Society of Critical Care Medicine (SCCM) Clinical Practice Guidelines for Rapid Sequence Intubation in the Critically Ill Adult Patient

Key Article:

- *Acquisto NM, Mosier JM, Bittner EA, et al. Society of Critical Care Medicine clinical practice guidelines for rapid sequence intubation in the critically ill adult patient. Crit Care Med. 2023 Oct;51(10):1411-1430.*

Background

- Rapid sequence intubation (RSI) is performed prior to endotracheal intubation with a sedative-hypnotic induction agent and a paralytic agent given in rapid succession.
- RSI is commonly performed for emergency airway management in the emergency department and intensive care settings to reduce the risk of aspiration and optimize intubation conditions and success.
- There remains practice variation and many unanswered questions related to RSI including around ideal patient positioning, preoxygenation and minimizing peri intubation hypoxia and hypotension, interventions to minimize aspiration risk, ideal induction and paralytic agents, and more.
- The American College of Critical Care Medicine (ACCM) constructed a multidisciplinary guideline panel to develop clinically relevant questions and help standardize RSI for providers based on expert review of current literature.
- The multidisciplinary panel consisted of pharmacists, physicians, nurse practitioners, and respiratory therapists with backgrounds in critical care medicine, emergency medicine, anesthesiology, and prehospital medicine.

Objective

- The ACCM guideline panel's goal is to provide evidence-based recommendations on pharmacologic and non-pharmacologic topics related to RSI.

Methods

- Panelists voted on the most clinically relevant questions for inclusion in the guidelines.
- These questions were given a PICO format (population, intervention, comparison, and outcome).
- Two panelists were assigned two each of the 10 questions and found papers with publication dates between 2000 to 2020.
- The GRADE framework (Grading of Recommendations, Assessment, Development, and Evaluation) was used to assess the quality of evidence for the studies related to a particular question.
- The strength of recommendation (i.e., strong, conditional, or best practice) was assigned to each question based on quality of evidence.
- The panel provided a recommendation or suggestion for each of the 10 questions related to RSI in regard to critically ill adult patients.

#1-Positioning

Question: Is there a difference between the semi-fowler (head and trunk inclined) versus supine positions regarding first-pass success, oxygen desaturation, or pulmonary aspiration?

Rationale

- RSI is commonly performed in a supine position perhaps with a shoulder ramp to promote a sniffing position.
- Semi-fowler position may increase FRC, enhance preoxygenation/denitrogenation, reduce the risk of aspiration, and improve the laryngeal view.

Evidence:

- The panel reviewed 17 studies in total.
- There were mixed results on first pass success (FPS) rates between the two positions.
- There was no significant difference in rates of oxygen desaturation and pulmonary aspiration.
- The semi-fowler position was superior with improved laryngoscope view, increased intubation success, and increased safe apnea time, in a cadaveric study, simulation trials, and surgical patients in OR. This position is also beneficial for patients with difficult intubations and at high risk for aspiration.

Guidance

- The panel **suggests** a semi-fowler position (head and torso inclined) during RSI. (Conditional recommendation, low-quality evidence)

Discussion

- Rational and easy-to-implement recommendation.
- Could combine semi-flower and sniffing position.
- Variation in definition of semi-fowler and angle of incline
- Ultimately may be considered in critically ill patients, particularly those with low oxygen reserve, restrictive lung physiology (obesity), and risk for aspiration.

#2-Preoxygenation

Question: When it comes to preoxygenating the critically ill adult**,** is there a difference between high flow nasal oxygen (HFNO) versus facemask, bag valve mask (BVM), or noninvasive positive pressure ventilation (NIPPV) when it comes to desaturation, gastric insufflation or pulmonary aspiration?

Rationale:

- Effective preoxygenation prolongs safe apnea time and helps prevent peri-intubation hypoxia.
- We have varying methods of oxygen delivery but unclear how they compare.
- HFNC offers high flow rates at 100% oxygen, PEEP for alveolar recruitment, with the added advantage of providing apneic oxygenation.
- This is particularly important for patients with hypoxemic respiratory failure and low oxygen reserves and/or prolonged intubations.
- Preoxygenation with a nonrebreather face mask or bag valve mask are common.

Evidence:

- Panel reviewed 13 studies total.
- HFNO had reduced rates of oxygen desaturation and improved safe apnea times compared to a face mask, but not necessarily when NIPPV used.
- HFNO seemed to have no effect on aspiration risk.
- There was inconclusive evidence around cardiovascular collapse given very low quality of evidence.

Guidance

- The panel **suggests** preoxygenation with HFNO when laryngoscopy is challenging and preoxygenation with NIPPV in patients with severe hypoxemia PaO2/FiO2 < 150. (Conditional recommendations, low-quality evidence)

Discussion

- HFNO provides dual benefit of improved oxygen delivery and apneic oxygenation. This is likely beneficial for patients with anticipated challenging airways or hypoxia.
- NIPPV on the other hand is likely beneficial for patients with more severe hypoxia. Identifying candidates based on PaO2:FiO2 ratio may not be feasible in the emergency department without invasive arterial access but can be extrapolated from SpO2 measurements.

#3-Medication Assisted Preoxygenation

Question: Is there a difference between medication-assisted pre-oxygenation versus usual care in patients who are agitated, delirious or uncooperative with respect to the incidence of desaturation or hemodynamic instability?

Rationale:

- Effective preoxygenation, to minimize peri-intubation desaturation, is challenging in the uncooperative patient.
- A sedative-hypnotic agent may help the uncooperative patient tolerate the oxygen delivery device for more effective preoxygenation.

Evidence:

- There was improved oxygen saturation after a sedative-hypnotic agent was given and before a paralytic was given although the body of evidence was very low quality.

Guidance

- The panel **suggests** using medication-assisted pre-oxygenation for these patients who are agitated, delirious, or combative. (Conditional recommendation, very low quality of evidence)

Discussion

- Medication-assisted preoxygenation, also termed delayed sequence intubation (DSI), can promote more effective preoxygenation in uncooperative critically ill patients.
- Ketamine and Precedex may be ideal agents that sedate patients while maintaining their respiratory drive.

- More research is needed to investigate the ideal sedative-hypnotic agent and dosing as well as other outcomes including desaturation, aspiration, hemodynamic instability, and cardiac arrest.

#4-Nasogastric Tube (NGT) Decompression

Question: Is there a difference in the incidence of vomiting/aspiration in critically ill patients at high risk of aspiration prior to RSI when comparing NGT placement vs no placement?

Rationale:

- NGT placement prior to RSI will decompress the stomach and minimize the risk of regurgitation, pulmonary aspiration and peri-intubation hypoxia.

Evidence:

- In 1970, Dr. Stept and Safar published a paper introducing RSI and promoting NGT placement to prevent gastric content aspiration.
- No high-quality clinical trials exist looking at the benefit of gastric decompression before RSI.

Guidance

- The panel **advises** using NGT decompression for patients whom the benefits of gastric decompression outweigh the risk of placement. (Best practice statement, ungraded)

Discussion

- Clinicians must identify patients at high risk of aspiration (i.e., intestinal obstruction, upper gastrointestinal bleeding, or gastric distension).
- Risks of NGT placement includes nasopharyngeal bleeding, vomiting, esophageal perforation, and tracheal placement.
- The clinician must make the non-evidence-based clinical decision to place NGT based on benefits and risks for each individual patient undergoing RSI.

#5 Peri intubation Vasopressors

Question: In hypotensive patients, is there a difference when peri-intubation vasopressors are administered versus IV fluid (IVF) resuscitation alone with respect to the incidence of hypotension and cardiac arrest?

Rationale:

- Induction agents in RSI can worsen hypotension in critically ill adults.
- Vasopressor administration prior to induction may in theory mitigate peri-intubation hypotension and cardiac arrest.

Evidence:

- 4 studies included total, none of which compared vasopressors to IVF directly.
- There was evidence that vasopressors increased systolic and diastolic BP.
- There was no difference in cardiac arrest rate in two studies with intubation bundle including fluids and vasopressors.

- Special mention of two studies published after this study's inclusion dates include PREPARE II and INTUBE II trials.
    - PREPARE II: a multicenter RCT showed that an IVF bolus, compared to no bolus, failed to prevent cardiovascular collapse in critically ill patients undergoing RSI.
    - INTUBE II trial: a multicenter prospective study in critically ill patients undergoing RSI comparing vasopressors to IVF boluses. There was no difference in cardiovascular collapse although patients were not necessarily hypotensive.

Guidance

- The panel states there is insufficient evidence to make a recommendation.

Discussion

- No current evidence that vasopressors improve outcomes in critically ill hypotensive adult patients undergoing RSI.
- We should continue diagnosing the underlying etiology of hypotension or shock and prioritizing resuscitation prior to intubation with IVF, blood, and pressors.
- We should also identify populations at high risk for cardiovascular collapse with induction for example patients with right heart failure, pulmonary hypertension, and critical aortic stenosis.
- Medication dosing errors is a concern with push-dose vasopressors and clinicians familiar with these drugs should administer them.

#6-Induction Agent Use

Question: In critically ill adults with hemodynamic instability and depressed level of consciousness, Is there a difference between giving sedative-hypnotic agent with NMBA versus NMBA alone relating to cardiovascular collapse or awareness during paralysis post-intubation?

Rationale:

- Induction agents may worsen hemodynamic instability and precipitate cardiovascular collapse.
- Perhaps avoiding an induction agent and strictly giving a NMBA will minimize this risk. The risk of this is awareness during paralysis due to inadequate sedation.

Evidence:

- One secondary analysis of a prospective cohort study found no difference in adverse event rates between NMBA versus NMBA and sedative hypnotic.
- Recent observational data found 2.6% patients intubated in ED had awareness with paralysis with RSI. That effect would likely be amplified if no induction agent is used.

Guidance

- The panel advises administering a sedative-hypnotic agent when NMBA. (Conditional recommendation, low-quality evidence)

Discussion

- Standard practice at this time is to give both sedative-hypnotic agents and paralytics and should remain so.
- For hemodynamically unstable patients, emphasis should be on adequate resuscitation and selection of the induction agent and dose to minimize hemodynamic effects while avoiding awareness during paralysis.

#7-Induction Agent Selection

Question: Is there a difference between etomidate versus other induction agents (ketamine, midazolam, propofol) regarding mortality, hypotension, and vasopressor use in peri-intubation period and through hospital discharge?

Rationale:

- Different induction agents vary in their hemodynamic effects.
- Etomidate has a favorable hemodynamic profile but can cause hypotension and has been implicated in adrenal suppression.
- Ketamine has sympathomimetic properties which is often favorable in increasing vascular tone.
- Propofol and midazolam can more significantly lower the blood pressure.

Evidence:

- The panel reviewed 9 studies in total.
- Multiple studies compared etomidate to other induction agents including ketamine, fentanyl, and propofol and mostly showed no difference in mortality, variable evidence around hypotension, and no difference in vasopressor use.

Guidance

- The panel **suggests** there is no difference between etomidate and other induction agents in RSI regarding mortality, hypotension, and vasopressor use in peri-intubation period and through hospital discharge. (Conditional recommendation, moderate quality of evidence)

Discussion

- Etomidate is familiar, cheap, and readily available. With the current evidence, it remains a reasonable induction agent in RSI with no significant mortality difference.
- Providers should still select the induction agent based on the hemodynamics of the patient.

#8 Etomidate and Corticosteroid Use

Question:
When using etomidate for RSI, is there a benefit to coadministration of corticosteroids with respect to mortality, vasopressor use, risk of infection, multiple organ dysfunction, ventilator days or ICU length of stay?

Rationale:

- Etomidate is thought to have adrenal suppressant effects.
- Exogenous corticosteroid administration may in theory help mitigate the clinical effects of adrenal suppression.

Evidence:

- The panel reviewed 7 studies in total.

- There was no difference in mortality, multi-organ dysfunction, vasopressor use, or length of stay.
- There was mixed evidence around ventilator-free days.
- No studies documented the risk of infection, so this outcome could not be evaluated.

Guidance

- The panel **suggests** against administering corticosteroids following RSI with etomidate. (Conditional recommendation, low quality of evidence)

Discussion

- Current practice likely should be against the coadministration of exogenous steroids prior to RSI with etomidate unless indicated for another reason including primary or secondary adrenal insufficiency or refractory septic shock.

#9 Neuromuscular-Blocking Agent Use

Question: Is there a difference between giving a sedative-hypnotic agent with an NMBA versus just the sedative-hypnotic agent with respect to FPS, respiratory arrest and cardiovascular collapse, need for surgical airway, vomiting/aspiration during the peri intubation period?

Rationale:

- A paralytic agent can optimize intubation conditions via improved mouth opening, vocal cord paralysis, blunted gag.
- However, with paralysis comes the risk of not recovering from a failed airway, particularly in a patient who cannot be intubated or ventilated.

Evidence:

- The panel reviewed 6 studies in total.
- NMBA improves the FPS rate.
- NMBA decreases the rate of respiratory or cardiovascular collapse and the risk of vomiting and aspiration.
- Limited evidence around the effect of NMBA on the need for surgical airway.

Guidance

- The panel recommends an NMBA when sedative-hypnotics are used for induction. (Strong recommendation, low quality of evidence)

Discussion

- Evidence points to the benefit of NMBA in improving FPS and minimizing peri-intubation complications.
- Providers should continue to use paralytic agent in RSI and always be prepared to ventilate the paralyzed patient between attempts if needed and adequately sedate our patients to prevent awareness.

#10 Neuromuscular-Blocking Agent Use

Question: Is there a difference between rocuronium versus succinylcholine as the paralytic agent during RSI with respect to mortality, FPS, adverse events, and risk of awareness in the peri-intubation period and through hospital discharge?

Rationale:

- Rocuronium and succinylcholine are two NMBA commonly used during RSI.
- Succinylcholine is a short-acting depolarizing NMBA that can lead to hyperkalemia, bradycardia, and malignant hyperthermia.
- Rocuronium is a longer acting nondepolarizing NMBA without significant adverse advents. Rocuronium has become increasingly popular although its longer duration of action places patients at risk for awareness during paralysis if sedation is inadequate.

Evidence:

- The panel reviewed 31 studies in total.
- No quality evidence on mortality.
- No significant difference of FPS.
- Multiple studies looked at adverse events including hemodynamic, desaturation, vocal cord injury, hyperkalemia but were not powered to find significant outcome differences.
- Multiple RCTs evaluated patient awareness. Post-intubation sedation and analgesia were provided more rapidly when succinylcholine was administered. Also, some studies showed patient awareness could be mitigated when a clinical pharmacist was involved in RSI.

Guidance

- The panel suggests either rocuronium or succinylcholine for RSI when no contraindications exist to succinylcholine. (Conditional recommendation, low quality of evidence)

Discussion

- Many providers favor rocuronium for its better safety profile than succinylcholine, especially with undifferentiated patients.
- Succinylcholine should be avoided in cases of hyperkalemia (crush injuries, burns, rhabdomyolysis, renal failure), hx malignant hyperthermia, bradycardia, and neuromuscular diseases).
- We should remember to provide adequate postintubation analgosedation particularly when using rocuronium with longer paralysis times of 30-60 mins.
- We should recruit clinical pharmacists for help when resources permit.

Summary

- Expert panelists selected clinically relevant questions for emergency and ICU providers with specific relevant outcomes.
- The best research studies over 20 years were selected for each question although the evidence was still low to very low quality and therefore the strength of the recommendations was mostly conditional.

Topic	Guidance
Positioning	The panel **suggests** a semi-fowler position (head and torso inclined) during RSI.

Preoxygenation	The panel **suggests** preoxygenation with HFNO when laryngoscopy is challenging and preoxygenation with NIPPV in patients with severe hypoxemia PaO2/FiO2 < 150.
Medication-assisted preoxygenation	The panel **suggests** using medication-assisted pre-oxygenation for these patients who are agitated, delirious, or combative.
NGT Decompression	The panel **advises** using NGT decompression for patients whom the benefits of gastric decompression outweigh the risk of placement.
Peri-intubation vasopressors	The panel states there is insufficient evidence to make a recommendation.
Induction agent use	The panel advises administering a sedative-hypnotic agent when NMBA.
Induction agent selection	The panel **suggests** there is no difference between etomidate and other induction agents in RSI regarding mortality, hypotension, and vasopressor use in peri-intubation period and through hospital discharge.
Etomidate and corticosteroid use	The panel **suggests** against administering corticosteroids following RSI with etomidate.
NMBA use	The panel recommends an NMBA when sedative-hypnotics are used for induction.
NMBA selection	The panel suggests either rocuronium or succinylcholine for RSI when no contraindications exist to succinylcholine.