From Life In the Fast Lane: https://litfl.com/delayed-sequence-intubation-dsi/

Delayed sequence intubation (DSI)

by Dr Chris Nickson, last update June 17, 2019

OVERVIEW

Delayed sequence intubation (DSI) is procedural sedation, where the procedure is preoxygenation

- DSI may be useful in the patient for whom rapid sequence intubation would inevitably result in significant hypoxaemia because they cannot be preoxygenated by other means
- Ketamine is the ideal DSI induction agent as it preserves airway reflexes and respiratory drive

Also see Preoxygenation and Apnoeic oxygenation

INDICATIONS

- Patient who is agitated or is otherwise intolerant of preoxygenation via nasal prongs, non-rebreather mask, bag-valve-mask, and/or non-invasive ventilation
- Another procedure is required before intubation, but the patient will not tolerate it (e.g. nasogastric tube placement prior to intubation in the setting of GI haemorrhage)

PROCEDURE

- identify agitated patient requiring emergency intubation (see indications)
- position the patient 'head up' at 30 degrees (or more), with auditory meatus above the jugular notch
- administer induction agent, ideally ketamine 1mg/kg IV
    - give as slow IV push over 15-30 seconds to prevent apnoea
    - can give further doses of 0.5mg/kg IV to achieve complete dissociation if required
- Ensure the patient has a patent airway
- Place standard nasal cannula at 15 L/min prior to placement of the preoxygenation device
- Choose preoxygenation device based on the patient's SpO2:
    - if SpO2 >95% use:
        - bag-valve-mask (BVM) with PEEP valve and a good seal at 15 L/min O2, or
        - non-rebreather (NRB) mask and a good seal at 15 L/min O2 (or more)
    - if SpO2 <95%:
        - BVM with PEEP valve and a good seal

- preoxygenate for at least 3 minutes
- administer neuromuscular blocker and wait 45-60 seconds
    - use suxamethonium 1.5mg/kg IV or rocuronium 1.2mg/kg IV
- intubate patient

COMPLICATIONS

Usual complications associated with:

- non-invasive ventilation
- intubation
- medication side-effects

A particular concern is that DSI goes against the tenets of rapid sequence intubation and may increase the risk of aspiration.

OTHER INFORMATION

Other induction agents

- other agents have been suggested as the induction agent for DSI, such as dexmedetomidine, remifentanil and droperidol
- these agents do not have the same constellation of rapidity of onset, preservation of airway reflexes, preservation of respiratory drive and safety profile as ketamine

Neuromuscular blockade

- Rocuronium at 1.2 mg/kg is the ideal neuromuscular blocker
    - achieves rapid paralysis comparable to suxamethonium for intubating conditions
    - absence of defasciculation decreases oxygen consumption compared to suxamethonium
- rarely, DSI averts the need for intubation as the patient (e.g. severe asthma) is no longer agitated and oxygenation improves
    - in these cases it is reasonable to avoid administering the neuromuscular blocker — either allow the sedative to wear off or administer further boluses to maintain ongoing oxygenation
    - However, DSI should only be initiated with the intention of proceeding to intubation

KSI (“ketamine sequence intubation”)

- the term KSI was proposed by Reuben Strayer
- KSI is similar to DSI, but an important difference
- KSI involves performing laryngoscopy and intubation as per the DSI procedure but without using neuromuscular blocker

- This means that the patient continues to breath spontaneously during the entire procedure (traditionally, keeping patients breathing spontaneously is a central tenet of difficult intubation strategies)
- Lack of neuromuscular blockade may result in suboptimal intubation conditions however

EVIDENCE

The current evidence for DSI consists of uncontrolled observational data only

- Weingart et al, 2014
    - prospective observational study
    - convenience sample of 64 patients (two lost to analysis)
    - patients were those requiring emergency intubation who did not tolerate pre-oxygenation with traditional methods, and were not predicted to have a difficult airway
    - DSI was performed using ketamine resulting in significantly improved oxygen saturations prior to intubation: 88.9% vs 98.8% (increase of 8.9%, 95% C.I. 6.4-10.9)
    - two patients with asthma improved sufficiently to avoid intubation all together
    - there were no complications – two well oxygenated patients had minor reductions in their oxygen saturations but they did not receive nasal cannulae for pre/apneic oxygenation

There are also case reports of use in paediatric patients (Miescier et al, 2015; Lollgen et al, 2014; Schneider and Weingart, 2013)

FINAL WORDS

- Delayed sequence intubation may be a useful technique for preoxygenation when patients do not tolerate other means of preoxygenation and emergency intubation would be otherwise unsafe due to the risk of hypoxaemia
- DSI should only be performed by experienced clinicians with airway expertise

References and Links

LITFL

- CCC — Preoxygenation
- CCC — Apnoeic oxygenation
- CCC — High-flow nasal cannula

Journal articles and textbooks

- Gill S, Edmondson C. Re: preoxygenation, reoxygenation, and delayed sequence intubation in the Emergency Department. The Journal of emergency medicine. 44(5):992-3. 2013. [pubmed]
- Löllgen RM, Webster P, Lei E, Weatherall A. Delayed sequence intubation for management of respiratory failure in a 6-year-old child in a paediatric emergency department. Emerg Med Australas. 2014 Jun;26(3):308-9. PMID: 24712856.
- Miescier MJ, Bryant RJ, Nelson DS. Delayed sequence intubation with ketamine in 2 critically ill children. The American journal of emergency medicine. 2015. [pubmed]
- Schneider ED, Weingart SD. A case of delayed sequence intubation in a pediatric patient with respiratory syncytial virus. Ann Emerg Med. 2013 Sep;62(3):278-9. doi: 10.1016/j.annemergmed.2013.03.027. PMID: 23969131.
- Skupski R, Miller J, Binz S, Lapkus M, Walsh M. Delayed Sequence Intubation: Danger in Delaying Definitive Airway? Annals of Emergency Medicine. 67(1):143-4. 2016. [pubmed]
- Weingart SD, Trueger NS, Wong N, Scofi J, Singh N, Rudolph SS. Delayed Sequence Intubation: A Prospective Observational Study. Ann Emerg Med. DOI: http://dx.doi.org/10.1016/j.annemergmed.2014.09.025
- Weingart SD, Trueger S, Wong N, Singh N, Rudolph SS. In reply:. Annals of Emergency Medicine. 67(1):144-145. 2016. [article]
- Weingart SD. Preoxygenation, reoxygenation, and delayed sequence intubation in the emergency department. J Emerg Med. 2011 Jun;40(6):661-7. Epub 2010 Apr 8. PMID: 20378297. [Free fulltext]
- Weingart SD, Levitan RM. Preoxygenation and prevention of desaturation during emergency airway management. Ann Emerg Med. 2012 Mar;59(3):165-75.e1. Epub 2011 Nov 3 PMID: 22050948. [Free fulltext]
- Weingart SD. Re: preoxygenation, reoxygenation, and delayed sequence intubation in the Emergency Department. The Journal of emergency medicine. 44(5):993-4. 2013. [pubmed]

FOAM and web resources

- Auckland HEMS — DSI, apnoeic ventilation and preoxygenation (2012)
- EMCRIT — EMCrit Podcast 40 – Delayed Sequence Intubation (DSI) (2011)
- EMCRIT — Preoxygenation, Reoxygenation and Deoxygenation
- EMCRIT — EMCrit Podcast 137 – Delayed Sequence Intubation (DSI) Update (2014)
- EMCRIT — Response to a Letter to the Editor on DSI Study (2015)
- PK SMACCtalk video — Pediatric Preoxygenation & DSI — Kids are not little adults, they are worse by Rob Bryant (2013)