

Tricks of the Trade

Robotic Nephrectomy for Kidney Cancer in a Horseshoe Kidney with Renal Vein Tumor Thrombus: Novel Technique for Thrombectomy*

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Introduction

SURGICAL MANAGEMENT of a renal vein thrombus during radical nephrectomy can be challenging under laparoscopic conditions. Laparoscopic radical nephrectomy in the setting of a renal vein tumor thrombus has been described using various GIA stapling, Statinsky clamping, or hand-assist techniques to milk back the renal vein thrombus.¹ These techniques for milking the tumor thrombus have potential limitations, such as the challenge of placing a wide GIA stapler between the inferior vena cava (IVC) and thrombus while avoiding a positive margin at the staple line, the potential for injury to the renal vein when a Statinsky clamp is used to milk the thrombus, or the need for a hand port.

We present that case of a 63-year-old woman with an 11-cm left renal mass in a horseshoe kidney and a renal vein tumor thrombus that extended to the IVC (Fig. 1) that was managed using robotic assistance for radical heminephrectomy and renal vein thrombectomy. We describe a novel Hem-o-Lok clip technique for management of a renal vein thrombus during radical nephrectomy with a minimally invasive approach.

Technique

Our technique of patient positioning, trocar placement, and robot docking for robotic transabdominal kidney surgery has been described previously.² Using robot assistance, the bowel was mobilized to expose the aorta and IVC. The renal isthmus and renal artery were dissected using robot assistance and transected using laparoscopic staplers. The renal vein and IVC were carefully dissected, and a laparoscopic ultrasound probe was used to identify the thrombus in the renal vein.

An extra-large Hem-o-Lok clip was partially closed around the renal vein proximal to the tumor thrombus and was used to retract the thrombus toward the kidney (Fig. 2A). The clip was then applied, creating a space in the renal vein between the clip and the IVC, which was confirmed to be free of tumor thrombus by intraoperative ultrasonography. Additional Hem-o-Lok clips were applied on the renal

vein at the junction with the IVC. The renal vein was incised circumferentially between clips, with visual confirmation of absence of thrombus at the resected margin (Fig. 2B), and the kidney was removed using a specimen retrieval bag.

Operative time was 190 minutes, and blood loss was 450 mL. No complications occurred, and discharge was on post-operative day 2. Histologic evaluation confirmed clear-cell renal-cell carcinoma, Fuhrman grade 3 with negative surgical margins, pT_{3b}N0Mx (Fig. 3).

Discussion

Desai and associates¹ and other groups have described laparoscopic radical nephrectomy in the setting of a renal vein tumor thrombus using various stapling or clamping techniques. Bhayani and colleagues³ described laparoscopic heminephrectomy in a horseshoe kidney for renal-cell carcinoma. We report the first case of robot-assisted heminephrectomy for kidney cancer in a horseshoe kidney with a renal vein thrombus. The decision was made to use robot assistance in the event that a cavotomy with intracorporeal suture repair of the IVC was needed. Although IVC reconstruction did not prove to be necessary, we did identify a novel technique for retraction and exclusion of a renal vein thrombus using extra-large Hem-o-Lok clips.

Early ligation of the renal artery may decrease venous pressure and retract the thrombus slightly to enable placement of an extra-large Hem-o-Lok clip across the renal vein, which can be used to milk the thrombus away from the IVC. A potential advantage of using Hem-o-Lok clips is that they may be easier to place between the IVC and thrombus than a wider endovascular stapling device, and it avoids the possibility of thrombus being incorporated into the staple line. The Hem-o-Lok clip can be partially closed around the renal vein with a controlled amount of pressure to facilitate milking of the thrombus without undue force that could cause trauma to the renal vein. Our technique also allows for confirmation of absence of tumor thrombus at the surgical margin, both by intraoperative ultrasonography and by direct visualization as the renal vein is incised.

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*A video demonstrating the technique described here is available online at www.liebertpub.com/end.

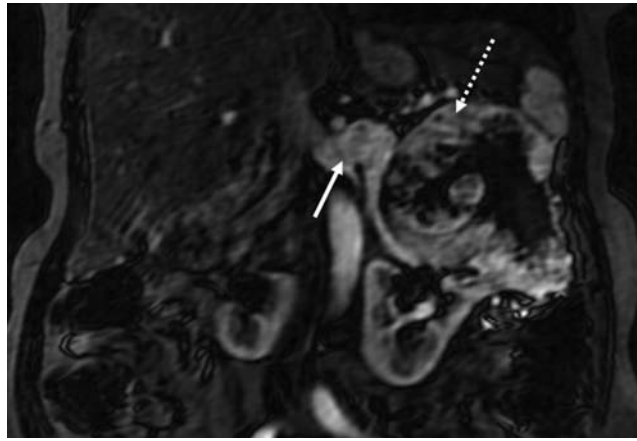
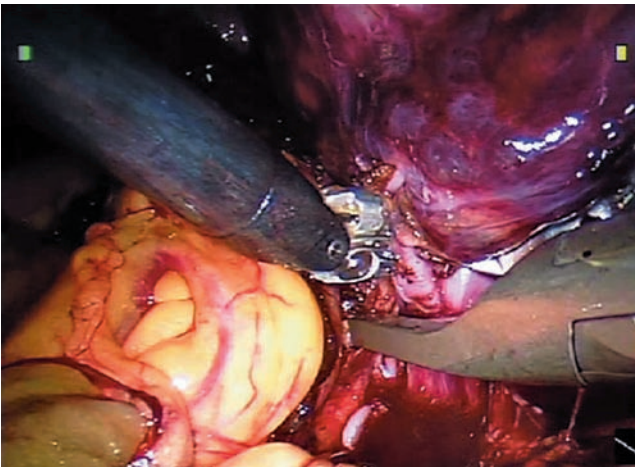


FIG. 1. Preoperative abdominal MRI that demonstrates an 11-cm upper pole mass (dashed arrow) in the left moiety of a horseshoe kidney with a left renal vein thrombus (straight arrow) extending to the confluence of the inferior vena cava.

A



B

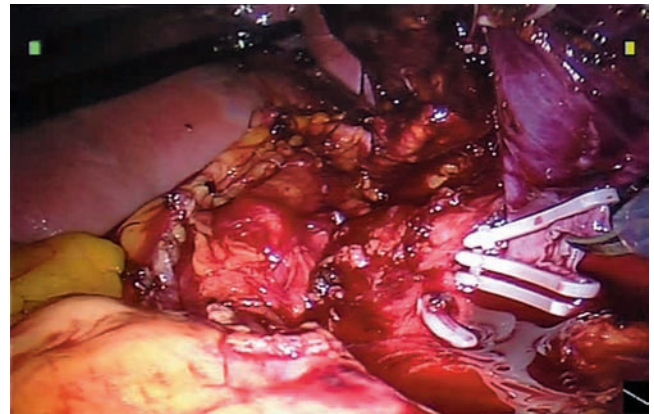


FIG. 2. Intraoperative view that shows use of extra-large Weck clips to retract the renal vein thrombus (**A**) and to exclude a portion of the thrombus-free renal vein for resection (**B**).



FIG. 3. Intact extracted heminephrectomy specimen with intraluminal renal vein thrombus exposed after removal of Hem-o-Lok clip (arrows). Venous resection margins were negative for cancer.

We recognize that some renal veins could potentially be too wide for safe use of the Hem-o-Lok clip, although the extra-large clip should accommodate most situations. Our technique of using Hemo-o-Lok clips to control the tumor thrombus avoided the need for a cavotomy and IVC reconstruction in this patient. This technique can be used with either a robotic or laparoscopic approach.

Robot-assisted radical nephrectomy is feasible in the setting of a horseshoe kidney and/or a renal vein tumor thrombus. Hemo-o-Lok clips can be used to retract and entrap the renal vein thrombus, facilitating successful tumor resection. Experience with minimally invasive radical nephrectomy is recommended before attempting management of a renal vein thrombus using this technique.

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Abbreviations Used

IVC = inferior vena cava

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Editorial Comment

WITH THE ADVENT of minimally invasive surgical techniques, the treatment of renal tumors has undergone a fundamental change in the last two decades. More recently, the expanding use of robotic technology has allowed urologists to safely perform both radical and partial nephrectomies.^{1,2} As the experience continues to grow, larger, more complex tumors may be approached robotically. Challenging anatomic variations, such as ectopic and horseshoe kid-

neys as well as various tumor characteristics (tumor thrombus), may also be approached cautiously in well-selected patients. Thus far, only laparoscopic techniques have been described for radical nephrectomy of renal masses in a horseshoe kidney^{3–5} and those individuals with level 1 tumor thrombus.⁶ In the current case report, the authors describe the robotic-assisted management for radical heminephrectomy and renal vein thrombectomy for an 11-cm tumor. More importantly, the novel technique of Hem-o-lock clip (Weck Closure Systems, Research Triangle Park, NC) milking of the tumor thrombus is demonstrated and confirmed using laparoscopic ultrasound.

Although the authors should be complemented for their advanced technique, a word of caution must be made for novice and intermediate robotic surgeons. Such cases of large renal tumors, particularly in the setting of anatomic and vascular variation as well as the presence of a tumor thrombus, should only be performed robotically by expert hands.

Attention must also be given to the bedside assistant who must apply the Hem-o-Lock clip through a standard laparoscopic technique. Suitable laparoscopic experience is also required for safe and reliable deployment of the clip. Although the 10- or 15-mm clips can be used for the milking thrombus technique, the potential of clipping through the vein or inferior vena cava exists. In situations where the vein is too wide, use of the vascular EndoGIA stapler (Ethicon, Cincinnati, OH) may provide an alternative technique.

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