Airway Management in the Obese Patient

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• None:
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  ◦ Is not an associate of the former mayor of Detroit, Kwame Kilpatrick.

Scope of the Problem

• Some 30% of the adult U.S. population is classified as obese – BMI > 30 kg/m², BMI > 40 kg/m² = morbidly obese.
• This is particularly affecting the pediatric population and obese children almost inevitably are obese adults.
• A significant part of the mortality and morbidity of obesity revolves around the respiratory system that becomes all the more exacerbated when the obese patient presents to the ED critically ill.
The “reality” of Grey’s Anatomy is all too real in the emergency department.

Pulmonary Physiology

- Changes in pulmonary physiology in the obese patient can be profound and include:
  - Diminished total lung capacity and vital capacity as the result of reduced chest wall compliance and pressure from the mass of abdominal contents.
  - Diminished expiratory reserve volume as small airways collapse leading to V/Q mismatch of well perfused but poorly ventilated areas of the lung, particularly at the bases—markedly exacerbated by a supine position and inefficient respiratory muscles.
  - Functional residual capacity falls precipitously as BMI increases so obese patients have little oxygen reserve and rapidly desaturate with RSI induced apnea.
  - Obese patients have increased O\(_\text{2}\) consumption and higher CO\(_\text{2}\) production due to increased work of breathing.

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Total lung capacity = Inspiratory Reserve + Functional residual capacity
FRC = exp. reserve volume + residual volume, air remaining at the end of a quiet respiration
V\(_\text{i}\) = tidal volume when breathing at rest
VC = vital capacity, volume of expelled air from a position of full inspiration
IC = inspiratory capacity, volume of air taken at a full inspiration
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GI Physiology

- From the GI perspective, obese patients have:
  - High incidence of hiatal hernias and GERD.
  - Larger gastric volume.
  - Lower pH of gastric contents.
- They are at high risk for aspiration and tolerate aspiration even more poorly than the patient with a normal body habitus.

Difficult Airway in the Obese Patient

- The difficult airway is defined as:
  - "Difficulty with face mask ventilation of the upper airway, difficulty with tracheal intubation, or both."
- Whether BMI predicts the potential for a difficult airway has been contradictory in the literature but most experts believe it does represent a greater potential than the average patient.


Difficult Airway in the Obese Patient

- The bag-valve mask is the main rescue device in airway management with RSI.
- BVM use in the obese patient is often difficult due to:
  - Difficulty fitting the mask.
  - Chest wall weight and reduced compliance.
  - Redundant supraglottic tissue.
  - Reduced diaphragm excursion and increased upper airway resistance.
It does not take much imagination to see how difficult it would be to use a BVM on this patient. So preparation for enhancing the use of a BVM is crucial.

Optimizing the BVM

- Nasal and oral airways or both.
- Use the best fitting mask.
- Use the 2-3 person technique to bag with bilateral support of the jaw.
- Upright/sitting position.

Positioning

A propped up semi-sitting position in the obese patient starts the preparation for intubation in the obese patient:
- gravity is more your friend with tongue and oral tissues less likely to fall back and obstruct the airway
- the airway is more aligned making intubation easier
Preoxygenation

- Is key to increasing the typically short apnea time in obese patients that can often be < 60 seconds to critical desaturation.
- As air is 21% oxygen and ~ 78% nitrogen the goal is replace nitrogen in the alveoli with oxygen providing a reserve when apnea occurs as part of RSI.
- In the normal BMI patient preoxygenation can be accomplished with breathing through a NRB mask at 15-30 L/min flow (cranked up as high as possible) for 3-5 minutes.

Preoxygenation

- Preoxygenation is more critical and more difficult in the obese patient.
- Getting the obese patient sitting up at least to 25° or even higher can help.
- Start with a NRM mask at 15-30 L/min flow.
- Use of noninvasive positive-pressure ventilation can be particularly useful to preoxygenate the obese patient.

Preoxygenation

SAY HELLO TO MY LITTLE PREOXYGENATION FRIEND!

Both CPAP and Bi-PAP can be used and are effective in preoxygenating the obese patient – have a low threshold to moving to it as you prepare to intubate the obese patient.
CPAP at 10 cm H20
Bi-PAP start at 4 & 10 cm H20

* Personal note: I prefer Bi-PAP as I can increase the positive pressure to a higher level than with CPAP, often up to 15 cm H20 is typical in an obese patient to overcome the high upper airway resistance.
Pharmacology of RSI in the Obese Patient

- Drug metabolism can be difficult to predict in the obese patient due to:
  - Renal blood flow is higher so clearance of some drugs might be faster.
  - Volume of distribution is often larger, particularly for lipophilic agents.
  - Liver kinetics are typically normal in the obese patient.

Ideal vs. Actual Body Weight

- General rule of thumb:
  - Hydrophilic drugs dose according to ideal body weight.
  - Lipophilic drugs dose based on actual body weight.

- That nice guideline that falls down in the ED because:
  - Who can remember which drug is hydro or lipophilic save for Propofol.
  - Estimates of both actual and ideal body weight are often erroneous, even the patient is unlikely to know how much they actually weigh.

Induction Agents

- Etomidate is lipophilic – dose per total body weight.
- Ketamine — experts disagree but best evidence supports the dose based on lean body mass (ideal wt. + 20%) though some experts say base the dose on a number halfway between actual and ideal weight.
- Benzodiazepine half-life is increased in obese patients so dose best at ideal body weight.
- Propofol — highly lipophilic and dose based on actual body weight.
Opiates

- Opiates are generally lipophilic but their metabolism and pharmacokinetics is very complex making predictions on dosing almost impossible.
- Dose is likely based best on clinical effect – give some, see what effect is obtained, give some more.
- Some suggestion that fentanyl should be dosed by total body weight.


Neuromuscular Blockers

- There are better and more studies with NMB's in obese patients then the induction agents.
- Succinylcholine – best paralytic conditions with dose of 1mg/kg based on total body weight.
- Rocuronium, vecuronium – dosed by ideal body weight.

It is now time to bite the bullet and intubate the patient.
Sequence starts with:
- position the patient
- consider awake intubation
- have fiber optic or video laryngoscope available
- have intubation wand/tracheal tube introducer available
- have supraglottic devices on hand (LMA)
- surgical airway as last resort, be prepared
**Position**

The “ramped up” position significantly facilitates intubation by aligning the chin and sternal notch to optimize view of the tracheal opening, also improves preoxygenation.

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**Awake Intubation**

- It is felt to be safer if paralysis of the obese patient can be avoided.
- Adequate topical anesthesia is key and 40 cc’s of atomized 2% lidocaine can be used safely in most obese patients.
- Topical anesthesia can be difficult in the obese patient, aerosol sprays can be helpful along with nebulized lidocaine.
- Transtracheal injection through the cricothyroid membrane of lidocaine can also decrease coughing as the ETT is passed.

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**Awake Intubation**

Placing 2-4cc’s of 4% lidocaine diluted with NS and nebulizing the solution into the oropharynx can provide effective topical anesthesia.

Additional lidocaine (3-4cc of 1%) injected through the cricothyroid membrane.
Awake Intubation

- Sedation for awake intubation can include:
  - Fentanyl and/or midazolam have been shown to be safe in bronchoscopy in obese patients.
  - For those with experience with Ketofol a combination of ketamine and propofol, small aliquots to obtain sedation until the ETT passes into the trachea and then a larger dose is given to heavily sedate the patient can also be effective.

Advanced Airway Techniques

- Preparation in case standard orotracheal intubation is impossible is mandatory in the obese patient.
- Have available:
  - Fiberoptic or video laryngoscope.
  - Intubation wand.
  - Supraglottic airway such as an LMA.
  - Surgical airway kits.
  - **LOTS OF HELP!**

Fiberoptic, Video Laryngoscope

Flexible fiberoptic laryngoscope can be very effective in the obese patient but requires frequent use to maintain skills, it is very expensive and rather delicate, can be difficult in the obese patient due to redundant tissue.

The Storz, GlideScope Cobalt, and Levitan FPS laryngoscopes allow video visualization of the glottic opening and are highly effective in the obese patient.
Intubation Wand

The straight or Frova curved intubating wands can be one of the most effective means to intubate the obese patient as one can maneuver the wand in the reduced oropharyngeal space often encountered in the obese patient.

Use of the intubating stylet/wand is akin to the Seldinger wire technique of intubation. The tracheal opening is visualized either by direct laryngoscopy or a video laryngoscope. The wand is passed into the trachea and the ETT is passed over the wand that guides it into the trachea. The wand is then pulled out and the patient is successfully intubated. A key step is to keep the laryngoscope in place to lift the epiglottis out of the way. The wand can be used with awake intubation or an LMA device.

Supraglottic Airways

The I-LMA (intubating laryngeal mask airway) affords both an effective oral airway that fits over the tracheal opening and one that an endotracheal tube can be passed through.

The I-gel and air-Q versions are different styles of LMA.

Surgical Airway

- Surgical airway:
  - **CANNOT INTUBATE, CANNOT VENTILATE.**
  - There is a paucity of literature on the success rate of surgical airways placed ED in obese patients.
  - Landmarks are often obscured or completely buried in the fat of the neck.
  - Cricothyrotomy is technically feasible in patients with difficult anatomy.

[Presenters recommendation – the Seldinger wire assisted cricothyrotomy kits (by Cook)]

Melker cricothyrotomy Kit is a self-contained surgical kit that facilitates a Seldinger wire facilitated cricothyrotomy.
Post-intubation Management

- Confirm that the ETT is in the trachea by multiple means – ETCO2 detectors, auscultation, CXR.
- Continuous ETCO2 monitoring is suggested.
- Respiratory mechanics and gas exchange are impaired in obese patients.
  - Pressure controlled ventilation is often necessary.
  - Lower tidal volumes and higher rates can reduce acute lung injury as often overestimate lung size for obese patients.
  - PEEP can help improve oxygenation (10cmH2O), take care as venous return to the heart can be reduced.
  - Reverse Trendelenburg position can improve respiratory mechanics and improve oxygenation.

Summary

- Airway management in obese patients can be challenging and fraught with difficulty.
- When possible an awake intubation can be safer.
- Drug pharmacokinetics are altered in obese patients with more lipophilic drugs being dosed according to total weight and others by ideal body weight.
- Use of the BVM and preoxygenation can be difficult in obese patients – use nasal/oral airways and sit the patient up to preoxygenate.
- Preoxygenate sitting up, use CPAP/BiPAP liberally.

Summary

- Visualization of the airway can be difficult, keep in mind intubation adjuncts like fiberoptic and video laryngoscopes, intubating wands, and LMA’s.
- Have surgical airway kits on hand, Seldinger wire kits most effective.
- Keep in mind the post-intubation ventilator issues with low TV (6cc/kg, ideal body weight), PEEP, and using reverse Trendelenburg positioning.
Summary

Keep in mind the advice from Elmer Fudd in regards to airway management in the obese patient:

“Be vewy, vewy careful.”

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