Laparoscopic pelvic nephrectomy: essential preoperative and intraoperative considerations

Kelly A. Healy, MD,[1] Andrew Margules, MD,[2] Chandan Kundavaram, MD,[1] Scott G. Hubosky, MD,[1] Costas D. Lallas, MD[1]

[1]Department of Urology, Thomas Jefferson University, Philadelphia, Pennsylvania, USA
[2]Jefferson Medical College, Philadelphia, Pennsylvania, USA

HEALY KA, MARGULES A, KUNDAVARAM C, HUBOSKY SG, LALLAS CD. Laparoscopic pelvic nephrectomy: essential preoperative and intraoperative considerations. The Canadian Journal of Urology. 2012;19(3):6299-6302.

Pelvic kidneys are typically asymptomatic, but surgical intervention may be required in select cases. Laparoscopic pelvic nephrectomy is a feasible option. Given the highly variable vascular anatomy, careful surgical planning and meticulous technique are necessary. We present our experience with this minimally invasive approach. A 46-year-old male with a painful, non-functioning left pelvic kidney initially underwent left ureteral stent placement. He was noncompliant and lost to follow up. He re-presented and elected for laparoscopic pelvic nephrectomy. The procedure was performed without complications. Key features included detailed preoperative vascular imaging, ureteral catheterization, optimal port placement, and dissection from a cephalad to caudal direction. Laparoscopic nephrectomy is a safe and efficacious treatment for diseased pelvic kidneys.

Key Words: pelvic kidney, laparoscopic, nephrectomy

Introduction

During weeks 6-9 of normal fetal development, the kidneys ascend from their origin in the pelvis to their final location in the lumbar retroperitoneum. Failure of normal ascent results in an ectopic kidney at any point along this path. Those that fail to migrate beyond the sacrum and the aortic bifurcation are called pelvic kidneys, which occur in an estimated 1:2100 to 1:3000 births.[1] Similar to other forms of renal ectopia, there is a left-sided predominance and no sex predilection. While most pelvic kidneys remain asymptomatic and are discovered incidentally, 56% will have a hydronephrotic collecting system resulting from obstruction or reflux.[2] Surgical intervention may be indicated for recurrent infection, symptomatic obstruction, chronic pain, polycystic kidney disease, or neoplasm. The first laparoscopic pelvic nephrectomy was described in 2001,[3] with several additional reports since then.[4-7] Herein, we present a laparoscopic nephrectomy performed for a painful, non-functioning pelvic kidney and highlight key preoperative and intraoperative considerations.

Accepted for publication March 2012

Address correspondence to Dr. Kelly A. Healy, Department of Urology, Thomas Jefferson University, 1025 Walnut Street, Room 1112 Curtis Building, Philadelphia, PA 19107 USA

Case report

The patient is a 46-year-old gentleman who initially presented 3 years prior with chronic left lower quadrant pain. Computed tomography (CT) of the abdomen and pelvis revealed a left pelvic kidney with severe hydronephrosis and diffuse cortical thinning, Figure 1. Mag-3 renal scan confirmed this to be non-functional. Based on these findings, the recommendation was made for simple nephrectomy, but the patient declined definitive treatment. Instead, his symptoms were originally managed with an indwelling double pigtail ureteral stent. However, he was noncompliant and lost to follow up. He returned approximately 2 years later in significant pain with an encrusted, retained stent. Again, he elected for conservative management and underwent stent exchange. After careful discussion regarding treatment options, he chose to undergo a laparoscopic nephrectomy.

Preoperative computed tomography angiogram (CTA) was obtained in order to evaluate aberrant vasculature and visceral anatomy. This demonstrated two arterial branches supplying the left pelvic kidney, originating from the aorta just above the bifurcation and below the inferior mesenteric artery. The medial branch coursed posteriorly and supplied the majority of the kidney, while the lateral branch coursed anteriorly to supply the lower pole. Additionally, CTA showed a tortuous left ureter, Figure 2, and a retroaortic left renal vein.

The patient was placed in a 45° modified left flank position. First, flexible cystoscopy was performed and the indwelling stent was removed. Then, a 6-Fr open-ended ureteral catheter was inserted and secured to a Foley catheter.

Figure 1. CT scan of the abdomen and pelvis with severe hydronephrosis and cortical thinning. An arrow marks the ureteral stent within the renal pelvis.

Figure 2. CT angiogram. **a)** White arrow identifies anomalous artery to the left pelvic kidney arising from the abdominal aorta, just proximal to the bifurcation. **b)** The ureteral stent follows a tortuous course.

Abdominal access was obtained using a Veress needle. After insufflation, a 12 mm camera port was inserted under direct vision. Two additional 12 mm working ports were then placed, Figure 3. Next, the white line of Toldt was taken down and the descending colon was mobilized medially until the lateral aspect of the pelvic kidney was identified. At this point, a 5 mm assistant port was inserted to help retract the colon medially and better expose the medial surface of the pelvic kidney, Figure 3. The upper pole was identified and dissection proceeded down to the anterior surface of the aorta. The aberrant renal vasculature was then isolated and successively ligated, including two renal arteries and multiple small renal veins. Following this, dissection continued inferiorly toward the redundant renal pelvis. With the assistance of the open-ended catheter, the ureter was then identified and divided. Finally, the kidney was placed in a laparoscopic entrapment sac, morcellated, and removed.

Estimated blood loss was 100 cc. The patient's postoperative course was uneventful and he was discharged home on postoperative day 3. His creatinine remained stable at his baseline of 0.9. At last follow up, he was recovering well and no longer requiring narcotics.

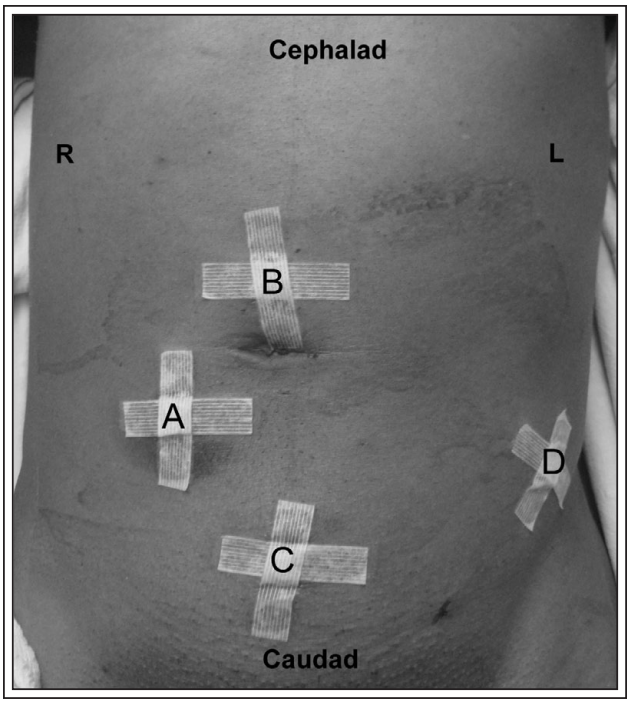

Figure 3. Laparoscopic port placement, including three 12 mm ports **(a-c)** and one 5 mm port **(d)**. Note the camera port **a)** slightly across the midline on the contralateral side. **b,c)** Two working ports oriented at the midline. **d)** One assistant port on the ipsilateral side allows for medial retraction of the colon.

Discussion

While laparoscopic pelvic nephrectomy may be performed safely and effectively, surgeons must be keenly aware of the unique challenges presented by aberrant vascular and visceral anatomy. Hence, thorough preoperative evaluation and meticulous technique are of paramount importance. The authors would like to highlight four critical elements of a properly performed laparoscopic pelvic nephrectomy: preoperative CTA or magnetic resonance angiogram (MRA), open-ended ureteral catheterization, appropriate port placement, and renal dissection proceeding from a cephalad to caudal orientation.

First and foremost, detailed preoperative vascular imaging with CTA or MRA is crucial in order to elucidate the renal vasculature, which is always anomalous. One or two main renal arteries may arise off the aorta or the aortic bifurcation (as in our case), with or without aberrant branches arising from the common or external iliac, or even the inferior mesenteric artery. In fact, the kidney may be supplied entirely by aberrant vasculature, without any branches arising from the aorta.[1] In such cases, extensive dissection may be required to delineate renal vessels from other pelvic vasculature. Visualization may be limited by restricted working space within the pelvis, which may be particularly problematic on the left side due to potential interference by the sigmoid colon.[3]

Secondly, our dissection was aided by the initial placement of an open-ended ureteral catheter. This helped delineate the circuitous course of the ureter within the patient's pelvis. Additionally, it facilitates identification of the renal pelvis, which is commonly oriented abnormally.

Thirdly, special consideration must be given to port placement for removal of a pelvic kidney. Typically, laparoscopic nephrectomy ports do not cross the midline as non-ectopic kidneys have migrated to a lateral position in the lumbar flank. Previous reports of pelvic nephrectomy have held to this convention, moving ports medially only as far as the umbilicus.[3-7] Pelvic kidneys, in contrast, are essentially midline structures with the renal hilum at their most medial aspect. For this reason, ideal visualization may be achieved by placing the camera port a few centimeters off the midline on the contralateral side of the abdomen, just below or at the level of the umbilicus. This provides good perspective of the complicated pelvic anatomy and also excellent visualization of the renal hilum. Moving the camera laterally has the added benefit of allowing the two working ports to be placed at the midline, directly over the hilum. Furthermore, it may be helpful to add a fourth laparoscopic port on the ipsilateral side and lateral to the pelvic kidney. This 5 mm assistant port may be used for medial traction of the colon and better exposure of the kidney.

Finally, we found it beneficial to initiate dissection at the upper pole and to proceed caudally in order to ligate the hilar vessels up front; in contrast, during the traditional laparoscopic nephrectomy dissection begins at the lower pole and moves cephalad. In doing so, the surgeon may more safely secure the hilum and thereby prevent any potential vascular complications.

Laparoscopic nephrectomy may be a safe and definitive procedure for many problems associated with ectopic pelvic kidneys. Special efforts must be taken, however, to assure ideal management of complex and highly variable anatomy. Preoperatively, this requires detailed vascular imaging via CT or MR angiography. Furthermore, open-ended ureteral catheterization may later prove invaluable while attempting to navigate through the network of unfamiliar structures. Intraoperatively, the goal is to achieve good visualization within the crowded pelvis. Proper port placement is essential. Given the medial location of a pelvic kidney, placement of the camera

port on the contralateral side across the midline is an excellent option. Lastly, carrying the dissection from a cephalad to caudal direction allows one to ligate the aberrant vasculature at the beginning of the case and thus taking this out of concern. Taken together, these measures make laparoscopic pelvic nephrectomy a safe and efficacious minimally invasive treatment for diseased pelvic kidneys. □

References

1. Bauer, SB. Anomalies of the upper urinary tract. Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA (eds). Campbell's Urology. 9th ed. Philadelphia: Saunders Elsevier; 2007;3278-3281.
2. Gleason PE, Kelalis PP, Husmann DA et al. Hydronephrosis in renal ectopia: Incidence, etiology & significance. *J Urol* 1994;151(6): 1660-1661.
3. Sriprasad S, Poulsen J, Muir G et al. Laparoscopic removal of a multicystic dysplastic pelvic kidney. *J Endourol* 2001;15(8):805-807.
4. Milhoua PM, Knoll A, Koi PT et al. Laporoscopic nephrectomy for a nonfunctioning pelvic kidney in preparation for renal transplantation. *JSLS* 2006;10(4):538-540.
5. Chung BI, Liao JC. Laparoscopic radical nephrectomy in a pelvic ectopic kidney: Keys to success. *JSLS* 2010;14(1):126-129.
6. Brown CT, Kooiman G, Sharma D et al. Scarless single-port laparoscopic pelvic kidney nephrectomy. *J Laparoendosc Adv Tech* 2010;20(9):743-746.
7. Nishio H, Kojima Y, Mizuno K et al. Laparoscopic nephrectomy for pelvic multicystic dysplastic kidney. *Urology* 2011;78(2):434-436.