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CASE REPORT

Aortic transection for resection of middle mediastinal tumor

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ABSTRACT

Background: Visceral mediastinal tumors are rare with challenging surgical approaches due to their location in close proximity with the great vessels and the pulmonary trunk. The aim of this paper is to discuss surgical strategies for complex cases of primary mediastinal tumors

Methods: We present two cases of patients with middle mediastinal tumor, one synovial sarcoma and one paraganglioma. For both patients, surgical access was performed through a sternotomy with beating heart cardio-pulmonary bypass and aortic transection, allowing optimal exposure of the carina, of the common pulmonary artery and its bifurcation. Both tumors were resected 'en-bloc'. The postoperative course was uneventful and the two patients had a 3 months postoperative follow-up CT-scan showing no evidence of recurrence.

Results: Surgery remains the cornerstone of treatment for synovial sarcoma and for paraganglioma of the visceral mediastinum and this location may be difficult to deal with. Many different surgical accesses exist and our approach of ascending aortic transection allows optimal exposure to the pulmonary artery, but also provides access to the upper airways.

Conclusion: For visceral mediastinal tumor with close contact with vascular and respiratory structures, aortic transection allows an excellent exposure and control of the tumor with oncological resection.

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KEYWORDS
Mediastinal tumor; aortic transection; surgical technique

Introduction

Mediastinal tumors, even if quite rare, often remain of difficult surgical approach due to their location. The cornerstone of the treatment is complete surgical resection which can be performed through different accesses based on their side, location and contact with the mediastinal structures. We describe two cases of large mediastinal tumors located in the middle/visceral mediastinum and intimate contact with the respiratory tract and the great vessels. In both cases, we performed a median sternotomy with cardiopulmonary bypass and aortic transection in order to provide an optimal exposure. We demonstrate that this technique is technically feasible and safe.

Case presentation

We present 2 cases of patients with visceral mediastinal tumors.

The first case is a 14 years-old male, referred to our hospital for exertional dyspnea. He had no others symptoms. He was well-known for a history of primary visceral mediastinal synovial sarcoma 1 year ago. The check-up diagnosed a biphasic synovial sarcoma, with immunohistochemistry confirmation by FISH (Fluorescence *In Situ* Hybridation). The work-up did not show any other abnormalities. He underwent surgical resection by axillary thoracotomy-manubriotomy that was incomplete (R2), followed by radiotherapy (55GY) and chemotherapy (doxorubicin – ifosfamide and ifosfamide – etoposide).

His follow-up chest CT scan (Figure 1) showed a $53 \times 33 \times 37$mm mass located in front of the tracheal bifurcation with no apparent cleavage plane and nearly complete compression of the main left bronchus. Direct contact with the aortic arch and esophageal wall was suspected. The CT scan also showed a 2 mm right pulmonary node.

The case was discussed in the multidisciplinary oncology consultation and a surgical approach was decided with en-bloc resection of the tumor and biopsy of the pulmonary nodule.

We performed a median sternotomy with anterolateral and posterolateral dissection of the aortic arch, of the pulmonary arteries and of the superior vena cava. The tumor invaded the

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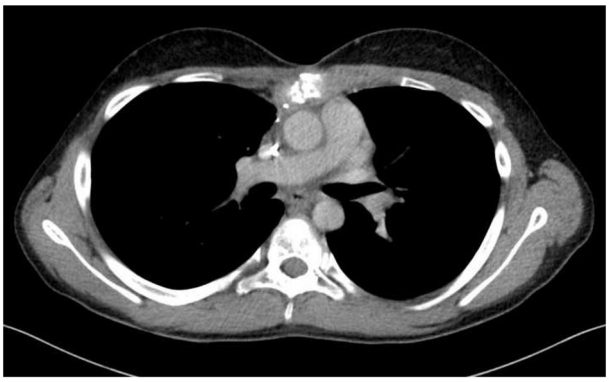

Figure 1. Preoperative Chest CT of patient 1.

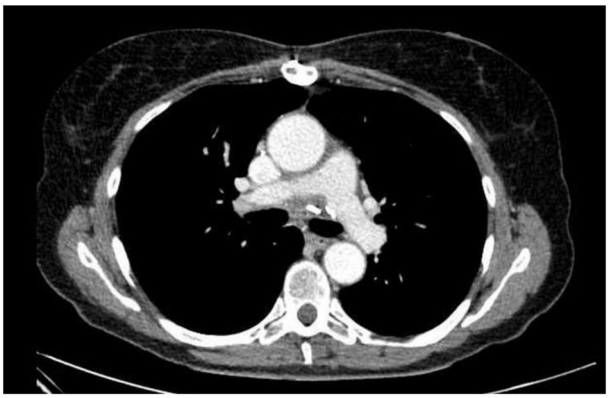

Figure 2. Postoperative Chest CT of patient 1.

innominate vein and superior vena confluent. We dissected the anterior part of intrathoracic trachea. This surgery was helped by a beating heart cardiopulmonary bypass with continuous bulbar perfusion. Aortic, innominate venous trunk and inferior vena cava cannulation were performed. The aorta was clamped and then transected to obtain optimal exposure of the tumor. The tumor was resected with a patch of superior vena cava that was reconstructed with autologous pericardial patch. The superior part of the mass was then released from the lower trachea and the carina and from the oesophagus. The tumor was resected 'en-bloc' with lymph node dissection of station 7 and 11 R. We also performed a biopsy of the right pulmonary nodule. The aorta was reconstructed by end-to-end primary anastomosis. The patient was easily weaned off cardiopulmonary bypass.

The total duration of heart beating cardio-pulmonary bypass was 198 min. The patient benefited from the transfusion of 1 unit of platelets during surgery but had no need for red blood cells transfusion.

The postoperative course was marked by an episode of temperature with pulmonary infection treated by vancomycin switched for piperacillin-tazobactam for a mild renal insufficiency. The evolution was then favorable and the patient was discharged at day 20.

At 1-month follow-up, the patient was asymptomatic.

The final histology of the tumor confirmed the diagnosis of biphasic synovial sarcoma (compatible with the previews sarcoma of our patient). The size of the tumor was 65 mm and the resection was complete with free margins. The superior vena cava patch resected was free from tumor and there was no invaded lymph node. The fluorescence *in situ* hybridation test confirmed the SS18 rearrangement that is typical of that kind of tumor.

At 3 months, a thoracic CT scan (Figure 2) was performed for oncological follow-up. It showed no evidence of local or distant recurrence of the disease and no signs of late complications of the surgery.

Unfortunately, in the later follow-up, the patient developed multiple pulmonary metastasis and died at 6 months follow-up.

Our second patient is a 61-year-old woman diagnosed with a paraganglioma in the visceral mediastinum. Her past medical history included treated arterial hypertension, autosomal dominant polycystic kidney disease and carbohydrate intolerance. She had no known allergies and no alcohol or tabaco abuse.

At the time of the diagnosis, she was fully asymptomatic on the respiratory plan, had no dyspnea, no hoarseness and no chest pain.

She underwent a thoracic MRI for a benign shoulder lesion, which highlighted the presence of a large tumoral mass in the visceral mediastinum. A CT-scan was performed to specify the characteristic of the mass. Its size was $92 \times 72 \times 78$mm and had no calcifications. It was highly vascularized. The tumor had close contact with the ascending aorta, aortic arch, both right and left pulmonary arteries and pulmonary trunk, azygos arch and superior vena cava. It was also near the anterior part of the trachea, carina and stem bronchi with a light compressive effect but no mass effect on the vascular structures (Figure 3).

Based on the CT-scan, the differential diagnosis was between a carcinoid tumor, a paraganglioma or Castelman disease. We decided to perform a surgical biopsy due to a high hemorrhagic risk associated with percutaneous biopsy. The biopsy was performed through a thoracoscopic approach with conversion to a right thoracotomy for hemostasis. The anatomopathological result confirmed the diagnosis of paraganglioma with testing for

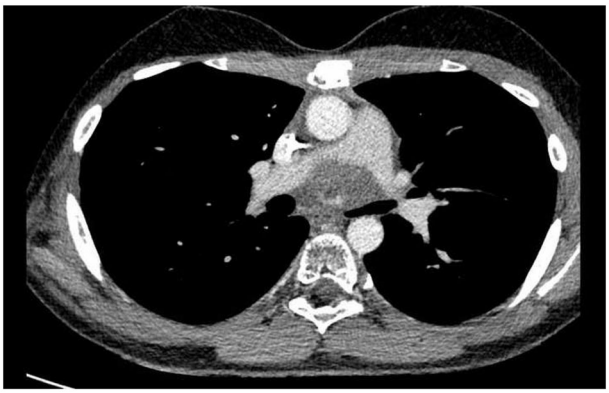

Figure 3. Preoperative Chest CT of patient 2.

Chromogranin and Synaptophysin highly positive. The proliferation index (KI67) was low (<5%).

The case of this patient was discussed in the multidisciplinary oncology consultation and a surgical approach was chosen. She underwent, prior to surgery, a radiological embolization of the main arterial branch supplying the tumor, in order to limit blood loss during surgery. This procedure was successful but uncomplete due to the importance of the vascularization of the tumor.

Thereafter we performed the surgical resection. It was made by a median-sternotomy with dissection of the residual thymic tissue and of the brachio-cephalic trunk. We ligated all vascular supplies from the apical part of the tumor. The tumor was intimately adherent to both the ascending aorta and the main pulmonary artery. Canulation and aortic cross clamping were therefore performed followed by cold cardioplegia. Then aortic transection was realized and the tumor was dissected from the posterior ascending aorta, from the right pulmonary artery and the main pulmonary artery which were free from tumor invasion. The dissection was then pursued from the tracheal plane down to the bronchial bifurcation. The tumor was then removed 'en-bloc'. We reconstructed the aorta by end-to-end primary anastomosis.

The total bypass time was 155 min and total aortic clamp time was 126 min.

The postoperative course was complicated by fluid overload treated by diuretic therapy and the transfusion of one unit of red blood cells.

The anatomopathological examination confirmed a mediastinal paraganglioma with $85 \times 64 \times 55$mm size with a lot of necrotizing tissue (linked to the preoperative selective embolization). The surgical margins were locally millimetrical. They were no lymph node invasion (0/18) or invasion of the surrounding pericardial tissue.

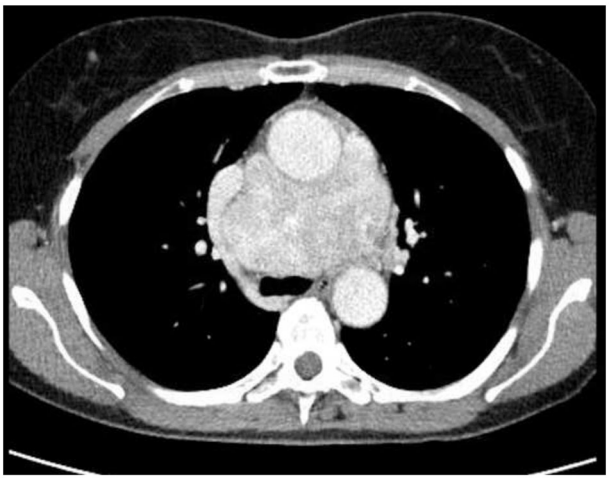

Figure 4. Postoperative Chest CT of patient 2.

At the 3 months follow-up, the patient was in excellent general state apart from dysphonia as the result of an iatrogenic lesion of the left recurrent nerve during surgery. This lesion was confirmed by an ORL-investigation and the patient is currently undergoing ORL reeducation.

The follow-up CT scan showed no evidence of local recurrence (Figure 4).

Discussion

Our purpose was to present 2 cases of visceral mediastinal tumor optimally resected by transaortic approach. Both tumors had close contact with the respiratory tract and the vascular trunk.

Mediastinal tumors are quite rare and the location in the visceral mediastinum occurs in only 13,5% of patients, with the anterior mediastinum being the most frequent location (69,8% anterior vs 5,4% posterior) [1]. Sarcoma represent 2% of primary mediastinal tumor (with 2% being synoviosarcoma) with only 10% originating from the visceral mediastinum [2–3] and the incidence of paraganglioma in the mediastinum represent only 0,3% of all mediastinal tumors [4]. For both of them, it is actually well known that the best survival rate occurs when a complete surgical resection can be performed [5–6].

The surgical access can be done by different procedure. For large tumors, the most commonly used is median sternotomy with or without help by cardio-pulmonary-bypass. This technique allows good exposure of the hilar structure and a wide surgical field. Another classical approach is by lateral thoracotomy. For smaller tumor, minimally invasive procedure by classic thoracoscopy or Video-Assisted Thoracoscopic Surgery has been described with good results and few

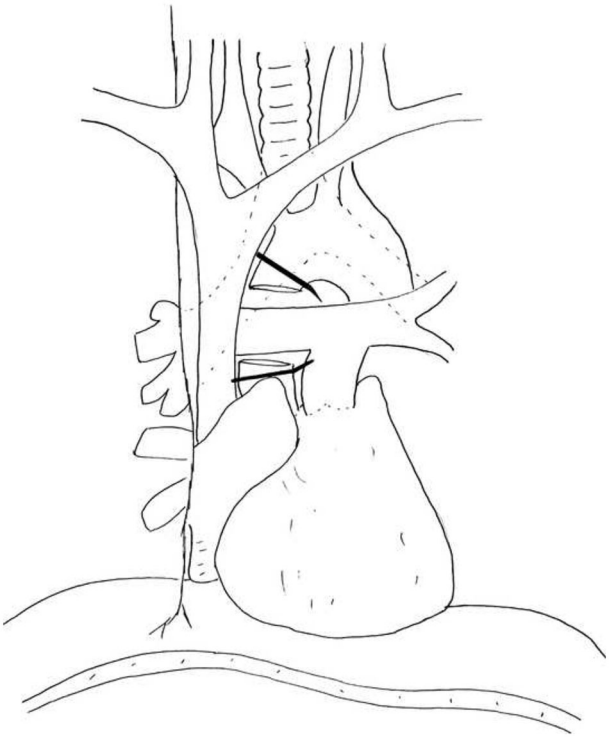

Figure 5. Schematic illustration of the surgical technique.

complications. Robotic-assisted thoracoscopy is also an alternative for selected cases [7].

The technique that we describe is almost not find in the literature with only one case report describing the same procedure as we performed for what we know [8]. Our objective was to show that for large mediastinal mass with close contact with noble structures and no accessibility through a classic thoracotomy approach, a median sternotomy with aortic transection (Figure 5) and thereby reconstruction is feasible, permit excellent exposure of the lesion, good vascular control with few operative and postoperative complications and complete surgical excision confirmed by anatomopathological examination.

Conclusion

In conclusion, for visceral mediastinal tumor with close contact with vascular and respiratory structures, our technique of aortic transection allows an excellent exposure and control of the tumor with oncological resection.

Disclosure statement

The authors report no conflict of interest.

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