

Role of Etomidate in Critical Care for Rapid Sequence Intubation

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ABSTRACT

Rapid sequence intubation is a process involving the administration of a sedative induction agent and a paralytic agent to facilitate endotracheal intubation. Administration of an induction agent followed by a rapidly acting neuromuscular blocking agent to produce unconsciousness and motor paralysis provide optimal intubation condition and protect the patient's airway. Etomidate is gamma amino butyric acid agonist administered to facilitate a state of unconsciousness; it has a rapid onset of action and duration of action for 4-10 min, minimal cardiovascular effects, respiratory depression of histamine release and provides protection from myocardial and cerebral ischemia. This review discuss the importance of Etomidate as the first line induction agent in emergency department. A detail literature review of rapid sequence intubation in emergency department was carried out from PubMed using the keywords Etomidate, Ketamine, Propofol, Rapid sequence intubation. Etomidate is the first line drug in thermodynamically stable patients and in traumatic brain injury. However, it should not be used as an infusion or as repetitive bolus doses for maintenance dosage adjustment in elderly patients. Etomidate when used provides sedation within 1 min and eliminates critical monitoring requiring only basic monitoring parameters like blood pressure, pulse and ECG readings. Incidence of hypotension is low and when occurs can be managed with IV fluids, the sedation lasts for about 30 mins. However patient specific factors must also be considered during the selection of intubating agent.

Key words: Rapid, Sequence intubation, Etomidate, Ketamine, Propofol, ECG changes.

INTRODUCTION

Airway management is one of the primary roles of emergency personal when critically ill patients present to the emergency department. Rapid sequence intubation is a process involving the administration of a sedative induction agent and a paralytic agent to facilitate endotracheal intubation.¹ This technique has been utilized by anesthesiologist and physicians in emergency situation at emergency department and intensive care units. RSI has become the standard goal for airway management in critical care. Administration of an induction agent followed by a rapidly acting neuromuscular blocking agent to produce unconsciousness and motor paralysis provide optimal intubation condition and protect the patient's airway.²

RSI involves a series of 8 steps often referred to as 8 p's; Planning, Preparation, Pre-oxygenation, Pre-treatment, Paralysis with

induction, Placement of tube in the trachea, Proof of proper positioning along with Post intubation management. Pretreatment occurs 3 mins before the administration of induction agent and neuromuscular blocking agent. The purpose of pretreatment is to attenuate the pharmacological response to laryngoscope and intubation.³ The common induction agents are Etomidate, Ketamine and Propofol.

An ideal RSI agent should have wide safety in patients and the dosage regimen should be straight forward should provide ideal intubating conditions without compromising stability of vulnerable organ systems like cardiovascular, respiratory and central nervous system.⁴ However the selection of induction agent, muscle relaxant and opioid remain controversial. This review deals about the advantage of Etomidate over other induction agent.

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Etomidate is a Gamma Amino Butyric Acid (GABA) agonist administered to facilitate a state of unconsciousness; it has a rapid onset of action (within 10-20 sec) and duration of action for 4-10 mins, minimal cardiovascular effects, respiratory depression or histamine release and provides protection from myocardial and cerebral ischemia.⁵ Etomidate inhibit the conversion of cholesterol to cortisol by reversible and concentration dependent blockade of 11 beta hydroxylase and lesser extent to 17 alpha hydroxylase and leads to adrenal suppression. Etomidate can be used for induction of RSI as a single bolus dose in the ED setting. Etomidate with high therapeutic index and its minimal effect on breathing and blood pressure led physicians to use it as an anesthetic induction and maintenance agent, as well as a sedative drug in the Emergency Department. Rapid recovery occurs at a typical anesthetic dose 0.3mg/kg. Etomidate is 75% protein bound with a half-life of approximately 5 hrs and metabolized by enzyme hepatic esterase.⁶

Etomidate has a greater ability to suppress adrenocortical steroid synthesis, which results in binding with high affinity to the cytochrome P 450 11 beta hydroxylase.⁷ Etomidate cannot be administered as a continuous infusion because of its potential lethal effect. Hence Etomidate is used as a single bolus dose in Rapid sequence intubation⁸ Etomidate causes a modest decrease in arterial blood pressure along with minimal effect on ventilation and cerebral blood flow, cerebral metabolic rate and intracranial pressure are decreased.⁹ Anesthetic action of Etomidate is mainly due to carboxylated imidazole ring and provides a stable hemodynamic with no effect on sympathetic nervous system as well as on the baroreceptor reflex regulatory system.¹⁰ Because of this hemodynamic stability Etomidate has been used as an induction agent in the emergency room and the intensive care unit for RSI and also for induction of general anesthesia in the cardiac surgeries.¹¹

Aim of the Review

This review discusses the importance of Etomidate as the first line induction agent in emergency department.

MATERIALS AND METHODS

A detail literature review of rapid sequence intubation in emergency department was carried out, specifically comparing used drugs (Induction agent and neuromuscular blockers) from PubMed using the keywords Etomidate, Ketamine, Propofol, Rapid sequence intubation.

RESULTS

Etomidate is the first line drug in thermodynamically stable patients it has a neuroprotective effect in traumatic brain injury because of its ability to decrease cerebral metabolism and decrease intracranial pressure. However, it should not be used as an infusion or as repetitive bolus doses for maintenance of sedation after intubation. Etomidate alters cortisol levels hence its use is controversial in septic shock patients. Etomidate is excreted through kidney and hence its excretion is delayed in patients with impaired renal function hence dosage adjustment is recommended in elderly patients.

DISCUSSION

Ketamine is a schedule 3 general anesthetic agent and like most sedative has a rapid onset of action (30-60 sec). It is administered in doses of 1-2 mg/kg intravenously and 4-10 mg intramuscularly.^{12,13} Ketamine is the first line agent in hypertensive patients but not recommended in patients with traumatic brain injury, hypertension and arrhythmias. Those induced with Ketamine suffers from visual hallucinations (emergency phenomena) as well as nystagmus.¹⁴

Propofol is also given to normotensive patients for induction in doses of 1.5-2.5 mg/kg intravenously. It however has a short duration of action and requires repetitive doses to maintain sedation in RSI.¹⁵ The role of Propofol as an induction agent in RSI is limited because of its adverse effects such as myocardial depression, hypotension and reduction in cerebral perfusion pressure. This side effect can sometimes be utilized in patients with traumatic brain injury.¹⁶

Etomidate have minimal cardiovascular effects apart from a mild reduction in the peripheral vascular resistance responsible for decline in arterial blood pressure. Its administration does not release histamine however large doses produce anesthesia and must not be solely used for induction.¹¹ Apart from a slight increase in arterial carbon dioxide tension (PaCO₂) the drug has no respiratory effect. Etomidate is the first line drug in thermodynamically stable patients it has a neuroprotective effect in traumatic brain injury because of its ability to decrease cerebral metabolism and decrease intracranial pressure.¹⁷ However it should not be used as an infusion or as repetitive bolus doses for maintenance of sedation after intubation. Etomidate alters cortisol levels by stimulating production hence its use is controversial in septic shock patients. Etomidate is excreted through kidney and hence its excretion is delayed in patients with impaired renal function hence dosage adjustment is recommended in elderly patient.¹⁸ Since the drug is metabolized by

liver caution should be used in patients with impaired hepatic function, they require lower doses and are more susceptible to adverse reactions.

According to the study which compared Etomidate and Ketamine conducted by Megan A, Vanberkel *et al.* there is no considerable difference in the incidence of hypotension or shock in patients induced. Ketamine however demonstrated significant hemodynamic instability and reduced cardiac output, there were even cases of cardiac arrests.¹⁹ Perbet *et al.* reported that increase in the intubation with Ketamine and Etomidate from 35-76% significantly reduced incidence of hypotension in their ICU patient population. It also revealed that implementation of an intubation management protocol reduced the intubation related ICU complications.²⁰ In the study conducted by Choi *et al.* it becomes clear that administration of a primary dose of Rocuronium 0.06mg/kg 3 min before intubation reduced the frequency of myoclonus. Zed *et al.* also demonstrated that administration of Etomidate even in patients with low pre RSI blood pressure has shown favorable hemodynamic stability.⁵

CONCLUSION

An ideal RSI induction agent in emergency department should be rapidly acting, permit optimal intubation condition and to be devoid of life-threatening adverse effects. Etomidate qualify all the above-mentioned parameters, along with hemodynamic stability even in hypovolemic patients and also patients with limited cardiac reserve. Etomidate when used provides sedation within one minute and eliminates critical monitoring requiring only basic monitoring parameters like blood pressure, pulse and ECG readings. Incidence of hypotension is low and when occurs can be managed with IV fluids, the sedation lasts for about 30 mins. Even if Ketamine is switched for Etomidate as RSI induction agent there will be no significant improvement in the clinical outcomes including hospital mortality, ICU ventilation free days and transfusion requirements.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

ICU: Intensive Care Unit; **ED:** Emergency Department; **RSI:** Rapid Sequence Intubation; **GABA:** Gamma Amino Butyric Acid.

SUMMARY

Even if Ketamine is switched for Etomidate as RSI induction agent there will be no significant improvement in the clinical outcomes including hospital mortality, ICU ventilation free days and transfusion requirements.

Ethics Approval

All the above mentioned studies were approved by their representative Institutional Ethical committees.

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