

Right heart failure due to benign metastasizing leiomyoma: a case report of this exceedingly rare condition and review of the literature

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Background

Benign metastasizing leiomyoma (BML) is a smooth muscle tumour of genital origin occurring in women with a history of uterine or pelvic leiomyoma. Although histologically benign, it exhibits metastatic behaviour. Lungs are the most common site of metastasis. The heart is a rare site and metastasis at this location has been described in just few cases.

Case summary

A 42-year-old woman with a resected uterine leiomyoma and a subsequent and still not-resected left periovarian solid mass began complaining of shortness of breath 2 weeks before presentation. Echocardiography showed a mass located in the right ventricular cavity, enlargement of the right ventricle, and severe tricuspid regurgitation. Cardiac magnetic resonance revealed two masses suggestive of tumours in the right ventricle causing right ventricular outflow tract obstruction. Cardiac surgery was performed and, intraoperatively, a third small mass was detected on the tricuspid valve. The masses were resected, and tricuspid valve replacement was performed. Ten days later, the patient underwent an abdominal surgery for the pelvic mass resection. Immunohistochemical analysis of the cardiac and pelvic masses corroborated the diagnosis of benign leiomyomas. The patient was discharged in good clinical condition.

Discussion

Benign metastasizing leiomyoma to the heart is a rare condition. The pathogenesis remains controversial and includes: (i) vascular or lymphatic spread of myomatous tissue cells when leiomyoma resection or hysterectomy is performed and (ii) smooth muscle cell proliferation in multiple regions. The more usual locations of BML in the heart seem to be the tricuspid valve and the right face of the interventricular septum.

Keywords

Benign metastasizing leiomyoma • Cardiac tumour • Right ventricle mass • Tricuspid valve mass • Uterine leiomyoma • Case report

Learning points

- Benign metastasizing leiomyoma (BML) is a smooth muscle tumour of genital origin occurring in women with a history of uterine or pelvic leiomyoma. Although histologically benign, BML exhibits metastatic behaviour.
- Heart is an exceedingly rare site of metastasis. The more usual locations of BML in the heart seem to be the tricuspid valve and the right face of the interventricular septum.

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Primary Specialties involved other than cardiology

Pathology, Anatomy, and Gynaecology

Introduction

Cardiac neoplasms are categorized according to their histological characteristics (benign or malignant) and their site of origin (metastatic or primary). Metastatic lesions are 20–30 times more common than primary lesions and are mostly malignant.¹ Benign metastasizing leiomyoma (BML) is a smooth muscle tumour of genital origin occurring in women with a history of uterine or pelvic leiomyoma and may manifest many years after the uterine operation. Although histologically benign, BML, as its name implies, may present a local malignant character and influence heart function. Here we report a clinical case of a cardiac BML and present a review of the most common locations in the heart of this extremely rare tumour.

mass with an approximate volume of 90 mL. Surgery for resection of the mass was scheduled but could not be performed because of abrupt onset of the current symptoms suggestive of heart failure.

The patient was transferred to our hospital for further evaluation. On admission, her vital signs were within normal limits. On physical examination, we disclosed a regular cardiac rhythm, hypophonic first heart sound, and a regurgitation murmur at the left inferior sternal border associated with an increased v wave venous pulse on internal jugular vein compatible with tricuspid regurgitation. A transthoracic echocardiography performed in the emergency room revealed a mobile and well-defined mass measuring $\sim 3.0 \times 1.6$ cm located in the right ventricular cavity, apparently adhered to the interventricular septum, and a probable thickening of the tricuspid subvalvar apparatus and severe tricuspid regurgitation (*Figure 1*). The right ventricle (RV) was enlarged with depressed systolic function. Left ventricle (LV) dimension and systolic function were normal. As it was not clear if the mass was a thrombus or a tumour, the patient underwent cardiac magnetic resonance (CMR) imaging which revealed two large and independent masses in the right ventricular cavity (*Figure 2*). Both lesions were iso-intense to the signal of myocardial tissue on T1 and

Timeline

Two years prior to presentation:	Hysterectomy (uterine leiomyoma).
Six months prior to presentation:	Onset of pelvic pain.
Two months prior to presentation:	A left periovarian solid mass found by abdominal ultrasound; mass resection surgery was scheduled but could not be performed because of abrupt onset of symptoms suggestive of heart failure (detailed below).
Two weeks prior to presentation:	Onset of retrosternal pain and shortness of breath on moderate efforts.
One day prior to presentation:	Pulmonary thromboembolism ruled out by normal chest computed tomography angiography performed at another hospital.
Upon presentation to our institution:	Echocardiography showed a large mass in the right ventricle, right cardiac chambers enlargement, and severe tricuspid regurgitation.
One day after presentation:	Cardiac resonance showed two masses in right ventricle suggestive of tumours.
Two days after presentation:	Cardiac surgery (two masses resected and a third small neoformation intraoperatively detected on the tricuspid valve, which was replaced by a porcine bioprosthesis).
Five days after cardiac surgery:	Magnetic resonance imaging of the pelvis confirmed large solid mass in contact with the left ovary and suggestive of leiomyoma.
Ten days after cardiac surgery:	Abdominal surgery (pelvic mass resection).
Two days after abdominal surgery:	Echocardiography revealed no residual cardiac mass, good function of the tricuspid prosthetic valve, and normal size and systolic function of the right ventricle. Hospital discharge in good clinical condition.

Case presentation

A 42-year-old female patient presented at a regional hospital complaining of retrosternal pain and shortness of breath on moderate efforts that started 2 weeks before. Pulmonary thromboembolism was initially suspected; however, chest computed tomography angiography ruled out this diagnostic hypothesis.

The patient had undergone a hysterectomy 2 years earlier due to leiomyoma. She had been experiencing pelvic pain during the past 6 months. An abdominal ultrasound performed 2 months prior to presentation showed an apparently vascularized left periovarian solid

T2-weighted imaging. The first-pass gadolinium-enhanced perfusion imaging showed heterogeneous nature of flow of contrast suggesting vascularity within the masses and both showed heterogeneous late gadolinium enhancement. These characteristics suggested the tumoural nature of the masses and ruled out the hypothesis of thrombus (*Figure 3*). The largest one, measuring 5.3×2.7 cm, was adhered to the anterior face of the right ventricular outflow tract (RVOT) and was responsible for a significant RVOT obstruction. The second tumour presented as a multilobulated, pedunculated, and mobile mass attached to the interventricular septum. Right ventricle enlargement and moderate global systolic deficit (estimated ejection

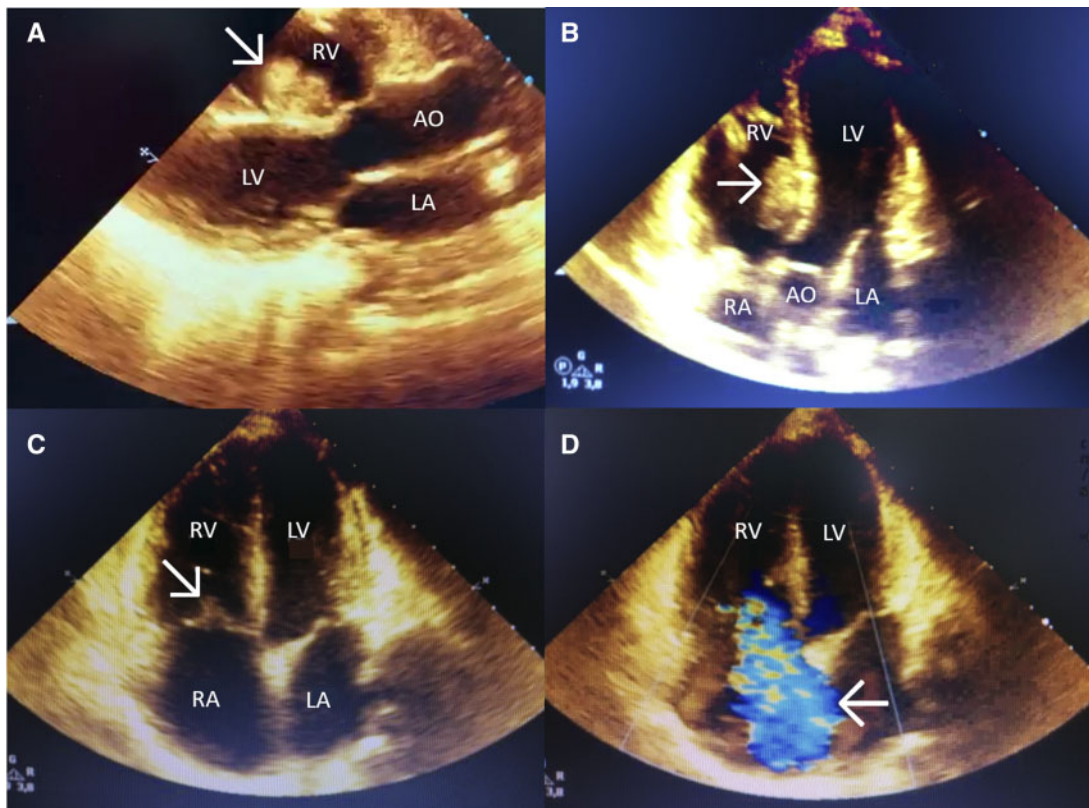


Figure 1 Echocardiographic images on admission; (A) long-axis parasternal view showing a large mass (arrow) apparently adhered to the right side of the interventricular septum; (B) anteriorly angulated four-chamber apical view showing the same mass (arrow); (C) four-chamber apical view showing right chambers enlargement and thickening of the tricuspid subvalvar apparatus (arrow); (D) tricuspid regurgitation (arrow) qualitatively graded as severe because of its colour flow jet area greater than 10 cm^2 . LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle.

fraction of 39%) were found and both were attributed to the RVOT obstruction. Mild pericardial effusion and bilateral pleural effusion were also observed.

Because of the significant obstruction of the RVOT, surgical treatment was mandatory. An operation was performed through median sternotomy with standard bicaval cardiopulmonary bypass. The two masses described in the CMR were carefully resected. A third small neoformation was intraoperatively detected on the tricuspid valve, adhered to the ventricular face of the anterior leaflet and to the chordae (Figure 4). A significant segment of the anterior leaflet was resected along with the mass and a valve replacement with bioprosthesis (St. Jude Medical Stented Porcine 31 mm) was performed. The masses were well capsulated without signs of local spread in the surrounding myocardial tissue. At gross examination, they had a nodular, fragmented appearance, elastic consistency, and presented a smooth whitish-yellow capsule. The surgery was performed with no complications and the immediate postoperative course was uneventful.

Histologic examination revealed a mesenchymal neoplasm consisting of spindle cells with predominantly uniform nuclei and eosinophilic cytoplasm, arranged in long bundles amid collagenized stroma and resembling smooth muscle cells. No mitosis, areas of necrosis, or signs of malignancy were found. A vascular component of varying calibre was observed, sometimes showing thickened walls and

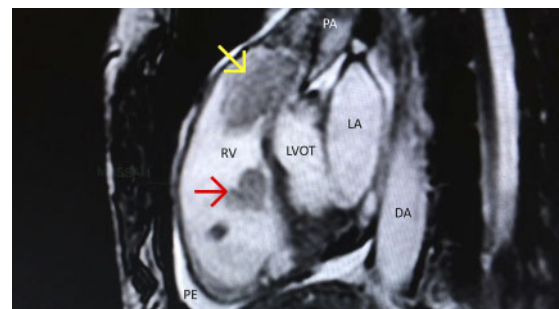


Figure 2 Cardiac magnetic resonance cine imaging in the sagittal view showing a large mass (yellow arrow) at the right ventricular outflow tract and a smaller one (red arrow) attached to the right face of the interventricular septum. DA, descending aorta; LA, left atrium; LVOT, left ventricular outflow tract; PA, pulmonary artery; PE, pericardial effusion; RV, right ventricle.

permeating the tumour (Figure 5A). A segment of the cardiac valve accompanied the specimen and had a normal histological appearance.

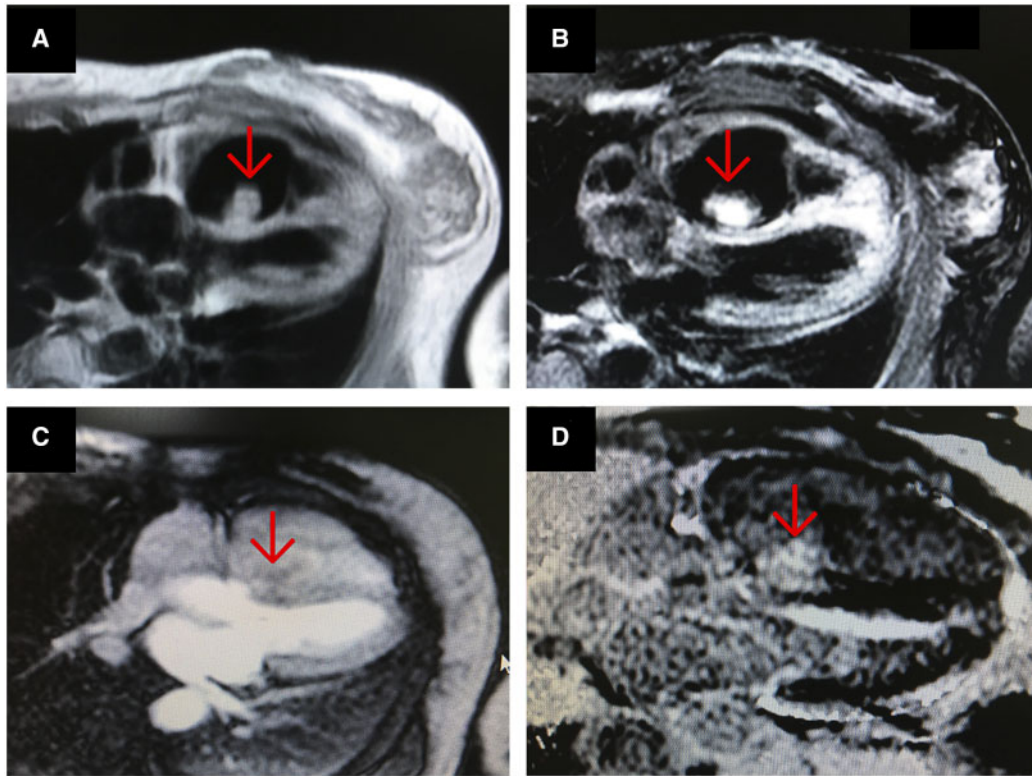


Figure 3 Tissue characterization of the masses by cardiac magnetic resonance imaging. The four images are in the axial plane and showed the mass attached to the right face of the interventricular septum (red arrow). The lesion is iso-intense to the signal of myocardial tissue on both T1-weighted imaging (A) and fat suppressed T2-weighted imaging (B). The first-pass gadolinium-enhanced perfusion imaging (C) showed heterogeneous nature of flow of contrast suggesting vascularity within the mass. The late gadolinium enhancement imaging (D) revealed heterogeneous uptake of the mass. The characteristics described above suggested the tumoural nature of the masses and ruled out the hypothesis of thrombus.



Figure 4 Macroscopic aspect of cardiac masses. (A) Mass adhered to the tricuspid valve and to the chordae. Note the valve tissue (arrow); (B) mass attached to the right face of the interventricular septum; (C) mass attached to the anterior face of the right ventricular outflow tract.

Immunohistochemically, the tumour cells expressed desmin and caldesmon (Figure 5B and C), corroborating smooth muscle differentiation. In addition, tumour cells were strongly positive for oestrogen receptors (Figure 5D) which is supportive of origin in female genital

tissues. From both the histologic and immunohistochemistry examination the final diagnosis was cardiac leiomyoma.

The gynaecology team started to monitor the case immediately after cardiac surgery due to the knowledge of a previously identified pelvic mass which could be palpated through physical examination. The patient underwent a magnetic resonance imaging of the pelvis. A heterogeneous solid mass was found in the left paramedian situation of the pelvic cavity, measuring about $8.1 \times 8.0 \times 6.9$ cm, in close contact with the left ovary and suggestive of leiomyoma (Figure 6).

Due to the large size of the mass, it was decided to extract it immediately. On the 10th postoperative day of the cardiac procedure, the patient underwent pelvic tumour resection surgery. The tumour's morphological aspect was suggestive of leiomyoma. The surgical procedure was performed with no complications.

Histologic analysis of the surgical specimen revealed proliferation of myoid spindle cells without atypia, mitosis, or necrosis (Figure 7A), compatible with the diagnosis of leiomyoma. The tumour cells expressed desmin and caldesmon (Figure 7B and C), corroborating smooth muscle differentiation.

Postoperative echocardiography revealed no residual cardiac mass, good function of the tricuspid prosthetic valve, and normal RV size and systolic function. The patient was discharged from hospital in

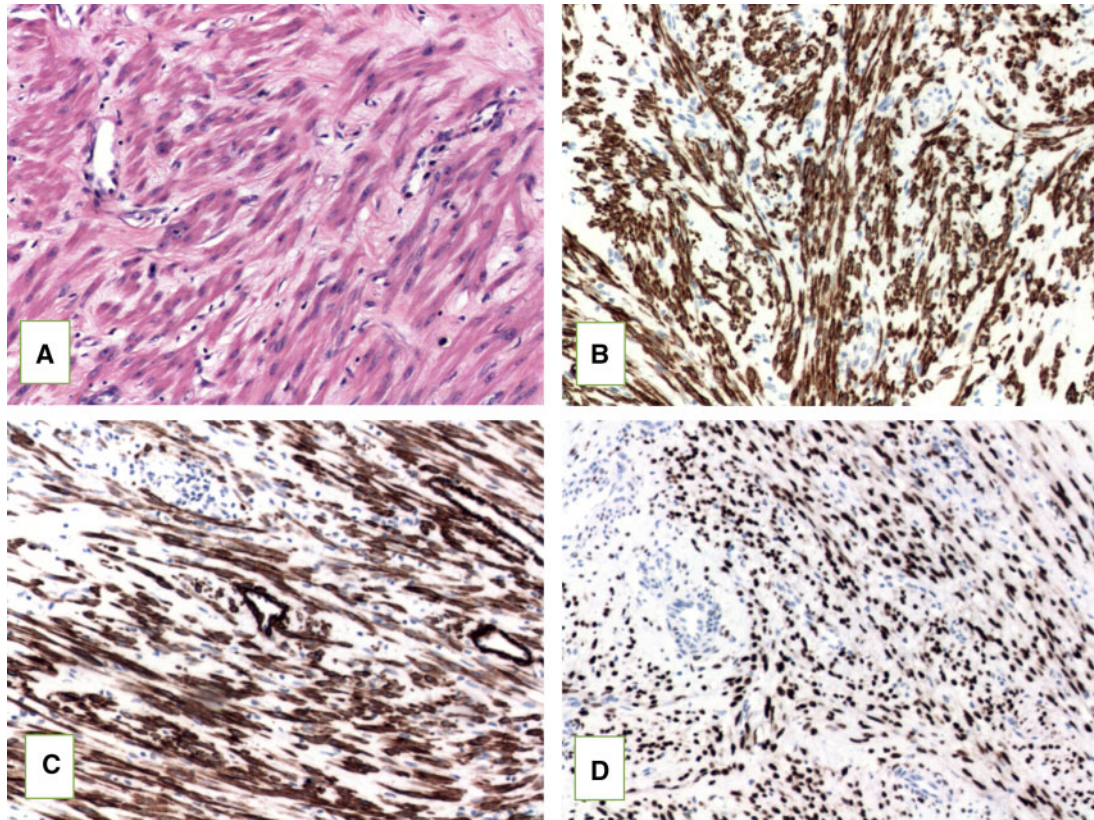


Figure 5 (A) The cardiac tumour was composed of smooth muscle spindle cells with interlacing bundle organization, without cellular atypia, mitosis, or necrosis (haematoxylin and eosin stain, 100× field); the tumour cells expressed desmin (B) and caldesmon (C) confirming the smooth muscle nature (both 100× field) and were positive for oestrogen receptor (D), which is supportive of genital origin (100× field).

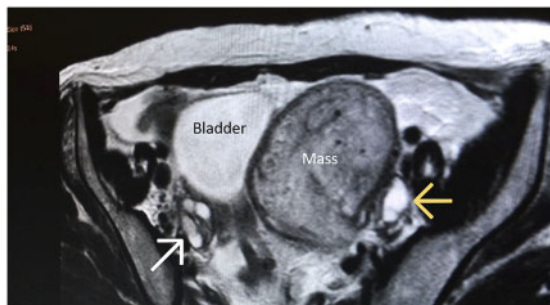


Figure 6 Magnetic resonance imaging of the female pelvis, T2-weighted, axial view, showing a large heterogeneous solid mass in the left paramedian situation of the pelvic cavity (yellow arrow: left ovary; white arrow: right ovary).

good clinical and haemodynamic conditions with a final diagnosis of BML to the RV, tricuspid valve, and pelvic leiomyoma. Four months after hospital discharge, the patient reported being in good physical condition and denied any complications.

Discussion

The patient of our case report had simultaneous cardiac and pelvic masses with similar morphological and immunohistochemical characteristics, both compatible with smooth muscle cell tumour. The absence of mitosis, necrosis, and marked cellular pleomorphism in the tumours corroborated the diagnosis of benign leiomyomas and the positivity for oestrogen receptors suggested their genital origin.

Uterine leiomyomas are the most common gynaecological tumour in women of reproductive age. Rarely, associated extrauterine benign-appearing smooth muscle tumours are found.² Benign metastasizing leiomyoma is most common in the lungs, although other sites such as the heart, skeletal muscles, lymph nodes, peritoneum, and retroperitoneum are also occasionally involved.³

Besides BML, two other settings of cardiac smooth muscle tumours have been described: (i) intravenous leiomyomatosis, which is the direct extension of leiomyoma originating from the uterus into the right cardiac cavities through the inferior vena cava⁴; and (ii) primary cardiac leiomyoma, histologically similar to BML but occurring in patients with no previous history of uterine leiomyoma. Although all three entities are rare, intravenous leiomyomatosis is the most common.⁵

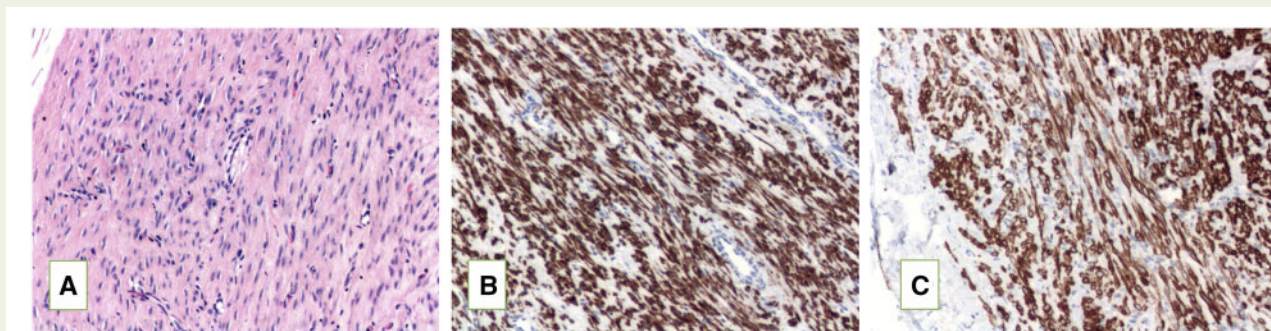


Figure 7 (A) The pelvic tumour was composed of smooth muscle spindle cells without cellular atypia, mitosis or necrosis (haematoxylin and eosin stain, 100× field); the tumour cells expressed desmin (B) and caldesmon (C) confirming the smooth muscle nature (both 100× field).

Table 1 Case reports of benign metastasizing leiomyoma to the heart

Author	Location in the heart	Surgical treatment
Takemura et al. ⁷	Tricuspid subvalvar apparatus (attached to papillary muscle)	Tumour excision Tricuspid valve replacement
Thukkani et al. ¹²	Tricuspid valve	Tricuspid valve replacement
Galvin et al. ⁸	Right ventricle (interventricular septum)	Tumour excision
Cai et al. ³	Multiple nodules in the RV wall	No surgery (no haemodynamic disturbance and high operative risk)
Consamus et al. ⁵	Right atrium (interatrial septum)	Tumour excision
Williams et al. ⁹	Right ventricle (interventricular septum) Epicardium	Intracavitary and epicardial tumours Excision
Meddeb et al. ¹⁰	Tricuspid subvalvar apparatus (attached to papillary muscle)	Tumour excision Tricuspid valve repair
Gad et al. ¹¹	Tricuspid subvalvar apparatus (attached to the chordae)	Tumour excision Tricuspid valve repair
Present case	Tricuspid subvalvar apparatus (attached to the chordae) Right ventricle (interventricular septum and RVOT)	Tumour excision Tricuspid valve replacement

RV, right ventricle; RVOT, right ventricular outflow tract.

The pathogenesis of BML remains controversial and includes (i) vascular or lymphatic spread of myomatous tissue cells to other tissues when leiomyoma resection or hysterectomy is performed²; and (ii) smooth muscle cells proliferation in multiple regions due to an overresponse to oestrogen or progesterone stimulation in genetically susceptible individuals.³

Benign metastasizing leiomyoma may present many years after the uterine operation. The mean time from the primary uterine surgery to BML diagnosis was 8.8 years according to a recent review.⁶ Our patient had a previous hysterectomy 2 years earlier.

The clinical presentation of BML to the heart is non-specific and depends on the haemodynamic repercussion secondary to the location of the tumour. In the present case, there were two independent masses at the right ventricular cavity, one of them obstructing the RVOT and responsible for the RV enlargement and systolic

dysfunction. A small third one was attached to the tricuspid subvalvar apparatus and probably contributed to the significant tricuspid regurgitation.

To the best of our knowledge, there are only eight prior case reports of BML to the heart.^{3,5,7-12} No intravenous leiomyoma was described in any of them. All other patients had previous history of uterine surgery except one case⁹ in which the patient was scheduled for a hysterectomy by the time the cardiac surgery was performed.

The tumour was found adhered to the leaflets or to the subvalvar apparatus of the tricuspid valve in four of the case reports (Table 1).^{7,10-12} Williams et al.⁹ reported a patient with two independent masses, one at the right face of the interventricular septum and the other at the epicardium. Other two cases described an isolated mass at the interventricular septum⁸ and at the right face of the interatrial septum.⁵ Cai et al.³ described a patient with multiple

nodules in the RV wall. This was the only case in which the masses were not excised because of the high operative risk. The diagnosis of BML was assumed because the patient had several other lesions in the abdominal wall, right arm, lungs, liver, muscles, and pelvic cavity. Pathological examination of the nodule in the right arm showed leiomyoma of genital origin.

Conclusions

Benign metastasizing leiomyoma is a rare aetiology of cardiac tumour and should be considered as a differential diagnosis in all female patients presenting with cardiac mass and past medical history of uterine leiomyoma. Although histologically benign, by definition, BML exhibits metastatic qualities. The most usual locations of BML in the heart seem to be the tricuspid valve and the right face of the interventricular septum, although other unusual locations as right atrium, RV wall, and epicardium have been reported.

Lead author biography



Cesar Pedrosa is a cardiologist, member of the Cardiovascular Imaging Department of the Brazilian Society of Cardiology Member of the Echocardiography and Cardiac Magnetic Resonance Departments of Biocor Instituto.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

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Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

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