital, death, or completion of hospital stay.

Final outcomes including complications, duration of ICU stay, need for tracheostomy, and in-hospital mortality were recorded and analysed.

Results

A total of 200 patients who underwent emergency endotracheal intubation in the Emergency Department were included in the study.

Table 1 shows that majority of cases were between 21 and 60 years of age, with each decade group (21–30, 31–40, and 41–50 years) accounting for 18.5% of cases. Patients aged more than 70 years constituted 10%, while those below 20 years accounted for 4.5%. Table 2 illustrates clear male predominance, with 139 (69.5%) males and 61 (30.5%) females, resulting in a male-to-female ratio of 2.3:1.

Medical causes were responsible for most intubations, accounting for 157 patients (78.5%), while trauma-related cases constituted 43 patients (21.5%) (**Table 3**).

Table 4 shows that altered sensorium was the most common indication for emergency endotracheal intubation, observed in 136 patients (68%). Breathlessness at rest was noted in 48 patients (24%). Other presentations included gasping respiration with cardiac arrest (4%), chest pain with breathlessness (3.5%), and chest pain with palpitations (0.5%).

Figure 1 illustrates cerebrovascular accident was the most frequent provisional diagnosis (16.5%), followed by head injury (13.5%), metabolic encephalopathy (11.5%), and respiratory failure (9%). Other diagnoses included meningitis, polytrauma, aspiration pneumonitis, myocardial infarction with cardiogenic shock, diabetic ketoacidosis, and neuromuscular disorders.

Figure 2 shows that most patients had significant neurological impairment at presentation. The most common Glasgow Coma Scale (GCS) score was 5 (28%), followed by GCS 7 (23.5%) and GCS 4 (17.5%). A large proportion of patients had a GCS \leq 5, indicating the need for urgent airway protection.

Figure 3 shows that pre-intubation oxygen saturation (SpO₂) ranged between 81–90% in 76.5% of cases. Severe hypoxemia (SpO₂ <70%) was present in 10% of cases, while only 4.5% had SpO₂ values above 90% prior to intubation.

Figure 4 shows that first-pass success was achieved in 190 patients (95%). Two attempts were required in 9 patients (4.5%), and only one patient (0.5%) required three attempts, demonstrating a high first-pass success rate.

Table 7 shows that immediate complications following intubation were infrequent, with hypoxia being the most common complication (**Figure 5**). Late complications included ventilator-associated pneumonia, septic shock, and acute respiratory distress syndrome (**Table 5**). The incidence of complications increased with multiple intubation attempts (**Table 7**). There is a highly significant association between the number of intubation attempts and the occurrence of immediate complications ($p < 0.001$). This strongly suggests that multiple intubation attempts are linked to increased risk of complications, reinforcing the importance of achieving first-pass success during airway management.

Patients were followed until discharge or death (**Table 6**). There is a high statistically significant association between pre-intubation GCS score and patient outcome ($p < 0.001$). Favourable outcomes were more common in patients with higher pre-intubation GCS scores (**Table 8**). Adverse outcomes, including prolonged ICU stay, need for tracheostomy, and mortality, were more frequent among patients with severe neurological impairment and those requiring multiple intubation attempts (**Table 9, Figure 6, 7**). Table 9 illustrates association between initial clinical presentation and patient outcome is statistically significant ($p = 0.0057$).

Table 1: Age Distribution

Age group (years)	No. of Patients	Percentage
<20	9	4.5
21-30	37	18.5
31-40	37	18.5
41-50	37	18.5
51-60	35	17.5
61-70	25	12.5
>70	20	10

Table 2: Gender Distribution

Gender	No. of Patients	Percentage
Male	139	69.5
Female	61	30.5

Table 3: Category of Cases [N=200]

Category	No. of Patients	Percentage
Medical	157	78.5
Trauma	43	21.5

Table 4: Clinical Presentation at the Time of Intubation [N=200]

Clinical presentation	No. of Patients	Percentage
Altered sensorium under investigation	136	68
Breathlessness at rest	48	24
Chest pain with breathlessness at rest	7	3.5
Gasping breathing with cardiac arrest	8	4
Chest pain+palpitation	1	0.5

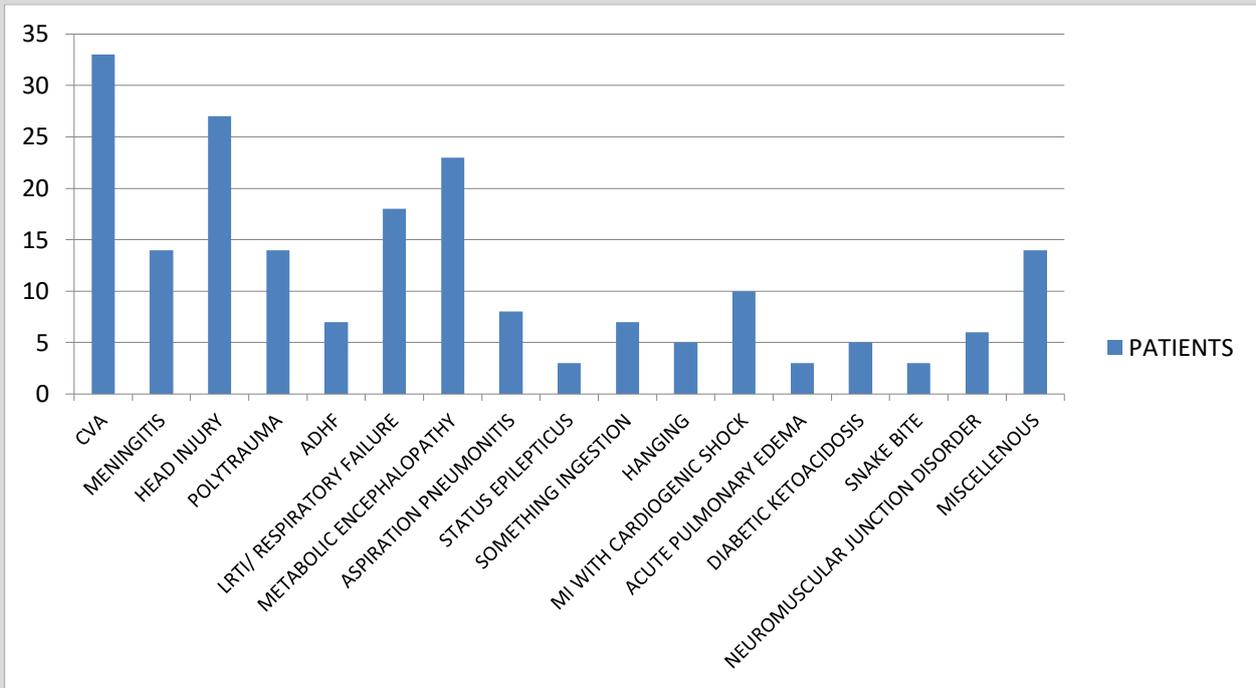


Figure 1: Provisional Diagnosis at the Time of Intubation

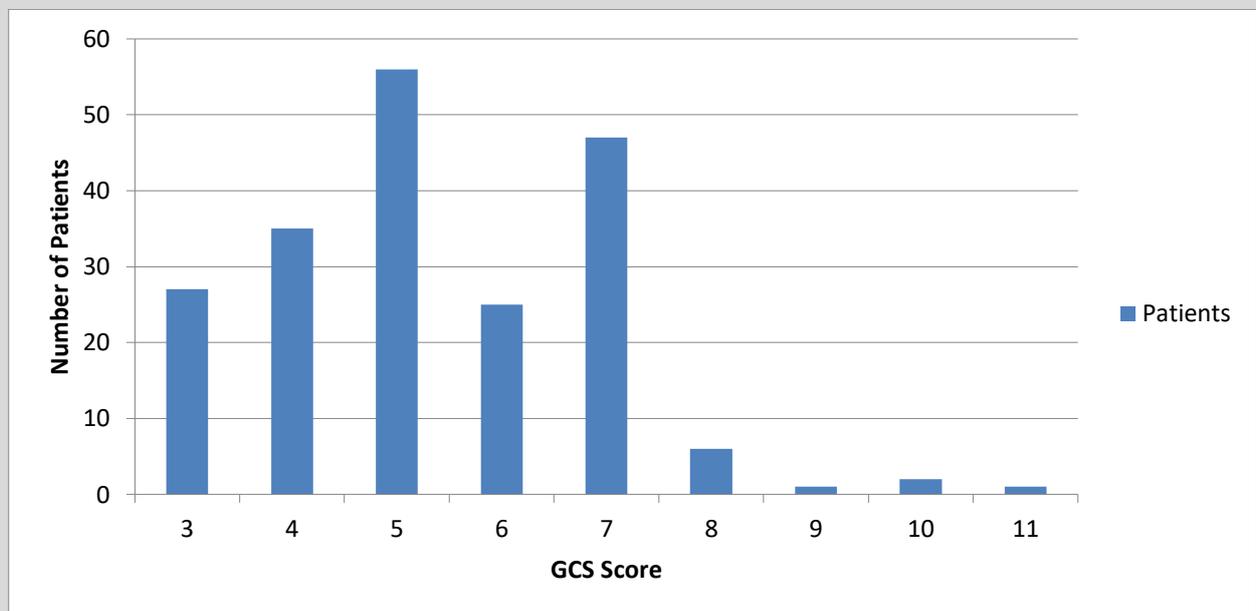


Figure 2: Glasgow Coma Scale (GCS) at Presentation

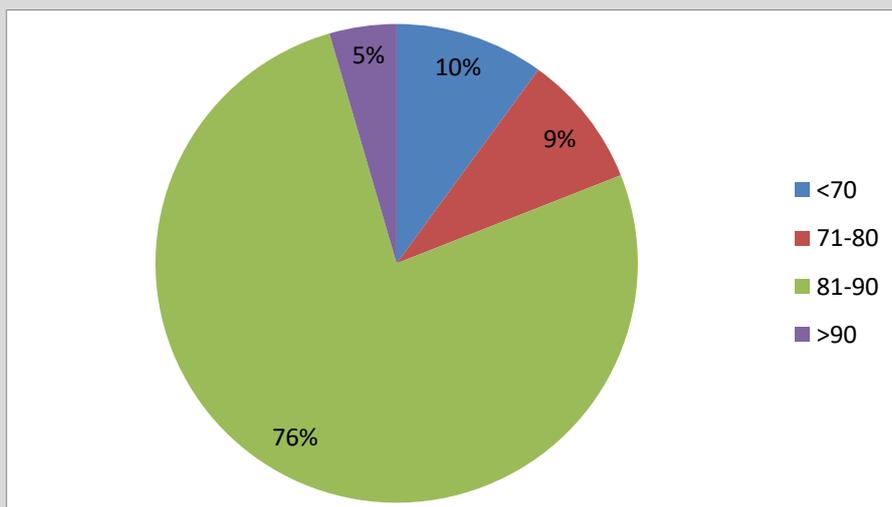


Figure 3: Distribution of Pre-Intubation SpO₂ (%) Among Patients

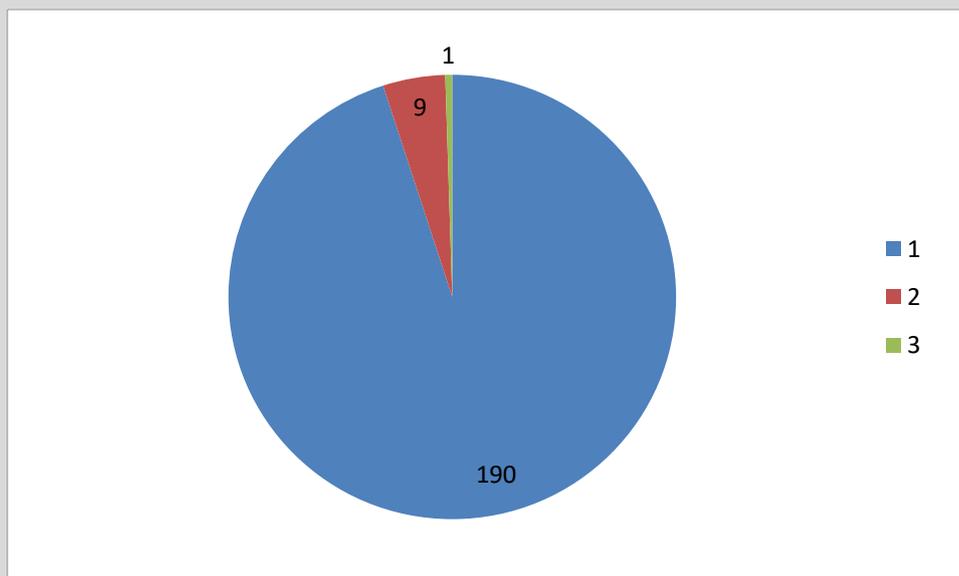


Figure 4: Distribution of Number of Attempts Required for Successful Endotracheal Intubation

Table 5: Distribution of Late Complications Following Emergency Endotracheal Intubation (n = 200)

Late complications	No. of Patients	Percentage
None	112	56
Cardiac arrest	14	7
Ventilated associated pneumonia	32	16
Septic shock	24	12
Ards	8	4
Pneumothorax	5	2.5
Arrhythmia	5	2.5

Table 6: Final Outcome Distribution in Intubated Patients (n = 200)

Outcome	No. of Patients	Percentage
Discharged on room air	107	53.5
Death	55	27.5
Discharged with t stomy in situ	32	16
Dischared with t stomy in situ+craniotomy	6	3

Table 7: Distribution of Immediate Complications According to Number of Intubation Attempts (n = 200)

Complications	Number of attempts		
	1	2	3
No complication	172	0	0
Tachyarrhythmia	10	1	1
Bradyarrhythmia	2	0	0
Dental trauma	1	9	1
Hypoxia	2	3	1
Aspiration	5	2	1

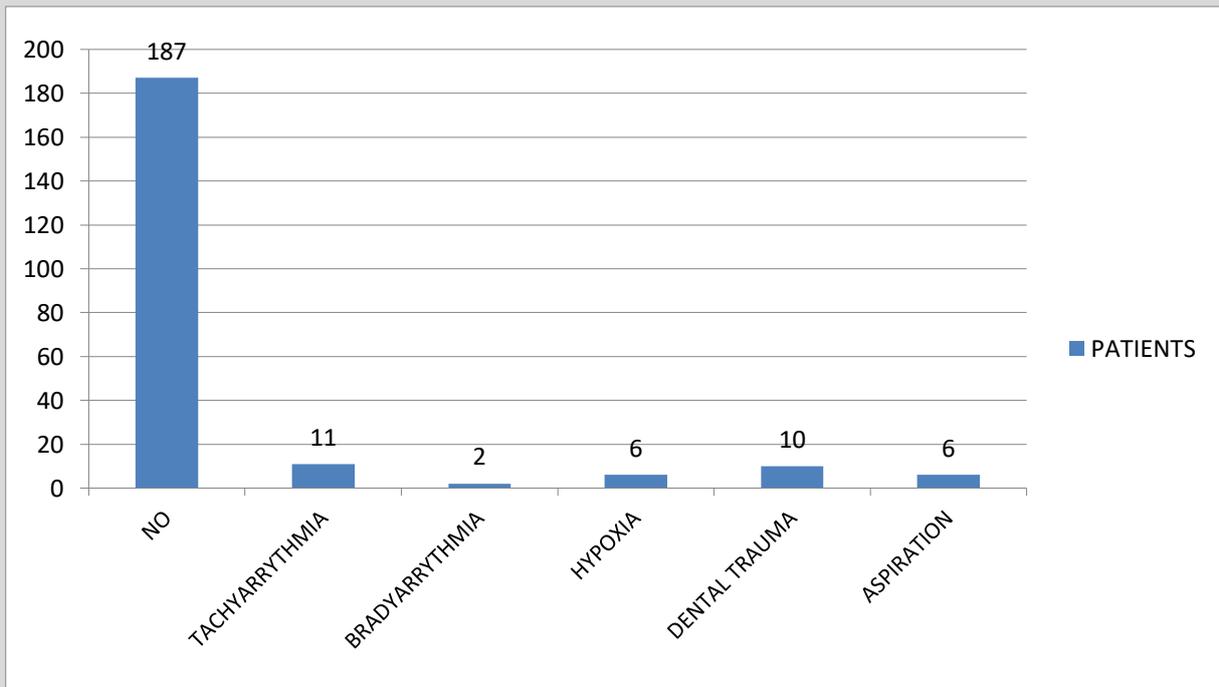


Figure 5: Immediate Complications Following Endotracheal Intubation

Table 8: Outcome Distribution According to Pre-Intubation GCS Score (n = 200)

Outcome	3	4	5	6	7	8	9	10	11
Dc	18	20	12	3	2	0	0	0	0
Discharged with Tracheostomy in situ+craniotomy	1	0	1	0	4	0	0	0	0
Discharged	0	9	37	18	36	4	1	1	1
Discharged with tracheostomy in situ	8	6	6	4	5	2	0	1	0

Table 9: Distribution of Outcomes Based on Clinical Presentation at Time of Intubation (n = 200)

Clinical presentation	Discharged	Discharged with tracheostomy in situ	Discharged with tracheostomy in situ + craniotomy	Death
Altered sensorium under investigation	72	27	6	31
Breathlessness at rest	30	5	0	13
Chest pain with breathlessness at rest	4	0	0	2
Chest pain with cardiac arrest with breathlessness	0	0	0	2
Chest pain+palpitation	1	0	0	0
Gaspig breathing with cardiac arrest	0	0	0	7

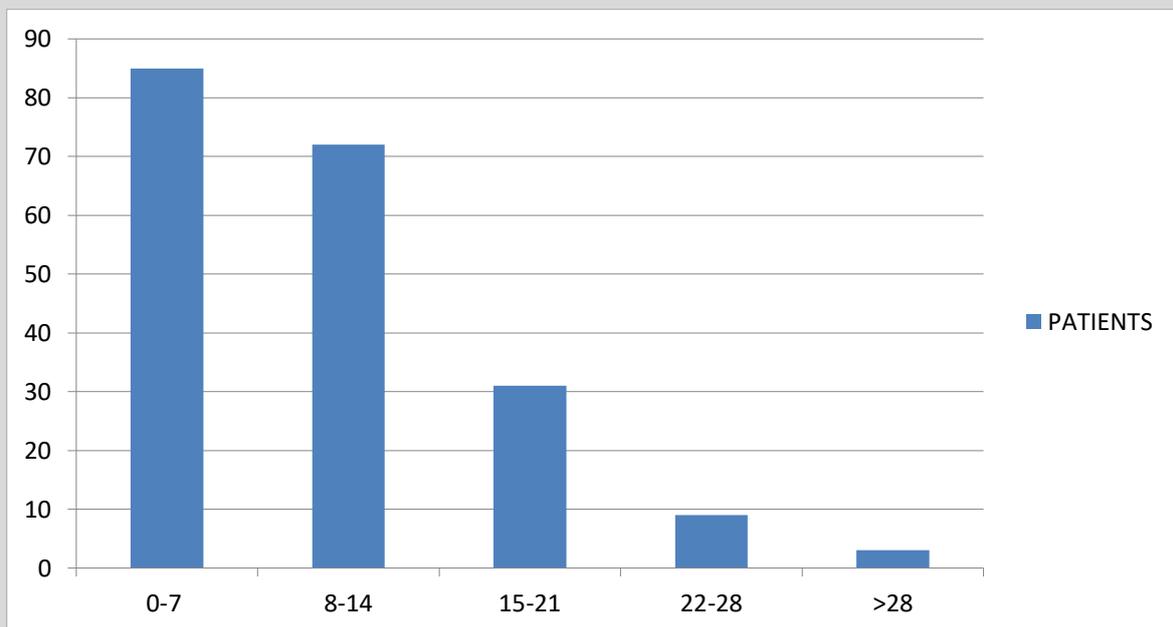


Figure 6: Distribution of ICU Stay Duration Among Intubated Patients

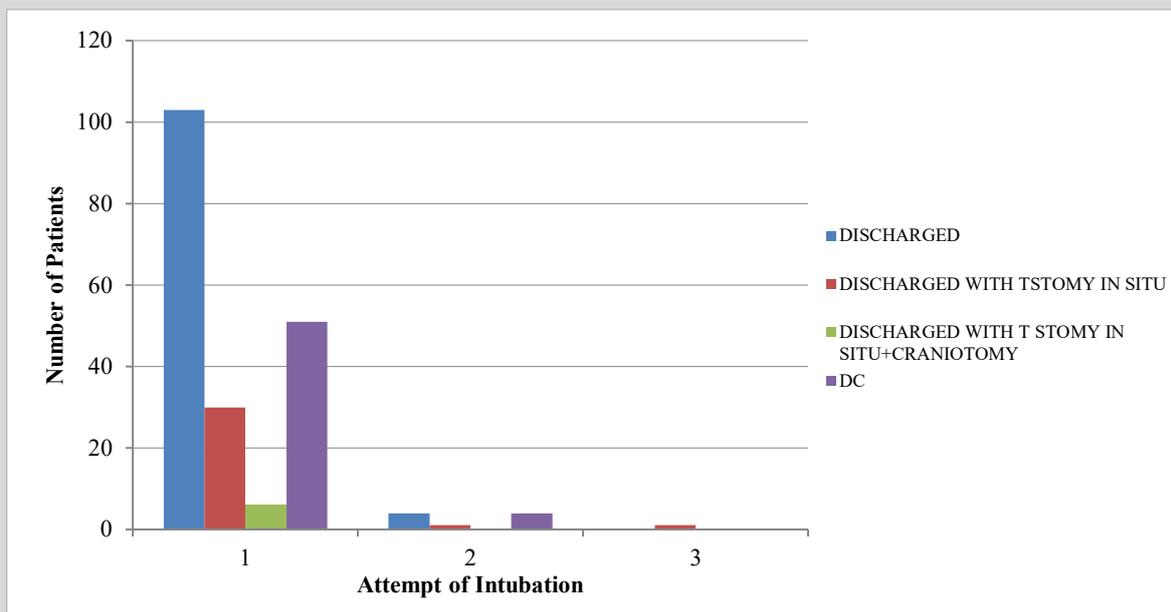


Figure 7: Outcome Distribution by Intubation Attempts

Discussion

Emergency endotracheal intubation is a critical intervention in the management of acutely ill patients presenting to the emergency department (ED). Unlike elective intubations, emergency airway management is frequently performed under suboptimal conditions, often in physiologically unstable patients with limited time for preparation. The present prospective observational study evaluated the clinical profile, procedural characteristics, complications, and outcomes of patients undergoing emergency endotracheal intubation in a tertiary care emergency department.

In our study, the majority of patients requiring emergency endotracheal intubation were between 21 and 60 years of age, with a clear male predominance. This demographic pattern is consistent with findings reported by Sakles et al. and Goto et al., where males constituted a higher proportion of emergency intubations, possibly reflecting increased exposure to trauma and severe medical illnesses among males in this age group [10,11].

Medical causes accounted for most intubations in our study, with altered sensorium being the most common clinical indication. Similar observations have been reported in previous studies, where neurological impairment and decreased level of consciousness were leading reasons for airway protection in the ED [12,13]. Cerebrovascular accident and metabolic encephalopathy were the most frequent provisional diagnoses in our cohort, highlighting the importance of early airway protection in patients with compromised neurological status.

Glasgow Coma Scale (GCS) at presentation emerged as a key clinical parameter in our study. A substantial proportion of patients had a GCS score ≤ 5 , indicating severe neurological dysfunction. Previous studies have consistently demonstrated that lower GCS scores are associated with increased need for airway intervention and poorer clinical outcomes, including higher mortality [14,15]. Our findings reinforce the role of GCS as a simple yet reliable predictor for the need for intubation and overall prognosis.

The first-pass success rate of endotracheal intubation in our study was high (95%), which is similar to rates reported in well-organized emergency departments with trained emergency physicians [16,17]. High first-pass success is clinically significant, as multiple intubation attempts have been shown to increase the risk of

adverse events such as hypoxemia, aspiration, hypotension, and cardiac arrest [18]. The low rate of multiple attempts in our study likely contributed to the relatively low incidence of immediate complications.

Hypoxia was the most common immediate complication observed following intubation, which is consistent with previous literature identifying hypoxemia as the most frequent adverse event during emergency airway management [19]. Late complications such as ventilator-associated pneumonia and acute respiratory distress syndrome were also observed, particularly in patients requiring prolonged ICU stay. Similar complication profiles have been reported in other emergency airway studies, emphasizing the need for meticulous post-intubation care and early ICU management [20].

Clinical outcomes in the present study were closely related to pre-intubation neurological status and the number of intubation attempts. Patients with higher GCS scores and successful first-pass intubation demonstrated more favorable outcomes, while those with severe neurological impairment and multiple attempts had higher rates of adverse outcomes, including mortality. These findings align with existing evidence underscoring the importance of early airway control, structured airway assessment, and skilled execution of intubation in improving patient outcomes [21,22].

Overall, the findings of this study highlight that emergency endotracheal intubation, when performed by trained emergency physicians using standardized protocols, is associated with high success rates and acceptable complication profiles. Emphasis on airway assessment, optimization of first-pass success, and early identification of high-risk patients may further enhance patient safety and outcomes in the emergency department.

Conclusion

Emergency endotracheal intubation is a vital life-saving intervention in the emergency department and is most frequently required in patients with altered sensorium, respiratory failure, and severe neurological impairment. In the present study, emergency endotracheal intubation performed by trained emergency physicians demonstrated a high first-pass success rate with an acceptable complication profile.

Pre-intubation neurological status, as assessed by the Glasgow Coma Scale, and the number of intubation attempts were

important determinants of clinical outcome. Patients with lower GCS scores and those requiring multiple intubation attempts had poorer outcomes, including prolonged ICU stay and increased mortality.

These findings emphasize the importance of early airway assessment, optimization of first-pass success, and adherence to standardized intubation protocols in the emergency department. Strengthening airway management training and ensuring structured post-intubation care may further improve patient safety and outcomes in emergency settings.

Declarations

Ethical Clearance

The study was approved by Institutional Ethics Committee, B. J. Medical College & Civil Hospital, Ahmedabad vide no. EC/Approval/311/2024 dated 14/12/2024.

Conflict of interest

None

Funding/ financial support

None

Contributors

SVS: Conceptualisation (lead), Writing (editing and review), Writing original draft (lead), Data analysis (supporting)

JS: Methodology (lead), Writing original draft (lead), Writing (review and editing) (lead), Data analysis (supporting), Data acquisition, data analysis and software (lead)

SRP: Writing (editing and review) (supporting), Methodolgy (supporting), Writing (review) (supporting), Data acquisition, data analysis and software (supporting)

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