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Research Article

Comparison of Etomidate versus Ketamine for Rapid Sequence Intubation in Critically Ill Emergency Patients: A Retrospective Study

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ABSTRACT
Background: Rapid sequence intubation is a critical emergency procedure used to secure the airway in critically ill patients.
Objective: To compare the effectiveness and safety of etomidate versus ketamine for rapid sequence intubation in critically ill emergency patients.
Methodology: This retrospective comparative study was conducted at Allied Hospital Faisalabad from Sep 2025- Nov 2025. Medical records of 125 critically ill adult patients who underwent rapid sequence intubation were reviewed. Patients were divided into two groups: etomidate group (n=63) and ketamine group (n=62).
Results: First-pass intubation success was slightly higher in the etomidate group than the ketamine group (90.5% vs. 85.5%, p=0.390). Post-intubation hypotension (15.9% vs. 29.0%, p=0.078) and vasopressor requirement (19.0% vs. 32.3%, p=0.089) were lower in the etomidate group, although not statistically significant. Mean arterial pressure reduction was significantly lower with etomidate compared with ketamine (11.8 ± 7.4 vs. 15.6 ± 8.2 mmHg, p=0.008). ICU mortality (19.0% vs. 24.2%, p=0.480) and in-hospital mortality (23.8% vs. 29.0%, p=0.511) were comparable between groups.
Conclusion: Both etomidate and ketamine were effective induction agents for rapid sequence intubation in critically ill emergency patients. Etomidate demonstrated better peri-intubation hemodynamic stability, while first-pass success, complications, ICU stay, hospital stay, and mortality were comparable between the two groups.

Keywords: Etomidate, Ketamine, Rapid Sequence Intubation, Emergency Medicine, Critically Ill Patients.

INTRODUCTION

Rapid sequence intubation (RSI) is a lifesaving procedure used to secure the airway in the critically ill patient who needs urgent respiratory support [1]. It is common in the prehospital, intensive care unit, and emergency department for patients with altered mental status, cardiac arrest, shock, and severe trauma to present with respiratory failure [2]. Effective RSI is based on the use of a potent induction agent followed by a neuromuscular blocking agent to ensure speedy endotracheal intubation with minimal risk of aspiration and hypoxemia. The selection of the induction agent is an important factor in achieving success for the procedure, as critically ill patients frequently have poor cardiovascular reserve and may be at risk of peri-intubation hypotension, hypoxia, and cardiac arrest [3]. Airway management in the critically ill patient is still one of the greatest challenges in emergency medicine. Emergency patients often have significant physiological derangements, such as hypovolemia, sepsis, trauma, metabolic acidosis, and cardiovascular

instability, compared with patients undergoing elective surgery. These patients have significant complications associated with endotracheal intubation, including hypotension, oxygen desaturation, dysrhythmias, aspiration, and death [4]. Thus, finding an induction agent that offers sufficient sedation and maintains hemodynamic stability has become a prominent area of research in the field of emergency airway management. Emergency airway interventions are still increasing worldwide due to the increasing burden of trauma, cardiovascular disease, sepsis, and respiratory illnesses [5]. Emergency and critical illnesses cause millions of deaths every year, according to the World Health Organization (WHO) and trauma and respiratory failure are significant indications for emergency intubation. In Pakistan, the Emergency departments (EDs) see a significant proportion of patients with critical conditions necessitating stabilization of their airway, due to road traffic accidents, infectious conditions, poisoning, neurological and cardiovascular conditions [6]. In addition to that, the challenges of airway management are further compounded by the scarcity of resources coupled with the delayed presentation in the emergency, thus emphasizing the importance of evidence-based choice of induction agents in the emergency situation [7,8].

Common agents used for rapid sequence intubation for the critically ill patient include etomidate and ketamine. Etomidate is an imidazole-based sedative-hypnotic that has a rapid onset of action, short duration of action, and little cardiovascular depression. It is generally preserved in systemic vascular resistance, myocardial contractility, and blood pressure; thus, etomidate has traditionally been the drug of choice for hemodynamically unstable patients [9]. There are, however, concerns about transient adrenal suppression due to 11β-hydroxylase inhibition, which could reduce cortisol production and have a possible effect on outcome in septic shock and other patients with sepsis [10]. Ketamine is a dissociative anesthetic that acts to antagonize the N-methyl-D-aspartate (NMDA) receptors to create hypnosis, analgesia, and amnesia. Ketamine is a stimulant of the sympathetic nervous system, increasing heart rate, cardiac output, and blood pressure in patients who have normal catecholamine reserves [11]. It also maintains airway reflexes and respiratory drive better than other alternative sedatives and offers bronchodilation, making it particularly useful in patients with severe asthma or bronchospasm [12]. However, in patients with prolonged shock or depletion of catecholamines, ketamine can cause myocardial depression and hypotension, which might pose safety concerns in extremely unstable patients. There are several randomized controlled trials and observational studies that have compared etomidate to ketamine for RSI, but it is not clear which is the best induction agent [13].

Objective

To compare the effectiveness and safety of etomidate versus ketamine for rapid sequence intubation in critically ill emergency patients.

METHODOLOGY

This retrospective comparative study was conducted at Allied Hospital Faisalabad from Sep 2025- Nov 2025. The study included adult patients aged 18 years and above who underwent rapid sequence intubation for emergency airway management due to critical illness. Patients who received either etomidate or ketamine as the induction agent during rapid sequence intubation were included. The total numbers of patients included in the study were 125. Hospital medical records were reviewed in a retrospective manner to identify eligible patients with the pre-defined inclusion criteria and enroll them in the study consecutively. A non-probability sampling technique – consecutive sampling was used. A total of 125 patient records were available and reviewed until several patients equal to that required for the study period had been obtained.

Data Collection

A structured data collection proforma was used to retrieve the data from electronic medical record and patient charts. Demographic data, comorbidities, main diagnosis, indication for intubation, type of induction drug used, number of intubations attempts and peri-intubation hypotension, oxygen desaturations, vasopressor requirements, cardiac arrest, admission to the intensive care unit, duration of mechanical ventilation, hospital stay and in-hospital death were documented.

Data Analysis

SPSS version 26.0 was used for analysis. Data were presented as mean ± SD, median (interquartile range) or frequency and percentage depending on the data distribution; categorical variables were presented as frequency and percentage. The independent-samples t-test or Mann–Whitney U test was used for continuous variables, while the Chi-square test was used for categorical variables.

A p value of < 0.05 was deemed to be statistically significant.

RESULTS

Overall, 125 critically ill patients were studied, of whom 63 were given etomidate and 62 were given ketamine for rapid sequence intubation. There was no difference in mean age between the etomidate and ketamine groups (57.8 ± 15.2 vs. 55.4 ± 14.8 years). There was also a predominance of males (61.9% vs. 59.7%). The mean BMI was similar between groups (27.4 ± 4.1 vs. 26.9 ± 3.9 kg/m²). The most prevalent comorbidities were hypertension in 55.6% of patients treated with etomidate and 51.6% with ketamine, and coronary artery disease in 27.0% of patients in the etomidate group and 24.2% of patients in the ketamine group. The proportion of patients with sepsis was 31.7% and 30.6% in the etomidate and ketamine groups, respectively, and the number of patients with trauma was 25.4% and 29.0% in the etomidate and ketamine groups, respectively.

Table 1. Baseline Demographic and Clinical Characteristics

Variable	Etomidate (N=63)	Ketamine (N=62)
Age, Years	57.8 ± 15.2	55.4 ± 14.8
Male Gender	39 (61.9%)	37 (59.7%)
BMI, Kg/M²	27.4 ± 4.1	26.9 ± 3.9
Hypertension	35 (55.6%)	32 (51.6%)
Diabetes Mellitus	24 (38.1%)	21 (33.9%)
Coronary Artery Disease	17 (27.0%)	15 (24.2%)
Sepsis	20 (31.7%)	19 (30.6%)
Trauma	16 (25.4%)	18 (29.0%)
APACHE II Score	21.6 ± 5.8	22.3 ± 6.1
SOFA Score	8.5 ± 2.4	8.8 ± 2.5

First-pass intubation success was achieved in 57 (90.5%) patients receiving etomidate and 53 (85.5%) receiving ketamine, although the difference was not statistically significant (p=0.390). The mean number of intubation attempts was similar (1.16 ± 0.41 vs. 1.24 ± 0.53; p=0.328), as was the mean intubation time (46.2 ± 13.5 vs. 48.7 ± 15.1 seconds; p=0.334). Difficult airway was encountered in 12.7% of patients in the etomidate group and 16.1% in the ketamine group (p=0.590), while video laryngoscopy was used in nearly half of both groups (46.0% vs. 43.5%; p=0.776).

Table 2. Intubation Characteristics

Variable	Etomidate (N=63)	Ketamine (N=62)	P-Value
First-Pass Success	57 (90.5%)	53 (85.5%)	0.390
Intubation Attempts	1.16 ± 0.41	1.24 ± 0.53	0.328
Intubation Time, Seconds	46.2 ± 13.5	48.7 ± 15.1	0.334
Difficult Airway	8 (12.7%)	10 (16.1%)	0.590
Use Of Video Laryngoscope	29 (46.0%)	27 (43.5%)	0.776
Peri-Intubation Hemodynamic			
Post-Intubation Hypotension	10 (15.9%)	18 (29.0%)	0.078
Vasopressor Requirement	12 (19.0%)	20 (32.3%)	0.089
Oxygen Desaturation <90%	8 (12.7%)	11 (17.7%)	0.435
Cardiac Arrest During Intubation	2 (3.2%)	3 (4.8%)	0.642
Mean Arterial Pressure Decrease, Mmhg	11.8 ± 7.4	15.6 ± 8.2	0.008

Patients receiving etomidate required mechanical ventilation for a mean of 6.8 ± 3.7 days compared with 7.4 ± 4.0 days in the ketamine group (p=0.385). The mean ICU stay (8.9 ± 4.6 vs. 9.6 ± 4.8 days; p=0.404) and hospital stay (12.4 ± 6.1 vs. 13.1 ± 6.4 days; p=0.536) were also comparable.

Table 3. Clinical Outcomes

Variable	Etomidate (N=63)	Ketamine (N=62)	P-Value
Mechanical Ventilation, Days	6.8 ± 3.7	7.4 ± 4.0	0.385
ICU Stay, Days	8.9 ± 4.6	9.6 ± 4.8	0.404
Hospital Stay, Days	12.4 ± 6.1	13.1 ± 6.4	0.536
ICU Mortality	12 (19.0%)	15 (24.2%)	0.480
In-Hospital Mortality	15 (23.8%)	18 (29.0%)	0.511

Increasing APACHE II score was independently associated with a lower likelihood of first-pass success (adjusted OR 0.94, 95% CI 0.88–0.99; p=0.031), indicating that greater illness severity adversely affected intubation success. Difficult airway also significantly reduced the probability of successful first-pass intubation (adjusted OR 0.28, 95% CI 0.09–0.84; p=0.024).

Table 4. Multivariable Logistic Regression Analysis for Predictors of First-Pass Intubation Success

Variable	Adjusted OR	95% CI	P-Value
Etomidate (Vs. Ketamine)	1.74	1.03–3.96	0.041
Age (Per Year Increase)	0.99	0.97–1.02	0.538
Male Gender	1.16	0.59–2.31	0.669
APACHE II Score	0.94	0.88–0.99	0.031
SOFA Score	0.91	0.82–1.01	0.072
Sepsis	0.78	0.36–1.70	0.528
Trauma	1.34	0.62–2.90	0.456
Difficult Airway	0.28	0.09–0.84	0.024

DISCUSSION

This retrospective comparative study compared the efficacy and safety of induction agents (etomidate vs. ketamine) for rapid sequence intubation (RSI) in acute critical care patients. Demographic and clinical data at baseline were similar in both groups, including age, gender, BMI, comorbidities, severity of illness, and indication for intubation, and there were no statistically significant differences between groups. This resemblance suggests that the two groups were well matched and that selection bias was minimized, making a proper comparison of procedural and clinical results possible. Similar baseline characteristics were also reported in previous studies comparing patients receiving etomidate and ketamine, lending credence to comparisons between the two induction agents. The first pass intubation success rates in both groups were high; 90.5% for those infused with etomidate and 85.5% for those infused with ketamine, but these were not statistically different. Likewise, the intubation attempts, intubation times, difficult airways and the use of video laryngoscopy were similar for both groups [14]. The results indicate that both induction agents are satisfactory for intubating in emergency airway management. Previous studies have also shown similar first-pass success rates when using etomidate or ketamine, showing a small difference when experienced clinicians manage the airway [15].

The significantly lower drop in mean arterial pressure after intubation with etomidate than with ketamine was one of the most interesting findings of this study. No statistical differences in incidence of post-intubation hypotension or vasopressor use were found between the groups, although the number was lower in the etomidate group. The results of this study reinforce the long-established cardiovascular stability that has been attributed to etomidate and is thought to be beneficial for patients with hemodynamic instability [16]. Previous studies have consistently shown that etomidate has fewer effects on blood pressure and fewer incidences of hypotension around the time of intubation compared to other drugs used as induction agents, especially in septic shock, trauma, and cardiovascular instability. There were no significant differences between the two treatment groups in terms of oxygen desaturations, peri-intubation cardiac arrest, or other immediate complications [17]. Similarly, no statistically significant differences were seen in mechanical ventilation time, intensive care unit (ICU) stay, hospital length of stay (HLOS), mortality in the intensive care unit (ICU) or in-hospital mortality. These results indicate that etomidate could be associated with better short-term hemodynamic stability during induction, but both drugs lead to similar short-term clinical results. Previous trials have also shown no consistent differences in peri-intubation physiological responses or death

rates between etomidate and ketamine, despite some minor differences in responses. The comparable mortality seen between the two groups is also important in the current controversy about the best induction agent for rapid sequence intubation [18]. While apprehensions have been expressed about the potential for transient adrenal suppression with etomidate, more recent investigations have shown that this biochemical effect does not always lead to an increase in mortality or clinical outcomes. Similarly, ketamine has sympathomimetic effects that could be beneficial for maintaining blood pressure during induction, but it has not been consistently proven to have a survival benefit for critically ill populations [19]. The results of the present study are therefore in line with earlier studies indicating that both types of induction agents are viable choices if they are chosen based on the patient's underlying physiology. The present study has clinical implications for the emergency physician. Etomidate seems to maintain better hemodynamic stability during rapid-sequence induction and achieves a similar success rate to ketamine in rapid-sequence induction [20].

Limitations

There are a number of limitations in this study. First, because of its retrospective nature, the study did not allow for drawing causal conclusions about induction agent and clinical outcomes and was sensitive to the accuracy and completeness of medical records. Secondly, the study was undertaken in a single centre and had a small study population, and thus the results may not be transferable to other healthcare settings. Third, the type of induction agent was not allocated randomly to the group, but rather selected by the physician according to the patient's condition, which may be a source of selection bias and residual confounding despite statistical adjustment.

CONCLUSION

Rapid sequence induction for emergency critically ill patients was equally successful with either agent (etomidate or ketamine). Peri-intubation hemodynamic stability was better with etomidate, which resulted in significantly less MAP decrease, with no difference between the two groups in first-pass success, intubation complications, ICU or hospital stay or mortality. Therefore, the selection of the induction agent should be tailored to the particular clinical situation, hemodynamics and airway risks of the patient.

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