Europe vs US
Differences, Similarities and Contrasts in managing the difficult pediatric airway

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Differences, Similarities and Contrasts in managing the difficult pediatric airway

I have no COI to disclose

> 50% of perioperative morbidity is related to respiratory adverse events

2.5/1000 in children < 1 year of age: unexpected difficult intubation
Younger children are at higher risk

Airway management complications in children with difficult tracheal intubation from the Pediatric Difficult Intubation (PeDI) registry: a prospective cohort analysis

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Impossible face mask ventilation
- Extremely rare and predicted in 5/6 patients
- Improvement by muscle relaxation 4/6, SAD 2/6
- Tracheal intubation was successful in all cases

I have no COI to disclose
Incidence of difficult tracheal intubation in ICU: 9%.

Risk factors:
- Younger age (median 1 year (0-4) vs. 2 (0-8) years, p = 0.046)
- History of difficult tracheal intubation, particularly if associated to airway obstruction (22 vs. 8%, p<0.001)

Difficult tracheal intubation

SaO₂ < 80% (0 vs. 15%, p=0.006)
Adverse TI associated events (3 vs. 26%, p=0.001)
Severe TI associated events (3 vs. 6%, p=0.001)


Respiratory events are life-threatening complications

5%: bad oxygenation/ventilation

Be prepared = difficult airway cart

Drawer 1: Label: Failed oxygenation
LMA – sizes 1, 1.5, 2, 3, 4, and 5 (in duplicate)
Intubating LMA (ILMA) – sizes 3, 4, and 5
Alternative supraglottic airway devices

Drawer 2: Label: Failed intubation Plan A
- Selection of laryngoscopy blades (McCoy, Wisconsin, Miller), videoscope
- Gum Elastic Bougie (sizes 5F and 10F), malleable stylet (sizes 2F and 5F)
- Choice of visualization or intubation aid (depending on local preference and availability)

Drawer 3: Label: Failed intubation Plan B
- Airway exchange catheters sizes:
  - 7F (ID 2.5 mm), 8F (ID 3.0 mm), 11F (ID 4.0 mm), 14F (ID 5.5 mm), 19F (ID 7.0 mm)
- Endotracheal tubes (VBM sizes 1, 3, and 5)

Drawer 4: Label: Rescue
Cricoidotomy needle kit (Melker) – Label (age >8 years)
Surgical Cricoidotomy kit – Label (age >5 years)
Different-sized cannulas for cannula cricoidotomy, Manujet, and connection tubing
Scalpel (×2), tracheal hook, artery forceps
Surgical gloves

Most children are healthy.
There are also patients with syndromes and genetic disorders:
- Down syndrome,
- Apert syndrome,
- Crouzon…

Be aware of children with co-morbidities:
- Obesity
- CHD, …
Criteria for difficult intubation in children

- Mallampati: low sensitivity and specificity
- Clinical assessment:
  - Neck: flexion-extension
  - Soft tissues, tongue, palate, incisive protrusion
  - Thyromental distance: Child’s three fingers
  - Mouth opening: Child’s three fingers

Consider multiple criteria to enhance the sensitivity and the percentage of false positive.

Similarietrs

Airway management
One size fits all

Preoxygénation ou Denitrogenation?
- Usefulness?
- For how long?
- Time before desaturation?

Expected ?

Unexpected ?

Suspected ?

Adequate ventilation

Adequate oxygenation


Lenght between apnoea and SaO2 of 90% (early) and SaO2 of 40% (late)

<table>
<thead>
<tr>
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<th>PreO2</th>
<th>1 min PreO2</th>
<th>3 min PreO2</th>
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<td>Total</td>
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<td>Obstructed airways</td>
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<td>1.00 1.20</td>
<td>1.20 1.40</td>
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<td>1 year</td>
<td>0.36</td>
<td>1.08 1.18</td>
<td>1.18 1.38</td>
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<td>8 years</td>
<td>0.47</td>
<td>1.24 1.34</td>
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<td>18 years</td>
<td>0.74</td>
<td>1.42 1.62</td>
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Patent airways

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<th>3 min PreO2</th>
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<tr>
<td></td>
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<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td>1 month</td>
<td>0.30 1.00</td>
<td>1.00 1.20</td>
<td>1.20 1.40</td>
</tr>
<tr>
<td>1 year</td>
<td>0.40 1.10</td>
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<tr>
<td>8 years</td>
<td>0.51 1.20</td>
<td>1.20 1.40</td>
<td>1.40 1.60</td>
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<tr>
<td>18 years</td>
<td>0.82</td>
<td>1.54 2.10</td>
<td>2.10 2.70</td>
</tr>
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</table>
**Oxygenation**

**Ventilation**

**Tracheal intubation**

Anatomical Airway Obstructions

Functional Airway Obstructions

Differences?

Separation of the problems

Anatomical Airway Obstructions

Functional Airway Obstructions

- Inadequate anaesthesia
- Laryngospasm
- Muscle rigidity
- Bronchospasm

- Inadequate head position
- Poor facemask technique
- Large adenoids / tonsils / obesity
- Secretions

Repositioning

- Reposition Euro/naso – pharyngeal airway
- Two-hand – jaw thrust / open mouth
- 2 persons ventilation

Deepen anesthesia

- Myorelaxant
- Epinephrine

**CANNOT VENTILATE – CANNOT INTUBATE**

- Adequate level of anaesthesia
- Adequate myorelaxation
- Good position
- Good size laryngoscope
- Good light, Stylet
- Soft pressure on the Larynx

*CANNOT VENTILATE – paralyze!

Even if it was not part of the initial airway management strategy, if CICV occurs and waking the patient up is not an option, a muscle relaxant should be given before determining the need to proceed to a surgical airway.*

**Good conditions**

**DEEPEN ANAESTHESIA**

**PARALYZE**
Myorelaxant for tracheal intubation: is there a debate?

**PRO**

- Sub-optimal intubation conditions
- Important hemodynamic modifications
- Increase laryngeal morbidity

**CON**

- Possible intubation:
  - Propofol-fenta, alfenta, -remifenta
  - Sevoflurane with or without lidocaine
- Decrease risk for allergy
- Lack of residual curarisation
- Important hemodynamic modifications
- Increase respiratory complications
- Increase laryngeal morbidity

(Maciej Ch et al. Paediatr Anaesth. 2004; 14:218)

Why should you question the use of myorelaxant?

Sevoflurane vs Propofol

- Propofol
  - Requires good mouth opening
  - Despite visualization, often difficult to advance and insert tracheal tube
  - No standardization
  - Not enough evidence of their benefit in children

Optical and videolaryngoscope that might help

- Storz straight blade laryngoscopes
- Glidescope
- Seward & Macintosh McCoy levering laryngoscopes
- Ballard™
- Airtraq®

Popularity of Airtraq®, with potentially insertion of a bougie

Walden R et al. Ped Anesth 2009; 19 (S1) 77-87

Can ventilate, cannot intubate

Failed intubation Plan A

- Use improved or visualized intubation technique
- Limit to 3 attempts
- Insert LMA and intubate through the LMA

Control of the ventilation, oxygenation and anaesthesia depth

Fiberoptic Intubation through the LMA: gold standard

Equipment needed: LMA, guidewire, Cook airway exchanger.
Intubation through the LMA

Guidewire technique
An extra long J-tipped guidewire is passed through the suction channel of the bronchoscope than Insert a Cook airway exchanger. Needs minimum 2.8 mm bronchoscope

Two ETT technique
Telescoping of the 2 ETT tubes over bronchoscope than through the LMA Direct vision

Flexible bronchscopy via the facial mask
Could be an alternative if failed to insert a LMA; 2 attempts

Multimodal approach for difficult airways
New Trend
Combination of a videolaryngoscopy + FOB
Facilitate the process of FOB intubation

Cannot ventilate, cannot intubate
Rescue
Maintain 2-hands/2-persons face mask ventilation with naso/oropharynx airway to provide some oxygen to the patient while preparing rescue maneuvers

Rescue airways in children
Cannula cricotomy
Surgical airway
Rigid bronchoscopy
> 8 years of age

Cricotomy
Tracheostomy
All ages
Which is the best rescue technique?

- Urgency of the situation
- Presence of bleeding
- Operator and/or equipment available

Surgical airway: « not so easy »

Be prepared: 6 Rules

Rule 1: Never start a case before doing the Check List
Rule 2: Identify potentially difficult intubation during preoperative assessment
Rule 3: Maintain spontaneous breathing: in case you expect difficult intubation
Rule 4: Do the right things and the things right: do not innovate
Rule 5: Proceed step by step and always rule out anatomical or mechanical obstruction
Rule 6: Adapt the procedures to your environment

Cannula cricotomy

- The Arndt Emergency Cricothyrotomy Set (Cook Critical Care) provides a 3.0-mm ID airway
- The Ventilation-Catheter (VBM): 16 gauge (infant), 14 gauge (child)
- Two lateral eyes at its distal end and a combined Luer-lock and 15 mm connector at its proximal end (allowing either jet or standard bag valve ventilation).
- The Pertach®: a split needle on a syringe puncture
- Portex PediaTrake
- The QuickTrach Emergency Cricothyrotomy Device (Rüsch Inc) 2 sizes: 2 and 4 mm

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