

## Oncology

## Renal cell carcinoma with tumor thrombus in the lower cava vein reaching the right atrium – Case report and brief review of the literature

Cyro Rezende Laghi<sup>\*</sup>, Bruno Costa do Prado, Germano de Freitas Dan, Gustavo Ruschi Bechara, Bruna Afonso Venturini, Claudio Ferreira Borges

Department of Urology, Federal University of Espírito Santo (UFES), Vitória, ES, Brazil

## ARTICLE INFO

## Keywords:

Renal cell carcinoma  
Caval thrombectomy  
Right atrium thrombus  
Hypothermic circulatory

## ABSTRACT

Approximately 15% of cases of renal cell carcinoma (RCC) can invade the inferior vena cava, leading to the formation of a thrombus inside it, which can reach the cardiac chambers in up to 1% of cases. This article reports a case of RCC with venous thrombus that reached the right atrium. The patient underwent radical nephrectomy with lymphadenectomy and tumor thrombectomy with extracorporeal circulation associated with hypothermia, without total cardiac arrest. The surgical success of this case highlights the need to study new techniques that represent better operative approaches for solid kidney injuries.

## Introduction

Renal cell carcinoma (RCC) represents the most common solid kidney injury (90%) and is the most lethal of all urological cancers.<sup>1</sup> This tumor requires surgical treatment and can be very aggressive with a poor prognosis. It is known that up to 15% of the cases of these tumors can invade the inferior vena cava (IVC), leading to the formation of a thrombus inside, which can reach the cardiac chambers in up to 1% of patients.<sup>2</sup> If no surgical approach is performed, the survival of these patients is five months. Surgical removal is able to offer the patient an increase in survival of 40–60% in 5 years.<sup>3</sup>

This article reports a case of RCC with venous thrombus that reached the right atrium (RA) treated at the Urology Department of Hospital Universitário Cassiano Antônio de Moraes, followed by a literature review on the best operative conduct for these cases.

## Case report

A 57-year-old man, with no previous comorbidities, comes to the urological referral center with low back pain and weight loss of 10 kg in the last two months, associated with intermittent hematuria. Physical examination indicated skin pallor and weight loss, with a bulging and painful abdomen on the right. Laboratory tests revealed hemoglobin of 9 g/dL, creatinine 0.85 mg/dL, total calcium of 10 mg/dL and lactate dehydrogenase (LDH) of 229U/L.

Computed tomography (CT) revealed a massive infiltrative expansive formation in the abdomen that affected practically the entire right kidney, measuring 16.3 cm × 15.3 cm × 11.7 cm that invaded the collecting system and was in close contact with the right hepatic lobe. It also stood out the infiltration of the renal vein on this side and IVC extending to its intrahepatic portion, until the confluence of the suprahepatic veins, whose tumoral thrombus measuring about 13.3 cm in length, with almost complete luminal occlusion associated with the presence of lymph nodes in the interlesional, portocaval, retrocaval and paraortic regions of a maximum of 11 mm (Fig. 1A and B).

As a complement diagnostic, angio-resonance, CT scan chest did not reveal metastases, in addition to a transthoracic echocardiogram with hyporefringent image occupying the entire vena cava, which suggested the involvement of RA.

After a multidisciplinary discussion, the patient underwent radical nephrectomy with lymphadenectomy and tumor thrombectomy with extracorporeal circulation (ECC) associated with hypothermia, without total cardiac arrest. The incision made was a bilateral subcostal incision followed by median thoracotomy (Fig. 1C and D).

Table 1 presents a summary with the main steps for this combined procedure.

## Discussion

Protopapas et al.<sup>2</sup> showed in a serial study of 40 years, 784 patients

<sup>\*</sup> Corresponding author. Department of Urology, Federal University of Espírito Santo (UFES), Hospital Universitário Cassiano Antônio de Moraes – HUCAM, Av. Marechal Campos - Nazareth, Vitória, ES, 29041-295, Brazil.

E-mail address: [cyro.uro@hotmail.com](mailto:cyro.uro@hotmail.com) (C.R. Laghi).

<https://doi.org/10.1016/j.eucr.2020.101551>

Received 16 December 2020; Accepted 24 December 2020

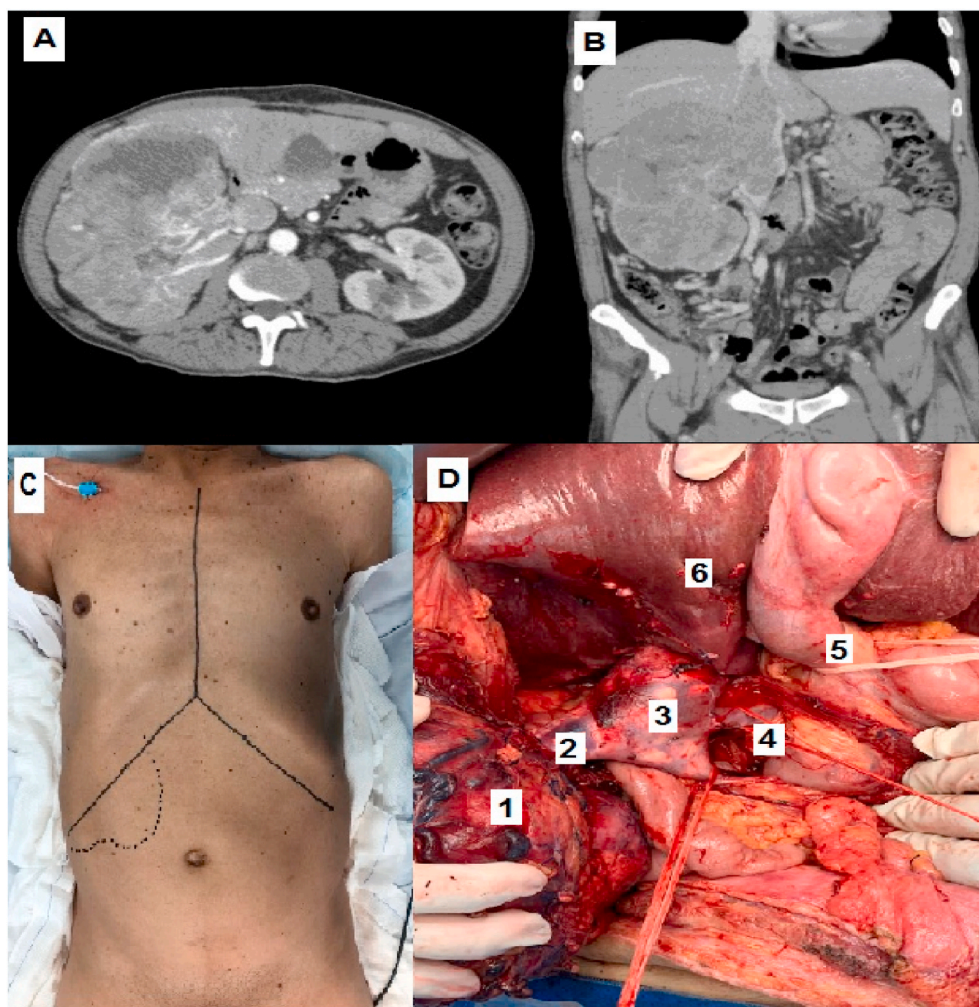
Available online 29 December 2020

2214-4420/© 2021 The Authors.

Published by Elsevier Inc.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).



**Fig. 1.** A) Axial section of abdominal CT. B) Coronal section of abdominal CT. C) Surgical access. D) Intra-operative strategy: 1 = Right Kidney; 2 = right renal vein with intraluminal thrombus; 3 = exposure of the inferior vena cava with the presence of a thrombus; 4 = preserved left renal vein; 5 = Pringle maneuver; 6 = batting liver.

with tumoral thrombus in the inferior vena cava, of which 98% were RCC. Such a disease is important due to its frequent complications with intracava and/or intracardiac thrombus. The majority (64%) of primary tumors were seen on the right side. 29% of patients underwent preoperative embolization in order to reduce intraoperative bleeding.

As for the surgical access described in this research, the highest prevalence occurred through a Chevron incision. Abdominal dissection is based on hepatic beating known as “piggy-back” and on hepatic vascular control through the Pringle maneuver. Still in this perspective, many surgeons indicated the practice of sternotomy and cardiac bypass. Circulatory arrest was used in 60% of level V tumors, and ECC with an average of 103 minutes (considered an elevated time in our review), resulting in an average operating time of 362 minutes.<sup>2</sup>

Numerous surgical strategies for the management of RCC with cavoatrial extension of the thrombus are available. Although little is known about the techniques, Gaudino et al.<sup>4</sup> reported in their systematic review that cardiopulmonary bypass with severe hypothermia is the most commonly used technique when the level of invasion is above the diaphragm. This technique has the advantage of the possibility of better

hemodynamic stability, better exposure, with direct visualization of the thrombus and less blood loss. Regarding the disadvantages, there is the risk of a longer surgical time and coagulopathies, which can lead to a higher rate of complications.<sup>4</sup> In our report, after right atriotomy, it was possible to remove the tumor thrombus entirely through the abdominal route, and we were more conservative in hypothermia (32 °C), also avoiding total cardiac arrest and minimizing ECC time. In this way, we suppress the greatest risk of complications.

## Conclusion

RCC with cardiac chamber extension is a rare event. The purpose of this publication was to demonstrate the main surgical steps for successful treatment, as recommended by the literature. Radical nephrectomy with thrombectomy using extracorporeal circulation and hypothermia is challenging and requires surgeons with good operating practices and a multidisciplinary team dedicated to the safety and success of these procedures.

**Table 1**

Summary of the main stages of the combined surgical procedure.

Procedure	Notes on techniques
1) BILATERAL SUBCOSTAL INCISION	<ul style="list-style-type: none"> <li>- Cattel-Braasch manoeuvre;</li> <li>- Preparation of the right renal artery and vein;</li> <li>- Exposure of the inferior vena cava (IVC) to intrahepatic level with mobilization of the liver;</li> <li>- Loop for pringle maneuver (possible bleeding);</li> </ul>
2) MEDIAN STERNOTOMY AND PREPARATION FOR CARDIOPULMONARBYPASS (CPB)	<ul style="list-style-type: none"> <li>- Systemic heparinization;</li> <li>- Purse-string suture in the right auricle</li> <li>- Brachiocephalic trunk cannulation (selective cerebral perfusion, if necessary);</li> </ul>
3) EXTRACORPOREAL CIRCULATION (ECC)	<ul style="list-style-type: none"> <li>- ECC with an estimated time of 30 minutes;</li> </ul>
4) LIGHT HYPOTHERMIA	<ul style="list-style-type: none"> <li>- Maintenance of temperature between 32 and 35 °C, different from the severe (&lt;18 °C) proposed in the literature, which has a higher risk of complications;</li> </ul>
5) NEFRECTOMY AND THROMBO REMOVAL IN VCI	<ul style="list-style-type: none"> <li>- Right atriotomy with visualization of the tumoral thrombus at the entrance of the right atrium, close to the Eustachian valve;</li> <li>- Cavotomy and removal of the tumor thrombus entirely through the abdominal route together with the right kidney;</li> </ul>
6) CLOSING RA AND IVC	<ul style="list-style-type: none"> <li>- No need for reconstruction with bovine pericardium;</li> </ul>
7) ECC OUTPUT AND SYSTEMIC CIRCULATION RESTORATION	<ul style="list-style-type: none"> <li>- Reheat;</li> <li>- Hemostasis;</li> <li>- Administration of protamine;</li> </ul>
8) DRAINAGE AND CLOSING OF ABDOMINAL AND THORACIC ROUTINE	<ul style="list-style-type: none"> <li>- It was not necessary to perform anoxic cardiac arrest or total circulatory arrest (differently from the literature that can lead to total circulation arrest, inducing a greater risk of surgical complications.</li> </ul>

## References

1. Ferlay J, Colombet M, Soerjomataram I, et al. Cancer incidence and mortality patterns in Europe: estimates for 40 countries and 25 major cancers in 2018. *Eur J Canc.* 2018; 103:356–387. <https://doi.org/10.1016/j.ejca.2018.07.005>.
2. Protopapas AD, Ashrafian H, Athanasiou T. Tumour thrombi in the suprahepatic inferior vena cava: the cardiothoracic surgeons' view. *ISRN Vasc Med.* 2013:1–8. <https://doi.org/10.1155/2013/546709>.
3. Haidar GM, Hicks TD, El-Sayed HF, Davies MG. Treatment options and outcomes for caval thrombectomy and resection for renal cell carcinoma. *J Vasc Surg Venous Lymphat Disord.* 2017;(5):430–436. <https://doi.org/10.1016/j.jvsv.2016.12.011>.
4. Gaudino M, Lau C, Cammertoni F, et al. Surgical treatment of renal cell carcinoma with cavoatrial involvement: a systematic review of the literature. *Ann Thorac Surg.* 2016;101:1213–1221. <https://doi.org/10.1016/j.athoracsur.2015.10.003>.