

Primary Cardiac Tumours: A Series of Four Cases

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ABSTRACT

Primary cardiac tumours are uncommon, and approximately 90% of them, in both children and adults, are benign. Primary tumours are less prevalent than secondary malignancies that spread to the heart. The subtle and non specific nature of the clinical signs could cause a delay in diagnosis, as well as surgical treatment. Although epidemiology and multimodality imaging approaches are helpful, the definitive diagnosis often necessitates histologic evaluation, and histological characterisation continues to be the gold standard in diagnostics. Herein the authors described four (two males and two females) cases of intriguing primary cardiac tumours. All the cases were diagnosed to have a cardiac mass/clot by Echocardiography (Echo), and the cases underwent tumour excision. Histopathological analysis revealed three benign cases diagnosed as atrial myomas, and one malignant case diagnosed as high-grade spindle cell sarcoma, specifically rhabdomyosarcoma. Immunohistochemistry (IHC) was required for the definitive diagnosis of the malignant patient. All the patients were followed-up for a period of one year. All benign cases were symptom-free, while the patient who had rhabdomyosarcoma expired. The aim of the present case series was to highlight the importance of histopathological examination, as well as the prognosis of cardiac tumours.

Keywords: Atrial myxoma, Benign, Malignant, Rhabdomyosarcoma, Spindle cell sarcoma

INTRODUCTION

Primary cardiac tumours are not common worldwide. The first indirect premortem diagnosis of cardiac sarcoma was made by Barnes in 1934, while Columbus of Padua first described cardiac tumours in 1559 [1]. Primary cardiac tumours are divided into two categories: benign and malignant. The benign tumours are further divided as acquired and congenital types. They can produce a wide range of clinical signs and symptoms, many of which often mimic more prevalent cardiovascular and systemic disorders. Echo remains the initial diagnostic method of choice [2].

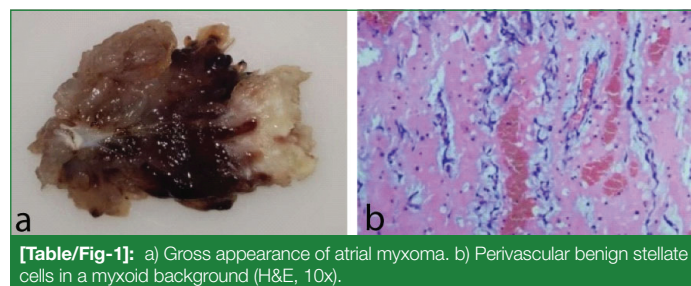
Most primary cardiac tumours are benign (90%), while the remaining 10% are malignant and typically classified as sarcomas histologically [3]. The most frequent benign tumour is the myxoma, accounting for 50% to 70% of benign heart lesions. Other benign heart lesions include papillary fibroelastoma, cystic tumour of the atrioventricular node, haemangioma, fibroma, and lipoma. The most frequent malignant sarcoma (30%) is angiosarcoma, followed by rhabdomyosarcoma (20%). Surgical resection is the most common and effective treatment for both benign, as well as malignant tumours. It is crucial for prognosis and limiting the risk of embolic events [2,4].

Data from patients who underwent surgery for primary cardiac tumours between January 2017 and December 2021 were included in the study. A total of four primary cardiac tumours were identified. Age, gender, complaints, Transthoracic Echocardiography (TTE) findings, surgical procedure, gross and microscopic features, as well as the final diagnosis, were recorded.

Case 1

A 54-year-old male patient presented with breathlessness for two months. He was a known hypertensive for the past 13 years and has been taking regular medication, Tab. amlodipine 5 mg Once Daily (OD). The patient underwent evaluation, and a 2-dimensional (2D) Transthoracic Echocardiogram (TTE) was performed. The TTE revealed a Left Atrial (LA) mass attached to the LA septum, along with mild Pulmonary Arterial Hypertension (PAH) and an Ejection Fraction (EF) of 69%. The differential diagnosis includes LA thrombi and a primary cardiac tumour, most probably atrial myxoma. The

tumour was excised, and upon gross examination, the specimen showed a soft, vaguely nodular, gelatinous, grey-brown mass with haemorrhage, measuring 8.5×6×2.2 cm [Table/Fig-1a]. Microscopy revealed a hypocellular spindle cell neoplasm embedded within the myxoid stroma, with areas of haemorrhage and hyaline change [Table/Fig-1b]. The final diagnosis was LA myxoma with degenerative changes. The postoperative period was uneventful, and a follow-up Echo showed no residual tumour. The patient was advised to continue antihypertensive medication and undergo routine follow-up for one year. The patient remained symptom-free during the follow-up period.

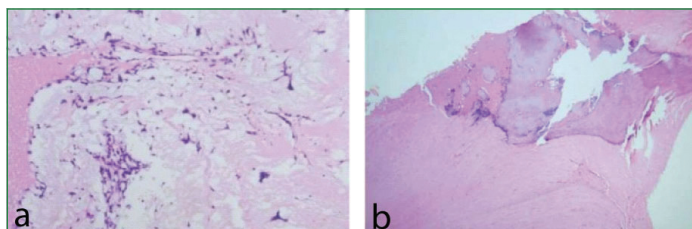


[Table/Fig-1]: a) Gross appearance of atrial myxoma. b) Perivascular benign stellate cells in a myxoid background (H&E, 10x).

Case 2

A 35-year-old female patient presented with complaints of dyspnoea at rest aggravated by eating for one week. The patient also had bilateral pedal oedema and reduced urine output. She was a known case of Rheumatic Heart Disease (RHD) with mitral stenosis for 10 years. A 2D TTE revealed RHD, severe mitral stenosis, dilated LA with a large LA clot. The EF was 65%. Non Enhanced Computed Tomography (NECT) of the chest showed gross cardiomegaly with a dilated pulmonary trunk. The differential diagnosis includes LA thrombus and atrial myxoma with cardiac failure and pulmonary oedema. The patient was prescribed tab. digoxin 0.25 mg OD, tab. diltiazem 30 mg three times daily, tab. aldactone 25 mg OD, tab. dytor 10 mg twice daily, and tab. pentids 400 mg twice daily. Since the patient had Atrial Fibrillation (AF) on Electrocardiogram (ECG) and a large LA clot, oral anticoagulants were started. The patient was scheduled for Mitral Valve Replacement (MVR) and clot

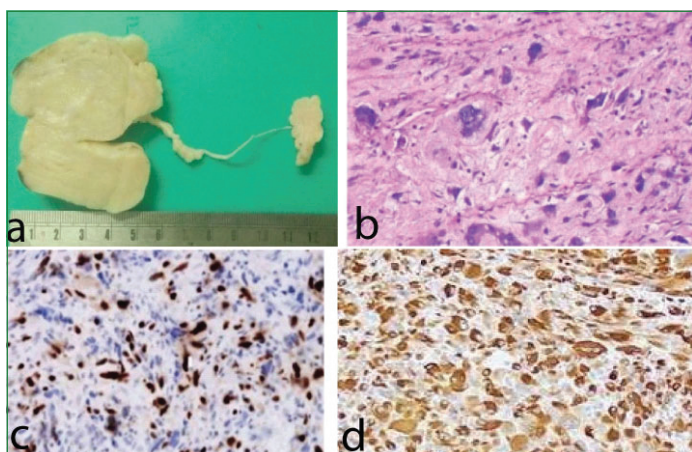
removal under general anaesthesia. Gross examination revealed grey-tan friable tissue bits with an adherent clot and a single, pearly white, deformed mitral valve leaflet with marked thickening and extensive calcification. Microscopy revealed extensive areas of superficial haemorrhage, adherent thrombosis, and a blood clot with fragmented mildly cellular neoplasm composed of fusiform/stellate cells in a myxomatous matrix. The valve showed degenerative changes and calcification. The final diagnosis was LA myxoma with adherent thrombus and chronic valvulitis with extensive calcification [Table/Fig-2a,b]. The patient was advised to continue warfarin, beta-blockers, and calcium channel blockers. During follow-up at six month intervals for one year, the patient remained symptom free.



[Table/Fig-2]: a) Stellate cells in a myxomatous matrix (H&E 4x). b) Calcification of mitral valve leaflet (H&E 4x).

Case 3

A 30-year-old female patient presented with high fever and chills for two days, accompanied by breathlessness. New York Heart Association (NYHA) class II symptoms progressed rapidly to NYHA class IV within one week. The patient also had pedal oedema. Based on the clinical findings, she was diagnosed with congestive cardiac failure and severe anaemia through haemoglobin estimation. She revealed a past history of tumour resection in the left atrium, which was diagnosed as intermediate grade spindle cell sarcoma three years ago in another hospital. However, the patient did not receive further treatment for it. A 2D TTE indicated the recurrence of a tumour in the left atrium measuring 3.7×3.5 cm, causing mild to moderate mitral valve obstruction and moderate PAH. Mild tricuspid regurgitation was also observed. The patient's EF was measured at 60%. A chest Computed Tomography (CT) scan revealed a large, well-defined hypodense mass occupying the left atrium, protruding into the left ventricle through the mitral valve. There was no extension of the lesion outside the cardiac chambers. Due to the recurrence, clinical diagnosis was considered as recurrent malignant cardiac tumour. A redo sternotomy was performed, and the left atrial tumour was excised. Gross examination of the tumour revealed dimensions of 6×5.5×2 cm with a pedunculated stalk [Table/Fig-3a]. Histopathological examination {Haematoxylin and Eosin (H&E)} confirmed the diagnosis of undifferentiated pleomorphic sarcoma, and IHC demonstrated positive staining for myogenin and desmin [Table/Fig-3b-d]. The final diagnosis was high-grade

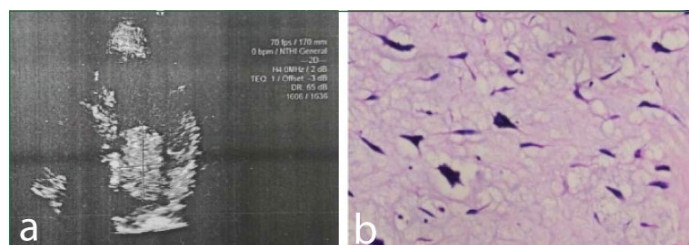


[Table/Fig-3]: a) Gross homogenous whitish appearance. b) Markedly atypical spindle cells having pleomorphic hyperchromatic nuclei (H&E, 10x). c) Nuclear myogenin positivity (10x). d) Cytoplasmic desmin positivity (IHC, 40x).

spindle cell sarcoma-rhabdomyosarcoma. The patient was referred to a higher centre where she underwent radiotherapy and multiple cycles of chemotherapy and remained healthy for one year, but later developed haemopericardium and unfortunately passed away.

Case 4

A 72-year-old male patient, known to be hypertensive, presented with chest pain for two weeks, dyspnoea on exertion, cough with expectoration, and bilateral pedal oedema for six months. The ECG showed ST-elevation Myocardial Infarction (STEMI). A 2D TTE revealed mild mitral regurgitation, moderate PAH, and a mass attached to the posterior wall of the LA via a short pedicle [Table/Fig-4a]. Coronary angiography was performed, which showed triple vessel disease. The differential diagnosis included atrial myxoma and papillary fibroelastoma. Coronary Artery Bypass Graft (CABG) and resection of the LA mass were carried out. Gross examination showed multiple, gray-brown, friable tissue fragments aggregating to measure 5.5×5×2 cm. Microscopy revealed a hypocellular spindle/stellate cell neoplasm with abundant oedematous and hyalinised/myxomatous stroma, along with extensive areas of haemorrhage [Table/Fig-4b]. The final diagnosis was LA myxoma. The patient was advised to continue calcium channel blockers, beta-blockers, statins, and warfarin. During the one year follow-up, patient remained symptom free [Table/Fig-5].



[Table/Fig-4]: a) TTE showing mass in LA. b) Stellate cells with dense chromatin (H&E, 40x).

DISCUSSION

Cardiac masses encompass a wide range of lesions, which can be either neoplastic or non neoplastic, and often pose significant diagnostic, as well as therapeutic challenges. The prevalence of primary cardiac tumours has notably increased over the previous 10 years [5]. The availability and use of multimodality imaging have contributed to this rise in the identification of cardiac tumours [6]. These tumours can affect various structures of the heart. Myxomas are more commonly found in the left atrium, while lipomas are more frequent in the right atrium or ventricle. Fibromas and rhabdomyomas are generally observed in the ventricle, while angiosarcomas primarily affect the right atrium. Pleomorphic undifferentiated sarcomas, on the other hand, are more commonly seen in the left atrium [7]. Patients with cardiac masses often have co-morbidities such as hypertension, Coronary Artery Disease (CAD), and Valvular Heart Disease (VHD). In a study by Li S and Gao C, CAD, VHD, hypertension, diabetes, and Cerebrovascular Disease (CVD) were found in 19 (8.4%), 9 (4%), 31 (13.8%), 15 (6.7%), and 30 (13.3%) patients, respectively [8].

The present case series included three LA myxomas and one rhabdomyosarcoma. Cardiac myxomas most frequently occur during the fourth to sixth decade of life and show a slight female predominance (1.5:1). They are believed to develop from multipotent mesenchymal cells or subendocardial remnants near the fossa ovalis [9]. In the present series, all cardiac myxomas were located in the left atrium. This is supported by Velu D et al., who found that the most common location of cardiac myxoma was the LA (85%), followed by the right atrium (15%) [10]. Cardiac myxomas are morphologically described as polypoid and papillary types. They typically have lobulated edges and are connected to the atrial septum by a stalk like structure. They can exhibit calcification, necrosis, haemorrhage,

Case no.	Age (in years)	Gender	Chief complaints	Co-morbidities	Investigations	Site	Differential diagnosis	Histopathological diagnosis	Follow-up (one year)
1	54	Male	Breathlessness	Hypertension	2D TTE	LA	Left atrial thrombi atrial myxoma	Atrial myxoma	Symptom free
2	35	Female	Dyspnoea at rest, pedal oedema, reduced urine output	RHD	2D TTE ECG	LA	Left atrial thrombi atrial myxoma	Atrial myxoma	Symptom free
3	30	Female	Fever with chills, breathlessness	Spindle cell sarcoma-excised	2D TTE CT chest	LA	Recurrant malignant cardiac tumour	Spindle cell sarcoma high grade-rhabdomyosarcoma	Underwent radiotherapy and chemotherapy, expired after one year
4	72	Male	Chest pain, dyspnoea on exertion, cough with expectoration, pedal oedema	Hypertension, triple vessel disease	ECG 2D TTE angiogram	LA	Atrial myxoma, papillary fibroelastoma	Atrial myxoma	Symptom free

[Table/Fig-5]: Clinical findings and histopathological diagnosis of cases.

RHD: Rheumatic heart disease; TTE: Transthoracic echocardiography; ECG: Electrocardiogram; CT: Computed tomography

Name of author	Place	Year	No. of cases	Age group (in years)	Gender		Nature of tumour	
					Male n (%)	Female n (%)	Benign n (%)	Malignant n (%)
Yin L et al., [14]	Shangai, China	2016	131	18-75	50 (38.2)	81 (61.8)	104 (79.4)	27 (20.6)
Li S and Gao C [8]	Beijing, China	2017	225	8-76	139 (61.7)	86 (38.3)	223 (99.1)	2(0.9)
Wang JG et al., [15]	Qingdao, China	2018	212	12-77	62 (29.2)	150 (70.8)	199 (93.9)	12 (5.7)
Maimaitiaili A et al., [16]	Urumqi, China	2019	71	-	34 (47.9)	37 (52.1)	60 (84.5)	11 (15.5)
Kassi M et al., [17]	Houston, Texas	2019	66	-	36 (54.5)	(45.5)	27 (40.9)	39 (59.1)
González LR et al., [18]	Chile	2020	72	-	43 (59.7)	29 (40.3)	66 (91.7)	6 (8.3)
Nimisha S et al., [19]	Kerala, India	2022	7	17-73	3 (42.8)	4 (57.2)	5 (71.43)	2 (28.57)
Present study	Tamil Nadu, India	2023	4	30-74	2 (50)	2 (50)	3 (75)	1 (25)

[Table/Fig-6]: Comparison of clinicopathology features of cardiac tumour with other studies [4,14-19].

fibrosis, and cysts. Stellate cells within a myxoid stroma are the hallmark findings of cardiac myxomas in histopathology [2, 11].

Rhabdomyosarcomas are striated muscle tumours that account for approximately 4% to 7% of all cardiac sarcomas. These cancers tend to involve the valves, originate from the myocardium, and do not show a preference for any specific chamber. They are often bulky, invasive, and larger than 10 cm in diameter. Rhabdomyoblasts express desmin, myogenin, and myoglobin [12]. Typically, they exhibit signs of cardiac invasion or obstruction. The accepted treatment for rhabdomyosarcoma involves a combination of surgery, chemotherapy, as well as radiation therapy. This treatment strategy has been established through large scale clinical trials over the past few decades. Unfortunately, most patients with primary rhabdomyosarcoma of the heart survive for less than a year [13]. In the present case series, one case was diagnosed as rhabdomyosarcoma, and the patient survived for only one year despite receiving treatment. Comparative features of cardiac tumours with other studies are provided in [Table/Fig-6] [4,14-19].

The gold standard therapy for cardiac myxoma is surgical excision, ensuring complete removal of the tumour along with its base. Although the recurrence incidence of cardiac myxomas in non syndromic patients is less than 5%, patients with multifocal origins, a family history, or Carney complex appear to be more susceptible to recurrence. The optimal approach to treating malignant heart tumours still involves surgical excision combined with systemic chemotherapy. Without surgical resection, the survival rate at 9 to 12 months is only 10% [19].

CONCLUSION(S)

Regardless of the type of tumour, individuals with cardiac tumours can present in a variety of clinical ways based on the size and location of the tumour. Although cardiac tumours are uncommon, even benign tumours can cause major side effects, such as intracardiac obstruction and deadly arrhythmias. With the use of imaging techniques, they are being recognised more frequently

today; some are even diagnosed by chance. However, a biopsy is required to make a diagnosis in patients who desire treatment. Follow-up of these patients is mandatory to monitor for recurrence.

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