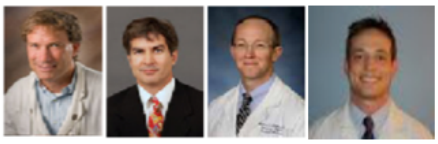
critical care perspectives in emergency medicine



Intubating and Ventilating the Obese Patient

Key Article

- *De Jong A, Chanques G, Jaber S. Mechanical ventilation in obese ICU patients: from intubation to extubation. Crit Care 2017; 21:63.*

Background

- Prevalence of obesity in the US has now risen to 35% of population
- Obesity is a significant problem in the ICU

Physiologic changes with obesity

- Oxygenation decreases with increasing in weight
    - Oxygen consumption increased – 1.5 times higher than in non-obese patients
    - Work of breathing increased – the spontaneous breathing rate in morbidly obese patients ranges from 15 to 21 bpm compared with 10 to 12 in non-obese patients
- Excess production of CO2
- Increased atelectasis
    - Negative effects of thoracic wall weight
    - Abdominal mass pushes up on diaphragm
    - Leads to decreased FRC
    - Further exacerbated in the supine position
    - Many changes persist even after extubation compared with non-obese patients
- Decreased pulmonary and thoracic compliance due to thoracic and abdominal adipose tissue
- Increased airway resistance
- Can develop OSA and obesity hypoventilation syndrome

Airway Management

- Patient positioning
    - Supine position significantly reduces pulmonary compliance
    - Elevate the head of the bed – put external auditory canal in line with sternal notch
- Pre-oxygenation
    - Patients are at high risk of desaturation due to poor cardiopulmonary reserve

    - Safe apnea time with facemask or NRB may be less than 1 minute!
    - NIV
        - Use a PEEP of 10 cm H2O during pre-oxygenation
        - Most beneficial when used for at least 5 minutes
    - HFNC
        - May be considered for pre-oxygenation or apneic oxygenation
- RSI
    - Obesity is an independent risk factor for difficult intubation and BVM
    - *Bhat R, et al. Analysis of rapid sequence intubation medication dosing in obese patients intubated in the ED. Am J Emerg Med. 2016*
        - Compare rates of inappropriate RSI medication dosing in obese and non-obese patients
        - Retrospective review of single center, urban, tertiary care, academic center
        - 440 patients: 29% obese
        - Used etomidate and succinylcholine as medications
        - Obese patients
            - More likely to be under dosed with succ (OR 63.7)
            - More likely to be under dosed with etomidate (OR 178.3)

Mechanical Ventilation

- Mode
    - No optimal mode of mechanical ventilation
    - Some prefer pressure controlled mode
        - Decelerating flow may allow better distribution of flow in alveoli
        - However, if airway resistance increases or compliance decreases, tidal volume will decrease and lead to hypercapnia
        - Must monitor tidal volume, minute ventilation, and capnography
    - Volume controlled mode
        - Carries the risk of increased pressure to provide desired tidal volume
        - Must monitor plateau pressure
- Tidal Volume
    - Lung protective tidal volumes – 6 to 8 ml/kg IBW
    - Based on height and not weight
    - *Goyal M, et al. Body mass index is associated with inappropriate tidal volumes in adults intubated in the ED. Am J Emerg Med. 2016*
        - Retrospective study from single center, urban, academic ED
        - To determine if BMI is associated with inappropriate TV settings
        - 517 patients
        - 21.7% had TV settings > 10 ml/kg IBW
        - Obese patients had higher odds of inappropriate settings
        - As BMI increased, tidal volume increased

- Respiratory Rate
    - Obese patients have excess production of CO2 due to increased oxygen consumption and increased WOB
    - Spontaneous breathing rates closer to 20 bpm in obese patients
    - RR should be set for increased breathing rate
- PEEP
    - Given decreased FRC, obese patients are more sensitive than non-obese patients to atelectasis and lack of PEEP
    - Better to apply PEEP at the start of mechanical ventilation in obese patients
    - PEEP of 10 cm H2O is recommended – though optimal level unknown
    - Must be balanced by hemodynamic effects of high PEEP
- Driving Pressure
    - Concept assumes that functional lung size is better quantified by compliance than by predicted body weight
    - Driving pressure = plateau pressure – PEEP
    - Lower levels of driving pressure are associated with increased survival
- Recruitment Maneuvers
    - In obese patients, shown to improve arterial oxygenation and available lung volume
    - Best recruitment maneuver not determined
    - Reference method is an expiratory pause with a PEEP of 40 cm H2O for 40 seconds
    - Alternative – progressive increase in PEEP until 20 cm H2O with a constant tidal volume within 35 cm H2O of plateau pressure
    - Careful with hemodynamic status during this maneuver
- Patient positioning
    - Higher tidal volumes and lower respiratory rates when patients placed in a reverse Trendelenburg position
    - Do not keep in supine position