

Episode 8 – Airway Controversies

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General approach to patient with respiratory depression

Transport patient to resuscitation area, notify the whole team (RNs, RTs, etc), and have all the equipment ready (IVs, advanced airways, cardiorespiratory monitors)

Consider 500cc to 1L bolus IV of NS; consider 4-point restraints before giving the naloxone to protect the patient and medical staff, as well as one attempt at bag-valve-mask ventilation (BVM) to rule out laryngospasm, which could cause negative pressure pulmonary edema if the patient inspires against a closed glottis once the naloxone is given

Oxygen (O₂) delivery

Nasal prongs deliver only slightly more than the 21% of O₂ contained in air because of the entrainment effect it creates, and “100% non-rebreather mask” only delivers 65-70% O₂ at best

To get better oxygenation, a better seal is needed, whether through BVM, non-invasive positive pressure ventilation (NIPPV), or endotracheal intubation

Tips for good BVM technique

A health care provider (experienced with BVM) delegated exclusively to this task in order to perform it adequately (RR = 8-12/min, not more!) with the right sized equipment, and consider using an oropharyngeal airway and/or 2 nasopharyngeal airways (trumpets)

2-handed, 2-person technique (2 hands on the mask, and a second person squeezing the bag) is much more effective at opening up the airway by moving the mandible forward into the mask, i.e. jaw thrust, instead of driving the mask down on the face, which makes the soft tissue obstruct the airway

Two methods for 2-handed technique: (a) mirror image of what is usually done for one-handed technique (upper picture¹), which allows 3 fingers per hand to lift the mandible; and (b) thenar eminences holding the mask with the thumbs in the direction of the patient’s feet, with 4 fingers per hand to lift the mandible (lower picture¹)



For bearded patients, consider putting a tegaderm patch on the beard (with a hole for ventilation!), or lubricant jelly in order to improve the seal; for edentulous patients, keep the dentures in for BVM (and remove for intubation), or put gauzes inside the cheeks

Mnemonic for difficult BVM: BOOTS – *Bearded, Obese, Old, Trauma* (eg, obstruction), *Stiffness* (eg, OSA, COPD); also consider the effects of radiation therapy, which increases stiffness and decreases mouth opening

Indications for intubation

General indications: obtain and maintain an airway in the setting of obstruction; correct deficient gas exchange (hypoxia or hypercarbia); prevent aspiration of blood, saliva, or other secretions; and predicted clinical deterioration

¹ Weiss AM and Lutes M. Focus On - Bag-Valve Mask Ventilation. September 2008. <http://www.acep.org/publications.aspx?LinkIdentifier=id&id=40992&fid=3430&Mo=No&taxid=112591>. Last accessed October 9th, 2010.

Additional pearls

Dogmatic approach like “GCS less than 8 means intubate” is inappropriate because it neglects the expected clinical course of the patient, and also because the GCS scores have only been validated in the setting of trauma (although GCS can still be used as a universal language to communicate with other team members)

Patient not protecting his/her own airway is assessed by pooling of secretions in the oropharynx or absence of *cough* reflex; the presence or absence of *gag* reflex is not reliable (many elderly patients don't have it at baseline, and shown to have no correlation with passive aspiration in patients undergoing swallowing studies)

Other reasons to intubate: completely unresponsive patient with no expected early improvement; airway protection needed to decontaminate a patient with overdose; and severe sepsis and refractory shock, where the mechanical ventilation is meant to decrease the energy used by the patient for breathing, energy which can then be diverted towards other productive uses by the patient's body

Sellick's maneuver

Cricoid pressure (different than BURP – see below) to prevent passive aspiration by occluding the esophagus against the vertebral bodies

The evidence supporting it is poor: it does *not* decrease passive aspiration, it does not improve intubation success rates, it increases air trapping, it distorts of laryngopharyngeal landmarks, and it decreases venous return from the heart by occluding jugular veins

In order to decrease the likelihood of aspiration, Sellick's maneuver may be used but should be abandoned quickly if it impairs intubation attempts, and better techniques to avoid aspiration include keeping a low positive pressure during ventilation in order to decrease gastric insufflation

BURP maneuver

Backwards, Upwards, Rightward Pressure used by intubator or assistant to improve laryngoscopic view by pushing the larynx towards the patient's right while the laryngoscope pushes the tongue towards the patient's left

Difficult airway

Predictors of difficult laryngoscopy: LEMON

Look externally for gestalt assessment of difficulty (not sensitive but quite specific) such as small mandible, large teeth, large tongue and short neck

Evaluate 3-3-2, with 3 of patient's own fingers between the teeth during mouth opening, 3 fingers of mandibular length between the chin and the hyoid bone, i.e. the base of the tongue, and 2 fingers between the hyoid bone and the thyroid cartilage

Mallampati: Class I when all buccal structures visible with mouth opening and tongue out; Class II when tonsillar pillars not visible; Class III when minimal pharyngeal wall visible; Class IV when only palate visible

Obstruction or Obesity

Neck mobility: C-spine collar or rheumatoid arthritis preventing C-spine movement

Predictors of successful intubation

Experienced intubator, patient's lack of muscle tone, optimal positioning of intubator and patient (see below), optimal blade length and type, adequate laryngeal manipulation (eg, BURP)

7 Ps of Rapid Sequence Intubation (RSI)

Preparation, Pre-oxygenation, Pretreatment, Paralysis and induction, Position, Placement with proof, Post-intubation management

Preparation

SOAP ME: Suction, Oxygen, Airways (BVM, blades, with plan B and C – eg, Glidescope, Trach light, intubating LMA), Pharmacology, Monitors, Escape plan (anticipate 2-3 steps down a worst-case scenario for each individual patient)

Pre-oxygenation

Non-rebreather mask or BVM in order to replace the patient's FRC (functional residual capacity) from nitrogen to oxygen, which will allow for more time before arterial desaturation

Delayed Sequence Intubation (DSI):

DSI is a form of procedural sedation for means of pre-oxygenation with positive pressure ventilation when traditional pre-oxygenation is unsuccessful (due to alveolar shunting seen in primary pulmonary or septic conditions)

Method: insertion of behavioural control of the patient (i.e. calm him/her) before paralysis with ketamine sedation while still maintaining spontaneous respirations in order to tolerate oxygenation with PEEP (eg, CPAP), which will ultimately result in better pre-oxygenation and better intubation conditions

Problem with DSI: possibility of awareness of the intubation attempts given that patient is ultimately paralyzed with only moderate levels of sedation

Pretreatment (3min before induction)

Lidocaine 1.5mg/kg IV used in reactive airway diseases and elevated intracranial pressure (ICP), but the evidence is poor

Fentanyl 3µg/kg IV used in elevated ICP and patients with cardiovascular disease to prevent the reflex sympathetic response to laryngoscopy, which raises both heart rate and blood pressure

Volume rehydration with 12cc/kg of crystalloid to correct the patient's relative dehydration

Avoiding hypotension, hypoxia and hypercarbia is even more important than the above methods, and therefore an individualized approach to each patient should be done (eg, if patient is hemodynamically unstable and propofol is the only available induction agent, then foregoing fentanyl would be reasonable as it will create even more hypotension)

Non-defasciculating dose of non-depolarizing neuromuscular blocking agent (when succinylcholine will be used as the paralytic agent) should not be used as pretreatment

Induction agent choices

Etomidate (might lower seizure threshold), Ketamine (can be used in head-injured patients as the concerns about raised ICP are unfounded), Propofol (probably best in the setting of seizures given antiepileptic properties, although it might cause hypotension), Ketofol (not recommended by EMC experts as an induction agent)

Paralytic agent

Neurologic assessment needs to be performed before paralysis in order to assess serial changes, including GCS score (including best motor response), pupillary size and reaction, and reflexes

The 3 EMC experts use rocuronium (1mg/kg) because of the lack of contraindications attached to succinylcholine (SCh), and they feel that the longer time to action (60sec compared to the 45sec of SCh) is not clinically significant; moreover, they feel that the longer time of action (40-60min compared to 7min) is irrelevant because the patient will need paralysis to go to the CT scan, and the neurological status of the patient cannot have changed so dramatically that another neurological assessment is necessary within minutes of intubation

Suggamadex is a new medication that completely reverses the effects of rocuronium in 1-2min at a dose of 4mg/kg; in most cases, however, unlikely that reversal of paralysis is needed immediately after intubation

Succinylcholine (dose of 1.5mg/kg) is favoured by the Cochrane database for RSI due to better intubating conditions and less post-paralysis pain, but contraindications need to be remembered: hyperkalemia (eg, dialysis); burns, crush injuries and neurological dysfunction (eg, stroke) starting at 5 days after the insult

Positioning

Optimal position: bed at the level of the intubator's belt line, straight back and arms at a distance from the patient, holding the laryngoscope blade at the base of the handle, with the appropriate blade type (curved blade allows for better tongue control, but straight may be used if attempt is unsuccessful with straight blade)

Optimal patient position: sniffing position (although simple head extension without lower C-spine flexion may be just as good); for trauma patients, C-collar removed while assistant is providing manual in-line stabilization from below, to allow for movement of the mandible forward and optimization of the glottic view

Consider using adjuncts – Glidescope (which may lead to less C-spine mobilization than direct laryngoscopy), Trach light (light wand), intubating LMA or fiberoptic scope – and don't repeat the exact same sequence twice if you fail: something has to be changed to provide better intubating condition and be successful

Placement with proof

Reference standards: End-tidal CO₂ monitoring, either with capnography (number and waveform) or colorimetric (Yellow color = "Yes", and purple = "The colour of the patient when tube in the wrong place", but has a 4-7% failure rate) – ETCO₂ will be negative in 1/3 of cardiac arrests due to lack of cardiac output; another confirmation method is confidently seeing the endotracheal tube going through the vocal cords

Other methods: Esophageal detector device (squeeze the bulb and apply to tube – it will stay collapsed if in the esophagus, but pop open if in the trachea), auscultation, misting of the tube

Placement of the tube at 21cm of length at the upper teeth (or alveolar ridge if edentulous) in women will result in the tip being at 3cm from the carina in 95% of individuals; the number in males is 23cm

Immediate post-intubation management

First step: adequate analgesia with fentanyl 25-50µg IV q5min PRN based on vital signs

Second step: sedation (especially if patient paralyzed) with midazolam 5mg (± 2 mg depending on patient's weight and hemodynamics) or lorazepam 1-2mg IV push; assess degree of sedation with facial muscle tension, movements and increased heart rate and blood pressure

Third step: start propofol or midazolam drip, volume resuscitation, NG tube, consider using ketamine or phenylephrine IV push for hypotension, and wrist restraints in case the patient wakes up

Tips and pearls for obese patients

Optimize preoxygenation because of RAPID desaturation (decreased FRC and increased metabolic rate, with resting hypoxemia and hypercapnia even without underlying lung pathology), higher likelihood for and worse consequences from aspiration (larger gastric volumes with lower pH); all of BVM, laryngoscopy, intubation and surgical airway will be difficult, so prepare plans B and C (and D)

Consider putting a "ramp of blankets" under obese patients (eg, 7 blankets under the occiput, 5 under the shoulder and 3 under the scapula) so that the external auditory canal is on an horizontal line with the sternum, as well as reverse Trendelenburg position (to push the abdominal content away from the lungs)

Remember that other types of patients also desaturate quickly: pregnant, extremes of age, CHF, COPD

In the setting of severe asthma:

Intubate only if all treatment modalities have been optimized and are still unsuccessful – getting the air out of the lungs is the patient's problem and a ETT will likely not help so much for that; eg, patient is peri-arrest and will go into PEA if not intubated (have ENT or anesthesia back-up present), and consider using ketamine

Ventilation of the asthmatic or COPD patient

Permissive hypercapnia: low tidal volume, low plateau pressure and low peak inspiratory pressure in order to protect the lungs from barotrauma and ventilator-induced lung injury, with low respiratory rate and long expiratory phase in order prevent air trapping, hyperinflation and subsequent cardiovascular compromise; results in higher than normal CO₂ and lower than normal pH (down to 7.2)

If an episode of hypotension occurs, you should (1) disconnect the patient from the ventilator to allow for full exhalation of the air that is likely trapped (manual chest pressure may help), (2) assess the DOPE mnemonic – *Displacement of tube, Obstruction of tube, Pneumothorax and Equipment failure*

Do not forget to continue standard therapies such as volume resuscitation, inhaled bronchodilators, and consider using inhaled anesthetics in the OR as a last ditch effort