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Bronchial Rupture, A Complication of Use of the Robertshaw Double-lumen Tube

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Double-lumen endotracheal tubes for selective endobronchial intubation have provided improved conditions for thoracic surgery and the ability to selectively isolate infected or emphysematous lungs. Proper positioning of the tube can be difficult, and is more critical than placement of the standard endotracheal tube. In a recent review of Robertshaw tubes, the problems of cross-leaks, difficulties with lung deflation, and hypoxemia are discussed.¹ These investigators, however, make no mention of damage to the tracheobronchial tree. The following is a description of a complication of endobronchial intubation not previously reported.

REPORT OF A CASE

A 51-year-old, 94-kg, white man was scheduled for resection of the right upper lobe for evaluation of a noncalcified pulmonary nodule. Following induction of anesthesia with 375 mg thiopental and muscle relaxation with 8 mg pancuronium, the trachea and left mainstem bronchus were easily intubated on the first attempt with a large left Robertshaw endobronchial tube. After confirmation of our ability to ventilate the right and left lungs independently, the endobronchial tube was secured and the patient turned to the right lateral decubitus position. Anesthesia was maintained with halothane and oxygen. Resection of the right upper lobe proceeded uneventfully, with good isolation and collapse of the right lung. Analysis of arterial blood obtained during the resection showed: P_{O_2} 208 torr, P_{CO_2} 32 torr, pH 7.46, and base excess +0.3 mEq/l. Ventilation was accomplished without difficulty. At the time of testing the right-upper-lobe bronchus for air leakage by application of 40 cm H_2O of sustained positive pressure, bubbles were unexpectedly noticed to arise from the mediastinum. Further investigation revealed the source of the air leak to be a 4.5-cm split in the posterior wall of the left mainstem bronchus, extending distally from the carina. The left bronchial cuff of the Robertshaw tube was herniating through the bronchial tear, partially tamponading the air leak.

Surgical repair of the lesion was accomplished with a double row of 4-0 Prolene® sutures, beginning distally and proceeding toward the carina with the endobronchial tube being gradually withdrawn as the repair advanced. Postoperatively, a 40 per cent left pneumothorax resolved rapidly following insertion of a left intrapleural chest tube. The remainder of the postoperative period was uneventful. The histologic report of the resected lesion was "old fibrotic granuloma with histoplasma-like yeast organisms."

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DISCUSSION

The diagnosis of tracheal tear can be difficult to make.² Although signs vary and may initially be absent, subcutaneous emphysema, pneumomediastinum, and pneumothorax with rapid deterioration of vital signs have all been reported. Therefore, the possibility of bronchial tear should be considered when any of the above-mentioned signs occurs following endobronchial intubation, especially when pneumothorax develops on the side of the selectively intubated bronchus.

Tracheal rupture by endotracheal tubes has recently been reviewed by Kumar *et al.*³ Many of the properties of endotracheal tubes that tend to increase the risks of tracheal rupture are inherent in endobronchial tubes. The Robertshaw tube is made of stiff red rubber, and curves in two planes. The tip of the tube is, therefore, more likely to tear the tracheal or bronchial wall during placement or movement of the patient. This tube has high-pressure endotracheal and endobronchial cuffs. A cuff of this type is more likely to distend the bronchus, and has a tendency to dilate asymmetrically, driving the tip of the tube into the bronchial wall.⁴ If the patient is then moved, the bronchial wall may be lacerated.

In order to prevent the problem of bronchial tears with Robertshaw tubes, we make the following recommendations. First, when the bronchial cuff does not seal with a reasonable quantity of air (about 2–5 ml in our experience), then size and position of the tube should be reassessed. Second, one should deflate the bronchial cuff before moving the patient. Finally, one should check the integrity of the intubated bronchus with the bronchial cuff deflated at the time of testing the resected bronchus for air leak. This is especially important following pneumonectomy, when compromise of the remaining lung could be disastrous.

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