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Case Report

A Unique Case of Uterine Leiomyoma Metastasis to the Heart Uterine Leiomyoma with Cardiac Metastasis

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Abstract

Smooth muscle tumors of the heart are exceedingly rare and typically manifest in three clinical scenarios: as extensions of pelvic leiomyomas into cardiac vasculature, benign metastases from uterine leiomyomas, or as primary cardiac tumors. We present the case of a 50-year-old patient with a history of cardiac rhabdomyoma resection. She presented with symptoms suggestive of right heart failure, notably exertional dyspnea and syncopal episodes. Additionally, a palpable mass in the abdomen was noted, alongside a history of multiple masses in different locations. Diagnostic assessment revealed a mass within the right atrium, likely causing dynamic obstruction. Furthermore, extensive imaging revealed a sizable pelvic mass requiring surgical intervention. The patient underwent a two-stage surgical procedure. The first stage involved tumor resection from the abdomen, conducted by the gynecologic oncology team, with assistance from cardiothoracic surgery to assess its extension within the inferior vena cava. Subsequently, the cardiac mass was excised during the second stage of the surgery. Pathological examination of the mass from the cavo-atrial junction reported a leiomyoma with benign features. This case highlights the challenges in the differential diagnosis of cardiac tumors and the importance of multidisciplinary approaches involving specialists in gynecology-oncology, cardiovascular surgery and cardiology.

Keywords: heart neoplasms; leiomyoma; rhabdomyoma; case reports; cardio-oncology.

Introduction

The incidence of primary cardiac tumors ranges from 0.17% to 0.19%, with the majority being benign and particularly prevalent during the neonatal stage[1]. The most common sites of metastases are pulmonary (80%) and the occurrence of smooth muscle tumors in the heart is particularly uncommon[2]. These tumors typically arise in three distinct clinical scenarios: as extensions of pelvic leiomyomas into the cardiac vasculature, as benign metastases from uterine leiomyomas, or as primary tumors originating within the heart itself, including leiomyomas and leiomyosarcomas[3]. The incidence of intravascular leiomyomatosis is low, with only approximately 400 cases reported in the literature since 1896[4]. They are predominantly observed in women of reproductive age, often with a history of uterine leiomyoma resection or hysterectomy. Cardiac tumor clinical presentations vary based on factors like size and location, often mimicking other cardiac

conditions, leading to misdiagnosis. Diagnosis typically involves echocardiography, considered the gold standard for intracavitary tumors, with a sensitivity of 95% and specificity of 86%.[5,6]. Cardiac MRI and CT scans are also used, although pathological analysis remains the definitive method for confirmation[7].

We report a rare case of uterine leiomyoma metastasizing to the heart in a patient previously treated for intracardiac rhabdomyoma four years prior. This case report adheres to the principles outlined in the CARE guidelines[8].

Case report

Patient Information

We present the case of a 50-year-old female patient with a history of surgical resection of an adult cellular intracardiac rhabdomyoma in 2019 and multiple masses located in ovaries, kidney and thyroid. Following the procedure, she remained symptom-free until 2022. However, in the past month leading up to her consultation, she began experiencing symptoms indicative of congestive heart failure. These included exertional dyspnea, orthopnea, oedema of lower extremities and a significant decline in functional capacity to NYHA class III/IV. Additionally, she reported perioral cyanosis with mild exertion and multiple syncopal episodes. Patient denied previous heart failure diagnosis.

Clinical findings

During the physical examination, she exhibited mucocutaneous pallor. No notable dyspnea was observed and no findings were noted upon cardiac and pulmonary auscultation. She presented with edema in the lower extremities and a palpable mass in the hypogastrium and mesogastrium.

Diagnostic Assessment

A transthoracic echocardiogram (TTE) was performed, revealing a significantly enlarged right atrium with an indexed volume of 63 mL/m2. Within it, a sizable mass with a combination of soft tissue and cystic components was identified. This highly mobile, multilocular mass, measuring 44 mm x 39 mm, seemed to restrict the flow of blood into the right ventricle, potentially due to a thin pedicle oriented towards the interatrial septum. During ventricular diastole, the mass intermittently impinged upon the tricuspid annulus, causing dynamic obstruction. Additionally, an echodense, cylindrical, tubular image was observed entering via the superior vena cava and projecting onto the right atrium inlet tract, with its distal end in contact with the previously described mass. Considering the patient's history of tumor resection in the right atrium, the differential diagnosis includes a neoplastic lesion or thrombi at various stages of evolution. The tricuspid valve appeared normal, with three leaflets and competent function on Doppler, without any signs of stenosis. The aortic gradient was measured at 9 mmHg.

Furthermore, an abdominal vessel computed tomography revealed a lobulated mass with heterogeneous density in the right adnexal region, extending superiorly to the mesogastrium, measuring approximately 220 x 177 x 58 mm (length x anteroposterior x thickness), and displacing the intestinal loops posteriorly and superiorly. This mass exhibited multiple vascular structures enhancing similarly to the aorta and showed signs of extension to the right gonadal vein and inferior vena cava at the level of the right renal vein arrival to the right atrium due to the presence of tumor thrombus. Its lower aspect contacted the uterine fundus.

Therapeutic Intervention

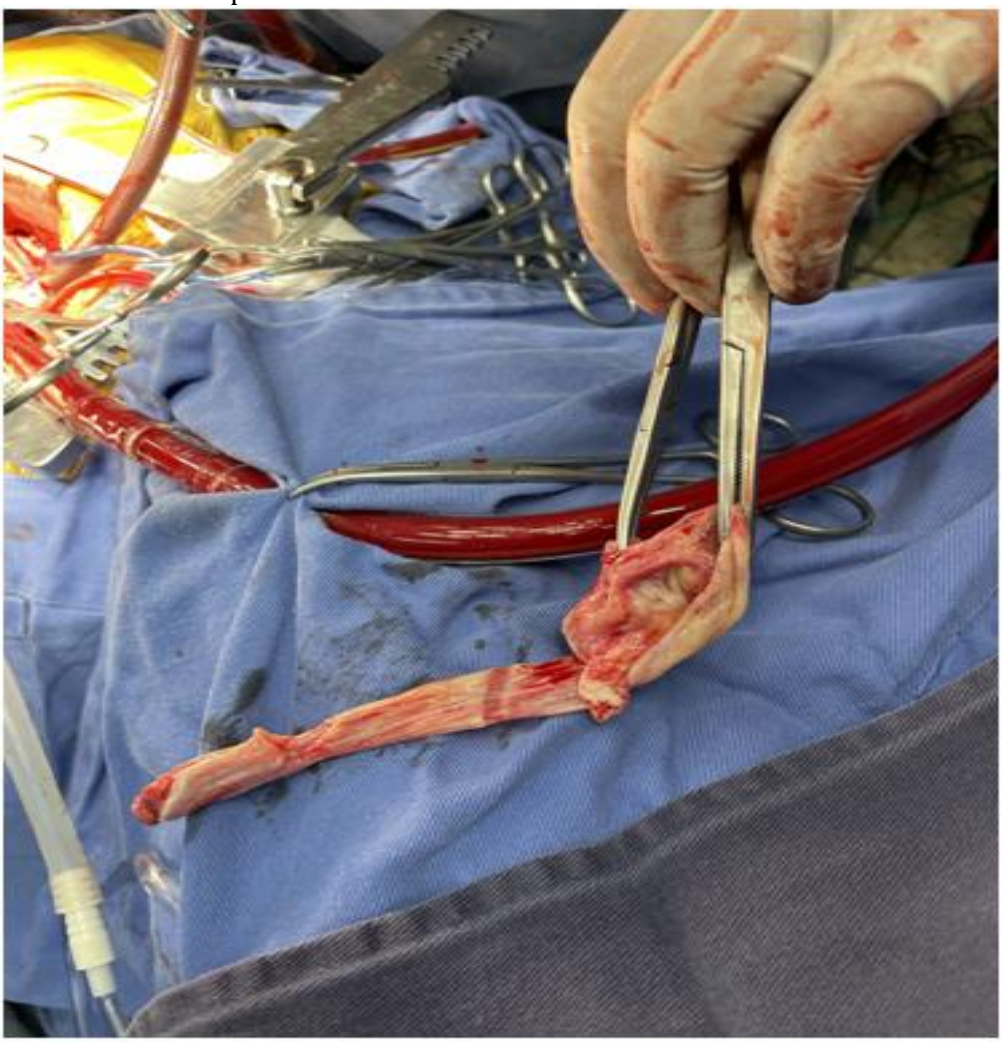
The patient underwent surgery in two stages. Initially, the gynecologic oncology service performed extraction of the retroperitoneal tumor with dissection of retroperitoneal vessels, along with extended oncological abdominal hysterectomy, bilateral salpingo-oophorectomy, pelvic lymphadenectomy, para-aortic lymphadenectomy, ureterolysis, and partial omentectomy via laparotomy. During the initial surgical intervention, the cardiovascular surgery team was present to evaluate potential involvement of the inferior vena cava. Exploration of the

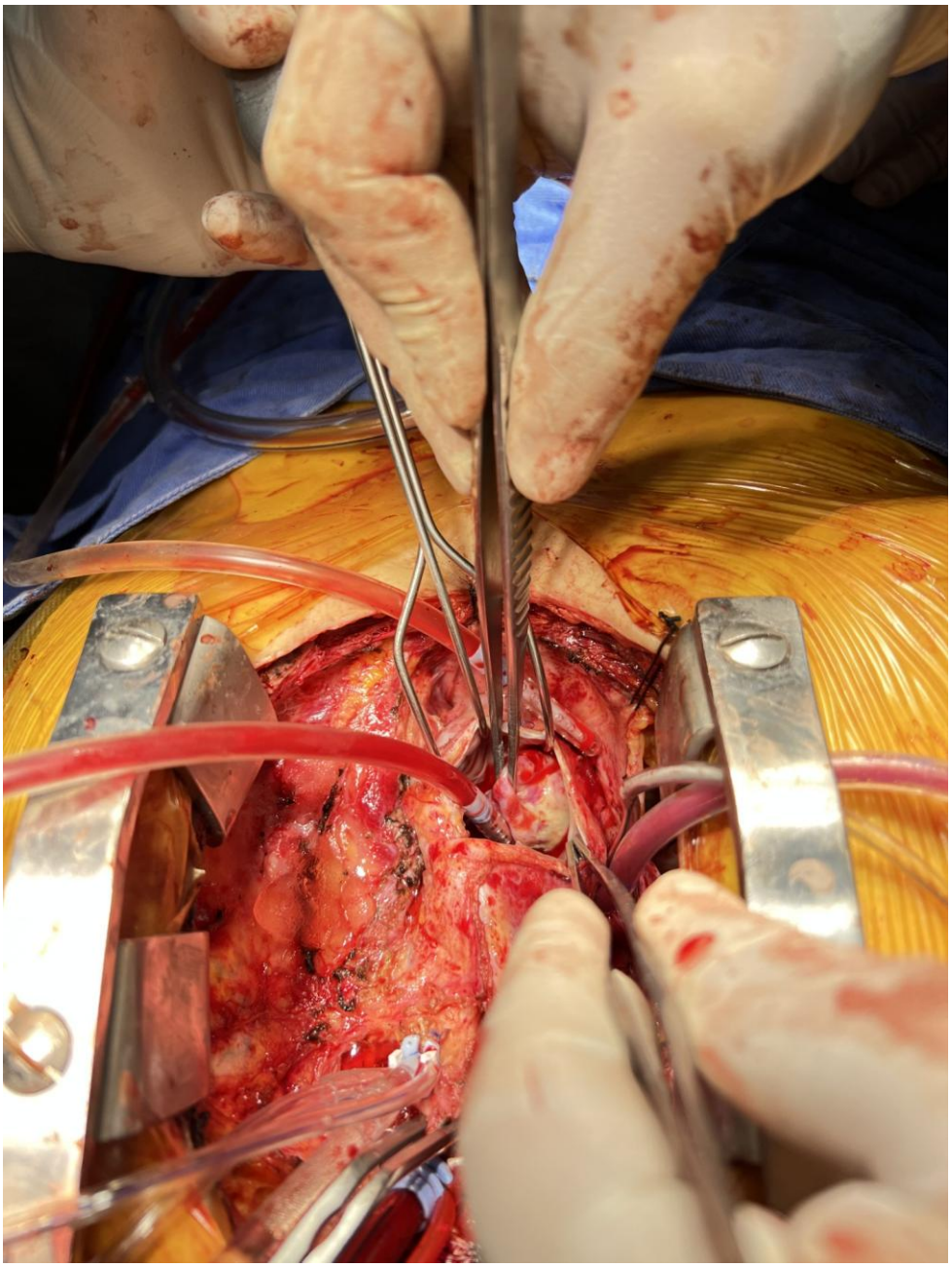
infrarenal segment showed no macroscopic evidence of intravascular tumor.

Due to the patient's prior cardiac tumor resection four years ago and the increased risk of recurrence, coupled with the detection of a new primary gynecological tumor, a multidisciplinary team was assembled to deliberate on the case. Given the heightened risk of embolism associated with the cardiac tumor and its potential malignancy, the decision was made to proceed with the resection of the cardiac mass.

Upon admission to the operating room, anesthesia was administered, and stringent aseptic measures were employed to ensure sterility. Exploration of the right femoral artery and vein was conducted, with tourniquets applied for potential emergency cannulation. A midline sternotomy incision was made, and systemic heparinization was administered. Cannulation of the ascending aorta, right femoral vein, and superior vena cava was performed to facilitate perfusion at 24 degrees Celsius. Complete release of cardiac structures was achieved following dissection of adhesions in the anterior mediastinum and pericardium.

Aortic cross-clamping and administration of crystalloid, hypothermic cardioplegia (HTK Bretschneider type, 1000 cc continuous), resulted in cardiac arrest without complications. Left ventricular suction was applied via the right superior pulmonary vein. Following achievement of 24 degrees Celsius, a 1-minute circulatory arrest was induced. Subsequently, the right atrium was opened, and traction was applied to the tumor. Low-flow circulation was restarted, and exploration of the inferior vena cava from the atrium was conducted. The tumor was resected from its pedicle with a scalpel, and the entire tumor was then tractioned from the inferior vena cava, as depicted in Figure 1. Complete resection of the tumor anchoring site was performed, along with fulguration and resection of part of the right atrial wall. Figure 2 depicts the excised tumor.





The remaining cavity was inspected, and the tricuspid valve function was verified. Closure of the right atrium in the first plane was completed, along with the removal of tourniquets from the vena cavas. Full pump restart and heating to 36.5 degrees Celsius ensued. External suture of the right atrial wall with prolene 5-0 at the tumor resection site was performed.

Air purge from the left cavities was conducted through a suction line in the ascending aorta. Release of the aortic clamp under suction in the aortic root led to the recovery of electro-mechanical activity of the heart in ventricular fibrillation rhythm. Defibrillation with internal paddles at 15 joules was performed once 30 degrees Celsius was reached, returning to sinus rhythm. Temporary pacemaker electrode placement on the inferior surface of the right ventricle was carried out. Upon reaching 36.5 degrees Celsius, cessation of perfusion in sinus rhythm with 70 beats/min and under inotropic support with dobutamine and noradrenaline followed, with stable blood pressure and oxygen saturation.

Heparin reversal was performed, followed by the removal of the right femoral venous cannula and subsequent closure of the femoral vein. Central cannulas were then removed, followed by the completion of hemostasis and resuscitation using crystalloids and autologous blood. Surgicell

was placed along suture lines for hemostasis. Two 34 Fr mediastinal tubes were then placed, connected to a thoracic drainage system, before sternal closure. Closure of soft tissues and the femoral wound was accomplished. Finally, the patient was transferred to the intensive care unit for postoperative monitoring.

Follow-up and Outcomes

At the one-month follow-up, the patient exhibited a favorable postoperative evolution. The surgical wound at the sternum was found to be in good condition and stable, with no signs of surgical site infection. Pathology findings from the tumor resection at the cavo-atrial junction in the heart region revealed a tumor consistent with leiomyoma. Histological grading indicated a benign lesion with an expansive growth pattern. The tumor measured 11 cm in size, and the margin of resection (including the pedicle sent in the same container) showed contact with the lesion. There was no evidence of necrosis or cellular atypia. The tumor cells were positive for desmin, smooth muscle actin, and estrogen receptors, while CD34 and CD31 showed positivity in the vascular component. S100 was negative. The mitotic count revealed 1 mitosis in 10 high-power fields, indicating a low proliferative activity. The cell proliferation index, assessed with Ki67, was 1%. Immunohistochemical markers myogenin, MyoD1, and S100 were negative.

Pathological examination of the specimens from the hysterectomy along with bilateral salpingo-oophorectomy was also conducted. The findings revealed a leiomyoma and a smooth muscle tumor with uncertain malignant potential (STUMP). These tumors exhibited mild atypia, with no evidence of necrosis. The leiomyoma, located subserosally, displayed hyaline and cystic degeneration, measuring 19 x 7 x 6 cm. Additionally, chronic cervicitis and mature squamous metaplasia of the endocervix were observed. The endometrium appeared proliferative, while the parametria, fallopian tubes, and ovaries were free from tumoral involvement.

No further specific treatments were recommended beyond cardiac rehabilitation and regular follow-up appointments with a cardiologist. The patient's overall condition remained satisfactory with no notable complications post-surgery. Nonetheless, ongoing monitoring is crucial to evaluate the possibility of disease recurrence and distant metastasis over the long term.

Discussion

In our approach to this case, we demonstrated strengths in our thorough diagnostic process, which included comprehensive clinical history review, morphological assessment, and immunohistochemical analysis leading to a diagnosis of benign metastasizing leiomyoma (BML) to the heart. However, the rarity of BML presents limitations in treatment decisions, given the controversy surrounding its management. Additionally, despite our meticulous evaluation, uncertainties remain regarding the optimal treatment strategy. Continued research and collaboration are essential to address these challenges and enhance patient care.

Different types of extrauterine growth of benign uterine leiomyomas include disseminated peritoneal leiomyomatosis (DPLM), retroperitoneal leiomyomatosis (RPLM), parasitic leiomyoma, benign metastasizing leiomyoma (BML), and intravenous leiomyomatosis (IVL)[9]. DPLM and RPLM are characterized by multiple leiomyomatous masses typically found in the submesothelial tissues of the abdominopelvic peritoneum and the abdominopelvic retroperitoneum. In contrast, BML and IVL more frequently metastasize to the chest. IVL is distinguished by vascular invasion and extension of benign smooth muscle lesions into the pelvic and systemic veins[9,10], while BML does not typically present with macroscopic intravascular lesions. No macroscopic intravascular lesion was observed in the infrarenal vena cava in our patient, as described earlier, aligning more closely with the characteristics of BML. Furthermore, the aggressive clinical presentation of IVL, characterized by intraluminal growth and symptoms of venous obstruction, stands in contrast to the typically indolent clinical course of BML[9,11]. This distinction contributes to the diagnosis of BML, a

condition that, despite its benign nature, markedly impacts quality of life.

BML is an uncommon condition characterized by the metastasis of histologically benign smooth muscle tumors to sites outside the uterus. Its manifestation in the heart is particularly uncommon, given that approximately 80% of cases involve pulmonary metastasis[2]. It commonly occurs in women of premenopausal age, usually in patients with a history of leiomyomas treated surgically with myomectomy or hysterectomy[2]. Pathogenesis of BML remains unclear[12]. Several theories have been suggested, including mechanical dissemination or intravascular migration of uterine smooth muscle cells to distant sites, arising from multiple independent foci of smooth muscle growth, and stemming from low-grade leiomyosarcoma. The prevailing hypothesis suggests hematogenous spread of a monoclonal component within a benign smooth muscle tumor. This mechanism aligns with our suspicions regarding the pathogenesis in our patient, considering the clinical context. Other possible mechanisms include lymphovascular embolization, mesothelial mesenchymal metaplasia, and metastasis from misdiagnosed low-grade uterine leiomyosarcomas[2].

Often, it is initially misinterpreted as a malignant tumor until pathology confirms its benign nature after surgical intervention. However, our case diverges from this typical pattern due to the patient's history of a benign cardiac rhabdomyoma. It's important to note that the presence of a cardiac rhabdomyoma in adulthood is extremely rare and typically occurs sporadically and are rarely observed in individuals without tuberous sclerosis complex (TSC)[5,13]. TSC is an autosomal dominant genetic disorder characterized by multiorgan involvement, epilepsy, and cognitive disorders, wherein multiple primary tumors present in isolated locations. Given the patient's history of multiple masses, consideration of this condition as a potential differential diagnosis is warranted. As genetic testing was not conducted for our patient, a conclusive diagnosis according to the updated diagnostic criteria, which include the identification of pathogenic mutations in TSC1 or TSC2 genes, cannot be established[13].

After surgical resection and subsequent biopsy, the initial suspicion of intracardiac rhabdomyoma recurrence was ruled out by the negative result of immunohistochemical markers myogenin and MyoD1[14]. During the pathological examination of specimens obtained from the hysterectomy and bilateral salpingo-oophorectomy, a smooth muscle tumor with uncertain malignant potential (STUMP) was described. However, this pathological finding was not observed in the specimen obtained from the cavo-atrial junction.

Prognosis is usually favorable due to its histologically benign nature[2]. Nevertheless, despite its benign nature under the microscope, it carries the potential for clinical malignancy. Leiomyomatosis can occlude the inferior vena cava and produce symptoms of heart failure, including syncope and decreased functional capacity, as observed in our patient. The optimal treatment for BML remains a topic of debate and uncertainty. Nonetheless, relying solely on medical treatment proves inadequate when dealing with intracardiac tumors, considering the risk of heart failure and potential sudden death due to complete outflow tract obstruction[9]. According to current literature, complete surgical removal of intracardiac tumors is curative, in stark contrast to a one-third recurrence rate observed in patients who underwent partial resection, regardless of postoperative antiestrogen therapy [9,15]. Given our patient's medical history, close follow-up is imperative to promptly detect any changes suggestive of new masses.

Clinical suspicion is crucial in cases like this, where a patient presented with non-specific signs and symptoms of heart failure, including exertional dyspnea, orthopnea, a decline in functional capacity to NYHA class III/IV, perioral cyanosis with exertion, and syncopal episodes. Despite no notable findings upon cardiac and pulmonary auscultation during the physical examination, edema in the lower extremities and a palpable mass in the

hypogastrium and mesogastrium were observed. Given the patient's background, further tests were necessary for diagnosis of both the pelvic mass and the congestive symptomatology. An echocardiogram proved instrumental, highlighting the importance of such screening in patients exhibiting signs of heart failure.

Conclusions

The key takeaway is to recognize the intricate process involved in diagnosing and managing rare conditions like BML that spread to the heart. Through meticulous diagnostic evaluation and interdisciplinary collaboration, the medical team successfully identified and treated the patient's condition. However, uncertainties persist regarding the optimal management strategies for BML due to its rarity and varied clinical presentations. Further research is warranted to elucidate the pathogenesis and guide more effective treatment approaches for improving patient outcomes in similar uncommon scenarios. Close follow-up and ongoing surveillance are essential to detect any potential disease recurrence or new masses promptly.

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