Considerations to Prevent Intraoperative Fluid Spillage Into the Airway From a Bronchogenic Cyst During Anesthesia: A Case Report

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In patients with bronchogenic cysts, spillage of cyst contents into the airway during anesthesia and surgery has been reported. Methods to prevent this complication are not definitive. A 21-year-old man with a large bronchogenic cyst was scheduled for cyst excision during which large quantities of purulent fluid spilled into the airway immediately after induction of anesthesia. This was due to unmasking of the existing communication between the cyst and the bronchial tree. Preoperative percutaneous drainage of the cyst contents, awake intubation, and lung isolation with a bronchial blocker before paralyzing and positioning the patient may be helpful. (A&A Practice. 2022;16:e01625.)

GLOSSARY

CT = computed tomography; **DLT** = double-lumen tube; **SLT** = single-lumen tube

Bronchogenic cysts are fluid or air-filled cysts arising from the primitive foregut and are usually located adjacent to the tracheobronchial tree or within the lung parenchyma.[1] Although predominantly seen in the pediatric age group, they are also seen in adults.[2] While some are asymptomatic, even these can be eventually life-threatening by producing compression, hemorrhage, infection, and rupture.[2] They are commonly treated by surgical resection because they represent an undiagnosed thoracic mass, and depending on the location or size, can cause cardiovascular compromise, respiratory distress, or lethal airway obstruction.[1] A few instances of cyst rupture and spillage into the airway immediately after anesthesia induction are reported.[3–5] Little is known about the mechanism and conceivable ways to prevent this serious complication. We propose that position-dependent spillage of the cyst contents, but not rupture, may be the cause of tracheobronchial tree contamination. We further suggest strategies to avoid this complication. Written informed consent from the patient for the publication of this case report has been obtained.

CASE DESCRIPTION

A 21-year-old man weighing 44 kg presented with a history of cough, intermittent episodes of fever, and hemoptysis for the past 5 years. He also had complaints of halitosis and difficulty lying supine for the past 2 years. He preferred to sleep in either the right lateral or in a sitting or prone position. Any attempt to lie supine induced a distressing cough. For the past few months, has a vigorous cough after eating. His functional status was >4 metabolic equivalents, and oxygen saturation was 99% on room air. A chest radiograph revealed a large cyst with an air-fluid level occupying the complete left hemithorax and displacing the trachea and heart to the right (Figure 1B). Computed tomography (CT) of the thorax (Figure 1A) was done in a prone position (as the patient could not lie supine) and revealed a thin-walled cystic lesion with an air-fluid level measuring 11 cm × 15 cm × 18 cm in its maximum dimensions occupying the middle mediastinum and compressing the underlying left lung. A provisional diagnosis of a bronchogenic cyst was made, and the patient was planned for a thoracotomy with cyst excision.

On the day of surgery, in addition to attaching routine monitors, a right radial artery catheter was placed before anesthesia induction. A thoracic epidural catheter was placed with the patient in a sitting position. Because the patient could not tolerate being supine, preoxygenation and anesthesia induction were planned with the patient in a right lateral position. Following induction and repositioning to supine, lung isolation using a double-lumen tube (DLT) was planned. But, toward the end of the anesthesia induction with intravenous propofol, the patient had a few bouts of coughing followed by the appearance of profuse, creamy, moderately thick, purulent fluid from the oral and nasal cavities. The patient was turned supine for intubation, but the fluid continued for the next 2 minutes, filling

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Accepted for publication July 18, 2022.

Funding: None.

The authors declare no conflict of interest.

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DOI: 10.1213/XAA.0000000000001625

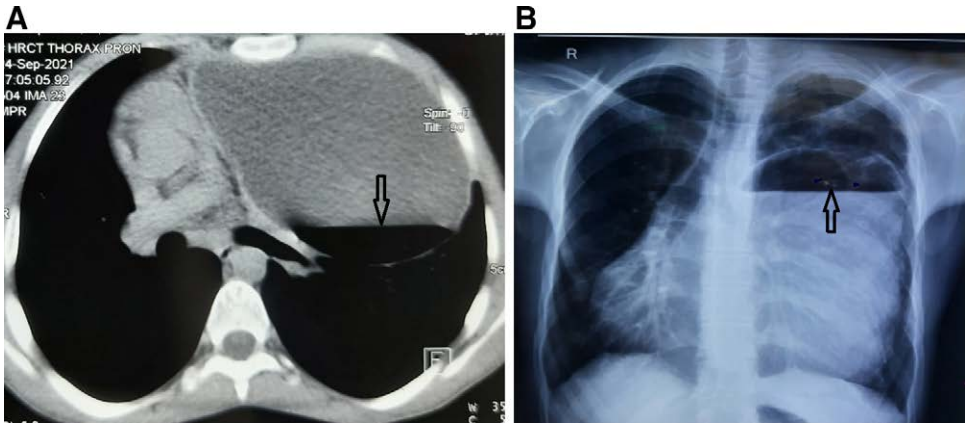

Figure 1. Chest imaging. A, High-resolution computed tomography of the thorax. A large bronchogenic cyst occupying the left hemithorax, pushing mediastinal structures to the right. The air-fluid level inside the cyst cavity (downward arrow) is inverted, as the CT scan was taken with the patient in a prone position. B, Chest radiograph (posteroanterior view) of the patient in the upright position. A horizontal air-fluid level (upright arrow) can be seen inside the cyst cavity.

the patient's oral and nasal cavities. Three minutes after induction, the patient was intubated using an 8.5-mm single-lumen tube (SLT) when the purulent fluid flow into the upper airways subsided. Even after intubation, the patient could not be ventilated as there was a continued need to suction the fluid through the SLT for the next 30 seconds. The patient was kept in a Trendelenburg position to drain the fluid. Approximately 1.5 L of purulent fluid was drained from the oral and nasal cavities over 3 to 4 minutes. By the time the patient could be ventilated, his oxygen saturation fell to 45% and his blood pressure to 63/36 mm Hg. Over the next 20 minutes, the oxygen saturation increased to 99% with 60% oxygen, the blood pressure was stabilized, and his peak airway pressure decreased to 22 cm H_2O from an initial value of 38 cm H_2O. Once favorable hemodynamics were attained, lung isolation was achieved using a left-sided 39-Fr DLT. The correct position of the DLT was confirmed by auscultation and bronchoscopy. After the cyst was opened, approximately 300 mL of residual fluid was present, which showed Gram-positive cocci. Posterosuperiorly, the cyst had 3 distinct openings (each measuring 2–3 mm in diameter) into the left upper lobe subsegmental bronchi. These openings were repaired, and the cyst wall was excised. The patient was hemodynamically stable, and blood gas parameters were satisfactory, so the trachea was extubated at the conclusion of surgery.

DISCUSSION

There are case reports describing bronchogenic cyst rupture and spillage of contents immediately after anesthesia induction,[3–5] but the pathophysiology and possible preventive measures are not clearly described. Our patient was examined in the preanesthesia clinic in a sitting position. The patient was moved to the operating room in the right lateral position. Unfortunately, his complaint of inability to lie supine was not considered significant during the preanesthesia visit, and was thought to be due to the large cyst compressing major broncho-vascular structures on the left side. Halitosis was also evident during the visit, but its clinical significance was not realized. On retrospective analysis of the intraoperative findings, it was realized that

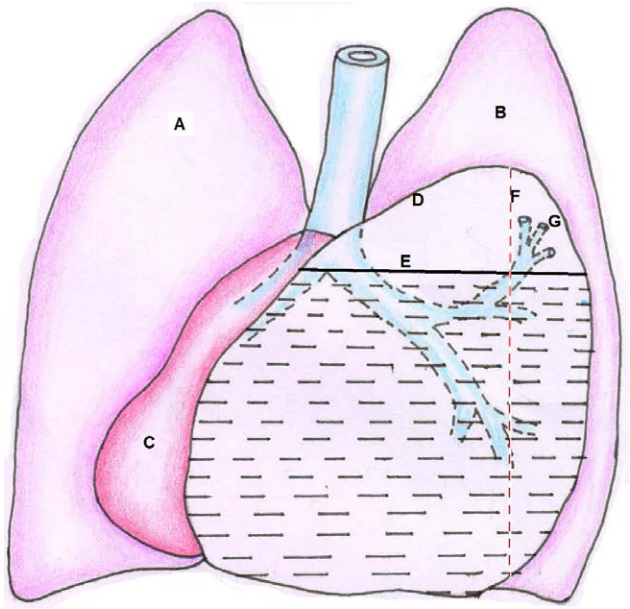

Figure 2. A sketch diagram showing the relationship of the air-fluid level and the left tracheobronchial tree. A, Right lung. B, Left lung. C, Heart which has been pushed to the right by the large bronchogenic cyst. D, The horizontal solid black line inside the cyst (E) shows the air-fluid level of the cyst when the patient is in the upright position. The vertical dotted red line (F) shows the air-fluid level when patient lies in the right lateral position. Note that the 3 openings of the left upper lobe subsegmental bronchi (G) into the cyst cavity are above the air-fluid level in both positions.

the cyst was communicating posterosuperiorly with the left subsegmental bronchi. So, in retrospective, by avoiding the supine position, the patient was trying to prevent the cyst fluid from spilling into the bronchi (Figure 2). The right lateral, sitting, and prone positions mitigated the fluid level of the cyst rising to the level of the communication with the bronchi in our patient (Figure 2). The supine or left lateral position allowed fluid in the cyst to communicate with the bronchial tree, triggering an incessant cough. After consuming a meal, the patient had coughing spells, which resolved after he expectorated purulent sputum. This may have been

caused by postprandial cephalad movement of the diaphragm due to gastric distension displacing the purulent fluid into the tracheobronchial tree, triggering cough. This resolved by deliberate expectoration of the fluid, decreasing the air-fluid level inside the cyst cavity below the communication level. One more interesting finding was the presence of halitosis due to communication between the cyst cavity containing purulent fluid and the airway. Halitosis in patients with bronchogenic cysts has not been reported.

The emptying of the cyst contents immediately following anesthesia induction in the right lateral position, even without positive pressure ventilation, may be due to cephalad movement of the diaphragm. Cephalad movement of the diaphragm might have increased the air-fluid level inside the cyst and brought the fluid into communication with the bronchial tree that led to the spillage. Turning the patient supine further increased the drainage. A similar case was reported in a 14-year-old girl who was unable to lie supine and underwent a large bronchogenic cyst excision.[3] She used to sleep either in a prone or sitting position and did not tolerate supine positioning during anesthesia induction similar to our patient. She was induced in a sitting position and on turning her supine for intubation, profuse, odorless, creamy, watery discharge was seen emerging from her oral and nasal cavities.[3] They described this event as a case of cyst rupture on induction of anesthesia. But, given the similarity of the presentation with our case, it is likely that turning the patient supine led to the spillage of contents through the existing communication rather than from rupture of the cyst. In both cases, the patients were adopting postures to prevent entry of fluid into the lower airways. Attempts to lay patients supine during anesthesia induction unmasked the connections. Airway spillage of cyst contents after anesthesia induction before muscle relaxation was reported in a 6-year-old child.[4] The inability to lie in a given position probably depends on the level of fluid in the cyst and the location of communication with the airway. Preoperative physical examination in different positions (right lateral, left lateral, prone or supine) may be helpful to discover occult communication between the cyst and the tracheobronchial tree.

CT-guided percutaneous aspiration of the cyst with a large needle and bleomycin sclerotherapy was found to be safe and effective in a limited series.[6] A safer way to approach the airway in patients like this is to percutaneously drain the fluid with a large-bore needle before administering anesthesia. If the cyst is not amenable to complete drainage due to technical or anatomical challenges, as much fluid as possible needs to be drained. An awake fiber-optic intubation using an SLT may be undertaken with assiduous attention to positioning, with an aim to maintain the greatest distance between the fluid and the bronchial communication. Then, the patient may be sedated and induced maintaining spontaneous ventilation (preferably) that facilitates lung isolation with the help of a bronchial blocker. Once satisfactory lung isolation is achieved, the patient may be paralyzed and placed in the optimal surgical position. The team should be prepared to suction the cyst contents if spillage occurs.

DISCLOSURES

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This manuscript was handled by: BobbieJean Sweitzer, MD, FACP.

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