

Extensive Neoplastic Venous Thrombosis in a Patient Diagnosed With Renal Neoplasia Submitted to Total Nephrectomy and Embolectomy: A Case Report

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ABSTRACT

Venous thromboembolism (VTE) is a well-recognized complication in patients with cancer. Renal cell carcinoma (RCC) is among the malignancies associated with an increased risk of VTE. We present a case report of a patient diagnosed with extensive venous thrombosis in the setting of renal cell carcinoma. A 45-year-old male with previous diagnosis of chronic kidney disease (CKD) in hemodialysis, received the diagnosis of Renal Cell Carcinoma (RCC) in a computed tomography (CT) of routine has appeared a heterogeneous expansile mass was seen in the upper third of the right kidney invading the renal pelvis, inferior vena cava and hepatic veins. Open surgical intervention was performed for exeresis of RCC and extensive thrombus. Patient is clinical and hemodynamically stable since then. Further research is warranted to better understand the underlying mechanisms and develop effective strategies for prevention and treatment of thromboembolic events in patients with RCC.

Keywords: renal cell carcinoma, venous thrombosis, deep vein thrombosis, pulmonary embolism, hypercoagulability.

INTRODUCTION

Venous thrombosis represents a severe complication among cancer patients and significantly impacts both

morbidity and mortality rates. Renal cell carcinoma (RCC), the most common form of kidney cancer, has been associated with an increased risk of thrombotic events, particularly venous thromboembolism¹. Understanding the mechanisms underlying extensive venous thrombosis in patients with renal cancer is essential for improved risk assessment, prevention, and management strategies².

Extensive venous thrombosis poses significant challenges in the management of patients with renal cancer^{1,2}. Studies have demonstrated an elevated incidence of venous thrombotic events in this population, with rates varying depending on cancer stage and treatment modalities. Venous thromboembolism, including deep vein thrombosis and pulmonary embolism, contributes to increased morbidity, prolonged hospital stays, and reduced overall survival³.

The mechanisms underlying the prothrombotic state in renal cancer patients are multifactorial. Tumor-related factors, including enhanced coagulation activity, production of procoagulant substances, and release of inflammatory mediators, contribute to a hypercoagulable state⁴. Moreover, the tumor microenvironment, hypoxia, and interactions between tumor cells and platelets further promote thrombus formation. Additionally, specific genetic alterations and acquired mutations have been implicated in thrombotic events in renal

cancer patients^{4,5}.

The classification of Mayo⁶ divides the neoplastic thrombus in:

0. Limited to the renal vein;

I. Involvement of the inferior vena cava and extension less than 2 centimeters;

II. Extension greater than 2 centimeters, but below the hepatic veins;

III. Located from the hepatic veins, however, below the diaphragm;

IV. Above the diaphragm.

Our article aims to describe the case of a patient diagnosed with renal cell carcinoma that evolved with extensive thrombosis of the renal vein, vena cava extending to the right atrium, where radical nephrectomy and thromboembolctomy was performed with good recovery of the patient.

CASE REPORT

A 45-year-old male, previously healthy, non-smoker, non-drinker, no diagnosis of hypertension or diabetes mellitus, dialysis for 25 years for an undetermined etiology, followed-up in outpatient nephrology service, without significant clinical complaints in routine evaluation. The patient underwent contrast-enhanced CT scan of the abdomen of routine in April 2022, where heterogeneous expansile mass was seen in the upper third of the right kidney, measuring approximately 8.6 x 6.1 x 6.0 cm, with signs of invasion of the renal pelvis and inferior vena cava in the intrahepatic pathway and descending portion.

Considering the surgical risk of the patient, a preoperative transthoracic echocardiogram was performed, which showed inferior vena cava of 22mm in diameter, filled by a tumor mass extending into the right atrium, with a mass of 39 x 15mm visible inside.

A computed tomography with contrast (CT-C) was performed with diagnosis of renal cell carcinoma with vascular invasion of inferior vena cava (Figure 1).

Scheduled surgical approach for exeresis of heterogeneous tumor expansive formation and thrombectomy of extensive thrombotic formation. A Makuuchi incision was made and the surgery was performed by open approach due to the extent of renal involvement, as well as the vascular invasion evident on imaging exams. The surgery was performed in a single operation, without the need for cardiopulmonary bypass (ECMO).

The surgical specimen removed was the heterogeneous appearing renal neoplasm on left CBCT, as well as the neoplastic thrombus evident on IVC.

The surgical specimen involving both the right kidney and the installed renal neoplasm weighed 645g (Figure 2 and 3). The right kidney had the following dimensions: 15 x 12 x 7.5cm (1350cm³) and the neoplastic lesion evident in the upper and middle pole was 13 x 10 x 7cm (910cm³). Microscopy showed renal cell carcinoma.

Patient evolved without surgical wound infection (Figure 4). On the first postoperative day, the patient developed pneumonia acquired in the hospital environment and required admission to the ICU to resolve the condition, requiring nora-drenaline to maintain stable blood pressure, and also using Meropenem and Piperacillin-Tazobactam. About 7 days after diagnosis and after finishing the antibiotic regimen, the patient evolved with clinical and hemodynamic stability, being weaned from VAD and transferred to a ward bed, from where he was discharged with significant clinical improvement for outpatient follow-up.

DISCUSSION

We present the case of a previously CKD patient diagnosed by imaging with a solid expansive heterogeneous renal lesion with features typical of malignant neoplasia and significant vascular neoplastic invasion, with an indication for an extensive surgical approach for nephrectomy and thromboembolctomy.

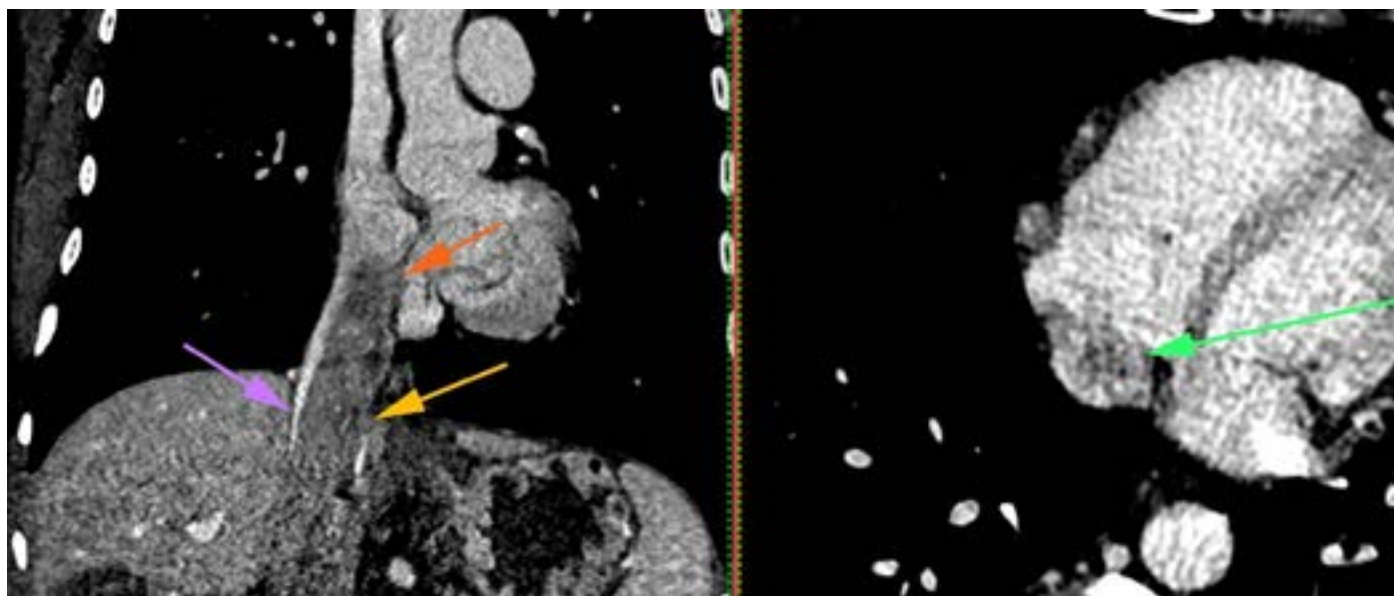
Renal cell carcinoma (RCC) is a common malignancy originating from the renal parenchyma, with venous thrombosis being a known complication associated with advanced disease¹⁻³. The presence of extensive venous thrombosis in RCC patients presents numerous challenges, including increased surgical complexity, risk of embolization, and higher mortality rates. This discussion aims to explore the physiopathological mechanisms involved, surgical considerations, and the impact on patient outcomes^{1,4}.

Venous thrombosis in RCC often involves the renal vein and can extend into the inferior vena cava (IVC). It is hypothesized that tumor invasion into the venous system triggers a hypercoagulable state through various mechanisms, including direct endothelial damage, secretion of procoagulant factors, and activation of platelets and the coagulation cascade^{7,8}. Additionally, the presence of tumor thrombus can disrupt normal blood flow, leading to stasis and further promoting thrombus formation⁹.

The presence of extensive venous thrombosis in RCC is associated with increased morbidity and mortality rates.

FIGURE 1

Solid expansive renal formation on the right invading the inferior vena cava through the renal vein up to the level of the cavoatrial junction.



Fonte: Arquivo Pessoal.

Studies have reported higher rates of intraoperative bleeding, perioperative complications, and postoperative mortality in patients with advanced tumor thrombus¹⁰. The extent of thrombus invasion, tumor stage, and patient comorbidities influence the prognosis and survival outcomes. Therefore, a thorough preoperative assessment, careful patient selection, and comprehensive surgical planning are crucial to improve the chances of successful outcomes.

The management of RCC with extensive venous thrombosis requires a multidisciplinary approach involving urologists, vascular surgeons, and interventional radiologists. The surgical strategy aims to achieve complete tumor resection while ensuring minimal perioperative complications¹¹. The level of thrombus extension, as classified by the Mayo or Neves classification systems, guides the selection of the surgical technique, including thrombectomy, cavotomy, or combined procedures with cardiopulmonary bypass¹². Advanced imaging techniques, such as preoperative computed tomography (CT) and magnetic resonance imaging (MRI), aid in surgical planning and identification of the extent of thrombus.

CONCLUSION

RCC is a disease characterized by being indolent and only usually shows symptoms in advanced stages. The diagnosis is usually made by imaging examinations that are requested for other purposes, as was the case with our patient. He also had extensive vascular invasion, with a venous thrombus

extending from the inferior vena cava to the right atrium, although he remained asymptomatic. The surgical approach performed involved urologists, vascular surgeons, and a wide incision for correct evaluation and performance of nephrectomy and thromboembolotomy. Patients submitted to such a procedure usually evolve with a poor prognosis and unstable clinical status, which did not occur with our patient, who developed pneumonia that was soon resolved and the patient remains in outpatient follow-up in our service.

We emphasize that further studies involving the follow-up of patients with concomitant diagnosis of renal cell carcinoma and extensive venous thrombosis are needed in order to define the best management.

FIGURE 2
Macroscopic aspect of the renal tumor removed via total nephrectomy and part of the venous thrombus removed by thromboembolism.



Fonte: Arquivo Pessoal.

FIGURE 4
Post-operative scar appearance (Makuuchi's incision) by total open nephrectomy and thromboembolism at the same surgical time.



Fonte: Arquivo Pessoal.

FIGURE 3
Intraoperative aspect of renal neoplasia with vascular involvement and view of the thrombus in IVC.



Fonte: Arquivo Pessoal.

REFERENCES

1. Smith AB, et al. Venous thromboembolism in patients undergoing surgery for renal cell carcinoma: Insights from the National Surgical Quality Improvement Program. *Urol Oncol.* 2019;37(10):777-784. doi:10.1016/j.urolonc.
2. Sheng, Iris Y., et al. "Thromboembolism in patients with metastatic renal cell carcinoma treated with immunotherapy." *Targeted Oncology* 16.6 (2021): 813-821.
3. Ihaddadene, R., et al. "The risk of venous thromboembolism in renal cell carcinoma patients with residual tumor thrombus." *Journal of Thrombosis and Haemostasis* 12.6 (2014): 855-859.
4. Yokom, Daniel W., et al. "Increased risk of preoperative venous thromboembolism in patients with renal cell carcinoma and tumor thrombus." *Journal of Thrombosis and Haemostasis* 12.2 (2014): 169-171.
5. Woodruff, Daniel Y., et al. "The perioperative management of an inferior vena caval tumor thrombus in patients with renal cell carcinoma." *Urologic Oncology: Seminars and Original Investigations*. Vol. 31. No. 5. Elsevier, 2013.
6. Reis, Matheus NM, et al. "Tumor Renal Esquerdo Associado a Regressão de Trombo Tumoral em Veia Cava Inferior após Axitinib Tratado Através da Plataforma Robótica: Relato de Caso." (2023).
7. Park, Hyunkyung, et al. "Influence of tumor thrombus on occurrence of distant venous thromboembolism and survival in patients with renal cell carcinoma after surgery." *Clinical and Applied Thrombosis/Hemostasis* 25 (2019): 1076029618823288.
8. Nalluri, Shobha Rani, et al. "Risk of venous thromboembolism with the angiogenesis inhibitor bevacizumab in cancer patients: a meta-analysis." *Jama* 300.19 (2008): 2277-2285.
9. Erol, Mehmet Emir. "Surgical treatment of massive pulmonary thromboembolism due to renal cell carcinoma." *Turkish Journal of Thoracic and Cardiovascular Surgery* 30.3 (2022).
10. Blute ML, Leibovich BC, Lohse CM, et al. The Mayo Clinic experience with surgical management, complications and outcome for patients with renal cell carcinoma and venous tumour thrombus. *BJU Int.* 2004;94(1):33-41.
11. Moinzadeh A, Libertino JA. Prognostic significance of tumor thrombus level in patients with renal cell carcinoma and venous tumor thrombus extension: a prospective study. *J Urol.* 2004;171(2 Pt 1):588-592.
12. Ljungberg B, Bensalah K, Canfield S, et al. EAU guidelines on renal cell carcinoma: 2014 update. *Eur Urol.* 2015;67(5):913-924.