Things We Put into the Mouth

Part II: The Neonatal Airway
Diane Paratore DO, FACOEP, FACEP, FAAEM; MEd; MBA
Program Director Emergency Medicine
Beaumont-Farmington Hills

Objectives

• *Review Neonatal and Pediatric Airway and their differences from the Adult Airway
• *Review Intubation Techniques
• *Review Difficulties and Pitfalls
• *Examine Syndromes that cause Challenges.
Disclosures

• None

The Airway

- Vallecule
- Epiglottis
- Vocal cords
- Tracheal opening
- Arytenoid cartilages
- Piniform fossa
- Oesophagus
Figure 1. Comparison Of Infant And Adult Airway

From Har vog, et al., Textbook of Pediatric Emergency Procedures

A
CLASS I | CLASS II | CLASS III | CLASS IV

B
GRADE I | GRADE II | GRADE III | GRADE IV


Copyright © The McGraw-Hill Companies, Inc. All rights reserved.
Which Tube?

- traditionally uncuffed until 8 years (cuffed tubes now widely used)
- aim for leak @ 20cmH2O
- <700g, #2
- <1200-1500g, #2.5
- <3kg, #3 – term, #3.5 – 6-12 months #4 – 1-2 years #4.5 – >2 years (age/4) + 4
- length @ lips = age/2 + 12
- length @ nose = age/2 + 15
- confirm clinically

The correct endotracheal tube (ETT) size and length of insertion (tip to lip distance) can be estimated from the infant's weight

<table>
<thead>
<tr>
<th>Weight</th>
<th>ETT</th>
<th>Depth of Insertion (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kg</td>
<td>2.5</td>
<td>7</td>
</tr>
<tr>
<td>2 kg</td>
<td>3.0</td>
<td>8</td>
</tr>
<tr>
<td>3 kg</td>
<td>3.5</td>
<td>9</td>
</tr>
<tr>
<td>4 kg</td>
<td>4.0</td>
<td>Add 1 cm for each additional kg of body weight.</td>
</tr>
</tbody>
</table>

Insertion Depth (cm) = 6 + wt (kg)
Pediatric Endotracheal Tube Depth

Depth = ETT size x 3

<table>
<thead>
<tr>
<th>Pediatric Laryngoscope Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Premie/Newborn</td>
</tr>
<tr>
<td>1 month – 2 years</td>
</tr>
<tr>
<td>3 – 6 years</td>
</tr>
<tr>
<td>6 – 12 years</td>
</tr>
<tr>
<td>&gt; 12 years</td>
</tr>
</tbody>
</table>

Positioning Infants and Children for Airway Management

A. CRITERIA:
   1. ALIGN THE GLABELLA HORIZONTALLY WITH THE CHIN
   2. OPEN THE ANTERIOR NECK SPACE
   3. ALIGN THE EXTERNAL AUDITORY MEATUS (EAM) HORIZONTALLY WITH THE SUPRASTERNAL NOTCH (SN)

B. STEPS: (assess criteria after each step. Move to next step if criteria are not met)
   I. NEONATES, INFANTS AND TODDLERS
      STEP 1: SIMPLY EXTEND THE NECK WITH THE CHILD ON A FLAT SURFACE. (NO SHOULDER ROLL OR HEADREST)
      CHECK AND SEE IF ALL CRITERIA ARE MET (SOMETIMES THIS IS ALL THAT IS REQUIRED)
      STEP 2: PLACE A SHOULDER ROLL, THEN CHECK IF CRITERIA ARE MET
      STEP 3: ADD A HEADREST – ADJUST HEADREST – SHOULDER ROLL COMBINATION UNTIL CRITERIA ARE BEST MET
   II. OLDER CHILDREN
      STEP 1: ADD A HEADREST AND CHECK IF CRITERIA ARE MET
      STEP 2: ADD A SHOULDER ROLL IF NEEDED TO BRING PLANES IN THE BEST POSSIBLE ALIGNMENT. (SIMILAR TO RAMP USED FOR PATIENTS WITH MORE OBESITY)
Preparation: Pretreatment

Drugs to mitigate adverse effects of intubation

- Lidocaine (reactive airways or elevated ICP)
- Opioids (blunts sympathetic response and increased BP)
- Atropine (bradycardia – mainly kids)
- E fasciculating Agents (low dose competitive neuromuscular blocker in elevated ICP)
LMA

- #1 < 6.5kg
- #2 < 20kg
- #3 < 30kg
- #4 > 30kg
- \( \text{air} = (\text{size} - 1) \times 10\text{mL} \)
FASTrach *Intubation Laryngeal Mask*

Newest FASTrach
### Table 2: Overview of VL devices with pediatric sizes available

<table>
<thead>
<tr>
<th>Device</th>
<th>Design</th>
<th>Blade Style</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>GlideScope</td>
<td>Hyper-angled blade ideal for anterior airways</td>
<td>Reusable or disposable plastic covers.</td>
<td></td>
</tr>
<tr>
<td>C-MAC PB</td>
<td>Miller and Macintosh blades, Macintosh-style angle curvature</td>
<td>Reusable or disposable plastic covers.</td>
<td></td>
</tr>
<tr>
<td>Macintosh MAC 8MM</td>
<td>Macintosh-style angle curvature</td>
<td>Reusable or disposable plastic covers.</td>
<td></td>
</tr>
<tr>
<td>Rusch Airtraq SP</td>
<td>Macintosh-style angle curvature, Single-use channel loading device.</td>
<td>Pediatric sizes 2 blade available with noocone size 3 coming soon.</td>
<td></td>
</tr>
<tr>
<td>VeloTrac</td>
<td>Macintosh-style angle curvature, Single-use channel loading device.</td>
<td>Macintosh-style angle curvature, Single-use channelled and traditional blades available.</td>
<td></td>
</tr>
<tr>
<td>KingVision</td>
<td>Macintosh-style angle curvature, Single-use channel loading device.</td>
<td>Macintosh-style angle curvature, Single-use channelled and traditional blades available.</td>
<td></td>
</tr>
</tbody>
</table>

**Image:**

Down the Right Mainstem Bronchus

[Image of a chest X-ray]
Too High Above the Carina

Just Right
Mechanical Ventilation

• use children's ventilator in kids <20kg
• pressure controlled ventilation reduces risk of barotraumas (this mode compensates for leak around ETT)
• volume controlled ventilation allow monitoring of lung compliance
• Pimp 16-20cmH2O, RR 16-24, PEEP 4
• hand ventilation with Ayre's T-piece can be very helpful in certain circumstances (reduction of gastroscisis or exomphalos or tracheoesophageal fistula repair)

Congenital Abnormities

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Airway Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pierre Robin sequence</td>
<td>Micrognathia, glossopatia, cleft palate</td>
</tr>
<tr>
<td>Goldenhar syndrome</td>
<td>Micrognathia (unilateral), cervical dysplasia</td>
</tr>
<tr>
<td>Treacher Collins syndrome</td>
<td>Micrognathia, small oral opening, zygomatic hypoplasia</td>
</tr>
<tr>
<td>Apert syndrome</td>
<td>Limited cervical motion, macrognathia, micrognathia, maxilla hypoplasia</td>
</tr>
<tr>
<td>Hunter and Hurler syndrome</td>
<td>Cervical dysplasia, macrognathia</td>
</tr>
<tr>
<td>Beckwith-Wiedemann syndrome</td>
<td></td>
</tr>
<tr>
<td>Freeman-Sheldon syndrome</td>
<td></td>
</tr>
<tr>
<td>Down syndrome</td>
<td></td>
</tr>
<tr>
<td>Klippel-Feil syndrome</td>
<td>Circumoral fibrosis, microstomia, limit cervical motion</td>
</tr>
<tr>
<td>Hallerman-Strait syndrome</td>
<td>Atlantoaxial abnormalities, small oral cavity, macrognathia</td>
</tr>
<tr>
<td>Anthroglossous</td>
<td>Cervical fusion</td>
</tr>
<tr>
<td>Oculo-oral syndrome</td>
<td>Micrognathia</td>
</tr>
<tr>
<td>Edwards syndrome</td>
<td>Micrognathia, laryngomalacia</td>
</tr>
<tr>
<td>Fibrous dysplasia osteofibros progressive</td>
<td>Limited cervical motion</td>
</tr>
</tbody>
</table>
Pierre Robin Syndrome

- Cleft palate
- Retrognathia
- Macroglossia and antiloglossia uncommon
- Glossoptosis
- Micrognathia
Apert Syndrome
Edwards Syndrome

Edwards Syndrome (Trisomy 18)

- Kidney, Heart, CNS malformations
- Many die in utero
- Half of those born don’t survive past 1st week.
- Can be diagnosed in utero via ultrasound and maternal serum markers like α-fetoprotein.
References

- Slide Share: Pediatric Anaesthesia and My Experiences at DSH by Captain Shoaib Bin Kashem trainee Anesthesiology
- Technique for insertion of an endotracheal (ET) tube
  Iowa Neonatology Fellows
  Revised: John Dagle MD, PhD
  Peer Review Status: Internally Peer Reviewed
- Paediatric Anaesthetic Equipment
  by Dr. Chris Nickson, last update March 22, 2019
- Government of Western Australia
  - Department of Health
  - Child and Adolescent Health Services
Guidelines for the management of difficult mask ventilation in children aged 1-8 years, published by DAS (Difficult Airway Society) at http://www.das.uk.com/guidelines...

Beyond the Basics: Pediatric Assessment
05/01/2006
Issue: May 2006
Facebook Twitter LinkedIn Email Print

Netter Drawings
Quizlet

doi: 10.4103/2229-5151.128015
PMCID: PMC3982373
PMID: 24741500
Pediatric airway management
Jeff Harless, Ramesh Ramaiah, and Sanjay M Bhananker
Jeff Harless
Department of Anesthesiology and Pain Medicine, University of Washington School of Medicine, Seattle, Washington, USA
Find articles by Jeff Harless
Ramesh Ramaiah
Department of Anesthesiology and Pain Medicine, University of Washington School of Medicine, Seattle, Washington, USA
Find articles by Ramesh Ramaiah
Sanjay M Bhananker
Department of Anesthesiology and Pain Medicine, University of Washington School of Medicine, Seattle, Washington, USA
Find articles by Sanjay M Bhananker
Author information Copyright and License information
Disclaimer
Endotracheal Intubation in Children: Practice Recommendations, Insights, and Future Directions
By Maribel Ibarra-Sarlat, Eduardo Terrones-Vargas, Lizett Romero-Espinoza, Graciela Castañeda-Mucino, Alejandro Herrera-Ladero and Juan Carlos Núñez-Enríquez
Submitted: March 6th 2017Reviewed: July 11th 2017Published: December 20th 2017
DOI: 10.5772/intechopen.70356

Mass Casualty Incident pemplaybook.libsyn.com
https://www.google.com/url?q=https%3A%2F%2Fpemplaybook.libsyn.com%2Frss&sa=i&ved=0ahUKEwiXk5eY1vPIAhUJpFkKHazBhMQMwthRKAAwAA&usg=AOvVaw2usLgSWVdJ27xCHOQtp3cT&ust=1560969371437953&ictx=3

Comparison of Endotracheal Intubation Through I-gel and Intubating Laryngeal Mask Airway
Bharat Choudhary, Rakesh Karnawat, Sadik Mohammed, Monika Gupta, Bharath Srinivasan and Rakesh Kumar
Dr. S. N. Medical College, Jodhpur, India
Received: February 11, 2016 Revised: June 24, 2016 Accepted: June 24, 2016

Endotracheal Intubation in the ICU David Oxman, MD July 12, 2013
JEMS: An Overview of EMS Pediatric Airway Management
Wed, Mar 1, 2017
By Dorothy A. Habrat, DO, Daniel R. Shocket, MD, MPH, Darren Braude, MD, EMT-P

Elemental EM: Pediatric Intubation
Jun 29th, 2017
Courtney Cassella
categories: Elemental EM
This week's Elemental EM discusses how to get more mental pediatric intubation practice.
Author: Courtney Cassella, MD (@Corablacas, EM Resident Physician, Icahn SoM at Mount Sinai) //
Edited by: Alex Koyfman, MD (@EMHighAK, EM Attending Physician, UT Southwestern Medical Center / Parkland Memorial Hospital) and Brit Long, MD (@long_brit, EM Attending Physician, SAUSHEC, USAF)

Paediatric Airway Anatomy
by Steven McVea