Hypoxia

Non-CO_2 retainer < 92%, CO_2 retainer (Chronic lung disease) < 88%

- Try to achieve saturation targets within minutes
- Reduce RR within 1 hour

Targets

- 94-98% - non-CO_2 retainer
- 88-92% - CO_2 retainer

Start with assessment of RR

- RR < 10 → BBVM + IPPV
- RR > 10

Basic Oxygenation	&	Basic Ventilation

- NRBM 10-15 l/min

- Prop up (Provided BP Normal)
- Suggestive of COPD/Asthma → Nebulization
- Suggestive of HF → IV Frusemide if SBP> 90

- Next -

Hypoxia Corrected		Hypoxia Not Corrected

Move to Circulation

Exclude other **major presentations**

- Correct BP Refer Shock Guideline
- Refer to the Guide on escalation of respirator support and initiate HFNO/NIV/IPPV

Treat the cause simultaneously (Refer SOB Workup)

- Acute Asthma
- Anaphylaxis
- Pneumonia
- COPD Exacerbation
- Pulmonary Embolism
- Pneumothorax
- Interstitial Lung Disease
- Pleural Effusion
- ACS
- Acute Pulmonary Edema
- DKA
- Sepsis
- Anemia

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

Guide for escalation of respiratory support

Targets

RR < 25

SpO2- 94%-98% non-CO2 retainer, 88-92% in CO2 retainers (HCO3 30 or more on the VBG)

Timing to achieve targets

Saturation-within minutes

RR- within hours

Parameter									
Respiratory rate, work of breathing		Normal	⇑	⇑	⇑⇑		⇑⇑⇑	⇑⇑⇑	⇓
Saturation		Normal	Normal	⇓	⇓		⇓	⇓	⇓
PCO_2		Normal	⇓	⇓	Normal		⇑	⇑⇑	⇑⇑⇑
Impression		No respiratory failure	**Impending respiratory failure**	**Early Type 1 respiratory failure**	**Late Type 1 respiratory failure**		**Early Type 2 respiratory failure**	**Late Type 2 respiratory failure**	**Near fatal type 2 respiratory failure**
Support	Basic Ventilatory Support	Prop up if BP normal, Nebulize if Rhonchi IV Frusemide if evidence of acute pulmonary oedema	Prop up if BP normal, Nebulize if Rhonchi IV Frusemide if evidence of acute pulmonary oedema	Prop up if BP normal, Nebulize if Rhonchi IV Frusemide if evidence of acute pulmonary oedema	Prop up if BP normal, Nebulize if Rhonchi IV Frusemide if evidence of acute pulmonary oedema		Prop up if BP normal, Nebulize if Rhonchi IV Frusemide if evidence of acute pulmonary oedema	Prop up if BP normal, Nebulize if Rhonchi IV Frusemide if evidence of acute pulmonary oedema	Prop up if BP normal, Nebulize if Rhonchi IV Frusemide if evidence of acute pulmonary oedema
	Basic Oxygenation	Nil	FM 5-10L/min	NRBM 10-15/L/min Follow early advanced therapy	NRBM 10-15/L/min Follow early advanced therapy	NRBM 10-15/L/min Follow early advanced therapy	NRBM 10-15/L/min Follow early advanced therapy	NRBM 10-15/L/min Follow early advanced therapy	NRBM 10-15/L/min Follow early advanced therapy	Ambu ventilation with 100% O2+ nasal cannula
	Advanced Ventilation + Advanced Oxygenation			+/- HFNC 60L/min	HFNC 60L/min	CPAP/BiPAP	HFNC 60L/min (If NIV is contraindicated)	BiPAP Single limb Maximum O2 flush	BiPAP dual limb/ IPPV Maximum o2 flush	NOV Dual limb/ IPPV
	Type of ventilation	Negative pressure spontaneous	Negative pressure spontaneous	Negative pressure spontaneous	Negative pressure spontaneous	Positive pressure spontaneous	Negative pressure spontaneous	Positive pressure spontaneous	Positive pressure spontaneous	Spontaneous / mandatory positive pressure ventilation
Key problem			SOB	Hypoxia	Hypoxia		Hypoxia		Hypoxia	Hypoxia
Treat the underlying cause		Preventive measures	Refer SOB workup	Hypoxia workup ⇑ Then SOB workup			Hypoxia workup → ⇑ Then SOB workup			

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

Indications for HFNC

- Type 1 respiratory failure
- Intubation (pre-oxygenation and apnoeic oxygenation)
- Post-extubation respiratory distress
- Do-not-intubate/ palliative settings
- Oxygen supply during invasive procedures, e.g. BAL, TOE, upper GI endoscopy

Contraindications for HFNC

- epistaxis
- base of skull fracture
- surgery to the nose or upper aero-digestive tract
- nasal obstruction; e.g. nasal fracture, tenacious secretions, tumour

Indications for NIV

- An acute exacerbation of chronic obstructive pulmonary disease (COPD) with a respiratory acidosis (pH 7.25-7.35)
- Type II respiratory failure secondary to chest wall deformity or neuromuscular disease Cardiogenic pulmonary oedema which is unresponsive to CPAP

Contraindications for NIV

- Facial burns/ trauma/ recent facial or upper airway surgery
- Vomiting
- Fixed upper airway obstruction
- The presence of an undrained pneumothorax

Relative contraindications include:

- Recent upper gastrointestinal surgery
- Severe co-morbidities
- Confusion/agitation/decreased level of consciousness
- Bowel obstruction

Targets

- RR< 25
- SpO2- 94%-98% non-CO2 retainer, 88-92% in CO2 retainers (HCO3 30 or more on the VBG)

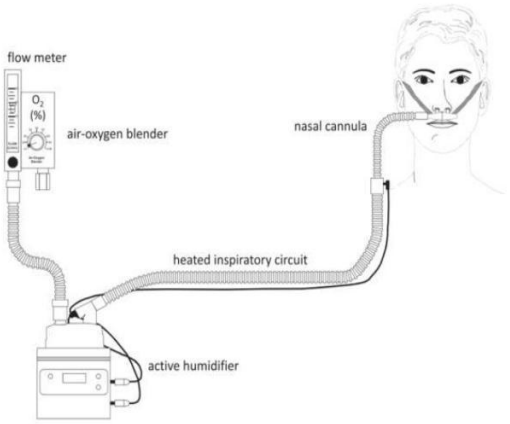
Timing to achieve targets

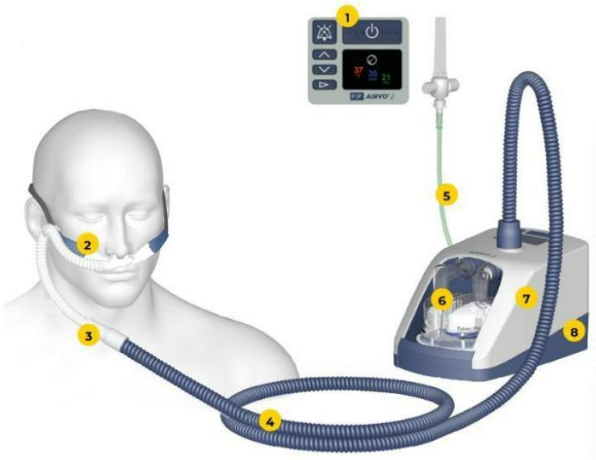
- Saturation-within minutes
- RR- within hours

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

High Flow Nasal Cannula (HFNC)

The high flow nasal cannula (HFNC) is a special device that can deliver a continuous flow of gas between 20 and 60 L/min and offers many physiological advantages that other oxygen delivery systems do not. It requires specific devices, (i.e. OptiFlow™, Airvo etc.) which blend compressed medical air and oxygen to deliver a continuous flow of 20-60 L/min through a warmed and humidified circuit.





How does it work? It's the Flow.

1. HFNC washes out nasopharyngeal dead space, improves oxygenation, decreases the work of breathing and respiratory rate.

- The high flow rate makes breathing more efficient because it washes out the dead space.
- When a patient is in distress, the wash out of dead space makes breathing more efficient because it significantly decreases the amount of re-breathed carbon dioxide and acts as a continuous reservoir of new gas.
- This ultimately decreases the respiratory rate and work of breathing in your patient.

2. HFNC delivers flow, not pressure like CPAP or BiPAP, but the flow can generate an estimated 2-5 cm H_2O of PEEP.

- Even these low levels of upper airway pressure can increase the functional residual capacity (FRC) and lung recruitment

3.HFNC can match your distressed patient's inspiratory flow, high-flow nasal cannula can deliver near 100% FiO2—more than a NRB can.

- HFNC is a better oxygen delivery and respiratory support device than the standard non-rebreather oxygen mask, venturi-mask, and simple low flow nasal cannula in a hypoxic patient.

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

- In respiratory distress, a patient's inspiratory flow and minute ventilation are much higher than the 15 L/min flow of oxygen from a non-rebreather mask.
- This means with each breath room air is being inhaled along with the supplemental oxygen, ultimately decreasing the total FiO_2 being delivered to your patient.
- HFNC can better match the inspiratory flow and minute ventilation of most patients to deliver a consistent amount of oxygen and less inhaled ambient room air

1. **Heat and humidification make the high flow tolerable and probably helps with secretion clearance.**
    - Patients are able to tolerate the high flow rates from a HFNC because of heating and humidification. Prior to reaching the patient's nose, the air can be humidified to 100% and warmed to body temperature.
    - This both improves patient comfort and preserves mucociliary function.
    - It improves secretion management and can reduce re-intubation related to upper airway obstruction.
    - It can also decrease the amount of energy the patient expends heating and humidifying inspired air.
    - **Don't set it and forget it; increase the flow to match your patient's distress.**
    - Beware of the patient on 60 L/min of flow and 100% FiO_2 who remains in respiratory distress! This patient is failing despite a tremendous amount of support from the high flow device and will need escalation of respiratory support to NIV.

2. **HFNC is effective at pre-oxygenation and apneic oxygenation during an intubation attempt.**
    - Leave the HFNC cannula in place throughout induction and laryngoscopy, as the continuous high flow promotes apneic gas exchange.
    - If the patient is already being treated with a HFNC, our practice is to leave it in place with maximal flow and FiO_2 during induction and laryngoscopy.

3. **Similarly, in a patient with a difficult airway who requires an awake fiberoptic intubation, consider initiation of HFNC while preparing to intubate.**
    - For an urgent orotracheal intubation with a patient sitting upright, this approach offers pre-oxygenation while the proceduralist readies equipment and applies topical anesthetic to the mouth and glottis.
    - The nasal cannula does not obstruct the proceduralist and offers respiratory support during the awake intubation.

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

High Flow Machine Setup

Steps

1. Preparation of Breathing Circuit & Chamber/Nasal Interface

1. **Water Chamber Preparation:**
    - Fill the sterile water into the water chamber up to the lower level of the black line around the chamber.
    - Fit the connector into the water chamber to bridge the machine.
    - Insert the water chamber into the machine.
2. **Water Bag Setup:**
    - Prepare a sterile water bag and connect the tube attached to the water chamber.
3. **Breathing Circuit Connection:**
    - Connect the breathing circuit (tube) to the machine.
4. **Nasal Cannula Selection:**
    - **Criteria for Selection:**
        - The nasal cannula should occlude 50% of the nostrils.
        - The nasal cannula should meet the prescribed flow rate.
    - **Flow Ranges for Nasal Cannulas (L/min):**
        - **Adults:**
            - Small (Orange): 10–50
            - Medium (Blue): 10–60
            - Extra Large (Green): 10–60
        - **Juniors:**
            - Small (Red): 2–8
            - Medium (Yellow): 2–20
            - Large (Purple): 2–20
            - Extra Large (Green): 2–25
5. **Final Connection:**
    - Attach the selected nasal cannula to the breathing circuit (tube).

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2. Machine Settings

1. **Power On the Machine:**
    - Turn on the machine.
2. **Mode Selection:**
    - Set the mode based on the patient group:
        - **Junior:** 2–25 L/min
        - **Adult:** 10–60 L/min
    - Long-press the triangle button for 3 seconds to select the mode.
3. **Temperature Setting:**
    - Unlock by pressing two arrow keys simultaneously.
    - Adjust the temperature:
        - **Junior:** 34°C
        - **Adult:** 37°C (recommended) — can increase by 34°C if needed.
4. **Flow Rate Setting:**
    - Unlock by long-pressing two arrow keys simultaneously.
    - Set the flow rate:
        - **Junior:** 2 × weight (kg) L/min
        - **Adult:** 30 L/min (above 30 L/min if needed).
5. **FiO_2 Setting:**
    - Adjust FiO_2 using the O_2 flow meter.

Final Note

Before connecting the nasal cannula to the patient:

- Run the machine for at least 5 minutes with room air only (do not supply O2).
- This practice is subject to the time of emergency.

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

Administration of NIV- BIPAP/CPAP

Continue basic ventilation and oxygenation support

- Ventilation
  i. Propped-up
  ii. Nebulize if suggestive of Asthma/COPD
  iii. If crepts+ & suggestive of heart failure -> IV Frusemide

- Oxygenation
  i. Face mask 5-10L/min
  ii. NRBM 10-15L/min

Re assess the patient RR and SpO2

if RR>25/min or SpO2 <94% or

SpO2 <88% in chronic CO2 retainers (HCO3 >30 in ABG/VBG)→ Consider escalation to High Flow Nasal Cannula (HFNC)/ NIV- CPAP-BIPAP

Starting BiPAP ventilation

1. Plug the machine
2. Connect the machine to high flow 25L oxygen flow meter(25-70L) and start 251 oxygen flow rate
3. Switch on the machine
4. Unlock the machine & go to settings and select options as mentioned below
   - Pathology- Normal
   - Mode - ST
   - IPAP-10
   - EPAP-5
   - Backup Rate – 15

5. Select the appropriate mask
   - If the mask is a vented mask can directly connect to the inspiratory limb.
   - If the mask is a non-vented mask connect additional ventilatory port to the mask before connecting to the inspiratory limb.
6. Run the Machine - Feel the gas flow coming out from the machine
   - Explain about Non-Invasive Ventilation to the patient.
7. Slightly remove the NRBM and fit the NIV mask.
   - Fit the mask tightly to reduce leak <25L/min
8. Keep tidal volume (TV) at 6-8ml/kg 7ml/kg
   - Adjust TV 7ml/kg by increasing AP (adjust IPAP by 1cm H20 increments - Correct ventilation with achieving the target TV.
9. After achieving target TV if SPO2 less than 94%
   - Increase FiO2 by increasing 02 flow rate above the 25L up to 701

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

- Increase EPAP by 1cmH20, Keep the same AP (Each 1cmH20 increment in EPAP should follow 1cmH20 increment in IPAP to maintain constant (try to maintain AP > 5cm H2O) (If the patient having obstructive lung disease (BA/COPD) never increase EPAP above 5cm H2O.)
- Increase I time (min/max)
- Increase fall time
- Decrease rise time.

10. Re assess the patient clinically after setup and arrange ABG/VBG one hour after starting NIV Target RR <25
    - SPO2 294
    - PCO2 <45

11. while maintaining SPO2294 If PCO2 245
    - Increase TV up to 8ml/kg
    - Decrease EPAP
    - Increase fall time.

12. Monitoring
    - Continuous monitoring ed SPO2, RR, PR and 3 lead ECG BP, TV every 5 min

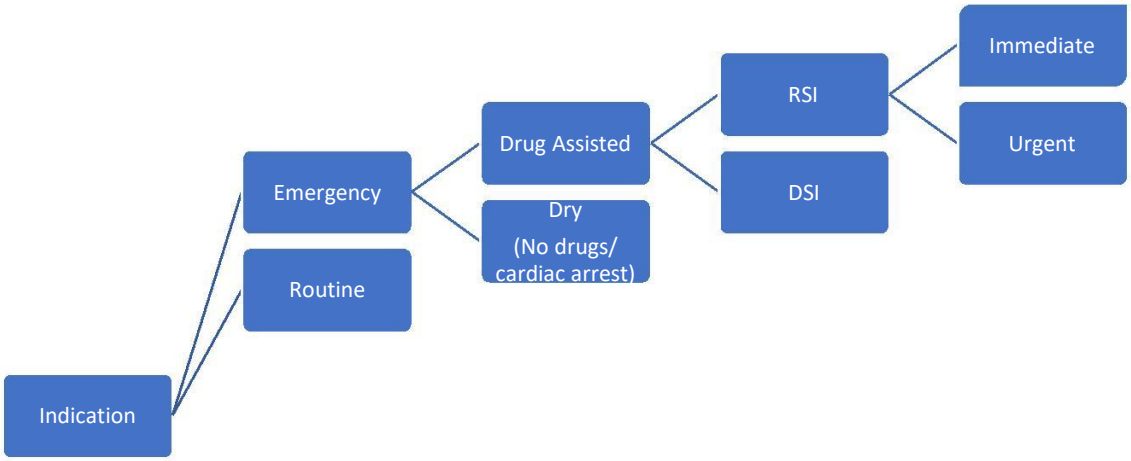
13. De-escalation of NIV support
    - Consider de-escalation when the patient is receiving tidal volumes exceeding 6-8 mL/kg with the given IPAP/EPAP settings, and there is clinical improvement with reduced work of breathing.
    - Begin by reducing oxygenation through a gradual decrease in EPAP.
    - Simultaneously decrease IPAP while maintaining a AP of >5 cmH2O.
    - Once EPAP is reduced to 5-7 cmH2O, continue decreasing IPAP further as tolerated.
    - Adjust the oxygen flow rate downward using the flow meter.
    - Transition to a non-rebreather mask (NRBM) with an oxygen flow rate of 10-15 L/min once the settings reach minimal levels (IPAP 10/ EPAP 5)

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

Intubation in the emergency room

1. Identify indication for intubation

   1.Keep airway patent and continue advanced ventilation with IPPV
   2.Patient with patent airway but requiring advanced respiratory support with IPPV according to escalation criteria.
   3.To keep airway protected in an unconscious/airway -threatened patient and continue advanced ventilation with IPPV



Immediate- Unable to provide basic ventilatory support e.g., Neck trauma, airway injury

Urgent- Encourage Resuscitation supported intubation, if low SPO2 and BP correct with O2 and IVF, inotropes.

2. Identify and treat reversible causes that may negate need for intubation

3. Continue basic and advance ventilatory support up to NIV

Basic Airway> Basic Ventilation> Advance Ventilation HFNC/NIV> Advance airway

4. Identify difficult airway with airway assessment (**LEMON**) and anticipate difficult intubation

- **Look**
- **Evaluate 3-3-2 rule**
- **Mallampati score 1,2,3,4**
- **Obstruction**
- **Neck mobility**

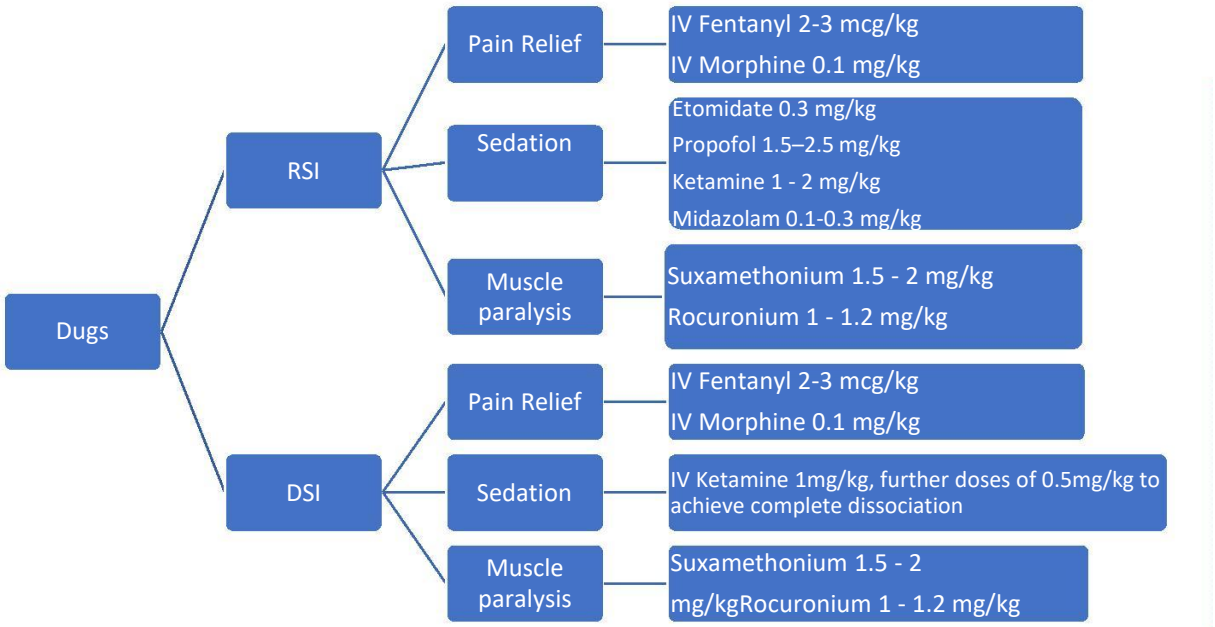
5. Preparation for RSI (**PEACH)**

5.1 Positioning- pre oxygenation and intubation

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

5.2 Equipment

- Monitoring- capnography, pulse oximeter, 3-lead ECG, non invasive BP
- Basic airway & other resuscitation equipment
- Advance airway equipment
- Equipment for failed intubation
- Drugs- induction, paralysis



5.3 Attach

Minimum standard monitoring

Two sources of oxygen- preoxygenation and apneic oxygenation- Ambu, HFNC, NIV

5.4 Checks

Intubation Check List (Annex 01)

Identify backup plans

AMPLE history

IV access with two functioning cannula, contralateral arm BP

ABCDE assessment, identify and treat HOP killers

5.5 Help and assign roles

6. Pre-oxygenation

7. Apnoeic oxygenation

8. Pretreatment if indicated

9. Induction agent and muscle relaxant in quick succession in precalculated doses

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

10. Cricoid pressure or BURP with loss of consciousness

11. laryngoscopy and proceed with intubation

Follow Plan A>B>C>D in difficult airway guideline (Annex 02)

Plan A: Position, Maneuver (BURP), Blade, View

- **Grade 1- just insert the tube**
- **Grade 2- Stillet**
- **Grade 3A- macoid blade**
- **Grade 3B- bougie, connector of size 2 tube**
- **Grade 4- Fiber optic laryngoscope/Video laryngoscope**

Plan B- LMA

Plan C- Face mask ventilation

Plan D- Difficult airway drill/ FONA (Annex 03)

No 10 blade, Bougie, size 6 ET tube

12. Confirm tracheal tube placement

- Hold tube in left hand
- Continue ambu ventilation by the assistant
- Inspect B/L symmetrical chest wall expansion
- Wave form capnography
- Five-point auscultation and confirm tube position with the right hand

13. Cricoid pressure removed

14. Secure tracheal tube with tape/tie

15. Post intubation review

- Reassess vitals using ABCDE- HR, BP, SPO2, RR
- Tube- Lip level 22-24 women, 24-26 men, check cuff pressure ideal is to use a pressure gauge
- Use a suction catheter to clear material form proximal airway
- Continue monitoring
- Request a chest xray to examine position of tube

16. Prepare dugs for sedation and paralysis

- Sedation- midazolam
- Paralysis- long-acting neuromuscular blocking agent if indicated e.g.; vecuronium
- Analgesia- morphine

17. Prepare and connect to the ventilator

- Check the tubing
- Plug
- Ventilator settings

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

- Connect to the ventilator
- first correct **ventilation** (MV= TV * RR), then correct **oxygenation**

1. Select mode
   Obstructive- SIMV volume control
   Restrictive/ Paralysed- SIMV pressure control (VC cause more volume & baro trauma)
2. TV- 6-8ml/kg
3. RR
   - Restrictive- Rate that achieved targeted SPO2 and capno, usually around 25-30
   - Obstructive- 8-12/min

4. PEEP
   - Restrictive- start at 5 and increase
   - Obstructive- 0 to less than 5

5. Trigger low- both restrictive and obstructive

6. PS- 10

7. Adjust RR while keeping TV at 6ml/kg until capno or HR come to target (capno 35-45, HR<120)

8. FIO2 – 100% initially

9. Increase oxygenation

Obstructive-

- Increase FIO2
- low PEEP 0 to 5
- Reduce I time and increase E time
- Increase rise time
- Increase fall time

Restrictive-

- Increase FIO2
- Increase PEEP
- Increase I time and decrease E time
- Reduce rise time
- Reduce fall time

18. Assess ongoing need for paralysis

- Continue paralysis- head injury, post cardiac arrest, massive fluid shifts causing sever acidosis
- Off paralysis all other situations

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

19. Look for spontaneous breaths, keep the trigger low

- No spontaneous breaths- further reduce trigger
- Spontaneous breaths present- Adjust trigger until patient takes 25% spontaneous breaths (8) out of total breaths (32) and 75% mandatory breaths (24) out of total breaths.

20. ABG in one hour

- CO2 ⬆ - increase TV and RR
- CO2 normal- cont same settings
- CO2 ⬇ - Start weaning

21. Weaning off from a ventilator

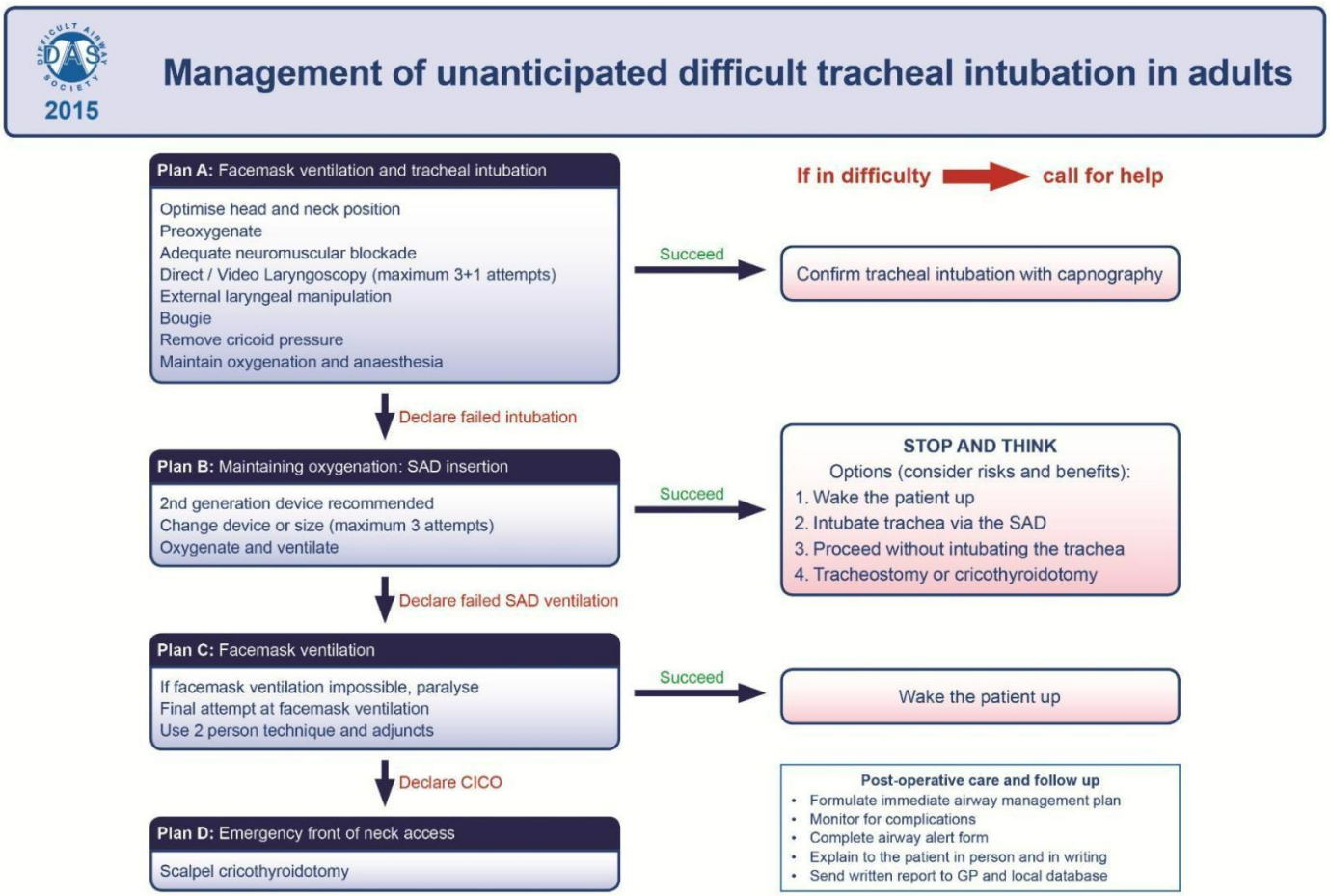
- Reduce FIO2 first- blood Pao2>600 reduce FIO2 100%> 80% >60%, keep at 60%
- Reduce mandatory breaths 20>15
- Increase spontaneous breaths 8>10>15
- Adjust TV with PS
- Total RR<25, 75% spont breaths, 25% mandatory breaths out of total breaths extubate and change to NIV

22. Spontaneous BiPAP in ventilator or NIV

- Dual limb vented mask
- PS 10, PEEP 5, PIP 15
- IPAP 15, EPAP 5 >> IPAP 10/ EPAP 5 >> HFNC >> NRBM

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

Annex



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Failed intubation, failed oxygenation in the paralysed, anaesthetised patient

2015

CALL FOR HELP

Continue 100% O_2
Declare CICO

Plan D: Emergency front of neck access

Continue to give oxygen via upper airway
Ensure neuromuscular blockade
Position patient to extend neck

Scalpel cricothyroidotomy

Equipment: 1. Scalpel (number 10 blade)
2. Bougie
3. Tube (cuffed 6.0mm ID)

Laryngeal handshake to identify cricothyroid membrane

Palpable cricothyroid membrane
Transverse stab incision through cricothyroid membrane
Turn blade through 90° (sharp edge caudally)
Slide coude tip of bougie along blade into trachea
Railroad lubricated 6.0mm cuffed tracheal tube into trachea
Ventilate, inflate cuff and confirm position with capnography
Secure tube

Impalpable cricothyroid membrane
Make an 8-10cm vertical skin incision, caudad to cephalad
Use blunt dissection with fingers of both hands to separate tissues
Identify and stabilise the larynx
Proceed with technique for palpable cricothyroid membrane as above

Post-operative care and follow up
- Postpone surgery unless immediately life threatening
- Urgent surgical review of cricothyroidotomy site
- Document and follow up as in main flow chart

This flowchart forms part of the DAS Guidelines for unanticipated difficult intubation in adults 2015 and should be used in conjunction with the text.

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9