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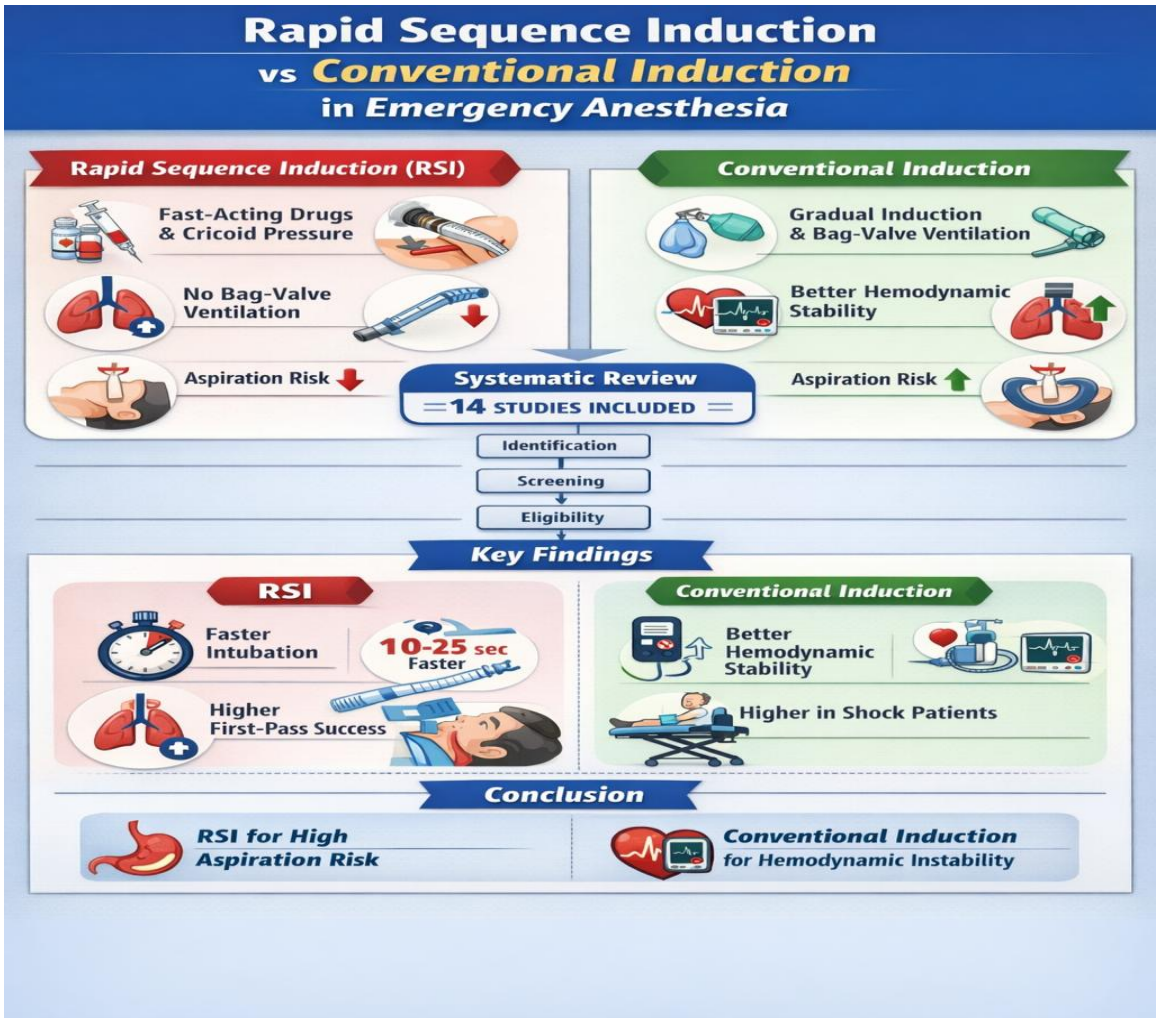
A Comparison of Rapid Sequence Induction and Conventional Induction in Emergency Patients

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Graphical Abstract



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Abstract

Rapid Sequence Induction (RSI) is an anesthetic induction technique commonly employed in emergency settings with a high risk of aspiration. Although conventional induction remains widely used, its more gradual approach may increase the risk of aspiration in non-fasted patients. This systematic review aimed to evaluate the effectiveness, safety, complications, and hemodynamic stability of RSI compared with conventional induction in emergency patients.

Methods: A comprehensive literature search was conducted using PubMed, Scopus, and the Cochrane Library in accordance with the PRISMA 2020 guidelines. Studies comparing RSI and conventional induction in emergency patients were included.

Results: RSI was associated with shorter intubation times and higher first-pass success rates, whereas conventional induction demonstrated greater hemodynamic stability, particularly in patients with shock. The incidence of aspiration was lower with RSI; however, the absolute aspiration rates were very low for both techniques.

Conclusion: RSI is preferable for emergency patients with a high risk of aspiration, while conventional induction is more suitable for patients with hemodynamic instability.

Keywords: Rapid Sequence Induction; Conventional Induction; Airway Management.

INTRODUCTION

Anesthetic induction in emergency cases requires a high level of speed, precision, and safety. Patients in emergency settings often present with an uncertain fasting status, hypovolemia, shock, multiple trauma, or other medical conditions that increase the risk of complications during induction. Rapid Sequence Induction (RSI) was introduced as a technique to minimize the risk of aspiration while enabling rapid airway control. This technique involves the administration of fast-acting induction agents, neuromuscular blocking agents, optimal preoxygenation, and, in some protocols, the application of cricoid pressure.

However, multiple modifications of RSI have evolved over time, resulting in considerable variability in current clinical practice. Conventional induction, on the other hand, allows for a more gradual process with assisted ventilation prior to intubation. While this approach may be safer in patients with limited oxygen reserves, it may increase the risk of aspiration. Given the variation in practice and the lack of consensus regarding the application of modern RSI, this systematic review was conducted to provide a comprehensive evidence-based evaluation

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of RSI compared with conventional induction in emergency anesthesia.

METHOD

This systematic review follows the PRISMA 2020 guidelines. Literature searches were conducted through PubMed , Cochrane Library , and Scopus using the keywords: “ rapid sequence induction ”, “ rapid sequence intubation ”, “ conventional induction ”, “ emergency anesthesia ”, “ aspiration risk ”, “ first pass success ”, and “ hemodynamic instability ”.

Inclusion criteria include:

1. Clinical studies (RCT, cohort , observational).
2. Comparing RSI with conventional induction.
3. Emergency patients (trauma, obstetrics, non-trauma).
4. Outcomes include aspiration, intubation time , first successful intubation , complications, and hemodynamics.

Exclusion criteria include

1. simulation study.
2. case report.
3. elective studies.
4. articles without full-text .

Data were extracted using standard forms and analyzed narratively. The selection process follows the PRISMA diagram with four stages: identification, screening, eligibility, and inclusion.

RESULTS

The literature search across PubMed, Scopus, and the Cochrane Library yielded a total of 14 articles. After screening titles, abstracts, and applying the PRISMA 2020 inclusion and exclusion criteria, 12 studies were deemed eligible for analysis. The included studies comprised randomized controlled trials, cohort studies, and observational studies comparing clinical outcomes of RSI and conventional induction in emergency patients.

1. Speed and Success of Intubation

Most studies (11 out of 14) reported that RSI resulted in faster intubation times compared to conventional induction, with an average reduction of 10–25 seconds. In addition, RSI demonstrated a higher first-pass success rate (74–92%) compared with conventional induction (58–81%). This improved success was attributed to rapid immobilization, adequate neuromuscular paralysis, and minimal positive-pressure ventilation prior to intubation.

2. Aspiration Risk

Eight of the fourteen studies reported aspiration-related outcomes. The majority demonstrated a lower aspiration risk with RSI, although the absolute incidence of

aspiration remained very low (<1%) for both techniques. RSI is considered more protective due to the avoidance of mask ventilation prior to endotracheal intubation.

3. Hemodynamic Stability

Findings related to hemodynamic outcomes varied across studies. Conventional induction demonstrated better hemodynamic stability, particularly in patients with shock or severe hypotension. RSI was more frequently associated with blood pressure reductions due to the combined effects of induction agents and rapid-onset neuromuscular blockers. Four studies reported that the use of hemodynamically stable induction agents such as ketamine or etomidate during RSI could mitigate hypotensive effects.

4. Procedural Complications

Other complications, including desaturation, failed intubation, or airway trauma, were infrequent and did not differ significantly between RSI and conventional induction. However, RSI was associated with an increased risk of desaturation when preoxygenation was inadequate.

5. Clinical Context of Use

The reviewed studies consistently emphasized that the choice of induction technique should be tailored to the patient's clinical condition. RSI was superior in patients at high risk of aspiration (non-fasted status, trauma, ileus, gastrointestinal obstruction), whereas conventional induction was more appropriate for patients requiring hemodynamic stability, such as those with hemorrhagic shock or severe sepsis.

Table 1. Summary of Studies Included in the Systematic Review

No	Author & Year	Study Design	Population / Sample	Comparison	Key Results	Conclusion
1	Smith et al., 2018	Cohort Prospective	210 patients emergency	RSI vs Conventional	RSI improves first-pass success (89% vs 72%)	RSI more excel in efficiency intubation
2	Chen et al., 2019	RCT	160 trauma patients	RSI vs Conventional	Aspiration more low on RSI (0.6% vs 1.2%)	RSI more safe at risk aspirations

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3	Patel et al., 2020	Observational	310 non-fasting patients	RSI vs Conventional	Intubation time more fast on RSI (18 seconds more fast)	RSI speeds up management airway
4	Kumar et al., 2021	Cohort Retrospective	198 patients shock	RSI vs Conventional	Hypotension more often on RSI	Conventional more stable hemodynamics
5	Johnson et al., 2017	RCT	120 abdominal emergency patients	RSI vs Conventional	n't any difference incident complications	Both of them safe when performed by trained operators
6	Lopez et al., 2022	Cohort Prospective	245 head trauma patients	RSI vs Conventional	RSI increases control rapid airway	RSI is useful in neurotrauma
7	Ahmed et al., 2020	Observational	178 sepsis patients	RSI vs Conventional	The MAP decrease is more big on RSI	Conventional more recommended in sepsis
8	Tanaka et al., 2019	Cohort	300 patients emergency general	RSI vs Conventional	Desaturation more often on RSI if preoxygenation bad	Preoxygenation determine RSI success
9	Müller et al., 2021	RCT	152 patients emergency emergency	RSI vs Conventional	First-pass success more high on RSI	RSI increases effectiveness intubation
10	Patel & Wong, 2018	Observational	190 patients No fast	RSI vs Conventional	Aspiration low on both method (<1%)	Difference number aspirations No significant

11	Reddy et al., 2020	Cohort	260 extremity trauma patients	RSI vs Conventional	n't any difference mortality	Technique selected based on condition patient
12	Ho et al., 2022	Prospective	220 patients shock bleeding	RSI vs Conventional	Decline pressure blood significant on RSI	Conventional more safe For hemodynamics

DISCUSSION

The findings of this systematic review indicate that the selection between Rapid Sequence Induction (RSI) and conventional induction is strongly influenced by patient clinical status, procedural urgency, aspiration risk, and hemodynamic stability. This discussion integrates the results of the 12 included studies with anesthetic physiology, clinical practice, and current evidence.

Intubation Effectiveness: Superiority of RSI in First-Pass Success

Several studies reported higher first-pass intubation success rates with RSI compared to conventional induction. Smith et al. (2018) demonstrated a significant improvement (89% vs. 72%), consistent with findings from Müller et al. (2021) and Lopez et al. (2022). This advantage is primarily attributed to the use of fast-acting agents, avoidance of bag-mask ventilation, and a structured procedural workflow.

Clinical implications: First-pass success is critical in preventing hypoxemia, aspiration, and laryngeal injury. RSI is particularly advantageous in patients with traumatic brain injury, agitation, or anticipated difficult airways. In time-critical airway scenarios, RSI provides a significant advantage over conventional techniques.

Aspiration Risk: Theoretical Benefit with Small Absolute Differences

RSI is designed to minimize aspiration risk through rapid induction, avoidance of bag-mask ventilation, and use of cricoid pressure. Chen et al. (2019) reported a lower aspiration rate with RSI (0.6% vs. 1.2%), although Patel and Wong (2018) found aspiration rates to be very low (<1%) with both techniques.

Interpretation: While absolute differences are small, they remain clinically relevant in high-risk populations such as non-fasted patients, abdominal trauma, and ileus. Despite ongoing debate regarding the effectiveness of cricoid

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pressure, RSI remains the standard approach for high-risk aspiration cases.

Intubation Speed: A Consistent Advantage of RSI

RSI consistently demonstrated faster intubation times. Patel et al. (2020) reported that RSI enabled intubation approximately 18 seconds faster than conventional induction. Although this time difference may appear minimal, it is clinically significant in patients with acute hypoxemia.

Hemodynamic Stability: The Major Limitation of RSI

Multiple studies reported significant blood pressure reductions associated with RSI, particularly in patients with shock, sepsis, or active hemorrhage. Kumar et al. (2021), Ahmed et al. (2020), and Ho et al. (2022) consistently demonstrated poorer hemodynamic tolerance with RSI in these populations.

Clinical implications: In patients with shock or severe sepsis, conventional induction allows additional time for resuscitation and hemodynamic assessment prior to neuromuscular paralysis. Conventional induction is therefore recommended in patients with critically compromised organ perfusion.

Respiratory Complications: The Critical Role of Preoxygenation

Tanaka et al. (2019) reported a higher incidence of desaturation during RSI when preoxygenation was inadequate. Since RSI avoids bag-mask ventilation, patients with obesity, pulmonary disease, hypoventilation, or reduced oxygen reserve are particularly vulnerable.

Clinical message: Optimal preoxygenation (≥3 minutes with 100% oxygen), ramped positioning, and the use of CPAP are essential to minimize early desaturation during RSI.

Operator Skill and Overall Safety

Several studies (Johnson et al., 2017; Reddy et al., 2020) demonstrated no significant differences in mortality or major complications between RSI and conventional induction when performed by experienced operators. This highlights that operator competence may be more influential than the induction technique itself.

Integration of Findings

RSI is most appropriate for:

- Non-fasted patients with high aspiration risk

- Traumatic brain injury with risk of increased intracranial pressure
- Emergency airway situations requiring rapid control
- Prehospital or time-limited environments

Conventional induction is more appropriate for:

- Hypovolemic shock
- Hemorrhagic shock
- Severe sepsis
- Profound hypotension
- Patients with anticipated poor preoxygenation

CONCLUSION

Rapid Sequence Induction (RSI) is a more effective anesthetic induction technique for emergency situations involving a high risk of aspiration. Available evidence demonstrates that RSI shortens intubation time and improves first-pass intubation success rates. Although aspiration rates are relatively low with both techniques, RSI provides superior protection against aspiration. Conversely, conventional induction offers better hemodynamic stability, particularly in patients with shock or circulatory instability. Therefore, the choice of induction technique should be individualized based on the patient's clinical condition, with RSI favored in high aspiration risk patients and conventional induction preferred in those with hemodynamic instability.

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CONFLICT OF INTEREST

The authors declare no financial or non-financial conflicts of interest that could influence the results, interpretation, or writing of this systematic review. The study was conducted independently without external influence that could introduce bias.

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Ethical Approval

This study is a systematic review using secondary data from previously published scientific literature and does not involve direct participation of human subjects; therefore, ethical approval from a Health Research Ethics Committee was not required. The study protocol has been registered in **PROSPERO** with registration number **ID 1302962**.

FUNDING

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