Intraoperative Transesophageal Echocardiographic Evidence of SVC Compression by a Bronchogenic Cyst

Himani V. Bhatt, DO, MPA, Din Z. Kagalwala, DO, and Gregory W. Fischer, MD

Bronchogenic cysts are uncommon congenital lesions located within the mediastinum. These lesions usually are asymptomatic and rarely require surgical intervention. The authors present a unique case demonstrating intraoperative transesophageal echocardiographic evidence of superior vena cava (SVC) compression by a bronchogenic cyst without any preoperative clinical or sonographic evidence of vascular compromise. These findings suggest that transesophageal echocardiography (TEE) potentially can be a useful modality in monitoring mediastinal masses to manage patients and guide surgical excision during the intraoperative course.

CASE REPORT

A 33-year-old woman presented with substernal, nonradiating chest pressure and shortness of breath. These symptoms were exacerbated in the supine position. Her vital signs were stable, and the physical examination was negative for any significant findings. All her laboratory values, including a comprehensive metabolic panel, complete blood cell count with a differential, and coagulation studies, were within normal limits. A preoperative transesophageal echocardiogram (TEE) performed in the supine position was normal; however, a computed tomography angiogram of the chest revealed an 8-cm by 9-cm by 8-cm right upper mediastinal cystic lesion, consistent with a hemorrhagic or proteinaceous core. The lesion appeared to be situated between the right upper cardiac border and right main pulmonary artery, with some accompanying effacement of the right superior vena cava and right pulmonary artery without airway involvement. After a detailed discussion with the patient, she was scheduled for mass excision via median sternotomy.

On the day of surgery, the preoperative examination revealed mild lightheadedness and mild shortness of breath in the supine position. Vital signs were noted to be stable, with oxygen saturation (SpO2) equal to 100% on room air. The anesthetic plan, including an examination of preoperative imaging, was discussed with the surgical team and the patient was brought into the operating room. A 20-gauge left radial arterial catheter and large-bore intravenous catheter (IV) were placed and the patient positioned semi-upright with the head of the bed raised to approximately 30 degrees. Anesthesia was induced with midazolam, 2 mg, etomidate, 20 mg, and fentanyl, 150 µg. Once mask ventilation was established successfully, rocuronium, 50 mg, was administered, the patient intubated with a 7.5 cuffed endotracheal tube, and a transesophageal probe was placed. Subsequently, the patient was placed in a neutral position and a 9.0-French introducer was placed in the right internal jugular vein under ultrasonographic guidance. The anesthetic was maintained with isoflurane and intermittent boluses of fentanyl. Shortly after induction, the patient’s blood pressure decreased from 140/75 to 85/55 mmHg and the central venous pressure (CVP) was noted to be 18 to 20 mmHg and remained consistently between 6 and 12 mmHg for the remainder of treatment. The phenylephrine infusion could be stopped and a remifentanil infusion, 0.1 µg/kg/min started. After the procedure was finished, the patient was awakened from general anesthesia and extubated without any complications and transferred to the cardiothoracic intensive care unit (CTICU) in stable condition.

The postoperative course was uncomplicated and the patient was discharged home on the fifth postoperative day in stable condition. The pathology report of the excised lesion demonstrated a hemorrhagic respiratory epithelial-lined section consistent with a bronchogenic cyst.

DISCUSSION

Mediastinal cysts are responsible for 12% to 30% of all non-neoplastic primary based mediastinal masses. Classification of these cysts are commonly based on etiology and tissue of origin, including bronchogenic, mesothelial, and hydatid.

Bronchogenic cysts make up 7% to 15% of all mediastinal cysts and originate as sequestrations of the ventral foregut, the antecedent of the tracheobronchial tree. Bronchogenic cysts usually are located in the middle and posterior mediastinum. They are more common in women than men. Prevalence is frequent in the fourth and fifth decades of life, with a median age of 39. The cyst wall consists of ciliated, pseudostratified, columnar epithelium. They also can contain bronchial glands and cartilaginous plates. Bronchogenic cysts are symptomatic in 40% of cases and most commonly present with dyspnea and chest pain. These masses are best defined by computed tomography (CT) scanning, in which they appear as a discrete, nonenhancing homogenous density. On echocardiography they appear as thick-walled echodense masses. Most bronchogenic cyst are asymptomatic and discovered as an incidental finding;

From the Department of Cardiothoracic Anesthesiology, The Mount Sinai Medical Center, New York, NY.

Address correspondence and reprint requests to Himani V. Bhatt, DO, MPA, Department of Anesthesiology, One Gustave L. Levy Pl, PO Box 1010, New York, NY 10029-6574. FAX: (212) 876-3906. E-mail: Himani.bhatt@mountsinai.org

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however, most patients with bronchogenic cysts can become symptomatic over time. Treatment of bronchogenic cysts is based on symptomology and location. Symptomatic patients undergo surgical resection. The decision to approach the cyst via thoracotomy versus a median sternotomy is based on anatomic location and the size of the cyst. Surgical resection for the asymptomatic patient is controversial. Thus, these patients usually are followed radiographically.

Numerous case reports have been documented showing mediastinal bronchogenic cysts effacing surrounding structures, including pulmonary vessels, right ventricle, left atrium, and SVC. In all these reported cases the patients demonstrated characteristic symptoms of the structures being compressed. And, in most of the cases, a TTE confirmed compression of mediastinal structures by the cystic tumor. Sporadic reports of SVC compression by bronchogenic cysts have been published by others, with an occurrence rate of 3%.2

The authors present a case in which intraoperative TEE was able to demonstrate SVC compression from a bronchogenic cyst (see Fig 1). Unique to this case was the fact that the patient denied any characteristic features of SVC compression preoperatively, including edema of the head, neck, and upper extremities; distended neck veins; cyanosis; headache; and confusion. A preoperative transthoracic echocardiogram did not demonstrate any vascular involvement, and a CT scan revealed an 8-cm by 9-cm by 8-cm right upper mediastinal cystic lesion situated between the right upper cardiac border and right main pulmonary artery, with some accompanying effacement of the right superior vena cava.

Despite no clinical evidence of SVC syndrome, the authors found this mass compressing the SVC on intraoperative TEE exam (see Fig 1 and Video clip 1). The patient remained relatively hypotensive during this period, requiring intermittent use of fluid boluses, vasoactive medications, and slight left tilt of the bed dependent on surgical access. The intraoperative period before resection of the mass showed turbulent flow across the point of compression of the SVC, which varied based on bed positioning and surgical manipulation (see Fig 2 and Video 2). Left tilt of the bed was noted to mildly attenuate the SVC compression. The authors did not note any compression of the pulmonary artery, and the remaining TEE examination was otherwise normal. The SVC compression and hypotension were alleviated simultaneously by drainage (see Video clip 5) and...
complete resection of the mass (see Fig 3 and Video clip 3). The patient was hypertensive after resection of the mass, necessitating additional anesthetics and vasodilators to help maintain normal arterial pressures. TEE examination after mass excision demonstrated return of laminar flow through the prior point of compression (see Fig 4 and Video clip 4).

After induction of general anesthesia and muscle relaxation, the anatomic location of large mediastinal masses can shift, leading to compression of surrounding structures. Airway obstruction and hemodynamic compromise are the most feared complications. The anesthetic approach toward patients with mediastinal masses is dependent on the location and size of the tumor, with a common goal of hemodynamic stability and maintaining ventilation. A conservative method using awake fiberoptic intubation, or maintaining spontaneous ventilation, has been described as the preferred anesthetic technique by many authors secondary to the loss of chest wall muscle tone and airway patency after general anesthesia and muscle relaxation; however, a routine intravenous induction and intubation has been performed safely for mediastinal masses in patients who do not exhibit any symptoms or radiologic signs of airway/vascular compression. If airway compression or vascular compromise is of concern or the patient deteriorates after induction of general anesthesia, numerous techniques have been described, including preoperative airway stenting, rigid bronchoscopy, use of reinforced or double-lumen endotracheal tubes, changing patient position to attenuate tumor mass effect, and initiation of cardiopulmonary bypass.9,10 The CT scan on this patient showed signs of SVC and some right pulmonary artery effacement; however, there were no indications of airway compromise. Furthermore, the patient had mild preoperative symptoms without any classic signs of SVC syndrome or symptoms of airway involvement. Secondary to this preoperative information, the authors chose to perform a routine intravenous induction using a large-bore IV and intubation with preparation to initiate cardiopulmonary bypass as a precautionary measure. After induction in a semi-upright position, the authors were able to control the hypotension with intermittent fluid boluses, vasopressors, and bed positioning.

Detailed knowledge of the CT scan delineating the anatomic extent and severity of airway involvement or vascular compromise has been found to be adequate to structure an anesthetic plan for the management of patients with mediastinal masses. However, the dynamic nature of mediastinal masses often can lead to airway or cardiovascular compromise after induction of anesthesia, and real-time imaging, such as TEE, can be useful for intraoperative patient management. Although TTE has been used in the past, the detailed and real-time evaluation, which only TEE can provide intraoperatively, has been found to be effective in identifying and managing vascular compression secondary to mediastinal tumors.9 In addition, preoperative TTE may not identify vascular compression exaggerated by the initiation of general anesthesia and muscle relaxation seen on a perioperative TEE examination.9 This most likely explains the SVC compression noted on intraoperative TEE compared with the preoperative TTE in this patient.

In this case report the authors present intraoperative TEE evidence of SVC compression in a female patient presenting for resection of a bronchogenic cyst without demonstrating any classic clinical evidence of SVC compression during her preoperative evaluation. Her preoperative TTE showed no evidence of vascular compromise and CT showed some effacement of the SVC. Intraoperative TEE showed SVC narrowing and turbulent flow through the area of compression. This finding corresponded to intraoperative elevations in CVP and hypotension. After complete resection of the mass, CVP declined and laminar flow was seen in the SVC. The use of intraoperative TEE aided in the diagnosis and management of the SVC compression with this patient. It is concluded that TEE can be a useful imaging modality to monitor intraoperative course, guide management, and evaluate surgical excision in patients with mediastinal masses.

APPENDIX A. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1053/j.jvca.2013.10.012.

REFERENCES