Fifteen-year experience with renal cell carcinoma with associated venous tumor thrombus

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Background. *For patients with renal cell carcinoma with venous tumor thrombus (VTT), the importance of the extent of the VTT on survival has inconsistent published results. The aim of the study was to evaluate the prognostic value of the VTT on morbidity and mortality of our patients with renal cell carcinoma.*

Methods. *This was a single institution review of all patients who underwent resection of renal cell carcinoma with VTT over a 15-year period.*

Results. *Thirty-seven patients (26 men, 11 women) with a mean age of 61 years were analyzed. The majority of the cohort were of Neves level II (n = 19), while 8 were of Neves 0 (only renal vein) or I, and 10 were of Neves III (extending into retrohepatic cava) or IV (extending supradiaphragmatically). When compared with Neves 0–II patients, there were more Neves III–IV patients with operative time >3 hours (70% vs 30%), blood loss >2,000 mL (70% vs 33%), and intensive care unit stay longer than one day (60% vs 30%) (P ≤ .05 each). Mean follow-up was 58 months. The overall 5-year survival was 71%, and all 10 patients with Neves III–IV had survived since the operation.*

Conclusion. *We found advanced tumor thrombus involvement did not impact long-term survival; however, cases with suprahepatic VTT had increased operative time, blood loss, and duration of hospital stay. (Surgery 2016;160:915-23.)*

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Cancers affecting the kidney and renal pelvis are among the top 10 cancers affecting men and women.[1] The majority, 90–95% of malignant neoplasms of the kidney and renal pelvis, are attributed to renal cell carcinoma (RCC). With the increasing usage of imaging in recent decades, there has been an increase in the detection of RCC.[2,3]

RCC is usually found with concomitant venous tumor thrombus (VTT), which can extend from the renal vein and into the inferior vena cava (IVC) in 4–24% of cases.[4,5] The current TNM staging system of the American Joint Committee on Cancer (AJCC) uses the level of extension of the tumor thrombus to classify kidney cancers.[6] Kidney cancers with VTT extending to the renal vein, extending to the subdiaphragmatic IVC, or extending to the supradiaphragmatic IVC are classified as T3a, T3b, and T3c, respectively. Although radical nephrectomy with venous tumor thrombectomy is the current standard of treatment for RCC with VTT, the extent of VTT and its effect on survival remains controversial, leading to debate on the relevance of the current classification scheme.

Previous studies evaluating the level of VTT and its prognostic value in long-term survival have yielded inconsistent outcomes. These reported results range from finding no relationship between the level of extent of VTT and survival, to finding a notable relationship between the level of extent of VTT and survival.[7-18] Of those studies identifying a relationship, outcomes continue to vary with some finding a survival difference in VTT isolated to the renal vein compared to thrombus in the IVC, VTT which remains infrahepatic compared to suprahepatic, or VTT which remains infradiaphragmatic compared to

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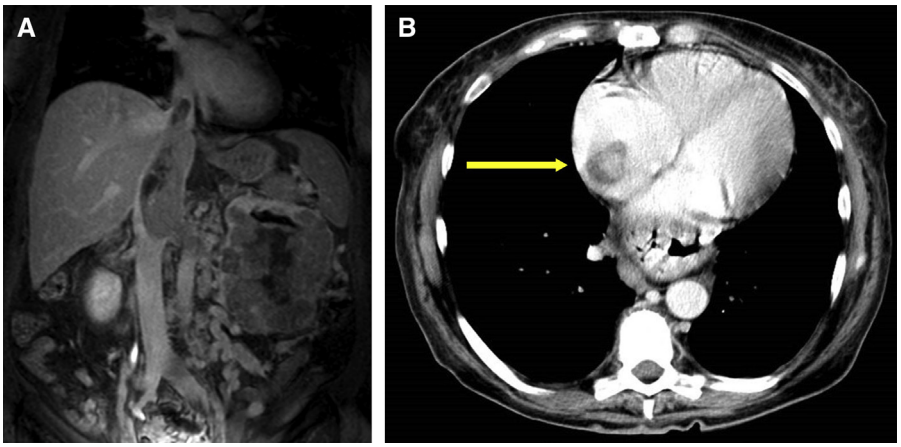

Fig 1. Computed tomography angiography of a patient with Neves IV renal cell carcinoma with venous tumor thrombus in the inferior vena cava (*A*) and extending into the right atrium (*B, arrow*). (Color version of this figure is available online.)

supradiaphragmatic. Given the ongoing debate and dissimilar outcomes, the aim of our study was to evaluate the prognostic value of levels of extension of the VTT on morbidity and mortality of patients with RCC.

METHODS

Approval by our Institutional Review Board was obtained to perform a single-institution, retrospective chart review of patients who underwent radical nephrectomy with associated VTT from 2000 to 2015. Thirty-seven patients met inclusion criteria and were included in the study. Patient demographics, tumor pathology, level of VTT, presence of metastasis, cancer staging, Fuhrman grade, TNM class, perioperative outcomes, and postoperative survival were obtained from inpatient and outpatient records. Pathologic reports were reviewed for Fuhrman grade of the surgical specimen based on nuclear characteristics, status of the venous margin, and nodal metastasis. In addition, all patients were queried in the Social Security Death Index database to confirm documentation of recorded death or to evaluate for undocumented patient death.

Neves classification system. Level of VTT extension was determined based on preoperative computed tomography or magnetic resonance imaging, intraoperative transesophageal echocardiogram, and operative reports, and was categorized based on the Neves classification system.[19] Neves level 0 included VTT isolated to the renal vein, level I included VTT extending <2 cm into the IVC, level II included VTT extending >2 cm within the IVC but inferior to the intrahepatic vena cava, level III included VTT extending to the intrahepatic vena cava but remaining infradiaphragmatic, and level IV (Fig 1, *A* and *B*) included VTT extending to the supradiaphragmatic vena cava.

Operation for Neves 0–II. Either a thoracoabdominal or transabdominal incision was utilized by urologists to enter the abdomen. When required, standard techniques were utilized to mobilize colon and small bowel to expose the infrahepatic IVC. Prior to lateral venotomy of the IVC, the artery or arteries to the kidney were ligated, and the IVC and all major venous tributaries were controlled with vessel loops. Additionally, to ensure a bloodless field, the vascular surgeons ligated and divided all posterior lumbar venous tributaries. Once control of the suprarenal and infrarenal IVC was obtained, a lateral venotomy was made at the confluence of the renal vein and the IVC as described previously.[20]

When VTT was found to extend into the IVC, the thrombus was milked from the IVC en bloc with the renal vein. Once grossly negative venous margins were obtained and all debris and air was flushed from the IVC, the IVC was evaluated for closure. If the IVC could be repaired without clinically relevant narrowing, the IVC was then repaired primarily with a running 3-0 or 4-0 monofilament polypropylene suture (Prolene; Ethicon, Somerville, NJ). When tumor dissection resulted in removal of a portion of IVC that would result in narrowing, a bovine patch venoplasty was utilized to maintain IVC patency (Vascu-Guard; Synovis, St. Paul, MN).

Operation for Neves III–IV. When tumor thrombus involved the hepatic veins and supradiaphragmatic IVC, a transabdominal incision was