CASE REPORT

A Rare Case of Direct Invasion of Inferior Vena Cava by Renal Cell Carcinoma

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ABSTRACT

There has been a global increase in the incidence of renal cell carcinoma (RCC) during the last two decades. Metastatic RCC can spread to the lung, bone, lymph nodes and liver. RCCs tend to invade the vascular system, with the involvement of the renal vein and extend into the inferior vena cava (IVC). The venous invasion changes the staging and prognosis of the disease. We present a case of a 60-year-old male patient who incidentally discovered a right renal mass on ultrasound. A contrast-enhanced computed tomography (CECT) was performed in our institute which showed a mass involving the mid and lower pole of the right kidney, causing distortion of renal architecture. The mass was directly infiltrating into the inferior vena cava with no evidence of thrombosis or invasion into the renal vein. Our case highlights the importance of standard preoperative imaging to assess IVC invasion for optimum surgical planning.

Keywords: *Inferior vena cava, tumor thrombus, renal cell carcinoma, contrast-enhanced CT, metastasis.*

INTRODUCTION

RCC is the most common malignant tumor that arises from the proximal convoluted tubule. It has a male predominance with a mean age of diagnosis of 64 years [1]. Renal cell carcinoma can spread by growing directly into nearby tissue and by vascular or lymphatic spread. Metastatic RCC is present at the time of diagnosis in around one-third of people [2]. A study showed the prevalence of RCC tumor thrombus by about 10% to 18% in the renal vein, 4% to 23% in the inferior vena cava (IVC), and 1% spreading to the right atrium [3]. In cases of IVC wall invasion, the operative procedure is more grueling and may require IVC resection [4]. The invasion of the IVC wall is also associated with a poor prognosis, especially if the renal or caval vein margins are also involved [5]. The long-term prognosis of patients with tumor thrombus is controversial but surgical management has improved the survival outcomes [6]. Usually, the tumor thrombus first extends into the renal vein and then involves the inferior vena cava. A rare case of RCC with direct IVC invasion without renal vein involvement is reported here.

CASE PRESENTATION

A 60-year-old male, non-diabetic, non-hypertensive presented for evaluation as a potential donor for a renal transplant for his immediate family member. He reported no associated symptoms such as flank pain, hematuria, fever, anorexia, nausea, or morning fatigue and denied any history of drug abuse. On examination, he was hemodynamically stable, with unremarkable abdominal examination, routine biochemical and hematological parameters were within normal limits. Initial ultrasound revealed an isoechoic soft tissue lesion in the lower and interpolar region of the right kidney. Subsequent contrast-enhanced computed tomography (CECT) showed a heterogeneously enhancing mass measuring 86 x 64 x 76 mm involving the lower and mid-polar region of the right kidney, causing distortion of renal architecture. The mass was found to be infiltrating posteromedially into the inferior vena cava, with associated cortical breach and wall invasion (Mayo staging level-1) as shown in Fig. **(1)**. There was normal contrast opacification of the right renal vein with no evidence of thrombosis. Minimal right perinephric fat stranding was also noted. Additionally, there was no evidence of regional adenopathy or ascites. Unfortunately, an MRI of the abdomen was not performed preoperatively due to lack of affordability.

A complete right nephrectomy was performed by the treating nephrologist after taking oncological consultation. The surgery was complex, and the IVC tumor thrombus was not removed at that time because it was not causing any luminal compromise. No postoperative complications were reported, and the patient was kept on short-term follow-up. The biopsy of the mass confirmed clear cell RCC WHO/ISUP Grade 1. The nephrectomy specimen revealed a 72 x 63 x 40 mm tumor protruding from the lower and mid pole of the kidney, with indentations on the surface and is located 0.1 cm from the outer inked capsule. The peri-renal fat, renal hilum and renal sinus were all free of tumor. Histopathology of the specimen showed a malignant neoplasm arranged in a papillary architecture. The cells appeared round with clear to eosinophilic cytoplasm, vesicular coarse chromatin, prominent nucleoli and distinct membranes. The renal hilum, renal sinus fat, ureteric resection margin

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Received: July 13, 2024; Revised: October 01, 2024; Accepted: October 05, 2024
DOI: https://doi.org/10.37184/nrjp.3007-5181.1.5

 ISSN: 3007-519X (Online)

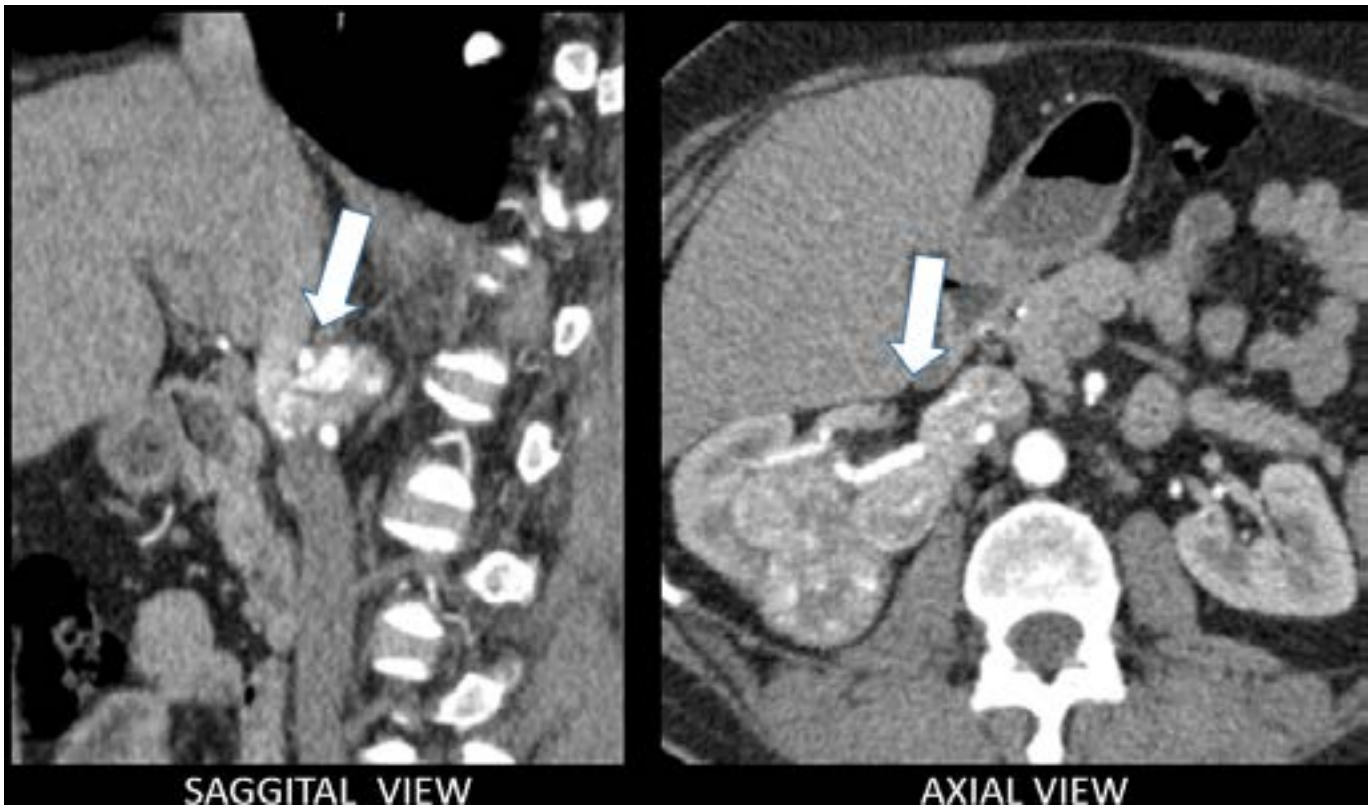

Fig. (1): Post contrast CECT abdomen shows a heterogeneously enhancing mass involving the mid and lower polar region of the right kidney with direct tumor thrombus invasion of IVC. Arrow-pointing tumor thrombus invading the inferior vena cava.

and vascular margins were all clear of the tumor, with a distance of 0.1 cm from the capsule.

The follow-up CECT after 9 months showed post-operative right nephrectomy changes with no evidence of enhancing soft tissue in the right renal bed. However, it showed a heterogeneously enhancing residual tumor measuring 14 x 16 x 15 mm along the posterior wall of IVC just invading its wall. The venous and delayed phase showed a gradual washout of enhancement from this nodular component projecting into the IVC. These findings confirm the direct invasion of the tumor. These CECT findings became more evident after radical nephrectomy as shown in Fig. **(2)**. The patient had to undergo a second surgery for the removal of the IVC tumor thrombus. The tumor thrombus was successfully removed and the patient was discharged from the hospital.

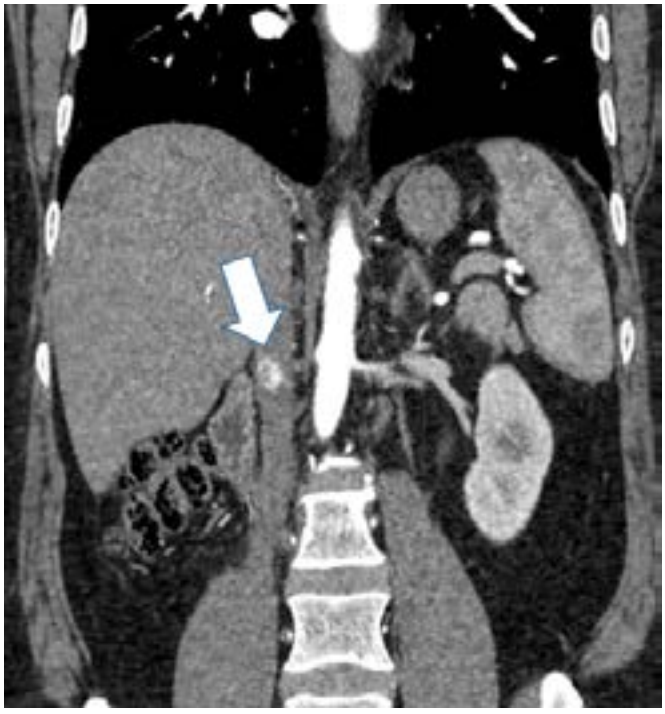

Fig. (2): Post-contrast CECT abdomen after surgery shows right nephrectomy with a heterogeneously enhancing tumor thrombus in the inferior vena cava.

DISCUSSION

The most common sites of metastatic renal cell carcinoma are the lungs, lymph nodes, bones, and liver in decreasing order of frequency [7]. Intravascular tumor extension, also known as tumor thrombus, extending into the renal vein or inferior vena (IVC) changes the staging of the tumor [8]. The RCC has a predilection of spreading through the renal vein into the IVC and then extending within its lumen. Tumor thrombus may be asymptomatic or may cause symptoms related to complications of thrombus, such as dyspnea due to pulmonary embolism and varicocele or leg swelling due to deep venous thrombosis [6].

Table 1: TNM staging (8th edition) (In relation to vascular invasion).

TNM Staging (8th Edition)		Mayo Classification	
T3a	Tumor Thrombus involves renal vein	Level 1	IVC Tumor Thrombus less than 2 cm above the renal vein
T3b	Tumor Thrombus involves IVC below Diaphragm	Level 2	IVC Tumor Thrombus more than 2 cm below the renal vein
T3c	Tumor Thrombus involves IVC above Diaphragm	Level 3	Tumor Thrombus extending into hepatic vein below the diaphragm
		Level 4	Tumor Thrombus extending above the diaphragm into the right atrium

We encountered a rare case of RCC with a tumor thrombus directly invading the IVC without involving the renal vein. Tumor thrombi are usually more aggressive with high recurrence rates and require surgical management like radical nephrectomy with thrombectomy [8]. According to the 8th edition of TNM staging of RCC, when the tumor thrombus involves the renal vein and IVC; staging changes as described in Table **1**.

An alternative Mayo Clinic classification of tumor thrombus **(Table 1)** is useful for surgical planning [9]. IVC wall invasion is more challenging and may even need IVC resection. MRI can more clearly identify wall invasion, vessel breach, or complete occlusion of the IVC lumen [10].

Pre-operative assessment of tumor level is valuable for optimizing management. When in doubt, MRI should be advised by the radiologist for better surgical management. In this case study, the patient had to undergo a second surgery for the removal of IVC thrombus which was more evident after radical nephrectomy. Radiologists need to mention the extent of involvement of tumor thrombus for better preoperative surgical planning and keeping in mind the direct invasion of the tumor thrombus in the IVC without renal vein involvement; can also be the possibility.

It is a well-known fact that tumor thrombus often extends into the IVC by involving the renal vein. A rare case of tumor thrombus directing invading the IVC is reported here. In the literature review, many case reports were available with better prognosis upon early detection of vascular involvement by RCC. Also, radical nephrectomy and inferior vena cava thrombectomy can assure longstanding survival rates and better prognosis.

CONCLUSION

RCC with IVC tumor thrombus changes the staging, surgical management, and prognosis of the disease. Direct Invasion of IVC by tumor thrombus is also possible without the involvement of the renal vein. Cross-sectional imaging should be performed for staging of RCC and to characterize wall invasion and vessel breach. It is imperative to mention these details while reporting cases of RCC for better pre-operative planning.

CONSENT FOR PUBLICATION

Informed consent was obtained from the patients involved in this study.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

Declared none.

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