

consequent laryngotracheal mucosal microtrauma. On the contrary, the cuffed tubes can better adapt, thanks to the latest generation in cuff design, the ellipsoidal geometry airway and, contrary to what history has always claimed, they represent a considerable advantage in terms of efficacy and safety in pediatric patients as compared with the uncuffed tubes.

However, another important aspect should be taken into consideration regarding the variability of the geometry and morphology of the airways that is observed in neonates affected with a congenital disorder or after some operations where the geometric relationship between the endotracheal tube and airway may change dramatically, accentuating the problems described using uncuffed tubes. In his study, Fayoux⁴ reported postnatal tracheal changes after *in utero* fetoscopic balloon tracheal occlusion in seven consecutive newborn infants with severe congenital diaphragmatic hernia. On careful examination of the bronchoscopic images reported by Fayoux in his article, a significant change is observed in the tracheal diameter indicating a more evident tendency to collapse during the expiratory phase, followed by a progressive dilatation of the trachea during the inspiratory phase, and a greater expansion of the upper part of the trachea compared with the lower similar to tracheomalacia. The geometric appearance taken, which one can observe, is exactly that of an ellipsoid. In this circumstance, or in clinical circumstances similar to the one just described, in a newborn inadequately adapted to the mechanical ventilator, the tracheal mucosa would produce repeated movements toward and away from the surface of a tube not fitted with a cuff causing micro-lesions in the mucosa and, moreover, no guarantee of an adequate seal for gas exchange. Even in these cases, the uncuffed tubes may not represent an advantage for children. Another disadvantage of uncuffed tracheal tubes is related to the geometric variation of the airways in relation to the progressive deepening of anesthesia over the course of its entire duration. In the initial stages of anesthesia, the tracheal tube may be adequate in size and seal without gas leakage. In the later stages, as a result of the deepening of the neuromuscular block and the incremental administration of anesthetic drugs and associated movements of the head and neck, the airway caliber is modified, and the presence of uncuffed tubes does not guarantee an adequate seal of the gas with consequent losses from the breathing circuit, inadequate ETCO_2 and capnography readings, and lung hypoventilation. With the cuffed tubes, this problem does not exist because the cuff ensures a greater seal and immobilization of the tube also with respect to the movements of the neck even when using tubes of underestimated size. In conclusion, we cannot fail to agree on the safety of using cuffed tubes in children. But at the same time, we should not underestimate the variations and changes in the geometry and anatomy of the airways, particularly in newborns, at various stages of pediatric development and in some comorbidities. Regarding technological

innovations and new ideas for study, the analysis of the relationship between the cuffed/uncuffed tracheal tubes and laryngotracheal morphology with ultrasound-guided technique can be, in our opinion, a valuable additional tool for noninvasive real-time investigation especially in cases in which it is necessary to monitor the consequences of prolonged intubation.⁵

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In Reply:

We thank Galante and Caruselli for their comments concerning our editorial¹ on the disadvantages of continuing to use uncuffed endotracheal tubes in the pediatric population. In addition to the reasons we discussed, Galante and Caruselli provide insights into the unique anatomical aspects of the pediatric trachea and thus, provide additional reasons to support the abandonment of uncuffed endotracheal tubes in pediatric patients. They also point out that the shape of the trachea may change during the course of a general anesthetic, and this change can only worsen the effects of an uncuffed endotracheal tube on the surface of the tracheal mucosa. However, we believe that the most important clinical consequences of the consistent use of cuffed endotracheal tubes will be evident in chronically intubated newborns, who seem to bear the brunt of ventilation-associated tracheal damage. An additional consideration for the smallest infants, who comprise the most likely population to require prolonged intubation, is the lack of availability of a size 2.5 cuffed tube. Endotracheal tubes with such small diameters are prone to plugging from secretions, and do not suction easily. In these infants, an uncuffed 3.0-sized tube may be the best available option for prolonged intubation in this vulnerable infant population.

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Searching for the Ideal Endobronchial Blocker

To the Editor:

We read with great interest the editorial in which Edmond Cohen¹ extensively reviews the use of endobronchial blockers (BBs) *versus* double-lumen tubes. We support his message that the anesthesiologist should be familiar with alternative devices for a double-lumen tube. However, some of his comments on our work² on the EZ-blocker (EZB) deserve our attention.

First, Cohen points out that the most important limitation of the EZB is its inability to remove secretions through this blocker or to apply any effective suction. Indeed, the central lumen of the EZB is narrower than that of other BBs. It is, however, doubtful whether thick slimy secretions can be successfully removed through any of the BBs. All BBs are also in a fixed position and cannot be moved forth and back in search of a collection of secretions. Therefore, one needs a larger suction catheter or a flexible bronchoscope that can be used only with a double-lumen tube.

There is no immediate need to aspirate air from the lung with our technique of acquiring lung collapse, *i.e.*, 3-min preoxygenation, followed by disconnection of the single-lumen tube from the ventilator for 60 s (starting just before the surgeon opens the pleural space), then insufflation of the cuff of the EZB. In our study, the quality of lung collapse with an EZB was comparable to that with a double-lumen tube, and it was not necessary to aspirate residual air. In cases outside our study, it proved to be possible to remove residual air through the lumen of the EZB by intermittent suction. This practice must be performed with caution because of the risk of negative pressure edema. Oxygen can be administered through the lumen of the EZB to the collapsed lung with a continuous positive airway pressure system because of a low flow suffices, *e.g.*, when hypoxemia occurs during one-lung ventilation.

Second, there seems to be confusion about some properties of the EZB *versus* those of other BBs. As reported,¹ BBs such as the Arndt blocker, the Cohen blocker, or the Uniblocker have low-pressure, high-volume cuffs. This does certainly not apply to the EZB, which often needs cuff pressures² of more than 110 cm H₂O. Another difference is that the pilot balloons at the proximal end of the EZB are

larger. A substantial amount of the volume that is insufflated remains in the pilot balloon and does not contribute to the volume of the distal cuff. Thus, the cuffs of the EZB should rather be classified as high pressure and low volume.

The authors obtained 50 EZ-blockers from the former manufacturer (AnaesthetIQ BV, Rotterdam, The Netherlands) for an equal price as 50 L-DLT's.

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In Reply:

I would like to thank Mourisse *et al.*¹ for their comments on my recent editorial. It was not my intention to review the properties of each endobronchial blocker but rather to encourage all anesthesiologists to become familiar with the use of these devices as an alternative to a double-lumen tube (DLT). I appreciate Mourisse *et al.*'s support of this concept.

The first issue raised by Mourisse *et al.* is the feasibility of suctioning through the lumen of the EZ-blocker. I agree that it is more effective to suction through a DLT using a suction catheter because unlike an endobronchial blocker in position, the suction catheter can be advanced and withdrawn. However, the perception that thick secretions can be suctioned through a DLT can be misleading. Suctioning through a DLT is performed using a long 10-French catheter, which is provided in the DLT kit. Figure 1 shows the three 9-French endobronchial blockers (Arndt, Cohen, Uniblocker) and the 10-French suction catheter (provided in a 37-French DLT Mallinckrodt kit; Covidien, Mansfield, MA) in cross-section to show the sizes of the lumens. There is no appreciable difference among the sizes of the lumens. The EZ-blocker has a 7.0-French lumen divided in two, which practically reduces the lumen of each individual suction channel to a bare minimum. This makes it practically impossible to remove secretions when the EZ-blocker is used.

Deflating the endobronchial blocker cuff to allow passive deflation of the lung through the single-lumen tube is

Dr. Cohen developed "The Cohen Flexi tip Endobronchial Blocker" with Cook Critical Care (Bloomington, IN). He receives lectures honoraria from Cook Critical Care.