Difficult Pediatric Airway Management: Anesthetic Considerations

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**Learning Objectives**

• At the conclusion of this activity, the participants should be able to:
  1. Describe risk factors for ped difficult airway
  2. Describe the American Society of Anesthesiology Difficult airway algorithm
  3. Describe ventilation techniques
  4. Describe intubation techniques
  5. Describe postoperative concerns
Definition of Difficult Airway

- Difficult mask ventilation
  - Including difficult SGA placement
- Difficult intubation
- Or both
Airway Exam

Difficult Ventilation:
1. Facial hair
2. Small mandible
3. Airway masses (papillomas, tonsils, mediastinal)
4. Nasal encephalocele

Difficult Intubation:
1. Craniofacial anomaly
2. Small mandible
3. Decreased mouth opening
Predictors

Difficult Ventilation
- 484 children
- 0-8 yo
- 6.6% incidence
- Predictors:
  1. Younger age
  2. ENT surgery
  3. Neuromuscular blockade

Valois-Gomez, Peds Anesth 2013;23

Difficult Intubation
- 11,200 patients
- Neonate to adolescent
- 1.35% incidence
- Predictors:
  1. Age < 1 yo
  2. ASA III & IV
  3. MP III & IV
  4. Low BMI

Heinrich, Peds Anesth 2012;22
DIFFICULT AIRWAY ALGORITHM

1. Assess the likelihood and clinical impact of basic management problems:
   - Difficulty with patient cooperation or consent
   - Difficult mask ventilation
   - Difficult supraglottic airway placement
   - Difficult laryngoscopy
   - Difficult intubation
   - Difficult surgical airway access

2. Actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.

3. Consider the relative merits and feasibility of basic management choices:
   - Awake intubation vs. intubation after induction of general anesthesia
   - Non-invasive technique vs. invasive techniques for the initial approach to intubation
   - Video-assisted laryngoscopy as an initial approach to intubation
   - Preservation vs. ablation of spontaneous ventilation

4. Develop primary and alternative strategies:

   **AWAKE INTUBATION**
   - Airway approached by Noninvasive intubation
     - Success
     - Fail
     - Cancel Case
     - Consider feasibility of other options
     - Invasive airway access

   **INTUBATION AFTER INDUCTION OF GENERAL ANESTHESIA**
   - Initial intubation attempts successful
   - Initial intubation attempts UNSUCCESSFUL
     - FROM THIS POINT ONWARDS CONSIDER:
       1. Calling for help
       2. Returning to spontaneous ventilation
       3. Awakening the patient

   **FACE MASK VENTILATION ADEQUATE**
   - Nonemergency pathway
     - Ventilation adequate, intubation unsuccessful
     - Alternative approaches to intubation
     - Successful intubation
     - FAIL after multiple attempts
       - Invasive airway access
       - Consider feasibility of other options
       - Awake patient
     - Emergency invasive airway access

   **FACE MASK VENTILATION NOT ADEQUATE**
   - Consider/attempt SGA
     - SGA ADEQUATE
     - SGA NOT ADEQUATE OR NOT FEASIBLE
     - Emergency pathway
       - Ventilation not adequate, intubation unsuccessful
       - Call for help
       - Emergency noninvasive airway ventilation
       - Successful ventilation
       - FAIL
       - Emergency invasive airway access
1. Assess the likelihood and clinical impact of basic management problems:
   - Difficulty with patient cooperation or consent
   - Difficult mask ventilation
   - Difficult supraglottic airway placement
   - Difficult laryngoscopy
   - Difficult intubation
   - Difficult surgical airway access

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- Airway approached by Noninvasive intubation
  - Initial intubation attempts successful
  - Initial intubation attempts UNSUCCESSFUL
  - FROM THIS POINT ONWARDS CONSIDER:
    1. Calling for help.
    2. Returning to spontaneous ventilation.
    3. Awakening the patient.

  - Invasive Airway Access
    - Succeed
    - Cancel Case

  - Consider feasibility of other options
    - Invasive airway access

**INTUBATION AFTER INDUCTION OF GENERAL ANESTHESIA**
- Initial intubation attempts successful
- Initial intubation Attempts UNSUCCESSFUL

**FACE MASK VENTILATION ADEQUATE**
- NONEMERGENCY PATHWAY
  - Ventilation adequate, intubation unsuccessful
    - Alternative approaches to intubation
      - Successful Intubation
      - FAIL after multiple attempts
        - Invasive airway access
        - Consider feasibility of other options
  - IF BOTH FACE MASK AND SGA VENTILATION BECOME INADEQUATE

**FACE MASK VENTILATION NOT ADEQUATE**
- CONSIDER/ATTEMPT SGA
  - SGA ADEQUATE
  - SGA NOT ADEQUATE OR NOT FEASIBLE
    - EMERGENCY PATHWAY
      - Ventilation not adequate, intubation unsuccessful
        - Call for help
        - Emergency noninvasive airway ventilation
          - Successful ventilation
          - FAIL
            - Emergency invasive airway access

*Confirm ventilation, tracheal intubation, or SGA placement with exhaled CO₂.*
Airway Management

• **Ventilation**

  Maintain spontaneous ventilation
  - Mask ventilation skills
  - Oral pharyngeal airway (OPA)
  - Nasal pharyngeal airway (NPA)
  - Two handed mask ventilation
  - Laryngeal mask airway (LMA)
  - Laryngoscopy
Non-Emergency Pathway

- **Intubation**
  - Laryngoscopy
  - LMA & fiberoptic scope
  - Fiberoptic intubation
  - Glidescope
  - Airtraq
  - Shikani
  - Rigid bronchoscopy (ENT)
Laryngoscopy

- Case series
- 6 infants with PRS
- Conventional laryngoscopy
  - grade 3-4 view
  - Failed intubation
- Paraglossal/bougie
  - Successful intubation 5/6
Laryngoscopy
Fiberoptic Scope
LMA & Fiberoptic Scope

- Case series
- 5 neonates
- 2.8-3.5 kg
- Awake LMA insertion
- FOS through LMA
- GA after ETT
LMA and FOS
<table>
<thead>
<tr>
<th>GVL Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GVL 0</td>
<td>Preterm, &lt;1.5 kg</td>
</tr>
<tr>
<td>GVL 1</td>
<td>Full term, 1.5-3.6 kg</td>
</tr>
<tr>
<td>GVL 2</td>
<td>Toddler, 1.8-11 kg</td>
</tr>
<tr>
<td>GVL 2.5</td>
<td>Sm child, 11-28 kg</td>
</tr>
<tr>
<td>GVL 3</td>
<td>Avg adult, 11kg-adult wgt</td>
</tr>
</tbody>
</table>
- Optical laryngoscope
- 5 mo, 4.8 kg PRS
- Lap nissen
- Miller 1
  - Cormack-Lehane grade 3 view
- Airtraq 0
  - Cormack-Lehane grade 1 view
Airway Management
Shikani Scope

- Case series
- 4 patients
- 19 mo with PRS
- Grade 4 view
- Intubated in 35 seconds with Shikani
4. Develop primary and alternative strategies:

**AWAKE INTUBATION**

- Airway approached by Noninvasive intubation
- Invasive Airway Access\(^{(b)}\)

- Succeed\(^{*}\)
- Fail

- Cancel Case
- Consider feasibility of other options\(^{(a)}\)
- Invasive airway access\(^{(b)}\)

**INTUBATION AFTER INDUCTION OF GENERAL ANESTHESIA**

- Initial intubation attempts successful\(^{*}\)
- Initial intubation Attempts UNSUCCESSFUL

FROM THIS POINT ONWARDS CONSIDER:
1. Calling for help.
2. Returning to spontaneous ventilation.
3. Awakening the patient.

**FACE MASK VENTILATION ADEQUATE**

**NONEMERGENCY PATHWAY**
Ventilation adequate, intubation unsuccessful

- Alternative approaches to intubation\(^{(c)}\)

- Successful Intubation\(^{*}\)
- FAIL after multiple attempts

**FACE MASK VENTILATION NOT ADEQUATE**

**CONSIDER/ATTEMPT SGA**

- SGA ADEQUATE\(^{*}\)
- SGA NOT ADEQUATE OR NOT FEASIBLE

**EMERGENCY PATHWAY**
Ventilation not adequate, intubation unsuccessful

- Call for help
- Emergency noninvasive airway ventilation\(^{(e)}\)

- Successful ventilation\(^{*}\)
- FAIL

**IF BOTH FACE MASK AND SGA VENTILATION BECOME INADEQUATE**

- Invasive airway access\(^{(b)}\)
- Consider feasibility of other options\(^{(a)}\)
- Awaken patient\(^{(d)}\)

Confirm ventilation, tracheal intubation, or SGA placement with exhaled CO\(_2\).
Emergency Pathway

Can’t Intubate, Can’t Ventilate

• Supraglottic (non-invasive)
  – LMA
  – i gel
  – King airway
  – Rigid bronchoscopy

• Subglottic (invasive)
  – Cricothyrotomy, Transtracheal jet ventilation
  – Tracheostomy

Consider ECMO
Cricothyrotomy
• Emergency invasive maneuver of choice
• 12/19 (65%) failed

Pediatric cricothyrotomy
• Difficult in inexperienced hands
• Slow
• Low success rate

Keywords: cricothyrotomy, tracheostomy, transtracheal; emergency airway; airway obstruction; pediatric

Cote, Ped Anesth 2009;19

Cook, BJA 2011;106
Extubation

• Many complications occur at this time
• Proactive planning
• Consider:
  1. Equipment-Endotracheal tube exchange catheter, diff airway cart
  2. Personnel-Anesthesia, ENT
  3. Location-OR vs PICU
  4. Resources-ECMO
Conclusions

• Preoperative recognition
  – Severity of airway obstruction

• Mobilize resources
  – Personnel
  – Equipment
  – Location

• Create extubation plan
Thank You