Ultrasound-guided supine mini-percutaneous nephrolithotomy in ectopic pelvic kidney

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ABSTRACT
Management of urolithiasis in an ectopic pelvic kidney is challenging and laparoscopic pyelolithotomy and laparoscopy-guided percutaneous nephrolithotomy (PCNL) are commonly favored options. We report a case of ultrasound-guided supine mini-PCNL in ectopic pelvic kidney in an adolescent female. Complete stone clearance was achieved with an uneventful postoperative period. Ultrasound-guided supine mini-PCNL is safe and effective treatment option for the management of calculus in the ectopic pelvic kidney. The risk of injury to surrounding structures associated with ultrasound modality of access can be avoided with proper case selection and careful technique.

INTRODUCTION
Ectopic pelvic kidney has an estimated incidence varying between 1 in 2200 and 1 in 3000.[1] The management of calculi in an ectopic pelvic kidney is relatively challenging, and the ideal technique is not yet clearly established. Treatment options for calculus in ectopic pelvic kidney include extracorporeal shockwave lithotripsy (ESWL), retrograde intrarenal surgery (RIRS), laparoscopy-assisted percutaneous nephrolithotomy (PCNL), and laparoscopic or open pyelolithotomy.[1]

The ideal methodology to obtain access in the cases of PCNL in the ectopic pelvic kidney is debatable. Apart from the perceived difficulties of malposition and malrotation, it is imperative to obtain a safe access without collateral damage to the surrounding structures. Laparoscopy-guided PCNL has been practiced with this aim, albeit with significant technical issues precluding its widespread use. We report a case of calculus in an ectopic pelvic kidney which was managed by ultrasound-guided supine mini-PCNL. We present our technique and report the outcome.

CASE REPORT
A 15-year-old female presented with complaints of lower abdominal pain of 1 month duration. Computed tomography demonstrated a functioning ectopic right kidney in the region of the abdominal pelvis near midline with a 2.5 cm renal pelvic stone (1100 Hounsfield unit density), and a normally located left kidney [Figure 1].

The procedure was performed under general anesthesia. The patient was placed in the supine position after ureteric catheter insertion. The ectopic right pelvic kidney was palpable in the lower abdomen under anesthesia. On placing the ultrasound probe on the palpable kidney in the supine position, it was confirmed that there were no intervening structures between the abdominal wall and the kidney.
Due to thin body habitus and good muscle relaxation under anesthesia, it was possible to ensure good contact between the undersurface of the abdominal wall and the surface of the kidney.

The upper calyx had the shortest distance from the skin and had good access to the pelvic stone. The pelvicalyceal system was distented by retrograde instillation of saline through the ureteric catheter, and ultrasound-guided puncture was performed with the help of a puncture guide, to the upper calyx. The puncture needle was clearly visualized on ultrasound [Figure 2] and the position was confirmed by fluoroscopy as well. Tract dilatation was performed under fluoroscopic guidance using a single-step 14Fr coaxial screw dilator. Mini-PCNL was performed with the 15Fr access sheath and 12Fr nephroscope. Fragmentation of the stone was achieved using Holmium laser at 30 watts setting (1.5 Joules and 20 Hertz). Complete clearance was confirmed on the table both endoscopically as well as fluoroscopically [Figure 3]. Ureteral stenting was done with a 5Fr double-J (DJ) stent under fluoroscopic guidance. A 12Fr nephrostomy tube was also placed at the end of the procedure. The total operative time was 55 min.

The postoperative period was uneventful. Postoperative X-ray abdomen confirmed stone clearance and stent position. Oral fluids were begun on postoperative day 1. Nephrostomy tube and urethral catheter were removed on the postoperative day 2 and the patient was discharged. The DJ stent removal was performed at 4 weeks after surgery. The patient was symptom-free at 6 months follow-up.

**DISCUSSION**

The high ureteral insertion and malrotation of the ectopic pelvic kidney are said to be predisposing factors for urinary stasis and urolithiasis.\(^2\) The pelvic location of the kidney surrounded by bony structures, the risk of injuring renal vasculature, and surrounding abdominal structures add to the complexity in the management of urolithiasis in such cases.\(^1,2\) Stone-free rates with ESWL in pelvic kidney show inconsistent results in various studies and many of the cases need repeated ESWL sessions or additional treatment.\(^3,4\) RIRS as treatment modality is described but the tortuous ureter with high insertion is highlighted as a concern.\(^1\) There have been reports of using ureteral access sheath to straighten the tortuous ureter for easier access in RIRS.\(^5\)

The principles of PCNL in a normally placed kidney cannot be applied to ectopic pelvic kidneys. The ectopic location covered by bony pelvis, abnormal pelvicalyceal orientation, unpredictable blood supply, and the surrounding loops of the intestine are the additional challenges while performing PCNL in an ectopic pelvic kidney. Laparoscopy-guided access is popular in PCNL for ectopic pelvic kidneys, largely because of concerns regarding possible bowel injury in the anterior approach. Several approaches, including both transperitoneal and extraperitoneal laparoscopy-assisted percutaneous access, have been described with good outcomes.\(^1\)

Ultrasound-guided access for ectopic pelvic kidney has also been found to be safe and effective, as published in a single-center experience of 26 patients from Nadiad, India.\(^2\) Despite the available evidence, ultrasound modality is not commonly used to gain access in pelvic kidneys during PCNL. Ultrasound-guided puncture for routine PCNL is the preferred method of access at our center. Ultrasound
visualization is complimented by a puncture guide to achieve desired access. The needle guide is particularly useful in pediatric age groups, patients with spinal deformities, and renal ectopia.[2] Ultrasound guidance provides the advantage of real-time imaging without the harmful effects of radiation. It allows clear visualization of the kidney immediately underneath the abdominal wall and helps in excluding the presence of interposed bowel between the abdominal wall and kidney, thus eliminating the risk of bowel injury.

Ultrasound also helps in understanding the orientation of the pelvicalyceal system and helps to choose the ideal calyx with the easiest access to the calculi. The other benefit of ultrasound is the feasibility to identify radiolucent calculi.[2] Complete stone clearance with minimal morbidity in our case can be attributed to the accurate puncture achieved by ultrasound guidance and the use of smaller tract.

Ultrasound-guided puncture for PCNL is not a new technique and there is sufficient published literature on the topic.[2] However, ultrasound-guided PCNL in pelvic kidney has not been widely practiced or published. We wish to present our experience to demonstrate that this procedure can be performed in selected cases successfully and safely with adequate training in the ultrasound-guided puncture.

CONCLUSION

Ultrasound-guided mini-PCNL is a safe and effective procedure for calculus in the ectopic pelvic kidney, with minimal morbidity. The fear of injury to surrounding structures associated with ultrasound modality of access can be eliminated with proper case selection and careful technique.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for/her images, surgical videos and other clinical information to be reported in the journal. The patient understands that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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