Anesthesia Recommendations for Patients Suffering from Prader-Willi Syndrome

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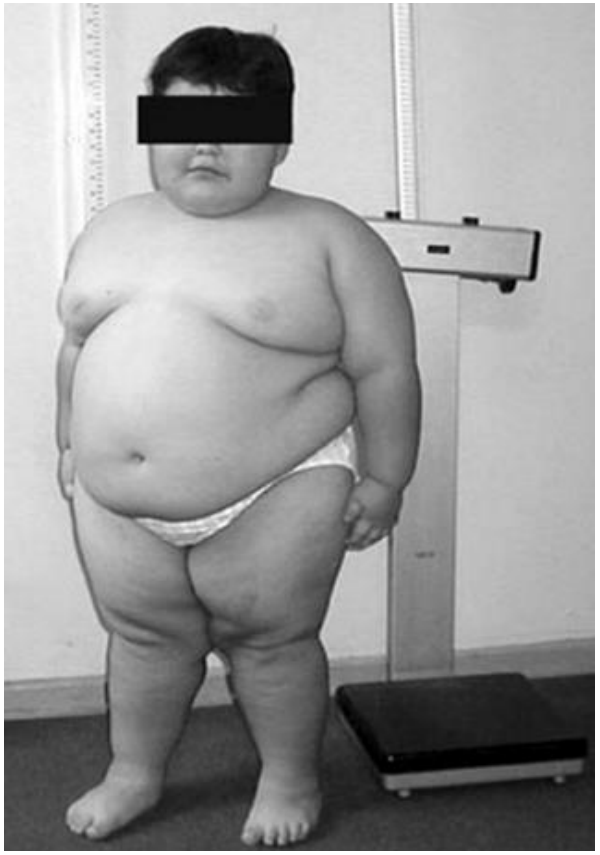
1. General considerations

- Rare genetic disorder (1:10.000 – 1:30.000 nn)[1]
- Hipotalamic-pituitary disfunction
- The most frequent cause for "syndromic" obesity[1]
- Newborns with marked hypotonia, of central origin
- Genitals with hypoplasia- cryptorchism
- Particular phenotype:
  - Narrow forehead
  - Almond-shaped eyes
  - **Sluggish saliva**
  - Turned mouth
  - **Thin upper lip**



Organ system involvement with PWS

Airway

- Difficult tracheal intubation
- Small glottic opening
- Limited neck mobility
- Macroglossia

Respiratory

- Hypotonia
- Poor cough – ineffective clearance
- OSA
- Intraoperative bronchospasm
- Restrictive lung disease

Cardiovascular

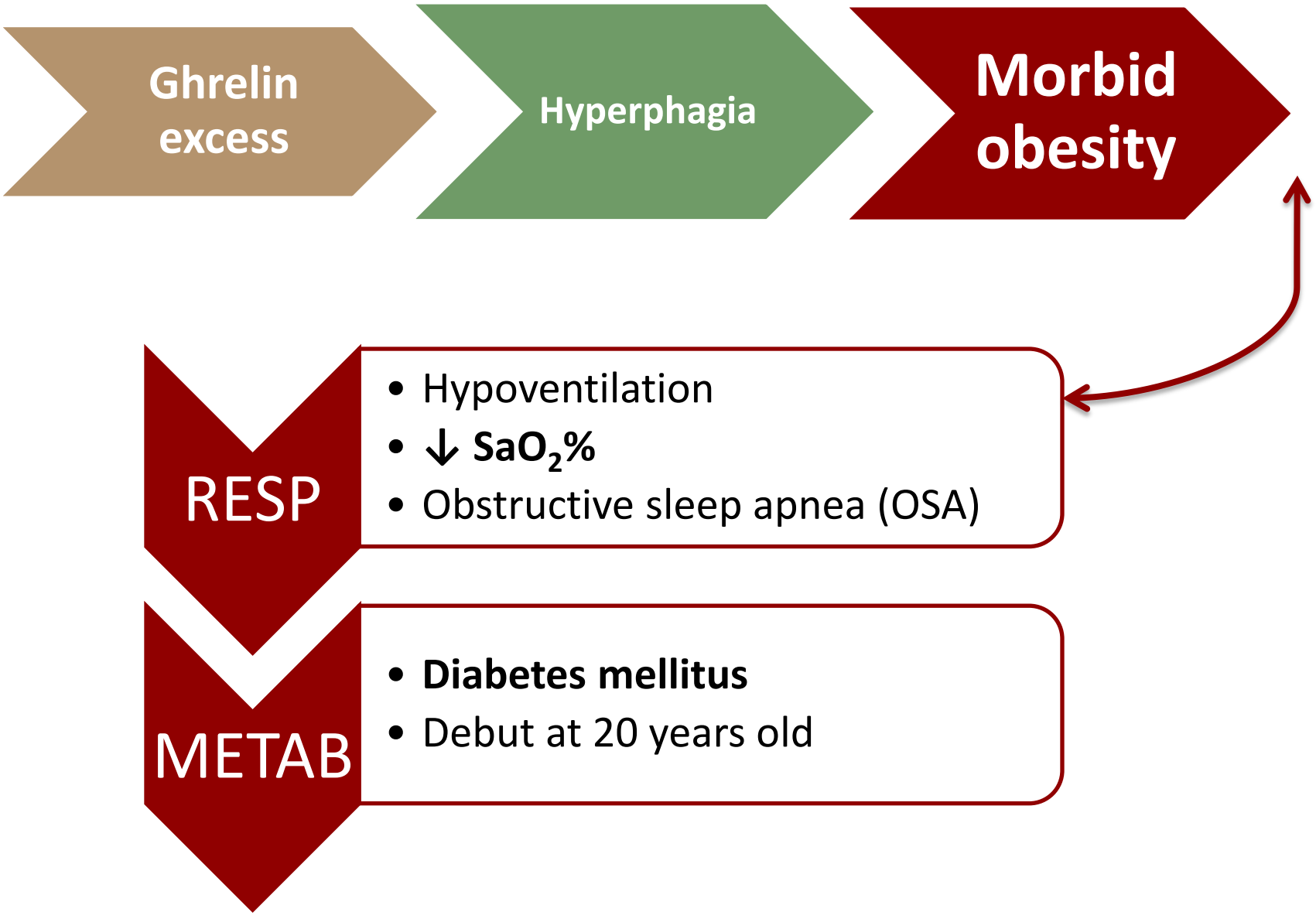
- Ventricular arrhythmia
- Hypertension
- Cor pulmonale

CNS

- Temperature instability
- Defective central control of ventilation
- Mental retardation
- Aggressive behavior

Miscellaneous

- Obesity
- Glucose intolerance
- Kyphoscoliosis
- Poor dentition
- Viscous saliva and airway secretions


Ghrelin excess
Hyperphagia
Morbid obesity
RESP
• Hypoventilation
• ↓ SaO_2%
• Obstructive sleep apnea (OSA)
METAB
• Diabetes mellitus
• Debut at 20 years old

Growth hormone deficit

- Short stature
- Hypogonadism

Decreased bone mineral density

Cognitive impairment

- Learning disabilities
- Behavioral troubles

Impaired speech and language development

2. Typical surgery in the case of PWS patients

- Orthopedic surgery:
  - Spinal surgery – scoliosis
- Cleft lip, palatal repair
- Dental treatment due to tooth decay
- Orhidopexy - cryptorchism

3. Anesthesia – Particularities

- Morbid obesity
- Obstructive sleep apnea (OSA)
- Difficult peripheral intravenous cannulation
- Difficult airway management
- Risk for perioperative respiratory failure
- Primary myocardial involvement
- Aggressive and violent behavior
- Convulsions
- Disturbances in thermoregulation
- Glucose intolerance

4. Management in General Anesthesia

Additional preoperative diagnostic procedures

- **BMI, neck circumference**
- Dental issues
- Evaluation of current **respiratory status**
  - Polysomnography – identification of patients with severe OSA
  - PaO2%, PaCO2%, oxygen saturation
  - !!! Children with PWS frequently suffer from restrictive lung disease (due to hypotonia, obesity, and kyphoscoliosis)
- 12 lead **ECG** ± echocardiography
- **EEG**
- Test for **CAI** (Central Adrenal Insufficiency)
- **Thyroid hormone levels** – possible hypothiroidism

Obstructive Sleep Apnea (OSA)

- Polysomnography
- **STOP-Bang Questionnaire** (loud **S**noring, **T**iredness, **O**bserved apnea, high blood **P**ressure – **B**ody mass index, **a**ge, **n**eck circumference, **g**ender)
- Patients with OSA lose airway stability upon induction of GA → **ventilation may be difficult or impossible**
- After extubation – use non-invasive CPAP in order to stabilize the airway

Aspiration risk

- Hypotonia – unable to cough effectively after use of breathing tube
- Decreased motility of GI tract
- Physiological setpoint for vomiting is abnormal
- Obese → Higher incidence for hiatal hernia
- Low esophageal sphincter tone

Lower the aspiration risk

- Pre-anesthetic fasting
- Peripheral iv cannula
- Routine monitoring
- Drugs that reduce gastric volume and lower the acidity of gastric contents
- Premedication
- Rapid sequence induction

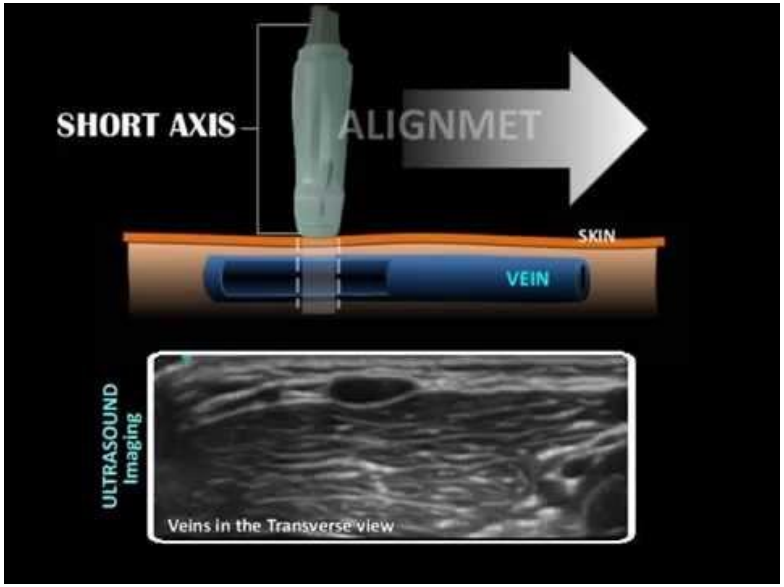
Pre-anesthetic fasting

Table 2 Royal College of Nursing recommendations for preoperative fasting (see web link). Grades of recommendations: A = at least one meta-analysis, systematic review or randomized controlled trial; B = body of evidence applicable to the target population, demonstrating consistency of results D = non-analytic evidence (case reports, case series), expert opinion/consensus

Grade	Recommendation
A	Water and other clear fluids (through which newsprint can be read), clear tea and black coffee up to 2 h before induction of anaesthesia for elective surgery are safe and improve patient well-being
B	Tea and coffee with milk are acceptable up to 6 h before induction of anaesthesia
D	Minimum preoperative fasting time of 6 h recommended for food (solids and milk)
D	Breast milk may be given up to 4 h before induction; formula or cows' milk up to 6 h before induction
B	Chewing gum should not be permitted on the day of surgery
D	Sweets (including lollipops) are solid food. Minimum preoperative fasting time of 6 h recommended

Peripheral intravenous cannula

- May be **difficult** due to the adipose tissue
- Should at first be attempted on the dorsal side of the hand
- **Ultrasound guided** iv cannula might be required
- Upon receiving informed consent the patient/parents should be warned of the eventuality of an **arterial cannula, central venous catheter** or other **invasive** monitoring techniques

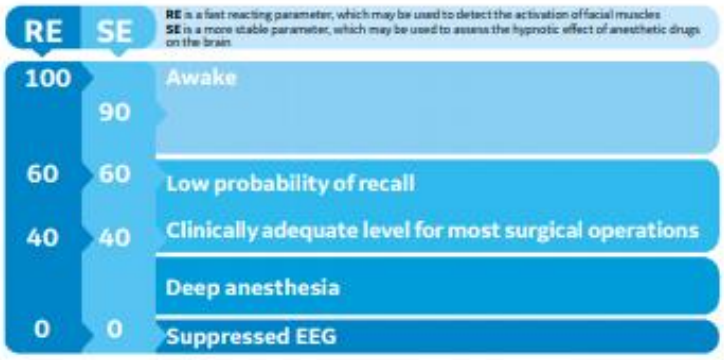


Routine monitoring

- **Hemodynamic monitoring** - BP cuffs should be of appropriate size
- **Ventilation monitoring** – capnography ($EtCO_2$)
- **Fasting glucose** – at risk for perioperative hypoglycemia – even in the absence of diabetes (lipolysis and și neoglucogenesis abnormalities)
- **Body temperature**– thermoregulation
- **Monitoring of the neuromuscular blockade**
  - NMT – Neuromuscular transmission
  - Entropy
- **Further monitoring in ICU** – at risk for: desaturation, hypercapnia, intermittent bronchospasm

Routine monitoring - Entropy

- Monitoring the state of the brain by data acquisition of EEG signals
- Monitoring the effects of certain anesthetic agents
- Help the user to titrate anesthetic drugs
- Reduction of anesthetic use and faster emergence from anesthesia
- Monitoring hypnotic effect of certain anesthetic drugs on the brain



2. During awake state and induction there is a difference between the two Entropies indicating muscle activity on the face.

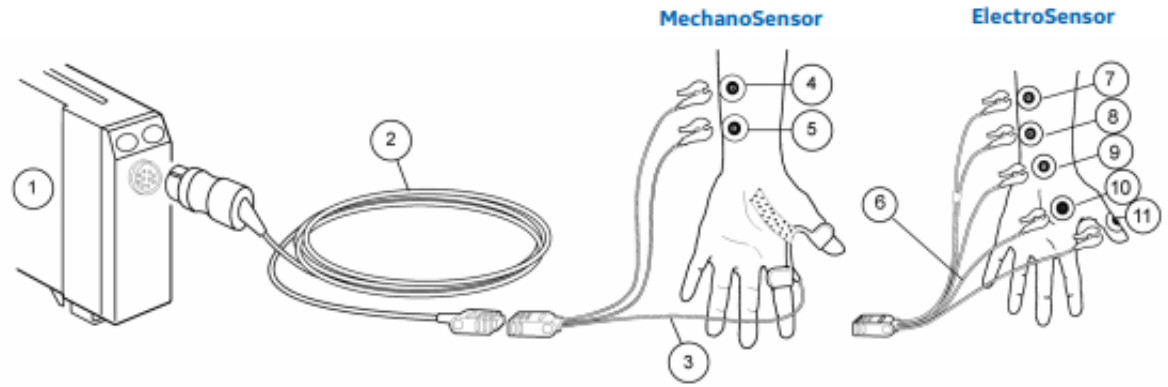
3. Decrease in the Entropy measurement may enable the physician to observe the moment when patient loses responsiveness.

4. Both Entropies stabilize during the operation.

Routine monitoring - NMT

- the transfer of an impulse between a nerve and a muscle in the neuromuscular junction.
- NMT can be blocked by neuromuscular blocking agents
- used to safely time extubation and avoid the occurrence of residual paralysis

- provides quantitative, automatic measurements of muscle response to stimulus and consequentially, the level of block



Premedication

- Aims of pharmacological premedication:
  - Anxiolisis, sedation, amnesia
  - Hemodynamic stability
  - Lower gastric secretion, increase gastric pH
  - Lower doses of anesthetic medication
  - Facilitation of anesthesia induction

Premedication

- **BENZODIAZEPINES - MIDAZOLAM**
  - Preferred because of short T ½ time
  - Sedative and anxiolitic
  - Amnesia
  - Doses: 0.07 mg/kg
  - !!! May lead to respiratory depression, airway collapse, respiratory failure, hypoxemia
- **OPIOIDS – FENTANYL**
  - !!! Associated with risk of respiratory distress
  - Doses are based on LBW (Lean Body Weight) - tissue that is metabolically active (increased due to obesity)
  - LBW = IBW + 0,3 (TBW-IBW)

!!! Prolonged and exaggerated response to sedatives and/or analgesic drugs is possible

Premedication

Drugs that lower gastric volume and gastric acidity

- **RANITIDINE**
  - H2 receptor blockade
  - Decreases gastric secretion as a response to histamine release, acetylcholine, and gastrin
  - Dose: 150 mg i.v., 1 h before surgery
- **METOCLOPRAMIDE**
  - Dopamine antagonist
  - Prokinetic
  - Pyloric sphincter relaxation – reduces gastric volume
  - Increases IES tone
  - Dose: 10 mg i.v., 1 h before surgery

Management of CAI

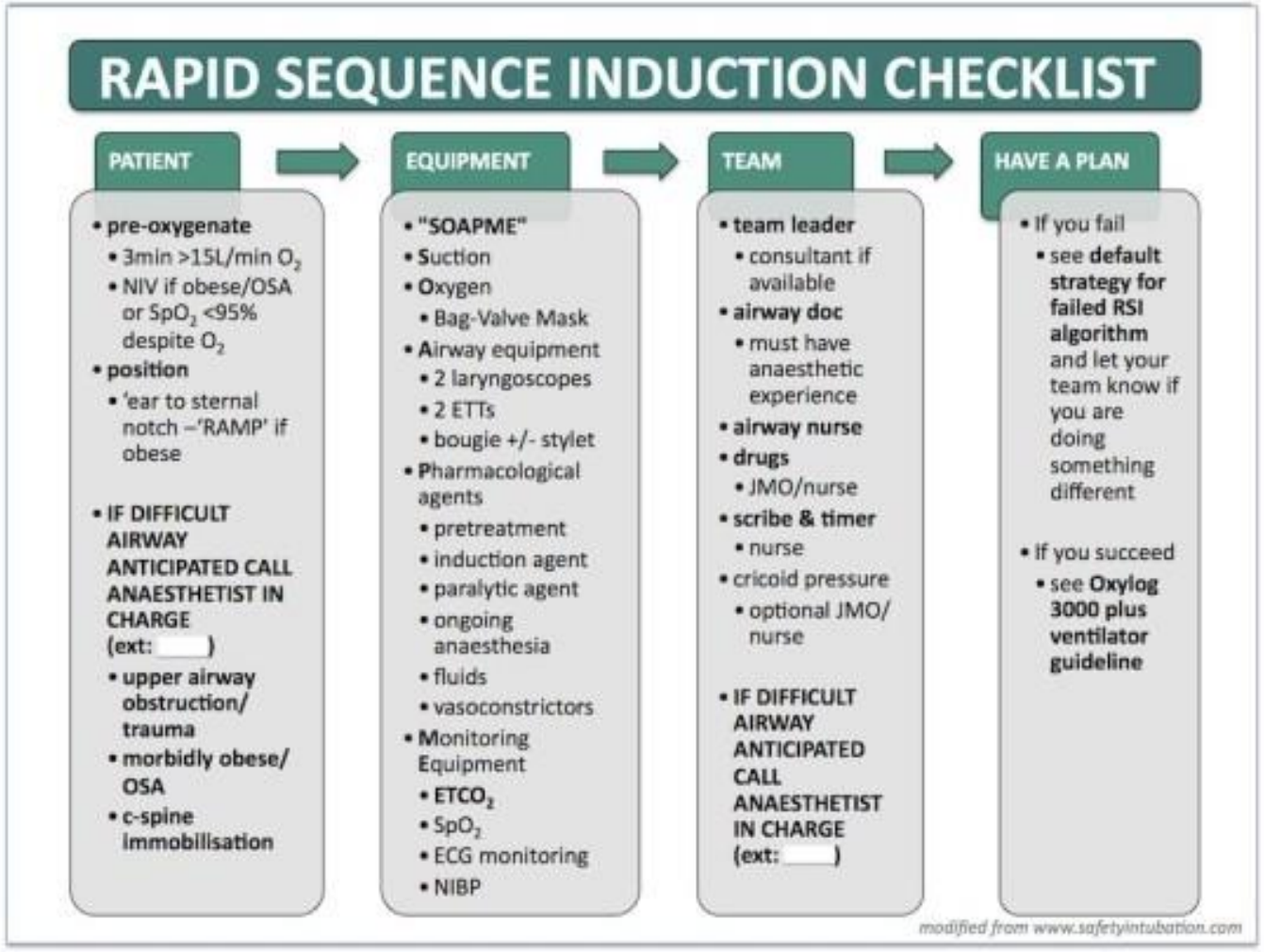
- **Hydrocortisone -** 100mg - 500 mg in adults; 0,56 si 4 mg/kg

Rapid sequence induction (RSI)

- Patient monitoring
- Preoxygenation – minimum 5 min.
- Sellick maneuver – continuous cricoid pressure starting when substances are administered and up until the airway is secured
- Anesthetics will be given fast, iv bolus
- Induction with Midazolam, Fentanyl, Propofol (2mg/kgc), and a neuromuscular blocking agent - Succinylcholine
- The patient will not be ventilated with facial mask

Figura nr. 4. Manevra Sellick

Rapid sequence induction (RSI)



https://lifeinthefastlane.com/ccc/difficult-airway-algorithms/

Neuromuscular blockade

- During RSI – use short-acting depolarizing blocking agents – **Succinylcholine** (Lystenon)

- Use of non-depolarizing blocking agents for muscle relaxation should be restricted - potential long-lasting neuromuscular blockade
- Safe use for: **Rocuronium** – rapid reverse possible with Sugammadex (Ciclodextrina)

- Neuromuscular monitoring - residual blockade should be antagonized with **Neostigmine**

Airway management

- Difficult airway because of:
  - Thick saliva – complicates extubation
  - Facial dimorphism
  - Micrognatia
  - Palate anomalies
  - Impaired mobility of cervical spine and temporomandibular joint
- 13-25% - difficult intubation
- 2/3 difficult ventilation[2]
- Anti-Trendelenburg position

!!! The appropriate equipment to deal with the **"cannot intubate/cannot ventilate"** scenario should be available

↑ risk for difficult airway

Fast desaturation

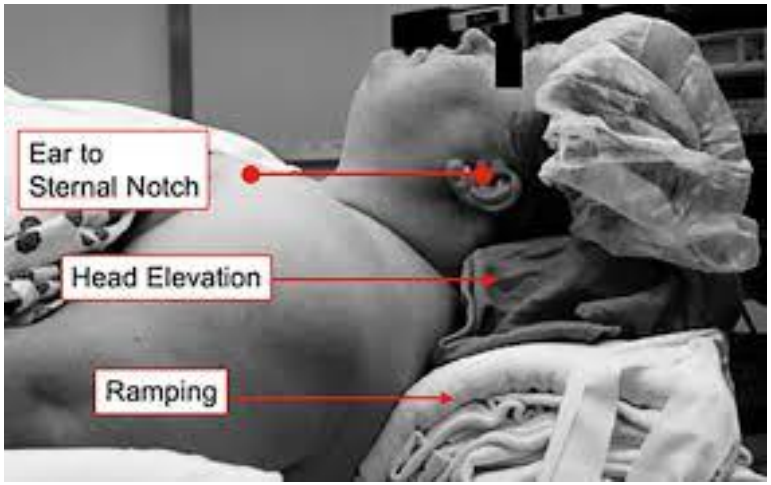
Preoxygenation

2-5 minutes on facial mask

- Positive pressure– CPAP – 8 cm H_2O

FiO2 0.9-1

- Fresh gas 10 l/min

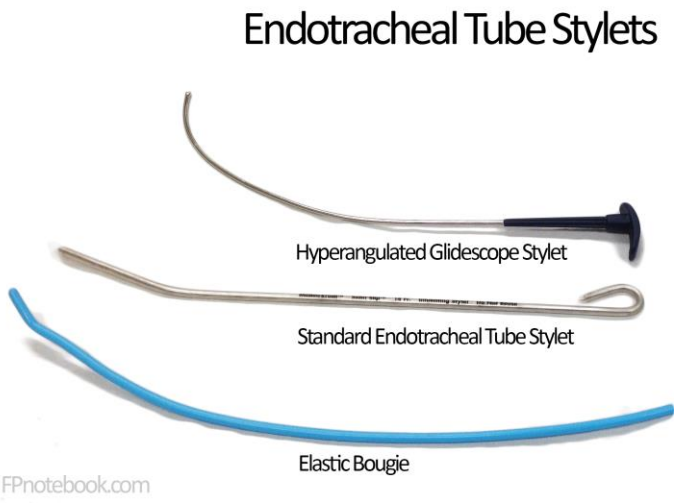


- Increases oxygen reserve
- Decreases severity of desaturation upon induction
- Reduces atelectasis formation

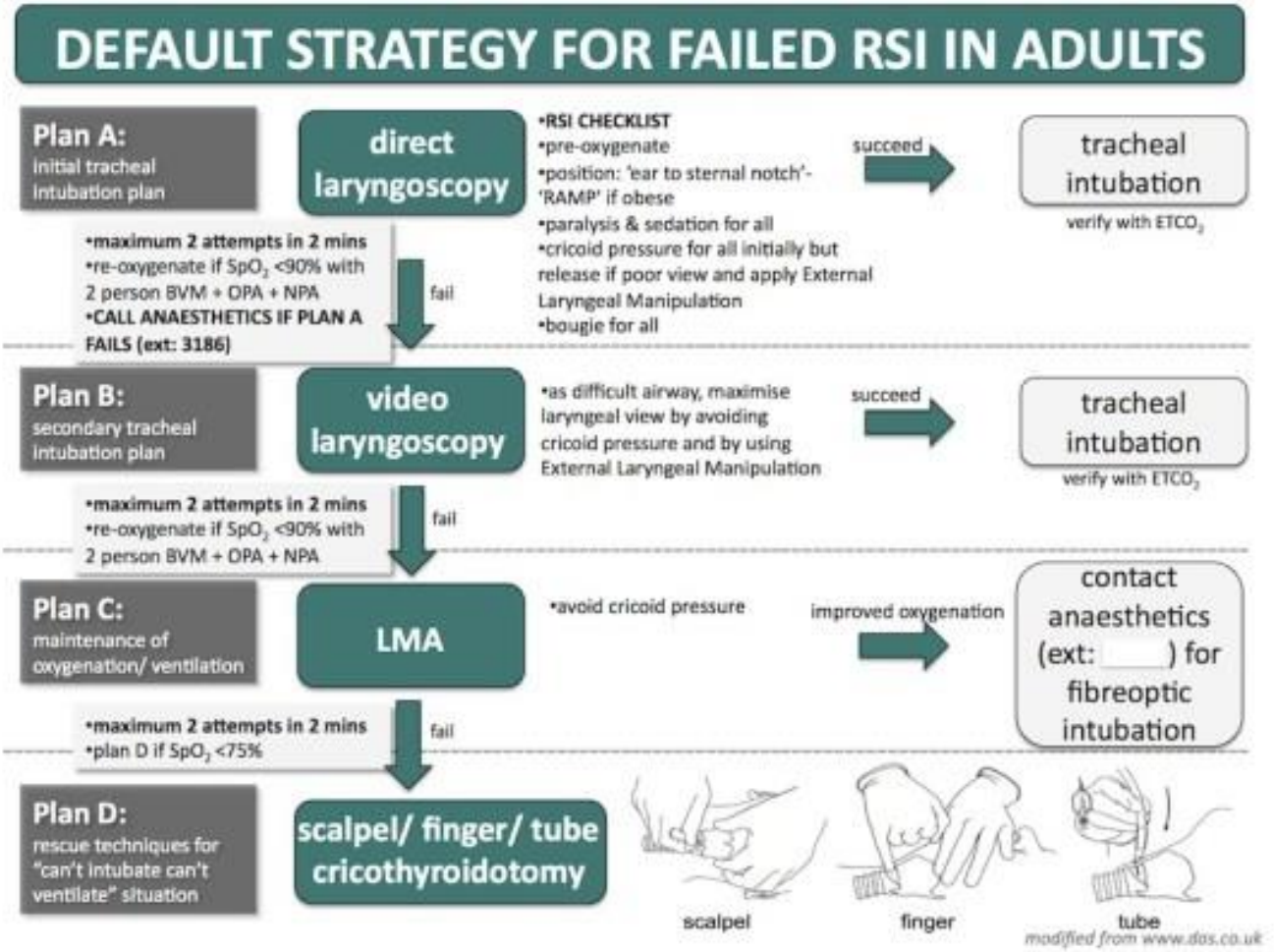
Airway management

Techniques for difficult intubation

- Alternative laryngoscope blades
- Awake intubation - video laryngoscope/fiberoptic scope
- Blind intubation (oral or nasal)
- Fiberoptic intubation
- Intubating stylet (Cook catheter or bougie)
- Invasive airway access



Airway management



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Maintenance of anesthesia

- **Propofol –** TCI
- Isoflurane
- **Sevoflurane**

- **Ketamine**
  - also able to provide sedation and analgesia
  - Limited effects on respiratory function
  - Should be administered with propofol or a benzodiazepine to limit potential emergence phenomena

5. Regional anesthesia in Prader-Willi syndrome

Eliminates perioperative risks of GA

Eliminates the need for GA

Provides

- Intraoperative anesthetic care
- Postoperative analgesia → limiting the need for opioids

Peripheral nerve blockade

Neuraxial techniques (epidural or spinal anesthesia)

5. Regional anesthesia in Prader-Willi syndrome

Landmarks for regional anesthesia may be obscured due to morbid obesity

Use ultrasound to facilitate placement of the block

Sedation needed for

- Facilitating placement of the block
- Limit incidence of complications

Use **routine monitoring**

Be ready to intubate if loss of airway

References

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Thank you!