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Blind endobronchial insertion of a movable bronchial blocker attached to an endotracheal tube, Univent tube™

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The endotracheal tube with a movable bronchial blocker, Univent tube™, used to effect one-lung ventilation is easy to use in endotracheal intubation. However, problems are often encountered when inserting the blocker into the bronchus. We herein describe a method which enables the easy blind insertion of the blocker into the left or right bronchus. The techniques of inserting the blocker into the left main stem bronchus will be described. With the patient in a supine position, the head of the patient is moved to the left. The operator then places his right hand fingers near the cricoid and presses to displace the larynx of the patient toward the right. While performing this procedure, the operator advances the blocker using the left hand. Finally, using a bronchoscope, the placing of the blocker is to be ascertained in an appropriate position inside the left bronchus. When strong resistance is left, the blocker should be retracted, the force of laryngeal displacement is altered and, then, the blocker is inserted again in a resistance-free manner. We have so far experienced no complications such as severe tracheobronchial hemorrhage, tracheobronchial perforation of laryngeal dislocation. We herein describe a useful and simple method for inserting the bronchial blocker of the Univent tube into the bronchus.

Key words : blind endobronchial insertion, one-lung ventilation, Univent tube™

The endotracheal tube with a movable bronchial blocker, Univent tube™, is used to effect one-lung ventilation. This tube is easy to use in endotracheal intubation, because it has the same form as a conventional endotracheal tube [1-4]. It has an additional advantage that there is no need to change to a conventional endotracheal tube in postoperative use. The Univent tube™ has two lumens. One lumen is used for ventilation, and its internal and external diameters do not differ from those of a conventional endotracheal tube. The other lumen accepts a movable bronchial blocker, 2 mm in diameter, located along the anterior wall inside the endotracheal tube. A balloon attached to the tip of the blocker can advance 8 cm from the end of the tube. One-lung ventilation can be achieved by manipulating this blocker. The blocker is inserted into the bronchus on the side of the lung in which ventilation is not desired. The balloon of the blocker is inflated, thus blocking ventilation and effecting a unilateral pulmonary collapse. However, problems are often encountered when inserting blocker into the bronchus. We herein describe a method that allows easy blind insertion of the blocker into the left or right bronchus.

TECHNIQUES

Because of the anatomy of the trachea and bronchi, left endobronchial intubation tends to be more difficult. The techniques for inserting the blocker into the left main stem bronchus will be described. When inserting the blocker into the right main stem bronchus, the side in the following descriptions should be reversed.

(1) After performing endotracheal intubation with the patient in a supine position, the head of the patient is moved until it

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Fig. 1 After performing endotracheal intubation with the patient in a supine position, the head of the patient is moved until it is facing the left. With the operator standing near the head of the patient, he places his right hand fingers near the cricoid and presses downward to displace the larynx of the patient toward the right. While performing this procedure, the operator advances the blocker using the left hand. If strong resistance is felt, the blocker should be retracted. After displacing the larynx again, the procedures are repeated.

is facing left. The curved surface of the Univent tube™ is positioned in parallel to the floor plane.

(2) With the operator standing near the head of the patient, he places his right hand fingers near the cricoid, and then press downward to displace the larynx of the patient toward the right (Fig. 1).

(3) While performing this procedure, the operator advances the blocker using the left hand. If strong resistance is left, the blocker is probably hitting the bronchial wall. In this case, any further advancement of the blocker by force will result in bronchial damage such as hemorrhage or perforation. Therefore, when strong resistance is felt, the blocker should be retracted. Then, after displacing the larynx again, procedure (2) and (3) are repeated.

(4) Finally, using a bronchoscope, it should be ascertained that the blocker is placed in an appropriate position inside the left bronchus.

The above procedures should be used to guide the blocker into the appropriate position inside the left bronchus.

DISCUSSION

The process of these manipulations should be monitored using a bronchoscope and chest radiographs. The bronchoscope provides a view from the tip of the Univent tube™. Prior to any manipulations, the tracheal bifurcation and both left and right bronchi are visible, with a better view of the right bronchus than the left bronchus (Fig. 2a). After initiating the procedure (1) with the patient facing left and the curve of the Univent tube™ parallel to the floor, the left bronchus shows a better view than the right bronchus (Fig. 2b). After performing the procedure (2) when the larynx is displaced to the left, the operator obtains a full frontal view of the bronchus while the right bronchus is almost invisible (Fig. 2c). Under these conditions, the blocker balloon can then be inserted directly into the left bronchus.

Chest radiographs showed that the alignment of the mouth, larynx and trachea corresponded to the curve of the Univent tube™ during such manipulations. The trachea and left main stem bronchus are almost in a straight line. An injection of contrast medium into the balloon revealed that the blocker balloon was correctly inserted into the left main stem bronchus in a straight line (Fig. 3).

We have now performed this procedure in over 2000 cases, including pediatric cases [5]. The success of completing this method was not affected by the patient's body position. The blocker balloon could not be guided successfully into the bronchus in a few cases [6], usually in patients with a severe malposition of the trachea and/or bronchus.

Bonica *et al.* [7] first describe the method

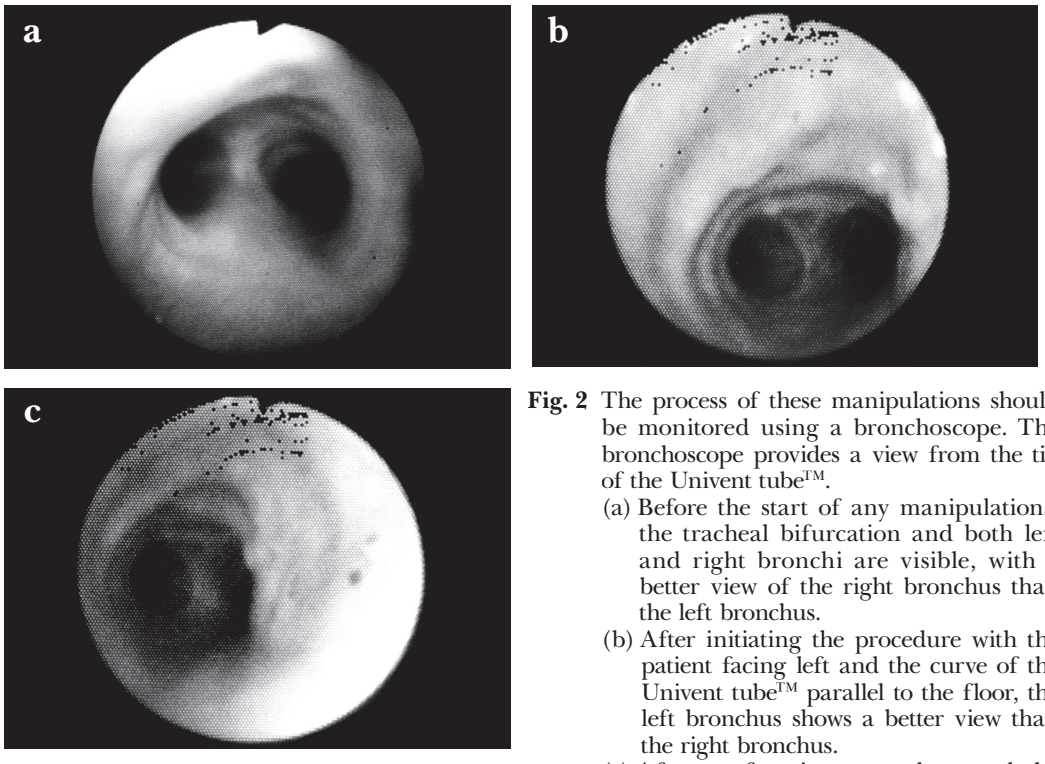

Fig. 2 The process of these manipulations should be monitored using a bronchoscope. The bronchoscope provides a view from the tip of the Univent tube™.
(a) Before the start of any manipulations, the tracheal bifurcation and both left and right bronchi are visible, with a better view of the right bronchus than the left bronchus.
(b) After initiating the procedure with the patient facing left and the curve of the Univent tube™ parallel to the floor, the left bronchus shows a better view than the right bronchus.
(c) After performing procedure and the larynx is displaced to the left, the operator obtains a full front view of the left bronchus while the right bronchus is almost invisible. Under this condition, the blocker balloon can then be inserted directly into the left bronchus.

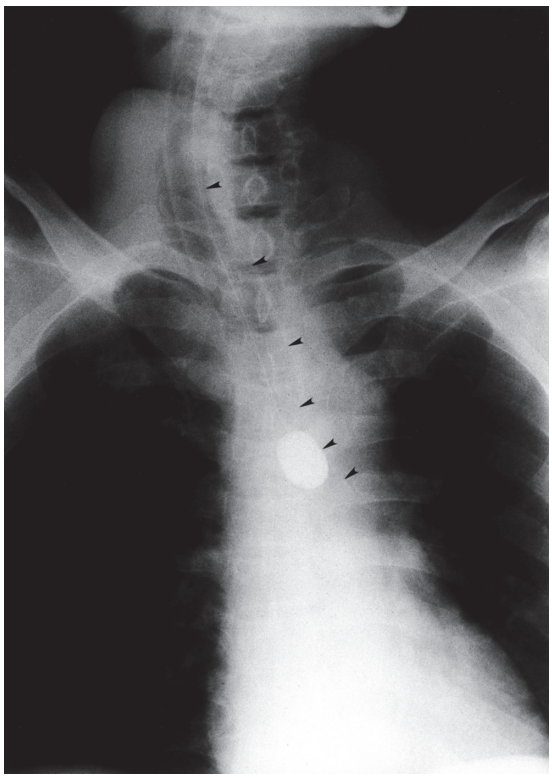

Fig. 3 Chest radiographs showed that the alignment of the mouth, larynx and trachea corresponds to the curve of the Univent tube™ during such manipulations. An injection of contrast medium into the balloon reveals that the blocker balloon is correctly inserted into the left main stem bronchus in a straight line.

of blind endobronchial intubation. After endotracheal intubation, the tube was rotated 90 degrees on the side where endobronchial intubation was intended to be performed by advancing the tube. By this maneuver, the tip of the tube was directed toward the left bronchus, thus facilitating intubation into the left bronchus. Kubota *et al.* [8] reported a 72 % success rate of left endobronchial intubation using Bonica's method, and attributed the low success rate to the inability of the method to cope with the anatomic problem of the trachea and bronchi. To improve the success rate of the left endobronchial intubation, they devised a method of turning the patient's face to the right and rotating the tube 180 degrees and, thereafter, obtained a success rate of 92 %. They used a polyvinyl chloride single-lumen tube. Since polyvinyl chloride is soft, the shape of the respiratory tract from the larynx to the bronchus is only minimally altered by endotracheal intubation. By turning the face to the left, the mouth, larynx, trachea and left main bronchus are almost completely aligned in a straight line, thus improving the success rate of endobronchial intubation.

A rotation method resembling Bonica's blind endobronchial intubation has also been used for inserting the Univent™ blocker. After endotracheal intubation, the side of the Univent tube™ is rotated 90 degrees toward the side of endobronchial intubation, and then the blocker is advanced carefully into the main stem bronchus. This method takes advantage of the features that the blocker balloon is located along the inner curve surface of the Univent™. By turning the Univent tube™ toward the side of the desired endobronchial intubation, the blocker is guided and inserted into the bronchus. However, in the case of left endobronchial intubation, the tracheal bifurcation angle is larger on the left, thus making intubation difficult. In the case of tracheobronchial deformation in diseases such as thoracic aortic aneurysm, the insertion of the blocker into the bronchus is often difficult even with the aid of a bronchoscope. In such cases, an alternative method could be the insertion of a bronchoscope into the bronchus, and then, using it as a stylet, to insert the Univent tube™ into the bronchus. The blocker alone is left inside the bronchus while the Univent tube™ is retracted to the trachea. However, this method may cause bronchial damage and tension pneumothorax.

Our method makes use of the curve and structure of the Univent tube™. The Univent tube™ is made of hard silicon which maintains its shape, such as the curve, better than polyvinyl chloride. By turning the patient to face left (the opposite to Kubota's method), the alignment of the mouth, larynx, trachea and bronchus matches the curve of the Univent tube™. The blocker balloon located on the inner curve of the tube is advanced along the tracheobronchial wall, which facilitates insertion. By displacing the larynx to align trachea and left bronchus in a straight line, the blocker insertion is further facilitated. The rotation method only takes advantage of the structural feature that the balloon is on the inner curve of the Univent tube™, but it does not match the curve formed by the mouth, larynx, trachea or bronchus with the curve of the tube. Additional guiding using a bronchoscope may also be difficult, because the axis of the Univent tube™ opening and the axis of the bronchus do not match. A great care has to be exercised when using the bronchoscope as a stylet, because the Univent tube™ has a thick and hard wall and may damage the mucosa if inserted into a small bronchus.

We have not experienced any complications such as severe tracheobronchial hemorrhage, tracheobronchial perforation or laryngeal dislocation. One reason is the recognition of the significance of the resistance felt during insertion of the Univent™. It may result from the tip hitting the bronchial wall, and advancing the blocker by force may cause hemorrhage and perforation [9]. When strong resistance was felt, we retracted the blocker, altered the force of laryngeal displacement, and tried to insert the blocker in a resistance-free manner. This is the best way to prevent complications.

The Univent™ has been used as a treatment for bronchial or intrapulmonary hemorrhaging [10]. In case of severe hemorrhage in the trachea and/or bronchus, bronchoscopic guide may not be possible due to the difficulty in performing a direct bronchoscopic examination. Our method enable simple bronchial blocking under any condition and it takes only a few seconds to perform.

CONCLUSION

We introduced a useful and simple method of inserting the bronchial blocker of the Univent tube™ into the bronchus.

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