Surgical management of intravascular leiomyomatosis

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ABSTRACT

Intravascular leiomyomatosis is a rare entity defined by benign smooth uterine muscle cells that typically originate from the uterus with the potential to spread into veins possibly up to the heart. The diagnosis for patients presenting with cardiac symptoms may be difficult and imaging often interpreted as thrombus or atrial myxoma. (J Vasc Surg Cases Innov Tech 2021;7:711-7.)

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Intravascular leiomyomatosis (IVL) is a rare condition that consists of a non-tissue-invasive benign smooth muscle tumor originating from the myometrium. It spreads through the venous circulation most often from the uterine vein to internal and common iliac veins, sometimes from the right ovarian vein into the inferior vena cava (IVC). Spreading through the left ovarian vein grows into IVC via the left renal vein, without affecting the iliac veins.[1] Once the IVC is reached, the pathology can spread to the right atrium (intracardiac leiomyomatosis), sometimes leading to heart failure and even death if left untreated.[2] The rarity of the IVL, as well as its fairly broad and variable clinical presentation, can easily lead to misdiagnosis[3] and delayed surgical resection of the tumor mass.[4] In this report, we describe the case of a patient presenting with IVL extending from the right ovarian veins up to the right heart and underwent a successful surgical excision. Consent from the patient was obtained to present this case.

CASE REPORT

A 41-year-old woman was admitted for worsening dyspnea that started 3 months earlier. She reported abdominal bloating and recent oligomenorrhea, with a negative pregnancy test. She had history of uterine myomectomy 4 years earlier and cholecystectomy. The blood test showed an increase in total bilirubin (1.159 mg/dL, jaundice 1+) and direct bilirubin (0.347 mg/dL), lactate dehydrogenase (223 U/L), international normalized ratio (1.5), CA 125 (396 U/mL), and brain natriuretic peptide (1536 pg/mL). The patient was not anemic.

A computed tomography angiography demonstrated a right pelvic adnexal hypervascular mass (6.7 × 7.6 × 8.0 cm) as well as distension of the right internal iliac vein and IVC up to the intrahepatic position (Fig 1, *A-C*). Considering the possible thrombotic nature of the intravascular mass, intravenous unfractionated heparin was started to prevent pulmonary embolism.

Echocardiography showed the presence of a large multilobed, hypermobile mass with variable echodensity in the IVC and up to the right atrium, protruding through the tricuspid valve. Inside the right atrium, the mass measured 4.7 × 2.0 cm. Inside the IVC, the mass measured 2.5 cm in diameter and had a longitudinal and homogeneous shape. The IVC was 2.7 cm dilated; the preserved lumen was only 2.0 mm.

Magnetic resonance imaging (MRI) was strongly suggestive of a tumor mass within the IVC, internal iliac, gonadal, and right obturator veins. Given the MRI findings and history of myomectomy, the main working diagnosis was IVL.

With the assumption that the mass extending to the heart was pedunculated, originating from the occluded right ovarian vein, the expertise of several surgical specialties was requested to treat the patient. The patient had a strong desire of fertility preservation and refused bilateral salpingo-oophorectomy and hysterectomy, although normally recommended to prevent recurrence of the suspected IVL.[4] The surgery was performed by the oncogynecological, cardiac, vascular, and hepatobiliary surgery teams, involved in this order and lasted 300 minutes with 68 minutes of extracorporeal circulation.

A midline xyphopubic incision and sternotomy was performed, allowing immediate cardiopulmonary bypass in case the mass embolized in the pulmonary arteries during tumor manipulations. First, the gyneco-oncologist surgeons started by exposing the uterus and right ovary. The IVC was then exposed from the iliac veins to the retrohepatic position using the Kocher and Cattel maneuvers. After mobilization of the distal infrarenal aorta and both common iliac arteries, dissection of the IVC bifurcation down to the iliac vein bifurcation

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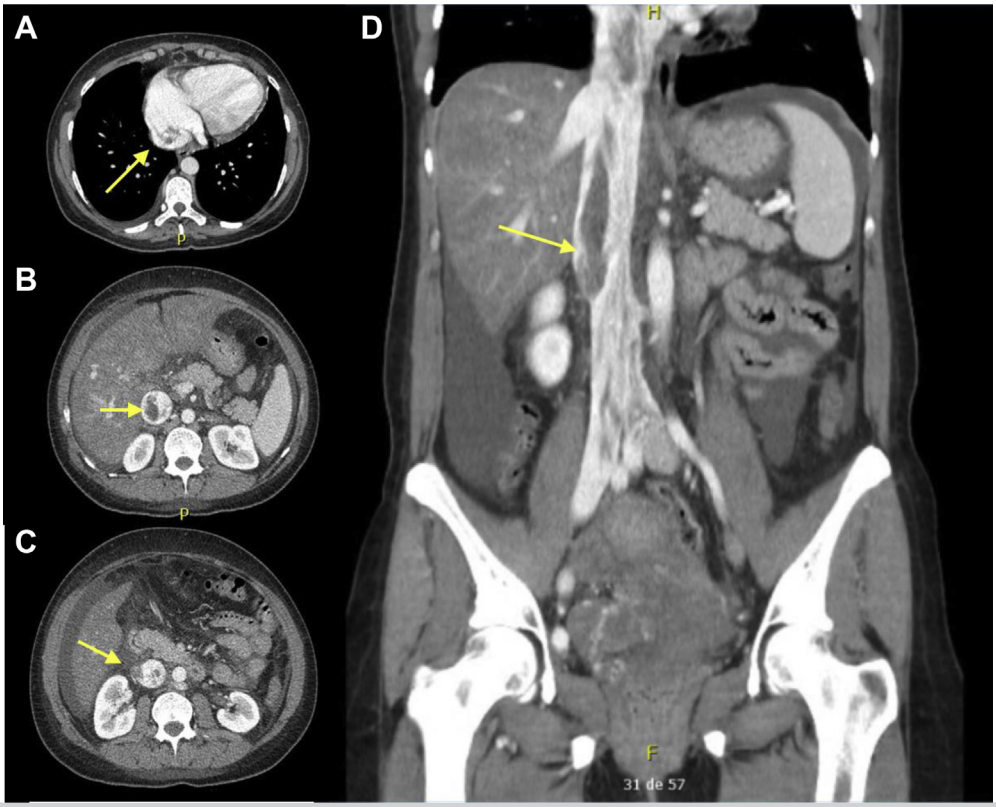

Fig 1. (A-C) Axial image of an abdomen and Pelvis computed tomography scan at the level of the right atrium, inferior vena cava (IVC), and right ovarian vein. Intraluminal material visualized within the IVC consistent with intravascular tumor (*yellow arrows*). **(D)** Coronal image of abdomen and pelvis CT scan at the level of the IVC. Intravascular leiomyomatosis (IVL) is marked with a *yellow arrow*.

was performed. The patient was then heparinized and extracorporeal circulation started with arterial cannulation of the ascending aorta and venous cannulation of the superior vena cava. The IVC was also cannulated from the right atrium because the tumor did not seem to be adherent to the lateral aspect of vena cava and was initially connected to a cardiotomy suction to avoid air lock (and later connected to the venous canula once the tumor excised). Both the superior vena cava and IVC were encircled with snares at proximity to the right atrium. The renal veins and the infrarenal IVC were clamped, along with the hepatic hilum. The occluded right ovarian vein was resected up to the vena cava and the venotomy was extended transversally into the IVC at this level, allowing finger dissection of the mass down to the internal iliac veins' origin. Most of blood loss during the intervention occurred during this maneuver. Blood lost was salvaged. The mass was found not to be adherent to the vena cava wall and to be constituted of several elongated extensions (Fig 2). To allow retrieval of the mass through the atrium and re-establish renal and liver circulation rapidly, each extension was cut through this IVC venotomy. Pedunculated extensions to the tricuspid valve chordaes were also sectioned to finally allow retrieval of the upper portion of the mass through the atrium. After IVC repair, the internal iliac veins were clipped at their origin hoping to prevent or delay recurrence. The liver was rapidly found to be softer and less tense. Intracardiac and intravenous tumors once extracted were solid and about 50 cm long. We found no evidence of thrombus (Fig 2).

The patient was discharged from the intensive care unit on the first postoperative day and experienced pericarditis 5 days postoperatively. An MRI done 6 days after surgery confirmed venous patency. The patient was discharged home 8 days after surgery with no oral anticoagulation.

A histopathologic examination concluded to a benign smooth muscle proliferation obliterating the vessels' lumen (Fig 3, *A*, *B*). No criteria of malignancy were identified. Immunohistochemistry staining were positive for smooth muscle markers caldesmon and smooth muscle actin (Fig 3, *C*). The tumor diffusely expressed estrogen and progesterone receptors, compatible with the presumed myometrial origin and consistent with IVL (Fig 3, *D*). Follow-up at 3 and 9 months showed complete recovery and no hospital readmission (Fig 4).

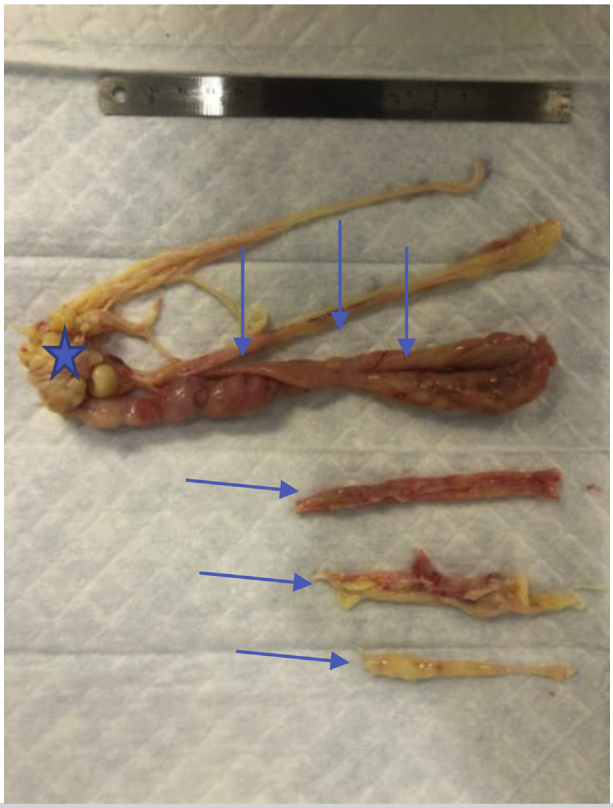

Fig 2. Intravascular leiomyomatosis (IVL) mass extracted after surgery, 50 cm, with the intracardiac (*blue star*) and intravascular (*blue arrows*) parts.

Our patient received leuprolide, a synthetic nonapeptide analogue of gonadotropin-releasing hormone postoperatively.

DISCUSSION

IVL is a rare condition that is most frequently documented in case reports or small case series. Kong et al[5] presented 12 patients with a histopathological diagnosis of IVL in a 20-month period. None of them had advanced presentations that involved the vena cava or the right heart chambers and the cases were diagnosed only after histopathological assessment of operative specimens. Li et al[1] (2014) reviewed specifically the echocardiographic features of seven patients. They concluded that the presence of a right-sided cardiac mass originating from the IVC, which has no stalk and freely moves within the IVC and right-sided cardiac chambers, is typical of IVL.

Our literature review on PubMed, found 13 case reports, which are summarized in the Supplementary Table. A one-stage surgery through the sternotomy with a midline laparotomy is the most commonly reported treatment. Only one of the case reports mentioned that they treated their patient with a gonadotrophin-releasing hormone agonist, resulting in significant decrease in tumor size.[6] Gonadotropin-releasing hormone agonists was used in this case because bilateral salpingo-oophorectomy to prevent recurrence was denied by the patient. The use of such therapy as already been reported, although its efficacy has not been demonstrated yet.[7,8]

In this case report, the internal iliac veins were clipped at their origin after IVC repair. This was done to prevent or delay recurrence. Unfortunately, the follow-up of this patient could only be done up to 9 months postoperatively. It is therefore not possible to determine whether the vein clipping method is effective in preventing recurrence.

CONCLUSIONS

IVL should be considered as part of the differential diagnosis in patients presenting with an intravascular or intravenous mass or thrombus in combination with right heart failure and a history of uterine fibroids or hysterectomy.

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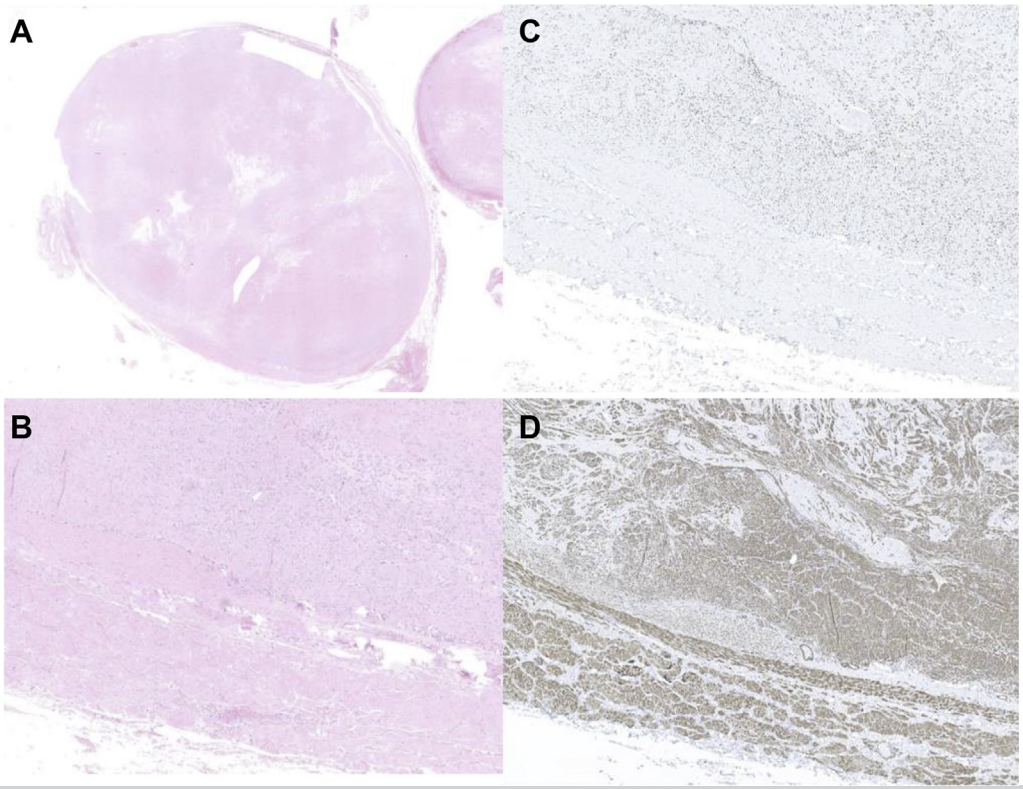

Fig 3. (A) Low magnification showed a spindle cell tumor filling the lumen of a large vein (stain: hematoxylin and eosin; original magnification ×2). **(B)** The tumor consisted of bland spindle cells without atypia or significant mitotic activity, similar in appearance to those of the vessel's media (stain: hematoxylin and eosin; original magnification ×20). **(C)** Caldesmone. The smooth muscle marker caldesmone showed staining by immunhistochemistry on both the tumor cell and the media of the vessel, immunohistochemical staining for caldesmone (original magnification ×20). **(D)** Staining for estrogen receptor (ER) showed positivity in the nuclei of tumoral cells but not those of the vessel's media, immunohistochemical staining for ER (original magnification ×20).

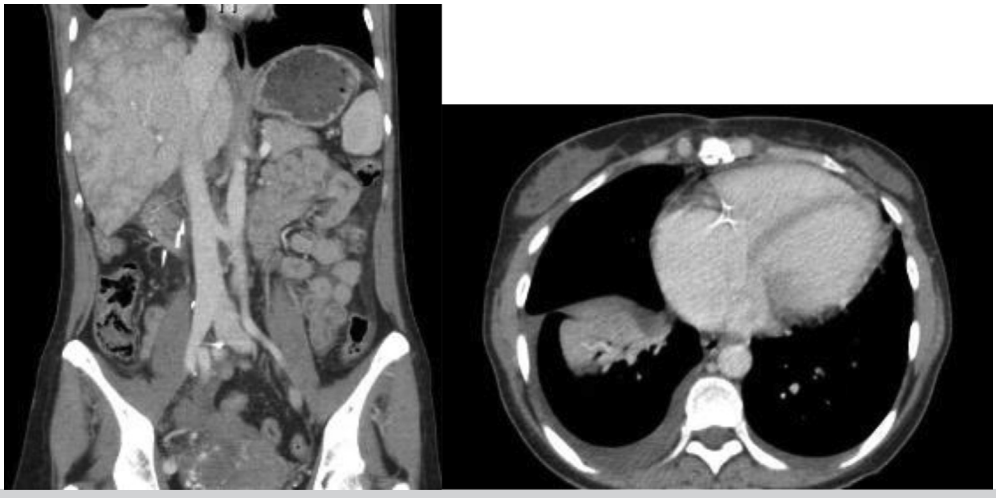

Fig 4. Axial and coronal computed tomography (CT) scans of the patient's inferior vena cava (IVC) and heart chambers at the 9-month follow-up.

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Supplementary Table. Summary of case reports about IVL found on PubMed

Authors	Year of publication	Age	Symptoms	Patient history	Investigations	Treatment	Outcome
Xu et al[9]	2019	48	Syncope	Not available	CT scan MRV	One-stage surgery with median sternotomy and laparotomy	Discharged without complications 21 days postoperatively
Chiang et al[2]	2018	49	Intermittent palpitation and chest tightness	Hysterectomy and left salpingo-oophorectomy for multiple uterine leiomyomas 18 months prior	Echocardiography CT scan	One-stage surgery with median sternotomy and laparotomy	Discharged without complications
Skripochnik et al[3]	2017	49	Left inguinal fullness and discomfort	Total abdominal hysterectomy for fibroids with IVL demonstrated on pathologic examination 4 years prior	CT scan MRI Duplex ultrasound examination	One-stage surgery with resection of the intravascular mass, and bilateral salpingo-oophorectomy	Discharged without complications
Harnoy et al[10]	2016	65	Not available	Hysterectomy and left salpingo-oophorectomy for multiple uterine fibromyomas associated with leiomyoma 15 years prior	CT scan	One-stage surgery with median sternotomy and laparotomy	Discharged without complications No signs of recurrence after 3 years
Mizuno et al[11]	2014	48	Dyspnea and leg edema	Bilateral hysterectomy 13 years prior	Chest radiograph Echocardiography MRI CT scan	One-stage surgery with median sternotomy and laparotomy	Discharged without complications except for pelvic AVF with small shunt found on MR angiography No evidence of recurrence 5 years after surgery
Lakhi et al[12]	2013	Not available	Asymptomatic	Not available	Not available	A two-stage surgery, first stage by laparoscopic hysterectomy and salpingo-oophorectomy and second stage by exploratory laparotomy to excise residual tumor	Not available
Galajda et al[13]	2010	40	Mild dyspnea on exertion, palpitations, and syncopes	Hysterectomy for uterine leiomyomatosis 5 years prior and salpingo-oophrectomy 3 years prior	PET scan CT scan	A two-stage surgery, first stage by open heart surgery for right atrial myxoma and resection of the tumor and second stage by resection of the pelvic tumoral mass a few months after	After discharge, the tumor grew again into the right atrium A single-stage procedure was again performed
Butler et al[14]	2009	47	Shortness of breath, bilateral lower extremity swelling, pleuritic chest pain, cyanosis, episodic loss of consciousness and hypotension	Abdominal hysterectomy for uterine fibroids 2 years prior	Duplex ultrasound examination CT scan Echocardiography	One-stage surgery with median sternotomy and laparotomy	Discharged without complications
Arif et al[6]	2006	42	Intermittent left lower back pain and pain radiating down her left buttock and into the posterior aspect of her thigh	Total abdominal hysterectomy for fibroids 13 years prior, right salpingo-oophorectomy and left ovarian cystectomy	MRI Pelvic ultrasound examination CT scan	Surgery in two stages The remaining tumor was treated with a gonadotrophin-releasing hormone agonist, resulting in significant reductions in tumor size	Discharged without complications

Supplementary Table. Continued.

Authors	Year of publication	Age	Symptoms	Patient history	Investigations	Treatment	Outcome
Baca López et al[15]	2003	42	Debilitation and engorgement of both lower extremities	Hysterectomy because of hysteromyoma 1.5 years prior	Echocardiography CT scan	One-stage surgery with median sternotomy and laparotomy	Discharged without complications
Stegmann et al[16]	1987	53	Not available	Abdominal hysterectomy for a myomatous uterus ten years prior	Not available	Two-stage operative management	Not available
Efthimiadis et al[8]	2015	37	Acute abdominal pain	Submucosal myoma diagnosed ten years prior No surgery	CT scan MRI angiography	A two-stage surgery; first stage by resection of a single ovary and laparotomy, second stage by laparoscopic resection 1 month later	Discharged without complications
Mizuno et al[17]	2014	Not available	Congestive heart failure	Not available	Not available	One-stage surgery with median sternotomy and laparotomy	Not available

AVF, Arteriovenous fistula; *CT*, computed tomography; *IVL*, intravascular leiomyomatosis; *MRI*, magnetic resonance imaging; *MRV*, magnetic resonance venography; *PET*, positron emission tomography.