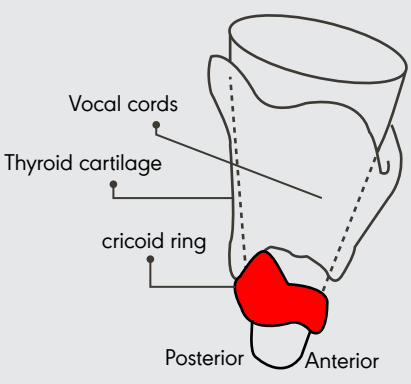
AVANOS

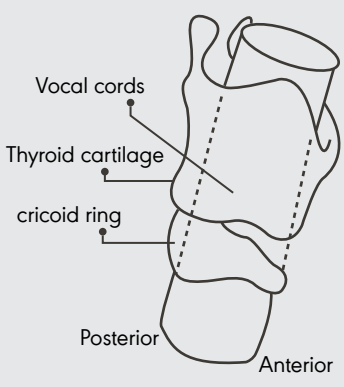
PEDIATRIC ENDOTRACHEAL TUBE DESIGN: A CRITICAL ISSUE FOR PEDIATRIC AIRWAY MANAGEMENT

Pediatric airway differs from that of an adult.[1]

- Funnel-shaped in children vs. cylindrical in adults[1]
- Infant cricoid cartilage ring is:[1]
  - Non-distensible
  - Narrowest point of the airway
  - Elliptical–difficult for the endotracheal tube to pass through the cricoid ring



Pediatric airway



Adult airway

Traditionally, uncuffed tracheal tubes were used in children below the age of 8 years. [2]

RISKS OF USING UNCUFFED TUBES AND POORLY DESIGNED CUFFED TUBES

WITH UNCUFFED ENDOTRACHEAL TUBES

Insertion of a round uncuffed tracheal tube into the non-circular cricoid lumen to seal the airway may exert pressure on the cricoid mucosal walls, cause damage and post-extubation respiratory complications.[2,3]

Airway injury[4]

- Risk of post-extubation damage due to **oversized tubes**[4]
- Excessive air leakage due to **undersized tubes**[4]

Tracheal tube exchanges[5]

- Higher tube exchange rate (30.8% for uncuffed vs. 2.1% for cuffed) to achieve the right size[5]

Gas leak size changes lead to:[6]

- Significant **changes in delivered tidal volumes or airway pressure and calculated compliance**
- **Environmental pollution** in operating environment
- Difficulty in utilizing low flow techniques in anesthesia
- Aspiration risk

WITH POORLY DESIGNED CUFFED ENDOTRACHEAL TUBES

Potential airway injury[2,5,7]

- Cuff hyperinflation[7]
- Wrongly positioned or missing depth marks[2,5]
- Presence of cuff in subglottic space[7]

Microaspiration[8]

- Thickness of PVC cuffs (up to 80 µm) leads to channel formation, causing air and fluid leakage[2]

For a better design of the cuffed tubes, a short high volume, low pressure cuff, cuff-free subglottic space and adequately placed depth markings are required.[7]

DID YOU KNOW

The American Heart Association (AHA) 2005 guidelines recommends the use of cuffed endotracheal tubes in infants (except newborns) and children in in-hospital settings at a cuff inflation pressure of <20 cmH_2O.[9]

The International Liaison Committee on Resuscitation (ILCOR) guidelines recommend that cuffed endotracheal tubes can be used in infants and children at a correct tube size and cuff inflation pressure.[10]

OUR SOLUTION

Avanos Pediatric MICROCUFF* has **distinct features** which makes it ideal for Pediatric anatomy

MATERIAL AND SHAPE

A short, cylindrical polyurethane (PU) cuff (10 µ), stronger than PVC (50–80 µ)—compensates for different airway sizes and shapes

DEPTH MARKINGS

Four precision bars to facilitate and confirm optimal tube placement

Benefits of Avanos Pediatric MICROCUFF*

- Reduced
  - Risk of using oversized uncuffed tubes
  - Re-intubation due to ill-fitting or undersized tubes
  - Risk to tissues due to short, cylindrical cuff shape—maximizes the cuff-free subglottic zone
  - Risk of aspiration
- Less gas leak around the tube
- Gases not wasted, resulting in cost savings
- Staff and anaesthesiologist protected from accidental inhalation
- Lower flow rates of anaesthesia
- Improved efficacy of ventilation
- Reliable end-tidal CO_2 and anaesthesia gas monitoring
- Diminished risk to mucosal tissue due to sealing below the commonly presumed capillary perfusion pressure in pediatric patients

References: 1. Harless J, Ramaiah R, Bhananker SM. Pediatric airway management. Int J Crit Illn Inj Sci. 2014; 4(1):65–70. 2. Weiss M, Dullenkopf A. Cuffed tracheal tubes in children: past, present and future. Expert review of medical devices. 2007; 4(1):73-82. 3. Wani TM, Bissonnette B, Rafiq M, Moore-Clingenpeel M, Al Sohaibani M, Tobias JD. Cricoid ring: Shape, size, and variability in infants and children. Saudi J Anaesth. 2017; 11(2):203. 4. Bailey CR. Time to stop using uncuffed tracheal tubes in children? Anaesthesia. 2018; 73(2):147-50. 5. Weiss M, Dullenkopf A, Fischer JE, Keller C, Gerber AC, European Paediatric Endotracheal Intubation Study Group. Prospective randomized controlled multi-centre trial of cuffed or uncuffed endotracheal tubes in small children. Br J Anaesth. 2009; 103(6):867-73. 6. James I. Cuffed tubes in children. Pediatric Anesthesia. 2001; 11(3):259-63. 7. Weiss M, Dullenkopf A, Gysin C, Dillier CM, Gerber AC. Shortcomings of cuffed paediatric tracheal tubes. Br J Anaesth. 2004; 92(1):78-88. 8. Haas CF, Eakin RM, Konkle MA, Blank R. Endotracheal Tubes: Old and New Discussion. Respiratory care. 2014; 59(6):933-55. 9. American Heart Association. 2005 American Heart Association (AHA) guidelines for cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) of pediatric and neonatal patients: pediatric advanced life support. Pediatrics. 2006; 117(5):e1005-28. 10. International Liaison Committee on Resuscitation. The International Liaison Committee on Resuscitation (ILCOR) consensus on science with treatment recommendations for pediatric and neonatal patients: pediatric basic and advanced life support. Pediatrics. 2006; 117(5):e955-77.