Death by ventilator

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Disclosures

› Don’t get $$$ from anyone related to this
› Or any other topic actually
  – Pretty sure can be bought so if you have a “killer” product call me!!!
Goals for today

› Be able to manage those difficult patients
› Manage the “Physiologically difficult airway”
› Manage the critical post intubation period
› Manage those patients you really shouldn’t intubate
Anatomically difficult airway
Everyone familiar with the “anatomically difficult airway” should recognize the “physiologically difficult airway”:
- Hypotensive
- Hypoxic
- Acidotic

Easy to kill with intubation so plan accordingly.
Periintubation hypotension

- Sympathetic drive
- Hypovolemia
- Increased intrathoracic pressure
- Medications we use
Resuscitation before intubation

› Hypotensive
  – Fluids first
  – Vasopressors first
  – Push dose pressors

› BE PREPARED
  – Pick drugs
  – Don’t rush
  – Have a plan
Normal patient breathing room air (PaO2 90-100) desaturation 45-60 sec.

Normal patient breathing 100% ("reservoir" full) desaturation 8 min

Faster in obese 2.7 min, moderately sick people 5 min, kids faster younger (smaller)

Goal of RSI is to get maximum reservoir of Oxygen BEFORE Intubation.
Oxygen reservoir?

Already hypoxic

Preoxygenate
  – Non Rebreather 15 l/m?
  – Add NC high flow
  – Delayed Sequence Intubation?
  – Sit upright?
Position

› Lane et al Anaesthesia 2005 Compared preoxygenation in supine vs 20 deg head up.
  Gave paralytic and measured time from 100%-95%
  - Head up 386 sec
  - Control 283 sec

› Altermatt Brit J Anaesth 2005 Obese patient (BMI 35) 25 deg head up SpO2 100%-90%.
  - 214 sec vs 162 sec

› Boyce et al Obes Surg 2003 Reverse trendelenburg (30 deg head up) similar results.
Delayed Sequence Intubation DSI

- Use of medications and BVM or NIV as a bridge to intubation.
- Sedation (propofol, etomidate, etc)
- Better Ketamine, dexmetetomidine
- CPAP/BiPAP
- Intubate
Apneic oxygenation

› Movement of oxygen and CO2 cause alveolar \textit{O2} pressure to be negative
› Causes oxygen to passively move into alveoli
› Optimal circumstances oxygenation up to 100 min without breathing (will get severely hypercarbic)
› Taha et al anaesthesia 2006 no desats 6 min at 5 L/m NC control 3.65 min
› Ramachandran J Clin Anesth 2010 obese patients 5 l/m
  \(\rightarrow\) 95\% 5.29 vs 3.49 min
Paralytic?

- 2 studies suggest time to desaturation is shorter with Succinylcholine than with rocuronium
- Taha Anaesthesia 2010
- At a dose of 1.2 mg/kg Rocuronium gives identical intubating conditions to Succinylcholine
DKA, Sepsis, Salicylate poisoning, ie any severely acidotic patient

Why are they breathing that fast???

Why would you want to intubate them???

If you do you will make them worse at least initially
  - Paralytic will rapidly increase CO2 (hence worsen acidosis)
  - Check ETCO2 before
  - Try to match that after
  - Recognize you can’t breath for them as well as they can

Now they are intubated how can you kill them? Special Cases
Welcome to Texas

“Come for the BBQ – stay for the angioplasty”
Now they are intubated how can you kill them?
Special Cases Continued

- Asthma COPD bronchospasm
- Problem is can’t EXHALE
- Intubation makes that worse not better use big tube
Vent settings to start

- TV 6 ml/kg IBW
- RR 10-12
- PEEP of 8-12
- High inspiratory flow rate
- Ignore peak pressure
- Plateau pressure ≤ 35
- Ignore ETCO2
- SAO2 goal 88-92%
- Treat hypoxia first with increasing PEEP FiO2 second
Dynamic hyperinflation/Breath Stacking

- What happens
  - Can’t exhale
  - Excessive TV
  - Don’t allow time to exhale
  - Excessive PEEP
Breath stacking/Dynamic hyperinflation

› Increasing thoracic pressure
› Decreasing venous return
› Increasing difficulty ventilating
› Confused with Tension Pneumothorax
Treatment?

› Step one Disconnect the ventilator
› Step two wait listen for prolonged exhalation
› Step three push on chest to force exhalation.
› If that doesn’t work bring out the needle
Use Ventilators

› BV ventilation is not accurate
› Use right numbers
› Way better
Right numbers???

› ARDS net only real data
› 6-8 ml/kg
› IDEAL BODY WEIGHT
Ideal Body Weight?

- IBW kg = 50 + 2.3(Height in inches - 60)
- IBW kg = 50 + 0.96(Ht in cm - 152.4)
- Example 5 ft tall IBW=50 kg
  \[-50 \times 7 \text{ml/kg} = 350 \text{ml tidal volume}\]
- Example 6 ft tall 50 + 2.3x(72-60)=77.6
  \[-78 \times 7 = 546 \text{ml tidal volume}\]
Ideal Body Weight?

› Use ulnar length to get height
› Much easier
› Appears way more accurate than “estimating”
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Delayed problems

› VAP
› Aspiration
› Secondary lung injury
› Hyperoxia
› Delirium/death
Prevention is key

› Avoid aspiration
  - (RSI) prolonged attempts
  - Keep head of patient elevated
  - Empty stomach (OG/NG)
  - Keep mouth empty (suction special ET tubes)
  - Keep mouth clean/sterile use swabs

› If you suction ET tube use sterile technique.
Secondary Lung Injury

› Ventilator Induced Lung Injury (VILI)
› Barotrauma
› Atelectotrauma
› Oxygen toxicity
› Fluid overload
Oxygen Toxicity

› Start with 100%

› Dial down as fast as possible
  - Unless head injury or myocardial ischemia 88-92% is goal. (or FiO2 0.21)
  - More and more evidence bad for injured brains and COPD maybe heart
Oxygen is good and 100% is the goal?

- Post ROSC? JAMA 2010 If patient was hyperoxic with a paO2 >300, they did worse than the patient with a paO2 <60.

- COPD patients? BMJ 2010 405 patients with presumed COPD exacerbations requiring EMS transport to the hospital that were placed into two groups; one group received high-flow oxygenation and the other titrated oxygenation to maintain O2 sats between 88---92%. The high-flow oxygenation group had a mortality rate of 9% compared to 4% for the titrated oxygenation.
Pain management

› Being intubated is painful
› Most intubated patients complain of pain
› Pain is bad for you
› Always, Always, Always treat pain first
› Try to use pain medications first and then add sedatives and avoid paralytics if possible
  - ARDS net data indicates prolonged use of paralytics is associated with increased difficulty weaning the patient.
Pain Management

- Fentanyl drip at 1-1.5mcg/kg/hr then bolus 50-100 micrograms until comfortable then add minimal sedation as needed. Propofol, dexmetetomidine best.
- Hemodynamic instability ketamine

Conclusion: Deep sedation first 48 hrs assoc with increased LOS and Mortality.
- 251 Critically ill patients
  - Deep sedation in first 4 hrs independent predictor of:
    - Time to Extubation
    - Hospital death
    - 180 day mortality
Clinical Practice Guidelines for the Management of Pain, Agitation, and Delirium in Adult Patients in the Intensive Care Unit Crit Care Med 2013

› Treat pain first and aggressively
› Use opiates first line
› Avoid Benzos use other sedatives
› Use validated pain and sedation scales.
Lung Protective Strategies

› Mechanical Ventilation and ARDS in the ED Fuller, B Chest 2015
  - Demonstrated that Lung protective strategy seldom used in Eds. Focus on ARDS but references to rest.

› Protective mechanical ventilation in the non-injured lung: review and meta-analysis Sutherasan Crit Care 2014
  - Evidence that lung protective strategies can prevent ARDS/VALI/VAP
  - TV 6-8 ml/kg
  - PEEP 10 (use peep increases for hypoxia instead of FiO2)
  - HOB elevated
  - Mouth clean
Summary

- Remember life begins after intubation
- Prevent desaturation
- Prepare for (better yet prevent) hypotension
- Be very afraid of the patient breathing fast
- Use the ventilator whenever possible
- Use the right settings
- Give pain medications
- Avoid excessive oxygen
- Protect the patient with elevation, suction, swabs and empty stomach.