Advanced Airway Management and Rapid Sequence Intubation (RSI)

Dan Kalin MD

Assistant Professor, Department of Emergency Medicine and Critical Care Anesthesiology UNMC

RSI - Goals

- Understand the basic principles and techniques of RSI
- Understand medication (induction/paralytic) indications and complications
- Review the current literature around etomidate and its mortality risk

Rapid Sequence Intubation (RSI)

- RSI is an airway management technique that produces immediate unresponsiveness (induction) and neuromuscular paralysis (neuromuscular blockade)
- Due to the cessation of respiratory effort RSI does involve considerable risk if the airway is unable to be secured
- Particularly useful in those critical ill patients that need acute airway management
- Alternatives to RSI would be delayed sequence intubation vs “modified” RSI (apneic oxygenation, titration of induction meds, etc)
    - For example, trying to avoid hypercarbia on top of a preexisting metabolic acidosis

RSI - Indications

- Current or impending respiratory failure
- Airway protection
  - Obtunded, burns, strokes, intracranial injuries, facial trauma, etc.
- Prolonged transfer
- Surgical interventions
- Hypoventilation
- Combativeness with concern for critical injury
- Need for neuroprotection

RSI - Contraindications

- Not a lot of absolute contraindications

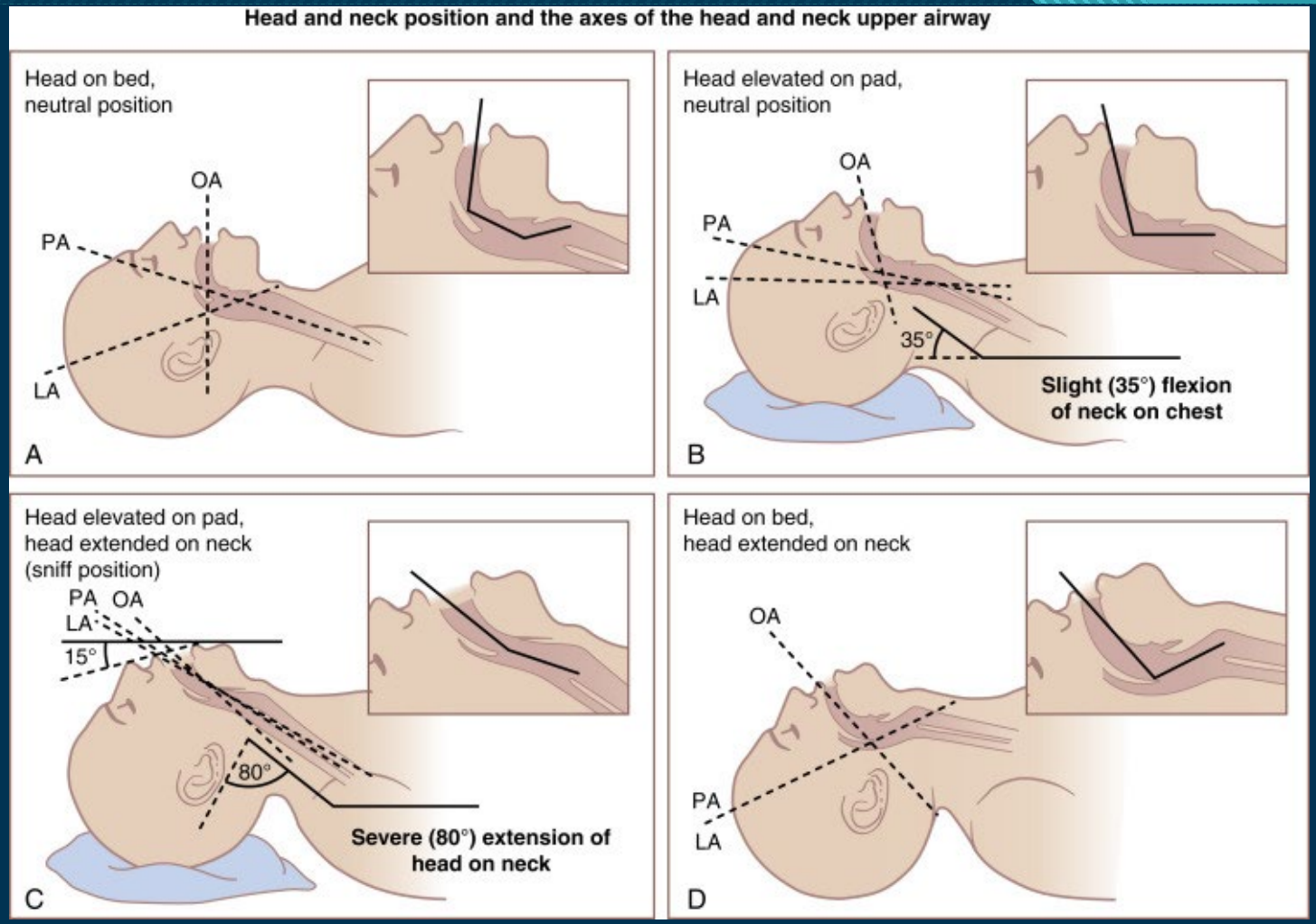
The biggest contraindication being the inability to secure the airway and need for a surgical airway

- Might want to consider alternative strategies in those patients who you are anticipating on having significant difficulty with airway manipulation.
    - If RSI is needed due to the emergent nature of the illness having a back up airway operator is recommended. Airway adjuncts, video scopes, etc
- Massive facial trauma, angioedema, rapidly expanding neck hematoma, head and neck cancers (depending on complications), significant kyphosis
    - Those conditions that extremely distort the airway anatomy
- Lack of requisite skills amongst providers

P's of RSI

- **Plan**
  - Initial intubation, backup devices/plan, 2nd airway operator?
- **Preparation**
  - Drugs, people, equipment, place
- **Protection** (c-spine)
- **Positioning**
  - Might be easier after paralytic is given
- **Pretreatment**
  - Oxygenation, atropine, fentanyl, lidocaine, etc
- **Paralysis/Induction**
  - Considerate selection of agents
- **Proof of placement**
  - $ETCO_2$, CXR, breath sounds, tube condensation, direct visualization of tube passing through the cords
- **Postintubation management**

RSI positioning



RSI Induction Agents

- **Etomidate**
  - 0.3 mg/kg IV, onset is 10-15s, can cause adrenal suppression, myoclonus
- **Ketamine**
  - 1.5 mg/kg IV, onset is about 60-90s., can cause increased secretions and cardiovascular SE's
- **Propofol**
  - 1.25 mg/kg IBW, onset is about 15-45s, can cause hypotension, direct myocardial depression, variable patient response
- **Midazolam**
  - 0.3 mg/kg IV, onset 60-90s, can cause hypotension, apnea, variable patient response
- **Fentanyl**
  - 2-10 mcg/kg TBW, onset is about 30-60s, duration is dose dependent, can cause bradycardia, apnea, rigid chest (high doses)

RSI – Paralytic Agents

- **Succinylcholine**
  - Depolarizing neuromuscular blocking agent
  - 1.5 mg/kg IV
  - Onset is 45-60s, lasts ~5-10m
  - Lots of contraindications (hyperkalemia, burns, prolonged immobilization, crush injuries, neuromuscular disorders)
- **Rocuronium**
  - Non depolarizing neuromuscular blocking agent
  - 1.2mg/kg IV IBW
  - Onset is about 60s but duration is long 20-60m – dose dependent
  - Can be used for any RSI but as mentioned it is a longer agent (could complicate neuro exams etc.)
  - Can be reversed with sugammadex

RSI – Postintubation management

- Sedation
  - Multiple agents available SCCM recommended non benzodiazepine over benzodiazepine sedation (propofol and dexmedetommidine)
  - Ideally use the least amount of sedation needed, helps to have nursing protocols to target sedations scores (RASS etc)
- Analgesia
  - Proper analgesia can reduce the sedation load, help lessen delirium
- Prolonged Neuromuscular blockade
  - Some patient may require continuous paralytic infusion for therapeutic cares
  - Ideally keep the dose as low and duration as short as possible
- Ventilator management
  - Minute ventilation may be significantly different post intubation so check blood gases to make sure the patient is being adequately ventilated
  - Ventilator adjustments based on airway pressures

Literature Update - Etomidate Previous Knowledge

- Previous meta-analysis in 2015 demonstrated that etomidate was associated with a higher SOFA score and a positive ACTH stimulation test but NO INCREASE in MORTALITY
- Previous studies had demonstrated that continuous infusion of etomidate increases mortality thus it is usually only used in bolus dosing
- Other meta-analysis combined with clinical trial data and retrospective trial have indicated an increase in mortality with etomidate thus leading to robust debate about its use
- Two recent papers have reignited the etomidate debate
  - **Etomidate vs ketamine for emergency endotracheal intubation: a randomized trial *Matchett et al. 2021***
  - **Etomidate as an induction agent for endotracheal intubation in critically ill patients: A meta-analysis of randomized trials *Kotani et al. 2023***

Literature Update - Etomidate vs Ketamine

- Design
  - Single center, prospective, open label, parallel assignment
  - 801 patients, 2 arms
  - Primary end point was 7d survival and secondary end point was 28d survival
  - Conducted as an Exception to Informed Consent (EFIC) trial
- Strengths
  - Standard airway team, standardized med dosing
  - Prospective and randomized
- Weakness
  - Open trial – Allowed clinicians to switch agents based on what they thought might be best. Possible bias
- Limitations
  - Single center, open label

Literature Update - Etomidate vs Ketamine

- Findings
  - Increased 7d mortality with etomidate
    - 77% vs 85%
  - No difference in mortality at 28d
    - 64% vs 66%
  - No difference in ICU length of stay, vasopressor use/duration, or duration of mechanical ventilation, adrenal insufficiency, or sequential SOFA scores
- Discussion
  - Authors chose this study design due to their own internal data from 2015 stating there seems to be negative outcome associated with etomidate
  - No significant differences in intubation technique (NMB, attempts, etc)
- Interestingly, ketamine has a higher percentage of patients with post procedure hypotension

Literature Update - Etomidate Meta Analysis

- Design
  - Meta Analysis of RCT of etomidate vs other agents for induction during RSI
    - 4399 records identified/screen, and 11 studies included
  - Studies between 1999-2022. U.S. (8), U.K. (1), France (1), Netherlands (1)
- Strengths
  - Meta Analysis
- Weaknesses
  - Retrospective, potential author bias
- Limitations
  - By its nature is retrospective, not a prospective RCT
  - 5 studies low bias, 5 with concerns of bias and 1 with sig concern for bias

Literature Update - Etomidate Meta Analysis

- Findings
  - Increase in mortality with etomidate use vs other agents (23% vs 20% P=0.03, NNH 31)
  - 98% hance etomidate increases mortality and 92% chance its clinically significant (NNT< 100)
- Discussion
  - Another meta-analysis changing the discussion around etomidate
  - Authors propose that the mortality is related to the reduced stress response in the intermediate period
  - Authors recommend considering an alternative to etomidate

Literature Update - Etomidate Discussion

- Per the most current meta-analysis there does seem to be some mortality effect with etomidate usage
- Also cause does dependent adrenal suppression (inhibition of 11 beta-hydroxylase)
  - Has been shown with ACTH stim tests but clinical significance unclear
- Subgroup analysis did not identify any outliers
- Also had increased mortality when ketamine was the comparator, excluding those with early death (within 48h of intubation), and where septic patients were the majority
- Other agents compared were ketamine, ketamine+midazolam, thiopental, midazolam, ketamine+propofol

Thank You!