Intracardiac Atypical Leiomyoma Involving All Four Cardiac Chambers and the Aorta

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Intravenous leiomyomatosis is a rare gynecologic disease that can be complicated with intracardiac involvement. All reported cases with cardiac extension involved the right cardiac chambers. Intracardiac leiomyoma may present with dyspnea, chest pain, palpitations, lower extremity swelling, or syncope. This is a unique case of a 40-year-old asymptomatic woman with incidental finding of a cardiac murmur. Echocardiography showed an echodensity in all cardiac chambers. Urgent cardiac surgery revealed an intracardiac leiomyoma, extending from the inferior vena cava and involving all four cardiac chambers and the aortic root.

[Rev Cardiovasc Med. *2014;15(3):271-275 doi: 10.3909/ricm0731*]

KEY WORDS

Intravenous leiomyomatosis • Intracaval • Intracardiac • Leiomyoma • Atrial septal defect • Echodensity

Intravenous leiomyomatosis (IVL) is a benign small-muscle tumor that occurs exclusively in women. It is more common in white, multiparous women with a median age of 50 years.[1] IVL was originally described in 1896 in an autopsy case by Birch-Hirschfeld.[2] Subsequently, in 1907, Durck reported the first case of IVL with intracardiac extension.[3] Few cases of intracardiac leiomyomatosis (ICL) have been reported; all of them involved the right side of the heart. Because of its rarity, IVL could be easily misdiagnosed, which can lead to lethal complications, such as pulmonary embolism and sudden death.

Case Report

A 40-year-old morbidly obese white woman presented to our hospital for echocardiography after an incidental finding of a cardiac murmur during her routine annual examination. She denied any chest pain, dyspnea, orthopnea, paroxysmal nocturnal

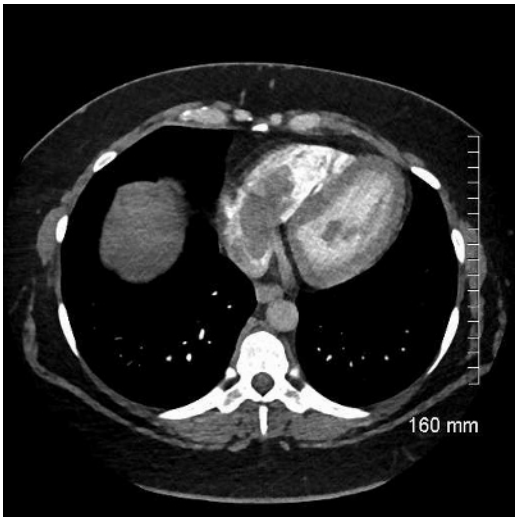

Figure 1. Computed tomography scan of the chest with contrast showing filling defects within the right atrium, right ventricle, and left ventricle.

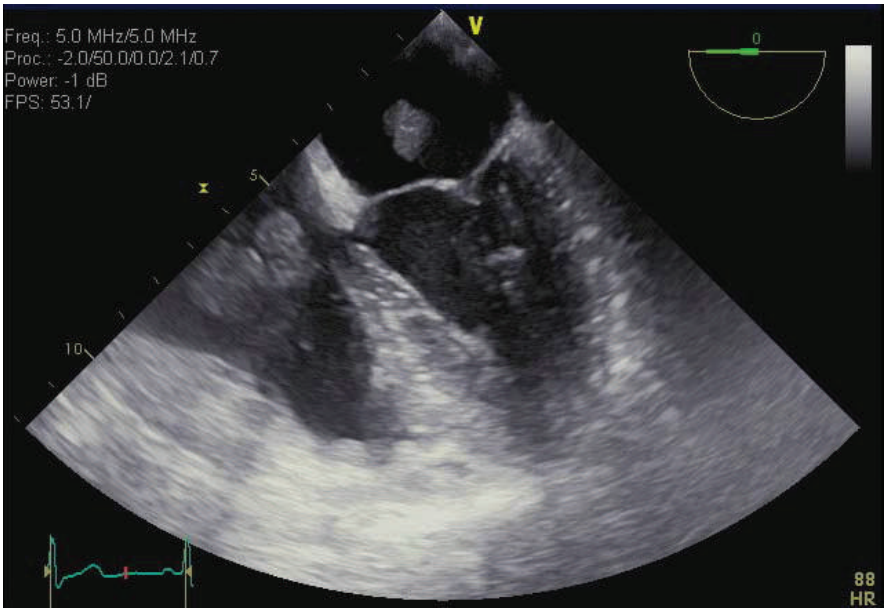

Figure 2. Transesophageal echocardiography four-chamber view, showing echodensity in the right atrium, left atrium, and left ventricle.

dyspnea, lower extremity edema, palpitations, syncope, abdominal fullness, pain, or abnormal vaginal bleeding. Physical examination was unremarkable except for morbid obesity and a nonradiating systolic heart murmur on the left sternal border. Her vital signs were normal except for mild tachycardia with a heart rate of 105 beats/min. A transthoracic echocardiography (TTE) showed a left ventricular ejection fraction of 65% with an echodensity in the right atrium and the right ventricle traversing through an atrial septal defect (ASD) to the left atrium and the left ventricle with possible attachment to the mitral and tricuspid valves. The patient was admitted emergently to the hospital. Laboratory evaluation was only significant for elevated D-dimer level of 2 mg/L, an elevated reticulocyte index of 2.8%, and an elevated lactate dehydrogenase level of 1542 IU/L. Hemoglobin and hematocrit levels were within normal range: 15.1 mg/dL and 46%, respectively. A computed tomography (CT) scan of the chest with contrast revealed filling defects within the right atrium, right ventricle, and left ventricle, with no pulmonary artery embolism (Figure 1). Electrocardiography revealed sinus tachycardia.

A decision for an urgent cardiothoracic surgery was made. Upon induction of anesthesia the patient had severe hypotension requiring resuscitative measures and urgent commencement of cardiopulmonary bypass. Preoperatively, a transesophageal echocardiography (TEE) was performed and confirmed the findings of the TTE (Figures 2 and 3). Intraoperatively, the patient was found to have an intracardiac mass extending into the inferior vena cava (IVC). The mass involved the right atrium with extension into the right ventricle and across an ASD into the left atrium and left ventricle, extending into the aortic root. A single-stage operation with cardiopulmonary bypass and hypothermic circulatory arrest was performed for resection of the tumor. The patient also had a primary repair of the ASD, measuring $1.5 \times 1 \times 3$ cm. Following removal, the intracaval and intracardiac tumor was measured at $15 \times 5 \times 5$ cm. A pathology report described smooth muscle neoplasm demonstrating focal areas of nuclear atypia with nuclear enlargement, nuclear contour irregularities, 4 mitoses per 10 high-power fields, central infarct-like necrosis, and focal coagulative necrosis (Figure 4). Immunohistochemical stains, histomorphology, and clinically abnormal uterus supported the diagnosis of atypical leiomyoma. Postoperatively, the patient had magnetic resonance imaging (MRI) of the abdomen and pelvis with gadolinium, which showed a large heterogeneous poorly defined adnexal mass (Figure 5) and uterine leiomyoma with no venous filling defects in the pelvic or systemic venous system. The patient was

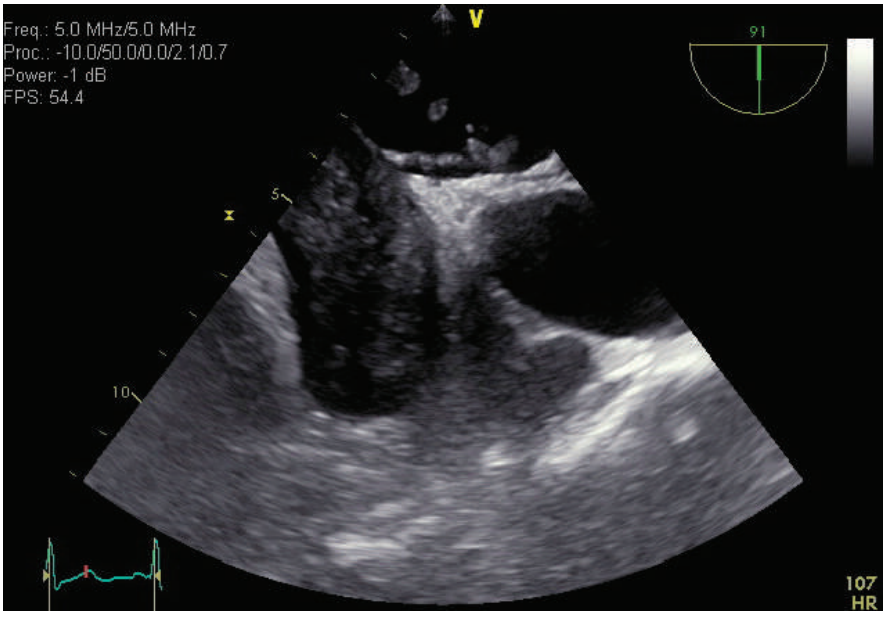

Figure 3. Transesophageal echocardiography biatrial view, showing echodensity in the right atrium traversing through an atrial septal defect into the left atrium.

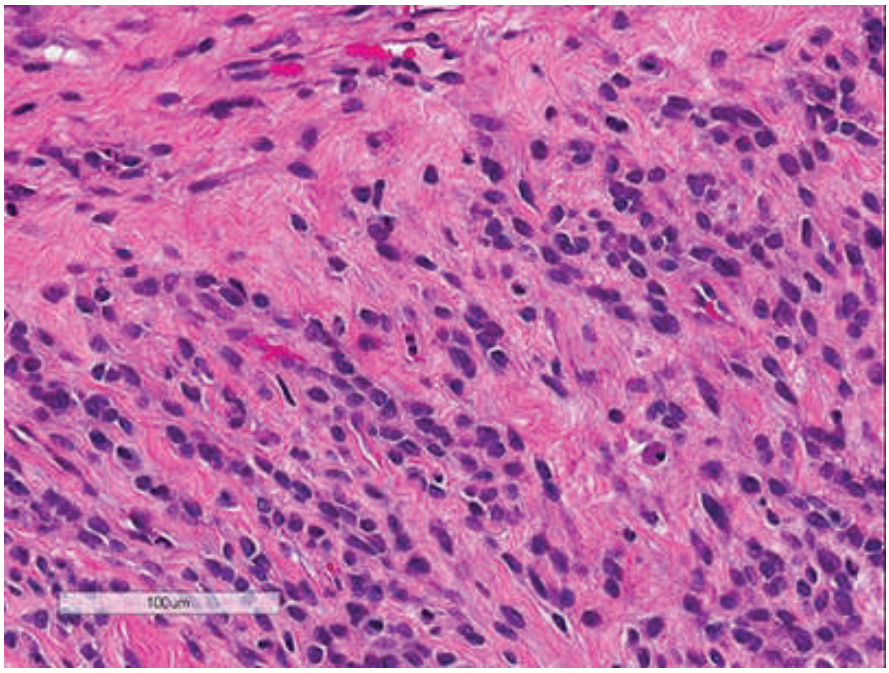

Figure 4. Hematoxylin and eosin–stained 40× objective photomicrograph shows hypercellular spindle cell neoplasm with round to oval nuclei and surrounding fibrillar pink cytoplasm and rare mitoses.

referred to a gynecologist for further evaluation. One month later, she continued to be asymptomatic with no major limitations.

Discussion

IVL is a rare gynecologic disease characterized by overgrowth of smooth muscle within the lumen of pelvic and systemic veins.[4] It was originally described in 1896[2] and since that time fewer than 300 cases of IVL have been reported, and fewer than 200 cases had cardiac involvement. IVL has a known association with uterine leiomyomas. In a review of 194 patients with ICL,[1] 104 patients (53.6%) had undergone a previous hysterectomy/myomectomy, and 58 (29.9%) had a coexisting uterine leiomyoma on admission. The average time between the hysterectomy/myomectomy and the detection of the ICL was 87.8 months (range, 3 months to 47 years).

There are two main theories regarding the origin of the IVL; the first theory suggests that the uterine leiomyoma, as the primary tumor, causes intravascular projections into an adjacent venous channel,[5] whereas the second theory maintains that the tumor originates de novo from the vein walls.[6]

Even with extensive intravenous extension of the tumor, symptoms may be absent until cardiac involvement occurs.[7,8] Symptoms include dyspnea, chest pain, palpitation, and lower extremity edema (Table 1).[1] Pulmonary embolism and sudden death might be the first presentation for a patient with intracardiac extension.[1,9,10] In the previous study,[1] pulmonary artery extension occurred in 22 patients (12.8%). Death occurred in four patients (2.1%) before surgical treatment. Intraoperative death occurred in three patients (1.5%), and four patients (2.1%) died during follow-up.

At imaging, IVL appears as a coiled or nodular soft tissue mass with wormlike extension into the lumen of the veins. The tumor is typically free floating in the vessel lumen, although, less commonly, it has attachments to the vessel or atrial wall. Ultrasound may show a hypoechoic mass within the lumen of pelvic veins and the IVC, showing flow on color Doppler ultrasound images.[4] Echocardiography is valuable in assessing intracardiac involvement and valvular function.[11] TEE is superior to TTE in evaluation of a right atrial mass. It has been used to show the fine details of the IVC, interatrial septum, tricuspid valve apparatus, and attachments of the tumor.[12] CT

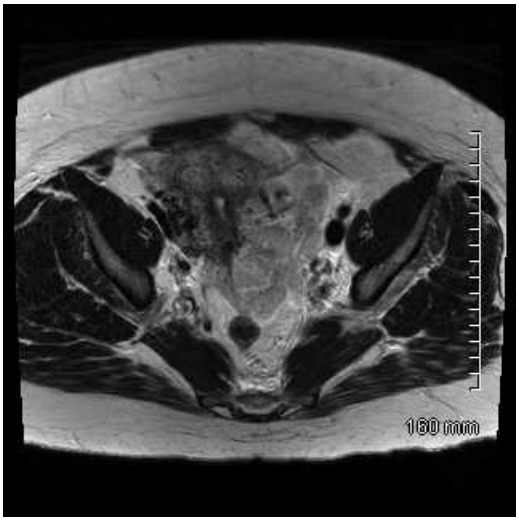

Figure 5. Magnetic resonance image of the pelvis with gadolinium showing a large heterogeneous poorly defined adnexal mass eroding the uterus.

TABLE 1

Summary of the Clinical Presentations of Intracardiac Leiomatosis

Presenting Symptoms	Percentage
Dyspnea	36.7
Syncope	26.6
Edema of the lower extremities	26
Palpitations	20.3
Fatigue	10.7
Ascites	9
Jugular vein distention	7.3
Chest pain	7.3
Abdominal pain	6.8
Asymptomatic	13

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and MRI are the imaging modalities of choice given their multiplanar capabilities and larger fields of view.[4] In general, it is a challenge to make a correct diagnosis of ICL before surgery,[12] but this has substantially improved with advances in imaging technologies.[13]

Surgical treatment is mandatory for complete removal of this tumor.[14] Timmis and colleagues[15] reported the first successful resection of the intracardiac extension of such a tumor in 1980. Various surgical approaches, including either single- or two-stage operation with cardiopulmonary bypass and hypothermic circulatory arrest, have been reported for total excision.[16,17] From our reviews, it is not completely clear if one approach is superior to another. Furthermore, with advanced minimally invasive techniques, a successful complete excision of IVL via thoracoscope alone has been reported.[18] A total hysterectomy is recommended if ICL is confirmed as originating from a coexisting uterine leiomyoma. Bilateral salpingo-oophorectomy should also be performed as the tumor is estrogen dependent. Ligation of the originating vein is important to prevent recurrence.[19]

Recurrence rates as high as 30% have been reported following incomplete resection,[1] and can occur as early as 6 months and as late as 15 years after initial presentation.[20] A standard follow-up regimen has yet to be established. Antiestrogen therapy has been suggested by some experts to prevent recurrence,[21] although a recent comprehensive analysis showed that postoperative antiestrogen therapy does not help to prevent recurrence.[1] In 1998, Barjot and colleagues[22] reported the first case when a gonadotropin-releasing hormone (GnRH) agonist was used to decrease the size of the tumor before surgery. Postoperatively, long-term treatment with a GnRH agonist may be useful in preventing recurrence of IVL with incomplete surgical resection.[23]

More attention should be given to this disease as IVL can be fatal if not recognized early. To our knowledge, this is the first case of IVL with intracardiac involvement of all four cardiac chambers and the aorta. We believe that this case explores the possibility of having a left-sided cardiac tumor with aortic extension as a complication of IVL. ■

This work was supported and accomplished with the help of Stanly Golden, MD, Karl David Young, PA-C, Cheryl Spangler, CRNP, and Mai Eladly, CP.

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MAIN POINTS

- Intravenous leiomyomatosis (IVL) is a benign small-muscle tumor that occurs exclusively in women; it can be complicated with intracardiac involvement.
- Even with extensive intravenous extension of the tumor, symptoms may be absent until cardiac involvement occurs. Intracardiac leiomyoma may present with dyspnea, chest pain, palpitations, lower extremity swelling, or syncope. Pulmonary embolism and sudden death might be the first presentation for a patient with intracardiac extension.
- Computed tomography and magnetic resonance imaging are the imaging modalities of choice, given their multiplanar capabilities and larger fields of view. Transesophageal echocardiography is superior to transthoracic echocardiography in the evaluation of a right atrial mass. It has been used to show the fine details of the inferior vena cava, interatrial septum, tricuspid valve apparatus, and attachments of the tumor.
- Surgical treatment is mandatory for complete removal of the tumor. Various surgical approaches, including either single- or two-stage operation with cardiopulmonary bypass and hypothermic circulatory arrest, have been reported for total excision; it is not completely clear if one approach is superior to another.