## **RESIDENT'S CORNER**

# Laparoscopic nephroureterectomy with a circumaortic left renal vein

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Renal vasculature anomalies can present technical challenges to laparoscopic urologic surgery. The use of preoperative imaging has made it possible to recognize and

## Introduction

Although laparoscopic nephrectomy in patients with anomalous renal vasculature has been described previously, laparoscopic nephroureterectomy necessitates extensive dissection to free the ureter, suggesting a higher risk of complications from anatomic variants. This report describes the preoperative planning, intraoperative management and postoperative outcomes in a patient with a circumaortic renal vein who underwent radical nephroureterectomy for high grade urothelial carcinoma.

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Address correspondence to Dr. Scott Hubosky, Thomas Jefferson University, Room 1102, 1025 Walnut Street, Philadelphia, PA 19107 USA plan for such aberrant vascular anatomy. We describe a patient with a circumaortic left renal vein who underwent successful laparoscopic radical nephroureterectomy for the management of urothelial carcinoma of the renal pelvis.

**Key Words:** laparoscopic nephroureterectomy, circumaortic renal vein, urothelial carcinoma, vascular anomalies

#### Case report

The patient was a 74-year-old Caucasian female referred for evaluation of gross hematuria accompanied by a left-sided collecting system filling defect on computed tomography (CT) urogram. Past medical history was remarkable for hypertension and a history of a laparoscopic cholecystectomy. Renal function was normal as were preoperative liver function testing and routine chest x-ray. Ureteroscopy demonstrated an approximately 2 cm papillary tumor in the renal pelvis. Biopsy and laser ablation of the tumor were performed. Final pathology demonstrated high grade urothelial carcinoma. Although deep biopsy of the renal pelvis is difficult to perform ureteroscopically, most high grade urothelial carcinomas are associated with an advanced stage. The remainder of her urothelium did not reveal any other lesions. Definitive treatment with laparoscopic radical nephroureterectomy was recommended.



**Figure 1.** Axial venous phase CT image showing the inferior vena cava (asterisk) with anterior portion of the circumaortic left renal vein (arrowhead) crossing the aorta just below the superior mesenteric artery.

## Preoperative planning

A high resolution CT scan of the abdomen and pelvis with and without intravenous contrast was performed as part of routine preoperative planning. Beyond characterization of the tumor and evaluating for the presence of lymphadenopathy, imaging may sometimes reveal anatomic variations that may complicate surgery. The preoperative CT scan in both axial and coronal sections demonstrated the presence of a circumaortic left renal vein. Taken together in this case, these images demonstrate the anterior component of the left circumaortic renal vein to be more cranial compared to the posterior component which seemed to course towards the lower portion of the kidney, Figures 1 and 2. This information proved beneficial in planning for this venous anomaly in that the first venous structure encountered during the hilar dissection would be the posterior portion of the circumaortic vein originating from the posterior and lateral border of the aorta. This situation clearly differs from the usual classic position of the left renal vein with relation to the aorta as normally seen during a transperitoneal laparoscopic approach for nephroureterectomy.

The patient was counseled preoperatively about the anatomic abnormalities seen on the preoperative scans. The patient consented to the possibility of conversion to an open radical nephroureterectomy.

## Surgical procedure

The patient was positioned in a modified supine



**Figure 2.** Axial venous phase CT image showing inferior vena cava (asterisk) with posterior portion of the circumaortic left renal vein (arrowhead) crossing beneath the aorta.

position with the left flank elevated about 20 degrees from the horizontal plane. A total of four laparoscopic ports were inserted as follows: a 10 mm/12 mm port at the level of the umbilicus at the left midaxillary line, a 10 mm/12 mm port at the umbilicus, a 10 mm/12 mm port in the subxiphoid position, and a 5 mm port midline and just above the pubic symphysis to aid with retraction. Following lysis of numerous omental adhesions, the descending colon was taken down along the white line of Toldt from the splenic flexure to the inguinal ring thus exposing the anterior surface of the left kidney. The ureter and gonadal vein were located distally and were freed as they coursed toward the kidney.

At this time, the posterior portion of the circumaortic renal vein was identified as it emerged from behind the lateral border of the aorta and inserted into the inferior portion of the kidney. The renal artery and anterior component of the circumaortic renal vein were then identified and isolated carefully. Once all three vessels were dissected out, a 45 mm endo GIA vascular stapler was used to first take down the posterior component of the circumaortic renal vein. The renal artery and lastly the anterior portion of the renal vein were taken sequentially with the laparoscopic stapler, and the kidney was successfully dissected from the adrenal gland. The pneumoperitoneum was reduced and hemostasis was verified.

To complete the procedure, a midline incision was made below the umbilicus to allow for the removal of the ureter down to the intramural tunnel of the bladder with primary cystorrhaphy. Where present, lymph node tissue was removed and submitted. The patient tolerated the procedure well and had a minimal intraoperative blood loss of 150 mL. Her postoperative course was uneventful and the patient was discharged on post operative day 4.

Final surgical pathology demonstrated a high grade urothelial carcinoma of the renal pelvis that invaded the peripelvic fat (T3N0M0). All surgical margins and lymph nodes were free of neoplasia.

### Discussion

Although anomalies of the renal vasculature are relatively rare, they increase the challenges of urologic surgery.<sup>1</sup> Nephroureterectomy is most often performed for the treatment of upper tract urothelial carcinoma and requires more extensive dissection than nephrectomy due to the ureteral component of the case. <sup>2,3</sup> The wide variety of inferior vena cava and left renal vein anomalies arises from their complex embryologic origins, which has been extensively described in the literature.<sup>46</sup> The inferior vena cava and renal veins are derived from the progressive development and regressions of three venous systems in utero (posterior cardinal, subcardinal and supracardinal veins). A circumaortic renal vein results from the normal development of the embryologic left renal vein and the persistence of the inter-supracardinal vein anastomosis, which subsequently becomes the accessory renal vein. Anatomically, the circumaortic renal vein forms a collar around the aorta.

Five and ten year survival estimates for the surgical management of urothelial carcinoma vary according to tumor location, with survival of 73.6% and 47.0% for the renal pelvis versus 67.8% and 32.3% for the ureter respectively.<sup>7</sup> Pathologic tumor grade, T stage, LN status, tumor architecture, and LVI are also important prognostic variables associated with oncologic outcomes.<sup>8</sup> The role of neoadjuvant chemotherapy in the management of upper tract urothelial carcinoma is evolving.

This case demonstrates that laparoscopic nephroureterectomy can be safely performed in the setting of a circumaortic left renal vein. Laparoscopic nephroureterectomy offers significant benefits in terms of reduced blood loss, postoperative pain and hospital length of stay.<sup>9</sup> Endoscopic and laparoscopic advances have allowed the management of upper tract urothelial carcinoma to become increasingly less invasive.

High quality preoperative imaging is essential for planning such an operation to not only evaluate the tumor but to also detect any abnormal anatomy. Extreme care must be taken when performing the extensive retroperitoneal ureteral dissection in any patient with anomalous vasculature.

#### References

- 1. Fettouh H, Herts B, Nimeh T et al. Prospective comparison of 3-dimensional volume rendered computerized tomography and conventional renal arteriography for surgical planning in patients undergoing laparoscopic donor nephrectomy. *J Urol* 2003;170(1):57-60.
- Lin C, Steinberg A, Ramani A et al. Laparoscopic live donor nephrectomy in the presence of circumaortic or retroaortic left renal vein. J Urol 2004;171(1):44-46.
- 3. Habuchi T, Narita S, Tsuchiya N, Kumazawa T, Horikawa Y, Sato S. Laparoscopic nephrectomy in patients with renal vein and/or inferior vena cava anomalies: video presentation. *Int J Urol* 2009;16(11):854.
- 4. Mathews R, Smith P, Fishman E, Marshall F. Anomalies of the inferior vena cava and renal veins: embryologic and surgical considerations. *Urology* 1999;53(5):873-880.
- 5. Bass E, Redwine M, Framer L, Huynh P, Harris J. Spectrum of congenital anomalies of the inferior vena cava: cross-sectional imaging findings. *Radiographics* 2000;20(3):639-652.
- 6. Satyapal K, Kalideen J, Haffejee A, Singh B, Robbs J. Left renal vein variations. *Surg Radiol Anat* 1999;21(1):77-81.
- Mouracade P, Velten M, Gigante M et al. Factors impacting survival in patients with upper tract urothelial carcinoma undergoing radical nephroureterectomy. *Can J Urol* 2012;19(1): 6105-6110.
- 8. Margulis V, Shariat SF, Matin SF et al. Outcomes of radical nephroureterectomy: a series from the Upper Tract Urothelial Carcinoma Collaboration. *Cancer* 2009;115(6):1224-1233.
- 9. Rassweiler J, Schulze M, Marrero R, Frede T, Redorta J, Bassi P. Laparoscopic nephroureterectomy for upper urinary tract transitional cell carcinoma: is it better than open surgery? *Eur Urol* 2004;6(6):690-697.