

Primary Malignant Cardiac Tumors (PMCTs) Successful Resection of a Huge Liposarcoma of the Heart

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Case Report

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Abstract Primary cardiac tumors are rare with an incidence ranging from 0.001% to 0.03% in autopsy series. The prognosis of cardiac sarcomas remains poor because it proliferates rapidly, and distant metastases are often found at diagnosis. We present a case of liposarcoma in the atrium of the heart as case report and same time, we do a literature review about it.

Case Report: We present the case of a 30-year-old female with a significant tumor of cardiac liposarcoma, with chief complaint of dyspnea, tachycardia and heart failure even angina pectoris.

Conclusion: The diagnostician's differential diagnosis must be broad when encountering common chief complaints, such as tachycardia, heart failure and angina pectoris.

Keywords: Malignant cardiac tumors, Liposarcoma, Pericardial metastasis, Heart failure, Heart neoplasm, Heart atrium/surgery, Heart neoplasms/surgery, Heart autotransplantation

Introduction

Primary malignant cardiac tumors (PMCTs) are extremely rare neoplasms of varying histopathology that originate within cardiac structures and display biologically aggressive behavior.[1]

PMCTs are rare clinical observations, different from secondary neoplasms (ten times more frequent), and 90% of all primary cardiac tumors are benign.[2]

Myxoma is by far the most frequent benign tumor (75%), typically located in the left atrium, and manifests with intra-cavitary obstruction, embolism and constitutional symptoms, but it may also be silent and discovered incidentally by echocardiography.[2] Papillary fibroelastoma is a tumor usually arising on the valvular or mural endocardium, which, although quite small, may become symptomatic through embolic events. Typical tumors of the pediatric age group include fibroma, rhabdomyoma and teratoma.

Primary malignant neoplasms account for 10% of all primary cardiac tumors and are represented by sarcomas (angiosarcoma, leiomyosarcoma, fibrosarcoma, liposarcoma, rhabdomyosarcoma, undifferentiated pleomorphic sarcomas) and primary lymphomas.[2]

Cardiac malignancies are rare, with primary cardiac tumors making up an extremely small subset. Cardiac tumors increase morbidity and mortality via a variety of mechanisms.[3] One mechanism is that the tumor can impede blood flow or valve function and potentially cause tamponade. The tumor's impedance can decrease forward blood flow, causing symptoms of heart failure such as angina, syncope, and dyspnea. A second mechanism is that the tumor can grow into the pericardium, causing a constrictive pericarditis.

Another mechanism of increased morbidity/mortality is that the tumor can interfere with the conduction system, leading to arrhythmias such as supraventricular tachycardia or heart block.[4]

Further, the tumor can embolize to the systemic circulation, an event that is more likely when the tumor is on the left side of the heart. The tumor's presence on the left side of the heart or metastasis from the right side of the heart can also lead to pulmonary hypertension. Finally, the tumor itself can lead to constitutional symptoms.[3] Despite these multiple potential mechanisms, many patients present with unrelated symptoms, or their cardiac tumors are found incidentally.

Epidemiology:

The prevalence of cardiac tumors differs among age groups: myxoma is the most common cardiac neoplasm in adults, whereas in childhood fibromas and rhabdomyomas are the most frequent[5]. Metastatic involvement is much more common than primary cardiac tumours with a reported prevalence of 2.3–18.3% [6-10].

[11]reported 662 cases among 7,289 with malignancies (9.1%), with a decreasing occurrence with age (16.8% in people <64 vs 8.5% in people >85), probably due to less biological aggressiveness in the elderly.[11]

Metastatic involvement of the heart can occur due to direct infiltration by mediastinal and lung malignancies; haematic pathway, in the case of distant primary neoplasm; lymphatic pathway due to a spread through the tracheamediastinal lymphatic network, especially in case of lung carcinoma (pericardial “carcinosis”); and endocavitary diffusion through the inferior vena cava (renal carcinoma and hepatocarcinoma) and pulmonary veins.[1]

According to the histological classification by the World Health Organization (WHO) in 2004, among the benign cardiac tumors, the majority (63%) were myxomas, followed by papillary fibroelastomas (8%).

Primary neoplasms, all benign, were also observed in the pediatric age group (<18 years) in 13% of cases and atrial myxoma was still the most frequent one (Table 1) [12].

Table 1. WHO Classification of primary tumors of the heart.

Benign tumours and tumour-like lesions	
Rhabdomyoma	8900/0
Histiocytoid cardiomyopathy	
Hamartoma of mature cardiac myocytes	
Adult cellular rhabdomyoma	8904/0
Cardiac myxoma	8840/0
Papillary fibroelastoma	
Haemangioma	9120/0
Cardiac fibroma	8810/0
Inflammatory myofibroblastic tumour	8821/1
Lipoma	8850/0
Cystic tumour of the atrioventricular node	
Malignant tumours	
Angiosarcoma	9120/3
Epithelioid haemangio-endothelioma	9133/3
Malignant pleomorphic fibrous histiocytoma	
MFH / Undifferentiated pleomorphic sarcoma	8830/3
Fibrosarcoma and myxoid fibrosarcoma	8840/3
Rhabdomyosarcoma	8900/3
Leiomyosarcoma	8890/3
Synovial sarcoma	9040/3
Liposarcoma	
Cardiac lymphoma	
Pericardial tumours	
Solitary fibrous tumour	8815/1
Malignant mesothelioma	9050/3
Germ cell tumours	

Leiomyosarcoma, malignant fibro-histiocytoma, angiosarcoma and mesothelioma represented the main malignant primary cardiac tumors (Figure 1).

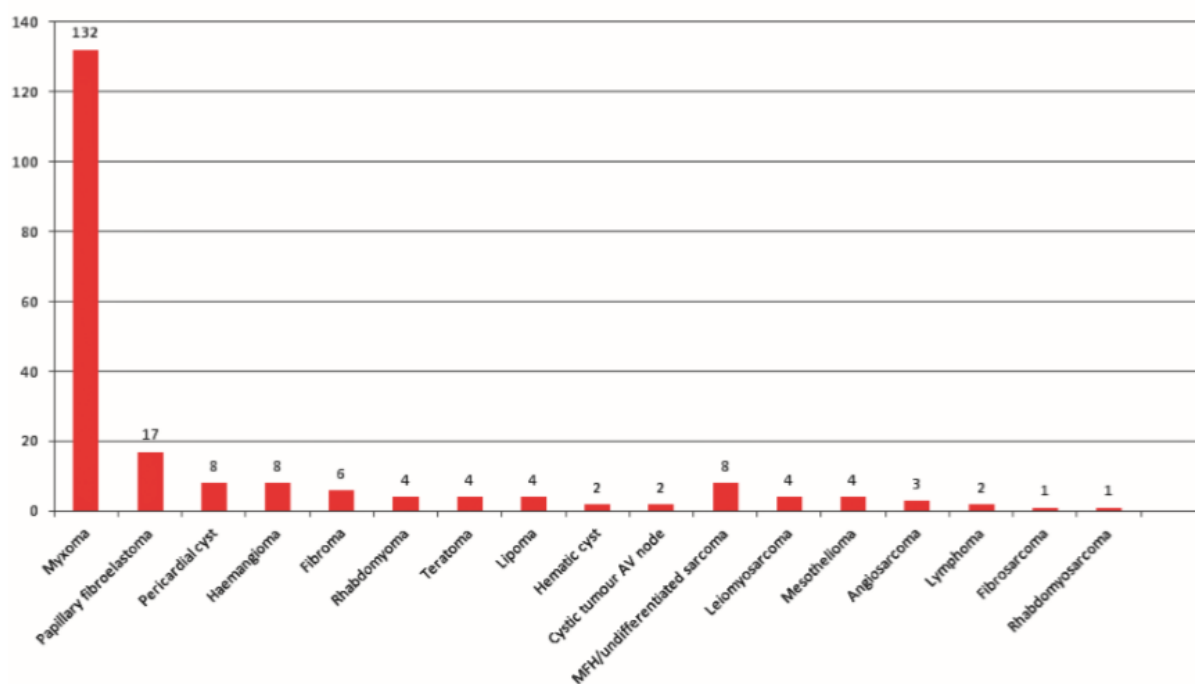


Figure 1. Primary cardiac and pericardial tumors at the Cardiovascular Pathology Unit, University of Padua (1970–2004): total n = 210 cases.

Myxoma

Myxoma is the paradigm of a benign intra-cavitary cardiac tumor, probably originating from residual embryonic cardiac jelly. Myxomas are in fact mostly found in the left atrium followed by the right atrium, and occasionally in the ventricles.[13] In the elderly, the “silent myxoma” may undergo calcification (“lithomyxoma”), like a sort of a self-healing.[14,15]

A familial incidence has been described, accounting for up to 7% of all cardiac myxomas, associated with Carney complex, an autosomal dominant hereditary disease. The subjects are younger than those with sporadic myxoma, have no female prevalence, present multiple chamber involvement and have a tendency of recurrence after surgery.

Papillary fibroelastoma

Papillary fibroelastoma, known also with the name of **endocardial papilloma**, is the second primary cardiac tumor following myxoma [14] and it is the most common primary heart valve tumor [14-18]

More than 95% of fibroelastomas arise in the left heart. The aortic valve (29%), mitral valve (25%), tricuspid valve (17%) and pulmonary valves (13%) are involved [19,20]

Lipoma

Lipoma is a benign tumor made up of mature fat cells, reported at any age with an equal frequency in both genders, with an incidence of 8%. Cardiac lipoma can occur in any location, on which depend the clinical manifestations, including compression, obstruction and arrhythmias. [15,21]

Haemangioma

Haemangioma accounts for approximately 1 to 5% of all benign cardiac tumours in different series.[15,22]

It occurs mostly in adults, and the clinical presentation varies depending on the location and size of the tumor.[23]

A total 75% of Haemangioma present with an intramural growth and 25% are sessile or polypoid, projecting into the atrial or ventricular cavities, sometimes mimicking myxoma. Epicardial location is also reported. Coronary angiography may be useful in detecting the distribution of the afferent vessels to the tumor.

Rhabdomyoma

Rhabdomyoma is considered the most common pediatric cardiac neoplasm, accounting for 90% of primary benign tumors in this age group.[24-28]

Cardiac rhabdomyoma is found in up to 80% of cases affected by tuberous sclerosis.[29]

Angiosarcoma

Angiosarcoma is the most common primary malignant cardiac tumor, with a peak in the 4th decade and no sex predilection. The most frequent location is the right atrial chamber.[30]

Fibrosarcoma

They represent nearly 5% of all primary cardiac malignancies. Fibrosarcoma consists of a malignant proliferation of mesenchymal cells with fibroblastic features and a storiform, herring-bone pattern with a collagen stroma.[12,31,32,33]

Being mostly left sided, signs and symptoms of pulmonary congestion, mitral stenosis and pulmonary vein obstruction are the most frequent.[33]

The most frequent location of Fibrosarcoma is in the atria (particularly the left), with both intracavitary and mural location. A pericardial form does exist (solitary malignant fibrous tumor of the pericardium), which may mimic a mesothelioma.

Leiomyosarcoma

Leiomyosarcoma is a primary sarcoma of smooth muscle cells and accounts for nearly 10% of all cardiac malignancies, with a peak in the 5th decade and no sex prevalence [12,31].

There are two usual sites of origin. One is the left atrium, where it may present as a single or multiple endocavitary mass, mimicking the left atrial myxoma although usually attached to the atrial roof rather than the atrial septum, the second, is the pulmonary infundibulum and artery, mimicking pulmonary embolism [34,35].

Rhabdomyosarcoma

Rhabdomyosarcoma is a rare malignant tumor of striated muscle, most frequently encountered in children with male prevalence[12,31,32].

Rhabdomyosarcomas arise de novo, not from malignant degeneration of a rhabdomyoma. It often diffusely infiltrates the myocardium at any location, presenting with cardiac obstructive phenomenon, arrhythmias or pericardial effusion. Embryonal rhabdomyosarcoma is the most frequent at cardiac level thus explaining the younger age at presentation.

Fibroma

Fibroma is the second most common tumor in the pediatric population after rhabdomyoma. In a study of 27,640 children evaluated by echocardiography an incidence of less than 0.02% was reported.[25,26,36]

Liposarcoma

Liposarcoma is a rare entity (1% of primary malignant tumours of the heart) that predominantly appears as a bulky endocavitary left atrial mass, mimicking myxoma, with early signs of local invasion and haemodynamic disturbance.[12,21,31]

Cardiac lymphoma

Cardiac lymphoma represents 5% of primary cardiac malignant neoplasms, which means 1% of all cardiac primary tumors. It occurs in ages from 5 to 90 years (median 60), the male/female ratio is approximately 3:1, and it does not necessarily occur in immune-deficient people.

Tumors of the pericardium

Primary pericardial tumors are rare, and include benign (cyst, teratoma, fibroma, angioma and lipoma) and malignant (mesothelioma and sarcoma) forms. More frequently, the pericardium is secondarily involved by direct extension, retrograde lymphangitic spread or hematogenous dissemination. The patients present with pericardial effusion and occasionally pericardial tamponade [37].

Pericardial cyst

A pericardial cyst is a relatively frequent mass, uni- or multi-loculated, full of serous liquid, probably dysontogenic in origin, but symptomatic in adult age because of increasing storage of fluid within the cystic cavity. Histologically, the thin wall consists of highly vascularized connective tissue covered by mesothelium on both sides [38].

Teratoma

Teratoma is a tumor of germinal cells, which represents nearly 10% of all pediatric cardiac tumors. In 90% of cases it is located within the pericardial cavity, usually at the base of the heart. Diagnosis is usually achieved within one month of age because of severe obstructive symptoms by compression of the arterial pole and lungs.[25,38]

Malignant mesothelioma

Malignant mesothelioma is the most common primary malignancy of the pericardium. It accounts for only about 1% of all mesotheliomas. It affects individuals of any age (mean 45 years), with a male predominance. The role of asbestos in pericardial mesothelioma is unclear.[39]

Why cardiac autotransplantation

Autotransplantation of the human heart was first attempted for treatment of Prinzmetal's angina but was soon abandoned because of the high morbidity and mortality rates associated with the procedure. The technique was reintroduced by Dr. Cooley in 1985 as an approach to a large left atrial pheochromocytoma that could not be resected by standard means.[41]

Primary cardiac malignancy presents an unusual and difficult surgical challenge. Malignant tumors of the left atrium have proved problematic due to their posterior location and difficulty of surgical exposure. The technique of cardiac explantation, *ex vivo* resection and cardiac reconstruction, and reimplantation—the cardiac autotransplantation procedure—was developed to solve this anatomic problem. This technique has proved useful in the approach to complex left atrial primary cardiac malignancies.[41]

Case Report

She was admitted to the ER than department of cardiology due to palpitation and dyspnea. On admission, the patient had moderate dyspnea. Signs of cardiac failure, including engorgement of the jugular vein and edema of the lower extremities, and clinical hepatomegaly were observed.

Electrocardiography revealed sinus tachycardia and incomplete right bundle branch block. Chest X-ray showed a large mass lateral to the left ventricle extending to the left chest wall. The initial ECHO examination was transthoracic and transesophageal ECHO showed that the EF was 50% with the diastolic dysfunction and low cardiac output TI grade II.

right atrial and ventricular sizes were enlarged; from right atrium a huge mass was observed in size of 3-5 cm, which shifted the heart to left hemithorax. The tumor adhered to the left atrium. Patient admitted in CCU after relative improvement in her symptoms were ready for heart surgery. Second day, the patient was qualified for radical tumor resection. The patient was referred to our institution for treatment. The heart was exposed via mid-sternotomy. After full heparinization and flooding of the surgical field with CO₂, the ascending aorta, bi-caval, were cannulated.

Cardiopulmonary bypass was commenced after the target ACT \geq 450s was reached. On complete bypass, the ascending aorta was cross clamped and multiple doses of cardioplegic solution were instilled via the aortic root. Shortly we realized that it was not possible to do radical tumor resection. We used the technique of cardiac explanation ex vivo tumor resection and reimplantation of the heart, which is known as *Cardiac Auto transplantation*. [Figure 2](#), [Figure 3](#).

Operation was without complication and she transferred to cardiac intensive care unit. Post-operative Echo was normal. Patient started her cardiac rehabilitation one week after operation.

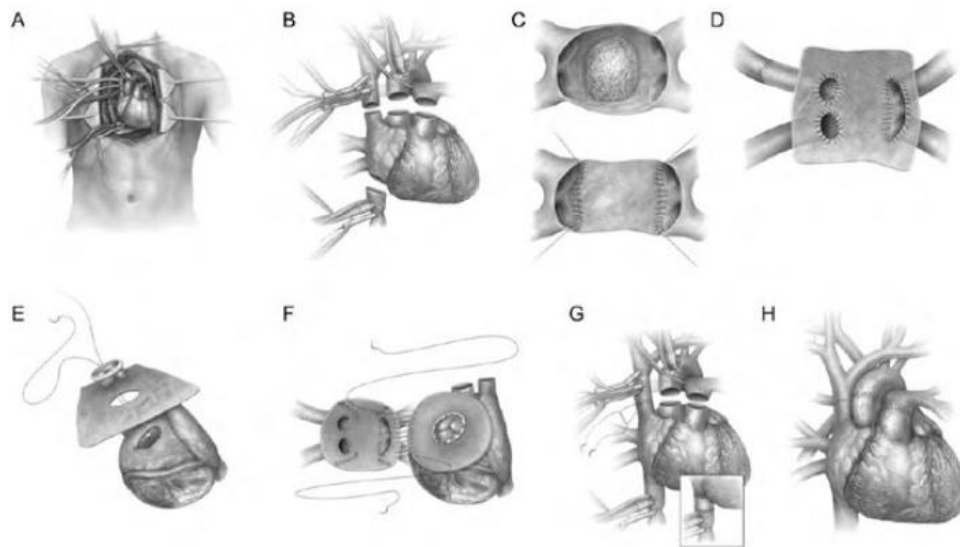


Figure 2. from (Shanda H et al) The technique of cardiac autotransplantation. (A) Median sternotomy, cannulation for cardiopulmonary bypass. (B) Explantation of the heart. (C) Ex vivo resection of left atrial tumor, reconstruction of the posterior wall using bovine pericardium. (D) Ex vivo reconstruction of the posterior wall and pulmonary vein using the Gortex TM graft. (E) Ex vivo reconstruction of the anterior wall using bovine pericardium and mitral valve replacement using bioprosthesis. (F) Orthotopic implantation — left atrial suture line. (G) Caval suture lines. If either cava is too short — an interposition graft might be very useful (insert). (H) After completion of the great vessels anastomoses.

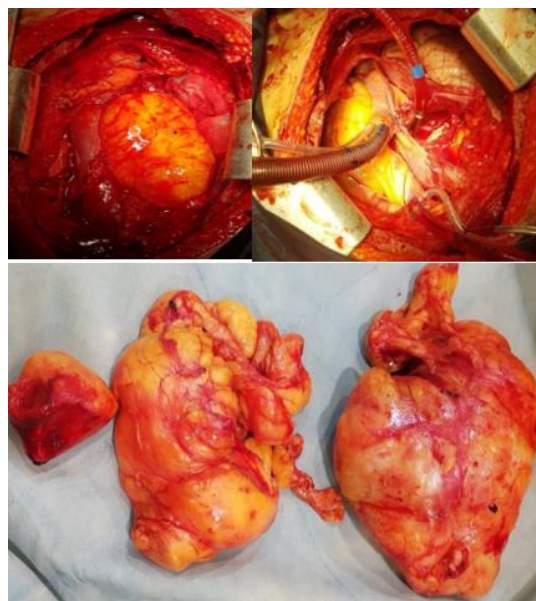


Figure 3. We used the technique of cardiac explanation ex vivo tumor resection and reimplantation of the heart which is known as **Cardiac Auto transplantation**

Liposarcoma is one of the most common soft tissue sarcomas in adults and often develops in the retroperitoneum and lower limbs. Liposarcoma usually metastasizes to different organs, but metastasis to the heart, including to the pericardium, is rare.[40]

Conclusions

Primary cardiac tumours are very rare compared to metastatic tumours; most primary neoplasms are benign and the majority are myxomas. The clinician should be aware that cardiac masses should not be considered as benign myxomas or thrombi just because they are intra-cavitary. All cardiac tumors should be subjected to histological examination to confirm the diagnosis and rule out malignancy, thus planning the best treatment. Malignant tumors of the left atrium have proved problematic due to their posterior location and difficulty of surgical exposure. The technique of cardiac autotransplantation procedure is useful to solve this anatomic problem.

Disclosure

The authors declare no conflicts of interest.

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