Resection of a mature giant teratoma with clamshell incision thoracotomy approach: Case report and literature review

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ABSTRACT

Introduction: Resection of giant teratomas can be challenging. An advanced surgical technique should be designed to ensure surgical safety and complete removal of giant teratomas. We describe a case of a mature giant teratoma successfully resected with a clamshell incision thoracotomy approach.

Case Description: A female, 11 years complained of shortness of breath for the last two weeks before being admitted to the hospital. Physical examination revealed a retraction of the patient’s chest wall, decreased breath sounds in the left lung field, and dull percussion in the left lung field. Chest CT scan with contrast was carried out with a minimal right pleural effusion with mediastinal mass size 14 x 17 x 16 cm. The patient underwent surgery to extract the mediastinal mass; an anterior thoracotomy was performed using the Clamshell incision method on the patient’s chest. Complete resection of the mass was performed. Histopathology examination was performed on the mass with the results in accordance with the description of Mature Cystic Teratoma. The patient returned home in good condition and then controlled through the outpatient polyclinic.

Discussion: Clamshell incisions provide enough exposure for tumors in the mediastinum that extend into the thoracic cavity. For complete removal of a gigantic teratoma, extensive surgical and visual fields are required, as in this case.

Conclusion: Clamshell incisions in anterior thoracotomy give a good surgical field and can be safely performed in patients with large mediastinal teratomas.

Keywords: giant teratoma, clamshell incision, thoracotomy.

INTRODUCTION

Infant and early adults can develop mediastinal mass, the most frequent of which are thymomas or teratomas.1 Teratoma are tumors that arise from one of the three germ layers. Teratomas are tumors that arise from the ectoderm, endoderm, and mesoderm, but they can also occur from a single germ layer.2 The sacrocaudal area (35–60%) and mediastinum (15%), rarely stomach (1%), and retroperitoneal space (5%) are the most prevalent locations.3

In mediastinal teratoma, patients are often asymptomatic, and the tumor is discovered incidentally on chest radiographs for other reasons.4 Large tumors may produce mass-effect symptoms due to compression of mediastinal structures. Patients may present with cough, dyspnea, chest pain, or pulmonary infection.4

Resection of giant teratomas can be challenging. When it comes to giant mediastinal teratomas, the surgical technique is crucial. When planning for resection, the operating surgeon should consider several issues. Despite the mass size, patients with teratomas rarely experience substantial symptoms; nonetheless, the mass effect can be significant.5 Preoperative simulation of the surgical position may aid in anticipating the risk of hypotension, which is thought to be caused by heart compression and a decrease in preload.4 This could change the surgical strategy because the patient may not be able to tolerate a supine posture for clamshell/median sternotomy or a lateral decubitus position for thoracotomy.

The benign or malignant nature of the teratoma, en bloc excision or piecemeal debulking, tumor size and location, relationships between the tumor and the accompanying important tissues, and the surgeon’s experience all play a part in the surgical strategy.4 To ensure surgical safety and complete removal of giant teratomas, an advanced surgical technique should be designed.

The clamshell incision was first used in cardiac surgery and was later rediscovered as a way to improve access to bilateral lung transplantation. Bains and associates demonstrated its utility for several malignant disorders in 1994.4

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This incision is mostly used for big mediastinal tumors in today’s minimally invasive thoracic surgery. Compared to a median sternotomy, the clamshell incision provides the best exposure. It enables good bilateral chest exposure and relieves pressure on important tissues during mass handling when dealing with large tumors. On the other hand, while median sternotomy provides sufficient vertical mediastinum exposure, it may not provide appropriate exposure to tumor portions that extend into the hemithoraces.

The use of a clamshell incision necessitates a thorough preoperative assessment of imaging, as well as knowledge of the deranged anatomy, critical surgical processes, and probable physiological difficulties connected with handling a large mediastinal tumor. We describe a case of a mature giant teratoma successfully resected with a clamshell thoracotomy approach.

**CASE DESCRIPTION**

A female patient aged 11 years complained of shortness of breath for the last two weeks and then worsened two days before admission to the hospital, accompanied by fever that had been felt for the last three days. The patient also complains of shortness of breath, especially during activity. The patient is also a child with nutritional status of underweight, stunting and malnutrition. During the last two weeks, the patient felt more comfortable with the left side position; when sleeping on his back, the patient felt his chest felt heavy and full.

On examination, the patient appeared alert but weak. Vital signs showed blood pressure 100/70 mmHg, heart rate 125x per minute, and respiratory rate 24x per minute, indicating 95% oxygen saturation with a non-rebreathing mask of oxygen, 15 liters per minute. The patient is 128 cm tall and weighs 20 kg. Physical examination also revealed a retraction of the patient’s chest wall, decreased breath sounds in the left lung field, and dull percussion in the left lung field. A chest X-ray and chest CT scan with contrast were carried out, with the results finding a minimal right pleural effusion with an inhomogeneous mediastinal mass in the left hemithorax that extends to the anterior mediastinum, the mass density is mainly cystic, and with septation, and with a fatty, solid and multiple calcified components. The mass seemed to push the heart to the right and cause the left lung to collapse. The largest mass size is about 14 x 17 x 16 cm

The patient underwent surgery to extract the mediastinal mass; an anterior thoracotomy was performed using the Clamshell incision method on the patient’s chest. A transverse incision was made to form the letter ‘W’ in the 5th intercostal space, opened layer by layer, ligated the left and right internal mammary arteries and then cut the sternum 1/3 distal with a sternum saw.
A mass was found in the patient’s left hemithorax, which compresses the left lung until it collapses and pushes the heart to the right. Complete resection of the mass suspected of being a teratoma was performed.

The mass was split open and found the formation of hairs and teeth in the mass proved a teratoma. Then an anatomical pathology examination was performed on the mass with the results in accordance with the description of Mature Cystic Teratoma. The tumor mass that was successfully resected was 12x11x9 cm and weighed 469gr.

The patient was placed on a thoracostomy chest tube on the right and left hemithorax. The patient was treated in the Pediatric Intensive Care Unit for three days after surgery until the patient was able to breathe well and for seven days in a normal room. For the lungs to expand properly after surgery, chest physiotherapy is performed.

The patient returned home in good condition and then controlled through the outpatient polyclinic. The surgical wound looks good, and the patient’s respiratory complaints have disappeared. Currently, the patient is focused on improving his nutritional status with the pediatrician.

**DISCUSSION**

The most prevalent location of chest masses in children is in the mediastinum. Giant mediastinal tumors can provide unique excision issues, such as circulatory collapse during anesthetic induction and harm to nearby structures that may be crushed, displaced, or infiltrated by the mass. Rather than invading neighboring structures, mature teratomas tend to displace them. The primary stay of therapy is total excision, which has a very good prognosis. Teratomas in the mediastinum can cause respiratory inefficiency in neonates and infants, posing a direct threat to the child’s life. The majority of mediastinal teratomas are operated on shortly after birth or during the first few months of life. Thoracic teratomas can, however, be misdiagnosed late.

In the case of a mediastinal tumor, many surgical techniques should be considered, especially in the case of a massive mediastinal tumor. Resecting mediastinal tumors by a median sternotomy is a routine procedure. However, it may not provide enough exposure for tumors in the mediastinum that extend into the thoracic cavity. Clamshell incisions are utilized to resect bilateral pulmonary metastases and massive mediastinal malignancies and bilateral transplant lungs. Clamshell incisions, including a broad transverse incision, offer good access to the intrapleural area on both sides.

The bilateral transverse bithoracosternotomy described in 1991 by Cooper is now called the clamshell incision or crossbow incision. Bains have emphasized its use in thoracic oncologic surgery. The transternal bilateral thoracotomy incision was used as the standard approach to the pericardial contents in the early eras of open heart surgery until the less traumatic median sternotomy replaced it. Recently, the benefits of this approach have been rediscovered, and it is the gold standard incision for sequential bilateral lung transplantation. This incision provides excellent exposure for the safe division of pleural adhesions. Both hilae can be approached with excellent visibility, including both lower lobes. In addition, it gives adequate exposure to cannulation and initiation of cardiopulmonary bypass.

The clamshell incision's primary benefit is that it provides superior exposure to all important thoracic tissues, allowing...
surgeons to treat complex thoracic disorders in a single session, avoiding the added perioperative mortality and morbidity of a second treatment. A study by Doss et al. shows encouraging experiences in the treatment of extensive aortic disease in pediatric cases via clamshell incision prompted them to employ this technique in concomitant complex cardiac and aortic lesions. In all of these cases, excellent exposition of the cardiac structures and thoracic aorta was obtained, enabling them to treat these children in 1 session.

The clamshell thoracotomy is a single symmetric incision, giving a good cosmetic result with two incisions and good quality of life. Although it causes more pain than a median sternotomy, it is better tolerated than a posterolateral thoracotomy. Multiple chest scars and the emergence of breast asymmetry are avoided with this incision, which is especially beneficial to women because the breasts partially hide the scar. The clamshell incision’s drawbacks have been discussed. The operation necessitates the closure of both internal thoracic arteries, which is a disadvantage. Griep and Ergin describe a seriously deleterious effect on pulmonary function in their patients after transverse thoracotomy. In our experience, the clamshell incision has no additional risk of respiratory insufficiency. Our findings are consistent with those of Kouchoukos and colleagues, who report a low mortality rate, no respiratory insufficiency, and a low rate of bleeding reoperations in their experience with the clamshell incision.

We chose a clamshell incision for this case report because we expected it to provide an adequate view of the tumor’s expansion into the thoracic cavity. For the complete removal of a gigantic teratoma, extensive surgical and visual fields are required, as in this case. We were able to secure appropriate surgical and visual fields to achieve full excision by combining clamshell thoracotomy with the use of several thoracotomy retractors. This strategy is technically simple and, as our data show, safe. It does not result in higher mortality or morbidity than expected based on the disease’s basic character and existing surgical management results.

**CONCLUSION**

In conclusion, we believe that clamshell incisions give a good surgical field and can be safely performed in patients with large mediastinal teratomas. As a result, it is advised that the clamshell method be used more widely in the surgical treatment of difficult intrathoracic abnormalities in infants and children.

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**CONFLICT OF INTEREST**

We declare that there were no conflicts of interest in this study.

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**AUTHOR CONTRIBUTION**

All of the authors are equally contributed to the study.

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