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Impact of Anesthesia Training on Knowledge and Practice of Rapid Sequence Intubation Among Emergency Physicians: a Survey Study.

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Running head: Knowledge of Rapid Sequence Intubation in the Emergency Department: a practice survey.

Key words: Rapid Sequence Intubation; Emergency department; Anesthesia training; Emergency airway management; Emergency anesthesia; Neuromuscular Blocking Agents; Emergency medicine Education

Word Count : 3388

Abstract

Background: Rapid sequence intubation is a critical procedure in emergency medicine designed to secure the airway promptly while minimizing the risk of aspiration. However, the level of knowledge regarding rapid sequence intubation and its associated medications varies among physicians.

Methods: A practice-based survey was conducted across emergency departments in French-speaking Belgium. Physicians with and without anesthesia training were compared with respect to knowledge of rapid sequence intubation, clinical practice patterns, and pharmacologic understanding. Self-reported data were analyzed using descriptive statistics, Student's t-test, and Fisher’s exact test.

Results: A total of 101 complete responses were analyzed. Succinylcholine was the primary neuromuscular blocking agent used. Nevertheless, its contraindications and adverse effects were poorly understood. Anesthesia training was associated with broader self-reported pharmacologic knowledge, greater familiarity with rapid sequence intubation principles, and with alternatives such as rocuronium and sugammadex.

Conclusion: Anesthesia exposure may contribute to improve emergency physicians’ understanding and safe application of rapid sequence intubation. Anesthesia rotations might be beneficial in promoting more standardized and improved clinical practice.

Background

Airway management is a critical skill in emergency medicine [1, 2], in which intubation carries a high risk of hemodynamic destabilization due to reduced physiological reserves [1, 3, 4]. Rapid sequence intubation (RSI) is the most commonly used technique [2, 5, 6] and represents the standard of care for critically ill patients [3, 7, 8, 9]. The primary objective of RSI is to minimize the risk of aspiration by shortening the interval between the loss of induction-induced protective airway reflexes and successful endotracheal tube placement [9, 10]. Contemporary RSI involves a bundle of interventions and requires drugs with specific pharmacokinetic properties [5] , such as rapid onset. The use of NMBA is strongly recommended [3, 8, 10-13] because it decreases pharyngeal and laryngeal trauma, improves intubation conditions, and increases first-pass success (FPS) rates [5, 10, 12-14]. FPS rates with NMBA use range from 72–95%, compared with 22–78% in the absence of NMBAs [8].

Current evidence from meta-analyses and clinical guidelines indicates that succinylcholine and rocuronium provide equivalent intubation conditions with similar FPS rates, thereby establishing both as recommended agents for RSI [3, 8-10, 13].

Practice patterns regarding the use of NMBAs appear to be heterogeneous and insufficiently documented among Belgian emergency physicians. Therefore, the aim of this study was to assess emergency physicians’ self-reported knowledge of RSI and to examine the rationale underlying their choice of

NMBAs. To address this objective, a practice-based study was conducted in emergency departments across French-speaking Belgium to evaluate knowledge of RSI and NMBAs. The focus was placed on Belgian practice due to the heterogeneity of emergency medicine training across Europe. The primary objective of this study was to determine whether formal anesthesia training influences clinicians' knowledge and clinical practice. Indeed, successful intubation depends not only on laryngoscopy skills but also on mastery of the entire RSI process [15].

Methods

This study was conducted as a practice-based survey. The aim of this study was to quantitatively analyze trends, practice habits, and knowledge regarding NMBA use during RSI among emergency physicians and to evaluate their understanding of the RSI procedure. Participants were eligible if they were at least in their third year of emergency medicine training or practicing as emergency physician in French-speaking emergency departments. No formal exclusion criteria were applied.

Formal anesthesia training was defined as any structured rotation in an anesthesiology department during postgraduate training lasting a minimum of three months. No information regarding the exact number of airway procedures performed during anesthesia rotations was collected which may have resulted in heterogeneity within the exposure group.

The questionnaire was developed by the authors. The document was reviewed internally, but no formal validation or pilot testing was conducted, thereby limiting the study's internal validity. The questionnaire consisted of 52 questions divided into five sections: demographics, intubation practice, rapid sequence intubation, succinylcholine, and rocuronium. It included yes/no questions, multiple-choice questions, and predominantly open-ended questions requiring written responses. The questionnaire took approximately 20 minutes to complete. All data were self-reported. The complete questionnaire is provided as Supplementary material.

The survey was distributed using a pyramid distribution strategy whereby departments heads disseminated the questionnaire to emergency physicians within their department.

Statistical analysis

Results were analyzed for the overall population and stratified according to prior anesthesia training. As multiple responses were possible, data are presented as absolute values and as percentages of the total responses.

Given the nature of the study, based on self-reported data, and sample size, analyses were primarily descriptive and based on unadjusted comparisons. No multivariable adjusted analyses were performed.

A statistical comparison between the two groups was performed. *Student's t-test* was used to analyze differences in means for quantitative variables,

whereas *Fisher's exact test* was used to assess differences in proportions. A *p-value < 0.05* was considered statistically significant.

Results

Results are presented descriptively for the overall cohort and stratified according to prior anesthesia training. The study, conducted via *LimeSurvey*, was launched online on March 15, 2022, and closed on September 15, 2023. All participants were informed about the study objectives and the anonymous use of their data. Completion of the questionnaire implied consent to participate.

Given the methodology used, which relied on a pyramid distribution through department heads, the exact number of survey distributions is unknown and a response rate could not be calculated, introducing a risk of selection bias. A total of 101 complete responses were included in the final analysis (Figure 1).

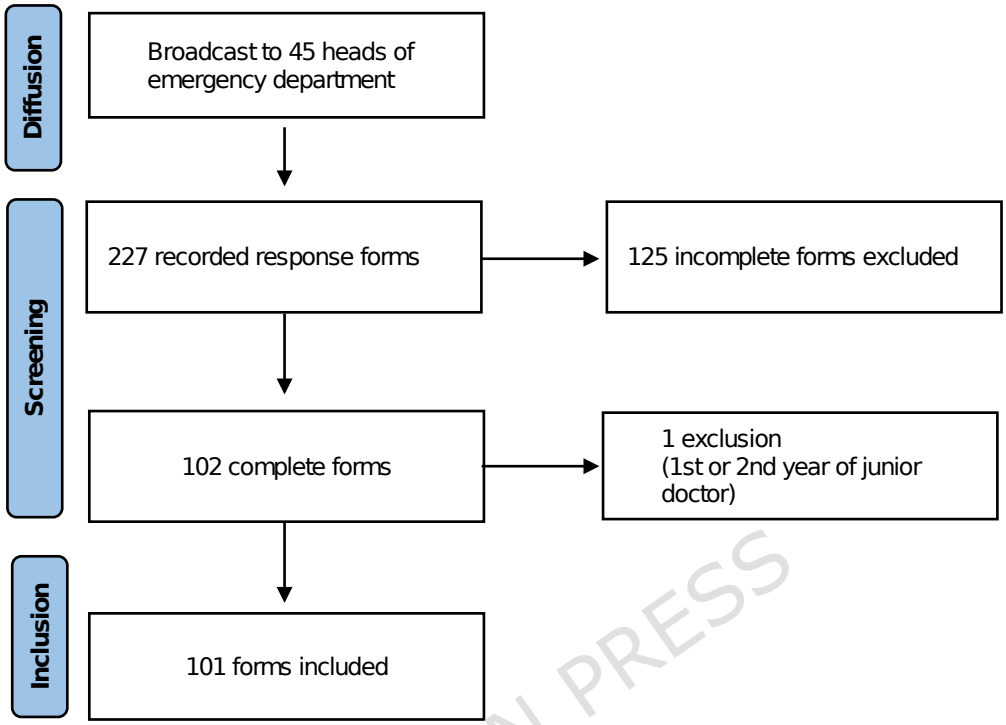

Figure 1. flowchart

The final study sample consisted of 38 women and 63 men. The cohort had a mean age of 40.78 years [28–62] and a mean professional experience of 13.46 years [0–34]. A key differentiating factor was that 55% (n = 56) of respondents had completed formal anesthesia training during their specialization.

Emergency physicians self-reported performing a mean of 3.56 intubations per month [0-20]. Respondents reported a mean of 0.83 failed first-attempt intubations per month [0-2]. Physicians with anesthesia training reported a higher mean number of intubations per year; however, this difference was not statistically significant ($p = 0.09$). There was a non-significant trend toward a

higher mean FPS rate for anesthesia-trained physicians (80.3% vs. 70.75%, p = 0.07). FPS rates were calculated from self-reported data provided by the participants.

Primary objective of RSI is to minimize the risk of aspiration by shortening the time between the loss of induction-induced protective airway reflexes and successful endotracheal tube placement [9, 10]. However, only 61% of respondents identified this as the purpose of RSI. The proportion was higher among physician with prior anesthesia training (70% vs. 50%, p = 0.04). Rapid airway protection and rapid achievement of optimal intubation conditions were also identified as goals of RSI (33% and 26%, respectively; see Table 1).

From a pharmacological perspective, 60% recognized the use of rapid-onset medications as a key principle of RSI, whereas 20% highlighted the importance of short-acting agents, and nearly 10% cited the use of rapidly reversible agents in cases of intubation failure. 3% reported never using an NMBA. The medications used are listed in Table 1.

Rapid Sequence Intubation	Global		Training with anesthesia		Training without anesthesia		p-value**
What is the purpose of RSI?							
Avoid gastric content aspiration	62	61,00%	43	77,00%	19	42,00%	0.0005
Quickly secure airways	33	33,00%	18	32,00%	15	33,00%	NS
Rapid achievement of intubation condition	26	26,00%	14	25%	12	27,00%	NS
Short-acting / curarization	11	11	4	7,00%	7	16,00%	NS
Avoid desaturation/limit Apnea	10	10,00%	5	9,00%	5	11,00%	NS
Avoid ventilation	7	7,00%	5	9,00%	2	4,00%	NS
Intubation of the unconscious/unstable patient	5	5,00%	2	4,00%	3	7,00%	NS
What is the medicinal principle of RSI?							
Drug with rapid action kinetics	61	60,00%	41	73,00%	20	44,00%	0.0043
Medications with a short duration	20	20,00%	12	21,00%	8	18,00%	NS
Medications with rapid reversibility in case of failure	10	10,00%	1	2%	9	20,00%	0.0046
Medications injected without titrations / by bolus	7	7	6	11,00%	1	2,00%	NS
Achieving the best intubation conditions	6	6,00%	3	5,00%	3	7,00%	NS
Use of hypnotics/sedatives and curares	47	47,00%	24	43,00%	23	51,00%	NS
Analgesic use	9	9,00%	6	11,00%	3	7,00%	NS
What drugs do you use in RSI?							
Etomidate	89	88,00%	48	86%	41	91,00%	NS
Succinylcholine	86	85,00%	49	87,50%	37	82,00%	NS
Ketamine	38	38,00%	28	50,00%	10	22,00%	0.0068
Rocuronium	31	31,00%	27	48,00%	4	9,00%	0.000023
Analgesic (Sufentanil-fentanyl)	26	26,00%	19	34,00%	7	15,50%	0.0416
Midazolam	21	21,00%	13	23,00%	8	18,00%	NS
Propofol	19	19,00%	17	30,00%	2	5,00%	0.0008

Table 1. *Practice and Medications Used During Rapid Sequence Intubation. RSI: Rapid Sequence Intubation, NS: Not Significant*

***Fisher's Exact Test.*

Succinylcholine was the primary NMBA used for RSI. Its use was more frequently reported among physicians without anesthesia training (92% vs. 73%, p = 0.02). More than 50% of respondents preferred succinylcholine because of its short duration of action, whereas 45% favored it because of its rapid onset (Table 2). The mean succinylcholine dose was 2.16 mg/kg [0.6–100], with a median dose of 1 mg/kg [0.6–100]. The reported mean onset time was 64.43 s [15–300], and the estimated mean duration of action was 8.2 min [1–60] (Table 2). Extreme reported values likely reflect misunderstanding or reporting errors and should be interpreted with caution.

Succinylcholine	Global [range]		Training with anesthesia [range]		Training without anesthesia [range]		p-value*
Mean dose of succinylcholine in RSI (mg/kg)	2,16 [0.6-100]		2,91 [1-100]		1,22 [0,6-10]		NS
Median dose of succinylcholine in RSI (mg/kg)	1 [0.6-100]		1 [1-100]		1 [0,6-10]		
What is the average onset of action of succinylcholine? (sec)	64,43 [15-300]		57,8 [15-300]		72,66 [15-300]		0.0449
What is the median onset of action of succinylcholine? (sec)	60 [15-300]		60 [15-300]		60 [15-300]		
What is the average duration of action of succinylcholine? (min)	8,2 [1-60]		7,37 [2-30]		9,22 [1-60]		NS
What is the median duration of action of succinylcholine? (min)	6 [1-60]		6,5 [2-30]		5 [1-60]		
Succinylcholine	Global (n=101)		Training with anesthesia (n=56)		Training without anesthesia (n=45)		p-value**
In what proportion do you use succinylcholine?							
Always succinylcholine	47	46,50%	19	34,00%	28	62,00%	0.0054
Succinylcholine in over 75% of RSI	38	37,50%	26	46,00%	12	27,00%	0.0623
Succinylcholine in 50-75% of RSI	8	8,00%	6	11,00%	2	4,50%	NS
Succinylcholine in less than 50% of RSI	3	3,00%	1	2,00%	2	4,50%	NS
Never succinylcholine	5	5,00%	4	7,00%	1	2,00%	NS
Why do you preferentially use succinycholine?							
Short duration of action	52	51,50%	27	48,00%	25	55,50%	NS
Fast action	46	45,50%	29	52,00%	17	38,00%	NS
Habit	37	36,50%	13	23,00%	24	53,00%	0.0033
Safety given the short duration if intubation failure occurs	20	20,00%	9	16,00%	11	24,50%	NS
Recommendation / protocols	10	10,00%	6	11,00%	4	9,00%	NS
Evaluation by fasciculations	9	9,00%	8	14,00%	1	2,00%	0.0404
Do you use any other curares besides succinylcholine?							
Yes	80	79,00%	52	93,00%	28	62,00%	0.0002
No	21	21,00%	4	7,00%	17	38,00%	0.0002
What are other NMBA for RSI?							
Rocuronium	84	83,00%	52	93,00%	32	71,00%	0.0063
Cisatracurium	13	13,00%	5	9,00%	9	20,00%	NS
No other curares	8	8,00%	4	7,00%	4	9,00%	NS
Others	5	5,00%	4	7,00%	1	2,00%	NS

Table 2. *Use and Knowledge of Succinylcholine in Rapid Sequence Intubation. RSI: Rapid Sequence Intubation, NS: Not Significant.*

**T-student, **Fisher's Exact Test.*

21% of respondents reported never using any alternative to succinylcholine; of these, eight of nine respondents who were unaware of alternatives lacked anesthesia training. Contraindications to succinylcholine use were the primary reason for selecting alternative NMBAs.

Among the 80 physicians who used rocuronium, 60% used it exclusively in cases of succinylcholine contraindications. The mean number of reported succinylcholine contraindications across respondents' careers was 4.2 [0–60], whereas 36% reported never encountering any contraindication. The mean rocuronium dose used during RSI was 1.3 mg/kg [0.4–20], with a median dose of 1 mg/kg [0.4–20]. The reported mean onset time for rocuronium was 105.21

s [30–600], with a median onset time of 60 s [30–600]. The estimated mean duration of action was 47.79 min [1–120] (Table 3).

Rocuronium	Global [range]		Training with anesthesia [range]		Training without anesthesia [range]		p-value*
Mean dose of rocuronium in RSI (mg/kg)	1,3 [0,4-20]		1,44 [0,5-20]		1,12 [0,4-2]		NS
Median dose of rocuronium in RSI (mg/kg)	1 [0,4-20]		1,2 [0,5-20]		1 [0,4-2]		
What is the average onset of action of rocuronium (sec)	105,21 [30-600]		89,16 [30-300]		124,9 [30-600]		0.0397
What is the median onset of action of rocuronium (sec)	60 [30-600]		60 [30-300]		90 [30-600]		
What is the average duration of action of rocuronium (min	47,79 [1-120]		47,7 [1-120]		47,88 [2-120]		NS
What is the median duration of action of rocuronium (min	45 [1-120]		45 [1-120]		50 [2-120]		
CI meeting on the use of succinylcholine (average)	4,20 [0-60]		5,73[0-60]		2,3 [0-15]		0.0493
Rocuronium	Global (n=80)		Training with anesthesia (n=52)		Training without anesthesia (n=28)		p-value**
In what proportion do you use rocuronium?							
Always rocuronium	5	6,25%	4	7,69%	1	3,57%	NS
Rocuronium in over 75% of RSI	3	3,75%	2	3,85%	1	3,57%	NS
Rocuronium in 50-75% of RSI	6	7,50%	4	7,69%	2	7,14%	NS
Rocuronium in less than 50% of RSI	18	22,50%	16	30,77%	2	7,14%	0.023
Only if contraindicated to succinylcholine	48	60,00%	26	50,00%	22	78,57%	0.0168
When do you use rocuronium?							
Contraindications to succinylcholine	47	58,75%	31	59,61%	16	57,14%	NS
Need for long-term curarization	18	22,50%	13	25,00%	5	17,85%	NS

Table 3. *Use and Knowledge of Rocuronium in Rapid Sequence Intubation. RSI: Rapid Sequence Intubation, CI: Contraindication, NS: Not Significant.*

**T-student, **Fisher's Exact Test.*

Knowledge of adverse events was limited. 27% of respondents were unaware of any contraindications or adverse effects associated with rocuronium. For succinylcholine, hyperkaliemia was the most frequently cited adverse effect (64%); however, awareness of other serious reactions remained low. Reported side effects and contraindications of succinylcholine and rocuronium are provided in the supplementary material.

Physicians with prior anesthesia training demonstrated a higher level of knowledge regarding sugammadex, as shown in Table 4. The mean dose of sugammadex used for RSI was 12.98 mg/kg [0.5–200], with a median dose of 16 mg/kg [0.5–200]. Importantly, only 32% of respondents reported having

sugammadex available in their department, and it was rarely used in cases of failed intubation (n = 2).

Sugammadex	Global		Training with anesthesia [range]		Training without anesthesia [range]		p-value*
Mean dose of sugammadex in RSI (mg/kg)	12,98 [0,5-200]		14,67 [0,5-200]		9,67 [0,5-18]		NS
Median dose of sugammadex in RSI (mg/kg)	16 [0,5-200]		16 [0,5-200]		9 [0,5-18]		
Sugammadex	Global (n=101)		Training with anesthesia (n=56)		Training without anesthesia (n=45)		p-value**
Do you know an antidote to rocuronium?							
Yes	88	87,13%	54	96,13%	34	75,55%	0.0024
No	13	12,87%	2	3,57%	11	24,45%	0.0024
What is the name of this antidote?							
Sugammadex	82	93,18%	53	94,64%	29	64,44%	0.0002

Table 4. *Use and Knowledge of Sugammadex in Rapid Sequence Intubation. RSI: Rapid Sequence Intubation, NS: Not Significant.*

**T-student, **Fisher's Exact Test.*

Discussion

Lessons learned and implications

This study suggests heterogeneity in emergency physicians' understanding of RSI and its associated pharmacology. However, physicians reporting prior anesthesia training appear to have broader knowledge and familiarity with RSI. Anesthesia training improved knowledge across all aspects of the procedure, including drug pharmacokinetics, dosing, and the fundamental principles of RSI which is a critical technique that requires proper training, as it involves multiple key elements, including patient positioning, preoxygenation, appropriate drug and blade selection, and the simultaneous administration of sedatives and NMBAs [9].

FPS depends not only on glottic exposure and laryngoscopy skills [10] but also on comprehensive procedural knowledge, clinician experience, and adequate

preparation [15]. Given the critical nature of airway management and the benefits of anesthesia training, dedicated anesthesia rotations would gain to be part of emergency medicine training programs.

Rapid Sequence Intubation

The study data showed that succinylcholine (85% of cases) and etomidate (88% of cases) were the most commonly used agents for RSI. Physicians with anesthesia training demonstrated a more diverse practice and showed significantly greater use of propofol, ketamine, and analgesic agents. Our findings demonstrate substantial heterogeneity in RSI practices among Belgian emergency physicians. Similar variability in RSI pharmacologic practices has also been reported among anesthesiologists. In a national Spanish survey, Sastre et al. demonstrated heterogeneity in drug selection and guideline adherence among anesthesia practitioners, highlighting that variability in RSI practice extends beyond emergency medicine [16].

Favorable intubation conditions rely on the administration of sedatives and NMBAs with a rapid onset of action, that are administered as a single bolus without titration [6, 9]. This principle was better understood by physicians with anesthesia training. Physicians without anesthesia training were more likely to choose short-acting medications due to concerns regarding failed intubation ($p = 0.046$).

Although the difference was not statistically significant, physicians with anesthesia training reported a higher annual intubation rate (48.75 vs. 35.33). The median intubation rate was 42 intubations annually. These values were higher than those reported in a U.S. study, in which emergency physicians had a median of 10 intubations per year [17].

There was no statistically significant difference in average failure rates. However, nearly a quarter of respondents reported never having failed a first-attempt intubation. This finding may reflect differing definition if intubation failure, underreporting of failure or potential overconfidence in intubation skill. Such overconfidence in knowledge and skills is a well-documented phenomenon among physicians [18, 19], that reduces the likelihood of modifying practices or engaging in self-reflection and increases the risk of transmitting incorrect information to trainees [18, 19].

In this study, the calculated mean FPS rate was 80.3% among physicians with anesthesia training and 70.75% among those without anesthesia training. These rates were lower than those reported in an international multicenter study, in which the mean FPS rate was 84.1% across 42,081 intubations [20]. The FPS rate is a common benchmark in intubation studies [21], and is directly linked to the incidence of complications and considered a quality indicator for intubation [20]. To achieve a 90% intubation success rate within two attempts, at least 50 intubations must be performed under optimal conditions in low-risk patients [22]. This number should be higher for emergency physicians

because of the increased incidence of difficult airways and adverse events in emergency settings [22]. In Australia [23], a 10.5% improvement in the FPS rate was observed following the implementation of several measures, including standardization of practices through an intubation checklist and a difficult airway management algorithm, a requirement of at least three months of anesthesia training, and mandatory use of video laryngoscopy. The requirement for anesthesia training was justified by the perceived benefits of standardized practice, improved recognition of potentially difficult airways, and reduced complication rates [21, 23]. However, in our study, nearly half of the respondents had not received formal anesthesia training.

These findings underscore the importance of experience in airway management and anesthesia training, as well as the need for standardized protocols. Current guidelines recommend the use of checklists, airway management algorithms and regular training [3, 9, 13]. Although videolaryngoscopy was not specifically assessed, current guidelines recommend the use of videolaryngoscopy as primary strategy for airway management [13, 24]. Videolaryngoscopy has been shown to reduce complication rates and improve first-pass success in critically ill patients in both the intensive care unit and emergency department settings, across all levels of operator experience [24, 25]. In addition to airway management algorithms, contemporary airway management strategies increasingly emphasize human-factor and system-based approaches to improve procedural safety and first-pass success [26].

Succinylcholine

Many physicians used succinylcholine for all intubations, with significantly higher use among those who had not undergone anesthesia training. Habitual use was common, particularly among physicians without anesthesia training, raising concerns regarding the adequacy of up-to-date knowledge. The primary justification for its use was its perceived short duration of action. These findings may reflect a perception among some physicians that short-acting agents provide a safety margin in the event of intubation failure, rather than a fully evidence-based rationale, as most physicians in this study underestimated the actual duration of action of succinylcholine. Among physicians with anesthesia training, more than half estimated the duration of action to be ≤6.5 min whereas among physicians without anesthesia training, more than half estimated it to be ≤5 min. The actual duration of action succinylcholine is 6–10 min [8, 11], and recovery of spontaneous ventilation occurs at approximately 10.8 min after injection [27]. In critically ill patients, reduced physiologic reserves lead to more rapid oxygen desaturation, making reliance on the recovery of spontaneous ventilation an unsafe strategy. When airway management is required, priority should be given to the use of a structured difficult airway management algorithm rather than reliance on potential spontaneous recovery of ventilation [7].

Although knowledge of the recommended dose of succinylcholine was adequate (1.0–1.5 mg/kg [28]), a significant difference was observed in the

perceived onset time, suggesting delayed initiation of laryngoscopy by physicians without anesthesia training, with a mean onset time of 72.66 seconds compared with 57.8 seconds among those with anesthesia training.

Despite its frequent use, knowledge regarding the adverse effects of succinylcholine was limited. Hyperkaliemia was the most frequently cited side effect. Similarly, awareness of contraindications to succinylcholine was low. The limited knowledge of succinylcholine's adverse effects and contraindications is concerning, as it suggests that the drug may be administered in situations in which its use is contraindicated. In a study by Groth and Acquisto, succinylcholine was administered during RSI despite contraindications in 13.1% of cases [28].

Rocuronium

Rocuronium use was primarily prompted by specific contraindications to succinylcholine. Physicians without anesthesia training rarely used it outside these scenarios, whereas those with anesthesia training employed it more broadly.

The recommended dose of rocuronium exceeds 1 mg/kg [29], with 1.2 mg/kg representing a commonly used dose [30, 31]. In this survey, the median dose was 1.2 mg/kg among physicians with anesthesia training and 1 mg/kg among those without anesthesia training, suggesting that half of the non-anesthesia-trained physicians administered doses below the recommended threshold.

Nonetheless, adherence to the recommended dosage is essential for achieving optimal intubation conditions and increasing FPS rates, thereby reducing intubation-related complications [8]. A significant difference in perceived onset time was observed between the two groups. The mean perceived onset time was 89.16 s (median 60 s) among anesthesia-trained physicians, whereas it was 124.9 s (median 90 s) among physicians without anesthesia training. These findings suggest that physicians without anesthesia training may underestimate the pharmacokinetics of rocuronium in the context of RSI, potentially leading to delayed laryngoscopy attempts.

Sugammadex

The existence of a reversal agent for rocuronium-induced neuromuscular blockade was significantly better known among physicians who had undergone anesthesia training.

The recommended sugammadex dose for RSI is 16 mg/kg [7, 29]. This exact dose was correctly identified by 52% of physicians with anesthesia training, compared with 24% of physicians without anesthesia training ($p = 0.0076$). This finding indicates that anesthesia training improves familiarity with appropriate sugammadex dosing. However, its use in the emergency department remained rare. In cases of intubation failure, adherence to an airway management protocol rather than reliance on sugammadex reversal is recommended, as securing a definitive airway remains the priority. Moreover,

evidence supporting the role of sugammadex in emergency medicine was limited, except for its potential use in neurological assessment [32].

Strengths and limitations

The strength of this study lies in its focus on the impact of anesthesia training, within the context of specialization in emergency medicine, on knowledge of RSI and its associated pharmacological agents. To our knowledge, this relationship has not been previously investigated. Another key strength of this study is its potential to improve clinical practice, as it highlights gaps in training, standardization, and continuing education within emergency departments.

Our study has certain limitations, including its survey-based design. This study was based solely on self-reported data, without direct observation of actual clinical practices and unadjusted comparison. The absence of adjusted analyses limits interpretation given that potential confounders such as experience and intubation volume were not controlled. Moreover definition of anesthesia training was not precisely characterized with details such numbers of procedures which may result in heterogeneity within this exposure. Because the study relied on self-assessment of knowledge and skills, there is a risk of response bias, as participants may have answered in a manner that served to maintain their self-esteem or professional reputation. Anonymizing responses could help minimize this bias. The study is also subject to self-report bias, as all data were based on participants' self-reported responses. Second, this

study primarily assessed theoretical knowledge rather than technical skills. Third, some errors may have resulted from the wording or interpretation of the questions in a survey that was not formally validated. To reduce this risk, most questions were designed to require simple responses or unambiguous multiple-choice answers. Another limitation is the sample size and the high proportion of incomplete responses, which were excluded from the analysis. The distribution strategy did not allow calculation of a response rate, preventing potential validation and could result in a substantial selection bias. Finally, this study was conducted in French-speaking Belgium, which limits the generalizability of the findings.

Conclusion

Succinylcholine remains the primary NMBA used by emergency physicians in French-speaking Belgium. Its use appears to be driven by habit and by a falsely reassuring belief that its short duration of action provides a safety margin in the event of intubation failure.

Many emergency physicians have an incomplete understanding of the RSI process, including limited knowledge of the pharmacological agents involved and their contraindications. As a result, succinylcholine may be used inappropriately, even in the presence of contraindications. Given these considerations, rocuronium appears to be a more rational choice for RSI, as both agents provide comparable intubation conditions.

This survey suggests that anesthesia training may be associated with greater understanding of RSI and the medications involved. These findings support potential value of standardized airway education, structured protocol and continuing-education sessions. Given the critical importance of airway management in emergency medicine, the experience required to achieve an adequate intubation success rate, and the broader pharmacological knowledge gained through anesthesia training, such a rotation may be beneficial as part of emergency medicine training programs.

Further prospective studies are needed to better define its optimal role within training curricula.

List of abbreviations

RSI: Rapid Sequence intubation; NMBA : Neuromuscular Blocking Agent; FPS: First Pass Success; Y: years; SMU: Specialist in Emergency Medicine; SMA: Specialist in Acute Medicine; BMA: Acute Medicine Certificate; TPPSU: Special Professional Title in Emergency Care; NS: Not Significant; CI: Contraindication; ICP: Intracranial Pressure; SCE: Succinylcholine Esterase.

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Declarations

Ethics approval :

Not applicable. According to the World Medical Association's Declaration of Helsinki, the ethical requirements for formal review and informed consent apply to medical research involving human subjects. Our study consisted solely of a voluntary and anonymous survey of physicians about their professional practices. No patients were involved, no interventions were performed, and no personal health data were collected. In line with the Declaration's principles of respect, confidentiality, and voluntariness, all participants were informed about the study objectives and the use of the data.

Consent to participate:

Completion of the questionnaire implied consent to participate. No formal written consent was required.

Consent for publication:

Not applicable.

Availability of data and materials:

All data generated or analyzed during this study are included in this article

Competing interests:

The authors declare that they have no competing interests

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Author’s contributions:

Conceptualization: LW, PD; Formal Analysis: LW; Investigation: LW; Methodology: LW, FT, PD; Writing original draft: LW; Feedback: FT, PD, English editing: PD; Supervision and validation: all authors.

Bibliography

[1] Reid C, Chan L, Tweeddale M. The who, where, and what of rapid sequence intubation: prospective observational study of emergency RSI outside the operating theatre. Emerg Med J. 2004;21(3):296–301; doi:10.1136/emj.2003.007344.

[2] Sakles JC, Laurin EG, Rantapaa AA, Panacek EA. Rocuronium for rapid sequence intubation of emergency department patients. J Emerg Med. 1999;17(4):611–6; doi:10.1016/S0736-4679(99)00046-3.

[3] Higgs A, McGrath BA, Goddard C, Rangasami J, Suntharalingam G, Gale R, et al. Guidelines for the management of tracheal intubation in critically ill adults. Br J Anaesth. 2018;120(2):323–52; doi:10.1016/j.bja.2017.10.021.

[4] Bernhard M, Bax SN, Hartwig T, Stepan R, Wenzel V, Gries A. Airway management in the emergency department (The OcEAN-Study): a prospective single-centre observational cohort study. Scand J Trauma Resusc Emerg Med. 2019;27:20; doi:10.1186/s13049-019-0599-1.

[5] Walls RM, Brown CA, Bair AE, Pallin DJ, Laurin EG, Sakles JC, et al. Emergency airway management: a multi-center report of 8937 emergency department intubations. J Emerg Med. 2011;41(4):347–54; doi:10.1016/j.jemermed.2010.02.024.

[6] Levin NM, Brown CA, Pallin DJ, Laurin EG, Sakles JC, Walls RM, et al. The association of rocuronium dosing and first-attempt intubation success in adult emergency department patients. CJEM. 2021;23(4):518–27; doi:10.1007/s43678-021-00119-6.

[7] Lentz S, Brown CA, Laurin EG, Pallin DJ, Sakles JC, Walls RM. What is the role of sugammadex in the emergency department? J Emerg Med. 2021;60(1):44–53; doi:10.1016/j.jemermed.2020.08.006.

[8] Acquisto NM, Khadem T, Groth CM, Brown CA, Laurin EG, Sakles JC, et al. Society of Critical Care Medicine Clinical Practice Guidelines for Rapid Sequence Intubation in the Critically Ill Adult Patient. Crit Care Med. 2023;51(10):1411–30; doi:10.1097/CCM.0000000000006000.

[9] Collins J, O'Sullivan EP. Rapid sequence induction and intubation. BJA Educ. 2022;22(12):484–90; doi10.1016/j.bjae.2022.09.001.

[10] Mosier JM, Sakles JC, Brown CA, Pallin DJ, Laurin EG, Walls RM. Tracheal intubation in the critically ill. Where we came from and where we should go. Am J Respir Crit Care Med. 2020;201(7):775–88; doi :10.1164/rccm.201908-1636CI.

[11] Adnet F, De La Coussaye JE, Jabre P. Intubation en séquence rapide : quels médicaments utiliser en préhospitalier? Réanimation. 2010;19(7):622–6; doi :10.1016/j.reaurg.2010.10.002.

[12] Fuchs-Buder T, Claudius C, Skovgaard LT, Eriksson LI, Mirakhur RK, Viby-Mogensen J, et al. Peri-operative management of neuromuscular blockade: a guideline from the European Society of Anaesthesiology and Intensive Care. Eur J Anaesthesiol. 2023;40(2):82–94; doi:10.1097/EJA.0000000000001769.

[13] Hohenstein C, Truhlář A, Deakin CD, Nolan JP, Perkins GD, Soar J, et al. Emergency airway management: an EUSEM statement with regard to the guidelines of the Society of Critical Care Medicine. Eur J Emerg Med. 2024;31(2):83–5; doi:10.1097/MEJ.0000000000001114.

[14] April MD, Bhat R, Hoffman J, Glickman SW, Brown CA, Walls RM, et al. Emergency department intubation success with succinylcholine versus rocuronium: a National Emergency Airway Registry study. Ann Emerg Med. 2018;72(6):645–53; doi:10.1016/j.annemergmed.2018.03.042.

[15] Driver BE, Mosier JM, Brown CA. The importance of the intubation process for the safety of emergency airway management. Acad Emerg Med. 2020;27(12):1362–5; doi:10.1111/acem.14041.

[16] Sastre JA, López T, Gómez-Ríos MA, Garzón JC, Mariscal ML, Martínez-Hurtado E, et al. Current practice of rapid sequence induction in adults: A national survey among anesthesiologists in Spain. Revista Española De

Anestesiología Y Reanimación (English Edition). 2020;1;67(7):381–90. https://doi.org/10.1016/j.redare.2020.03.003

[17] Carlson JN, Foster KM, Pines JM, Hollander JE, D'Onofrio G, Diercks DB, et al. Procedural experience with intubation: results from a national emergency medicine group. Ann Emerg Med. 2019;74(6):786–94; doi: 10.1016/j.annemergmed.2019.04.025.

[18] Bushuven S, Schmidbauer W, Gruber H, Wenzel V, Gries A, Bernhard M. Overconfidence effects and learning motivation refreshing BLS: an observational questionnaire study. Resusc Plus. 2023;14:100369; doi:10.1016/j.resplu.2023.100369.

[19] Naguib M, Brull SJ, Kopman AF, Hunter JM, Fulesdi B, Arkes HR, et al. Anesthesiologists' overconfidence in their perceived knowledge of neuromuscular monitoring and its relevance to all aspects of medical practice: an international survey. Anesth Analg. 2019;128(6):1118–26; doi:10.1213/ANE.0000000000003714.

[20] Park L, Zeng I, Brainard A. Systematic review and meta-analysis of first-pass success rates in emergency department intubation: creating a benchmark for emergency airway care. Emerg Med Australas. 2017;29(1):40–7; doi:10.1111/1742-6723.12704.

[21] Grant S, Green J, Park L, Brainard A, Zeng I, Driver BE. Safety of rapid sequence intubation in an emergency training network. Emerg Med Australas. 2021;33(5):857–67; doi:10.1111/1742-6723.13742.

[22] Buis ML, Maissan IM, Hoeks SE, van Schuppen HJ, Luitse JS, Stolker RJ. Defining the learning curve for endotracheal intubation using direct laryngoscopy: a systematic review. Resuscitation. 2016;99:63–71; doi:10.1016/j.resuscitation.2015.11.005.

[23] Fogg T, Alkhouri H, Vassiliadis J. The Royal North Shore Hospital Emergency Department airway registry: closing the audit loop. Emerg Med Australas. 2016;28(1):27–33. Doi:10.1111/1742-6723.12496.

[24] Gómez-Ríos MÁ, Van Zundert AAJ, McNarry AF, Law JA, Higgs A, De Jong A, et al. Guidelines on strategies for the universal implementation of videolaryngoscopy. Eur J Anaesthesiol. 2025;42(10):872–888. doi:10.1097/EJA.0000000000002210.

[25] Prekker ME, Driver BE, Trent SA, Resnick-Ault D, Seitz KP, Russell DW, et al. Video versus Direct Laryngoscopy for Tracheal Intubation of Critically Ill Adults. N Engl J Med. 2023;389(5):418–29. doi:10.1056/NEJMoa2301601.

[26] Gómez-Ríos MÁ, Michalek P, Gaszyński T, Van Zundert AAJ. Human Factors in Airway Management: Designing Systems for Safer, Team-Based Care. J Clin Med. 2025;14(24):8850. doi:10.3390/jcm14248850.

[27] Soto R, Fuentes R, Acosta J, Morales A, Rojas P, Salazar R, et al. Safety and efficacy of rocuronium with sugammadex reversal versus succinylcholine in outpatient surgery—a multicenter, randomized, safety assessor-blinded trial. Am J Ther. 2016;23(6):e1654–62; doi:10.1097/MJT.0000000000000206.

[28] Groth CM, Acquisto NM, Khadem T. Current practices and safety of medication use during rapid sequence intubation. J Crit Care. 2018;45:65–70; doi:10.1016/j.jcrc.2018.01.017.

[29] Tran DTT, Newton EK, Mount VAH, Lee JS, Wells GA, Perry JJ, et al. Rocuronium vs. succinylcholine for rapid sequence intubation: a Cochrane systematic review. Anaesthesia. 2017;72(6):765–77; doi:10.1111/anae.13903.

[30] Patanwala AE, Stahle SA, Sakles JC, Erstad BL. Comparison of succinylcholine and rocuronium for first-attempt intubation success in the emergency department. Acad Emerg Med. 2011;18(1):10–4; doi:10.1111/j.1553-2712.2010.00954.x.

[31] Mallon WK, Keim SM, Shofer FS, Seupaul RA. Rocuronium vs. succinylcholine in the emergency department: a critical appraisal. J Emerg Med. 2009;37(2):183–8; doi:10.1016/j.jemermed.2008.07.021.

[32] Jansson PS, Pimentel MPT, Seethala RR. Emergency department usage of sugammadex in a large regional health system. Acad Emerg Med. 2024;31(7):713–5; doi:10.1111/acem.14856.