

Preoxygenating the Difficult to Oxygenate Patient

A little bit of background

- Common causes of hypoxemia include inadequate alveolar oxygenation, diffusion abnormalities, dead space, shunt, and low venous oxygen saturation
- In the ED for patients already on supplemental oxygen, the 2 major causes of poor oxygenation are **physiologic shunt and low venous oxygen saturation**, especially when the two are combined
 - Physiologic shunt is caused when alveoli have intact blood supply but are blocked from conducting oxygen as in pulmonary edema, pneumonia, or atelectasis. It is important to realize that in these situations, no matter how high the FiO₂, these areas will never have improved oxygenation unless the shunt is fixed
- Preoxygenation is done in order to wash out nitrogen from the alveoli and build up an oxygen reservoir for the apneic period

What we normally do

- Standard preoxygenation is tidal volume breathing of oxygen from a high FiO₂ source (**non-rebreather mask**) for at least 3 minutes or a minimum of 8 vital capacity breaths
 - This can provide up to 8 minutes of lead time before oxygen saturation begins to fall in a healthy, non-obese adult patient and should be noted that this time is significantly decreased in obese or ill patients

Preoxygenating high-risk patients

- Non-invasive ventilation (NIV) is ideal in patients who are difficult to preoxygenate with standard techniques
 - One can provide adequate oxygenation as the mask seal can be properly obtained with the straps around the patient's head
 - Titrating the CPAP from 5-15 cm H₂O can also overcome shunt and increase oxygen saturations in patients who weren't able to be oxygenated via NRB or BVM
- If NIV is unavailable, BVM with attached PEEP valve and proper, tight mask seal can improve oxygenation as well

Reoxygenation after failed intubation attempt

- Standard method is to ventilate the patient with **BVM attached to high flow O₂**
 - **High risk of aspiration** with this method
 - Need to **bag in a slow, controlled** manner as not to overcome lower esophageal sphincter tone
 - **Ten, low tidal volume breaths per minute** is adequate for reoxygenation
 - The above are difficult to achieve in the ED surrounding the excitement of a difficult to oxygenate patient
- Standard ED ventilators can also be used to avoid the above problems with BVM

- Provides consistent, guaranteed, slow, low tidal volume breaths and PEEP can be added to overcome shunt

Delayed Sequence Intubation (DSI): Procedural sedation for preoxygenation

- Patients who become **delirious from hypoxia or hypercapnia may not be able to tolerate NRB or NIV techniques**
- DSI is the **administration of a sedative agent, which does not blunt spontaneous ventilations or airway reflexes, followed by a period of preoxygenation before the administration of a paralytic agent**
 - **1-1.5mg/kg of ketamine by slow IV push** causes a dissociative state and allows the application of a NRB or NIV. Once saturation of 100% is achieved, the patient is allowed 2-3 more minutes for nitrogen wash-out and paralysis and intubation can proceed as normal
 - In patients with tachycardia and/or elevated blood pressure, **1mcg/kg of dexmedetomidine** over 10 minutes can be used instead of ketamine
- This technique may also help improve respiratory status so much so that intubation may be able to be avoided
 - Sedative can be allowed to wear off, the patient can be reassessed (mental status and respiratory parameters), and the decision to intubate or not can then be made

References:

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