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Renal cell carcinoma with inferior vena cava tumor thrombus initially misdiagnosed as bland thrombus due to hypercoagulable state

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Abstract

Renal cell carcinoma with inferior vena cava tumor thrombus can be misdiagnosed as an inferior vena cava thrombosis if not evaluated carefully with imaging. We describe a case of renal cell carcinoma with inferior vena cava tumor thrombus that was initially misdiagnosed as an inferior vena cava thrombosis due to a possible hypercoagulable state. After 7 months of anticoagulation therapy with no improvement, a right radical nephrectomy and thrombectomy was performed without cardiopulmonary bypass, and a diagnosis of papillary renal cell carcinoma with a level-IIId tumor thrombus was confirmed with no presence of a bland thrombus. We demonstrate the complexity of identifying and treating renal cell carcinoma with venous tumor thrombus and the importance of differentiating between a malignant thrombus and a bland thrombus.

Keywords

Papillary renal cell carcinoma, inferior vena cava tumor thrombus, bland thrombus, hypercoagulable, nephrectomy

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Introduction

Renal cell carcinoma (RCC) represents the most common type of kidney cancers; however, venous migration and tumor thrombus (TT) formation is uncommon, occurring with extension into the inferior vena cava (IVC) in up to 4%–10% of patients.[1–4] Identification of TT on imaging is challenging and can be misdiagnosed as a bland thrombus (BT) if not evaluated carefully with multimodal imaging.[5] Renal vein thrombosis (RVT) can present acutely and is commonly associated with nephrotic syndrome, primary hypercoagulability disorders, malignant tumors, extrinsic compression, infection, or trauma.[6] Clinical presentation of RVT varies and is usually asymptomatic; however, its progression can cause the kidney to swell and engorge, leading to degeneration of nephrons and symptoms such as flank pain, hematuria, and decreased urine output.[6] A high suspicion for malignancy should arise when dealing with thrombosis on imaging as certain common features can help differentiate a malignant thrombus from a BT.[5]

Here, we report a patient who was initially diagnosed with right RVT with extension into the IVC due to a possible hypercoagulable state and was treated with anticoagulation therapy for 7 months with no improvement. On further evaluation, a nonspecific renal lesion on computed tomography (CT) imaging was identified, and a radical nephrectomy with thrombectomy was performed, which ultimately revealed a diagnosis of RCC with a level-IIId TT (supradiaphragmatic and infra-atrial) and no associated BT. We demonstrate the complexities of diagnosing RCC with TT and the surgical

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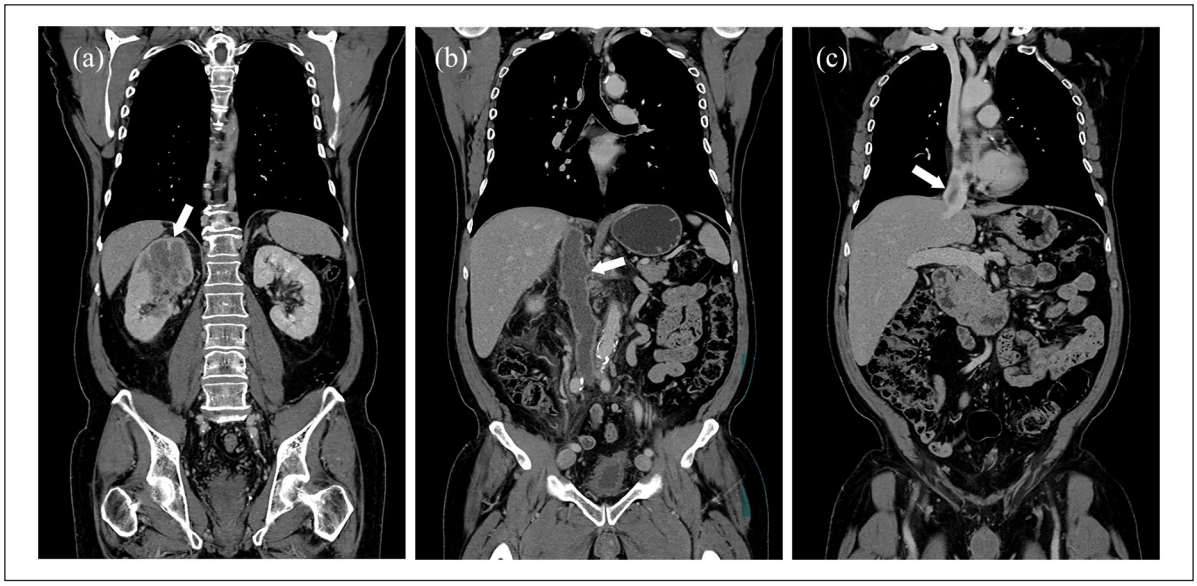

Figure 1. (a) Computed tomography (CT) scan showing a right kidney with an infiltrating mass (white arrow). (b) CT scan showing the inferior vena cava (IVC) full of tumor thrombus (TT) that was confused with bland or blood thrombus due to hypercoagulable state (white arrow). (c) CT scan showing tumor thrombus (Level IIId) supradiaphragmatic and infra-atrial (white arrow).

treatment of supradiaphragmatic RCC tumors without the use of cardiopulmonary bypass (CPB).

Case presentstion

We present the case of a 64-year-old male who presented to another hospital with abdominal pain, fever, and nausea. Laboratory workup at that institution revealed negative urine cytology. We unfortunately do not have any information regarding the radiologic imaging performed on this patient; however, he was ultimately diagnosed with right RVT with IVC extension secondary to a possible hypercoagulable state. At the time, the patient had no known comorbidities or proteinuria that contributed to his diagnosis of a hypercoagulable state. He was started on Coumadin and was referred to hematology for further evaluation. After 7 months on anticoagulation therapy with no improvement in the size of the blood thrombus or recanalization, he was referred to our institution.

He presented with a normal blood pressure and no lower extremity edema. General laboratory workup results were within normal limits, with a serum creatine of 0.9 mg/dL and no proteinuria. A repeat CT of the chest, abdomen, and pelvis at our institution revealed an irregular appearance of the right kidney with a filling defect in the renal parenchyma and a thrombus in the right renal vein with extension to the IVC below the right atrium (RA; Figure 1(a), (b), and (c)). We suspected a diagnosis of RCC with inferior vena cava tumor thrombus (IVCTT) extension.

After cardiology clearance, informed consent was obtained for a right radical nephrectomy and tumor thrombectomy with possible CPB. The tumor thrombus was level-IIId, supradiaphragmatic and infra-atrial, according to our own classification.[7]

Surgical procedure

The surgical technique has been described at length previously for large RCC with TT extension into the IVC.[1,7–12] A modified chevron incision was used, commencing approximately two fingerbreadths below the right costal margin, and extending out laterally to the mid-axillary line. The right kidney was mobilized laterally and posteriorly, and the perirenal collateral circulation was ligated. The renal artery was identified, ligated, and divided. The collateral circulation collapsed, making the rest of the dissection easier.[9]

The liver was completely mobilized off the IVC using an organ transplant-based approach, with the only remaining structural attachments being the hepatic veins and porta hepatis (Piggyback liver mobilization).[8] The central tendon of the diaphragm was dissected to the supradiaphragmatic area, and the intra-pericardial IVC was identified. The dissection was circumferential so that the intra-pericardial IVC could be encircled below or above the confluence into the RA. The RA was gently pulled beneath the diaphragm and into the abdomen.

Intra-operative transesophageal echocardiogram (TEE)[13] was used to delineate the cranial extent and mobility of the TT during the dissection of the retro-hepatic IVC, supradiaphragmatic IVC, and RA. Its use ensured that there were no pulmonary artery emboli or TT in the RA. In addition, it guided us during application of the partial clamp onto the RA, making sure that the clamp excluded the tumor and that the coronary sinus was not obstructed.[10]

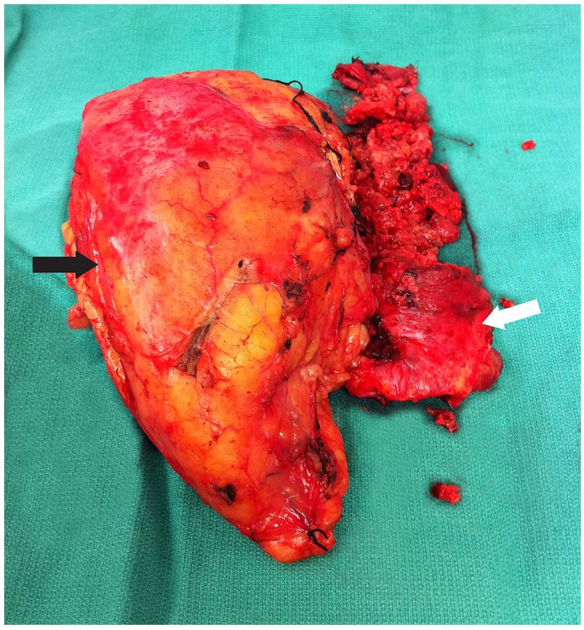

Figure 2. Pathology specimen of the right kidney with the mass (black arrow) and the IVC with the TT (white arrow).

Furthermore, a plane was created between the IVC and posterior abdominal wall. Small tributaries can become engorged to look like lumbar vessels, and they need to be identified and ligated. Vascular isolation of the IVC was then achieved superior and inferior to the thrombus and the left and right renal veins.

The TT could not be "milked" downward out of the intra-pericardial IVC, as this patient's TT was bulky and not freely mobile. A Pringle maneuver was performed to temporarily occlude blood inflow to the liver. Vascular clamps were placed in the infra-renal vena cava, followed by the left renal vein, and a Satinsky clamp was placed across the RA, under TEE monitoring or across the intra-pericardial or supra-hepatic IVC. The IVC was incised from the diaphragm to the renal vein and the TT was removed. The three major hepatic veins were visualized, and their orifices were inspected, leading to a small TT being removed from the right major hepatic vein (Figure 2). Following removal of TT and closure of the upper cava, the cava was repositioned below the hepatic veins. The Pringle maneuver was discontinued, and blood flow to the liver was re-established. Clamping below the major hepatic vein allows for a short Pringle maneuver. In some areas, the TT was infiltrating the IVC wall. The remaining IVC below the hepatic veins was stapled and removed en-bloc along with the right kidney tumor and TT. The left renal vein was stapled at the level of the cava and the distal IVC at 1 cm above the common iliac vein's bifurcation was oversew with 4-0 Prolene. TEE was performed again to rule out any pulmonary artery emboli or any piece of TT left behind.

Blood loss was 1200 mL. Blood transfusion was 2 units of packed red blood cell (PRBC).

Pathology examination revealed a 4 cm papillary RCC Fuhrman grade III.[14] The right adrenal gland was free of tumor, but two lymph nodes were positive for RCC papillary cell type. The patient was discharged home on post-operative day 7 with a serum creatinine of 1 mg/dL.

Seven months after the surgery, the patient was found to have retroperitoneal lymph node and left adrenal gland metastasis on follow-up imaging. He underwent adjuvant chemotherapy and radiotherapy. Unfortunately, he passed away 4 years later due to complications associated with the metastasis.

Discussion

RCC account for 80%–85% of all primary renal neoplasms[15] and is the ninth most common neoplasm in the United States;[16] however, diagnosis continues to be a challenge as most cases are incidentally detected on imaging and patients often present asymptomatically.[17] In a study by Gonzalez et al of 386 RCC patients with IVC TT, 83% of patients had clear cell RCC, 10% had papillary RCC, and 3% had mixed RCC.[2]

When dealing with a vena cava thrombus, it is critical to differentiate between a BT and TT using careful imaging.[18]

Imaging with CT and/or magnetic resonance imaging (MRI) provide excellent images of the IVC and play a key role in detection and differentiation of venous thrombi.[3,19] The filling defect is the main imaging finding on CT. A TT demonstrates similar enhancement characteristics with the primary source and the thrombosed vessel will appear enlarged, with perivenous tissues infiltrated by the TT.[5] Bland thrombi do not extend beyond the confines for the venous wall and is homogenously appearing with no contrast enhancement.[5] Early and accurate detection of venous thrombi will significantly alter treatment approach and prognostic stratification.

It is also important to consider how malignancy can lead to venous thrombus formation. Inferior vena cava thrombosis (IVCT) is quite rare and accounts for only 1.5% of all deep vein thrombosis (DVT) cases; however, the risk of venous thrombosis in cancer patients is generally high.[20] Three mechanisms can explain how malignancy can lead to an IVCT: (1) external compression by solid tumors, (2) tumor invasion and thrombosis, and (3) malignancy-related hypercoagulability.[21] A study by Kraft et al. demonstrates that patients with an IVCT were more likely to have an associated malignancy compared to those who had a DVT alone.[22] Specifically, RCC was the predominant cancer type observed in IVCT patients and accounted for 38% of malignancy-related cases of IVCT.[22] This demonstrates that a high index of suspicion for RCC should be kept when dealing with an IVCT and further investigation with imaging should be pursued for accurate diagnosis and treatment.

Although associated with significant morbidity and mortality, radical nephrectomy and tumor thrombectomy is the only possible cure for patients with RCC and IVC TT. Resection RCC with supradiaphragmatic TT is often performed with CPB, which has been shown to increase the risk of complications and in-hospital mortality.[23] To avoid further complications in our patient, we successfully performed the surgical resection without CPB.[9,24] We believe that this transplant-based approach with TEE guidance should be utilized in a multidisciplinary team effort for resection of these complex renal tumors.

Conclusion

A high suspicion of malignancy must arise when clinicians encounter a patient with an IVCT. A thorough search of the culprit malignancy with careful imaging may lead to earlier detection and election of the indicated therapy. Resection of RCC with IVCTT without CPB improves outcomes and should be strongly considered during preoperative planning.

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Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics approval

This case report was in accordance with the University of Miami Institutional Review Board and Helsinki Declaration (as revised in 2013).

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Informed consent

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References

1. Ciancio G, Livingstone AS and Soloway M. Surgical management of renal cell carcinoma with tumor thrombus in the renal and inferior vena cava: the University of Miami experience in using liver transplantation techniques. *Eur Urol* 2007; 51(4): 988–994; discussion 994.
2. Gonzalez J, Gaynor JJ, Martínez-Salamanca JI, et al. Association of an organ transplant-based approach with a dramatic reduction in postoperative complications following radical nephrectomy and tumor thrombectomy in renal cell carcinoma. *Eur J Surg Oncol* 2019; 45(10): 1983–1992.
3. Quencer KB, Friedman T, Sheth R, et al. Tumor thrombus: incidence, imaging, prognosis and treatment. *Cardiovasc Diagn Ther* 2017; 7(Suppl. 3): S165–S177.
4. Hevia V, Ciancio G, Gomez V, et al. Surgical technique for the treatment of renal cell carcinoma with inferior vena cava tumor thrombus: tips, tricks and oncological results. *Springerplus* 2016; 5: 132.
5. Rohatgi S, Howard SA, Tirumani SH, et al. Multimodality imaging of tumour thrombus. *Can Assoc Radiol J* 2015; 66(2): 121–129.
6. Mazhar HR and Aeddula NR. *Renal vein thrombosis*. Treasure Island, FL: StatPearls, 2022.
7. Ciancio G, Vaidya A, Savoie M, et al. Management of renal cell carcinoma with level III thrombus in the inferior vena cava. *J Urol* 2002; 168(4 Pt 1): 1374–1377.
8. Ciancio G, Gonzalez J, Shirodkar SP, et al. Liver transplantation techniques for the surgical management of renal cell carcinoma with tumor thrombus in the inferior vena cava: step-by-step description. *Eur Urol* 2011; 59(3): 401–406.
9. Ciancio G, Shirodkar SP, Soloway MS, et al. Renal carcinoma with supradiaphragmatic tumor thrombus: avoiding sternotomy and cardiopulmonary bypass. *Ann Thorac Surg* 2010; 89(2): 505–510.
10. Ciancio G, Farag A and Salerno T. Renal cell carcinoma with inferior vena cava tumor thrombus in two patients with previous coronary artery bypass graft: strategy for surgical removal. *Front Surg* 2021; 8: 676245.
11. Chen YH, Wu X-R, Hu Z-L, et al. Treatment of renal cell carcinoma with a level III or level IV inferior vena cava thrombus using cardiopulmonary bypass and deep hypothermic circulatory arrest. *World J Surg Oncol* 2015; 13: 159.
12. Imazuru T, Uchiyama M and Shimokawa T. Surgical treatment strategy with combined cardiopulmonary bypass for renal cell carcinoma with tumor embolism developed in inferior vena cava. *Heart Surg Forum* 2020; 23(1): E025–E029.
13. Calderone CE, Tuck BC, Gray SH, et al. The role of transesophageal echocardiography in the management of renal cell carcinoma with venous tumor thrombus. *Echocardiography* 2018; 35(12): 2047–2055.
14. Delahunt B, Cheville JC, Martignoni G, et al. The International Society of Urological Pathology (ISUP) grading system for renal cell carcinoma and other prognostic parameters. *Am J Surg Pathol* 2013; 37(10): 1490–1504.
15. Garfield K and LaGrange CA. *Renal cell cancer*. Treasure Island, FL: StatPearls, 2022.
16. Padala SA, Bensalah K, Bex A, et al. Epidemiology of renal cell carcinoma. *World J Oncol* 2020; 11(3): 79–87.
17. Oltean MA, Matuz R, Sitar-Taut A, et al. Renal cell carcinoma with extensive tumor thrombus into the inferior vena cava and right atrium in a 70-year-old man. *Am J Mens Health* 2019; 13(3): 1557988319846404.
18. Ayyathurai R, Garcia-Roig M, Gorin MA, et al. Bland thrombus association with tumour thrombus in renal cell

carcinoma: analysis of surgical significance and role of inferior vena caval interruption. *BJU Int* 2012; 110(11 Pt B): E449–E455.
19. Karaosmanoglu AD, Onur MR, Uysal A, et al. Tumor in the veins: an abdominal perspective with an emphasis on CT and MR imaging. *Insights Imaging* 2020; 11(1): 52.
20. Stein PD, Matta F and Yaekoub AY. Incidence of vena cava thrombosis in the United States. *Am J Cardiol* 2008; 102(7): 927–929.
21. Olson MC, Lubner MG, Menias CO, et al. Venous thrombosis and hypercoagulability in the abdomen and pelvis: causes and imaging findings. *Radiographics* 2020; 40(3): 875–894.
22. Kraft C, Schuettfort G, Weil Y, et al. Thrombosis of the inferior vena cava and malignant disease. *Thromb Res* 2014; 134(3): 668–673.
23. Toren P, Abouassaly R, Timilshina N, et al. Results of a national population-based study of outcomes of surgery for renal tumors associated with inferior vena cava thrombus. *Urology* 2013; 82(3): 572–577.
24. Ciancio G, Shirodkar SP, Soloway MS, et al. Techniques for avoidance of sternotomy and cardiopulmonary bypass during resection of extensive renal cell carcinoma with vena caval tumor thrombus extension above the diaphragm. *J Card Surg* 2009; 24(6): 657–660.