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Case Report

Cesarean Delivery in the Bronchoscopy Suite in a Patient with an Anterior Mediastinal Mass

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ABSTRACT

Mediastinal masses pose a significant challenge for anesthesiologists due to the risk of cardiorespiratory collapse. Pregnancy in of itself causes multiple detrimental changes to respiratory physiology. We present a case of cesarean delivery performed in the bronchoscopy suite followed by bronchoscopic airway evaluation in a patient at 33 weeks gestation with symptomatic anterior mediastinal mass. We discuss the multidisciplinary approach and anaesthetic management of this complicated case.

Introduction

Mediastinal masses are known to be a risk for cardiopulmonary complications, particularly during general anaesthesia. In addition, the physiologic changes of pregnancy can lead to a variety of well-known complications for the anesthesiologist. Complicated, interdisciplinary cases require significant preparation and consultation with various surgical and non-surgical services to ensure proper patient safety. We present a challenging case of a caesarean delivery and bronchoscopic examination in a 33-year-old pregnant female with a symptomatic anterior mediastinal mass.

Case Report

We report a case of a 33-year-old female patient with a history of fibrosing mediastinitis secondary to chronic histoplasmosis and eosinophilic esophagitis. Her condition had been stable for several years, and her primary providers felt that she should be allowed to become pregnant. The patient successfully conceived and had a relatively uneventful pregnancy up until she was 29-week gestation. At that point, she began to develop chest pain, worse in the supine position, which gradually exacerbated over 1-2 months. She had multiple visits to the emergency department during that time and had been treated with antibiotics and steroids. No imaging like computer tomography was performed due to her pregnancy.

Over time she also developed pain on deep inspiration and a cough with shortness of breath. These symptoms began to significantly interfere with her ability to function on a daily basis. She presented to the emergency department when she was 33 weeks pregnant due to the worsening of her symptoms. An EKG noted diffuse ST elevations, and an echocardiogram demonstrated a moderate pericardial effusion without tamponade physiology. A CAT scan was performed, showing a large anterior mediastinal mass which was compressing the trachea, superior vena cava and right subclavian and jugular veins with a moderate pericardial effusion (Figure 1). Her shortness of breath rapidly progressed to the point where she could not breath lying supine. She also

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had continuing chest pain and a cough. She was evaluated by the interventional pulmonology team, which indicated an urgent surgical evaluation and management of the anterior mediastinal mass with biopsy and stenting.

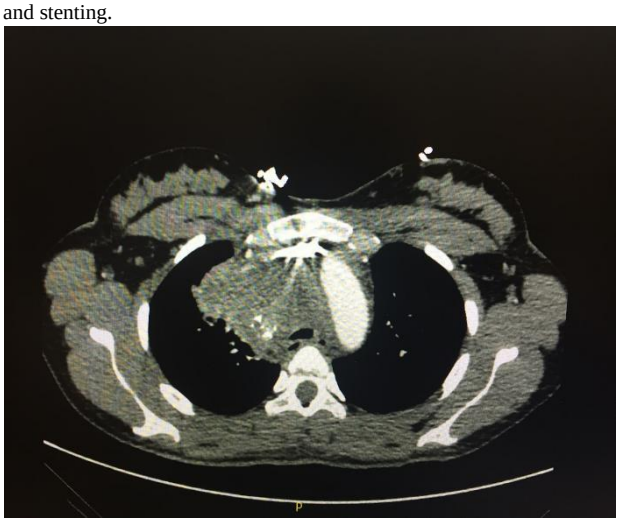

Figure 1: CT of chest exhibiting mediastinal mass.

A multidisciplinary team consisting of anaesthesia, cardiothoracic surgery, obstetrics, neonatology, and pulmonology was gathered at short notice to discuss the plan of management for the patient. The interventional pulmonary team proposed to proceed with airway examination under general anaesthesia and potential airway stenting using a rigid bronchoscope. After weighing risks and benefits, the multidisciplinary team agreed, that the baby should be delivered first due to the potential of hypoxemia during rigid bronchoscopy, and stenting, which could compromise the fetus. Another topic of discussion was the location of the delivery. It was decided that if complete airway collapse were to occur, the emergency treatment would involve placement of a rigid bronchoscope and the pulmonologists were most comfortable performing the procedure in the bronchoscopy suite. On the other hand, the obstetric surgeons felt most comfortable performing a cesarean delivery in the obstetric suite, but ultimately agreed to perform the surgery in the bronchoscopy suite. Cardiothoracic surgery agreed to be standby for emergency cardiothoracic surgery, including extra-corporal membrane oxygenation (ECMO) initiation- if emergently needed.

The patient was brought to the procedure room in the bronchoscopy suite and a multidisciplinary huddle was performed with the patient. The obstetric team agreed to perform the caesarean delivery in the semi-recumbent position (30 degrees) to as the patient could not lie supine due to her shortness of breath. We planned a combined spinal-epidural for the cesarean delivery, followed by a fiberoptic guided awake intubation under spontaneous ventilation for the subsequent bronchoscopic intervention, followed by rigid bronchoscopy for stent placement if needed.

Standard American Society of Anesthesiologists (ASA) monitors plus intraarterial continuous blood pressure surveillance had been applied. A 16-gauge IV catheter was placed in the upper extremity. Thereafter, a combined spinal-epidural was placed using the needle through needle technique. The spinal was dosed with 7.5 mg of hyperbaric bupivacaine and 100 mcg morphine. The epidural catheter was then threaded. Afterward, a femoral introducer catheter for central venous access was placed under ultrasound guidance. The femoral access could potentially be wire exchanged for femoral vein cannulation if emergency initiation of ECMO was required. As the femoral central line was being placed, the epidural was gradually dosed with 2% lidocaine to a sensory level of T4. The patient tolerated this well and did not experience worsening shortness of breath. Fetal monitoring was performed throughout and was reassuring.

The abdomen was prepped and draped and both groins were prepped for potential cannulation. The caesarean delivery proceeded uneventfully, and a healthy baby boy was delivered with Apgar scores of 8 at 1 minute and 9 at 5 minutes. During externalization of the uterus and closure, the patient began to complain of pain and discomfort. Ketamine 20 mg was administered as well as an additional 10 cc of 2% lidocaine to the epidural. Her pain continued to worsen, and she became distressed. At this point, we had been concerned, that the epidural catheter became displaced or was at least insufficient. Considering that closure of the abdomen, bronchoscopy, airway evaluation and potential airway stenting still needed to be performed, we decided to induce general anaesthesia. We elected to induce general anaesthesia with sevoflurane inhalation with the maintenance of spontaneous ventilation. When she was sufficiently deeply anaesthetized, we inserted a supraglottic airway (SGA). The patient maintained spontaneous ventilation throughout. Our plan was to continue spontaneous ventilation and perform the bronchoscopic procedure via the SGA, and remove the SGA and insert the rigid bronchoscope, if needed. Bronchoscopic examination of the airway through the SGA showed extrinsic compression in mid-distal trachea, right and left mainstem bronchi with effacement of the cartilages and erythema and prominent vasculature.

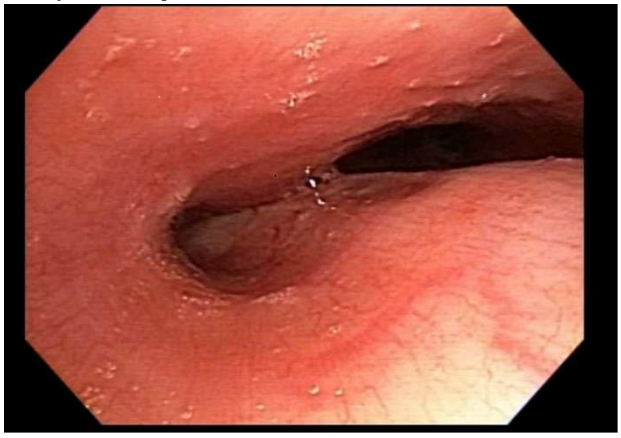

Figure 2: Tracheal compression seen on bronchoscopy.

The airway lumen was significantly compressed in the distal trachea to 50% (Figure 2). The compressed trachea was successfully traversed. Erythema was found throughout the tracheobronchial tree. Notable purulent secretions were found throughout the tracheobronchial tree, mostly in the right upper lobe. The standard bronchoscope was withdrawn, and the convex probe endobronchial ultrasound (EBUS) bronchoscope was inserted through the same route. Rapid On-Site Evaluation (ROSE) preliminary cytology was suggestive of benign inflammatory changes, necrosis, and pus in the right lower paratracheal region. As pathology suggested a more infective process than a neoplastic process, the pulmonologists opted not to perform a stent. They hoped that treating the infection medically, in combination with the improvement in functional residual capacity (FRC) following delivery,

would be sufficient to allow recovery of her compromised pulmonary status.

The patient was emerged from anaesthesia and successfully recovered in the post-natal unit. She had a prolonged hospital stay thereafter. Her postoperative course was complicated by a large pericardial effusion requiring a pericardial window and need for thoracentesis and mediastinoscopy. Her cultures grew *Streptococcus intermedius*, and she was successfully treated with antibiotics. It was thought that she had developed multiple mediastinal abscesses from an esophageal perforation secondary to a calcified lymph node. She was eventually discharged home in a stable condition.

Discussion

Mediastinal masses pose a significant challenge for anesthesiologists due to the risk of cardio-respiratory collapse [1]. Pregnancy in of itself causes multiple detrimental changes to respiratory physiology. Pregnant women have a reduced FRC along with an increased blood volume and swelling, which can diminish respiratory reserve in the patient [2]. The most common cause of mediastinal masses in pregnancy is Hodgkin's Lymphoma [3]. Pregnancy can make the diagnosis of a developing mediastinal mass difficult as the symptoms produced by the mass may be similar to symptoms from the normal physiological changes of pregnancy coupled with the reluctance to perform imaging on a pregnant patient [1]. Signs and symptoms usually consist of a cough, chest pain, dyspnea, orthopnea, superior vena cava syndrome, syncope, and dysphagia [4].

The combination of both a mediastinal mass and pregnancy, as presented in this case, is rare but extremely complicated, especially when anaesthesia is required. Pre-operative planning was crucial for the success of this case. Evaluation of the mass effect on the airway and major vessels, consideration of potential adverse consequences due to anaesthesia or surgical manipulation is mandatory. In our situation, a focused history and examination and appropriate discussion with, and availability of consultants resulted in a successful procedure.

In the case presented, there were many anaesthetic concerns that needed to be addressed before deciding the best anaesthetic plan for our patient. Choosing the correct anaesthetic technique is important as each technique has its own respective associated complications. Cesarean delivery could be performed with either general or regional anaesthesia, although regional anaesthesia is the preferred anaesthesia technique. However, general anaesthesia was required for the bronchoscopy and possible airway stenting portion of the procedure.

An anterior mediastinal mass can cause complete airway collapse when general anaesthesia is induced, and spontaneous ventilation is ablated. This can occur not only during induction but also during maintenance, positioning, and the emergence of anaesthesia. During spontaneous ventilation, the normal transpulmonary pressure gradient distends the airways and helps to maintain patent airways even in the presence of extrinsic compression. When this distending pressure is lost with positive pressure ventilation, the muscles of the chest wall and bronchi relax. The reduction in the size of the airways augments the effect of extrinsic compression. Even without the use of neuromuscular blockade, the loss of transpulmonary pressure gradient with positive pressure ventilation can lead to airway collapse. It is especially important to maintain spontaneous ventilation when anaesthetizing a patient with an anterior mediastinal mass [5-9]. Thus, general anaesthesia with awake intubation and maintenance of spontaneous ventilation was our priority for flexible bronchoscopy with possible rigid bronchoscopy and stenting.

Other potential hazards caused by mediastinal masses include SVC syndrome, pulmonary artery, and cardiac compression. Blank *et al*. described risk stratification of patients with mediastinal masses, with the patient being at either low, intermediate, or high risk of cardiovascular collapse based on symptoms and radiological evidence of tracheal compression [10]. Patients who have a tracheal compression of more than 50% are at high risk of complete airway collapse and serious consideration should be given to cannulation the femoral vessels in preparation for cardiopulmonary bypass [8]. The presence of cardiothoracic surgery with ECMO primed and ready in the procedure room was an essential consideration in case complete cardiovascular collapse were to occur.

We deliberated whether the caesarean delivery should be performed under regional or general anaesthesia. Regional would ensure a spontaneously breathing patient; however, we were concerned that the patient's respiratory function would deteriorate further during the caesarean delivery after initiation of regional anaesthesia due to chest wall anaesthesia. We were also concerned that she would not tolerate the semi-recumbent position required for the procedure. However, induction of general anaesthesia in a pregnant patient with an anterior mediastinal mass, even with the maintenance of spontaneous ventilation could lead to complete airway collapse. Spontaneous ventilation does not guarantee prevention of airway collapse. Decreased functional residual capacity and loss of muscle tone under general anaesthesia may be enough to cause a total collapse [4]. If this were to occur, positioning in the prone position to relieve airway pressure would be difficult with a gravid uterus.

General anaesthesia also exposes the fetus to anaesthetic medications and most mothers prefer to be awake and present for the birth of their child. There are several reported cases in the literature of pregnant patients with mediastinal masses having cesarean deliveries under regional anaesthesia [1, 11]. There are also reports of general anaesthesia being used due to patient's inability to lay supine for the procedure [12]. The benefit of general anaesthesia in our case would have been one anaesthetic only, performed for both procedures. However, the risk of total airway collapse during induction and difficulty with placing the patient in the prone "rescue" position, which would compromise both mother and baby, steered us towards the decision of regional anaesthesia for the cesarean delivery. Therefore, we proceeded with regional anaesthesia for the cesarean delivery followed by general anaesthesia with the maintenance of spontaneous ventilation for the airway exam and stenting. We performed a combined spinal-epidural with a low dose spinal followed by slow titration of the epidural to allow for better hemodynamic stability and supplementation of the block if required.

Our initial plan for awake fiberoptic upon completion of the cesarean delivery was adjusted when the patient was no longer able to tolerate closure of her incision. The pulmonologist requested to do an airway exam with biopsy first via EBUS before deciding on rigid bronchoscopy and stenting. The decision was made to induce general anaesthesia and

place an SGA even though the patient was at an elevated aspiration risk. We proceeded to induce general anaesthesia with sevoflurane mask induction with the maintenance of spontaneous ventilation. Should stenting of the airway have been needed, our plan was to remove the SGA and proceeded with rigid bronchoscopy and stenting. Our plan was to maintain anaesthesia and spontaneous ventilation with a ketamine infusion in this situation. Ketamine has the advantage of not obliterating spontaneous ventilation [13, 14]. Fortunately, the etiology appeared infectious, and stenting was not needed. The procedure was successful and the mother and baby both recovered successfully.

Conclusion

We present a case of the management of a cesarean delivery in the bronchoscopy suite prior to bronchoscopy due to the presence of a symptomatic mediastinal mass in a pregnant patient. This case was challenging not only because of the symptomatic mediastinal mass but also the physiologic changes of pregnancy. A multidisciplinary team approach and collaboration are crucial in these situations, as is meticulous planning. Choosing the correct anaesthetic technique is important as each technique has its own respective associated complications. In summary, mediastinal mass can be exceedingly difficult to manage. The proper evaluation must be completed pre-operatively, and a multidisciplinary team should be involved to ensure a safe anaesthetic.

Conflicts of Interest

None.

Author Contributions

Conception and design: Ursula Galway, Kurt Ruetzler; Administrative support: none; Manuscript writing: Ursula Galway, Kurt Ruetzler, Tom Gildea, Evan Parker; Final approval of manuscript: Ursula Galway, Kurt Ruetzler, Tom Gildea, Evan Parker.

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