

Case report

Preoperative inferior vena cava filter implantation to prevent pulmonary fat embolism in a patient showing renal angiomyolipoma extension into the renal vein: A case report and literature review

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Abstract

Renal angiomyolipoma without local invasion is usually considered benign entity, however, it may extend into the renal vein or the inferior vena cava. Renal angiomyolipoma with venous extension should be treated; however, surgical complications such as iatrogenic pulmonary fat embolism remain a serious concern. We present a case of a 66-year-old Japanese woman without tuberous sclerosis in whom a right-sided renal tumor was incidentally detected on ultrasonography during a health check-up. Further evaluation showed that the tumor extended into the renal vein, and she was successfully treated using preoperative inferior vena cava filter placement and radical nephrectomy. An inferior vena cava filter can prevent catastrophic pulmonary fat embolism during nephrectomy.

Key words: angiomyolipoma, tumor thrombus, IVC filter

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Introduction

Renal angiomyolipoma (AML) is the most common type of mesenchymal tumor. It is composed of smooth muscle, adipose tissue, and vascular elements and occurs more commonly in women¹. AML usually presents as a benign tumor without local invasion, although a few AMLs have shown aggressive behavior that is manifested as intravascular extension and pulmonary fat embolism. AMLs involving the

renal vein or the inferior vena cava (IVC) require surgical intervention to prevent fatal pulmonary embolization; however, the operation is associated with the risk of an iatrogenic complication of embolism.

We report the case of a patient with an asymptomatic renal AML with right renal vein invasion that was successfully treated with radical nephrectomy following preoperative IVC filter placement. Additionally, we have discussed the relevant literature.

Case Presentation

A 66-year-old woman with a history of surgical treatment for a large uterine myoma without tuberous sclerosis presented for a health check-up. A right-sided hyperechoic renal mass measuring 84 × 53 × 44 mm (transverse × anteroposterior × craniocaudal) was incidentally detected on ultrasonographic examination. Contrast-enhanced computed tomography revealed a large heterogeneous fat-containing renal mass with extension into the right renal vein (Figure 1). The tumor did not invade the IVC, and there was no pulmonary embolism. Based on these imaging findings, the patient was diagnosed with a suspected right renal AML showing extension into the right renal vein.

After considering the risk-benefit ratio, she subsequently underwent temporary IVC filter insertion the day prior to surgery. A retrievable IVC filter was placed in a suprarenal position via the internal jugular vein approach (Figure 2). The following day, the patient underwent an open right radical nephrectomy and tumor thrombectomy with retrieval of the IVC filter the day after surgery. No complications occurred perioperatively.

Histopathological findings indicated a large amount of mature fat admixed with smooth muscle cells and vessels

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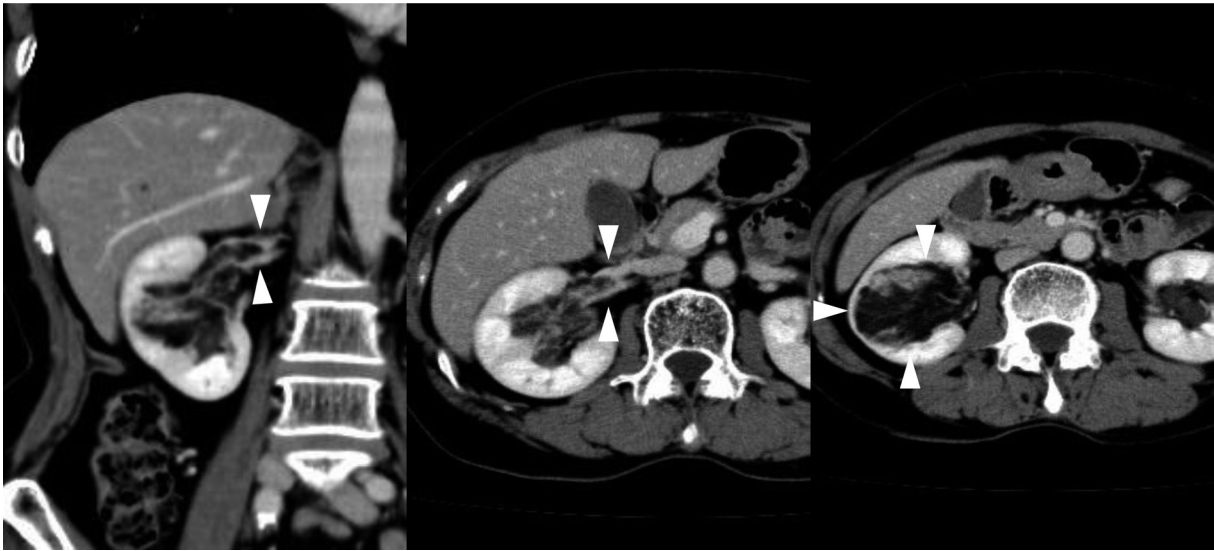


Figure 1 Coronal and axial contrast-enhanced computed tomography (CT) image shows a fat-density lesion (arrowhead) in the right-sided renal parenchyma extending into the right renal vein.



Figure 2 An inferior vena cava (IVC) filter (arrowhead) is observed above the right renal artery.

—a picture that typically represents classical AML. Tumor thrombus in the renal vein was composed of adipose tissue (Figure 3). Immunohistochemical staining for antibodies to human melanoma black-45 antigen was slightly positive, and there was no evidence of epithelioid AML.

Discussion

AML rarely extends into the renal vein, IVC, or the right atrium. Although the occurrence of venous extension is likely to be low, data regarding this condition remain limited/unclear. In a previous review of renal AMLs with venous extension, the mean tumor size was relatively large (86 mm); however, female predominance (83%) and mean age at diagnosis (47 years) were similar to these patient characteristics in those with AML without venous extension². Several studies have reported the occurrence of right-sided AML with an IVC thrombus^{3, 4}. The shorter length of the right renal vein may contribute to the greater predominance of tumors involving the IVC, although the exact reason remains controversial.

AML with venous extension may place the patient at risk for life-threatening pulmonary fat embolization. Several cases of pulmonary thrombosis have been reported in patients with AML with venous extension⁵⁻⁷. A few patients were asymptomatic; however, 1 death was reported⁸. Turowski reported a case of a 20-year-old patient who developed cardiac arrest secondary to pulmonary embolism during nephrectomy⁶. Furthermore, previous reports have described a patient showing AML with venous extension presenting with pulmonary fat embolization 2 days after nephrectomy⁹. AML is composed of large amounts of adipose tissue without a capsule. Compared to a renal cell carcinoma, AML being a fragile tumor shows a higher risk of intraoperative pulmonary fat embolism.

An IVC filter can prevent intraoperative iatrogenic pul-

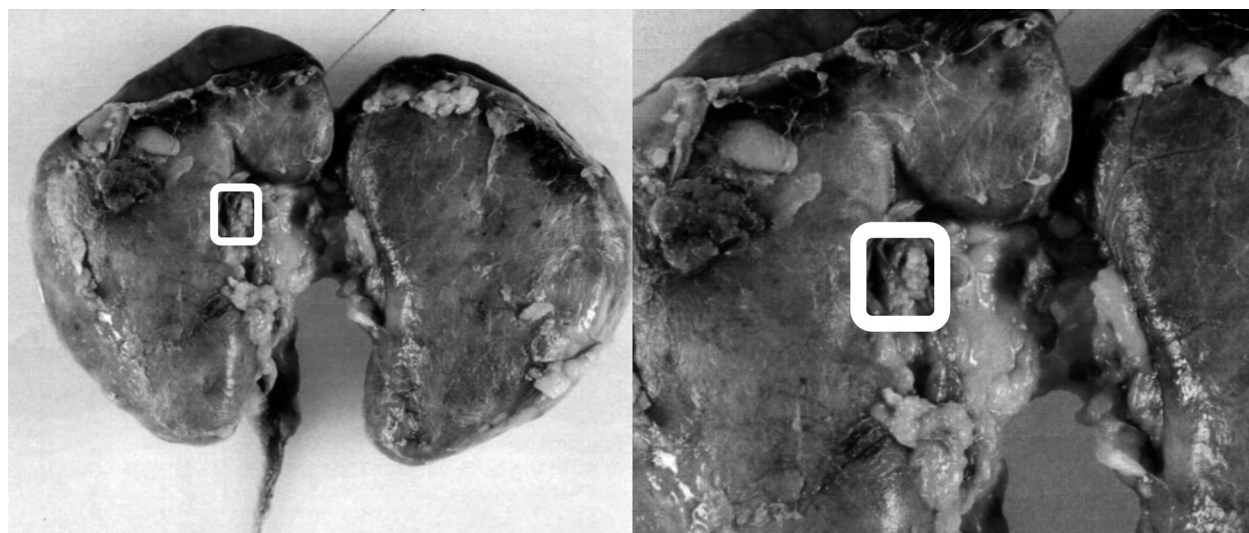


Figure 3 Gross examination shows the right kidney and the tumor thrombus protruding into the right renal vein.

Table 1 Reported cases of renal angiomyolipoma with venous extension treated with preoperative inferior vena cava (IVC) filter implantation

Case	Authors/year	Age/Sex	Side	Symptoms	Solitary/ multiple	Tuberous sclerosis	Tumor size (mm)	Thrombus level	Pulmonary embolism prior to surgery	Epithelioid morphology
1	Ban <i>et al.</i> 2008	70/F	right	none, incidental discovery	solitary	–	140 × 120 × 80	renal vein	+	–
2	Li <i>et al.</i> 2014	36/F	right	right flank pain for 3 months	solitary	–	50 × 50 × 40	IVC	–	+
3	Celik <i>et al.</i> 2015	33/F	right	chest pain, tachypnea	solitary	–	56 × 40	IVC	+	–
4	Comman-Homonoff <i>et al.</i> 2017	43/F	right	nausea, back pain	solitary	–	10 × 9 × 15	IVC	–	–
5	Ikarashi <i>et al.</i> 2017	57/F	right	intermittent back pain	multiple	+	10-30	IVC	–	–
6	Fujiwara <i>et al.</i> 2018	76/F	right	none, incidental discovery	solitary	–	84 × 53 × 44	renal vein	–	–

monary tumor thrombus formation that could lead to an increase in the mortality rate. We investigated 6 cases (including our case) of renal AMLs with venous extension treated with preoperative IVC filter implantation (Table 1)^{10–14}.

As shown in Table 1, the median age at diagnosis was 50 years (33–76 years). All patients were women with right-sided tumors. The mean tumor size was 62 mm. Two patients had already developed symptomatic pulmonary fat embolism preoperatively, and the occurrence of additional pulmonary embolism could therefore be fatal in such cases. The tumor thrombus extended into the renal vein in 2 patients and into the IVC in 4. The tumor thrombus were successfully surgically removed with temporary IVC filter implantation in all patients without perioperative pulmonary fat embolization. No complications associated with the IVC filter were observed. Our findings in these patients suggest

the usefulness of a temporary IVC filter to minimize the risks of pulmonary fat embolism perioperatively. Therefore, the IVC filter may have contributed to the reduced risk of embolization in our patient.

In summary, we report a rare case of renal AML with renal vein invasion and additionally present a review of previous reports that have described the use of an IVC filter as prophylaxis against pulmonary fat embolization. Preoperative IVC filter implantation can prevent catastrophic pulmonary fat embolization.

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