Cuffed vs. Uncuffed ETT

Patrick Ross, MD
The view you see
Depends on where you stand
Landmark Description of the Pediatric Airway

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SOME ANATOMIC CONSIDERATIONS OF THE INFANT LARYNX INFLUENCING ENDOTRACHEAL ANESTHESIA

JAMES E. ECKENHOFF, M.D.

Philadelphia, Pennsylvania

Received for publication October 10, 1950
Landmark Description of the Pediatric Airway

- The infant larynx is more cephalad
- The epiglottis is longer, stiff, U shaped
- The cricoid ring is the narrowest portion of the airway
- “A tube that cannot be advanced through the cricoid ring should not be left in situ but should be replaced with a smaller tube or the anesthesia completed without an endotracheal tube”
The History

- Initially there was no cuff and red rubber tubes caused mucosal irritation
- The first cuffs were high pressure
- High-compliance low pressure cuffs were developed in the 1970’s
- Size appropriate tubes are available from many manufacturers
- 2nd generation cuffed tubes with softer polyurethane are now available
Possible Advantages with CTT

- Fewer DLs due to sizing issues
- Less pollution with anesthetic gas
- Decreased gas use
- Decreased risk of aspiration
- Able to precisely control ventilation
- Able to guarantee PEEP
- Monitoring of respiratory function
- Able to adjust for change in compliance (burns)
A few arguments against cuffed tubes

- The presence of a leak ensures the tube is not compressing the tracheal mucosa against the nondistensible cricoid ring
- Extra care required for correct placement
- Cuffs cause trauma to the trachea
- Cuff pressure must be monitored
- Using a smaller tube limits the ability to suction or ventilate
What’s the Research


What’s the Research

  - Prospective randomized controlled multi-centre trial of cuffed or encuffed endotracheal tubes in small children
  - December 2009
Deakers TW et al. 1994

- Prospective, 243 Pts, 282 intubations
- Outcomes: Stridor, reintubation
- Pt with cuffed tubes older 8 vs. 2.5 yr
- Pt with cuff intubated longer 6.1 vs. 3.7d
- Incidence of stridor 14.9%
  - No difference between groups
- 2 cuffed and 4 uncuffed reintubated
  - No Difference between groups
Khine HH et al. 1997

- Prospective, 488 Pts, randomized
- Outcomes: Tube changes, Gas Flow, Nitrous Oxide contamination, # Tx for croup Sx
- Duration of intubation 1 hour
<table>
<thead>
<tr>
<th></th>
<th>Cuffed</th>
<th>Uncuffed</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td># Tube Change</td>
<td>3 (1.2%)</td>
<td>54 (23%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td># &gt; 2 lpm gas</td>
<td>3 (1.2%)</td>
<td>26 (11%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td># Tx croup</td>
<td>3 (1.2%)</td>
<td>3 (1.3%)</td>
<td>&gt;0.5</td>
</tr>
<tr>
<td># Admit croup</td>
<td>1 (0.4%)</td>
<td>1 (0.4%)</td>
<td>&gt;0.5</td>
</tr>
</tbody>
</table>
Khine HH et al. Outcome

<table>
<thead>
<tr>
<th>Nitrous Oxide Concentration (ppm)</th>
<th>&lt;10</th>
<th>11-25</th>
<th>26-299</th>
<th>&gt;300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncuffed ETT</td>
<td>19</td>
<td>6</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Cuffed ETT</td>
<td>39</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Khine Formula for cuffed ETT

- Cuffed tube size (mm ID) = (age/4) + 3
- Other formulas available but may not be better
- Should have leak with cuff down
Newth CJL et al. 2004

- Prospective, 860 Pts
- 597 Pts < 5 yrs, 210 cuff ed ETT
- Outcomes: Extubation success, racemic epi use, need for tracheostomy
- Pts under 2 years with cuff tube were intubated longer and had higher PRISM score
- No difference cuff vs. uncuffed for extubation success, # racemic Tx, # trached
Salgo B et al. 2006

- Evaluating new Microcuff cuffed ETT and ETT size selection
- 350 patients birth to 5 years
- Incidence of stridor 2.3%
- Treated for stridor 0.9%
Weiss M. et al 2009

- Multi-center, randomized, age 0 to 5 yr
- 1119 Microcuff PET cuffed
- 1127 uncuffed
- Max cuff pressure limited at 20 cm H2O
- Post-extubation stridor 4.4% cuffed and 4.7% uncuffed (p=0.54)
- Exchange rate 2.1% cuffed and 30.8% uncuffed (p<0.0001)
Cuffed tubes can be used with similar risk of post-op stridor

Limitations
- Only one brand of cuffed tube used
- Short length of intubation relative to ICU
- Outcome is stridor not injury
List of Editorials, Pro/Con Debates, Measurement and Case studies


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- Ashtekar CS et al. Do cuffed endotracheal tubes increase the risk of airway mucosal injury and post-extubation stridor in children? Archives of Disease in Childhood. 2005
List of Editorials, Pro/Con Debates, Measurement and Case studies

- Bernet V et al. Outer diameter and shape of paediatric tracheal tube cuffs at higher inflation pressures. Anaesthesia. 2005
- Fine G et al. The future of the cuffed endotracheal tube. Paediatric Anaesthesia. 2004
- Bell C. Endotracheal tube cuff pressure is unpredictable in children. Survey of Anesthesiology. 2004
- Dillier CM et al. Laryngeal damage due to an unexpectedly large and inappropriately designed cuffed pediatric tracheal tube in a 13-month-old child. Canadian Journal of Anaesthesia. 2004
List of Editorials, Pro/Con Debates, Measurement and Case studies


- Mhanna MJ et al. The “air leak” test around the endotracheal tube, as a predictor of postextubation stridor, is age dependent in children. Critical Care Medicine. 2002

- Ho A et al. The margin of safety associated with the use of cuffed paediatric tracheal tubes. Anaesthesia. 2002

- Orliaguet GA et al. Postal survey of cuffed or uncuffed tracheal tubes used for paediatric tracheal intubation. Paediatric Anaesthesia. 2001


Textbook recommendations

- 5th 2000
  - Uncuffed < 10 years
- 6th 2005
  - Uncuffed < 6 years
- 7th 2009
  - Cuffed OK even in infants
Textbook recommendations

- 3rd 2001
  - Uncuffed < 8 years

- 4th 2009
  - Traditional teaching...Uncuffed < 8 years
  - Recent data ...
Textbook recommendations

- 6th 1996
  - Uncuffed < 8 years

- 7th 2006
  - Uncuffed tubes may be OK
Textbook recommendations

- 3rd 1996
  - Uncuffed < 8 years

- 4th 2008
  - No mention in text
  - Charts indicate cuffed OK down to 2 years
Textbook recommendations

- 5th 2002
  - Uncuffed < 6 – 8 yrs
- 6th 2006
  - Uncuffed < 6 – 8 yrs
- 7th 2010
  - Recent evidence ... safe for all ages
Excellent Insight

- As far back as the 3rd Edition in 1994 the use of cuffed tubes is considered.
- Chapter by Dennis Fisher, MD
“Until recently I routinely used uncuffed ETTs for all patients less than 6 years of age. However, in many instances I found myself replacing tubes that leaked at low pressure. . . I now frequently insert a cuffed endotracheal tube, and measure the leak with the cuff deflated. If the leak pressure is appropriate I leave the tube in place and check periodically that the cuff has not inflated during administration of nitrous oxide.” Dennis Fisher MD
Where do we stand now?
The use of cuffed ETTs in young children increases the responsibility of the whole team.

Meticulous care with size, tube position, stabilization, sedation

Cuff pressure should be monitored
In the OR

- Cuffed tubes will reduce the number of reintubations and contamination from anesthetic gases
- Incidence of post-extubation stridor should not be greater with appropriate sized tubes
- May still consider uncuffed tubes in infants
Where I Stand

- I have been encouraged to take a stand
- If they are coming to the ICU, if they may be difficult to ventilate, if I only want to intubate once, I use a cuffed tube
- For short cases in infants I still use uncuffed tubes
Thanks