Clinical Presentation and Non-Invasive Investigations of Cardiac Myxoma: A Case Series.

Kim Fong Ng1, Mohamed Abdusalam Elwaifa2, Mohamed Abdelwahab Badawi2, Norliza Othman1.
1Sultanah Aminah Hospital, Johor Bahru.
2University of Cyberjaya, Cyberjaya.

Abstract
Cardiac myxoma represents 50% of all cardiac benign tumours, and the majority are located in the left atrium. We report three cases of left atrial myxoma. Our first patient presented with inferior myocardial infarction, while the other two had heart failure symptoms. Although embolic complications have been reported to occur in cardiac myxoma patients, the coronary angiography of our first patient showed chronic total occlusion of the left circumflex coronary artery. The heart failure symptoms were attributed to either obstructive complications of cardiac myxoma or reduced left ventricular systolic function. The diagnosis was confirmed with the use of cardiac magnetic resonance imaging (CMR), in which the size, location, mobility, presence or absence of stalk, and tumour prolapse into mitral annulus were visualized. Although two of our patients declined surgical intervention, the tumour was successfully resected in one patient. Post-surgical resection, the patient had one episode of arrhythmia but made a good recovery.

Key words: Left atrial myxoma; Heart Failure; Myocardial infarction; Cardiac Magnetic resonance imaging (CMR).

Introduction
Myxomas represent 50% of the benign cardiac tumours. The incidence rate of this tumour is 1.38 to 300 persons per 100,000 people. The most common location is the left atrium. This tumour can be sporadic or familial, and the familial form can arise in multiple locations. Cardiac myxoma (CM) affects more women compared to men. Although CM typically occurs between third and fifth decades of life, it can occur at any age. The clinical presentation of CM can be either due to obstructive symptoms, embolic complications, or constitutional symptoms. Cardiac magnetic resonance imaging (CMR) is more advantageous compared to echocardiography in the diagnosis of this condition, although echocardiography can be a useful tool in evaluating those patients. Once diagnosed, surgical resection of CM is the treatment of choice. CM has an excellent prognosis, although recurrence can occur. In this case series, we will shed some light on the clinical presentation of this tumour as well as on the use of CMR in the diagnosis of CM.

Case 1
A 53-year-old lady presented with symptoms suggestive of myocardial ischaemia. Her past medical history was significant for Hypertension. Electrocardiogram (ECG) on arrival was consistent with inferior ST segment elevation myocardial infarction (STEMI). She was treated with a thrombolytic agent (Streptokinase) followed by standard dual-antiplatelets therapy and an anticoagulant.

A transthoracic echocardiogram (TTE) showed the presence of left atrial (LA) mass attached to the interatrial septum with preserved left ventricular (LV) ejection fraction and grade I
diastolic dysfunction. The nature of the LA mass was later confirmed with cardiac magnetic resonance imaging (CMR) which revealed a mobile oval mass in the LA measuring 1.0 X 2.0 cm attached to the interatrial septum with an overlying thrombus (Figure 1&2). The mass prolapsed into the mitral valve during systole (Figure 1&2). Coronary angiography showed chronic total occlusion (CTO) at the left circumflex artery and mild proximal disease at the mid segment of the right coronary artery. She recovered well. However, she declined surgical intervention.

![Figure 1](image1.jpg)

**Figure 1**: (a) Coronal black blood, (b) Cine real-time 4 chamber, (c) Cine 2 chamber in atrial systole, (d) Cine 4 chamber in atrial diastole and (e) systole. The left atrial mass (white arrow) is mobile and attached to interatrial septum. The mass prolapsed into the mitral valve during atrial systole. Unable to visualize the stalk.

![Figure 2](image2.jpg)

**Figure 2**: Post contrast images, (a) first pass perfusion coronal, (b) early gadolinium 2 chamber, (c) late gadolinium, short axis and (d) late gadolinium 2 chamber. The mass (white arrow) in the left atrium shows no significant enhancement during first pass perfusion, early gadolinium, and late gadolinium phase.
Case 2
A 65-year-old lady presented with reduced effort tolerance, orthopnoea, and paroxysmal nocturnal dyspnoea. Past medical history was significant for Diabetes Mellitus, Hypertension, and chronic kidney disease (eGFR 36 mls/min). Transthoracic echocardiogram showed LA mass measuring 2.2 X 2.4 cm with reduced ejection fraction (LVEF 30 -35%). Furthermore, CMR showed dilated LA (16 cm²/m²) with the presence of a mobile oval mass in the LA measuring 2.3 x 2.2 x 2.0 cm attached to the interatrial septum (Figure 3&4). The stalk was not seen and no fat component, but the mass heterogeneously enhanced in the late gadolinium phase (Figure 3). She received guidelines-guided medical therapy for heart failure, she declined surgical intervention, however.

Figure 3: Transverse black blood (a), sagittal black blood (b), transverse white blood (c), short axis cine (d) and late gadolinium (e). The left atrial mass (white arrowhead) attached to the interatrial septum. No stalk or fat component. Heterogeneously enhanced in late gadolinium image.
Case 3
A 39-year-old man, with no significant past medical history, presented with worsening dyspnoea over a 3-day period with reduced effort tolerance and bilateral lower limbs oedema for 3 months. Grade III systolic murmur was heard over precordium. His ECG showed inverted T wave in leads III and V1 through to V4, and his chest x ray revealed cardiomegaly and bilateral pleural effusion. TTE indicated the presence of LA mass measuring 5.2 cm x 3.4 cm with evidence of haemodynamic impairment of mitral flow. CMR showed a huge LA mass attached to the interatrial septum measuring 5.8cm x 3.5cm x 4.6cm (Figure 5). The stalk is seen attached to the interatrial septum (Figure 5). In addition, progressive heterogeneous enhancement of LA mass is seen (Figure 6). The mass prolapsed into the mitral annulus during atrial systole, causing severe mitral regurgitation (MR) (Figure 5&7). The patient underwent surgical resection of the LA mass. LA myxoma measuring 6.0 x 4.0 x 2.0 cm was removed intraoperatively. Postoperatively, the patient developed one episode of atrial fibrillation with rapid ventricular response which was treated with intravenous amiodarone. Postoperative TTE showed no residual tumour with mild MR. He was discharged home at day six post-surgery and remained asymptomatic on follow up 2 weeks later.

5a
5b
5c

Figure 5: 5a and 5b HLA view in atrial diastole and systole showing the frond-like mass with a stalk attached to the interatrial septum. It prolapsed into the mitral annulus in systole. 5c Short axis of left atrium demonstrating the stalk and the mass attachment to the septum.
Discussion

Of the primary cardiac tumours, cardiac myxoma (CM) is the most common with an incidence rate of 1.38 to 300 persons per 100,000 people.\(^1\) It accounts for more than half of the primary cardiac tumours.\(^2\) Left atrium is the most common location of CM (75%) followed by the right atrium (23%).\(^2\) Only 2% of CM occur in the ventricles.\(^2\) In the familial form, CM could arise in multiple sites.\(^2\)

CM is more common in women compared to men.\(^3,4\) In some reports, 67% - 71% of CM patients were women while 23% - 33% were men.\(^3,5\) Majority of patients are diagnosed between the age of 30 and 50, although CM can occur at any age.\(^5,4,6\) In this case series, two of our patients were women and the CM was found in the LA in all of them, consistent with the literature about this condition.

CM is asymptomatic in 20% of patients.\(^4\) In one study 43% of patients presented with heart failure.\(^5\) Cardiac failure in this study was shown to be due mitral valve obstruction or stenosis by the LA myxoma.\(^5\) Other causes of heart failure in these patients are arrhythmias or concomitant rheumatic heart disease.\(^5\) In this case series, all three of our patients were symptomatic. Two of them had dyspnoea and/or other symptoms of heart failure while one patient presented with symptoms of myocardial infarction. The two patients who had cardiac failure were found to have mitral regurgitation (MR). The CMR of the last patient showed that the mass prolapsed into the mitral valve during atrial systole. Although that the first patient did not have heart failure, his CMR demonstrated the mass prolapsing into the mitral valve during systole too. It is likely that cardiac failure was exacerbated by the haemodynamic impairment.

**Figure 6:** 6a, 6b and 6c horizontal long axis (HLA) view during perfusion, early gadolinium, and late gadolinium phases. Heterogeneous progressive peripheral enhancement of the LA mass is seen.

**Figure 7:** 7a and 7b vertical long axis (VLA) view in atrial diastole and systole showing the frond-like mass prolapsing into the mitral annulus in systole.
of the mitral flow in these patients. Those haemodynamic consequences of the tumour can be intermittent due to the mobility of the tumour during the cardiac cycle. Systemic embolization, though less common, is a presenting feature of CM too. It is reported to occur in 10 – 45% of myxoma patients. Pine et al, in a large series of 112 patients, reported 29% prevalence of systemic emboli. Friability and mobility of the tumour seem to be the main determining factors in systemic embolization risk. Central nervous system remains the most common location of emboli in myxoma patients, accounting for over 60% of cases. Moreover, neurological symptoms tend to occur more in men compared to women, and complications are seen in about a quarter of these patients. The phenomenon of systemic embolization can affect any arterial bed such as the upper and lower extremities, kidneys, liver, spleen, eye, and coronary arteries.

Myocardial infarction due to coronary artery embolism is rare presentation of CM. The reported incidence of this complication is 0.06%. In one study, however, it was thought to be much more prevalent in myxoma patients; 10% - 30% of myxoma patients had evidence of coronary emboli. Coronary arteries are protected against embolization by aortic valve cusps, the small diameter of the coronary apertures and right angled junction of the coronary apertures within the aortic bulb. Nevertheless, right and left coronary arteries can be affected. The right coronary artery (RCA) is thought to be a more common site with inferior myocardial infarction is reported in a little over two-third of cases. The hypothetical explanation for this is that small fragments or emboli from the tumour could reside in the aortic bulb during diastole and later carried more easily to the right ostium due to its anatomical position relative to the aortic blood flow. Anterior myocardial infarction is reported to occur in 22.7% of cases while posterior wall infarction affects 9.1%. It is worth noting that the left circumflex artery (LCX) was reported to be the main culprit artery; accounting for 38% of cases, followed by the RCA (28.6%) in another study. Coronary angiography is reported to be normal in one third up to half of those patients, who are mostly in the younger age group. Despite that, this can be associated with large area of infarction. This could be explained by the high rate of spontaneous recanalization among myxoma patients, and that coronary occlusion, if found on angiography, is followed by complete and spontaneous resolution on a repeat test few days later. Furthermore, Braun et al suggested that a tumour embolus will be further fragmented within the coronary arteries followed by distal dispersion. One of our 3 patients in this case series had inferior wall STEMI. Her TTE showed hypokinetic posterior and inferior walls, while coronary angiography showed chronic total occlusion (CTO) of the LCX and mild disease of the RCA. In addition, the CMR showed infarction at the LCX territory and LA myxoma with superimposed thrombus. This patient has history of treated hypertension which makes an atherosclerotic etiology of the LCX disease is the likely cause of the patient’s presentation. However, and given the CMR findings, the clinical presentation, and the culprit artery being the LCX, embolization could not totally ruled out. Cardiac myxoma may present with constitutional symptoms such as fever and weight loss in 35% of cases. This is due to tumour production of cytokines, including interleukins. Distant metastasis in myxoma are rare, but they have been found in the brain, lung, bone and soft tissue. Our patients did not present with constitutional symptoms and there was no distant metastasis found at the time of diagnosis.

In patients younger than the age of 20, CM can be part of Carney’s syndrome. Carney’s syndrome is a triad of extracardiac myxoma in the breast or skin, spotty pigmentation, and endocrine disorders, testicular, thyroid, and hypophysis tumors. Although rare, younger patients should be investigated for this syndrome once myxoma is diagnosed. Transthoracic echocardiography (TTE) has a 95% sensitivity while transesophageal echocardiography (TEE) has 100 sensitivity for cardiac myxoma. Moreover, TTE could be used to evaluate the embolization risk in myxoma patients. Computed tomography (CT) and
cardiac magnetic resonance imaging (CMR) can provide more accurate assessment on the tumour attachment, tumour stalk presence, intra-cardiac localization, and size.\textsuperscript{5} In addition, CMR distinguishes between CM and other pathologies such as thrombus or calcified and fatty tumours.\textsuperscript{4,11} Coronary angiography is reserved for patients above the age of 40 to establish a concomitant coronary artery disease.\textsuperscript{2} CMR was used successfully on our patients to provide detailed assessment of the intracardiac location and size of the tumour. In addition, stalk was visualized in one patient prior to surgical resection. The mobility of the mass and its movement across the mitral valve were also clearly demonstrated using CMR.

Surgical excision is the treatment of choice for cardiac myxoma.\textsuperscript{2,5} It should be performed urgently to avoid embolic complications and sudden death.\textsuperscript{5} Although that the surgical removal is curative, recurrence can occur with a recurrence rate between 5% -14% of patients.\textsuperscript{5} It occurs few months upto 8 years after the initial resection.\textsuperscript{2,5} The cause of recurrence is unknown. However, there are multiple risk factors for this such as inadequate or incomplete resection, intracardiac implantation, intraoperative displacement of tumour material, to mention but few.\textsuperscript{2,5} Incomplete or inadequate resection is the most likely cause in sporadic cases.\textsuperscript{5} The overall risk of recurrence in Carney’s syndrome is 22% compared to 1% - 3% in sporadic cases.\textsuperscript{2,5} Regular follow-up with TTE is necessary and genetic screening for those with recurrent myxoma may help identify patients at risk for further recurrence.\textsuperscript{2} Only one of our patients underwent successful surgical resection while the other two refused surgery.

Cardiac myxoma has an excellent long-term prognosis.\textsuperscript{5,11} Operative mortality rate is between 0 – 3% while hospital mortality is 0 – 12%.\textsuperscript{5} The reported hospital mortality in literature is 4.7%.\textsuperscript{12} After surgical removal, transient supraventricular arrhythmia or bradyarrhythmia may occur, and only few patients require permanent pacing due to atrophicventricular conduction abnormalities.\textsuperscript{5} Our patient that underwent surgical resection of tumour had one episode of atrial fibrillation with rapid ventricular response which was treated with intravenous antiarrhythmic medication (amiodarone). No further episodes of arrhythmia recorded.

In summary, cardiac myxoma can affect any age group and the left atrium is the most common location. Heart failure develops in these patients due to haemodynamic disturbances of blood flow across the mitral valve. Although coronary artery embolism is a well recognized complication of cardiac myxoma, concomitant coronary artery disease should be excluded especially in those above the age of 40. Echocardiography is a useful tool in the diagnosis of this condition, however cardiac magnetic resonance imaging provides more detailed assessment of an intracardiac myxoma.


