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Cardiac Arrest from Pulmonary Outflow Tract Obstruction due to a Double-lumen Tube

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Double-lumen endotracheal tubes are often used in thoracic surgery procedures, permitting isolation, suction, or selective ventilation of either lung. We wish to report an unusual case of cardiac arrest directly attributable to the insertion of a double-lumen (Robertshaw) tube.

REPORT OF A CASE

A previously healthy 24-yr-old, 75 kg man had a 3-day history of severe retrosternal chest pain. It was continuous, but worse with deep breathing and the supine position. An erect postero-anterior chest roentgenogram showed a large (10 cm diameter) sub-carinal soft tissue mass. This mass was displacing both main-stem bronchi upwards and laterally to produce a splayed appearance of the carina and major bronchi (fig. 1). The lateral radiograph showed a spheroid mass occupying parts of the middle and posterior mediastinum with compression of adjacent large airways. A CT scan demonstrated the mass to be cystic and posterior to the pulmonary artery, and was compressing both the main and right pulmonary arteries (fig. 2). EKG, hematologic, and biochemical tests were all normal.

The patient was scheduled for an elective right thoracotomy to remove what was felt to be either a bronchogenic or enteric cyst. He was premedicated with papaveretum 15 mg (equivalent to morphine 10 mg) and hyoscine 0.3 mg im. Arterial blood pressure was 130/70 mmHg and heart rate was 95 bpm in sinus rhythm.

Anesthesia was induced with thiopental 400 mg and succinylcholine 100 mg iv, after which a semi-rigid, red rubber, large (approximate O.D. 15 mm), left-sided Robertshaw tube was easily passed. In spite of easy ventilation of both lung fields with 100% oxygen, cyanosis rapidly became apparent. The cardiac rhythm changed to rapid atrial fibrillation with a significant pulse deficit. One minute following intubation, the ventricular complexes became markedly widened, and the radial artery pulse became impossible to palpate. Arterial blood pressure was unrecordable. External cardiac massage was commenced. The surgeons considered this to be possibly due to a cardiac tamponade-like effect of the cyst and, for this reason, the patient was sequentially moved to the left lateral, right lateral, and, finally, semi-erect positions. In this last position, there was some improvement in his hemodynamic status, but not sufficient to maintain an adequate cardiac output. The patient was returned to the supine position and, simultaneously, the rhythm changed to ventricular tachycardia immediately followed by ventricular fibrillation. Sodium bicarbonate and lidocaine were administered iv. Several attempts at defibrillation were made. However, on each occasion that sinus rhythm was achieved, there was no cardiac output.

An emergency thoracotomy was then performed by way of a left sub-mammary incision, while external cardiac massage was continued. Internal cardiac massage was then combined with internal defibrillation, which, on four occasions, was once again only transiently successful in restoring sinus rhythm. During a 10-min period of internal cardiac massage, a reasonable cardiac output was achieved, as evidenced by palpable pulses and pupillary constriction.

To obtain better exposure of the cyst, the incision was extended across the sternum and into the right side of the chest. It was now possible to visualize a large, tense, bluish-colored mass lying inferior to the carina and main bronchi and behind the pulmonary outflow tract. Because of initial concern that this was a pulmonary artery aneurysm, a delay of several minutes occurred prior to aspiration of the cyst. A 19-G needle attached to a 20 ml syringe passed easily into the

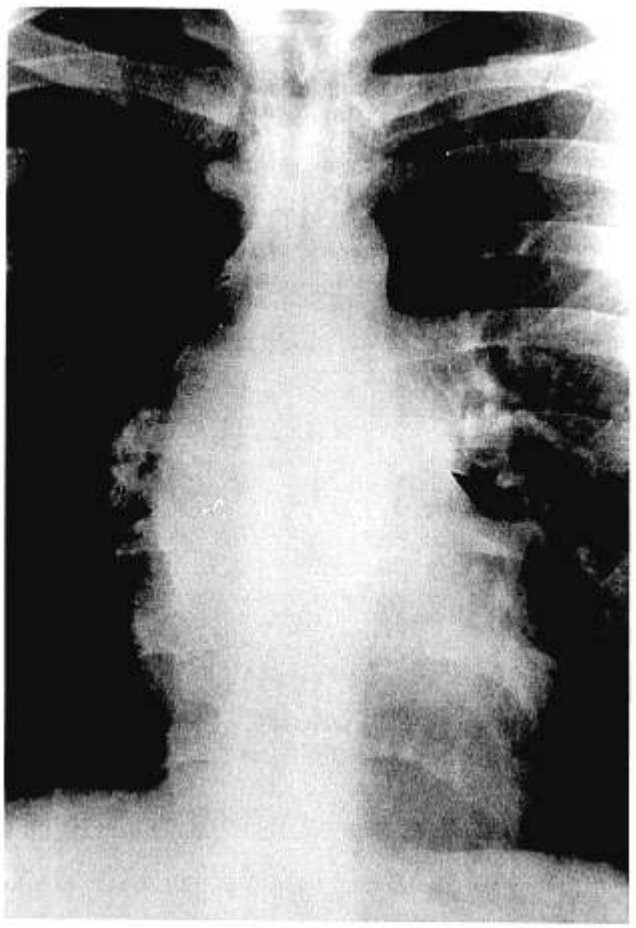

FIG. 1. Postero-anterior chest roentgenogram showing a large cyst displacing the main-stem bronchi. Markers show the lateral margins of the cyst. Trachea and main-stem bronchi are outlined.

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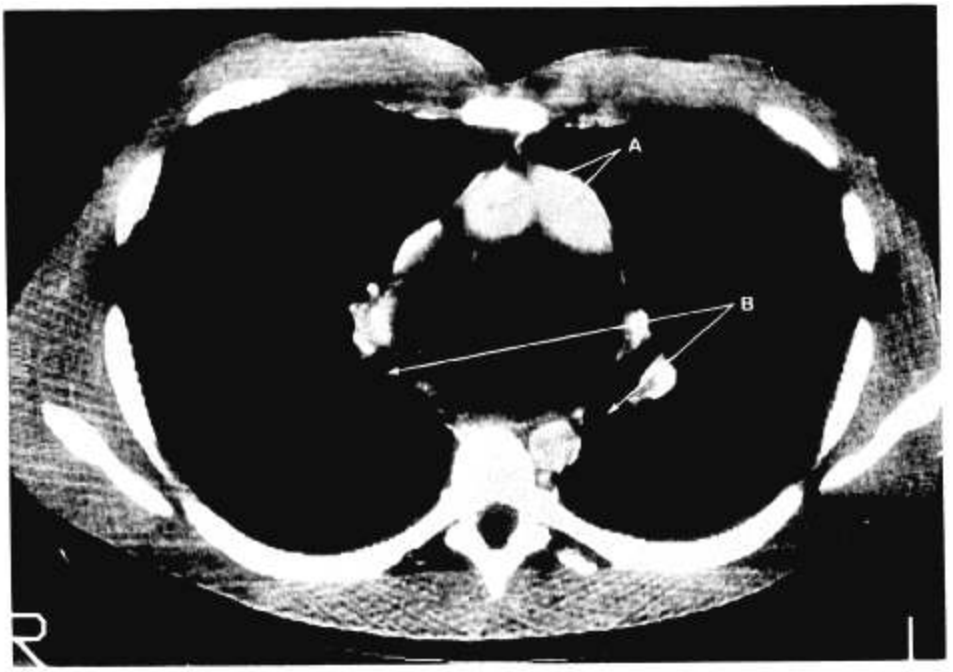

FIG. 2. Transverse CT scan through the center of the cyst showing displaced pulmonary arteries anteriorly filled with contrast (A) and right and left main bronchi indenting the cyst postero-laterally (B).

cyst, and spontaneously filled under pressure with thick, mucoid fluid. Despite the highly viscous nature of the fluid, removal of the syringe resulted in fluid spurting freely from the needle hub. Approximately 150 ml of fluid was drained from the cyst.

Immediately following this, defibrillation to sinus rhythm was accomplished with a rate of 100 bpm and arterial blood pressure 155/90 mmHg. A drain tube was then inserted into the cyst, and the chest was closed. A definitive resection of the cyst was postponed to a later date, when a right thoracotomy could be permitted. At the completion of the procedure, the patient was grossly neurologically normal, and the trachea was successfully extubated several hours later. The patient showed no evidence of persistent cardiac or neurologic impairment.

DISCUSSION

The use of double-lumen tubes has certain disadvantages. Probably the most common problem is arterial hypoxemia following introduction of anesthesia and dependent one-lung, positive pressure ventilation.[1] The tubes themselves can cause serious complications.[1,2] Brodsky *et al.* have described malposition of both right and left endobronchial tubes and increased resistance to air flow associated with the presence of two smaller lumens.[3] Because of the larger external diameter of double-lumen tubes, traumatic damage may occur to the larynx, trachea, carina, or main bronchi.[1] Traumatic tracheobronchial rupture has followed the use of both the Carlens[4] and Robertshaw[5] tubes.

In contrast to these complications, we described a case of cardiac arrest following satisfactory placement and normal ventilation through a double-lumen tube. In this case, the passage of a semi-rigid, large, left-sided Robertshaw tube would have splinted the left main bronchus and caused compression and displacement of the cyst. This would have lead to further compression of the pulmonary outflow tract which, superimposed on the reduction in cardiac output secondary to the use of thiopental and positive pressure ventilation, would have been sufficient to produce cardiac arrest. Resuscitation proved impossible in the presence of the endobronchial tube until drainage of the cyst permitted unobstructed flow in the pulmonary artery. It is conceivable that early replacement of the large, red rubber Robertshaw tube with a conventionally sized, soft plastic endotracheal tube would have decompressed the pulmonary artery sufficient to permit resuscitation.

In summary, the passage of an endobronchial tube in the presence of a mediastinal mass may cause compression or displacement of the mass, sufficient to cause obstruction to major vessels and consequent cardiac arrest. These cases will be refractory to resuscitation until the obstruction is relieved.

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