

Rapid Sequence Intubation: Current Concepts in Acute Care - A Narrative Review of Contemporary Evidence and Practice

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Abstract

Background: Rapid sequence intubation (RSI) is a fundamental emergency airway technique, which is frequently performed in physiologically unstable patients in whom there is little room for error. There is not a strong uniformity in the evidence on drugs, devices, and oxygenation strategies. Systematically reviewed the available evidence on emergency RSI and airway management.

Methods: The authors searched for English-language, open-access articles from 2015 to 2026 in the Scopus database on 28 September 2026, using the following keywords: title, abstract, keywords. Original studies, guidelines, and consensus papers concerning emergency RSI outside the operating room were included. Data were extracted by two reviewers. The Newcastle–Ottawa Scale, AXIS, QI-MQCS, JBI and AGREE II were used to assess the Risk of Bias for the design of the included studies. A narrative synthesis of findings was used after SWiM.

Results: There were 24 reports (6 cohort, 9 cross-sectional, 4 quality-improvement/before-after studies, and 5 guidelines or consensus statements) of 163 records; no randomised trials were found. Five were rated as 'high', 14 as 'moderate', and four as 'low' in terms of quality; one was not rated. The first-pass success was from 78.3% to 95.6% and complications from 9% to 58.4%. The first-pass success without adverse event was 70.9% on combined anatomical and physiological difficulty compared with 92.4% with no difficulty. Apnoeic oxygenation was linked to greater first-pass success and without hypoxaemia (aOR 2.2, 95% CI 1.5–3.3). Quality-improvement programmes increased 1st pass success by 9 to 23 percentage points or kept it above 90%.

Conclusions: There was a wide variation in the success and complications rate, and anatomic and physiologic difficulty had an impact on reducing first-pass success without causing any complications. Apnoeic oxygenation, videolaryngoscopy, and structured quality-improvement programmes were linked with improved results; however, these were non-randomised or uncontrolled studies. Multicentre prospective studies with standardised outcome definitions are needed.

Keywords: Rapid sequence intubation, Emergency airway management, First-pass success, Videolaryngoscopy, Quality improvement.

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1. Introduction

1.1 Background

Rapid sequence intubation (RSI) is an airway management strategy, commonly employed in anaesthesia, emergency medicine and intensive care to ensure the airway of a patient who is at risk of pulmonary aspiration [1]. The goal of RSI is to minimise the time the airway is unprotected by combining a rapid-acting induction agent with a rapid-acting neuromuscular blocking agent and, classically, withholding positive-pressure ventilation before laryngoscopy. The process is rarely conducted under ideal conditions, however, in acute care. Patients may have a limited physiological reserve, unstable haemodynamics, and an airway that is not assessed in advance; the

operator might only have one chance to get it right [2].

1.2 Clinical settings and risks in acute care

RSI can be implemented in many settings where surgery is performed under anaesthesia, such as the emergency department, the ICU, the prehospital environment, or in the operating theatre in the case of emergency surgery, and the risk balance varies between these settings [3]. There are many situations where the airway may be compromised on arrival in the ED, organ dysfunction may have been established in the ICU, or the patient may be a known fast patient yet have an unexpected difficulty with their airway on arrival in the operating theatre. Thus, the population and the environment influence the type of complications

that are likely to occur and the type of interventions that are likely to be useful [4].

These conditions are well known and have well documented effects. Severe cardiovascular collapse occurred in nearly one-third of the patients who were haemodynamically stable prior to intubation in a large multicentre cohort of intensive care unit (ICU) intubations [5]. Hypoxaemia is a second major hazard and has been associated with poor outcomes in some critically ill groups, such as patients with traumatic brain injury. Repeated laryngoscopy attempts increase the risk of adverse events, so first-pass success is an important target [6]. The aim of emergency intubation should therefore be not simply tube placement, but tube placement without causing hypoxaemia.

1.3 Oxygenation strategies

The prevention of hypoxaemia during the apnoeic phase of RSI has been the subject of much attention, with the evidence being inconsistent. The implementation of apnoeic oxygenation was correlated with a greater first-pass success rate without hypoxaemia (82.1% vs. 69.0%, adjusted odds ratio 2.2), and a related analysis found reduced levels of hypoxaemia in patients with intracranial haemorrhage in a prospective quality-improvement cohort of adult emergency department RSI [7]. A randomised trial conducted in a medical ICU, however, did not demonstrate a decrease in the number of patients with a minimum saturation < 90% (44.7% vs 47.2%), while a multicentre trial of high-flow nasal oxygen use for preoxygenation for hypoxaemic patients in the medical ICU demonstrated no statistically significant difference between the lowest saturation level reached during intubation (48.8% vs 48.9%). This conflicting evidence indicates that the impact of an oxygenation strategy varies depending on population, context, and physiological issue. This is the rationale behind the concept of the "physiologically difficult airway" in which the patient's cardiopulmonary status, and not just the anatomical aspect, is the determinant of risk for the procedure.

1.4 Drug selection

Another uncertainty is the choice of drugs. For neuromuscular blockade, a Cochrane systematic review including 50 trials and 4,151 patients found that succinylcholine had a greater effect than rocuronium in providing intubating conditions, but that this was not statistically different from rocuronium at 1.2 mg/kg and that the certainty of the evidence was rated as moderate [8]. Adrenal suppression when used as an induction agent has been a topic of debate regarding its use in patients who are critically ill. Etomidate-related adrenal suppression has been debated in critically ill patients. In a systematic review of randomised and observational studies, single-dose etomidate was not associated with increased mortality in sepsis.

Haemodynamic stability, speed of onset and duration of action all influence drug choice, and no single agent has been shown to be best for all patients [9].

1.5 Evolving practice

So practice has shifted from a fixed protocol that is applied to all patients. In modern practice, emphasis is given to predicting a decline in physiology, optimizing the patient before induction, optimizing drug selection and doses, and planning rescues beforehand, and this has led to the current usage of the term RSI to refer to a group of related practices rather than one procedure. This variation makes it difficult to compare studies and harder to apply the results of studies to the individual patient.

1.6 Cricoid pressure, guidelines, and laryngoscopy

The technique's long-established parts are also being reevaluated. A Cochrane review of cricoid pressure found one eligible randomised trial that showed no clinically relevant difference, and noted that non-randomised evidence indicates that RSI can be performed safely without it and suggested that it should be the subject of well-designed trials to resolve the issue [10]. Standards have developed separately. National guidance for unanticipated difficult intubation has been issued with only a single algorithm for both routine intubation and RSI, and has placed an emphasis on preparation, positioning, preoxygenation, maintaining oxygenation, limiting the number of interventions on the airway and the preference for video- or fiberoptic-guided intubation over blind techniques [11]. Separate guidance exists for failed and difficult intubation in obstetric practice. Although videolaryngoscopy is increasingly used, difficult intubation with direct laryngoscopy has been linked to more complications, and operator technique and preparation matter as much as the device [12].

1.7 Gap in the evidence

All these observations indicate that the information about RSI is limited. The studies are conducted in various settings, use various designs, definitions for the outcomes, and methodological quality, and the findings regarding any particular decision (e.g. the induction agent, the muscle relaxant, the laryngoscope, or the oxygenation strategy) are sometimes conflicting. As such, when clinicians work in emergency, critical care and anaesthetic settings, they are deprived of a single, critically appraised statement of what is known, what is uncertain and where further knowledge is needed. Definitions of outcomes, including hypoxaemia, hypotension and first-pass success, also differ between studies, which makes comparison harder.

1.8 Objective of the review

The aim of this systematic review is therefore to identify, appraise and synthesise the available evidence relating to RSI in acute care. It covers

induction agents, neuromuscular blocking agents, laryngoscopy and airway adjuncts, cricoid pressure and oxygenation strategies and their impact on first pass success, peri-intubation hypoxaemia, haemodynamic instability and other patient-centred outcomes. The review aims to gather all this evidence in one place to facilitate informed clinical decision-making, identify gaps in the literature, and help design future studies.

2. Methods

2.1 Search strategy

This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews (PRISMA 2020) statement. An initial exploratory search was run first to make sure pertinent research was not missed. The literature search was performed in the Scopus database on 28 September 2026. The terms "Rapid Sequence Intubation", "Airway Management" and "Emergency Medicine" were searched together in the Article title, Abstract and Keywords fields:

1. "rapid sequence intubation*"
2. "airway management"
3. "emergency medicine"

The following filters were applied: publication years 2015 to 2026, document type "Article", language English, and open access. The search identified **25 records**, which were exported as a CSV file. All records had a "Final" publication stage, and no duplicates were found. Reference lists of included articles were also hand-searched.

Records were screened against the PICOS criteria (population, intervention, comparison, outcome, and study design). Studies were selected according to the results of this screening.

2.2 Eligibility criteria

2.2.1 Inclusion criteria:

1. Original articles on rapid sequence intubation or emergency airway management in patients who require emergency intubation.
2. Guidelines and consensus statements (including clinical practice guidelines, Delphi studies and expert consensus documents) on emergency RSI or airway management.
3. Intubation in the emergency department, pre-hospital, trauma centre or emergency ICU as part of an emergency procedure, not in an elective operating room.
4. Reporting of 1 outcome or recommendation from the RSI practice or safety (first pass success, overall success, drugs/device(s) used, adverse events, quality indicators, recommended practice).

2.2.2 Exclusion criteria:

Narrative reviews without recommendations, editorials, letters, conference abstracts, animal/mankanin studies, and studies without data or recommendations for emergency RSI and airway management.

2.3 Data extraction

Data were extracted by two independent reviewers using a standardised data abstraction form, which included first author, year, country, document type and study design, setting, number of patients, population characteristics, indication for intubation, drugs (induction agents and neuromuscular blockers), devices, first pass and overall success, complications (hypoxia, hypotension, cardiac arrest, aspiration), quality improvement interventions, and main conclusions. The guidelines and consensus statements were extracted for guidelines and consensus statements, which were issued by the issuing body, developed by the method and the key recommendations.

2.4 Quality assessment

An appraisal tool was tailored to the design of each document. The following study types were assessed using the Newcastle–Ottawa Scale (NOS, maximum 9 stars: selection 4, comparability 2, outcome 3), cross sectional/diagnostic studies and surveys, quality improvement studies (QI-MQCS), the prospective before–after study with the JBI checklist for quasi-experimental studies, and guidelines/consensus statements. There were no RCTs identified, so RoB 2 was not required. The items were reduced to six domains for AXIS and QI-MQCS, rated as met Y or evidence of limitation N. The overall ratings were High, Moderate, or Low quality (NOS: ≥ 7 high, 5–6 moderate, ≤ 4 low). Each document was rated by two independent reviewers, and discrepancies between these ratings were resolved by a third reviewer. Findings were interpreted using quality ratings, but these ratings were not used to exclude studies.

2.5 Data synthesis

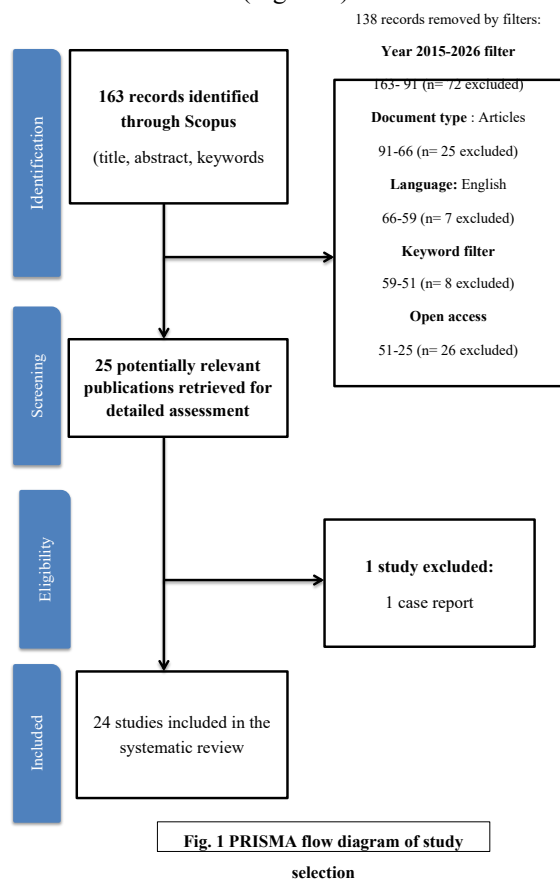
Due to variability in the designs, populations, interventions, and outcome definitions, meta-analysis was not performed. Findings were thus synthesized in a narrative manner following the guidelines of Synthesis Without Meta-analysis (SWiM). Documents were sorted by theme, and results summarized in tabular and text formats without the use of pooled estimates. The studies using the same institutional registry were marked off to prevent double counting.

3. Results

3.1 Study selection

The Scopus search identified 25 records. No duplicates were found. One record, a pediatric case report on tension pneumocephalus, was excluded at screening. Twenty-four documents were included. The Scopus search identified 163 records. After application of search limits (publication year 2015–2026, $n = 72$ excluded; document type "Article", $n = 25$; English language, $n = 7$; keyword, $n = 8$; open access, $n = 26$), 25 records remained. No duplicates were found. Twenty-five records were screened by title and abstract, and one (a paediatric case report on tension pneumocephalus) was excluded because it did not report emergency RSI

or airway management practice or outcomes. Twenty-four full-text documents were assessed, and all were included (Figure 1).



3. 2 Study characteristics

The 24 included documents were published between 2015 and 2026: 4 in 2026, 1 in 2025, 1 in 2024, 1 in 2023, 5 in 2022, 5 in 2021, 3 in 2020, 1 in 2019, 1 in 2018, 1 in 2016, and 1 in 2015. They came from 15 countries (United States 6, Saudi Arabia 2, Ireland 2, and one each from Australia, Canada, China, Colombia, France, Germany, India, Japan, South Africa, Thailand, Türkiye and the United Kingdom) plus two international expert panels. Table 1 summarises them. There were 6 cohort studies, 9 cross-sectional or descriptive studies including two surveys, 3 quality-improvement studies, 1 prospective before–after study, and 5 guidelines or consensus documents. Most were conducted in emergency departments. Three studies appear to draw on the same institutional continuous quality improvement (CQI) registry over overlapping periods (2007–2017, 2014–2018, and 2013–2015), so their patient populations may overlap.

Table 1. Characteristics of included documents (reference number in first column)

Ref	Study, country	Design; setting	N	Main findings
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13	Higgs 2018, UK	Clinical practice guideline (evidence + expert consensus); critically ill adults, all hospital locations	n/a	Modified RSI; emphasis on oxygenation and human factors; early videolaryngoscopy; second-generation supraglottic airway; scalpel–bougie–tube for front-of-neck access
14	Sakles 2019, USA	Prospective CQI registry, 10-year before–after; ED, adult RSI by EM residents	342 (year 1); 445 (year 10)	First-pass success (FPS) 73.1%→92.4%; adverse events 22.5%→14.4%; FPS without adverse events 64.0%→80.9%
15	Tazarourte 2022, France	Prehospital trauma flowcharts (cognitive aids, SFMU/SFAR); prehospital	NR	No abstract in Scopus; full-text extraction required

Rapid Sequence Intubation: Current Concepts in Acute Care - A Narrative Review of Contemporary Evidence and Practice

		al		
1 6	Pacheco 2021, USA	Prospecti ve CQI database, cohort; ED, adult RSI	1513	FPS without adverse events 92.4% (no difficult features), 82.1% anatomic, 81.7% physiologic, 70.9% both; aOR 0.37, 0.36, 0.19
1 7	Nakao 2015, Japan	Multicent re prospecti ve registry (JEAN), descriptiv e; 13 EDs, trauma	723	RSI initial method in 23.9%; success within ≤3 attempts 96%; first- attempt success 35.5–90.5% across EDs
1 8	Jishnu 2022, India	Prospecti ve observati onal; single tertiary ED	166	RSI 72.9%; FPS 78.3%; adverse events 58.4% within 15 min; post- intubation arrest ~5%
1 9	Saoraya 2021, Thailand	Retrospe ctive cohort from prospecti	220	≥1 difficult- airway predictor in 83.2%; LEMON-

		ve registry; academic ED		positive patients received fewer NMBAs (OR 0.46); FPS 74.3%
2 0	Kottmann 2022, Norway/S witzerland/ UK	Modified nominal group consensu s; prehospit al advanced airway managem ent	16 expe rts	17 quality indicators (3 structure, 9 process, 5 outcome)
2 1	Karamchan dani 2024, internation al	Delphi consensu s (7 rounds); critically ill adults, physiolog ically difficult airway	35 expe rts	Stable consensus on 53/61 statements (87%)
2 2	Sakles 2016, USA	Prospecti ve CQI cohort; ED, adult RSI	635	FPS without hypoxaemia : 82.1% with apnoeic oxygenation vs 69.0% without; aOR 2.2 (1.5–3.3)
2	Çorbacioğlu	Clinical	n/a	Recommen

Rapid Sequence Intubation: Current Concepts in Acute Care - A Narrative Review of Contemporary Evidence and Practice

3	u 2026, Türkiye	policy guideline (GRADE); ED		dations on preoxygenation, apnoeic oxygenation, bougie, push-dose vasopressors, ketamine with raised ICP
24	Lee 2026, Ireland	QI programme (PDSA cycles); single large ED	156 intubations (154 patients)	FPS 91.7%; complications 12.3%; targets (FPS >90%, complications <15%) maintained across four cycles
25	Umana 2022, Ireland	Multicentre prospective pilot audit; 11 EDs	118 patients (131 attempts)	FPS 89%; complications 19%; checklist 55%, VL 53%, bougie 64% at first attempts
26	Richter 2026, Germany	Multicentre prospective registry; 6 EDs	117	FPS 88.9%; complications 39% (hypotension 23.9%); FPS 92.5% with VL vs 88.2% with DL
27	Barnden 2026,	Retrospective	158	Median time to

	Australia	registry + EMR review; tertiary ED		post-intubation sedation 7.5 min (IQR 4.0–14.0); FPS 95.6%
28	Wilson 2020, USA	Retrospective quality review (aggregate level); ED	36,059 intubations with paralytics	Mortality 22/100,000 (succinylcholine) vs 90/100,000 (rocuronium/vecuronium); no patient-level linkage
29	Dean 2020, USA	Retrospective cohort; paediatric ED	NR in abstract	≥1 high-risk criterion: peri-intubation arrest 5.6% vs 0%; FPS 47.2% vs 66.1%; mortality 25% vs 2.3%
30	Bakhsh 2021, Saudi Arabia	QI initiative (retrospective data entry); academic ED	146	FPS 57.1%→80.0%; VL-adjusted OR 3.87 (1.13–13.23)
31	Bakhsh 2025, Saudi Arabia	Cross-sectional online survey; emergenc	491	81% reported conventional RSI; apnoeic

		y/critical care physicians		oxygenation 66.4%; waveform capnography 36.2%; head-up position 19.5%
32	Black 2023, Canada	Prospective quasi-experimental before–after; ED/critical care	630 (416 pre; 214 post)	FPS 73.1%→82.2%; oesophageal intubation 5.1%→0.5%
33	Naidoo 2022, South Africa	Cross-sectional questionnaire; COVID-19 intubation/extubation	135 intubations; 45 extubations	Desaturation 40.0%; fewer complications with fewer attempts and with checklists
34	Hawkins 2021, USA	Retrospective single-centre cohort; non-OR emergency intubation	406 (123 COVID-19 positive)	VL 91.1% vs 56.8%; FPS 89.4% vs 89.0%; desaturation 20.3% vs 9.9%
35	Muñoz 2021, Colombia	Retrospective descriptive cross-sectional;	401	FPS 90.5%; complications 9%

		ED		
36	Yang 2020, China	Retrospective single-centre; ED	128	FPS 93.8%; serious adverse events rare

ED, emergency department; VL, videolaryngoscopy; DL, direct laryngoscopy; NMBA, neuromuscular blocking agent; CQI, continuous quality improvement; PDSA, plan–do–study–act; NR, not reported; n/a, not applicable; aOR, adjusted odds ratio.

3.3 Quality assessment

Overall, 5 documents were rated high quality, 14 moderate and 4 low, and one could not be rated. Recurring limitations were single-centre design, retrospective data collection (eight studies), absence of a control group in the quality-improvement studies, no adjustment for confounding in three comparative cohorts, self-selected respondents in the two surveys, and possible overlap between three registry-based cohorts.

Cohort studies (Newcastle–Ottawa Scale)

Table 2. Risk-of-bias assessment of cohort studies (NOS)

Study	Selection (0–4)	Comparability (0–2)	Outcome (0–3)	Total (0–9)	Quality	Main concerns
Pac hec o 2021	3	2	2	7	High	Single-centre; operator-recorded difficulty features
Sao raya 202	2	2	2	6	Moderate	Retrospective;

1						complete records only
Sakles 2016	3	2	2	7	High	Non-randomised adoption of apnoeic oxygenation; single centre
Wilson 2020	2	0	2	4	Low	Aggregate data; no adjustment; no patient-level linkage
Deaton 2020	3	0	2	5	Moderate	Small numbers; unadjusted; criteria tested in derivation cohort
Howki	2	0	2	4	Low	Untested

ns 2021						patients used as controls; unadjusted; pandemic period
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Cross-sectional, descriptive and survey studies (AXIS, condensed)

Table 3. Quality assessment of cross-sectional and descriptive studies (AXIS domains)

Study	Aims and design	Sampling	Sample size justified	Data collection	Analysis	Selection / non-response bias	Quality
Nakao 2015	Y	Y	?	Y	Y	?	High
Jishnu 2022	Y	?	?	Y	Y	N	Moderate
Uma 2022	Y	Y	N	Y	Y	?	Moderate
Richter 2026	Y	Y	?	Y	Y	?	Moderate
Bar	Y	?	?	Y	Y	N	Mo

nde n 202 6							dera te
Ba khs h 202 5	Y	N	?	?	Y	N	Lo w
Nai doo 202 2	Y	N	?	?	Y	N	Lo w
Mu ñoz 202 1	Y	Y	?	?	Y	N	Mo dera te
Ya ng 202 0	Y	Y	?	?	Y	N	Mo dera te

Y, criterion met; N, limitation evident; ?, cannot be judged from the abstract.

Quality-improvement studies (QI-MQCS, condensed)

Table 4. Quality assessment of quality-improvement studies (QI-MQCS domains)

St ud y	Rati onal e and inter vent ion	Desi gn / com para tor	D at a so ur ce an d tim ing	Out co mes defi ned	Sus tai ned / spr ead	Lim itati ons disc usse d	Qu alit y
Sa kl es	Y	N	Y	Y	Y	?	Mo der ate

20 19							
Le e 20 26	Y	N	Y	Y	Y	?	Mo der ate
Ba kh sh 20 21	Y	N	?	Y	?	?	Mo der ate

Prospective before–after study (JBI quasi-experimental checklist)

Table 5. Appraisal of Black 2023 (ref. 31) with the JBI quasi-experimental checklist. Provisional overall quality: Moderate

Criterion	Rating	Basis (abstract)
Cause and effect clearly stated	Y	Protocol introduction (exposure) precedes outcomes
Participants in comparisons similar	?	Pre/post case-mix not reported in abstract
Same co-interventions in both periods	N	Concurrent pandemic-related practice changes likely
Control group present	N	Before–after design; no concurrent control
Multiple pre/post outcome measurements	?	Not stated in abstract
Follow-up complete / differences described	?	Not stated in abstract
Outcomes measured identically	Y	Consecutive prospective data collection

Outcomes measured reliably	?	Full text required
Appropriate statistical analysis	Y	Group comparison tests reported

Guidelines and consensus statements (AGREE II)

Table 6a. AGREE II appraisal of guidelines and consensus documents

Document	Type	Development signals in the abstract	Provisional rating
Higgs 2018	Guideline	Evidence-based where available, supplemented by expert consensus; algorithm; responds to NAP4	Moderate
Tazarourte 2022	Cognitive aid / guideline	Abstract unavailable; full text required	Not rated
Kottmann 2022	Consensus (nominal group)	16 international experts; 3 email rounds + meeting; usability tested against NQF criteria; not a guideline in the strict sense	Moderate

Karamchandani 2024	Consensus (Delphi)	Steering committee incl. Delphi methodology; 35-expert panel; 7 rounds; 53/61 statements reached consensus	High
Çorbacıoğlu 2026	Guideline (GRADE)	Research committee; systematic literature reviews; GRADE; five clinical questions	High

Table 6b. Summary of quality ratings by appraisal tool

Tool	Documents	High	Moderate	Low	Not rated
Newcastle–Ottawa Scale (cohort)	6	2	2	2	0
AXIS (cross-sectional/descriptive)	9	1	6	2	0
QI-MQCS (quality improvement)	3	0	3	0	0
JBIC quasi-experimental	1	0	1	0	0
AGREE II (guidelines/consensus)	5	2	2	0	1

Total	24	5	14	4	1
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3.4 Synthesis of findings

3.4.1 Practice patterns and outcomes in emergency airway registries

Seven descriptive registry or record-based studies described emergency intubation in Japan, India, Ireland, Germany, Australia, Colombia and China. RSI was the most frequent method in India (72.9%) and Germany (77.8%, with delayed sequence intubation in 21.4%). In Japanese trauma patients, it was the initial method in 23.9% overall and 35.5% of those without cardiac arrest, and its use varied from 0% to 50.9% between EDs. First-pass success was 78.3% in India, 88.9% in Germany, 89% in the Irish pilot, 90.5% in Colombia, 93.8% in China, and 95.6% in Australia. In Japan, first-attempt success ranged from 35.5% to 90.5% across EDs, although success within three attempts was 96%. Complication rates differed even more: 9% in Colombia, 19% in Ireland, 39% in Germany (hypotension 23.9%), and 58.4% within 15 minutes of intubation in India (desaturation, right mainstem intubation, equipment failure; post-intubation cardiac arrest about 5%). Definitions and observation windows were not uniform, so these figures are not directly comparable. Etomidate with rocuronium predominated in India, and ketamine (75.9%) with rocuronium (95.6%) in Australia. In Ireland, checklists, videolaryngoscopy and a bougie were used in 55%, 53% and 64% of first attempts; in Germany, videolaryngoscopy was used in 34.2% of intubations and had higher first-pass success than direct laryngoscopy (92.5% vs 88.2%).

3.4.2 Difficult airways

In a cohort of 1513 adult RSIs, first-pass success without adverse events was 92.4% with no difficult-airway features, 82.1% with anatomically difficult features, 81.7% with physiologically difficult features, and 70.9% with both. The adjusted odds ratios were 0.37 and 0.36 for anatomic and physiologic difficulty, and 0.19 for both. In a Thai cohort of 220 patients, 83.2% had at least one difficult-airway predictor; patients with LEMON-positive features received fewer neuromuscular blocking agents (OR 0.46, 95% CI 0.24–0.87) but had similar first-pass success and complications, and LEMON predicted unsuccessful first pass poorly. In a paediatric ED, children meeting at least one high-risk physiological criterion had more peri-intubation cardiac arrest (5.6% vs 0%), lower first-pass success (47.2% vs 66.1%) and higher in-hospital mortality (25% vs 2.3%). An international Delphi panel reached consensus on 53 of 61 statements, including a head-elevated position, routine videolaryngoscopy at the first attempt, preoxygenation with non-invasive ventilation, hemodynamic optimisation, use of a checklist, and an intubation team of at least three, including two operators.

3.4.3 Peri-intubation practices and drug choice

Apnoeic oxygenation was used in 59.8% of 635 adult RSIs and was associated with higher first-pass success without hypoxaemia (82.1% vs 69.0%; difference 13.1%, 95% CI 6.2–19.9; adjusted OR 2.2, 95% CI 1.5–3.3). A quality review of 36,059 ED intubations with paralytics (2013–2018) found crude mortality of 22 per 100,000 with succinylcholine and 90 per 100,000 with rocuronium or vecuronium; the authors could not link events to drugs at patient level and concluded that the data did not support removing succinylcholine. The median interval between paralysis and post-intubation sedation or analgesia was 7.5 minutes (IQR 4.0–14.0) in an Australian ED. Surveys showed variable practice: in Saudi Arabia, 81% of physicians reported conventional RSI; propofol (38.9%) and etomidate (32.2%) were the preferred induction agents in stable patients; apnoeic oxygenation was used by 66.4%; the head-up position by only 19.5%; and waveform capnography by 36.2%. Among South African clinicians intubating COVID-19 patients, propofol was used in 66.7% and was associated with fewer complications, as were fewer attempts and checklist use.

3.4.4 Quality improvement, protocols and governance

Three of the four studies that evaluated a structured programme reported improved first-pass success, and the fourth maintained it above its 90% target. A 10-year airway CQI programme raised first-pass success from 73.1% to 92.4% (difference 19.3%, 95% CI 14.0–24.6), lowered adverse events from 22.5% to 14.4%, and raised first-pass success without adverse events from 64.0% to 80.9%. A Saudi initiative built on a standard RSI guideline and intubation note raised first-pass success from 57.1% to 80.0%, with videolaryngoscopy (adjusted OR 3.87) and a good Cormack–Lehane view (adjusted OR 7.88) independently associated with success. An Irish governance programme (airway lead, registry data capture, checklists, videolaryngoscopy with recording, daily drills and competency sign-off) kept first-pass success above 90% and complications below 15% across four PDSA cycles. A COVID-19 intubation protocol raised first-pass success from 73.1% to 82.2% and lowered oesophageal intubation from 5.1% to 0.5%. All were uncontrolled or before–after designs, so secular trends and co-interventions cannot be excluded.

3.4.5 Guidelines and consensus statements

There were 5 documents used for guidance. The UK guidance for critically ill adults recommends a modified rapid sequence intubation with the screen visible to the whole team, ensuring oxygenation is prioritised, second-generation supraglottic airways for rescue, a scalpel–bougie–tube approach for front-of-neck access, and human factors. The 2026

Turkish policy incorporated GRADE to address five questions: preoxygenation strategies; apnoeic oxygenation; the bougie; push-dose vasopressors and ketamine for patients at risk of raised ICP. Fourteen quality indicators were generated during a nominal group process for prehospital advanced airway management (3 structure, 9 process, 5 outcome). The French prehospital trauma flowcharts were not characterised as they lacked an abstract in the Scopus database.

4. Discussion

The objective of this systematic review was to compile 24 documents between 2015 and 2026 that addressed rapid sequence intubation (RSI) and emergency airway management. They included six cohort studies, nine cross-sectional or descriptive studies, three quality-improvement (QI) studies, one prospective before-after study, and five guidelines or consensus statements from 15 countries and two international expert panels. There was no evidence from RCTs. The studies were not similar in design, population, or outcome definitions, so the results were synthesized in a narrative manner. The overall quality was moderate (5 high, 14 moderate, 4 low, and 1 not rated). The descriptive registries had 78.3% to 95.6% first-pass success rates and reported rates of complications ranged from 9 to 58.4%. As the anatomical and physiological difficulties increased, so did the rate of first pass success. In non-randomised comparisons, apnoeic oxygenation and videolaryngoscopy were linked to better first-pass results. The use of structured QI programmes led to a modest increase of approximately 9-23 percentage points or to keep the first-pass success above 90%.

Emergency RSI is carried out with minimal time, limited information regarding the patient, and operators of varying experience; therefore, success on the first attempt is important, as there is not much leeway for repeated laryngoscopy, as patients' physiology is limiting. As shown in the registries in this review, this margin is used in a variety of different ways across services. Of the six services that reported first pass, the average was about 89% to 96%. A Saudi emergency department (ED) began at 57.1%, and in Japanese trauma centres, the rate of success in the first attempt ranged from 35.5% to 90.5% across the EDs, with 96% of patients being intubated within three attempts. This difference may be due to variation in case mix, equipment, etc., and definitions of success among operators and should not be used as a single benchmark.

Comparable complication rates were more difficult. In Colombia, the rate of desaturation was 9%; right mainstem intubation was counted; and in Germany, about 39% desaturated within 15 minutes, with equipment failure and cardiac arrest after intubation counted in about 5% of cases. These differences

were not standardized for observation windows or definitions, and were therefore due to part of the procedure being measured, but not necessarily how safely it was performed. Despite this, the incidence of hypotension in the German registry and of arrest in India indicates that a high first-pass success rate (90%+) can be coupled with a significant incidence of physiological damage. This is in keeping with the outcome of several of the studies included, which was defined as first-pass success without adverse events or hypoxaemia, as a more meaningful goal than first-pass success.

Grading of difficulty was clearly given. The odds of successful first pass without events were 0.37, 0.36 and 0.19 for adults with no difficult features, anatomically difficult features and both difficult features, respectively (adjusted odds ratios). Physiological as well as anatomical difficulty posed a threat, and the two combined were the most hazardous. Children were found to be the same. The individuals who met at least one of the high-risk physiological criteria experienced more peri-intubation cardiac arrest (5.6% vs 0%), less first-pass success (47.2% vs 66.1%), and increased in-hospital mortality (25% vs 2.3%). Anatomical difficulty prediction was disappointing. Of the patients, 83.2% of patients in a Thai cohort had at least one DAP and the patients with DAP were administered fewer NMBAAs, however, LEMON poorly predicted an unsuccessful first pass in these patients. The results confirm the priority of the international Delphi panel on positioning the head, preoxygenation with non-invasive ventilation, and haemodynamic optimisation of the physiologically challenging airway. They recommend that a patient's physiology as well as anatomy should be assessed prior to induction.

Better outcomes were seen with oxygenation strategies, but this was not proven. Apnoeic oxygenation was associated with the acquisition of first-pass success without hypoxaemia in 82.1% of patients in the ED compared with 69.0% (adjusted OR 2.2, 95% CI 1.5–3.3). Preoxygenation and apnoeic oxygenation are GRADE questions in the Turkish policy, whereas oxygenation is a high priority in the UK guideline. This cohort, however, was single-centre and not randomised, and therefore cannot be considered as evidence of effect. There was also a lack of consensus regarding practice. The survey of Saudi emergency and critical care physicians revealed that only 66.4% used apnoeic oxygenation, 36.2% used waveform capnography, and 19.5% used the head-up position. It was a self-selected sample of respondents and a low-quality survey.

No pharmacological comparisons were made; rather, drug choice was described. Etomidate with rocuronium was preferred in India, followed by ketamine (75.9%). With rocuronium (95.6%), propofol (38.9%), and etomidate (32.2%) were

preferred for stable patients in Saudi Arabia. This review does not rank the induction agents or the neuromuscular blockers, as none of the studies included in this review compared them with the clinical outcome in a controlled manner. The largest dataset (36,059 ED intubations, of which 22 were with succinylcholine, and 90 were with either rocuronium or vecuronium) revealed crude mortality rates of 22 per 100,000 with succinylcholine and 90 per 100,000 with rocuronium or vecuronium. No adjustment was made; however, events could not be attributed to drugs at the patient level, and the study was rated low quality. Its authors concluded that it is incorrect to remove succinylcholine, as the difference is probably due to the patients whose removal the drugs was intended for. Two other observations have to be mentioned. Firstly, the median time from paralysis to post-intubation sedation/analgesia in an Australian ED was 7.5 minutes (IQR 4.0–14.0). That raises the question of whether the patients were sufficiently sedated during paralysis — especially since 95.6% of the time, rocuronium was used. Second, the use of propofol was correlated with fewer complications among the South African clinicians who were intubating COVID-19 patients, but this was a low-quality survey. Among the various risks due to drug use, hypotension, identified as the primary risk in the German registry, was the major risk factor that could not be clarified by the included studies. The questions that the Turkish policy addresses on the use of push-dose vasopressors and on ketamine for raised ICP indicate areas of guidance development.

In several settings, videolaryngoscopy (VL) was correlated with success. In the Saudi QI program, VL was an independent predictor of first-pass success (adjusted OR 3.87, 95% CI 1.13–13.23). The first-pass success rate in the German registry was 92.5% for VL and 88.2% for direct laryngoscopy. Early or routine VL was recommended by both the UK guideline and the Delphi panel. By comparison, among 406 emergency intubations outside the operating room, the use of VL was significantly higher among patients with COVID-19 (91.1% of COVID-19-positive patients vs 56.8% of untested patients). The success in the first pass was very similar (89.4% vs 89.0%), and desaturation was more common (20.3% vs 9.9%). The potential for VL might therefore be higher where the baseline is low, such as in the Saudi ED, which began at 57.1%, and lower where services are already high performing. It may also be influenced by the type of use of the device, as checklists, bougie use and team communication were a component of the programmes described with VL. Even the prospective audits showed low uptake of these (VL 53%, bougie 64% on first attempts)

The most regular signal was from QI programmes. A 10-year airway QI programme in a US ED increased the proportion of first-pass success (by 19.3%, 95% CI 14.0–24.6) and raised the proportion of first-pass success without adverse events (by 16.9%, 95% CI 12.4–21.4). Application of a standard RSI guideline and intubation note by a Saudi initiative has led to a significant improvement in the first-pass success rate from 57.1% to 80.0%. A COVID-19 intubation protocol increased its success rate to 82.2% and reduced oesophageal intubation from 5.1% to 0.5%. The programme of governance (airway lead, data capture in registry, checklists, VL with recording, daily checks and competency sign-off) maintained first-pass success over 90% and complications under 15% in four PDSA cycles in Ireland. The common characteristics of these programmes are the standardisation of the procedure, the checklist or intubation note, the measurement with feedback, and the training. This is similar to what was recommended in consensus statements, which recommended an intubation team of at least 3, two of whom were operators, as well as a checklist; and the nominal group that identified 17 quality indicators, with 3 being structural, 9 process, and 5 outcome. It is also consistent with the lower complication rates of the South African clinicians who used checklists and who had fewer attempts. In all of these studies, however, there was no control or before–after design. There are no rules against secular trends or co-interventions, and there is no way to determine which of the various components of any of the bundles caused the benefit.

Guidelines and consensus documents are aligned. The recommended approach for RSI in the UK is to prioritise oxygenation, to try to use a second-generation supraglottic airway to facilitate rescue, to use a screen to show the whole team (pre-VL), and to use the scalpel–bougie–tube approach for accessing the front of the neck. Attention to human factors is also recommended. The Delphi panel agreed on 53 out of 61 statements (87%), and the Turkish policy used GRADE to assess five clinical questions. Consensus, however, is not the same as evidence. The recommendations are largely based on expert opinion and on observation, and no randomised trial could be identified for this review. No abstract was found, and so one document (the French prehospital trauma flowcharts) could not be characterised. Evidence on special groups was also extremely poor, consisting of only one paediatric ED cohort and two poor quality COVID-19 studies.

4.1 Strengths and limitations

There are a number of caveats to be noted. A first is that only one database (Scopus) was searched with three broad terms and that only open access, English-language articles published in the last 12 years (2015–2026) were included. Important

research studies that are not in English, not available for free in the public domain, and/or published in journals not indexed in this database may not have been identified. A search of the publications from 2026 may have missed some of the indexing. Second, there was no description of randomised trials found and there was variation across the documents in terms of design, setting and outcome definitions. Pooled estimates could therefore not be calculated, and comparisons between studies (e.g., complication rates) are descriptive. Third, most of the studies were conducted at a single centre, eight studies were retrospective, and the QI studies lacked a control group. Fourth, the three registry-based cohorts seem to overlap in terms of patient numbers from the same institution across the same time period, suggesting an overestimation of consistency. Quality appraisal was in part done based on abstracts (No. 5). Several items were only judged as being unclear; no AGREE II domain scores could be calculated for one document, and one was not rated at all. Lastly, most studies were performed in EDs, and six of the 24 documents were from the U.S.; findings may not be directly applicable to prehospital, intensive care, or resource-limited settings. However, this review has some advantages. It comprised real-world studies, guidelines and consensus statements; included appraisal tools which were matched to each design; and included SWiM reporting with identification of potential patient overlap. There is a need for multicentre prospective studies that have standardised definitions of first-pass success, hypoxaemia, hypotension and adverse events. So are randomised controlled trials of drugs, devices, and oxygenation strategies to determine which aspects of RSI are beneficial to the patient.

5. Conclusions

Twenty-four documents were published in the years 2015–2026 and included in this review, which showed a large range in first-pass success for emergency RSI (35% to 96% across the studies and sites) and in reported complications (9% to 58.4%). The first-pass success rate decreased with increasing anatomical/physiological difficulty. The use of apnoeic oxygenation and of videolaryngoscopy was correlated with improved first-pass success in non-randomised comparisons. All were uncontrolled or before–after, quality-improvement programmes, which involved the addition of standardisation, checklists, training and feedback, increased or sustained first-pass success at levels greater than 90%. The recommendations and consensus statements included highlighted oxygenation, videolaryngoscopy and teamwork, and are largely based on expert opinion. Comparisons of induction agents and neuromuscular blockers were not possible. The conclusions are restricted by the limited search

(one database, open access limits) and abstract-level appraisal (if not corrected), as well as registry data which overlap and the exclusion of randomised trials that do not fulfil the search criteria. More multicenter prospective studies with uniform definitions of outcomes are required, and a synthesis should be conducted that incorporates other randomized trials.

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