

Indications

- Loss of airway protection
 - Loss of reflexes, e.g. obtunded / ↓GCS (<8), muscle relaxed (e.g. for hyperthermia)
 - Risk of aspiration from GIT, blood or secretions
- Loss of airway patency
 - Potential for obstruction: e.g. burns, epiglottitis
- Prophylactically
 - Likely to lose airway protection/patency: e.g. neck haematoma, airway burns
 - Control of airway: e.g. pre-transfer, unco-op patient needing urgent scan/Rx
- Inadequate ventilation
 - Treatment of hypercapnea: e.g. HI, TCA OD, severe COPD
 - Selective lung ventilation e.g. massive haemoptysis, bronchopulmonary fistula
- Inadequate oxygenation
 - E.g. Severe APO, ARDS, PE, CN or CO toxicity
- Other:
 - Drug delivery - rare except for neonates & surfactant

Contraindications

- Absolute
 - Total upper airway obstruction: a surgical airway is required
 - Total loss of facial/oropharyngeal landmarks: a surgical airway is required
- Relative
 - Anticipated "difficult" airway, in which intubation may be unsuccessful and result in 'can't intubate, can't ventilate' situation - esp if drugs given.
 - If currently able to ventilate with bag & mask, continue and:
 - Get help
 - Consider difficult airway adjuncts/algorithm or rarely awake intubation.

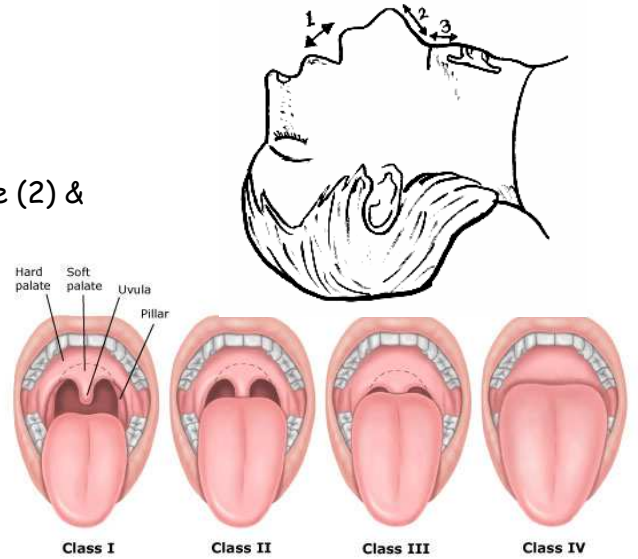
Rapid Sequence Induction/Intubation (RSI)

- Preferred method of endotracheal intubation in ED
- Results in rapid unconsciousness (induction) and muscle relaxation (paralysis)
- Aim is to intubate the trachea with minimal/no use bag-valve-mask (BVM) ventilation, which can cause gastric insufflation
- Important as most patients not fasted and at greater risk for vomiting and aspiration
- Other risk factors for gastric aspiration are:
 - intra-abdominal pathology - gastric paresis (drugs, pain, diabetes, uraemia),
 - intestinal obstruction, inflammation, peptic ulcer disease
 - oesophageal disease - symptomatic reflux, motility disorders
 - pregnancy
 - obesity
- RSI is not indicated/required in an unconscious, apnoeic or arrested patient; intubation proceeds without pre-treatment, induction, or paralysis.
- RSI should be used with caution in a patient with a suspected difficult airway to prevent 'can't intubate, can't ventilate' situation following sedating & paralyzing the patient.

The 10 P's of Intubation:

1) Predict difficulty

- **MOANS** - diff vent - **M**ask (beard, trauma), **A**ge > 55, **O**besse, **N**o teeth, **S**tiff (COAD, preg)
- **LEMON** - for a difficult laryngoscopic view
 - Look externally for any obvious impairment
 - Obese, congenital/acquired deformity
 - Evaluate 3-3-2 rule with patient fingers
 - Mouth opening (1), Mento-hyoid distance (2) & Hyoid-thyroid cartilage distance (3)
 - Mallampati - tongue/mouth size
 - **I** - Pillars/palate/uvula fully visible
 - **II** - Uvula partially visible
 - **III** - Only base of uvula visible
 - **IV** - None of 3 visible
 - Obstruction (OSA, epiglottitis, mass)
 - Neck mobility (RA, C-spine collar)
- **RODS** - diff LMA: **R**estricted mouth opening, **O**bstructed/obese, **D**istorted anat, **S**tiff



2) Preparation: SOAPME

- **S**uction
- **O**₂ & mask
- **A**irway equip - check laryngoscopes (Macintosh/Miller), ETTs, stylet, bougie, LMA, cric kit
 - ETT size - Neonate: 3.5. Child: age/4+4 (uncuffed) or +3.5 (cuffed). Adult: 7.5-8
 - ETT length@lips - Child: age/2+12, Adult: 20-23cm
- **P**ersonnel - at least airway nurse, drug doctor, intubator
- **M**edications - drugs and IV line checked
- **E**quipment - Pulse oximeter, BP, HR, ETCO₂

3) Plan A & Plan Bs: Decide on plan of choice, but also backup plan, difficult airway plan

4) Pre-oxygenate: 3min or 8 full breaths @ ≥15L O₂ NRB. Pos 20% head up. If SaO₂ < 95%: PEEP 5-15cmH₂O. After drugs: NP O₂ @ 15L/min & if SaO₂ < 95% cont BVM±PEEP @ 6 breaths/min.

5) Pre-treatment 3 mins before intubation: LOAD - controversial - not routinely used in RSI

- **L**ignocaine 1.5mg/kg - ?↓ICP peak, consider if ↑↑ICP, bronchospasm
- **O**pioid - **fentanyl** 3mcg/kg - if need to blunt symp. resp. e.g. dissection, IHD, ↑ICP
- **A**tropine 20mcg/kg (min 0.1mg, max 1mg) - if bradycardia in young child or from sux
- Defasciculating dose of NMB (eg **vecuronium** 0.01mg/kg) - rarely used to ↓SE of sux

6) Positioning: EAM-to-sternal notch position except infants or ?C-Spine injury. Jaw thrust.

7) Pressure on cricoid (Sellick)

- Evidence against it. However **BURP** (**B**ackward, **U**p, **R**ightward **P**ressure) may improve view

8) Pharmacy: induction then paralysis. Std adult dose in [], use ½-¾ induction dose if elderly/↓BP

- IV (**midazolam** 0.1-0.3mg/kg [5-10mg] ± **fentanyl** 1-5mcg/kg [100mcg]) OR **thiopentone** 3-5mg/kg [200mg], **ketamine** (asthma, ↓BP, not IHD, ↑BP) 1-2mg/kg [100mg] OR **propofol** [100mg] 0.5-1.5mg/kg (not ↓↓BP)
- IV **suxamethonium** 1-2mg/kg [100mg] (CI: {burns/crush/denervation/CVA/abdo sepsis}>5d, malig hyperT, neuromusc dz, ↑K⁺), **rocuronium** 1mg/kg [50mg] OR **vecuronium** 0.1mg/kg [5mg]

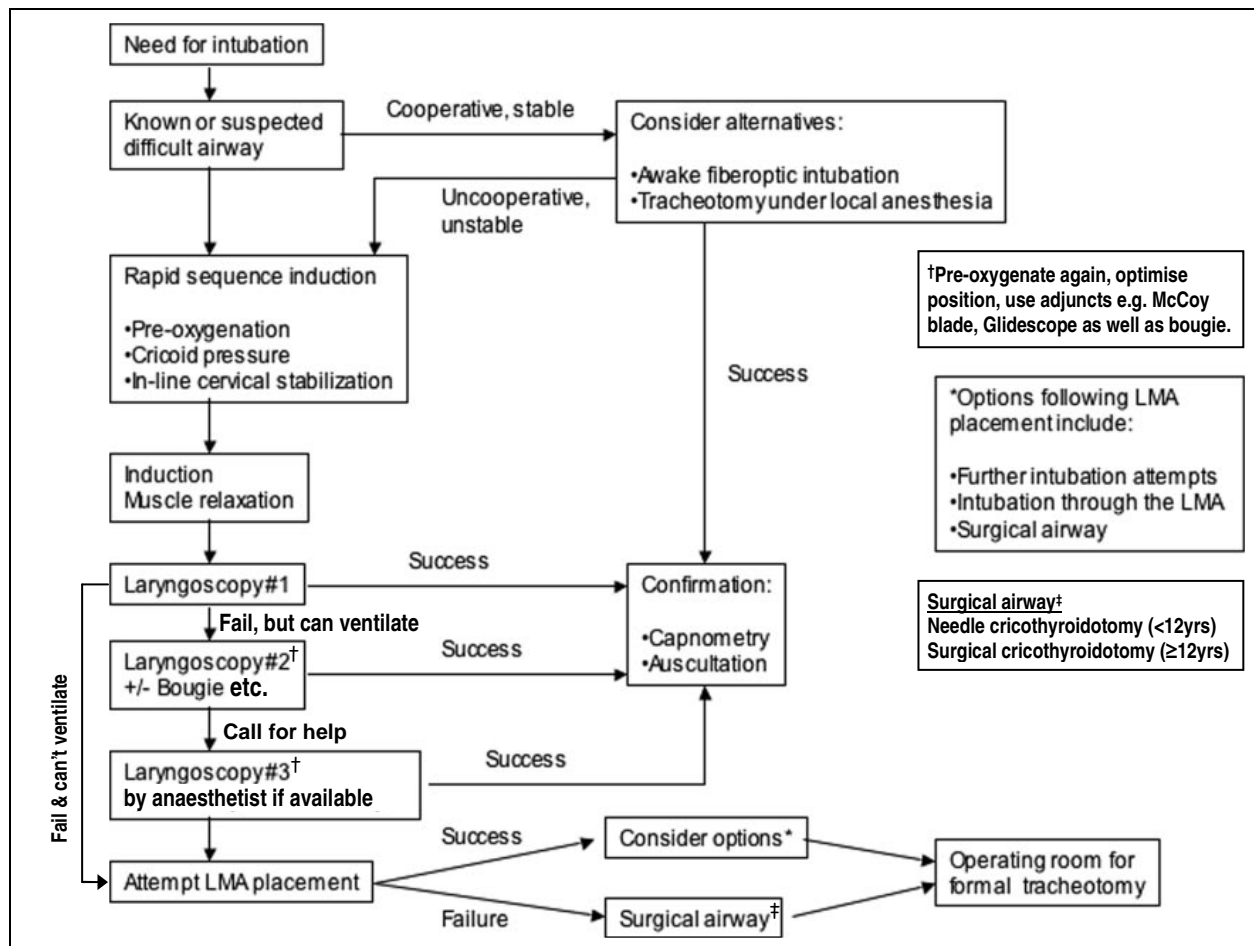
9) Place ETT, secure it & prove placement

- Direct vision through cords
- Listen @ axillae/epigastrium
- Equal chest rise
- Sustained ETCO₂
- Fogging of tube
- CXR

10) Post-tube sedation ± paralysis

- IV **morphine** 10-40mcg/kg/hr + **midazolam** 2-6mcg/kg/min OR **propofol** 1-4mg/kg/hr
- IV **rocuronium** OR **vecuronium** 0.1mg/kg q30-45min (Immed rev: **sugammadex** 16mg/kg)

Difficult / Failed Intubation Algorithm



Complications of Intubation

Laryngoscopy

- Mechanical
 - Damage to teeth, lips, gums or other soft tissues
 - Coughing, laryngospasm, bronchospasm, vomiting ± aspiration
 - Hyperextension cervical injury
 - TMJ dislocation
- Laryngoscopy Physiological
 - Cardiovascular responses - HT, tachy, arrhythmias, bradys in children, ischaemia
 - Respiratory responses - coughing, laryngospasm, bronchospasm
 - ↑ICP - ↑CBF proportional to CMRO₂, raised MAP, ↓venous drainage with coughing
 - Hypoxaemia / hypercarbia - difficult or prolonged attempts

Tracheal Intubation

- Failed intubation
- Misplaced intubation - oesophageal, endobronchial intubation
- Obstruction - kinking, cuff overinflation/herniation, blood, mucus, FB
- Mechanical damage - pharynx, larynx, cords, trachea, oesoph - dissection, perforation

Nasal Intubation

- Failure to pass a tube
 - Haemorrhage - coagulopathy, pregnancy, polyps, adenoids, other local pathology
 - Bacteraemia - CNS spread of infection, endocarditis risk
- Membrane necrosis / ulceration
- Sinusitis ± otitis (usually long-term intubation)
- Basilar skull perforation - usually base of skull #

Laryngeal Mask Airway

Indications

- Spontaneous ventilation anaesthesia - convenience or if airway difficult by other means
 - As an aid to intubation - through LMA (40% success) or with bougie (80% success)
 - Intubating LM (ILM) can use up to size 8.0 ETT
 - In failed intubation - Can't intubate, can't ventilate or anaesthesia must proceed

Disadvantages

- Does not protect the airway
- May result in pharyngeal discomfort or trauma
- Obstruction of the upper airway
- Limited use for IPPV - described, but risks of gastric aspiration - not recommended

Mask Size	Patient Size	Maximum Cuff Volume (Air)*	Largest ETT ID (mm)
1	Neonates/infants up to 5 kg	up to 4 ml	3.5
1½	Infants 5-10 kg	up to 7 ml	4.0
2	Infants/children 10-20 kg	up to 10 ml	4.5
2½	Children 20-30 kg	up to 14 ml	5.0
3	Children 30-50 kg	up to 20 ml	6.0***
4	Adults 50-70 kg	up to 30 ml	6.0***
5	Adults 70-100 kg	up to 40 ml	7.0***
6**	Large adults over 100 kg	up to 50 ml	7.0***

*These are maximum volumes that should never be exceeded.
It is recommended the cuff be inflated to 60 cm H₂O intracuff pressure.

**Available for LMA Classic™ only

*** = cuffed

Extubation

Criteria for Extubation

General

- Ability to protect the airway
- Adequate spontaneous ventilation
- Adequate oxygenation
- Ability to clear secretions

Specific

- FIO₂ < 50%
- PEEP < 5 cmH₂O
- PaO₂ > 60 mmHg
- PaCO₂ < 50 mmHg
- IMV < 4 bpm
- Spont RR < 30 bpm
- VC > 30 ml/kg
- A resolving CXR
- No other major organ failure

Extubation Procedure

- Check equipment - suction & ability to re-intubate
- Place Guedel/bite block
- Ensure sedation/muscle relaxation has worn off or reversed
- Suction NG tube, oropharynx
- Untape tube
- Remove air from cuff
- Remove ETT on expiration
- Re-suction oropharynx & apply oxygen by face mask
- Turn patient into recovery position and re-assess ventilation

Complications of Extubation

- Failure - hypoxaemia / hypercarbia, exhaustion
- Respiratory responses - coughing, laryngospasm, bronchospasm, vomiting ± aspiration
- cardiovascular responses - HT, arrhythmias (brady in children), myocardial ischaemia