

spontaneous uterine activity in the postpartum period of primi- or secundiparae.

Despite the fact that enflurane is known to relax uterine muscle, we have shown that enflurane can be used safely for patients undergoing therapeutic abortion, in that it does not increase blood loss when compared to a nitrous oxide/narcotic technique. The use of enflurane in low concentrations as an anesthetic for this outpatient procedure is advantageous because it obviates the need for narcotics or large doses of thiopental. It thus may allow more rapid recovery from anesthesia² and, although not examined in this study, earlier discharge from the hospital.

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Anesthesia for the Patient with Pulmonary Lobar Torsion

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Torsion of a segment, a lobe,^{1,2} or an entire lung³ following an intrathoracic surgical procedure is a rare event. Its occurrence can lead to pulmonary infarction with secondary gangrene if not recognized. Any patient with atelectasis or an expanding intrathoracic mass following thoracotomy should have lung torsion included in the differential diagnosis. During surgical correction of this condition, massive hemorrhage may occur into the airways, drowning the dependent lung and producing

severe hypoxia or death. Because of this, a double-lumen endotracheal tube should be inserted prior to surgery if lung torsion is suspected.

REPORT OF A CASE

A 20-year-old man with a history of recurrent, spontaneous left pneumothorax was scheduled for a left parietal pleurectomy. Preoperative laboratory studies were normal with the exception of the chest roentgenogram which revealed a 10 per cent left pneumothorax. Following induction of anesthesia with thiopental, pancuronium, and halothane a #36-French disposable left Robertshaw double-lumen tube was inserted into the trachea. Before pleurectomy with a $F_{I_{O_2}}$ of 1.0, pH_a was 7.48, P_{aCO_2} 34 mmHg, P_{aO_2} 571 mmHg, and HCO_3^- 25 mEq/l. In the right lateral decubitus position an 80 per cent pleurectomy was performed with oversuturing of a number of small blebs in the left superior and inferior lobes. The tracheal tube was removed at the end of the procedure and in the immediate postoperative period on a $F_{I_{O_2}}$ of 0.4 pH_a was 7.38, P_{aCO_2} 43 mmHg, P_{aO_2} 194 mmHg, and HCO_3^- 26 mEq/l. Breath sounds were reduced in the bases, but were otherwise normal as was the postoperative chest roentgenogram. A reduction in the left upper lobe breath sounds was noted for the first time seven hours postsurgery and 18 hours postsurgery the chest roentgenogram shown in figure 1 was obtained. The respiratory rate was 36/min and arterial blood pressure 140/100 mmHg. He complained of severe chest pain and at a $F_{I_{O_2}}$ of 0.4, pH_a was 7.4, P_{aCO_2} 44 mmHg, P_{aO_2} 89 mmHg, and HCO_3^- 28 mEq/l. A diagnosis of intrathoracic hematoma and accumulated clot in the left pleural space was made and the patient was taken to the operating room for evacuation of the clot. Following induction of anesthesia with thiopental and succinyl-

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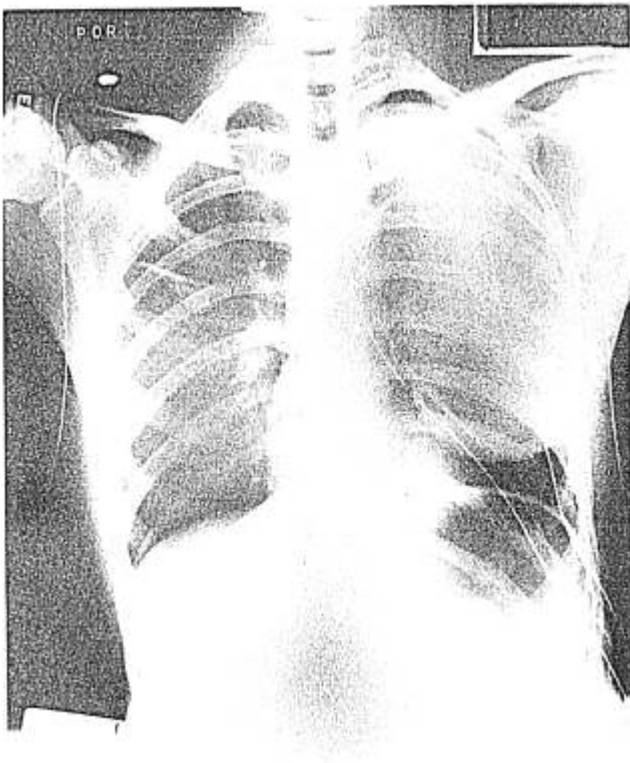


FIG. 1. Chest roentgenogram 18 hours postoperatively showing large left upper lobe mass.

choline, the trachea was intubated with an 8.0-mm ID, cuffed endotracheal tube and anesthesia was maintained with isoflurane and pancuronium in the right lateral decubitus position. When the chest was opened, the left upper lobe was noted to be tense and black and did not expand with ventilation. The left upper lobe had undergone a 180° torsion around its bronchial vascular pedicle. Immediately upon releasing the torsion, approximately 300 ml of blood gushed from the endotracheal tube. The patient was placed in Trendelenburg position, 10 cmH₂O of PEEP applied, and 2 g of iv methylprednisolone were given while bronchial lavage with normal saline was performed. At this point some expansion of the left upper lobe could be observed with about half the pulmonary tissue returning to its normal pink coloration. The lobe was left in place after suturing it to the inferior lobe for stability. Following closure, the patient was transferred to the Intensive Care Unit where a roentgenogram showed an infiltrate in the right lower lobe believed to be due to spillage of blood from the detorsed lobe. With a FI_O₂ of 0.5, pH_a was 7.36, Pa_CO₂ 35 mmHg, Pa_O₂ 162 mmHg, and HCO₃⁻ 25 mEq/l. Because of persistent bleeding from the endotracheal tube the trachea was intubated with a medium Carlen's double-lumen tube. A separate respirator was used for each lung and each lung was ventilated with a tidal volume of 400 ml, rate of 15/min and FI_O₂ 0.4 with PEEP of 5 cmH₂O added to the right lung. Values at these settings revealed a pH_a of 7.50, Pa_CO₂ 34 mmHg, Pa_O₂ 184 mmHg, and HCO₃⁻ 28 mEq/l. Two days later the trachea was extubated and with a FI_O₂ of 0.4, pH_a was 7.39, Pa_CO₂ 44 mmHg, Pa_O₂ 158 mmHg, and HCO₃⁻ of 28 mEq/l. The chest roentgenogram continued to show consolidation of the left upper lobe though air bronchograms could now be seen. A perfusion scan five days

postoperatively indicated a 50 per cent reduction in both perfusion and ventilation of the left upper lobe. Over the next two-week period, expansion of the left upper lobe progressed and repeat ventilation perfusion scan done 15 days postsurgery showed improved ventilation though perfusion continued to be reduced. A discharge roentgenogram 16 days postoperatively showed persistent loss of volume in the left hemithorax indicated by a leftward shift of the mediastinum.

DISCUSSION

Any patient having undergone an intrathoracic procedure who develops severe chest pain, signs of deteriorating respiratory function, and roentgenographic evidence of an enlarging intrathoracic mass during the postoperative period should be suspected of having pulmonary torsion. Other potential causes of a similar clinical picture include accumulated pleural clot from inadequately draining chest tubes, intrapulmonary hemorrhage from intraoperative trauma, and progressive atelectasis from bronchial obstruction. In each of these cases evolution of the clinical signs should occur within 24 hours following surgery. Both a ventilation perfusion study and bronchoscopy would be valuable in confirming a suspicion of pulmonary lobe torsion.

The anesthetic management and intraoperative safety of a patient who has torsion of the lobe would be greatly aided by insertion of a double-lumen endotracheal tube. By total isolation of one lung, soilage of the good lung from blood flowing from the detorsed lobe could be prevented. This would also isolate the affected lung if massive hemoptysis persisted, allowing some control over the amount of blood loss that could potentially occur. In the present case the decision not to place a double-lumen tube prior to reexploration could have been fatal if the massive intraoperative hemoptysis had persisted. This patient eventually required insertion of the double-lumen tube postoperatively due to spread of atelectasis to the right lung. This spread was presumed to be secondary to bleeding from the detorsed lobe as evidenced by the continued bleeding from the endotracheal tube. Though the cause of the bleeding was not known, the most likely etiology was a breakdown of the vascular integrity within the lobe during the ischemic period of torsion augmented by elevated venous pressure. Another advantage of a double-lumen tube in the postoperative period is the ability to perform differential lung ventilation. In our case, differential lung ventilation did not play a vital role, but it could have been very important if high levels of PEEP had been needed for reexpansion and maintenance of the affected lung tissue.

The anesthesiologist should also prepare for the rapid release of engorged blood accumulated in the lung parenchyma and bronchioles from the detorsed lobe by placing the patient in the Trendelenburg position. This

would be most helpful in patients with upper lobe torsions allowing hemorrhage to flow out of the endotracheal tube with minimal soilage of the lower lobe. Other intraoperative therapeutic modalities that the anesthesiologist should consider include the use of iv steroids to decrease any reactive pulmonary inflammation, use of PEEP to reexpand atelectatic lung tissue, and the use of saline lavage for the removal of any excess blood which might form clots in the normal airways, thereby obstructing good lung parenchyma.

Infarction of lung tissue induced by interruption of the vascular supply is difficult to produce in humans. This is due to the double arterial supply to pulmonary parenchyma tissue via the bronchial and pulmonary arterial circulations. Interruption of either the isolated pulmonary arterial⁴ or the bronchial arterial⁵ circulations normally will not lead to pulmonary parenchymal infarction. In addition, interruption or obstruction of the pulmonary venous supply while leading to engorgement of the lung and hemorrhage into the parenchyma, will rarely progress to infarction and secondary gangrene.⁶⁻⁸ In contrast, with torsion of a lobe about its pedicle, not only concurrent venous and arterial obstruction can occur, but in twisting, the bronchus also may become obstructed. This has been correlated with the production of infarction and infection of the affected lobe.^{1,3}

At present, several authors recommend that with such an occurrence the patient should undergo an immediate lobectomy.^{2,9} In our case, the torsion had compromised the left upper lobe bronchus and possibly the vascular drainage for a period of at least 17 hours (period during which the left upper lobe breath sounds were diminished). However, since reexpansion of the lobe following detorsion led to a return of pink coloration in some of the parenchyma, the lobe was left *in situ* in order to see if a return of function would occur. Over the two-week

period following re-operation a slow return of function was noted. This appears to be the first such reported instance of preservation of an engorged hemorrhagic lobe, though a case does exist of a nonischemic right middle lobe surviving which had become torsed spontaneously during an episode of pneumonia.¹⁰ Therefore, in similar cases, rather than lobectomy, consideration might be given to tacking the lobe back into normal position and observing it via ventilation perfusion scanning for return of function. Of course, during this period of observation any sign of sepsis or other indication that the lobe was undergoing gangrenous evolution needs to be treated by immediate lobectomy.

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