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Original Research

A Simulation-Based Training Program in Rapid Sequence Induction for Novice Anesthesiology Trainees Using a Novel Checklist

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Introduction

The rapid sequence induction (RSI) technique remains the technique of choice for emergency surgery to reduce the risk of regurgitation and aspiration.[1] In the context of the active phases of the current coronavirus disease 2019 pandemic, the Difficult Airway Society recommended RSI as the technique of choice for every intubation, underlining the key role of this competency for the novice anesthesiology trainee, who must assimilate the required range of cognitive, technical, and nontechnical skills for success.[2,3]

Studies of simulation over the last decade have demonstrated that simulation can enhance clinician capability, particularly in stressful situations. Simulation-based training has been used as a tool to improve competence in technical procedures and nontechnical skills and the effective management of crisis situations.[4] The evidence that simulation is superior to instruction in skills acquisition is robust.[4-6]

Although simulation-based training is an integrated component of anesthesiology training, no standardized, dedicated training in RSI currently exists.

We hypothesized that delivery of a customized, high-fidelity simulation-based training program designed specifically for novice anesthesiology trainees would succeed in achieving retention of learning when assessed 4 weeks later in the workplace.

The aims of our study were threefold: (1) to explore the effectiveness of a simulation program in the acquisition of competence in RSI for novice anesthesiology trainees, (2) develop an assessment scoring system (which could also function as a checklist) for trainees practicing RSI in the simulated operating theatre or performing RSI in the workplace, and (3) assess if this program met the participants' (novice anesthesiology trainees) expectations in terms of their perceived training requirements.

Methods

Ethical approval was sought from the Tallaght University Hospital (Dublin) Ethics Committee, which recommended submission to the local Research and Innovation Office, as full Ethics Committee was not required. The Research and Innovation Office at St. James's Hospital approved the methodology and data protection arrangements of the project. Written informed consent was obtained from all participants.

A novel, simulation-based training program was designed and was tailored specifically for the acquisition of RSI competency. Assessment of participants' performance in the simulator on the day of training and subsequently in the workplace following a 4-week interval was undertaken by applying a new scoring system developed using the modified Delphi technique[7] (Table 1).

Checklist Development

The initial RSI checklist of technical and nontechnical tasks was compiled based on the relevant task descriptions and checklists available in the literature.[8,9] This checklist was distributed to 6 experienced experts with expertise in simulation training and advanced airway management. The experts were asked to rank the importance of each individual task on the 5-point Likert scale, weighted from 1 to 5 (not important, slightly important, moderately important, very important, and extremely important, respectively). The experts were also invited to suggest elimination, addition, or modification of tasks and to add comments (round 1). The information was then collected, and medians of the Likert scores and ranges for each task were calculated and distributed again (round 2) with the comments. Each expert had an opportunity to re-evaluate their scores. Calculations were repeated and recirculated (round 3), and suggestions and modifications were introduced from the panel (Appendix 1). A consensus score of less than 3 resulted in the exclusion of a task from the checklist (for excluded parameters, see Appendix 1).

The content validity index of the final scoring system was determined by calculating the percentage of total items included in the checklist rated as either 4 or 5 by the experts. The content validity index ranged from 83 to 100% for each of

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the 37 tasks in the final scoring checklist; this exceeds the 80% threshold suggested previously as a criterion for acceptable content validity.[10]

The process generated a list of tasks for RSI based on final median scores from the expert group, each with a weight of importance ranging from 3 to 5. For each performance in the simulator on the day of training and during the workplace assessment, tasks could therefore be assessed as successfully completed or not. Tasks that were omitted or not completed successfully were scored as 0. Completed individual tasks were scored by application of the weighting factor and the sum of all the weighted scores used to provide a total individual score.

Participants' feedback in terms of perceived relevance to training requirements was obtained using a questionnaire following the simulation training.

Study Design

This was an exploratory study to gain insight into the value of simulation-based training for RSI skills acquisition in a group of anesthesiology trainees. The study design was that of pretest and posttest research using an observational study of a single cohort of novice anesthesiology trainees. Our primary outcome was the difference between performance scores in simulator and workplace assessments.

Participants

All participants were novice anesthesiology trainees who had commenced training during the previous 2 weeks.

Simulation Training Day

The simulation training component was conducted at the College of Anaesthesiologists' Simulation Centre, Dublin, Ireland, using a high-fidelity Operating Theatre Simulation Suite equipped with SimMan 3G (Laerdal Medical). The training day in the Simulation Centre consisted of an initial assessment of baseline knowledge of RSI using a customized questionnaire, which sought a description of the required preparation of equipment, drugs, and other resources, patient assessment technique, including explicit planning for difficulties encountered during airway management and intubation, and finally a description of critical steps in the event of a failed tracheal intubation (Appendix 2).[11] Participants underwent simulator orientation and familiarization and observed a demonstration of RSI by faculty. Each participant sequentially undertook the role of the anesthesiologist leading and conducting induction of anesthesia and airway management using the RSI technique on a simulated patient in a setting where RSI was indicated. Four scenarios of increasing complexity were used (Appendix 3).

Each participant was required to assess the simulated patient, to plan and communicate immediate and contingency airway management to the team, and conduct the RSI. The participant was also required to ensure that appropriate anesthesia and emergency drugs were available and prepared in advance and to ensure that all relevant equipment was available and checked. Each scenario concluded once the candidate had confirmed successful placement of the endotracheal tube. Any critical step that was omitted or incompletely or inaccurately executed was prompted. If the candidate was unsure how to proceed, the correct actions were prompted, and in each case, these steps were noted as a point for debriefing.

Debriefing occurred in a group setting, with learning outcomes reinforced. The RSI checklist was distributed to participants. Feedback questions were completed by participants (Appendix 4).

A two-stage evaluation was conducted. Video records of performance in the Simulation Operating Theatre Suite were reviewed, and the technical and nontechnical skills were scored independently by 2 assessors using the task analysis checklist. Steps that were omitted, prompted, or inaccurately or incompletely executed were noted as incomplete for assessment scoring.

Scores were calculated using the applied weighting factors generated by the modified Delphi technique (see below). Tasks were rated as complete and achieved a full score or as incomplete and achieved a score of 0.

Workplace Assessments

Workplace assessments were performed 4 weeks later using the same evaluation and scoring system by the same 2 independent expert assessors. This was chosen as a suitable timepoint before the candidates' commencement of out-of-hours and on-call duties and a greater degree of independent practice. The workplace assessment was followed by debriefing and feedback to each participant to facilitate reinforcement of learning outcomes. At this point, the number of opportunities to participate in RSI in the workplace were noted.

The same 2 expert assessors conducted both assessments independently.

Data Analysis (Performance Scoring)

The final task scoring checklist, achieved by consensus for scoring, consisted of 37 parameters, with a maximum performance score of 171. Both assessors used the validated checklist for both assessments.

When the assessors' scores did not concur, the mean of the 2 assessors' scores was used for comparison.[12] Interrater reliability was assessed by calculating the percentage of scores where the two assessors' scores concorded.

The differences between the mean scores in the simulator and workplace assessments were compared. Each component task in the scoring checklist was rated as either complete or incomplete, achieving either the maximum score or 0 for each task.

The overall scores at the 2 assessments were calculated and compared using group means, standard deviations (SD), and confidence intervals.

The number of participants was a convenience sample determined by the number of incoming novice anesthesiology trainees. This small sample size (8 participants) had implications for both power analysis and statistical testing. Power analysis was not conducted, as no previous studies existed to determine the effect size for this simulation-based training. A two-tailed paired *t* test comparison of mean performance scores at the 2 timepoints was performed.

The number of opportunities to participate in RSI in the workplace was recorded at the second assessment.

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Results

Eight participants were enrolled. All 8 participants completed training and both assessments.

The checklist tasks most frequently omitted by participants at the initial assessment included the airway assessment components (mouth opening, range of neck movement, and thyromental distance were each omitted by 6 of the 8, and dental issues/beard/history of difficult intubation were omitted by 7 of the 8) and team communication with respect to any or no anticipated difficulty, and planning of airway management was omitted by 4 of the 8.

An assessment of interrater reliability was made by calculating the concordance of scores between the 2 raters (Tables 2 and 3). The raters' scores concorded in 87.5% (7/8) of both the simulator and workplace-based assessments.

The mean performance score of participants in the simulator on the day of training was 105 (SD of 16). At the workplace evaluation, 4 weeks after simulation training, the mean performance score of participants had improved to 140 (SD of 14.5; $P = .001$; Tables 2 and 3, Figure 1). The 95% confidence intervals for the simulator and workplace participants' scores were 92 to118 and 128 to 152, respectively. Individual improvements in mean performance score ranged from a gain of 29 to 51.5 points. One participant had a lower workplace score then simulator score (116 versus 119.5).

Feedback from the questionnaires indicated that all participants rated the simulation training as strongly relevant to their learning needs and stage of training. Feedback included praise for realism and variety of the scenarios, the small group size, the debriefing, and the constructive learning environment (Appendix 5).

Discussion

Even before the pandemic, the traditional operating room-based experiential model of learning RSI may have been associated with significant gaps in early trainee preparation. Traditionally, the focus for novice trainees is on learning and practicing the technical aspects of airway management and intubation. Currently, challenges such as urgency, infection risks, and the constraints of personal protective equipment may limit clinical opportunities for novices to practice the demanding RSI sequence in the workplace.[13] The lack of opportunity both to practice the complex task sequence itself and within a team highlights the key role of deliberate practice outside the clinical interface. Nontechnical skills, such as team communication, contingency planning, and advance preparation, are crucial for successful RSI.[14] Accelerated acquisition of competence in RSI using simulation presents the novice anesthesiology trainee an opportunity to enhance their workplace experiential learning. Deliberate practice in the controlled environment of the high-fidelity simulator at this early stage in training may provide an opportunity to compensate for gaps in RSI training. Performance evaluation in the simulator can be subsequently mapped against assessment in the workplace.

This study explored the effectiveness of simulation-based training in RSI for novice anesthesiology trainees. Our study broadly followed the Kirkpatrick model for evaluation of a training program, measuring trainee reactions and incorporating assessments of learning both in the simulator and in the workplace.[15] A scoring system, which incorporated technical and nontechnical skills, was developed to facilitate assessment and comparison of performance on the day of training and 4 weeks later. Performance scores were significantly increased when assessed 4 weeks later in the workplace. We chose a simulation-based training modality to provide an opportunity to practice the full RSI sequence of technical and nontechnical skills. We chose this early stage of training for novice anesthesiology trainees to enhance the current system of workplace-based training in RSI.

Trainee feedback was positive, with all participants agreeing or strongly agreeing that the course learning goals were relevant (Appendices 4 and 5).

The results suggest that this simulation-based training in RSI was associated with an improvement in RSI performance in novice trainees, most importantly in the workplace. Checklist items most frequently omitted by participants included airway assessment parameters and team communication during the initial assessment. Body mass index and neck circumference assessments were frequently omitted during the workplace-based assessment, whereas team communication and airway assessment were almost always completed. These initial omissions may be due in part to the significant cognitive loading experienced by novice participants during the initial weeks of training.

These results build on existing evidence of a deficit in training for novice anesthesiology trainees, especially in nontechnical skills, and suggest a potentially useful role in complementing workplace-based acquisition of training in RSI.[15,16]

The authors of the NAP 4 report recommended approaching emergency induction of anesthesia (including RSI) with contingency plans in place for failure of both the original plan and the back-up plan.[14] This cannot be achieved without the ability to communicate, resource, and execute such plans. These are the key nontechnical skills that we integrated into our simulation-based training and RSI checklist, developed using a modified Delphi method to attain consensus on the list of tasks. A scoring checklist for RSI has not previously been devised using the Delphi method, which incorporates nontechnical skills.

There are few studies in the literature examining the use of simulation in teaching and learning the RSI technique. A systematic review of simulation-based studies focused on teaching and learning cricoid pressure application during RSI showed a large favorable effect, where study design used simulation with feedback.[6]

Although there are significant costs entailed in the delivery of simulation-based training, it affords opportunities for deliberate practice of the complex RSI task sequence,[16] which integrates essential nontechnical components. The significant increase in participants' performance scores in the workplace 4 weeks after training indicates retention of learning.

The generalizability of the results of this study is limited by the small number

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of participants, with recruitment being limited by the number of novice trainees entering the anesthesiology program. In addition, the initial assessment occurred on the day of training itself rather than in advance, which may be regarded as a confounding factor. As the assessment occurred following the demonstration of the complete RSI sequence by faculty, participant performance scores may have been impacted. A true baseline assessment of performance could have been conducted in advance of the faculty demonstration. It is likely that such baseline assessment scores would have been lower than those recorded in this study. Notwithstanding this fact, a significant increase in mean scores was noted at the second (workplace) assessment.

One participant's mean performance score did not improve at the second assessment. This may reflect a failure of the intervention for this participant or interrater variability between the 2 assessors. The raters' scores did not concord (87.5%) at the simulation assessment for this participant, but this level of assessor concordance has previously been rated as satisfactory as has the use of 2 assessors.[8,10,12]

In the absence of a control group, it is not certain if similar improvements in RSI performance scores would be achieved with traditional workplace learning alone. If the observed improvement in performance scores is attributable to the simulation training, it is also not possible to conclude if this was due to the simulation training alone, the cognitive aid, or both. In addition, we cannot be sure that measured improvements would be sustained beyond the 4-week interval when the second assessments were undertaken. Introduction of a control group in a future study would be the logical next step in confirming if these performance improvements are attributable to our simulation training intervention.

Currently, in the absence of specific RSI simulation training for novice anesthesiology trainees, this small study demonstrates that deliberate practice in the controlled environment of the high-fidelity simulator provides an opportunity to both compensate for gaps in trainee learning and allow performance evaluation. The use of a new scoring system applied to the RSI technique as a task analysis, which can also serve as a checklist and cognitive aid, can be used for such evaluation.

The participants in this study reported low numbers of opportunities to participate in the full RSI sequence in the workplace during the interval between training and the second assessment. This highlights the role of specific simulation-based RSI training where traditional training methods may be insufficient.

Future work is required to support these results in a larger study population with evaluation beyond the 4-week interval and also to independently evaluate the role of the new RSI scoring checklist and cognitive aid.

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Abstract

Background: The novice anesthesiology trainee is required to assimilate the technical and nontechnical skills required to safely perform a rapid sequence induction (RSI). Acquisition of this core competency is traditionally achieved using operating room-based experiential learning, which may be associated with significant gaps in early trainee preparation. We conducted a study to explore the role of a new, customized, high-fidelity simulation-based training program designed to address this gap in RSI training. We then assessed mean performance scores of participants in the simulator and 4 weeks later.

Methods: This observational study assessed participants' performance in the simulator on the day of training and in the workplace 4 weeks later. There is no universally agreed checklist or cognitive aid incorporating nontechnical skills and planning for unanticipated difficult airway management in RSI, so we applied a new scoring checklist developed by 6 experts using the modified Delphi technique.

Results: Our task scoring checklist included nontechnical skills and consisted of 37 weighted parameters with a maximum performance score of 171. On the day of training, mean performance score was 105 (SD of 16). At the workplace evaluation 4 weeks after simulation training, the mean performance score of participants had increased to 140 (SD of 14.5; P = .001). The 95% confidence intervals for the simulator and workplace participant scores were 92 to 118 and 128 to 152, respectively.

Conclusions: The results suggest that this simulation-based training in RSI was associated with an improvement in RSI performance in novice trainees and may complement the current system of workplace-based training.

Keywords: Anesthesiology, rapid sequence induction, simulation-based training, checklist

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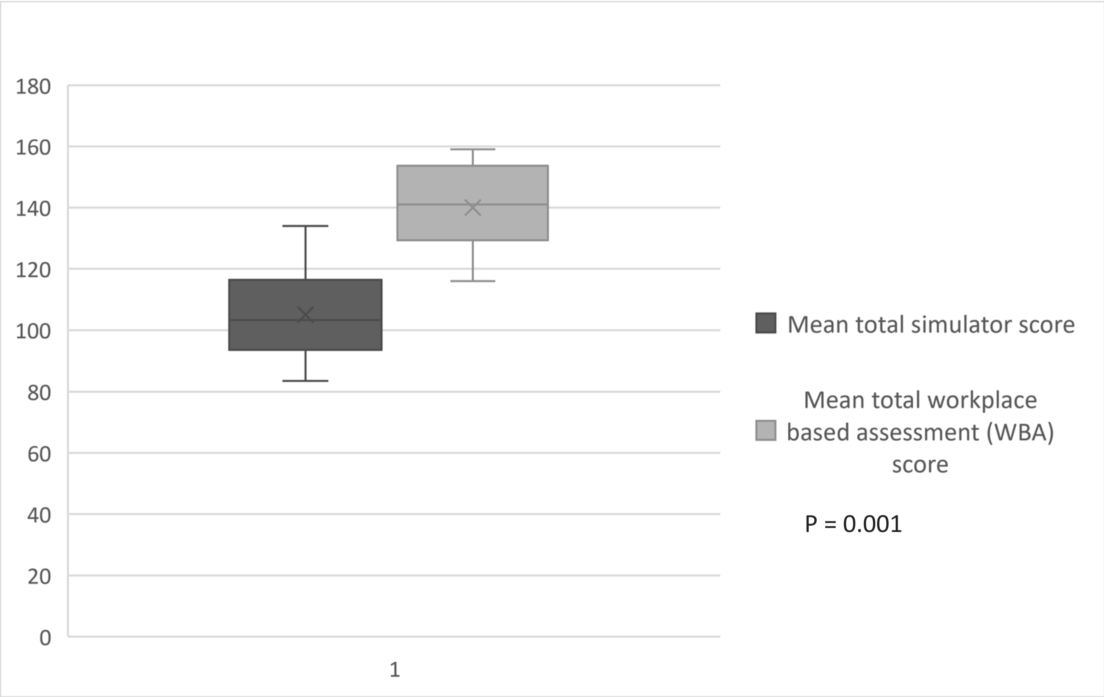
Figure

Figure 1. *Mean participant performance scores in the simulator and workplace-based assessments (WBA). Assessment out of a total of 171 marks.*



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Tables

Table 1. *Data Collection Form: Task Scoring System Developed Using the Modified Delphi Technique*

	Tasks	Maximum Achievable Score	Score Attained
Preoperative assessment	Overall assessment	5	
	Mouth opening	5	
	Neck movement	4.5	
	Neck circumference/size/pathology	4	
	BMI > 30/estimate	4	
	Thyromental distance	4.5	
	Other (dental, beard, OSA, previous difficult intubation)	4	
	Team communication (any/no anticipated airway issue)[a]	5	
	ECG	5	
	SaO_2	5	
	Blood pressure	5	
	End-tidal CO_2 (functionality)	5	
	Intravenous access	5	
Equipment check	Suction	5	
	Laryngoscope	5	
	Tracheal tube checked	5	
	Gum elastic bougie	4.5	
	Video-laryngoscope	4	
	Laryngeal mask airway	4.5	
	Tilting trolley	3.5	
	Difficult airway cart location	5	
Drug preparation	Opioid	3	
	Induction agent dose	5	
	Muscle relaxant dose	5	
	Emergency drugs	5	
Contingency planning	Plan A[a]	5	
	Plan for failure[a]	5	
Induction/ intubation	Position optimized	5	
	Procedure explained to patient[a]	4	
	Assistant familiar[a]	5	
	Preoxygenation	5	
	Drugs administered appropriately	4.5	
	View communication (laryngoscopy)[a]	4	
	Cuff inflated before ventilation	4	
	End-tidal CO_2 confirmation	5	
	Other confirmation of tube position	4	
	Anesthesia continued	5	
	Total score	171 (maximum)	Actual score

Abbreviations: BMI, body mass index; ECG, electrocardiogram; OSA, obstructive sleep apnea.

[a] Denotes nontechnical skill.

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Table 2. *Participants' Simulator Scores Assessed by 2 Raters and Interrater Agreement*[a]

Participant	Total Score		Mean Total Score	Interrater Concordance
	Rater 1	Rater 2		Yes/No
P 1	107	107	107	Yes
P 2	134	134	134	Yes
P 3	106.5	106.5	106.5	Yes
P 4	122	117	119.5	No
P 5	98	98	98	Yes
P 6	92	92	92	Yes
P 7	83.5	83.5	83.5	Yes
P 8	100	100	100	Yes
			% Interrater agreement	7/8
				87.50%

[a] Simulator assessment scores are out of a total of 171.

Table 3. *Participants' Workplace-Based Assessment Scores and Interrater Agreement*[a]

Participant	Total Score		Mean Total Score	Interrater Concordance
	Rater 1	Rater 2		Yes/No
P 1	158	153	155.5	No
P 2	159	159	159	Yes
P 3	138.5	138.5	138.5	Yes
P 4	116	116	116	Yes
P 5	148	148	148	Yes
P 6	143.5	143.5	143.5	Yes
P 7	130.5	130.5	130.5	Yes
P 8	129	129	129	Yes
			% Interrater agreement	7/8
				87.50%

[a] Workplace-based assessments are out of a total of 171.

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Appendices

Appendix 1. RSI checklist for evaluation of performance with weighting

Lists of tasks identified for performance of rapid sequence induction, rounds, and scores (summary); the maximum score is 171.

Each of the numbered components was weighted/rated using the Likert 5-point scale; scores of 3 or less meant that the component could be eliminated from the list (1 = not important, 2 = slightly important, 3 = moderately important, 4 = very important, 5 = extremely important).

	Round 1 Median (range)	Round 2 Median (range)	Round 3 Median (range)	Round 4 (final) Median (range)
Preoperative assessment				
Overall assessment	5 (0)	5 (0)	5 (0)	5 (0)
Mouth opening	5 (1)	5 (1)	5 (1)	5 (1)
Neck movement	4.5 (1)	4.5 (1)	4.5 (1)	4.5 (1)
Neck circumference	N/A	N/A	4 (3)	N/A
Neck circumference/size/pathology	N/A	N/A	4 (3)	4 (1)
BMI	N/A	N/A	N/A	N/A
BMI > 30/estimate	N/A	N/A	3.5 (2)	4 (1)
Thyromental distance	4.5 (2)	4.5 (1)	4.5 (1)	4.5 (1)
Dentition	4 (2)	4 (2)	N/A	N/A
Other (dental, beard, OSA, previous DI)	N/A	N/A	N/A	4 (1)
Preoperative				
Team communication (any/no anticipated airway issue)[a]	N/A	N/A	N/A	5 (0)
ECG	5 (1)	5 (1)	5 (1)	5 (1)
SaO_2	5 (0)	5 (0)	5 (0)	5 (0)
Blood pressure	5 (0)	5 (0)	5 (0)	5 (0)
End-tidal CO_2 (functionality)	5 (0)	5 (0)	5 (0)	5 (0)
Intravenous access	5 (0)	5 (0)	5 (0)	5 (0)
Equipment check				
Suction	5 (1)	5 (1)	5 (1)	5 (1)
Laryngoscope	5 (0)	5 (0)	5 (0)	5 (0)
Tracheal tube checked	5 (1)	5 (1)	5 (1)	5 (1)
Oro-pharyngeal airway	2 (2)	2 (2)	2 (2)	N/A
Gum elastic bougie	4.5 (1)	4.5 (1)	4.5 (1)	4.5 (1)
Video-laryngoscope	4 (3)	4 (1)	4 (1)	4 (1)
Laryngeal mask airway	4.5 (1)	4.5 (1)	4.5 (1)	4.5 (1)
Tilting trolley	3.5 (2)	3.5 (2)	3.5 (2)	3.5 (2)
Difficult airway cart location	5 (2)	5 (1)	5 (1)	5 (1)
Drug preparation				
Opioid	3 (3)	3 (3)	3 (3)	3 (3)
Induction agent dose	5 (1)	5 (1)	5 (1)	5 (1)
Muscle relaxant dose	5 (1)	5 (0)	5 (0)	5 (0)
Emergency drugs	5 (1)	5 (0)	5 (0)	5 (0)

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Appendices *continued*

Contingency planning				
Plan A[a]	5 (1)	5 (0)	5 (0)	5 (0)
Plan for failure[a]	5 (1)	5 (0)	5 (0)	5 (0)
Induction/intubation				
Position optimized	5 (0)	5 (0)	5 (0)	5 (0)
Procedure explained to patient[a]	4 (1)	4 (1)	4 (1)	4 (1)
Assistant familiar[a]	5 (1)	5 (1)	5 (1)	5 (1)
Preoxygenation	5 (1)	5 (1)	5 (1)	5 (1)
High flow nasal oxygen	N/A	N/A	1.5 (2)	N/A
Drugs administered appropriately	4.5 (1)	4.5 (1)	4.5 (1)	4.5 (1)
View communication (laryngoscopy)[a]	4 (2)	4 (2)	4 (2)	4 (2)
Cuff inflated before ventilation	4 (2)	4 (2)	4 (2)	4 (2)
End-tidal CO_2 confirmation	5 (0)	5 (0)	5 (0)	5 (0)
Other confirmation of tube position	4 (0)	4 (0)	4 (0)	4 (0)
Anesthesia continued	5 (1)	5 (1)	5 (1)	5 (1)
Eliminated parameters (see below)				
Oro-pharyngeal airway	2 (2)	2 (2)	2 (2)	N/A
High-frequency nasal oxygen	N/A	N/A	1.5 (2)	N/A
Neck circumference	N/A	N/A	3.5 (3)	N/A

Abbreviations: BMI, body mass index; DI, difficult intubation; ECG, electrocardiogram; N/A, not applicable; OSA, obstructive sleep apnea.

[a] Denotes nontechnical skill.

Appendix 2. Knowledge questionnaire

RSI questionnaire (before the start of simulation training for evaluation of baseline knowledge).

You are asked to manage a case on the emergency list. You will be getting ready to undertake a rapid sequence induction (RSI) in a nonpregnant adult (female) patient. No airway difficulty is predicted, and the patient is scheduled for a laparoscopic appendectomy.

1. Can you outline what you need to prepare in advance of the patient's arrival in the induction room—equipment, monitoring, drugs, other resources?
2. Describe how you would assess the patient's airway before induction.
3. Describe the optimal patient position.
4. Describe the steps necessary to perform the RSI. Include the doses of induction agent and relaxant.
5. Would you administer any opioid or other sedative before the induction agent? If yes, which and why?
6. Define cricoid pressure.
7. What should you do if the patient has a nasogastric tube in situ?
8. Describe what measures might be required to improve the view at laryngoscopy.
9. At what point would you declare a "failed intubation"?
10. If intubation were unsuccessful, what would you do next?

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Appendices *continued*

Appendix 3. Scripts for the 4 simulation scenarios used in the simulation-based assessment

In each case, intravenous access and routine physiological monitoring have been established before the commencement of each simulated scenario.

Scenario 1: "Jean"

Patient: 35-year-old female

Procedure: elective laparoscopic cholecystectomy

Relevant history: three episodes of biliary colic in the past 2 years

Medical history: fit and active nonsmoker

Medication: esomeprazole 20 mg daily for gastro-oesophageal reflux disease (postural, postprandial). No drug allergies

Diagnosis: biliary cholelithiasis

Investigations: hemoglobin 12 g/L, normal renal profile and liver function. Ultrasound confirmed stones in gallbladder

Exam: weight 90 kg, body mass index 30; awake, undistressed

Scenario 2: "Dylan"

Patient: 26-year-old male

Procedure: emergency laparoscopic appendicectomy

Relevant history: the patient has been feeling unwell for 48 hours, complaining initially of central abdominal pain, localizing later to the right iliac fossa. Associated nausea but no vomiting was reported.

Medical history: no relevant medical history. He is not on any medication and has no drug allergies. He plays football and is usually fit and active. He is a nonsmoker and drinks 5 to 10 units of alcohol weekly.

Diagnosis: clinical diagnosis of acute appendicitis (computed tomography confirmed)

Investigations: hemoglobin 14 g/dL; white cell count of 6,000/μL; renal profile normal.

Exam: weight 70 kg, temperature 37.4°C, blood pressure 110/60 mmHg, heart rate 100 bpm, SaO_2 99%; complaining of mild pain, no nausea.

Scenario 3: "Brian"

Patient: 65-year-old male

Procedure: urgent explorative laparotomy

Relevant history: he has been admitted through the Emergency Department with severe abdominal pain associated with nausea and vomiting. His symptoms started early this morning.

Medical history: alcohol excess (more than 50 units per week), hypertension, peptic ulcer disease

Medication: amlodipine 10 mg; lansoprazole (taken as required, every few days); he has recently started taking ibuprofen and solpadeine for intermittent abdominal pain. No drug allergies

Diagnosis: perforated duodenal ulcer

Investigations: hemoglobin 15 g/dL; white cell count 15,000/μL; chest X-ray, free air; computed tomography scan, confirms perforation and extravasation of contrast

Exam: distressed, in pain; diaphoretic; weight 80 kg, blood pressure 100/60 mmHg, heart rate 95 bpm, SaO_2 95%

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Appendices *continued*

Scenario 4: "John"

Patient: 77-year-old male

Procedure: emergency endoscopy plus/minus banding of varices/injection plus/minus laparotomy

Relevant history: he presented to the Emergency Department with hematemesis and abdominal pain 4 hours previously;

history of recent alcohol excess (60 units/week) and nonsteroidal inflammatory medication use in last 3 weeks; no regular medication; no known drug allergies.

Investigations: hemoglobin 9g/dL (hemoglobin 7 g/dL on presentation, transfused 2 units of red cell concentrate), serum creatinine 89 μmol/L, prothrombin time 18 seconds

Exam: distressed, nauseated; weight approximately 65 kg, blood pressure 90/55 mmHg, heart rate 102 bpm, SaO_2 95%

Appendix 4. Participants' postcourse (simulation-based RSI training) evaluation questionnaire

		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Please Circle One of the Statements Below
Q1	The course met the stated educational objectives						
Q2	The course matched my own training needs						Too advanced Too basic
Q3	I found the course relevant to my stage of training						Too advanced Too basic
Q4	I found the course relevant to my current clinical practice						Too advanced Too basic
Q5	The methods of delivery were adequate						
Q6	The pace of the course was appropriate						Too rapid Too slow
Q7	I am overall satisfied with the course						Above my expectations Below my expectations
Q8	The course will change my future practice						In what way?
	What did you like most about the course						
	What did you like least about the course?						
	What could we do to improve the course?						

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Appendices *continued*

Appendix 5. Results of feedback from participants