



EM CASES SUMMARY

Prepared by Dr. Keerat Grewal, Nov 2014

Episode 54 – Critical Care Pearls for the Community ED Physician (Part 1: Preoxygenation, Apneic Oxygenation, Delayed Sequence Intubation)

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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.



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.

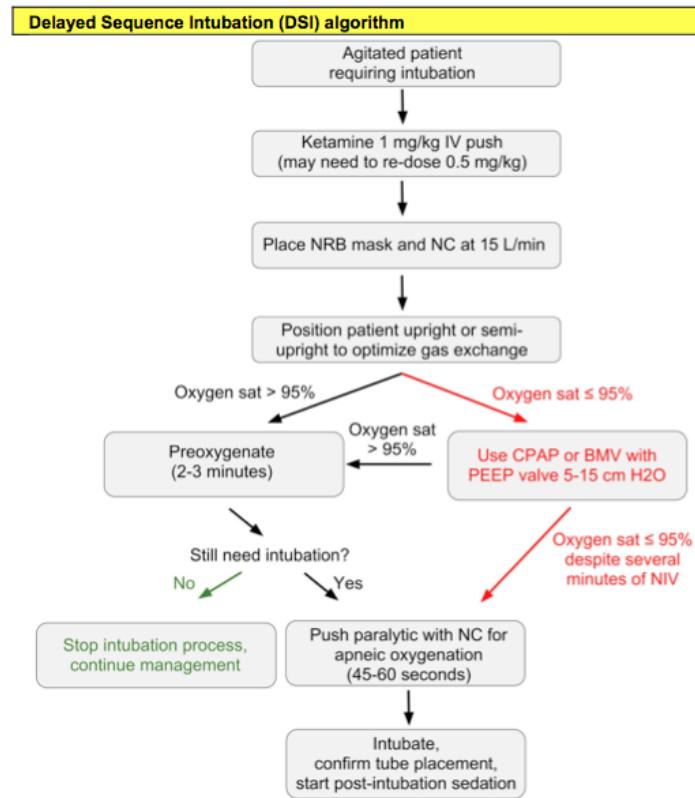
Once the patient is dissociated:

- 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>



NRB: Non-rebreather (mask)
NC: Nasal cannula
CPAP: Continuous positive airway pressure
BMV: Bag-valve mask ventilation
NIV: Non-invasive ventilation (e.g. CPAP, BMV)

Note:
 During CPAP or BMV, it may take several minutes (may be as long as 10 minutes) to bring the oxygen saturation > 95%, while increasing PEEP up to 15 cm H₂O.



Figure 1: DSI Algorithm (with permission Michelle Lin)

Key References

1. Weingart, SD & Levitan, RM. 2012. Preoxygenation and prevention of desaturation during emergency airway management. Ann Emerg Med, 59(3): 165-75. Full article: <http://www.annemergmed.com/article/S0196-0644%2811%2901667-2/fulltext>
2. Ramachandran, SK, Cosnowski, A, Shanks, A & Turner, CR. 2010. Apneic oxygenation during prolonged laryngoscopy in obese patients: A randomized, controlled trial of nasal oxygen administration. J Clin Anesth, 22(3): 164-8. Full article: <http://www.ncbi.nlm.nih.gov/pubmed/20400000>
3. Christodoulou, C, Mullen, T, Tran, T, Rohald, P, Hiebert, B & Sharma, S. 2013. Apneic oxygenation via nasal prongs at 10L/min prevents hypoxemia during elective tracheal intubation. Chest, 144(4- Meeting Abstracts): 890A.
4. Weingart, SD, Trueger, NS, Wong, N, Scofi, J, Singh, N & Rudolph, SS. In Press. Delayed Sequence Intubation: A prospective observational study. Ann Emerg Med. Full pdf: <http://emcrit.org/wp-content/uploads/2014/07/dsi-article.pdf>