CASE REPORT

Laparoscopic Radical Nephrectomy in a Pelvic Ectopic Kidney: Keys to Success

Benjamin I. Chung, MD, Joseph C. Liao, MD

ABSTRACT

Background and Objectives: Laparoscopic radical nephrectomy of a pelvic kidney for renal cell carcinoma is a procedure with little precedent, but one that offers the advantages of the minimally invasive approach. We present our experience with this unique procedure.

Methods: A 64-year-old male with a history of end-stage renal disease was diagnosed with a 2.6-cm enhancing mass in a pelvic left kidney with 2 separate sources of blood supply. He was offered either an open radical nephrectomy or a laparoscopic radical nephrectomy and opted for the minimally invasive approach.

Results: The procedure was performed successfully without complications and with minimal blood loss. The case was marked both by difficulty in mobilizing the sigmoid colon and the limited working space of the pelvis, which made localization of the numerous hilar vessels challenging.

Conclusions: Laparoscopic radical nephrectomy for a pelvic ectopic kidney appears to be safe and efficacious. Success is dependent on familiarity with pelvic anatomy, optimal port placement, and preprocedure knowledge of the often-complicated vascular anatomy of the ectopic kidney. Preoperative imaging to delineate anomalous vascular anatomy is mandatory, and ureteral catheter placement is helpful for intraoperative identification purposes.

Key Words: Laparoscopy, Radical nephrectomy, Renal cell carcinoma, Ectopic kidney, Pelvic kidney.

INTRODUCTION

A pelvic kidney is caused by complete failure of ascent of the metanephros between weeks 6 and 9 of gestation, with an estimated incidence of 1 in 2100 to 1 in 3000.[1,2] The incidence of renal cell carcinoma in this entity is not known, but overall, it is undoubtedly infrequently encountered. Despite the proliferation of minimally invasive techniques, laparoscopic radical nephrectomy of a pelvic kidney for renal cell carcinoma is a procedure with little precedent. Herein, we present the report of a successful laparoscopic radical pelvic nephrectomy for renal cell carcinoma. The performance of this procedure presents challenges unique to this entity, including a limited working space; proximity of various vital structures, including the great vessels; anomalous hilar structures; and difficulty encountered with optimal port placement. This procedure offers the advantages of the minimally invasive approach, with associated decreased convalescence and morbidity.

MATERIALS AND METHODS

The patient is a 64-year-old male with a history of end-stage renal disease, secondary to hypertension and diabetes mellitus, who is hemodialysis dependent. During workup for renal transplantation, a computed tomography (CT) scan revealed an ectopic pelvic left kidney with a 2.6-cm enhancing mass located in the anterior portion of the mid to lower pole **(Figure 1)**. The ectopic kidney measured 9.5 cm by 5.5 cm. The CT also revealed 2 separate sources of blood supply to the kidney. The first originated from the contralateral common iliac artery and vein and entered the kidney into the medial aspect. The second originated directly from the aorta and vena cava and entered the kidney from the anterolateral direction **(Figure 2)**. Incidentally, the renal vein entering the vena cava was retroaortically located. The patient was offered laparoscopic radical pelvic nephrectomy and open pelvic radical nephrectomy and opted for the laparoscopic approach.

A ureteral catheter was placed for intraoperative identification purposes, and the patient was positioned in a modified flank position, with his back at a 45-degree angle to the horizontal. The Veress needle was used to initially

Department of Urology, Stanford University School of Medicine, Stanford, California, USA (all authors).

Address correspondence to: Benjamin I. Chung, MD, Assistant Professor, Department of Urology, Stanford University School of Medicine, 300 Pasteur Dr, Room S-287, Stanford, CA 94305, USA. Telephone: (650) 725-5546, Fax: (650) 723-4200, E-mail: bichung@stanford.edu

DOI: 10.4293/108680810X12674612765623

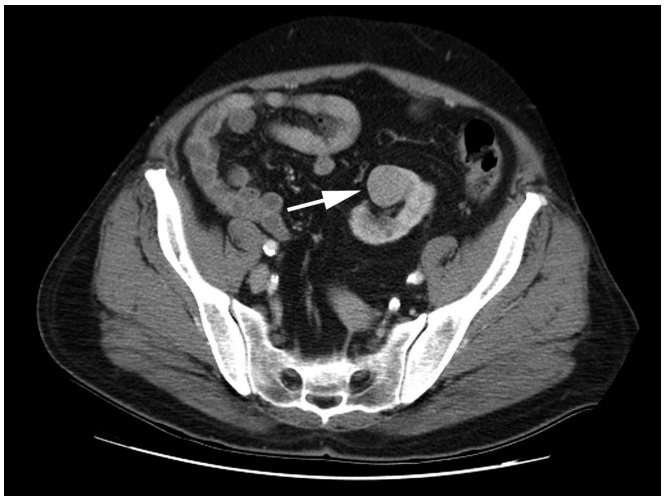

Figure 1. 2.6 cm mid to lower pole location of enhancing renal tumor (arrow).

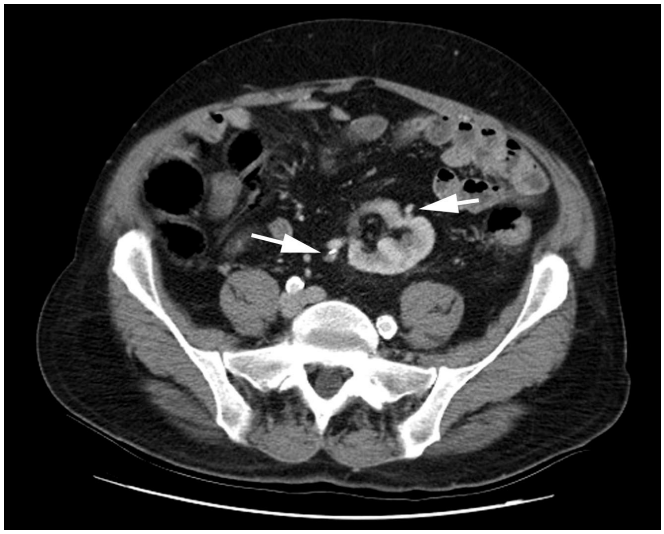

Figure 2. Separate hilar structures demonstrated with arrows.

insufflate the peritoneal cavity. The camera port was placed just to the left of the umbilicus. The left hand 12-mm port was placed along the lateral border of the rectus abdominis muscle lateral to the umbilicus. The right hand port was placed on the lateral border of the rectus near the dome of the bladder. A fourth port was placed laterally to retract the sigmoid colon medially **(Figure 3)**, because it was draped directly over the kidney and difficult to mobilize **(Figure 4)**.

The sigmoid colon was encountered first. It was mobilized medially by reflecting the bowel along the avascular line of Toldt. After the sigmoid was mobilized, some dense

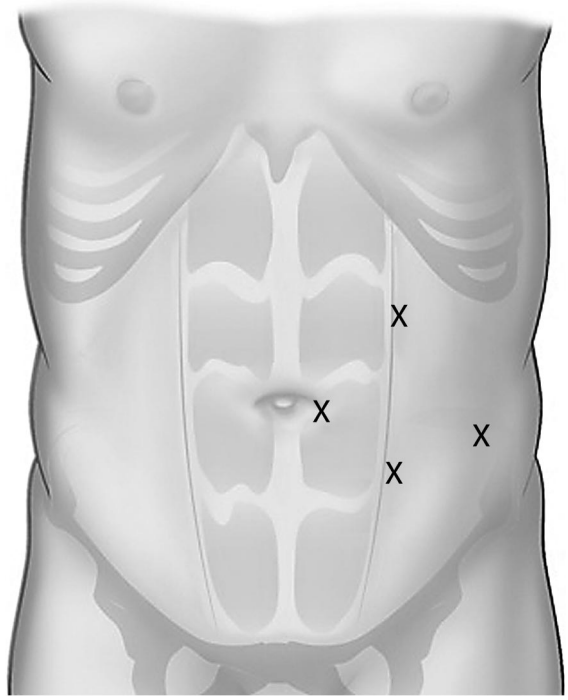

Figure 3. Location of port sites for left sided pelvic nephrectomy.

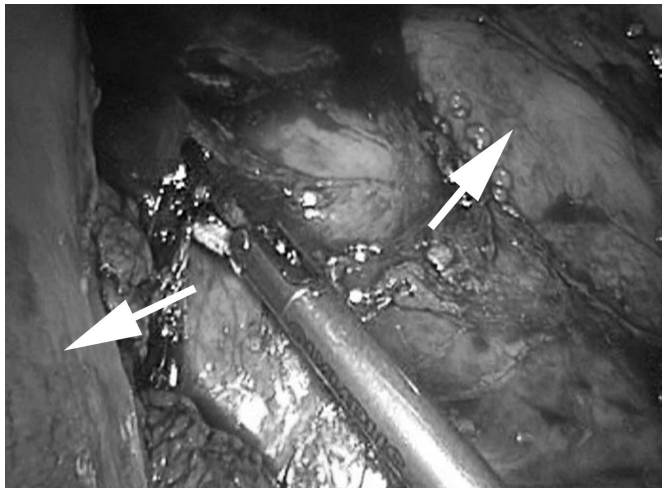

Figure 4. Sigmoid colon (left arrow) and anterior surface of kidney (right arrow) during medial mobilization of sigmoid colon.

adhesions were noted at the level of the internal ring. These were taken down with sharp and blunt dissection. Due to the relatively large size of the kidney and the overlying sigmoid colon, it was somewhat difficult to perform the medial dissection. A fourth port was placed laterally to retract the kidney medially. Dissection was

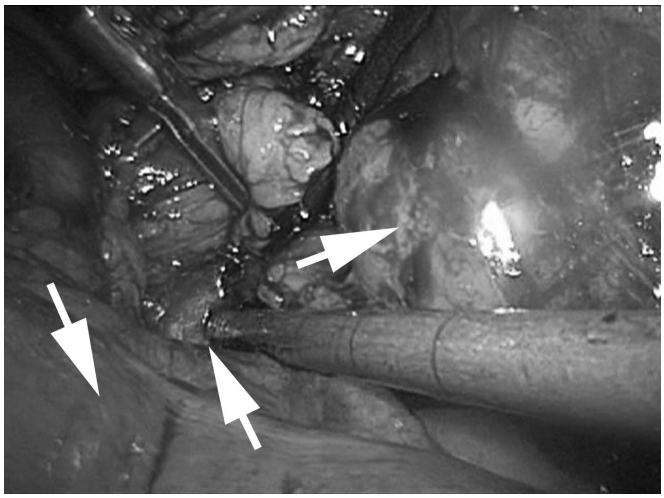

Figure 5. Difficulty encountered visualizing first set of hilar vessels (middle arrow), due to sigmoid colon (left arrow). Renal tumor visualized (right arrow).

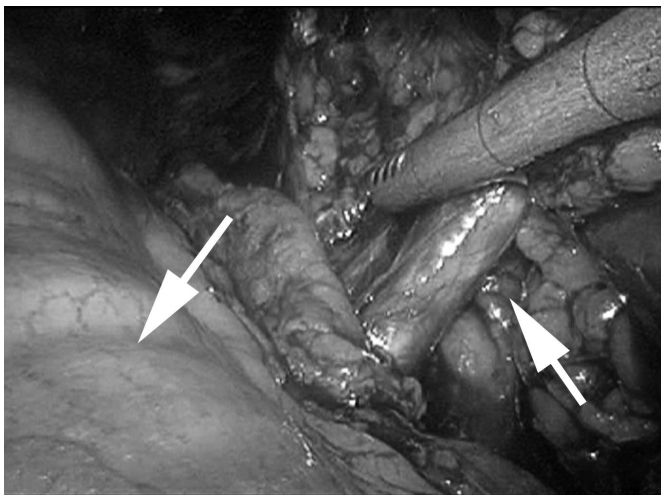

Figure 6. Second set of hilar vessels visualized (right arrow) with sigmoid colon in proximity (left arrow).

then carried posterior to the kidney, between it and the psoas muscle in a cephalad direction, but the medially located hilum could not be identified from this direction. Therefore, dissection was carried in a caudal direction starting at the upper pole, which then uncovered these hilar vessels that were draped over the ipsilateral common iliac artery **(Figure 5)**. The vessels were individually divided with the endovascular stapler. At the level of the upper pole, the second set of hilar vessels were identified and individually divided with the endovascular stapler **(Figure 6)**. The ureter was ligated after the removal of the ureteral catheter. The specimen was entrapped in a bag. Because of the possibility of a future renal transplant, the specimen was removed via a small, lower midline incision instead of a Gibson incision.

RESULTS

Estimated blood loss was 50cc. Total operative time was 210 minutes. No intraoperative or postoperative complications occurred. Pathology revealed a Fuhrman Grade 3 conventional clear cell renal cell carcinoma, 2.5cm in its largest dimension, with negative surgical margins. At 2-year follow-up, the patient is disease free and awaiting renal transplantation.

DISCUSSION

Advancements in laparoscopic procedures in urologic surgery continue to expand the boundaries of what is performed in a minimally invasive fashion. Although urologists who perform minimally invasive techniques are typically familiar with laparoscopic procedures in the pelvis, such as radical prostatectomy or pelvic lymph node dissection, the performance of a laparoscopic pelvic nephrectomy has certain inherent difficulties. The first is the limited amount of space in the pelvis, which becomes most apparent when an attempt is made to locate and dissect the hilar vasculature. On the left side, the limited mobility of the sigmoid colon can further limit visualization of medially located renal hilar vessels. In addition, the pelvic kidney is often located quite medially, causing difficulties in port placement. Anomalous kidneys such as these may have anomalous vascular anatomy creating additional challenges.[3]

The key to success is to perform the steps in an analogous fashion to laparoscopic nephrectomy of a traditional orthotopically placed kidney. The key step is to develop the plane posterior to the kidney from the level of the lower pole and trace gradually cephalad to the hilar vessels. In our case, when the sigmoid colon limited the exposure of the medial surface of the kidney, this issue was circumvented by then moving to the upper pole and gradually dissecting caudally.

The issue of port placement is especially germane to this particular procedure. An important first step is to gain access to the peritoneal cavity via a periumbilical port. After this is accomplished, the remaining ports can be placed under direct vision as best suits the level and anatomic position of the kidney. Placing the initial port at the umbilicus ensures that the camera position stays as medial as possible, because the pelvic kidney hilum is

medially located. The left hand port is placed along the lateral border of the rectus abdominis muscle, lateral to the umbilicus. The right hand port is placed in the same line as the left hand port and as close to the dome of the bladder as possible. A fourth port can be placed close to the anterior superior iliac spine **(Figure 3)**.

The anomalous vascular anatomy of the ectopic kidney often requires extensive dissection. For this reason, one must be wary of the possibility of unintentional ligation of vital pelvic vessels if definitive identification is not completed. We place a ureteral catheter to facilitate intraoperative identification of the ureter and delineate it from other vascular structures within the pelvis. Preoperative cross-sectional imaging (CT or MRI) to fully elucidate the anomalous vascular anatomy is also mandatory.[4] Terrone and colleagues[4] described a case of renal cell carcinoma in an ectopic presacral kidney, removed by an open radical nephrectomy. Their operative success was dependent on a thorough preoperative magnetic resonance angiogram, which delineated the anomalous vasculature. Preprocedure knowledge of the hilar location and originating vessels results in a successful procedure, whether performed laparoscopically or open.

The type of incision made for specimen removal is up to the surgeon's discretion. A Gibson incision or lower midline incision can both be utilized. In our case, we utilized a lower midline incision in the event that the left pelvic fossa would need to be used for a possible future renal transplantation.

CONCLUSION

The performance of laparoscopic radical nephrectomy for a pelvic ectopic kidney appears to be safe and efficacious. Success with this procedure is dependent on familiarity with pelvic anatomy, optimal port placement, and preprocedure knowledge of the often-complicated vascular anatomy of the ectopic kidney. Port placement should be initiated at the level of the umbilicus, and the ports should be placed in a fashion to best triangulate the ectopic kidney. Ureteral catheterization is also recommended as a helpful aid to better delineate the anatomy in a situation rife with anomalous structures.

References:

1. Bauer SB. Anomalies of the upper urinary tract. In Walsh PC, Retik AB, Vaughn ED JR, et al (eds). *Campbell's Urology*. 8th ed. Philadelphia: WB Saunders; 2002;1885–1895.

2. Park JM. Normal development of the urogenital system. In Walsh PC, Retik AB, Vaughn ED Jr., et al (eds). *Campbell's Urology*. 8th ed. Philadelphia: WB Saunders; 2002;1742–1743.

3. Sriprasad S, Poulsen J, Muir G, Kane P, Coptcoat MJ. Laparoscopic removal of multicystic dysplastic kidney. *J Endourol*. 2001;15(8):805–807.

4. Terrone C, Destefanis P, Fiori C, Savio D, Fontana D. Renal cell cancer in presacral ectopic kidney: preoperative diagnostic imaging compared to surgical findings. *Urol Int*. 2004;72:174–175.