

# The Anesthetic Considerations for a Patient with a Giant Fibrous Tumor of the Left Hemithorax

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## Abstract

We present the case of a 47-year-old female with worsening respiratory symptoms secondary to a giant mass in her chest. The tumor was diagnosed as solitary fibrous tumor of the pleura and she was elected to undergo resection of this tumor under general anesthesia. We discuss the unique features of this tumor and anesthetic management we chose in an anticipation of possible respiratory and/or cardiovascular collapse in induction or during maintenance of general anesthesia.

We highlight the importance of a multidisciplinary approach to this case and also how we used cardiopulmonary bypass as a rescue plan immediately available if any complication might arise intraoperatively. To our knowledge this is first report of successful anesthetic management of this extremely rare cancer in anesthesia literature.

## Keywords

Solitary fibrous tumor; Thoracic mass; Cardiopulmonary bypass; Anesthetic management

## Introduction

Solitary fibrous tumor of the pleura (SFTP) is a rare mesenchymal neoplasm which accounts for less than 5% of all pleural tumors with an incidence of 2.8 per 100000 registered hospital patients [1,2]. SFTPs are often misdiagnosed because of their vague clinical presentation and non-specific radiologic findings [3].

Surgical resection of the tumor is the treatment of choice for almost all cases with the intention of achieving complete en-bloc resection. The typical surgical approach is an anterolateral or posterolateral thoracotomy in most cases, whereas median sternotomy is reserved when there is suspected mediastinal vascular involvement [4].

Anesthetic management of patients with a large intrathoracic mass is associated with significant respiratory and cardiovascular complications due to the compression of the tracheobronchial tree, large vessels (especially superior vena cava, thoracic aorta, and pulmonary arteries), lungs, and heart. Any of these complications are potentially catastrophic if neither anticipated nor managed properly. Anesthetic management of a patient with a mediastinal mass has been described by many authors [5-11]. However, there is a paucity of literature regarding the optimal perioperative management of this rare tumor.

## Case Report

A 47-year-old woman (non-smoker, weight 53 kg, height 155 cm) was admitted through the emergency department with progressive dyspnea, left sided pleuritic chest pain, and a 40 pound weight loss over a three month period.

On physical examination, the patient was tachypneic and had an oxygen saturation of 90% on 4L/min oxygen via a nasal cannula. Emergency endotracheal intubation was required due to worsening hypoxia and altered mental status and she was admitted to intensive care unit (ICU).

A chest x-ray showed a large left pleural effusion with mediastinal shift (Figure 1). Computed tomography (CT) / angiography of the chest demonstrated a heterogeneous hypervascular necrotic 24 cm by 18 cm mass occupying the entire left hemithorax (Figure 2). There was severe mass effect on the heart, mediastinum, and the left lung resulting in complete left lung collapse, severe narrowing of the left pulmonary artery, and a rightward shift of mediastinum and heart. CT-guided needle biopsy of the mass was consistent with SFTP.

Preoperative transthoracic echocardiography demonstrated normal left ventricular function, mild right ventricular dilation, and severe pulmonary hypertension (pulmonary artery systolic pressure measured > 60 mmHg). After discussion between the cardiothoracic surgery and cardiac anesthesiology teams, the surgical approach was planned as an exploratory left thoracotomy with a planned en-bloc resection of the tumor.

Preoperatively in the ICU, her trachea remained intubated; she received minimal sedation in order to maintain spontaneous ventilation. She had peak airway pressures to 40 cmH<sub>2</sub>O and was able to achieve tidal volumes of only 200 -220 ml. En-route to the operating room (OR) the patient received 1 mg intravenous (IV) midazolam, and was connected to OR ventilator receiving 100% oxygen while spontaneous ventilation was maintained. Pre-induction vital signs were: blood pressure 138/68 mmHg, heart rate 122 beats/min, respiratory rate 30 breaths/min, and oxygen saturation 91% on 100% oxygen. While still awake, the patient's femoral artery and vein were cannulated under local anesthesia for the possible institution of cardiopulmonary bypass pump (CPB).

The CPB machine was primed and a perfusionist was present in the OR. Once the femoral vessels were cannulated, anesthesia was induced via the slow titration of increasing doses of sevoflurane and IV narcotics. Neuromuscular blocker (rocuronium) was given once it was deemed that the patient was able to tolerate an appropriate degree of anesthetic depth with the volatile anesthetic.

Mechanical ventilation was achieved with pressure-controlled ventilation (PCV) mode to keep peak airway pressures below 40 cmH<sub>2</sub>O with tidal volumes of 200 to 250 ml. Lung isolation was achieved with a 7-French wire guided endobronchial blocker (Arndt blocker, Bloomington, IN, USA) placed into the left main bronchus with placement confirmed via fiberoptic bronchoscopy. A left hemi-clamshell thoracotomy (a partial vertical median sternotomy combined with an anterior thoracotomy in the 4th intercostal space) was performed for resection of the tumor. Positive-pressure ventilation was maintained throughout the case without the need for CPB. The intraoperative course was complicated by massive hemorrhage from feeding arteries originating from the mediastinum necessitating transfusion of 6 units of packed red blood cells, 2 units of fresh frozen plasma, and 2 units of platelets.

In addition to the mass resection, a left lower lobectomy was also necessary because of dense adhesions. A giant mass was resected and sent for pathology. The patient remained hemodynamically stable for the remainder of the surgery and was transferred to ICU in stable condition. Her postoperative course was uneventful and follow-up imaging demonstrated full expansion of the remaining left lung. She was extubated on postoperative day one, her respiratory status improved significantly, and the balance of her hospital course was uneventful. She was discharged home on postoperative day six. The diagnosis of a benign SFTP without malignant features was confirmed on pathology examination.

## Discussion

The first pathologic description of SFTP was published by Klepner in 1931 and a submesothelial layer (a stromal layer under mesothelial layer) was proposed as the origin of the tumor [12]. This was later confirmed by advances in immunohistochemical, flow cytometry, and electron microscopic studies [13]. SFTPs are usually benign but malignant tumors have been reported in up to 20% of the cases [14]. The majority of patients present with non-specific symptoms such as chronic cough, dyspnea, and chest pain. Other rare presentations may include hemoptysis, weight loss, and fatigue [1,15,16]. SFTPs may be associated with paraneoplastic syndromes such as hypoglycemia secondary to insulin-like growth factor secretion (Doege-Potter Syndrome) or hypertrophic pulmonary osteoarthropathy described as clubbed fingers and arthritis (Pierre-Marie-Bamberg syndrome) [15].

A chest radiograph and CT scan of the chest are essential preoperative imaging studies to evaluate the extent of the disease and involvement of other major organs. However, radiological findings are not characteristic for SFTPs and differentiation between benign and malignant forms is impossible based on imaging [17].

En-bloc resection of the tumor using an anterolateral or posterolateral thoracotomy is the mainstay of the treatment for most cases [4,6]. Complete surgical excision with underlying tissue removal minimizes the risk of recurrence [18]. Video assisted thoracic surgery (VATS) has been used for small pediculated tumors [19].

The prognosis of SFTPs is favorable with a 5-year survival rate between 79% to 100% [4,16,18]. Perioperative management of these tumors is complicated by multiple factors. Complete obstruction of the airway below the level of endotracheal tube during induction, maintenance of anesthesia, or even with positioning is a major concern in management of these cases. This obstruction has been related to the loss of muscular tone by anesthetic agents resulting in complete collapse of airway [5]. This fatal complication has been well described in patients with a mediastinal mass compressing trachea in both adults and children with an incidence of 7% to 18%. Awake fiberoptic intubation and maintenance of spontaneous ventilation have been proposed as reasonable options to avoid this life-threatening complication until the airway is completely secured or another safe alternative is immediately available [6-8].

Pulmonary artery compression by a large intrathoracic mass and life threatening hypoxia is another concern which has been described by Hall et al [9]. In this case hypoxia was not evident in different positions as the patient was awake and severe hypoxia occurred only after induction of anesthesia and presumably loss of muscular tone in the thoracic cavity [9].

Mediastinal mass effect on the cardiovascular system has been evaluated in an animal model by Johnson et al [20]. This study showed that compression of the pulmonary artery by a mass may cause right ventricular (RV) distension and failure. RV distension will result in left ventricular (LV) compression and impairment of cardiac output. This phenomenon is described as ventricular interdependence [20].

There are case reports in the literature advocating cardiopulmonary bypass as a rescue measure if airway obstruction or hemodynamic collapse is anticipated in patients with mediastinal masses [5,10,11]. It has been recommended that groin cannulation is performed and CPB is ready to initiate in order to avoid the ischemic interval during emergent cannulation that may result in significant hypoxic neurologic injury [21].

Another concern with large masses compressing the lung is re-expansion pulmonary edema in postoperative course [22]. This rare complication usually develops within 24 hours following re-expansion of the collapsed lung and is characterized by acute arterial hypoxemia, decreased pulmonary compliance, and patchy or diffuse alveolar infiltrates in the re-expanded lung [22]. The exact pathogenesis of this phenomenon is unknown but increased permeability of pulmonary capillaries, ischemia reperfusion injury, free radicals, decreased functional surfactant, atelectasis, prolonged hypoperfusion, hypoxia, and decreased lymphatic drainage all may play a role. The treatment is supportive with the use of positive-pressure mechanical ventilation postoperatively, diuretics, and hemodynamic support [22-24].

## Figures



This case represents the first report of a giant thoracic SFTP. Our patient was felt to be at significant risk for airway obstruction and cardiovascular collapse during anesthesia induction; hence, it was decided that pre-induction femoro femoral cannulation to be prudent as a preparation for urgent transition to CPB should the patient decompensate at any time of operation. This case illustrates that management of large thoracic masses requires a multidisciplinary approach to formulate an individualized perioperative plan to obviate the potential catastrophic complications associated with these masses.

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