Preoxygenation Strategies

**Preoxygenation**: preoxygenation prior to intubation is required to de-nitrogenate the patient’s lungs and to prevent desaturation during the apneic period after induction and paralysis, and during intubation.

Traditionally with **Rapid Sequence Intubation (RSI)**, the patient is pre-oxygenated for 3 minutes of tidal volume or 8 vital capacity breaths with a non-rebreather. This only supplies an FIO2 of approximately 60%.

Consider **adding nasal prongs** with 15L of supplemental oxygen to 15L of O2 through the non-breather to increase the FiO2 closer to 100%.

Elevate the head of the bed to 20-30 degrees. This also helps improve visualization during intubation. If the patient is in spinal precautions, use the reverse trendelenberg position.

If the patient is still hypoxic with these maneuvers (O2 saturation <93%), consider adding **positive pressure** during preoxygenation. This can be done either with

1) A bag-valve-mask with a PEEP valve, using a good mask seal (do not administer breaths), or
2) Placing the patient on CPAP, leaving the nasal prongs on. Use up to a maximum of 15cm H2O to prevent opening the lower esophageal sphincter.

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*Fig 1: Bag-valve-mask with PEEP valve attached*
**The Triple 15 Rule For Pre-oxygenation**

Memory Aid Pearl: Triple 15 Rule for preoxygenation!

- **15L O2 by nasal prongs**, plus
- **15L O2 by non-rebreather**, and if oxygen saturation <95% then
- **15cm H2O of CPAP** while maintaining nasal prongs

**Apneic Oxygenation**

Apneic oxygenation: provides ongoing maximal oxygenation during the apneic period, immediately after induction and paralysis, and before intubation of the trachea with ventilation. Apneic oxygenation has been shown to increase the frequency and duration of higher oxygenation saturations during intubation (2,3).

**Indications for Apneic Oxygenation:**
- Patient who requires intubation, but is not predicted to crash imminently AND
- O2 saturation < 93%

**Method to provide apneic oxygenation:** leave nasal prongs at 15L/min on the patient during the apneic period. If the patient required CPAP for preoxygenation, they will require CPAP for the apneic period as well. This is done by leaving the bag-mask-valve with the PEEP valve or the NIPPV CPAP mask on the patient, using a good mask seal.

**Delayed Sequence Intubation (DSI)**

**When to use DSI:** Recommended by Dr. Weingart for the altered patient who is not cooperating with your attempts at securing the airway – a patient with agitated delirium from hypoxia, hypercapnia, or the underlying medical condition.

DSI is Procedural Sedation With the Procedure Being Pre-oxygenation: DSI uses a dissociative dose of ketamine (1.0-1.5mg/kg IV) in a critically ill adult patient. This will allow you to provide pre-oxygenation to the patient as described as above. DSI allows calm, deliberate securing of the airway in an otherwise uncontrollable patient and as such can be conceptualized as procedural sedation for airway intubation, with the procedure being pre-oxygenation.

Once the patient is dissociated:
- Place the patient on oxygen with 15L nasal prongs and either 15cm H2O via BVM plus peep valve or via CPAP
- When the O2 saturation is >95% allow the patient to breathe for 3 minutes
- Then administer the paralytic if required and leave the mask and nasal prongs on while the paralytic takes effect
- When ready for intubation, remove the face mask, leaving the nasal prongs in place and intubate (See the DSI Algorithm in Figure 1)
A recent multicentered study was conducted on 62 patients who required DSI for preoxygenation secondary to delirium (4).

- The primary outcome in this study was oxygenation saturation after maximal attempts at preoxygenation before DSI vs. saturation prior to intubation with DSI.
- No complications were observed in patients receiving DSI.
- All patients increased their oxygen saturations post-DSI, with 91% of patients increasing their O2 saturation post-DSI to greater than 93%.
- 2 patients avoided intubation post-DSI.

Dr. Weingart's deep dive into Delayed Sequence Intubation at EMcrit. http://emcrit.org/dsi
Key References


