

## AIRWAY MANAGEMENT

Types of airways utilized in the ICU

Endotracheal intubation - orotracheal vs nasotracheal

Most popular in the critical care setting

Advantages – allows effective mechanical ventilation, sputum toileting, airway protection against aspiration

Disadvantages – need expertise in tube placement, increase risk of nosocomial pneumonia, require sedation for tolerance of ETT, see complications of intubation below

Tracheostomy

Since SARS, we do not perform percutaneous tracheostomy in the ICU, although things may change in future. All tracheostomies are currently done in OT by surgeons – parent team surgeon or in medical patients, refer to ENT surgeons

Some of the indications for tracheostomy in the ICU patients (list not exhaustive)

- Prolonged intubation
- Prolonged mechanical ventilation
- Patient comfort
- Sputum toileting
- Airway protection
- Emergency in difficult airway

Oropharyngeal/nasopharyngeal airway

Limited use in ICU setting

Short term use for upper airway obstruction, suction

Require spontaneous breathing

May be appropriate in patients for limitation of therapy, refused endotracheal intubation

### Endotracheal intubation

In this SARS era, please take note of personal protection.

Orotracheal tube

- Generally preferred in ICU
- Allow tube with larger inner diameter
- Reduce risk of sinusitis

### Nasotracheal tube

- Preferred if patient often bites on the orotracheal tube
- Risk of sinusitis if intubation is prolonged
- Contraindicated in skull base fracture, bleeding tendency and nasal polyps

### Size of endotracheal tube for oral intubation:

Male: 7.5 – 8.5 mm

Female: 7.0 – 8.0 mm

Generally, you will not go wrong with a size 7.5 mm in an emergency situation  
However, may need to change to  $\geq 8$  mm if need to perform bronchoscopic lavage

### IV induction agents commonly used in ICU:

#### Etomidate

- First-choice induction agent in ICU for haemodynamically unstable patient
- 0.3 mg per kg iv
- Smaller dose may be necessary for unstable patients

#### Propofol:

- 1.5 to 2.5 mg per kg iv
- 20 mg to 40 mg every 10 seconds
- Dose has to be reduced for elderly, haemodynamically unstable patients
- Hypotensive effect is more marked compared with etomidate

### Muscle relaxants used in ICU

#### Suxamethonium

- 1 mg per kg
- Contraindicated in hyperkalaemia, burns (>24 hours), muscle dystrophy.  
Caution if difficult airway

#### Rocuronium

- 0.6 mg to 1.2 mg / kg
- Use in patients contraindicated to suxamethonium eg hyperkalaemia, burns
- Contraindicated in difficult airway, full stomach
- For RSI with rocuronium, acceptable intubation condition can be achieved using larger doses of rocuronium (0.9 – 1.2 mg/kg)

### Standby drugs for hypotension after intubation

## IV fluids

### Phenylephrine

- Draw up 0.1 ml of phenylephrine (10 mg/ml in 1 ml ampoule) with insulin syringe
- Dilute to 10 mls in normal saline; final concentration phenylephrine = 100 mcg per ml
- Give 0.5 ml or 1 ml of phenylephrine (0.1 mg/ml) for hypotension
- Phenylephrine MUST BE carefully labeled and checked before use
- Accidental injection of undiluted phenylephrine can be FATAL !

### Rapid sequence intubation

- Technique of simultaneous giving induction agent, muscle relaxant and cricoid pressure to facilitate intubation and reduce risk of gastric aspiration.
- Indicated when stomach is full, pain, gastroesophageal reflux disease
- Caution in difficult intubation
- Etomidate and suxamethonium are commonly in use for rapid sequence intubation in this ICU

### Cuff pressure

- Large volume and low pressure cuffed tubes are currently in use
- Ideal cuff pressure : 18 mmHg – 25 mmHg
- High cuff pressure predisposes to mucosa ischaemia
- Low cuff pressure may cause air leak

### Complications of tracheal intubation

#### During intubation

- 1) Hypotension or hypertension
- 2) Upper airway trauma – perforation or laceration of the pharynx, larynx
- 3) Intubation of the right main bronchus
- 4) Regurgitation with aspiration
- 5) Arrhythmia
- 6) Bleeding
- 7) Oesophageal intubation

#### Delayed complications

- 1) Sinusitis
- 2) Pneumonia
- 3) Tube blockage or kinking

#### Late complications

- 1) Tracheomalacia
- 2) Subglottic stenosis
- 3) Tracheoesophageal fistula
- 4) Vocal cord paralysis

#### Cuff leak test

- 1) Qualitative test: observation of presence of leak around the tube after cuff deflation and occluding the lumen of endotracheal tube.
- 2) Quantitative test: record the exhaled tidal volume of 6 consecutive breaths with cuff deflated. Choose the 3 lowest values and take the average. Subtract the average from the delivered tidal volume. Cuff leak of more than 110 ml predicts the absence of post-extubation stridor. Another study showed that the cuff leak of less than 10% of pre-deflation tidal volume predicts the occurrence of post-extubation stridor

#### Difficult airway

Defined as the clinical situation when a conventionally trained anaesthetist experiences difficulty in face mask ventilation of the upper airway, difficulty in tracheal intubation or both.

Difficult mask ventilation can be due to inadequate mask seal, gas leak and excessive resistance to gas flow.

Signs suggestive of difficult mask ventilation include inadequate chest movement, gastric distension, inadequate oxygen saturation and inadequate carbon dioxide excretion.

According to the literature on intubation on patients for elective operation, difficult intubation occurs in 1 to 3% of patients. Intubation fails in 0.1 – 0.4% of patients. A “cannot intubate cannot ventilate” situation occurs in 1 in 10000 patients.

#### “Airway history”

- 1) Look for congenital, acquired or traumatic causes that may make intubation difficult
- 2) Review previous anaesthetic or ICU records if any about direct laryngoscopy results

#### Physical examination

Different people have different routines in assessing airway.

Recent ASA guideline suggests looking for the following features:

- 1) Long upper incisors
- 2) Prominent overbite (upper incisors anterior to lower incisors) during normal jaw closure
- 3) Inability to bring lower incisor anterior to upper incisor during voluntary protrusion of mandible
- 4) Inter-incisor distance < 3 cm
- 5) Visibility of uvula (Mallampati classification)
- 6) High arched or narrow palate
- 7) Stiff, indurated mandibular space
- 8) Thyromental distance < 3 ordinary finger breaths
- 9) Short, fat neck
- 10) Cannot extend neck
- 11) Chin cannot touch chest

#### Predictors of difficult endotracheal intubation

- 1) Modified Mallampati oropharyngeal classification:

The patient oropharynx is examined by a pen torch in a sitting position with tongue fully protruding and mouth wide open and is NOT asked to phonate.

Class 1: faucial pillars, soft palate and uvula can be seen

Class 2: uvula can only be partly seen

Class 3: uvula is completely masked by the base of the tongue and the posterior pharyngeal wall is not visible.

Class 4: only hard palate is seen.

- Class 3 or 4 predicts difficult intubation

- 2) Thyromental distance: The straight line distance between the thyroid notch and the most anterior part of the chin with the neck fully extended and the mouth closed.

Thyromental distance < 6.5 cm is predictive of difficult intubation

- 3) Sternomental distance: The straight line distance between the superior border of the manubrium sterni and the bony part of the chin with the neck fully extended and the mouth closed. Sternomental distance < 12.5 cm is predictive of difficult intubation.

\*\*\*Preparation for intubation\*\*\*

Depends on whether situation is emergent (which is usually the case in ICU) or elective.

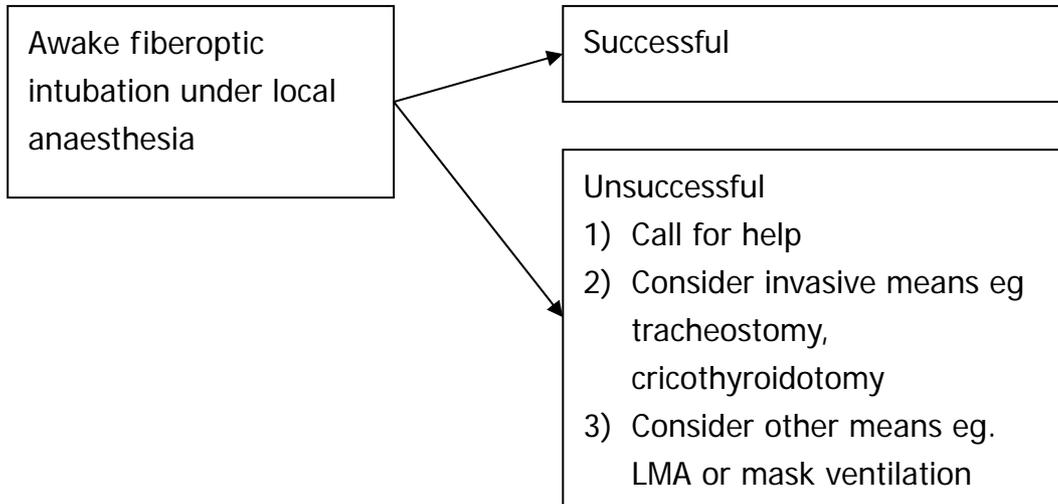
Some of the problems you may encounter in intubating critically ill patients

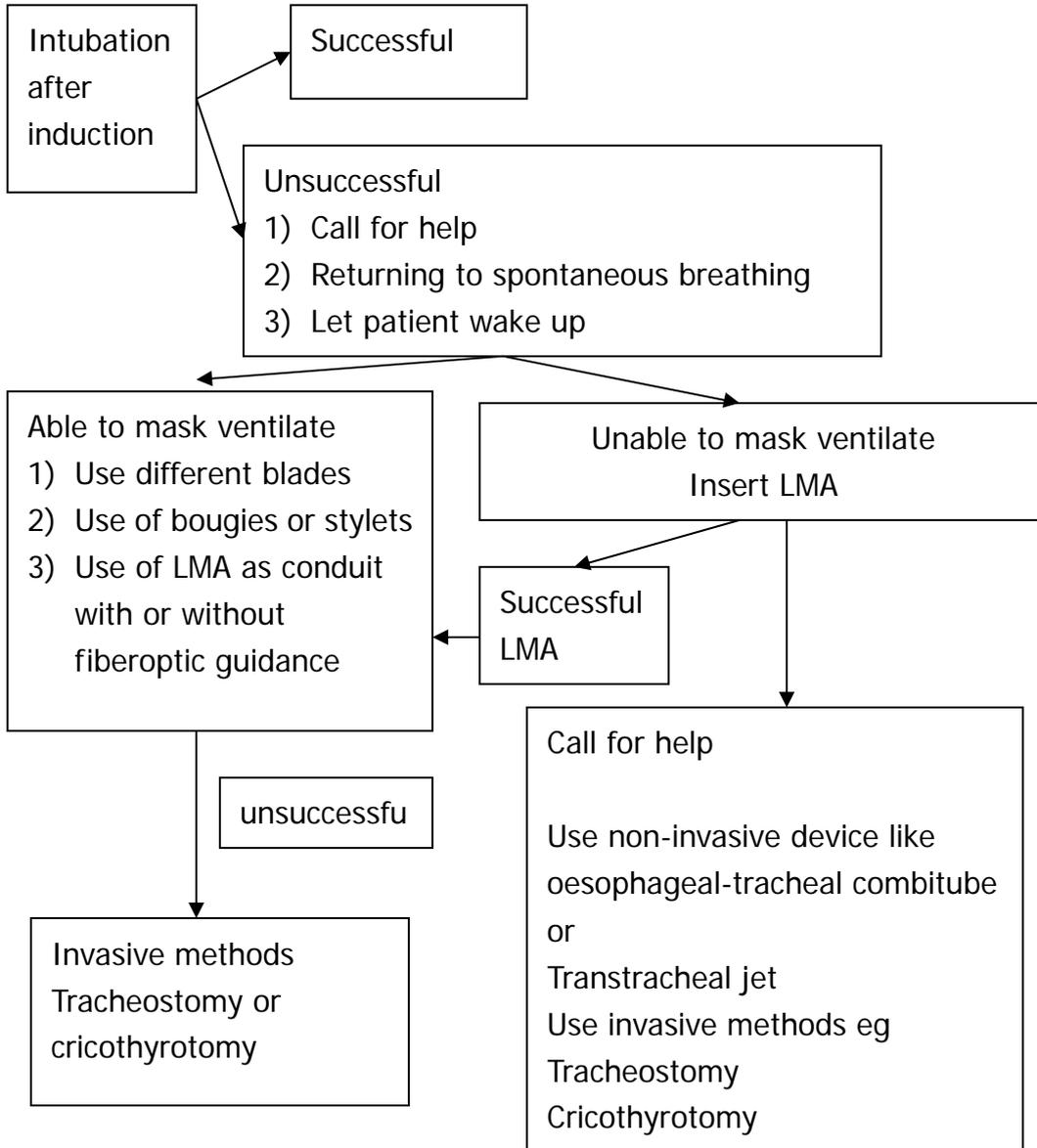
- During consultation in the wards/radiology/endoscopy
  - very ill, hypoxic, haemodynamically unstable patient
  - lack of time for proper assessment
  - Ill-equipped environment – bring your own equipment and drugs. Poor lighting, lack of space, don't know how to operate bed
  - Staff not trained to assist in intubation
  - History of full stomach/difficult intubation often unavailable
  - Far away from expert help
  - Tips: be prepared. Call for help early. If difficult airway expected and patient does not need emergent intubation, transfer to ICU first for intubation
- Problems of intubation in ICU
  - Less problems as staff well-trained to assist
  - Unstable patient
  - Airway may be more difficult after fluid resuscitation (airway and peripheral oedema)

If time permits -

- 1) Prepare for the equipment for difficult intubation including rigid laryngoscope blades of different sizes, tracheal tubes of different sizes, bougie, stylets, laryngeal masks, carbon dioxide detector, flexible fiberoptic intubation equipment and cricothyrotomy set (in selected cases).
- 2) Inform the patient the possible adverse outcomes of difficult airway management
- 3) Preoxygenation for 3 or more minutes (if clinical situation permits) by tidal volume ventilation. Fast-track preoxygenation by 4 maximal breaths in 30s has lower efficacy.
- 4) Assess the likelihood regarding difficult ventilation, difficult intubation, difficult patient cooperation and difficult tracheostomy.
- 5) Deliver supplemental oxygen throughout the process of difficult airway management by nasal cannula.
- 6) Three issues need to be addressed:
  - awake intubation or intubation after induction?

- Initial non-invasive technique for intubation or initial invasive technique?
- Preservation of spontaneous breathing versus muscle paralysis





## References

- 1) American Society of Anesthesiology Task Force on Difficult Airway. Practice guideline for management of the difficult airway. *Anesthesiology* 2003; 98: 1269-1277.
- 2) Tse JC et al. Predicting difficult endotracheal intubation in surgical patients scheduled for general anesthesia. A Prospective blind study. *Anesth Analg* 1995; 81: 254-258.
- 3) Iohom G et al. Prediction of difficult tracheal intubation. *European Journal of Anaesthesiology* 2003; 20: 31-36.
- 4) Eindhoven GB et al. A practical clinical approach to management of the difficult airway. *Europ J Anesth* 2001; 18S23: 60-65.