Management of rapid sequence induction during emergency laparotomy in a trauma center in Iran: A case report

Abstract

Aims: This study aimed to evaluate the effectiveness and clinical outcomes of rapid sequence induction (RSI) in a patient with abdominal trauma undergoing emergency laparotomy (EL) at an Iranian trauma center.

Methods: We report the case of a 50-year-old man with abdominal trauma and internal hemorrhage who underwent EL following RSI at a trauma center in Iran.

Findings: RSI was performed using ketamine as the induction agent, followed by succinylcholine to facilitate endotracheal intubation. The technique enabled successful airway management while maintaining acceptable hemodynamic stability in this patient with unstable hemodynamics undergoing emergency surgery.

Conclusion: RSI with ketamine followed by succinylcholine appears to be a feasible anesthetic approach for patients with unstable hemodynamics requiring EL. However, continuous training and regular updates of clinical care protocols are essential to optimize the implementation of this approach in Iranian medical centers.

Keywords: emergency, laparotomy, rapid sequence induction, succinylcholine, ketamine

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Introduction

Emergency laparotomy (EL) is an immediate surgical procedure which has various indications and is used for addressing acute abdominal conditions and pathologies, which requires immediate intervention. [1]. Although hemorrhage and trauma comprise a small percentage of EL, it is one of the most dangerous procedures due to the hemodynamic instability [2]. Mortality of EL is about five times higher than that of high-risk elective surgeries and it may have various reasons including hypovolemic shock [3]. Thus, careful selection of anesthetic agents and techniques is crucial for EL; while standard drugs are often used, the choice of muscle relaxants may vary [4].

Rapid sequence induction (RSI) is a specialized technique designed to minimize the risk of pulmonary aspiration by employing specific drugs, tools, and maneuvers [5]. It is indicated in the situations such as non-fasting patients, active vomiting, ileus, reduced laryngeal reflexes, gastrointestinal obstruction, pregnancy, and trauma [6]. This technique aimed to rapidly induce unconsciousness and muscle relaxation in the patient, thereby reducing the time interval between drug administration and intubation [5]. It entails the loss of consciousness during the application of cricoid pressure (CP), followed by intubation without the use of face mask ventilation leading to the intubation of the trachea as swiftly as possible [7]. RSI significantly mitigates potential risk of gastric contents refluxing into the esophagus, thereby enhancing patient safety during the procedure [5].

Rocuronium bromide is a widely utilized non-depolarizing neuromuscular blocker in clinical anesthesia [8]. Its rapid onset of action and predictable duration of action makes it an attractive option for facilitating airway management and providing muscle relaxation during surgical procedures [8]. Rocuronium exerts its effects by competitively antagonizing nicotinic acetylcholine receptors at the neuromuscular junction [8]. While traditional reversal agents, such as neostigmine and edrophonium, require the concurrent administration of anticholinergic medications to counteract muscarinic side effects, the advent of sugammadex has significantly improved the safety and efficacy of rocuronium reversal [8].

On the other hand, succinylcholine is a depolarizing neuromuscular blocking drug which is similar to acetylcholine in structure [9]. This drug binds to the acetylcholine receptor in a competitive manner with acetylcholine and causes a prolonged depolarization phase [9]. At full dosage (1-2 mg/kg), it induces fasciculation and paralysis, while also providing optimal conditions for intubation within a single circulation time of 15 to 45 seconds [10].

This case report presents a practical and in-depth review of involving RSI in EL at a trauma center in Iran; a situation that requires rapid decision-making, careful selection of anesthetic agents, and effective airway management. This report can be a useful model for anesthesiologists, anesthesia technicians, and emergency teams in managing critical situations. Also, documenting this experience provides a valuable foundation for future empirical research on anesthesia management in trauma and emergency care settings.

This article presents a 50-year-old man with an abdominal trauma who underwent an EL due to severe internal bleeding. In this study, the effect of RSI on the patient's physical conditions and vital signs is addressed.

Information and Methods

A 50-year-old man with an abdominal trauma and internal bleeding due to an accident was brought to a trauma center in Shiraz, Iran. Upon arrival, he was immediately transferred to the operating room as an emergency.

Findings

His Glasgow Coma Scale (GCS) was 13 and was anesthetized for laparotomy surgery with ASA grade V-E. The patient had severe hypotension (40/20 mmHg), tachycardia (120 bpm) and hematuria, despite having no known underlying medical conditions, which could be signs of hemorrhage and internal bleeding. Upon his arrival in the operating room, an ECG, a pulse oximeter, and a capnograph, as well as both non-invasive and invasive blood pressure monitors were connected to the patient. The invasive blood pressure measurement was taken after induction of the anesthesia due to the significant bleeding, as this procedure is painful and requires anesthesia.

The medical personnel observed hypotension and compensatory tachycardia, which suggested a significant blood loss. His pulse rate was 120 bpm, the non-invasive blood pressure was 40/20 mmHg and the invasive one was 38/19 mmHg. In addition, his End Tidal CO2 (ETCO2) and arterial oxygen saturation were 40mmHg and 95%, respectively.

Following the establishment of intravenous access and monitoring, RSI was performed. This included pre-oxygenation with 100% oxygen at 5 liter per minute, application of CP and induction with 120mg of ketamine. Succinylcholine (90mg) was administered, and after fasciculations, endotracheal intubation was facilitated with a cuffed endotracheal tube (ETT). After intubation, midazolam (2mg) and fentanyl (100 μg) were administered for amnesia and analgesia. Subsequently, four units of packed red blood cells were transferred due to hypotension and tachycardia.

An arterial blood gas (ABG) sample collected every hour. The patient's surgery lasted for four hours, and a total of 4 ABGs were taken. Accordingly, metabolic disorders and acidosis were minor in ABGs and were managed and treated by an anesthesiologist.

The patient also was administered 1 gram of tranexamic acid to help prevent further bleeding. To maintain anesthesia and increase blood pressure, propofol and epinephrine was injected with an infusion pump at doses of 100μg/kg/min and 8μg/min, respectively. During the operation, according to the fluid therapy calculations, the patient received 1000 ml of normal saline for the first hour, and 800 ml for each hour for the second hour onwards, alternating between normal saline and ringer. Following the above measures, the blood pressure returned to the normal values and his internal bleeding was successfully stopped by the surgeon. The unconscious patient was admitted to the ICU with an ETT, a blood pressure of 110/90 mmHg, a heart rate of 80 bpm, and an oxygen saturation of 97%.

Discussion

This study highlights the significance of RSI in critically injured patients with internal bleeding who require immediate surgical intervention. In such situations, EL is a critical intervention that allows for diagnosis and control of the bleeding source, thereby preventing further hemorrhage [2].

In current study, the patient status necessitated an RSI technique, which differs from the standard procedure for elective laparotomies. This technique involves a single pre-oxygenation phase followed by the immediate administration of anesthetic agents and a short-acting muscle relaxant [11]. This approach eliminates the waiting period between muscle relaxant administration and intubation, allowing for quicker and safer airway management [12]. The patient was continuously monitored during the procedure, and the use of succinylcholine and CP was effective in preventing complications. The successful intubation and connection to the anesthesia machine ensured a continuous oxygen supply throughout the surgery.

Following the induction and administration of medications, particularly ketamine, blood pressure stabilized. In most cases, propofol and sodium thiopental are the standard anesthetics used [6, 10];

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however, ketamine was selected for this patient due to the presence of hypovolemic shock, which increases the risk of cardiac arrest.

In traumatic patients, etomidate and ketamine are frequently employed anesthetics [13]. Etomidate is known for its hemodynamic stability and minimal impact on the cardiovascular system, making it an ideal choice for patients with unstable hemodynamics [13]. Conversely, ketamine is particularly suited for trauma patients experiencing bleeding and significant hypotension, as it enhances sympathetic tone and positively influences cardiovascular function [13]. In this case, a dose of 120 mg of ketamine, which was exactly the same as the induction dose, was injected due to the patient's unstable hemodynamic condition and significant bleeding. Finally, patient's blood pressure stabilized following the induction and administration of medications, particularly ketamine.

Succinylcholine, at a standard dose of 90 mg, was chosen as the muscle relaxant in this emergency surgery. Its rapid onset of action, typically within 60 seconds [9], is crucial for facilitating immediate intubation and controlling ongoing bleeding.

Rocuronium is a non-depolarizing muscle relaxant used in RSI. The availability of sugammadex, a selective rocuronium reversal agent, has increased its use in recent years [6]. Although rocuronium has a prolonged duration of action, which is advantageous considering the unpredictable nature of surgical timing, succinylcholine's quick onset of action was favored in this urgent scenario [14].

RSI is a widely utilized technique in anesthesiology [15]. This study illustrates the relationship between the anesthesia type used and the patient's health status, offering proof that this method can be crucial for patients in emergency situations.

Conclusion

In conclusion, for patients who experience unstable hemodynamics and are at high risk of pulmonary aspiration during endotracheal intubation, a RSI protocol employing ketamine followed by succinylcholine may be considered a suitable intervention to prioritize patient safety and preserve life. The ability of ketamine to stabilize hemodynamics can reduce the risk of hypotension and bradycardia commonly linked to induction agents, while succinylcholine offers rapid and efficient muscle relaxation, aiding in safe airway management.

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Conflicts of Interests

There are no conflicts of interest.

Ethical Approval

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