Case Report

Journal of INTERNATIONAL MEDICAL RESEARCH

Journal of International Medical Research
2019, Vol. 47(9) 4544–4550

DOI: 10.1177/0300060519865845
journals.sagepub.com/home/imr
SAGE

Minimally invasive treatment of an ectopic kidney stone: a case report and literature review

Chenglu Wang*, Lu Jin*, Xinyang Zhao, Guobin Li and Boxin Xue

Abstract

An ectopic pelvic kidney is a rare congenital anomaly with a high incidence of complications such as reflux, hydronephrosis, nephrolithiasis, and even renal failure. We herein report a case of transperitoneal laparoscopic pyelolithotomy for treatment of a left pelvic kidney stone and discuss various surgical procedures based on the published literature. A 64-year-old woman presented to our hospital with generalized weakness and occasional nonspecific waist pain in October 2017. Computed tomography showed a 2.6-cm renal pelvis stone located in the left ectopic pelvic kidney with severe hydronephrosis. The patient underwent transperitoneal laparoscopic pyelolithotomy and was discharged 7 days after surgery. Various treatment procedures are available for ectopic kidney stones. Proper preoperative assessment and selection of the most suitable surgical procedure play critical roles in successful treatment.

Keywords

Pelvic kidney, surgery, anatomic variation, renal ectopy, kidney stone, pyelolithotomy

Date received: 22 March 2019; accepted: 4 July 2019

Introduction

The metanephric kidney originates from the sacral region and subsequently becomes positioned more cranially during development. A kidney that fails to ascend from the pelvis to the renal fossa is considered an ectopic pelvic kidney. The actual

Department of Urology, The Second Affiliated Hospital of Soochow University, Suzhou, Jiangsu, P.R. China

*These authors contributed equally to this work.

Corresponding author:
Boxin Xue, Department of Urology, The Second Affiliated Hospital of Soochow University, No. 1055 Sanxiang Road, Suzhou, Jiangsu 215000, P.R. China.
Email: xbxurol@163.com

incidence of renal ectopia in an autopsy series was estimated at 1 in 900 without dramatic sex-related differences.[1] Furthermore, the occurrence rate of a pelvic kidney was reported at 1 in 2200 to 3000.[2] Because of the abnormal anatomy and aberrant rotation of an ectopic pelvic kidney, affected patients often have concurrent structural and architectural anomalies. Conditions such as reflux, hydronephrosis, nephrolithiasis, and even renal failure are more common in patients with than without a pelvic kidney. Nephrolithiasis is one of the most common causes of obstruction of the ureteropelvic junction in patients with an ectopic pelvic kidney. Various treatment methods for such stones include extracorporeal shock wave lithotripsy (ESWL), flexible ureteroscopy, laparoscopic-assisted percutaneous nephrolithotomy (PNL), and laparoscopic pyelolithotomy. The combination of laparoscopy and flexible ureteroscopy in the performance of pyeloplasty as well as robot-assisted laparoscopic pyeloplasty were recently reported as novel treatment modalities for these patients.[3,4] We herein describe a patient with an ectopic kidney stone and generalized weakness who was initially misdiagnosed with a neurological disease and discuss the case with reference to previously published literature.

Case report

This study was approved by the local Ethics Committee of The Second Affiliated Hospital of Soochow University, and the patient provided informed consent. A 64-year-old woman initially presented to our neurology clinic for evaluation of generalized weakness and occasional nonspecific waist pain in October 2017. Her medical history was unremarkable with the exception of chronic hypertension. Physical examination showed no abdominal abnormalities. The patient's baseline hematologic and biochemical parameters were normal. Laboratory tests revealed bacteriuria by urine culture. Computed tomography without contrast material showed an ectopic kidney located in the left iliac fossa accompanied by severe hydronephrosis and a renal pelvic stone (Figure 1). The neurologists accordingly referred the patient to the urologic surgery clinic. A retrograde pyelogram demonstrated a markedly dilated renal pelvis, severe hydronephrosis, and massively tortuous ureter accompanied by an ectopic pelvic kidney. The patient underwent transperitoneal laparoscopic pyelolithotomy after treatment of her urinary tract infection. She was placed in the supine position with lateral elevation on the left side. Pneumoperitoneum was established by a Veress needle. A 10-mm visualizing laparoscopic trocar was placed at the level of the umbilicus. Two 5-mm ports were inserted in the right and left midline, half a handbreadth below the umbilicus. One additional 12-mm port was placed in the right iliac fossa. Pyelotomy was performed, and the stone was then extracted by laparoscopic forceps. It was placed in a piece of a surgical glove for removal from the peritoneal cavity. We placed a double J stent in the left ureter via the renal pelvic incision and then closed the pyelotomy margins with 3-0 polyglactin. A 20-Fr silicone rubber catheter was placed in the operative region for postoperative drainage. The drainage tube was removed on postoperative day 3. The patient stayed in the hospital for 1 week without any complications. At her follow-up visits, an intravenous pyelogram showed stone clearance without hydronephrosis (Figure 2). The double J stent was removed 4 weeks after discharge.

Discussion

An ectopic kidney can be found in the pelvis, ilium, thorax, or abdomen; additionally, it can be contralateral or crossed fused.

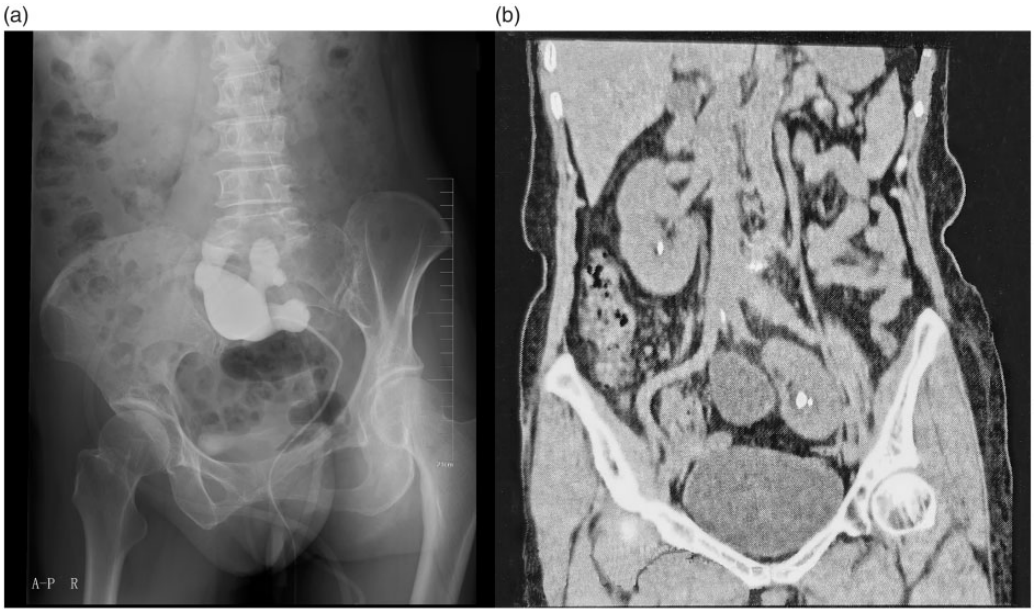

Figure 1. Preoperative retrograde pyelograms. A markedly tortuous ureter and hydronephrosis of the pelvic kidney are evident.

Maldevelopment of the ureteral bud and Wolffian duct in a developing fetus are thought to be the embryologic causes of an ectopic pelvic kidney.[5]

Because of the aberrant location, orientation, and shape of an ectopic pelvic kidney, conditions such as hydronephrosis and nephrolithiasis are more common in these patients. Therefore, treatment of pelvic kidney stones remains challenging for the urologist because of the structural and architectural anomalies of such kidneys. ESWL in the prone position was first recognized as a noninvasive method for treatment of patients with pelvic kidney stones in 1988.[6] Several studies have indicated that ESWL can be recommended as a first-line treatment option for anomalous kidney stones because of the high rates of stone clearance.[7,8] However, Demirkesen et al.[9] reported that ESWL for normal kidneys had a higher stone-free rate than that for aberrant kidneys (78% vs. 56%, respectively) and that aberrant kidneys had a higher rate of clinically insignificant residual fragments than did normal kidneys (37% vs. 18.5%, respectively). Consequently, ESWL was been viewed as the first-choice noninvasive treatment modality with a relatively poor success rate for pelvic kidney stones. Flexible ureteroscopy has emerged as an alternative treatment method for small- to medium-sized renal calculi because of its advantages of flexion and deflection. Several studies have shown that the success rates of flexible ureteroscopy in patients with pelvic kidneys range from 75.0% to 84.7%.[9–11] Nonetheless, anatomic alterations including a tortuous ureter and malrotated kidney have been suggested as significant factors that increase the difficulty of the procedure and influence the stone clearance rate in treatment by flexible ureteroscopy. The first laparoscopic pyelolithotomy was reported by Chang and Dretler in 1996.[12] They described peritoneal urine leakage after the catheter was

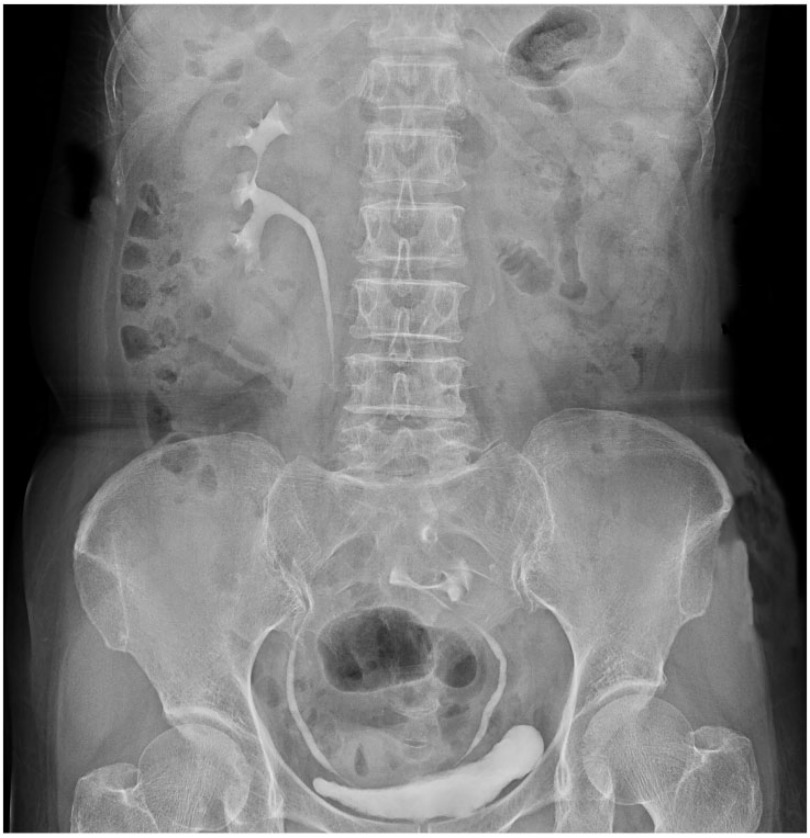

Figure 2. Postoperative intravenous pyelogram.

removed. Also in 1996, Harmon et al.[13] performed laparoscopic pyelolithotomy in a patient without closing the pyelotomy site. Because the patient experienced prolonged postoperative urine leakage, the indwelling stent and urethral catheter were not removed until postoperative day 6. In recent years, as experience has increased and technology has improved in the field of laparoscopic surgery, laparoscopic pyelolithotomy has been found to be an effective procedure with low morbidity in the treatment of pelvic kidney stones.[14] Transperitoneal, retroperitoneal, and transmesenteric access are the three most feasible approaches for laparoscopic pyelolithotomy, and each has its own advantages. The transperitoneal route has the advantage of clear exposure of the related structures as well as abnormal vessels. The retroperitoneal laparoscopic approach can be achieved without peritoneal contamination by urine. The transmesenteric route provides faster access to visibility of the pelvic kidney surface. Yin et al.[4] reported that the combination of laparoscopy and flexible ureteroscopy in the performance of pyeloplasty can be an alternative treatment procedure for patients with inaccessible caliceal stones. They treated 16 patients with a 100% stone-free rate, and no stone recurrence was found in follow-up visits.[4] The overall results of laparoscopic pyelolithotomy for treatment of patients with pelvic

kidney stones are satisfactory.[15] Therefore, laparoscopic pyelolithotomy is considered a good option for treatment of a single pelvic kidney stone, especially a renal pelvic stone.[16] PNL is a first-line treatment option for removal of large kidney stones. Although some authors have suggested the use of ultrasound or computed tomography guidance to achieve percutaneous access in patients with pelvic kidney stones, there is still a high risk of injuring the surrounding viscera and major vessels.[17] Laparoscopic-assisted PNL for a pelvic ectopic kidney was first introduced by Eshghi et al.[18] in 1985. In 1998, Holman and Toth[19] successfully performed transperitoneal laparoscopic-assisted PNL in 15 patients with pelvic kidney stones. They mobilized the surrounding bowel loops and dissected the bowel off to ensure that the kidney was visible under laparoscopic vision in the Trendelenburg position. Zafar and Lingeman[2] described two patients with ectopic kidneys who underwent laparoscopic-assisted PNL in 1996. They performed laparoscopic suturing on the nephrotomy site after the nephrolithotomy procedure to avoid placement of a transperitoneal nephrostomy tube. Troxel et al.[20] reported an improved laparoscopic technique including an extraperitoneal approach to the pelvic kidney and extraperitoneal placement of a drainage tube to limit the minimal postoperative drainage. In 2007, El-Kappany et al.[21] successfully treated five patients using laparoscopic-assisted PNL with no intraoperative or postoperative complications. Besides laparoscopic-assisted PNL, several unusual approaches including the suprailiac approach, trans-sciatic approach under fluoroscopic guidance, and transhepatic approach during PNL access have been described to reduce the risk of injuring the overlying bowel and aberrant vascular structures. Although the recurrence rate of stones after laparoscopic-assisted PNL is reportedly higher than that after laparoscopic pyelolithotomy, and although patients may need follow-up treatment after surgery, laparoscopic-assisted PNL is still an irreplaceable treatment option for patients with an ectopic pelvic kidney with caliceal calculi.[15] Robot-assisted techniques have gradually become a critical part of minimally invasive surgery. The use of such techniques can help to overcome the technical challenges associated with the laparoscopic technique. Patients who undergo robot-assisted surgery generally have better outcomes than those who undergo an open approach or pure laparoscopic approach. The first robot-assisted laparoscopic pyeloplasty for treatment of an ectopic pelvic kidney was reported by Nayyar et al.[3] In their study, the duration of surgery was 56 minutes and the patient was discharged from the hospital on the third day with no short-term postoperative complications.[3] However, there is still a need for long-term follow-up to compare the clinical outcomes between robot-assisted laparoscopic pyeloplasty and the pure laparoscopic approach or laparoscopic-assisted PNL.

Conclusion

In the present case, severe hydronephrosis and a markedly tortuous ureter accompanied a renal pelvic stone in a patient with clinically silent pelvic renal ectopia. Several treatment modalities are available for patients with ectopic kidney stones, including ESWL, flexible ureteroscopy, laparoscopic-assisted PNL, laparoscopic pyelolithotomy, and robot-assisted laparoscopic pyeloplasty. Because of our patient's large renal pelvic stone, we performed laparoscopic transperitoneal pyelolithotomy. ESWL is a better treatment method for an ectopic kidney with pelvic a stone smaller than 1.5 cm or for a patient who declines invasive surgery. For patients with an ectopic pelvic kidney containing caliceal

calculi, laparoscopic-assisted PNL may be a safe and effective treatment. Our case and the published literature indicate that proper preoperative assessment and selection of the most suitable surgical procedure play critical roles in the treatment of patients with ectopic pelvic kidney stones.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Funding

This work was supported by the Soochow Key Medical Subject: Urology (No. Szxk201505).

ORCID iD

Boxin Xue https://orcid.org/0000-0001-6197-6849

References

1. Stein RJ and Desai MM. Management of urolithiasis in the congenitally abnormal kidney (horseshoe and ectopic). *Curr Opin Urol* 2007; 17: 125–131. DOI: 10.1097/MOU.0b013e328028fe20.
2. Zafar FS and Lingeman JE. Value of laparoscopy in the management of calculi complicating renal malformations. *J Endourol* 1996; 10: 379–383. DOI: 10.1089/end.1996.10.379.
3. Nayyar R, Singh P and Gupta NP. Robot-assisted laparoscopic pyeloplasty with stone removal in an ectopic pelvic kidney. *JSLS* 2010; 14: 130–132. DOI: 10.4293/108680810X12674612015102.
4. Yin Z, Wei YB, Liang BL, et al. Initial experiences with laparoscopy and flexible ureteroscopy combination pyeloplasty in management of ectopic pelvic kidney with stone and ureter-pelvic junction obstruction. *Urolithiasis* 2015; 43: 255–260. DOI: 10.1007/s00240-015-0753-9.
5. Malek RS, Kelalis PP and Burke EC. Ectopic kidney in children and frequency of association with other malformations. *Mayo Clin Proc* 1971; 46: 461–467.
6. Jenkins AD and Gillenwater JY. Extracorporeal shock wave lithotripsy in the prone position: treatment of stones in the distal ureter or anomalous kidney. *J Urol* 1988; 139: 911–915.
7. Rigatti P, Montorsi F, Guazzoni G, et al. Multimodal therapy for stones in pelvic kidneys. *Urol Int* 1991; 46: 29–34. DOI: 10.1159/000281769.
8. Talic RF. Extracorporeal shock-wave lithotripsy monotherapy in renal pelvic ectopia. *Urology* 1996; 48: 857–861.
9. Demirkesen O, Yaycioglu O, Onal B, et al. Extracorporeal shockwave lithotripsy for stones in abnormal urinary tracts: analysis of results and comparison with normal urinary tracts. *J Endourol* 2001; 15: 681–685. DOI: 10.1089/08927790152596235.
10. Weizer AZ, Springhart WP, Ekeruo WO, et al. Ureteroscopic management of renal calculi in anomalous kidneys. *Urology* 2005; 65: 265–269. DOI: 10.1016/j.urology.2004.09.055.
11. Fayad AS. Retrograde holmium:YAG laser disintegration of stones in pelvic ectopic kidneys: would it minimize the risk of surgery? *J Endourol* 2008; 22: 919–922. DOI: 10.1089/end.2007.0289.
12. Chang TD and Dretler SP. Laparoscopic pyelolithotomy in an ectopic kidney. *J Urol* 1996; 156: 1753.
13. Harmon WJ, Kleer E and Segura JW. Laparoscopic pyelolithotomy for calculus removal in a pelvic kidney. *J Urol* 1996; 155: 2019–2020.
14. Kamat N and Khandelwal P. Laparoscopic pyelolithotomy–a technique for the management of stones in the ectopic pelvic kidney. *Int J Urol* 2004; 11: 581–584. DOI: 10.1111/j.1442-2042.2004.00827.x.
15. Elbahnasy AM, Elbendary MA, Radwan MA, et al. Laparoscopic pyelolithotomy in selected patients with ectopic pelvic kidney: a feasible minimally invasive treatment option. *J Endourol* 2011; 25: 985–989. DOI: 10.1089/end.2010.0521.
16. Gupta N, Mandhani A, Sharma D, et al. Is laparoscopic approach safe for ectopic pelvic kidneys? *Urol Int* 2006; 77: 118–121. DOI: 10.1159/000093903.

17. Desai MR and Jasani A. Percutaneous nephrolithotripsy in ectopic kidneys. *J Endourol* 2000; 14: 289–292. DOI: 10.1089/end.2000.14.289.
18. Eshghi AM, Roth JS and Smith AD. Percutaneous transperitoneal approach to a pelvic kidney for endourological removal of staghorn calculus. *J Urol* 1985; 134: 525–527.
19. Holman E and Toth C. Laparoscopically assisted percutaneous transperitoneal nephrolithotomy in pelvic dystopic kidneys: experience in 15 successful cases. *J Laparoendosc Adv Surg Tech A* 1998; 8: 431–435. DOI: 10.1089/lap.1998.8.431.
20. Troxel SA, Low RK and Das S. Extraperitoneal laparoscopy-assisted percutaneous nephrolithotomy in a left pelvic kidney. *J Endourol* 2002; 16: 655–657. DOI: 10.1089/089277902761402998.
21. El-Kappany HA, El-Nahas AR, Shoma AM, et al. Combination of laparoscopy and nephroscopy for treatment of stones in pelvic ectopic kidneys. *J Endourol* 2007; 21: 1131–1136. DOI: 10.1089/end.2007.9930.