



Pulmonary Metastatic Osteosarcoma with Left Atrial Extension: Cardiopulmonary Bypass-Assisted Resection

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Abstract

Osteosarcomas are highly metastasizing tumors with the lung being one of their primary targets. Left atrial extension of these pulmonary secondaries is not uncommon and mostly occurs through direct invasion of the pulmonary veins. We present a 22-year-old man who had a metastatic osteosarcoma to the right lung with large left atrial extension. Complete resection of the left atrial tumor combined with right middle lobectomy was achieved using cardiopulmonary bypass. The patient is alive and well 12 months later.

Keywords: Cardiac Tumors; Osteosarcoma; Lobectomy; Left Atrial Tumors

Introduction

Osteosarcoma is a bone tumor that affects approximately 3.4 million individuals annually, occurring in both children and adults [1]. Significant advancements in medical treatment have resulted in a five-year survival rate of 70% after diagnosis, achieved through a combination of surgical resection and chemotherapy [2]. However, osteosarcomas are notorious for their high recurrence rates, with 30-40% of patients developing metastases, particularly in the lungs [3]. Recent reports indicate poor long-term outcomes

for lung metastases, with a five-year survival rate of 30% [4]. Additionally, cardiac involvement with the tumor residing in either the left or right side of the heart has been documented and leads to even worse outcomes with a 20% survival rate after five years [5,6]. Prior studies have conflicting indications for whether cardiopulmonary bypass (CPB) is useful in these cases, but it is clear that if the tumor is extensive, cardiopulmonary bypass may be required to facilitate complete removal of the tumor especially in younger patients [7-9].

Case Report

A 22-year-old man with history of a high-grade left distal femur osteosarcoma, and previous limb-salvage resection combined with adjuvant therapy, was discovered to have a right lung mass during follow-up surveillance. Computed tomographic angiography (CTA) scan showed a right middle lobe mass with possible invasion into the left atrium (LA) [Figure 1]. Transesophageal echocardiogram (TEE) confirmed the presence of a large mobile mass measuring nearly 11 x 40 mm in the LA [Figure 2]. There was no inflow obstruction to the left ventricle. There was no evidence of other metastases. Decision was made to proceed with resection.

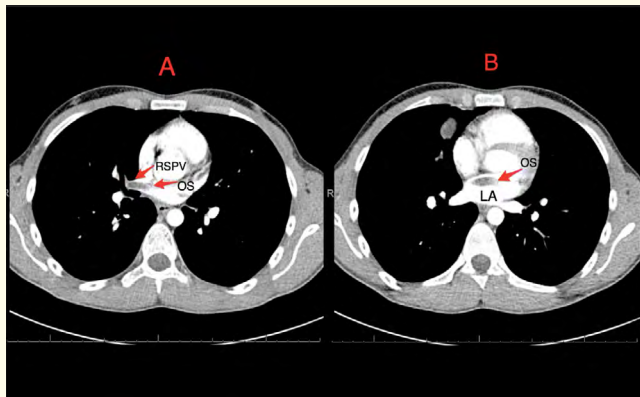


Figure 1: (A&B): Computed tomography (CT) scan showing invasion of the osteosarcoma, with (A) displaying the mass entering the left atrium through the right superior pulmonary vein; and (B) showing the mass in the left atrium. LA, Left Atrium; OS, Osteosarcoma; RSPV, Right Superior Pulmonary Vein.

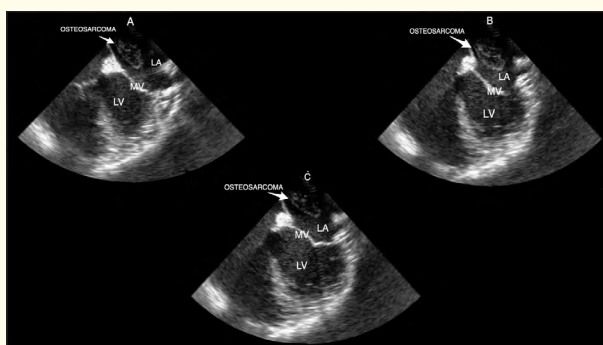


Figure 2: (A-C): Transesophageal Echocardiogram (TEE) images in (A) shows the osteosarcoma in the left atrium (LA) while the mitral valve (MV) is closed in systole; (B) shows a slight movement in the osteosarcoma as the MV opens for diastole; (C) shows the mobility of the osteosarcoma as it has moved further from the MV in systole. LA, Left Atrium; LV, Left Ventricle; MV, Mitral Valve.

Through a standard median sternotomy, the right pleural space was entered, and the right middle lobe mass was identified. CPB was initiated via aortic and right atrial cannulation without difficulty. We minimized manipulation of the mass till the aortic cross clamp was applied. The LA was entered through a standard vertical left atriotomy, and the large mass was visualized. The mass appeared to have invaded the left atrium via the right middle lobar pulmonary vein. It was also invading a portion of the right-sided pericardium, but the right phrenic nerve was free. We then proceeded with right middle lobectomy in the standard fashion. The right middle pulmonary vein was incised to expose the entire tumor extension and avoid breaking off the tumor. The right middle lobe was then removed with the left atrial extension as one mass, in addition to the involved portion of the pericardium. The left atrial incision was then closed in a single layer fashion. The heart was de-aired, and the aortic cross clamp was removed. The patient was subsequently weaned off CPB, and TEE showed no evidence of any residual tumor in the LA. The remainder of the procedure was completed in the standard fashion and the patient was extubated in the operating room.

Histopathological examination confirmed a high-grade malignant neoplasm consistent with metastatic chondroblastic osteosarcoma. The tumor was 13.1 cm in its largest dimensions and resection margins were free of tumor [Figure 3]. The aortic cross clamp time was 55 minutes and CPB was 63 minutes. The remaining post-operative course was uneventful, and the patient was discharged on the third postoperative day. He continued to do well 12 months after.



Figure 3: An intra-operative image of the resected specimen. This includes the right middle lobe, the mass and its intra-atrial extension.

Discussion

Osteosarcomas are bone tumors that affect 3.4 million annually [1]. With treatment, the 5-year survival rate is 70%, but may diminish to 20% or 30% with metastasis involving the heart or lungs, respectively [2,4-6]. In cases where the tumor resides in the heart through pulmonary metastasis, the risk of embolization is high. Given this, CPB may be needed in order to fully excise the tumor [7-9].

To our knowledge, the use of CPB in the presence of metastatic pulmonary osteosarcomas that extends into the LA has only been reported in a few cases [8,9]. A case report by Chai and colleagues, presented a 20-year-old woman who underwent successful resection of a secondary pulmonary osteosarcoma that metastasized to the left lower lobe and extended into the LA [8]. She underwent median sternotomy with resection of the LA mass using CPB, but the left lower lobe was removed after CPB was discontinued, unlike in our case.

A similar report by Senbo., *et al.* mentioned a 35-year-old woman who had an osteosarcoma in her left lower lung lobe, which extended into the LA through the left inferior PV [9]. She underwent surgery with CPB where the intra-atrial mass was resected and had her left lower lobe resected after CPB was weaned off. The patient, however, died 12 months after resection from metastasis in the lungs, adrenal gland, and liver.

Despite the lower survival with metastatic osteosarcoma, aggressive resection with the use of cardiopulmonary bypass is warranted especially in younger patients with cardiac involvement. The indication may not be to prolong survival, but rather than to avoid devastating systemic embolization that may affect quality of life. A multi-disciplinary team centered around the patient helps make these decisions that should be made on individual basis.

Disclosure

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