EMET ED Airway Management

RSI

Learning Objectives

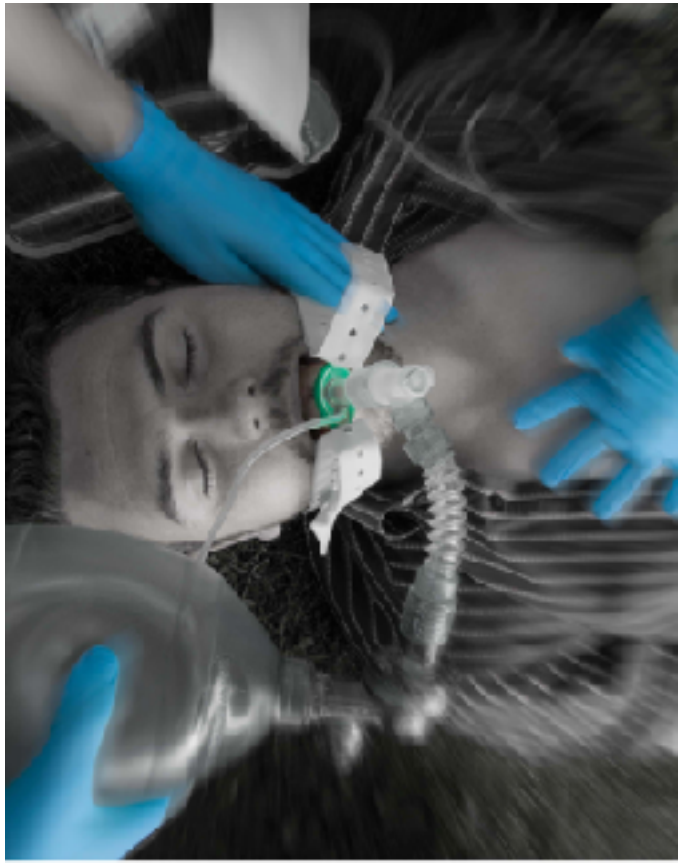
1. You will understand the essential elements of RSI.
2. You will understand the Indications for RSI.
3. You will understand risk assessment for RSI.
4. You will be able to discuss the essential steps of the process for RSI.
5. You will understand basic ventilation strategies.

RSI – RAPID SEQUENCE INDUCTION

- RSI is an airway management technique that induces immediate unresponsiveness (induction agent) and paralysis (neuromuscular blocking agent) as the fastest and most effective means of placing an endotracheal tube.
- Avoidance of bag-mask ventilation minimizes the inflation of air into the stomach, which might otherwise provoke regurgitation and aspiration.

RSI Risk

- The cessation of spontaneous ventilation with paralysis involves considerable risk if the provider does not intubate and ventilate the patient in a timely manner.



- Complications of Tracheal Intubation/Ventilation include:
    - Oesophageal intubation (tube in wrong place)
    - Accidental extubation (tube fell out)
    - Endobronchial intubation (tube in too far)
    - High airway pressures (blowing the ventilator or bagging too hard!!)
    - Hypotension (several reasons – usually too much drugs)

Indications for RSI

1. **Obtain and maintain** the airway (e.g. in the presence of an irreversible obstructed airway from any cause).
2. **Correct** abnormalities of gas exchange i.e. maintain or improve oxygenation and ventilation.
3. **Protect** the airway (e.g. against aspiration of gastric contents or blood).
4. **Secure** the airway early in the face of predicted clinical deterioration (in one of the previous three situations).
5. **Combative** patient

Indications for RSI

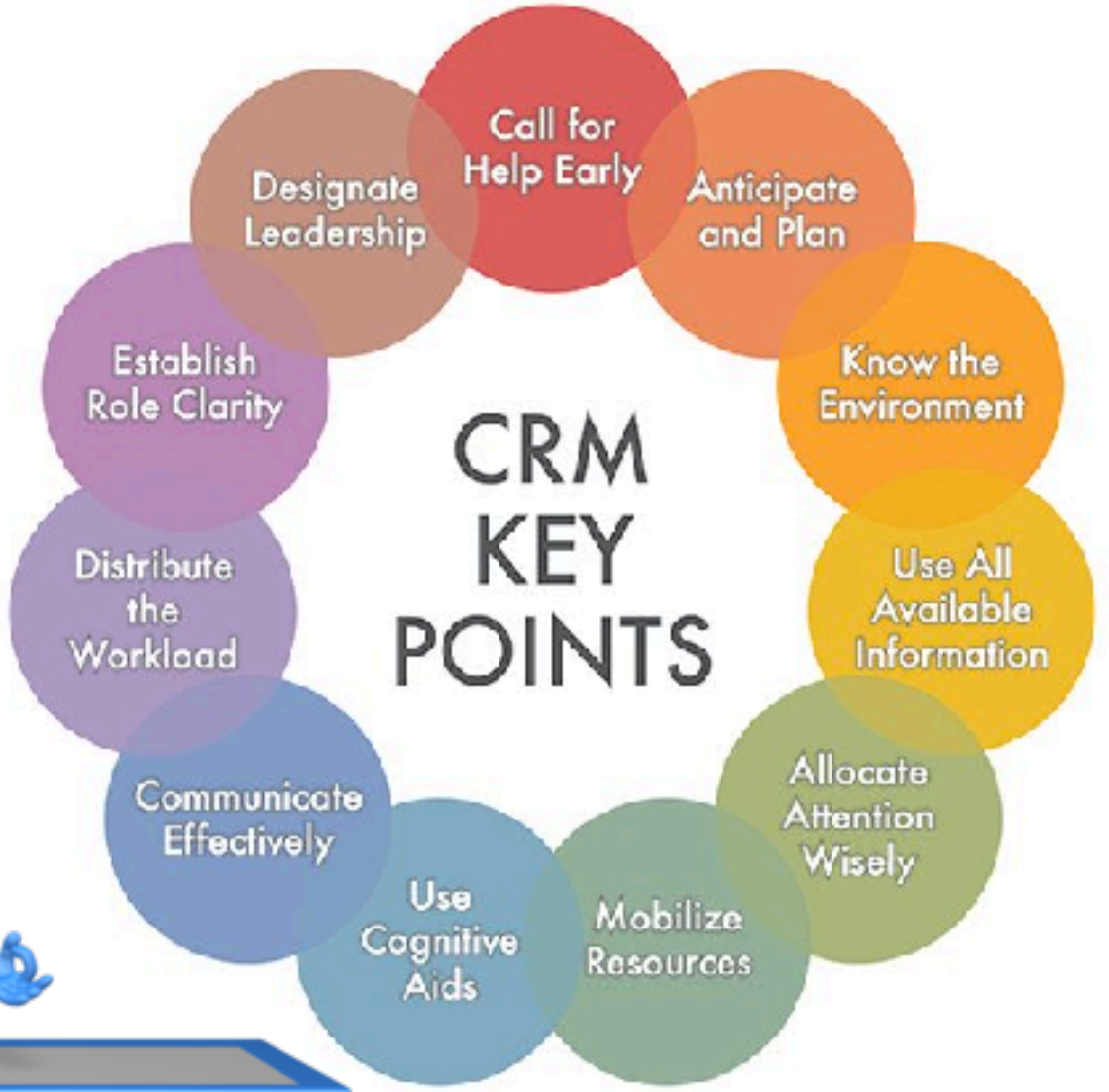
- “Indications” for RSI are rarely absolute, and the imperative to obtain a definitive airway will be determined by the acuity/urgency of the indication, balanced against patient (e.g. difficult anatomy/physiology) and provider (e.g. inexperience) factors.

Urgency

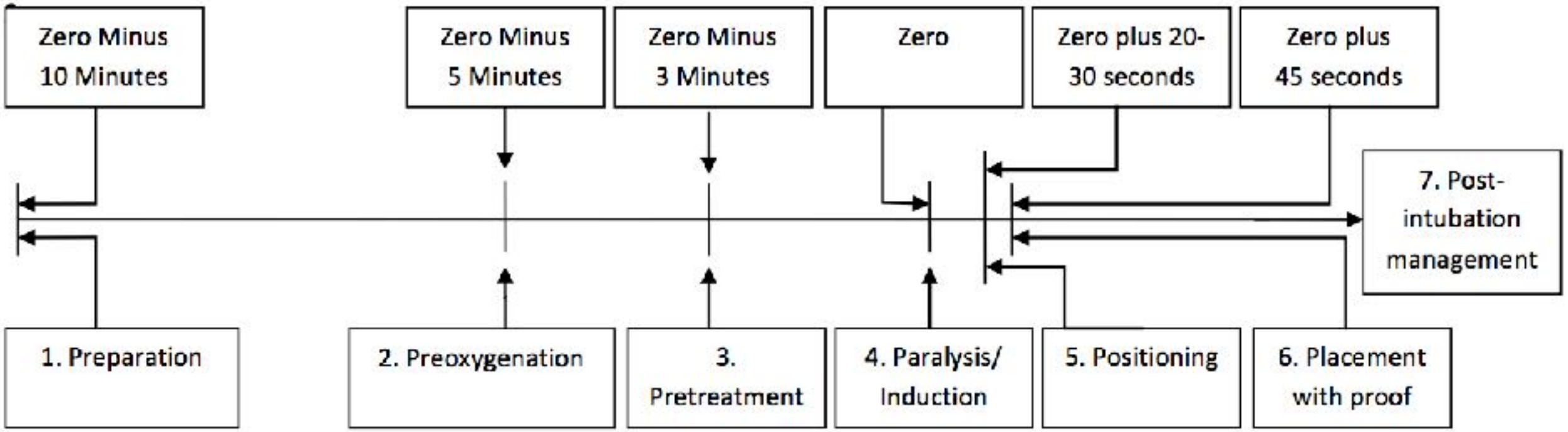
Operator experience,
Patient factors

RSI Team

- There should be a minimum of 3 people: an airway proceduralist, an airway assistant and a drug administrator.
- Ideally the team leader should be free of the above roles, so they can devote their attention to monitoring the clinical situation

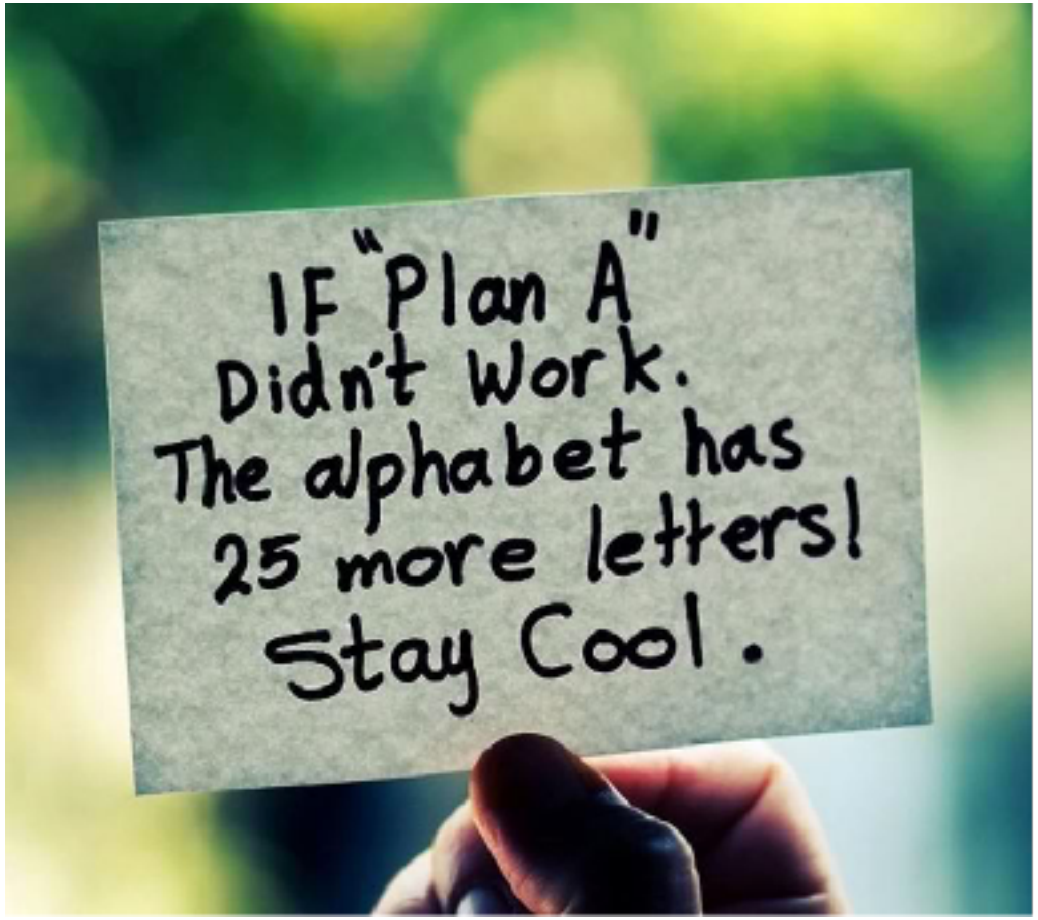


Process of RSI



Preparation

- The goal is to maximise the chance of intubation on the first attempt.
- Failure to identify difficult intubation or ventilation is one of the main causes of failed airway management.
- Even in a normal looking airway, there must be a backup plan for unanticipated difficult airway management.
- The airway plan, including backup plans, need to be clearly articulated to the team.



Southern NSW Local Health District Airway Algorithm

PLAN A
Initial tracheal intubation plan

Most senior MO to perform
Maximum 2 attempts in 2 mins
Re-oxygenate if $SpO_2 < 90\%$
2 person BVM + OPA + NPA
Call for help if PLAN A fails

Direct laryngoscopy

SUCCESS → **Verify tracheal intubation with $EtCO_2$**

OR

PLAN B
Secondary tracheal intubation plan

Change technique / adjunct aids
Maximum 2 attempts in 2 mins
Re-oxygenate if $SpO_2 < 90\%$

Video laryngoscopy

SUCCESS → **Verify tracheal intubation with $EtCO_2$**

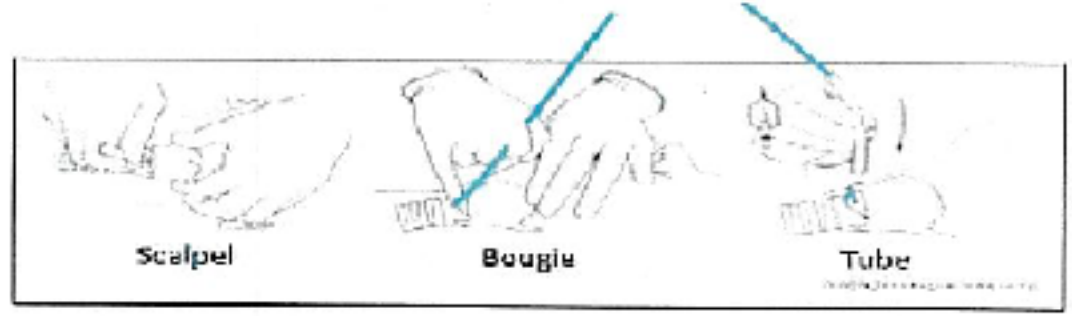
PLAN C
Maintenance of oxygenation / ventilation

Maximum 2 attempts in 2 mins
PLAN D if $SpO_2 < 75\%$

LMA → **Get HELP urgently**

PLAN D
Rescue techniques for "Can't Intubate, Can't Ventilate" situation

Cricothyroidotomy →



Aeromedical Retrieval:

Southcare Retrieval:

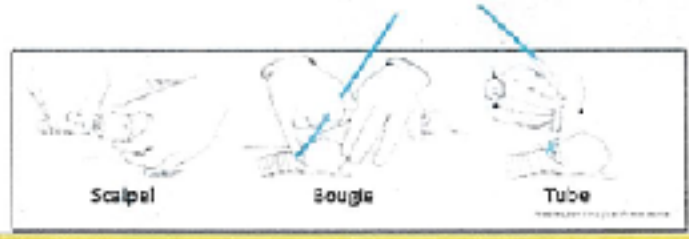
NETS:

Local Help:

SURGICAL AIRWAY

CALL FOR HELP → **INFORM TEAM** → **EMERGENCY TROLLEY**

Remove pillow & **extend neck**
Use non-dominant hand to **stabilise** larynx
Locate cricoid membrane If cricoid membrane **not** palpable then make a **vertical skin incision of** 8 – 10cm and **blunt dissect** with fingers of both hands
Horizontal incision through cricoid membrane
Rotate blade 90 degrees
Slide **bougie along blade** into trachea. Remove blade
Railroad **size 6.0 cuffed endotracheal tube over bougie**, directed down towards the lungs until the cuff disappears
Hold endotracheal tube securely while bougie is removed



Ventilation Guidelines*

- **Commence FiO_2 100% but weaning quickly to around 60% to aim for a SpO_2 of 90 - 95%**
- **Set tidal volume to 6ml/kg AND try to keep peak pressure below 35 cm H_2O**
- **PEEP 5 cm initially**
- **Initial respiratory rate 16-20/min**
- Once airway is secure ensure adequate analgesia and sedation and if ventilation remains difficult consider ongoing neuromuscular blockade to aid relaxation
- If oxygenation is not the primary reason for intubation, commence FiO_2 at 60% and titrate against SpO_2
- It is appropriate to allow hypercapnia to avoid excessive airway pressures being used, except in head injury
- Beware the patient with a high respiratory rate and tidal volume pre-intubation (eg. severe DKA), where you need a high respiratory and increased tidal volume post intubation to replace the existing high minute volume (eg. 30 breaths/min and TV 10-15ml/kg).
- ***ASTHMA – requires PEEP = 0** as autoPEEP often present, **longer expiratory phase** IE ratio of at least 1:4, **RR 6 – 10 bpm**
- **CAUTION when ventilating patients with PNEUMOTHORAX**

Out of Theatre Intubation Checklist – SNSWLHD

Complete for all intubations as part of the patient record

Oxygenate early

Team

Team Leader to clarify roles:

- ❑ Airway Proceduralist
- ❑ Airway assistant
  - o External laryngeal manipulation
- ❑ Drugs / circulation
- ❑ Scribe / monitoring
- ❑ Manual in-line stabilisation required? (trauma patients)

State airway plan:

- ❑ **Difficult airway likely?** (see airway algorithm) Yes No

Plan A

_____

Plan B

_____

Plan C

_____

Plan D

Equipment

- ❑ Resus bag & mask with **end-tidal CO_2**, connect & zero
- ❑ Oro and nasopharyngeal airway & LMA available
- ❑ Prepare:
  - ❑ Suction
  - ❑ 2 ET tubes
  - ❑ 2 laryngoscopes
  - ❑ Bougie
  - ❑ Check video-laryngoscope (charged & working)
  - ❑ Oxylog or ventilator circuit (with HME & corrugated adaptor)
- ❑ **IVC x 2 patent** + pump set primed
- ❑ Allergies?
- ❑ Prepare relevant drugs (paralytic, sedation & vasopressors)

Prepare patient

- ❑ **Optimise patient position**, eg: 'ramping' for obese
  - o Ear to sternal notch
- ❑ Apply manual in-line stabilisation if indicated
- ❑ Commence effective mask **pre-oxygenation + 15L nasal oxygen** (consider continuing NIV or using HFNC if available)
  - ➢ 3 mins via NRB mask or at least 8 breaths via BVM
- ❑ Haemodynamics

IV fluid bolus ☐
Blood products ☐
Vasopressor ☐

Patient Monitoring

$EtCO_2$ ☐
NiBP ☐
SpO_2 ☐
ECG ☐

Post intubation

<u>Verbally confirm</u> ETT placement:

- ❑ **$EtCO_2$ monitoring**
- ❑ Bilateral & symmetrical chest movement
- ❑ Bilateral air entry on auscultation
- ❑ Secure ETT – state length to teeth
- ❑ OGT / NGT (prior to CXR)
- ❑ Ventilator settings confirmed
- ❑ CXR to confirm position
- ❑ ABG attended
- ❑ Oxygenation maintained

Health
Southern NSW
Local Health District

Intubation Record

Patient ID

Date:

Medication administered

Allergies / Adverse Drug Reactions:					
Medication	**Route**	**Dose**	**Prescriber Signature + Print name**	**Given by**	**Time given**

Intubator: _____

Position: _____

Mobile / pager no: _____

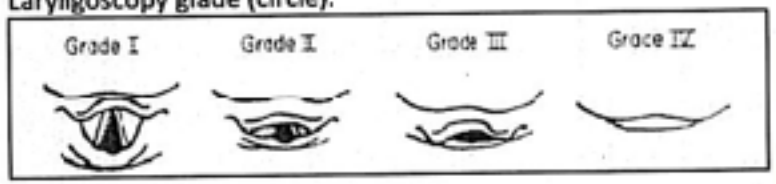
Signature: _____

Type of induction: Awake ☐ RSI ☐

Manual inline stabilisation used? Yes ☐ No ☐

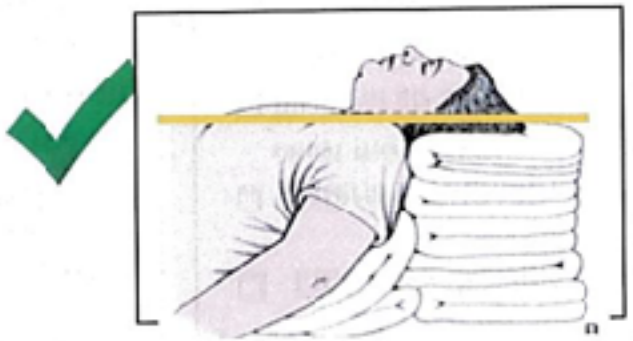
Endotracheal tube: Size..... at ..... cm at teeth / gums

Laryngoscopy grade (circle):

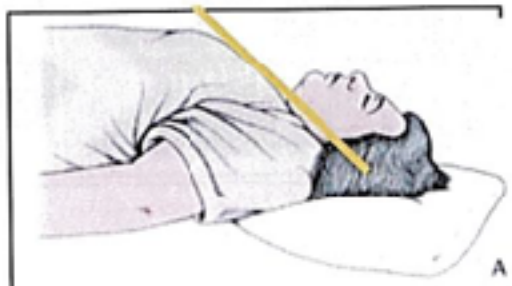


For further assistance contact:

Aeromedical Retrieval: **1800 650 004**
Southcare Retrieval: **1300 873 711**
NETS: **1300 362 500**



Ear to sternal notch positioning for the obese



Adjuncts used:

Bougie ☐ McCoy blade ☐ Video laryngoscopy ☐ iLMA ☐

Other: _____

Notes (difficult intubation etc): _____

_____

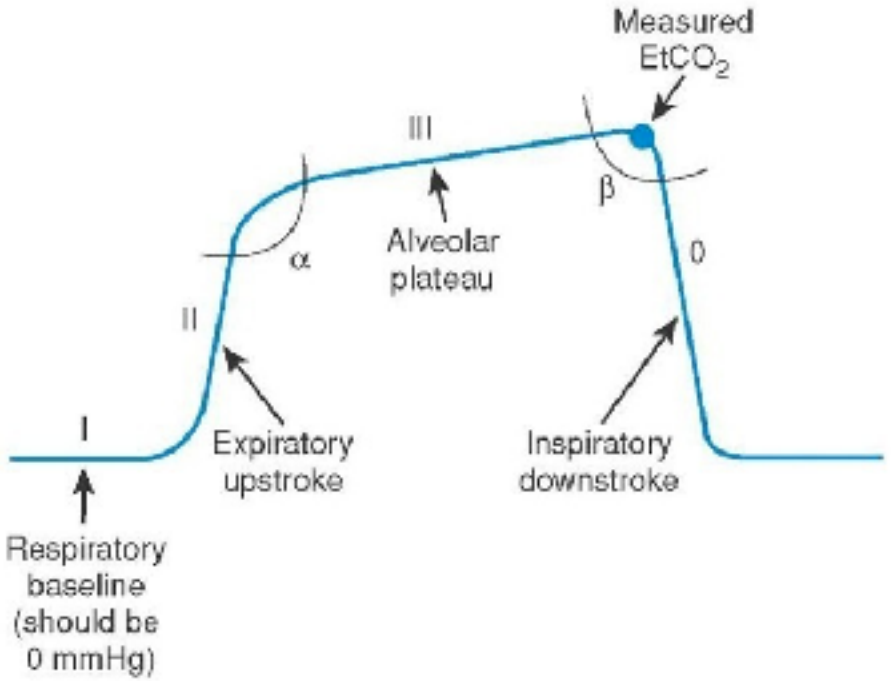
Please complete QARS audit & fax a copy to 4027 9100

Preparation

- **S**uction – at least one working suction, placed securely at head of bed
- **O**xygen – NRFM and BVM attached to 15 LPM of O2 with nasal prongs for apneic oxygenation
- **A**irways – 7.0 ETT for smaller females, 8.0 for larger males, 7.5 for most patients. Lubed stylet in tube, straight to cuff and bent 35 degrees from proximal end of cuff.
- **P**re-oxygenate the patient.
- **P**repare equipment = check laryngoscope light and have backups ready (bougie, VL, LMA, surgical cric kit)

Preparation for RSI

- **M**onitoring Equipment – cardiac monitor, sats, BP cuff opposite arm with IV
- **M**edications – induction agent, paralytic, vasopressor drawn up. Patient bolused with crystalloid.
- **E**nd tidal CO2



Induction Agents

- Midazolam:
  - Dose: 0.3 mg/kg IV TBW
  - Onset 60 – 90 sec
  - Duration: 15 – 30 min
  - Use: not usually recommended for RSI
  - Drawbacks: respiratory depression, apnea, hypotension, paradoxical agitation, slow onset, variable response

Induction Agents

- Fentanyl
  - Short acting narcotic
  - 100mcg = 10mg morphine =75mg pethidine
  - 50-100mcg induction dose (less in elderly)
  - Cardiac depression if used with nitrous
  - May cause severe hypotension if used with beat or calcium channel blockers
  - Avoid with MAOIs

Induction Agents

- Ketamine:
  - Dose: 1-1.5 mg/kg IV (4 mg/kg IM
  - Onset: 60 – 90 sec
  - Duration: 10 – 20 min
  - Especially in hemodynamically unstable, TBI, reactive airways disease (causes bronchodilation)
  - Caution in CV diseases (HTN, tachycardia), laryngospasm rarely, raised intraocular pressure.

Induction Agents

- Propofol:
  - Dose: 1.5 – 2.5 mg/kg TBW
  - ONSET: 15 – 45 secs
  - Duration: 5 – 10 min
  - Use: haemodynamically stable patients, reactive airways disease, status epilepticus
  - Drawbacks: hypotension, myocardial depression, reduced cerebral perfusion, pain on injection, variable response, very short acting.

Paralytic Agents

- Suxamethonium (succinylcholine):
  - Dose: 1.5 mg/kg IV and 4 mg/kg IM (in extremis)
  - Onset: 45 – 60 sec
  - Duration: 6 – 10 min
  - Use: widely used unless contraindicated
  - Drawbacks: hyperkalemia, malignant hyperthermia, bradycardia, fasciculations, elevated intra-ocular pressure.
  - N.B. Will not wear off fast enough to prevent harm in CICV situations

Paralytic Ager

- Rocuronium:
  - Dose: 1.2 mg/kg
  - Onset: 45 – 60 sec
  - Duration: 90 min
  - Use: rocuronium appears to have longer safe apnoea times than suxamethonium and has no significant contraindications.

Preoxygenation

- Preoxygenation is the most important component of RSI, especially in a compromised patient.
- Patients who require RSI are often critically ill and will be at high risk of desaturation during induction/ intubation due to factors such as underlying lung pathology, reduced FRC, and high metabolic requirements.
- Ideally, all patients in the ED who require intubation should continue to receive high flow oxygen.

Risk Stratification

Risk category	PreO2 period	Onset of muscle relaxation	Apnoeic period during intubation
Low risk SpO_2 96–100%	NRB mask with max O_2 flow rate	NRB mask and nasal O_2 at 15L/min	Nasal O_2 at 15L/min
High risk SpO_2 91–95%	NRB mask or CPAP or BVM with PEEP valve	NRB mask, CPAP, or BVM with PEEP and nasal O_2 at 15L/min	Nasal O_2 at 15L/min
Hypoxemic SpO_2 <90%	CPAP or BVM with PEEP	CPAP or BVM with PEEP and nasal O_2 at 15L/min	Nasal O_2 at 15L/min

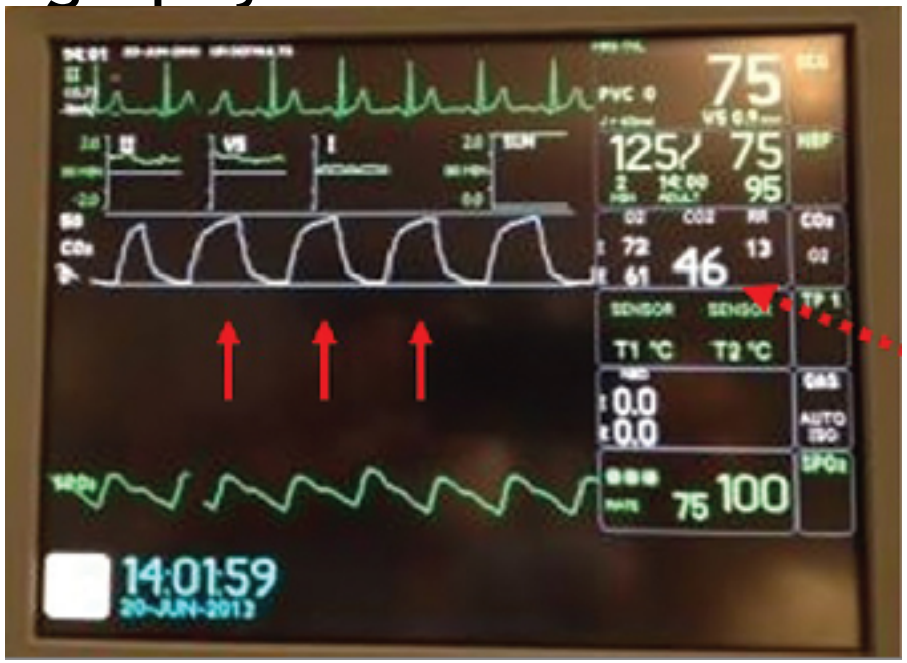
Weingart SD and Levitan RM: Ann Emerg Med 2011

Pretreatment

- Most patients in the ED requiring intubation will benefit from a bolus of IV crystalloid.
- Traditionally, pretreatment included drugs such as atropine, lignocaine, fentanyl and a defasciculating dose of NMB. There is little evidence that any of these are beneficial clinically and they should not be a routine part of clinical practice.

Confirmation of successful intubation

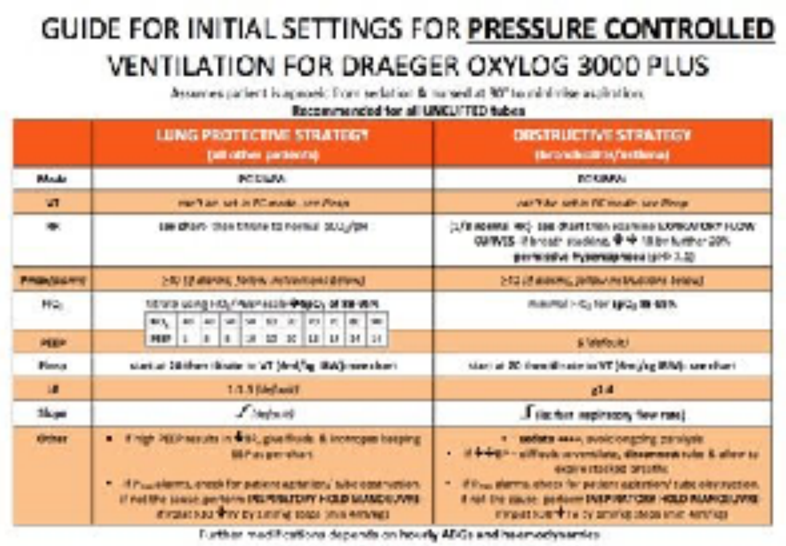
- The most reliable affirmation of intubation is seeing the ETT tip Pass between the vocal cords.
- All endotracheal intubations must be confirmed with quantitative wave-form capnography.



Postintubation

1. Inflate cuff and remove stylet
2. Ensure the ETT is in the trachea at an appropriate depth.
3. BVM ventilation and check ETCO2. (Set up the ventilator)
4. Recheck vital signs. Post-intubation hypotension is common, and if significant, should be treated with intravenous fluid administration and vasopressor medications.
5. Secure the ETT.
6. CXR to locate the ETT tip in relation to the carina.
7. Paralysis may be initiated, or continued after intubation, if indicated.
8. Appropriate sedative-hypnotic and analgesia must be maintained.
9. ETT cuff pressure can be adjusted to a “minimum leak” position.

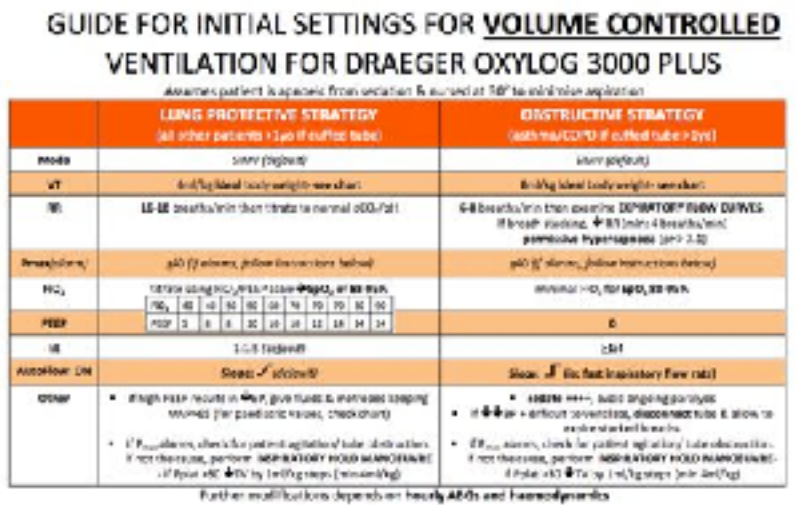
George Douros "Owning the Oxylog 3000" video


GUIDE FOR INITIAL SETTINGS FOR PRESSURE CONTROLLED VENTILATION FOR DRAEGER OXYLOG 3000 PLUS

LUNG PROTECTIVE STRATEGY

OBSTRUCTIVE STRATEGY

Further modifications depends on hourly ABGs and haemodynamics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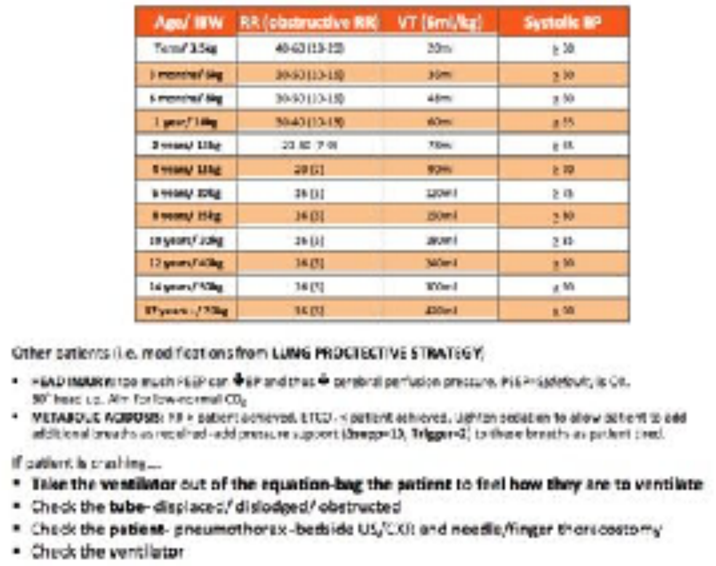
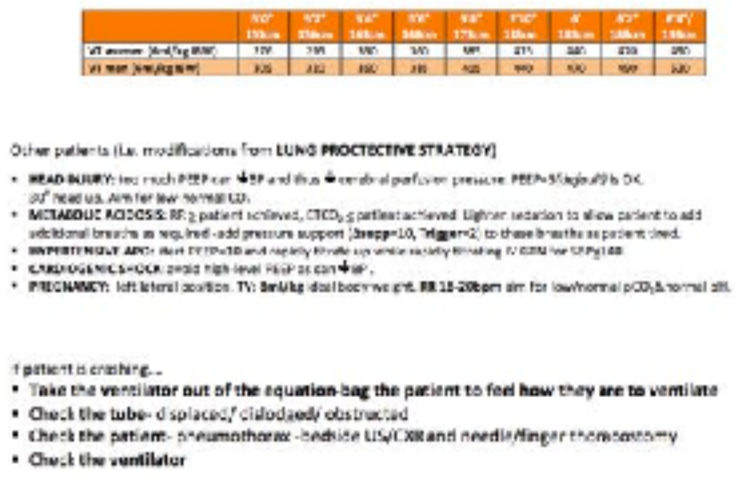

Age/ IBW | RR (obstructive RR) | VT (6ml/kg) | Systolic BP

Other patients (i.e. modifications from LUNG PROTECTIVE STRATEGY)

If patient is crashing...

- Take the ventilator out of the equation-bag the patient to feel how they are to ventilate
- Check the tube- displaced/ dislodged/ obstructed
- Check the patient- pneumothorax -bedside US/CXR and needle/finger thoracostomy
- Check the ventilator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Mode of Ventilation

- Pressure Control Ventilation (PC SIMV+)
  - i.e. Set pressure / Monitor Volumes
- Volume Control Ventilation (SIMV)
  - i.e. Set Volume / Monitor Pressures

Adjustables on the Ventilator

- Mode - usually SIMV / sometimes PCV
- Tidal Volume (VT) (only in volume control)
- Respiratory (RR)
- FiO2
- PEEP
- P insp (only in pressure control mode)
- Pmax
- Slope/inspiratory flow rate –*Patient Comfort*

Ventilation Strategies

- Lung Protection Strategy
  - i.e. all patients that are not obstructive
- Obstructive Strategy
  - asthmatics

Lung Protection Strategy

- Mode - Usually SIMV
- VT – *6-8 ml/kg*
- RR – *16-18*
- Pmax (< or =40)
- FiO2 and PEEP – *use peep table for stats 88-95%*
- Pinsp (pressure control mode only start at 20)
- I:E Ratio - *1:1.5 (default)*
- Slope/inspiratory flow rate –*default*

Keep Saturations 88-95% using the PEEP Table

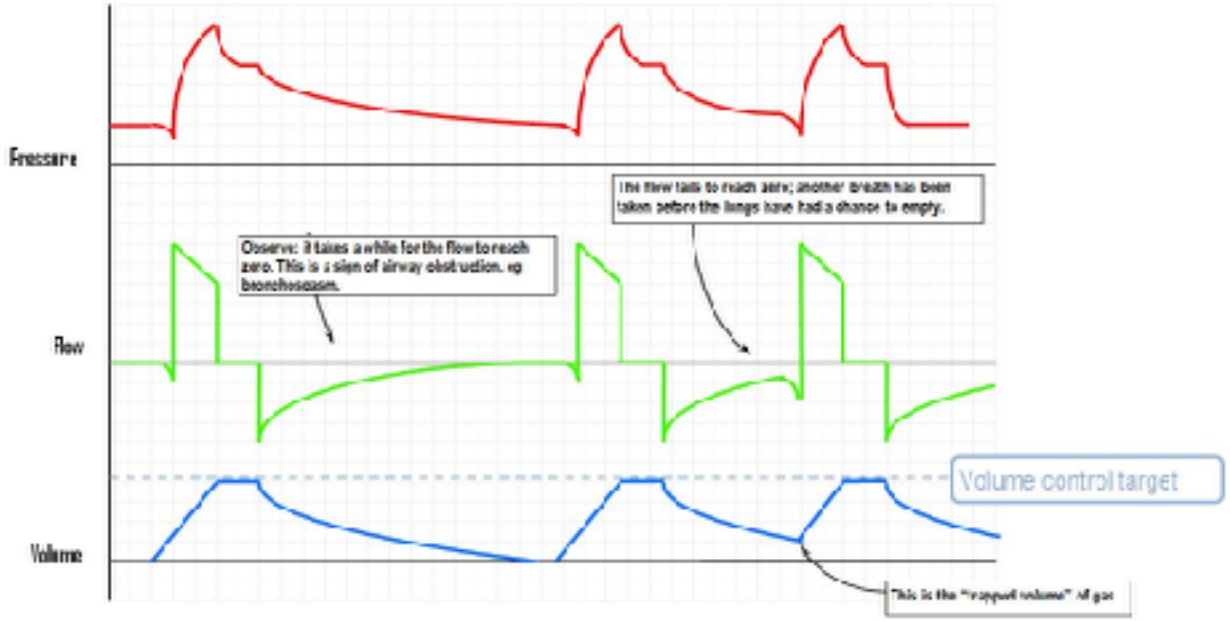
FiO2	.4	.4	.5	.5	.6	.7	.7	.7	.8	.9
PEEP	5	8	8	10	10	10	12	14	14	14

“the strategy helps keeps the alveoli just at the point where recruitment is maintained and avoids barotrauma”

Obstructive Strategy

- Mode - Usually SIMV
- VT – *6-8 ml/kg*
- RR – *6 - 10*
- Pmax (< or =40)
- FiO2 *to maintain sats of 88-95%*
- *Zero PEEP ("ZEEP")*
- Pinsp (pressure control mode only start at 20)
- I:E Ratio – *1:4 or 1:5*
- Slope/inspiratory flow rate – *fast*

- Look for gas trapping / auto peep / breath stacking
  - Watch flow waves
  - Check plateau pressure (if <30 not likely)



- IF PATIENT IS CRASHING……
  - TAKE OFF THE VENTILATOR AND HAND BAG
  - CHECK TUBE
  - CHECK PATIENT

…….then check ventilator

Summary

1. RSI offers the best chance of success for most airway challenges.
2. The indications and risks of RSI must be understood.
3. Proper preparation is the best way to reduce risk in RSI.
4. RSI is delivered by a team and CRM principles can optimize team performance in high risk situations.
5. Post intubation management is essential.