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# A new method of airway management with a long endotracheal-bronchial tube using a coaxial technique

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## Introduction

Small-bore, cuffed plastic tubes with sufficient length have been advocated for endobronchial intubation to facilitate one-lung ventilation [1–3]. We applied a long tube not only for one-lung ventilation during thoracic surgery but also for optimal airway maintenance during insertion of a tracheal stent. We combined the long tube with a conventional tracheal tube using a "coaxial" technique; this proved useful for airway management in the cases reported below.

## Apparatus

Two endotracheal tubes made of siliconized polyvinyl chloride with an internal diameter (I.D.) of either 5.0 mm or 5.5 mm were joined end-to-end to make a tube 45 cm long. A 2-cm wide, high-compliance cuff was attached to the unbeveled distal end. The inflation line of the cuff ran within the wall of the tube and exited 10 cm from the proximal end (Fig. 1). The improved tube had a thinner wall section at the cuff site.

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## Intubation

The long tube was passed through a large I.D. tracheal tube using a swivel connector. When one-lung ventilation was required, the long tube was positioned in the main bronchus on the appropriate side under fiberoptic bronchoscopy using a 3.5-mm bronchoscope.

## Application of the long tube to tracheal stenosis

A 58-year-old man developed progressive tracheal stenosis following a long intubation period. To ventilate him and place a silicone stent in the stenotic portion to maintain tracheal patency and prevent further stenosis, a 2.5-cm long silicone stent was scheduled for insertion in the stenotic portion.

A 5.0-mm I.D. long tube was passed through both the stent and an 8.5-mm I.D. endotracheal tube that was flattened at the distal end by removing the bevel (Fig. 2). Tracheal intubation was performed with this assembly in which the smaller I.D. tube alone could pass through the stenotic portion.

The stent was positioned by pushing it into the stenotic portion with the 8.5-mm endotracheal tube using the long tube as support (Fig. 3a). The patient was ventilated through the long, smaller I.D. tube throughout the manipulation. The smaller I.D. tube was then removed and ventilation was continued through the larger I.D. endotracheal tube (Fig. 3b).

## Application of the long tube to one-lung ventilation

### *Esophageal cancer*

We used the long tube in five cases (4 men and 1 woman) undergoing radical excision of esophageal

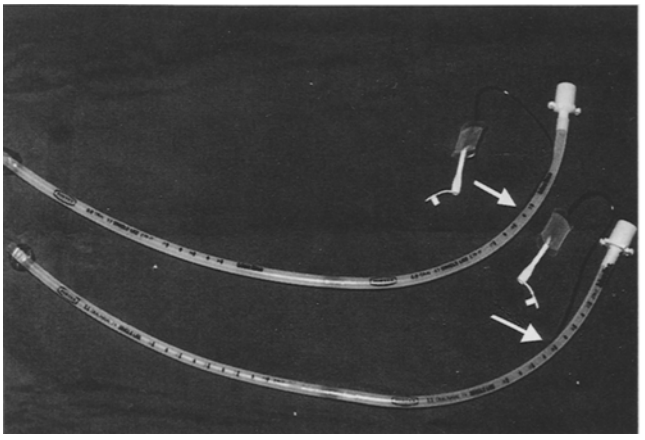

**Fig. 1.** Long tubes. The improved type has thinner walls in the portion indicated by *arrows*

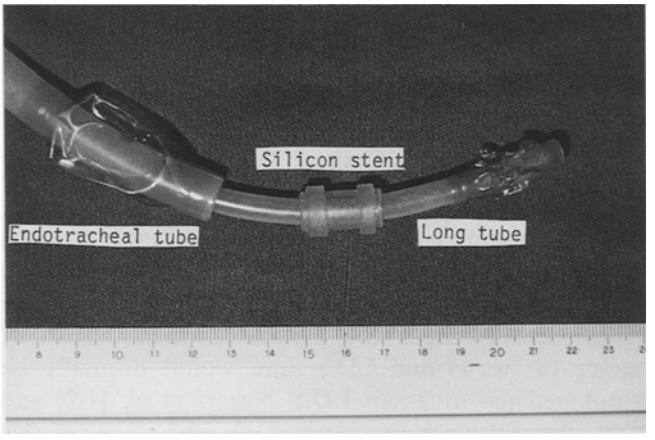


**Fig. 2.** A 5.0-mm inner diameter (I.D.) long tube passes through a 2.5-cm long silicone stent and a 9-mm I.D. endotracheal tube

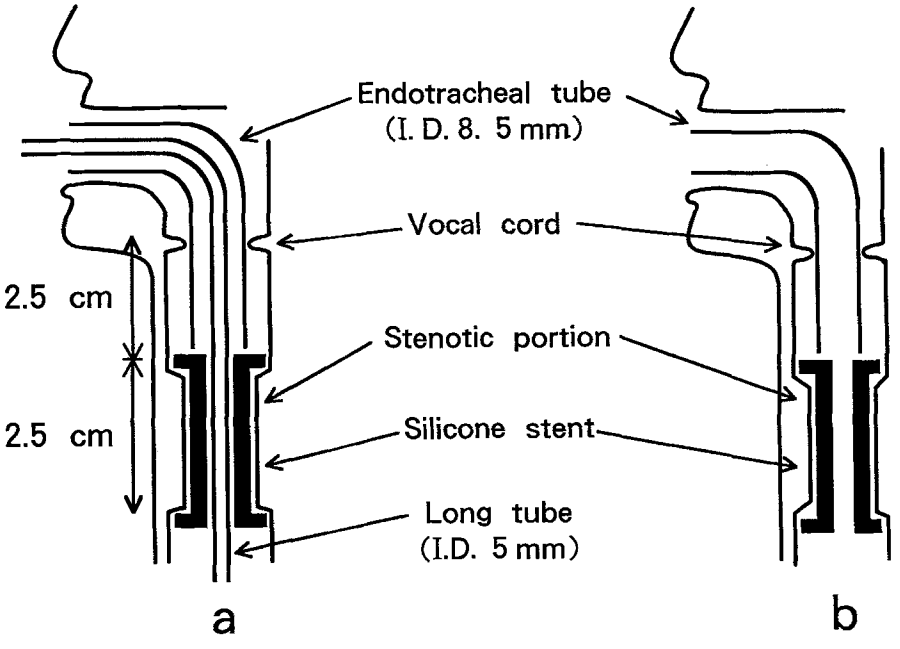


**Fig. 3. a** Schematic drawing of a tracheal tube, a long tube, and a silicone stent. The silicone stent could not be passed alone through the tracheal stenosis; only the long tube could. **b** The section after the stent was in place and the long tube withdrawn

cancer under right posterolateral thoracotomy. In four cases, the patients were intubated nasotracheally with an 8.5-mm or 9.0-mm I.D. tracheal tube following induction of general anesthesia. One of these cases was intubated using a fiberoptic bronchoscope due to a brittle jaw following radiotherapy. Neither naso- nor orotracheal intubation was successful in the remaining case due to the rigidity of neck and jaw, and a tracheostomy was performed.

Before thoracic engagement, the 5.0-mm I.D. long tube was inserted through the tracheal tube into a left main bronchus under fiberscopic guidance. One-lung ventilation was accomplished through the long tube during the excision of the thoracic esophagus and lymph nodes. Following the excision, the bronchial tube was removed and bilateral lung ventilation was resumed through the tracheal tube. This tube was left in position for postoperative respiratory care.

*Lung cancer*

The long tube was applied to 10 male patients undergoing either tracheoplasty or bronchoplasty together with the excision of lung cancer. All cases required one-lung ventilation. An 8.5-mm or 9.0-mm I.D. tracheal tube was initially intubated either nasally or orally in each case.

Under bronchoscopic guidance, one-lung ventilation was achieved by passing a long, small I.D. tube through the large tracheal tube and positioning the tip in the main bronchus opposite the surgical site. In two cases, the dependent lung was ventilated with inter-

mittent high frequency ventilation through the long tube.

## Discussion

Many methods for separately ventilating the lungs during surgery have been proposed. Among these, the use of long, small-bore tubes for endobronchial intubation was reported. In those reports, ventilation of one lung was achieved by the long tube and that of the other lung by the outer tracheal tube, the size of which was usually larger (9- to 11-mm I.D.) than would normally be employed (8- to 9-mm I.D.). Nazari et al. [1,2] and Conacher [3] have enumerated the advantages of this system for separate lung ventilation. While they utilized this in the case of oral intubation, nasal intubation is needed in other cases. Hence, we applied the method to patients who were scheduled for postoperative mechanical ventilatory support and were intubated nasotracheally. This method could be especially beneficial to patients undergoing tracheoplasty or transthoracic en bloc esophagectomy, as it may not be preferable to exchange their intubation tubes from the oral to the nasal route for a long period postoperatively. Such patients often have a swollen larynx and vocal cords due to various manipulations and the long operation time, and because neck extension is not easy, it may be difficult and risky to do the manipulation for intubation again following the operation, which could cause leakage or diastasis at anastomosis. When we used this method in such cases, we simply removed the endobronchial tube to reestablish normal ventilation after thoracic procedures under one-lung ventilation. There was no need to replace the tracheal tube postoperatively.

One problem with nasotracheal intubation was that we had to use endotracheal tubes with a small diameter to pass through the patients' nostrils. It was difficult to achieve appropriate ventilation through the gap between the outer tracheal tube and the inner bronchial tube. However, in our cases, ventilation to the endobronchial tube side was secure and ventilation to the surgical side was not necessary during surgical manipulation. Should it become necessary to ventilate both lungs, a normal patent airway can be established almost immediately by simply withdrawing the bronchial tube. Another disadvantage was that it is difficult to remove blood or secretions entering the trachea from the surgical field during one-lung ventilation. We had to apply proper suctioning through the tracheal tube as soon as the bronchial tube was removed.

Recently, we successfully made a 5.5-mm I.D. long tube with a thinner wall at the cuff section which can be passed through a standard 8.0-mm I.D. endotracheal tube. Therefore, applying the coaxial technique to smaller patients became possible. We now routinely use the new, long tubes for one-lung ventilation.

We used the long tube to insert a supportive stent in a stenotic trachea. This tube may also be useful for patients who have tracheal stenosis at the site of an anastomosis after lung transplantation.

In summary, we found long, small I.D. tubes useful and versatile during the management of difficult airways. They had the following advantages:

1. Application of the long tube is not limited to one-lung ventilation but can be extended to airway management for tracheal stenosis. The long tube can be used as a guide and pathway for ventilation while the stent is being pushed into the appropriate position.
2. The long tubes are useful in cases requiring one-lung ventilation during surgery and long-term mechanical ventilation postoperatively. These patients can be nasotracheally intubated with ordinary endotracheal tubes through which endobronchial tubes can be inserted or removed. We can use the same endotracheal tube postoperatively and avoid airway complications accompanying reintubation.

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