CUFFED ENDOTRACHEAL TUBES IN INFANTS

Keyword:	Anesthesia Equipment: Cuffed ETTs
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Question

A two month old male with no past medical history presents for unilateral cleft lip and alveolus repair. Which of the following has the **HIGHEST** endotracheal tube exchange rate following initial placement?

A. Traditional cuffed ETT
B. Microcuff ETT
C. Uncuffed ETT
D. Oral RAE cuffed ETT

Key Points

- The cuff of the endotracheal tube (ETT) permits inflation to target leak pressure, thus achieving an optimal seal with fewer intubation attempts.
- An uncuffed ETT allows for a larger internal diameter (ID) tube to be placed.
- When compared with an uncuffed ETT, an appropriately placed cuffed ETT does not increase the risk of either post extubation stridor or subglottic stenosis.

Considerations for Selection and Placement of Endotracheal Tubes in Infants

ETT Size: Appropriate ETT size and positioning are critical for adequate ventilation and reducing injury to laryngeal structures. The formulas can approximate ETT size in infants to children < 8 years:[1]

- Cuffed ETT ID (mm)= age (yr)/ 4 + 3.5
- Uncuffed ETT ID (mm)= age (yr)/ 4 + 4.

Airway Pressure: After confirmed ETT placement, the presence of an air leak at a pressure of 15-20 cm H_2O should be established. ETT exchange should occur if the air leak is <15 cm H_2O without adequate ventilation or if the cuff leak is in excess of 20 cm H_2O. The absence of leak >20 cm H_2O increases the risk of mucosal ischemia.

Cuffed vs Uncuffed ETT:

	Uncuffed ETT	Cuffed ETT
Pros	• Decreases work of breathing • Lowers airway resistance • Improves ability to suction • Lower cost	• Reduces multiple intubation attempts • Reduces OR pollution • Allows use of lower fresh and anesthetic gas flows • Reduces the risk of aspiration and pneumonia

Table 1. Advantages of uncuffed and cuffed ETT.

Radiographic studies suggest the cricoid ring is an elliptical structure most narrow in the transverse dimension.[2] An uncuffed ETT seals at the cricoid ring, which implies an air leak at 20 cm H_2O may exert a higher pressure on the lateral mucosa.

A cuffed ETT may be gradually inflated below the cricoid ring until air leak ceases at target pressure, thus increasing the likelihood of achieving an adequate seal on first intubation attempt.[1] Cuff pressures should be monitored periodically if nitrous oxide is used.

Microcuff ETTs

The unique design features of one particular cuffed ETT deserve discussion. Traditional cuffed ETTs have significant variation between manufacturers with regards to cuff shape, polyvinyl chloride cuff thickness, depth marker location, and tube external diameter.[1]

The microcuff ETT incorporates features tailored for pediatric airways, especially in neonates >3 kg and infants.[2] The ultrathin polyurethane cuff is 10 microns thick and minimizes the formation of longitudinal cuff folds that may contribute to air leaks and mucosal pressure points. The absence of the Murphy eye and a cuff near the ETT orifice allows for optimal tube depth placement where the cuff is both inferior to non-distensible cricoid ring and superior to the carina as to avoid main bronchus intubation. Clear markings on the Microcuff ETT further facilitate correct intubation depth.

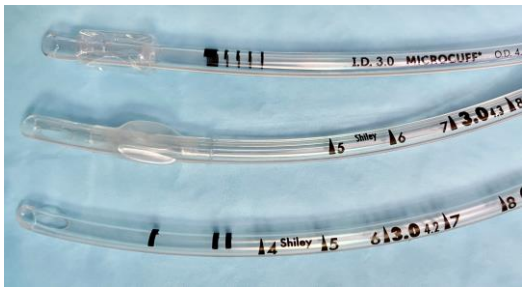

Figure 1. Microcuff, cuffed and uncuffed 3.0 mm ID ETTs.

Post Extubation Complications: Stridor, Stenosis, and Reintubation

Airway injury can occur with any intubation attempt regardless of which ETT is used. The incidence of injury increases with multiple intubation attempts, inappropriate ETT size or depth, leak pressure >20 cm H_2O, and prolonged intubation.[1] Airway instrumentation can cause subglottic edema and inflammation resulting in post-extubation stridor (PES), which may lead to extubation failure requiring reintubation. Acquired subglottic stenosis (SS) is caused by ischemic injury and eventual scarring and narrowing of the larynx below the vocal cords.

A meta-analysis did not show a difference in SS or PES between traditional cuffed ETT and uncuffed ETT in neonates to 8 years of age.[2,3,4] Furthermore, the tracheal tube exchange rate to find appropriately sized ETT was significantly lower in patients who received cuffed ETT, due to the ability to select a smaller diameter tube and then inflate the cuff against the mucosal wall.[4] The findings were similar in both operating rooms and intensive care units.[3] The same conclusions were drawn in a study comparing Microcuff ETT and uncuffed ETT.[2] Thus, cuffed ETT placement represents the standard of care for management of the infant airway when appropriately sized ETTs are selected and cuffed pressures of <20 mmHg are maintained.

References

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Answer: C. Uncuffed ETTs have higher reintubation rates compared to cuffed ETTs (approximately 30% in the uncuffed group versus 2% in the cuffed group).[2,4]

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