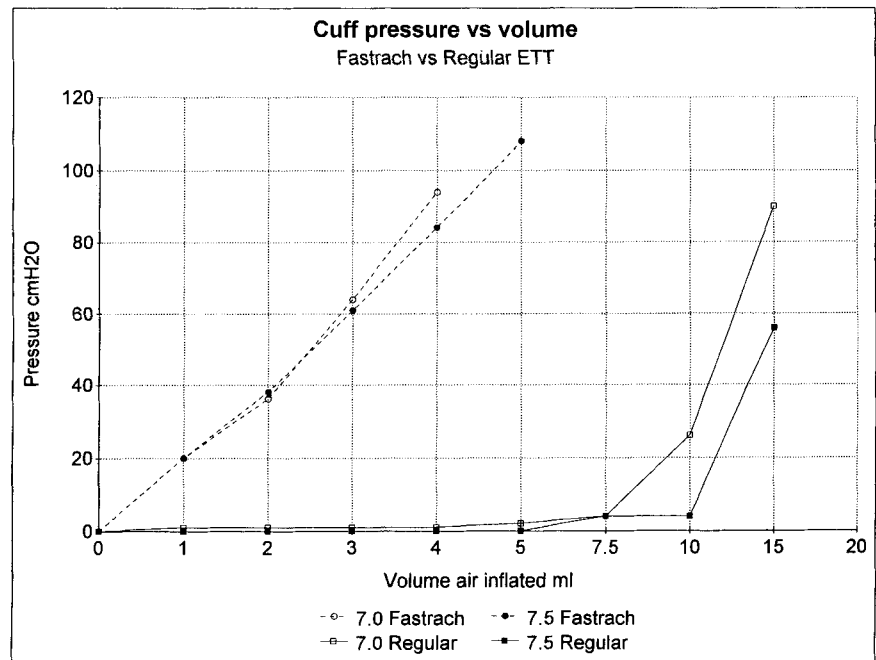


## CORRESPONDENCE

Fig. 1. Pressure–volume relations of Fastrach #7 and #7.5 endotracheal tubes compared with regular endotracheal tubes of the same sizes. New endotracheal tubes were inflated with air to the indicated volumes through a stopcock using a syringe. The resulting air pressure in the cuff was measured after equilibrium and plotted against the volume of air inflated.



cuffed one but was not labeled as such. They maintain that new high-volume, low-pressure endotracheal tubes will be provided in the future with the Fastrach LMAs, but many anesthesiologists may be unaware that they are using low-volume, high-pressure endotracheal tubes. The pilot balloon, when inflated to >120 cm water “feels” the same as a high-volume, low-pressure pilot balloon when it is palpated. Therefore, we recommend that the endotracheal tubes provided with the Fastrach LMA be tested before they are used and that high-pressure cuffs be avoided in patients who might need postoperative mechanical ventilation. If a low-volume, high-pressure endotracheal tube such as the one we describe is used, it can be changed to a more suitable endotracheal tube over a tube changer, such as one produced by Cook Catheter. An alternative is to use a regular endotracheal tube that has

been softened in warm water through the Fastrach LMA (and passed with the curve facing in the posterior position).

**Saul Wiesel, M.D., F.R.C.P.C.**

Associate Professor  
swiesel@flash.net

**Theodore Warm, M.D.**

Assistant Professor  
University of New Mexico School of Medicine  
Department of Anesthesiology and Critical Care Medicine  
Albuquerque, New Mexico

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*In Reply:*—We appreciate the opportunity to reply to the letter by Drs. Wiesel and Warm regarding the silicone ILM endotracheal tube (Euromedical, Sungai Petani, Kedah, Malaysia). The authors report successful tracheal intubation and ventilation in a 52-yr-old man for cervical spine stabilization using the intubating LMA-Fastrach (LMA North America, San Diego, CA) and a 7.5-mm silicone ILM endotracheal tube designed for use with it. The patient was ventilated for 3 days using this tube; however, when he subsequently required repeated intubation, the authors noted that a seal was not initially achieved. The problem was easily solved by inflating the cuff with more air, but the authors were concerned to note the pressure in the cuff was 100 cm water before a seal was achieved.

Wiesel and Warm make three points.

1. The product labeling does not state that the endotracheal tube is of the low-volume, high-pressure type, possibly resulting in anesthesiologists being unaware that they are not using a high-volume, low-pressure cuff.
2. Clinicians should test the cuff before use.
3. The product is unsuitable for patients who require postoperative mechanical ventilation.

We asked Dr. A. I. J. Brain, the inventor of the endotracheal tube in question, to comment on these points. His written reply from December 21, 1998 follows.

The silicone cuff of this tube is designed to form a close-fitting sleeve on the shaft to permit smooth passage through the intu-

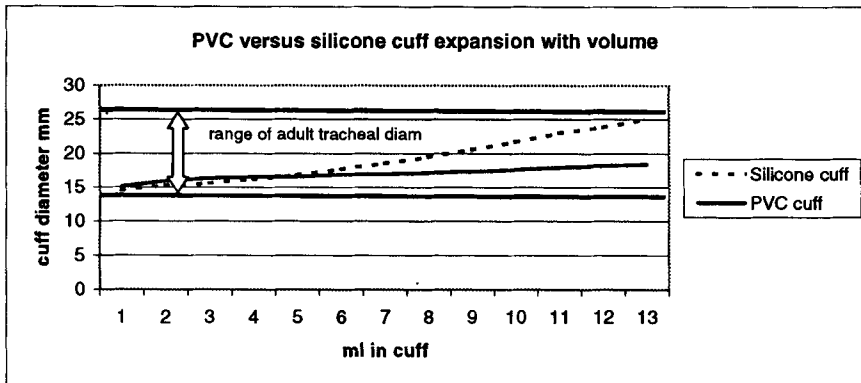


Fig. 1. PVC versus silicone cuff expansion with volume.

bating LMA. Technically, this makes the device a high-pressure, low-volume cuff that resembles the standard cuff of a plastic (nonsilicone) endotracheal tube, but the term is misleading when applied to this specialized tube. Unlike the standard plastic endotracheal tube cuff, the initial high pressure required to expand the silicone sleeve does not continue to increase when the cuff diameter reaches the tracheal diameter (figs. 1 and 2). In other words, the pressure-volume curve reaches a plateau at a cuff diameter approximating the tracheal diameter. Consequently, at the "just seal" volume, the cuff becomes extremely efficient, because the volume can be adjusted precisely without further increases in intracuff pressure. For example, when samples of the three sizes of tube (7.0, 7.5, and 8.0 mm) were inflated within an artificial trachea with a 1.9-cm diameter, seals of 62.4, 37.7, and 42.9 cm water were obtained for calculated wall pressures of 6.5, 5.2, and 7.8 cm water, respectively. This means that at sealing volumes, mucosal pressures should be well within safe limits, even though measured intracuff pressures are likely to be in the range of 100-130 cm water. Figures 1 and 2 illustrate the difference between these silicone cuffed tubes and a standard low-volume cuffed tube made from plastic (polyvinyl chloride). I hope this explains why the term "high-pressure, low-volume" is best avoided when describing this special tube.

I do not necessarily agree that it is safer to avoid using the ILM silicone tube in favor of high-volume, low-pressure cuffed tubes if prolonged ventilation is planned. First, the intubating LMA was not designed for plastic tubes. Large plastic cuffs may be torn on passage through the mask aperture, whereas the harder, more laterally placed

tube tip may damage the right vocal cord as it passes into the trachea. Second, using a high-volume, low-pressure cuffed endotracheal tube does not guarantee an effective seal against aspiration. Such cuffs have been shown in models<sup>1</sup> and clinically<sup>2</sup> to form longitudinal folds at their point of contact, with the mucosa resulting in leakage of fluids from above. Finally, recent data using an experimental tube with similar characteristics to the Euromedical tube indicate that by avoiding the longitudinal folding associated with the large-volume plastic cuff, an effective barrier to aspiration can be achieved.<sup>3</sup> In summary, no data exist to indicate that the Euromedical ILM tube is unsuitable for prolonged ventilation.

We do agree with Drs. Wiesel and Warm that all ILM endotracheal tubes should be tested before use, as stated on the labeling. With testing, it would be apparent to the clinician that the ILM endotracheal tube cuff is not the same as the high-volume, low-pressure cuffs found with polyvinyl chloride tubes.

Finally, I want to correct the impression that the newer ILM endotracheal tubes have high-volume, low-pressure cuffs. The cuff design has been improved to inflate more symmetrically, providing a better, consistent seal. Even though these newer cuffs are lower pressure than the original cuffs, they are not equivalent to the baggy, high-volume, low-pressure cuffs associated with polyvinyl chloride tubes.

**Helen C. Young, M.D.**  
 Director  
 Marketing and Medical Affairs  
 LMA North America, Inc.  
 San Diego, California

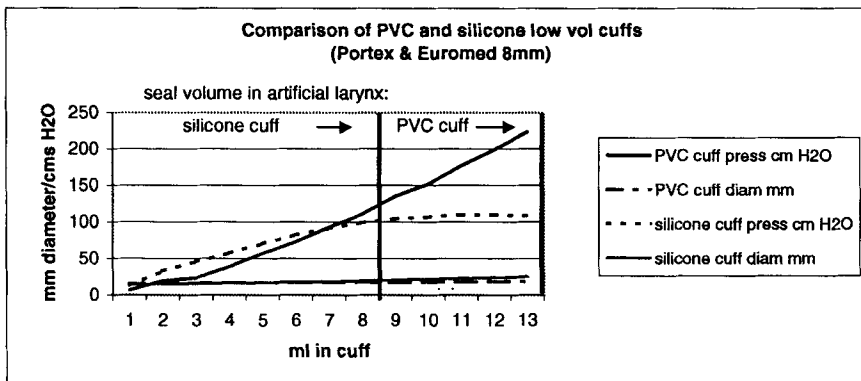


Fig. 2. Comparison of PVC and silicone low-volume cuffs (Portex & Euromed 8 mm).

## CORRESPONDENCE

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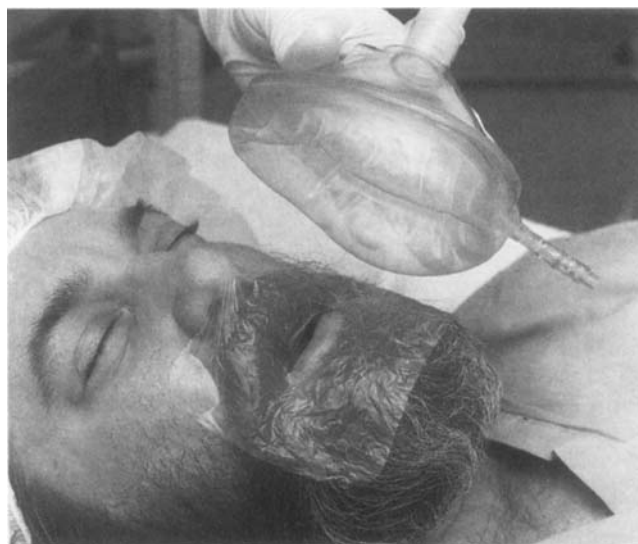
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## A Hairy Situation

*To the Editor:*—Difficult airway management begins with and sometimes reverts to adequate mask ventilation. Textbooks often list the facial qualities of patients that result in difficult mask ventilation, including obesity, edentulousness, and cachexia. Noted in only a few textbooks and not found in any published reference (but familiar to all practitioners) are mask ventilation problems associated with patients with beards or mustaches.<sup>1,2</sup> The only published solution to this problem consists of shaving the patient before induction.<sup>3</sup> Although the use of lubricant between the mask and beard has been suggested (personal communication), it may be messy and interfere with the anesthesiologist's grip. We describe a method that helps achieve a good mask fit for patients with whiskers using a traditional mask technique.

After preoxygenation and intravenous induction, a clear intravenous site dressing (*i.e.*, Tegaderm 10 cm × 12 cm; 3M Health Care, St. Paul, MN) is placed over the patient's mouth and facial hair, as illustrated in figure 1. The size of the transparent dressing should be larger than the hairy area covered by the face mask. An opening has been made in the center of the film that allows it to adhere lightly to the glabrous area around the lips (the nostrils also may be uncovered). An oral airway may be placed if needed to treat obstruction. We have found that this eliminates the leaks associated with positive-pressure ventilation and facilitates mask ventilation *en route* to endotracheal intubation. We have not found that this dressing sticks to the endotracheal tube, oral airway, or other devices used during the anesthetic. The dressing may be left in place until the end of the surgical procedure and is removed easily.

**Joel O. Johnson, M.D., Ph.D.**  
Associate Professor of Anesthesiology  
University of Missouri  
Columbia, Missouri  
johnsonjo@missouri.edu  
**James A. Bradway, M.D.**  
Assistant Professor of Anesthesiology  
University of Utah  
Salt Lake City, Utah  
**Todd Blood, M.D.**  
Staff Anesthesiologist  
Cottonwood Hospital  
Salt Lake City, Utah



**Fig. 1.** In this simulation using one of the authors (J.A.B.), the transparent dressing covers the hairy area contacted by the face mask.

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