Original Article

Laparoscopic-assisted mini percutaneous nephrolithotomy in the ectopic pelvic kidney: Outcomes with the laser dusting technique

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Abstract

Introduction: The treatment of renal lithiasis has undergone a sea change with the advent of extracorporeal shock wave lithotripsy (ESWL) and endourological procedures such as percutaneous nephrolithotomy (PCNL), ureterorenoscopy and retrograde intrarenal surgery (RIRS). The presence of anatomical anomalies, such as ectopic pelvic kidney, imposes limitations to such therapeutic procedures. This study is aimed to find a simple and effective way to treat the stones in ectopic kidney.

Materials and Methods: From 2010 to 2014, nine patients underwent laparoscopic-assisted mini PCNL with Laser dusting for calculi in ectopic pelvic kidneys at our hospital. Retrograde pyelography was done to locate the kidney. Laparoscopy was performed and after mobilizing the bowel and peritoneum, the puncture was made in the kidney and using rigid mini nephroscope, and stones were dusted with Laser.

Results: The median interquartile range (IQR) stone size was 18 (6.5) mm. Median (IQR) duration of the procedure was 90 (40) min. The median (IQR) duration of postoperative hospital stay was 4 (2) days. The stone clearance in our series was 88.9%, with only one patient having a residual stone. No intra- or post-operative complications were encountered.

Conclusion: Laparoscopy-assisted mini PCNL with Laser dusting offers advantages in ectopic pelvic kidneys in achieving good stone clearance, especially in patients with a large stone burden or failed ESWL or RIRS.

Key Words: Ectopic pelvic kidney, laparoscopic-assisted percutaneous nephrolithotomy, laser dusting, mini percutaneous nephrolithotomy

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INTRODUCTION

The pelvic kidney is the most common form of renal ectopy. Its incidence is estimated from 1 in 2200 to 1 in 1300.[1] Various factors predispose to the formation of renal calculi in an ectopic kidney like tortuous ureter with high insertion, leading to inadequate evacuation of urine.[2]

Renal lithiasis in the pelvic kidney can be managed by means of open surgery, extracorporeal shock wave lithotripsy (ESWL),

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percutaneous nephrolithotomy (PCNL), laparoscopic or ultrasound guided PCNL, and retrograde intrarenal surgery (RIRS). Open surgery has increased morbidity due to bowel mobilization, larger scar, and increased pain. ESWL in the pelvic kidney has a success rate of only about 54%.[3] PCNL, in a pelvic kidney, has to be conducted in a supine position, posing additional risk to the overlying bowel and blood vessels. Hence, the need for renal puncture and dilatation under vision.[4] Standard PCNL requires a larger tract, which may be unsafe in a kidney with anomalous blood supply.[5] There is also a risk of urinary extravasation in both tube and tubeless PCNL, thus causing ileus and morbidity, as it is a transabdominal procedure.[6]

Mini PCNL offers advantages in reducing the size of the puncture tract, hence reducing morbidity significantly.[7,8]

Hence, this study is aimed to find a simple and effective way to treat the stones in ectopic kidney. Here, we report the surgical management through laparoscopic assisted mini PCNL, using a laser to dust the stones, in nine such cases in our hospital.

MATERIALS AND METHODS

A retrospective study was undertaken by doing database search of our hospital records. A total of nine patients underwent laparoscopic-assisted mini PCNL with Laser dusting for calculi in ectopic pelvic kidneys, at our hospital from 2010 to 2014.

Three patients, who had stone size over 20 mm, opted for primary percutaneous procedure, and three patients each had failed previous ESWL therapy and RIRS. The median interquartile range (IQR) age of the patients was 36 (25) years. The patients median (IQR) weight and body mass index (BMI) were 70 (17) kg and 25 (3) kg/m,^{2} respectively. The median (IQR) stone size was 18 (6.5) mm. These calculi were located in the pelvis (2), upper (2), middle (3), and lower (5) calyx. None of these patients had any concomitant ureteric stones. Six pelvic kidneys were on the right and three on the left [Table 1].

Patient preparation

Preoperative laboratory examination for all patients was essentially within the normal limits. Computed tomography with urogram was performed preoperatively for all the patients to know the location of the kidney and the stones and the functioning status of the kidney [Figure 1]. Patients showing delayed contrast excretion (3) were subjected to diethylene triamine pentaacetic acid renogram to assess the kidney function.

Procedure

After induction of general anesthesia and placing a ureteral catheter by cystoscopy, patients were draped in the supine position.

Retrograde pyelography was done to locate the kidney. Laparoscopy was performed using three 5 mm ports one subumbilical and two lateral ports [Figure 2a]. Abdomen visualized with 5 mm 0° telescope. Intervening peritoneal covering was dissected and bowel mobilized.

The pelvic kidney was exposed [Figure 2b]. The vessels and ureters were identified by direct vision. Under laparoscopic guidance, the renal puncture was made, 0.032 hydrophilic guide wire placed, and the track dilated to 15F. Rigid mini nephroscope (LAHME'S, RICHARD WOLF) was inserted into the kidney [Figure 2c]. The abdomen was desufflated (6 out of 9 patients), a 16F Ryle's tube was placed via one 5mm port to act as a drain; and with normal saline irrigation, the calculi were dusted with Holmium laser (LUMENIS 100 watt) with high frequency (40–50Hz) and low energy (0.6–0.8J) settings using 550 μ laser fiber [Figure 2d]. In three patients who were quiet lean (BMI < 18), abdominal desufflation was not deemed necessary. The direct pelvic puncture was done in three patients due to anteriorly placed extrarenal pelvis, in other six calyceal puncture was made under c-arm vision. Only a single access was made in each case. A 5F double J (DJ) stent was placed antegradely [Figure 2e]. Extravasated fluid in the abdomen was aspirated along with any stone fragments that

Table 1: Patient demographics

Patient number	Age (years)	Sex	BMI kg/m^2	Site of pelvic kidney	Size and position of stone	Procedure previously undergone	Postoperative stay (days)
1	24	Male	22	Right	12 mm in upper calyx	RIRS	4
2	30	Female	25	Left	18 mm in lower calyx 12 mm in upper calyx	-	5
3	46	Male	26	Right	16 mm in renal pelvis	ESWL	3
4	53	Male	23	Left	14 mm in lower calyx	RIRS	3
5	22	Female	21	Right	18 mm in mid calyx	ESWL	6
6	28	Male	25	Right	15 mm in lower calyx 8 mm in mid calyx	-	4
7	36	Female	26	Left	14 mm in mid calyx 10 mm in lower calyx	-	5
8	49	Male	25	Right	16 mm in lower calyx	RIRS	4
9	58	Female	24	Right	19 mm in renal pelvis	ESWL	3

RIRS: Retrograde intrarenal surgery, ESWL: Extracorporeal shock wave lithotripsy, BMI: Body mass index

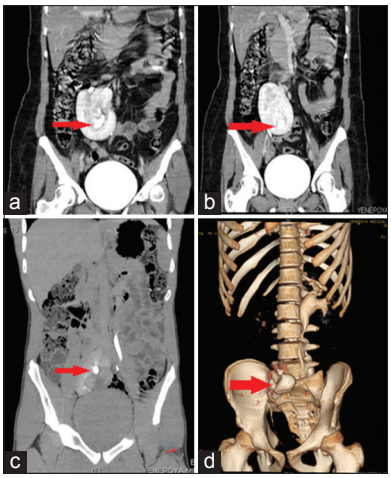

Figure 1: Patients demographics. (a-c) Coronal sections of plain computed tomography of patients showing ectopic kidney with the stones (arrow). (d) Three-dimensional reconstruction of the patient shown in Figure 1c, after contrast injection (excretory phase), showing both functional kidneys

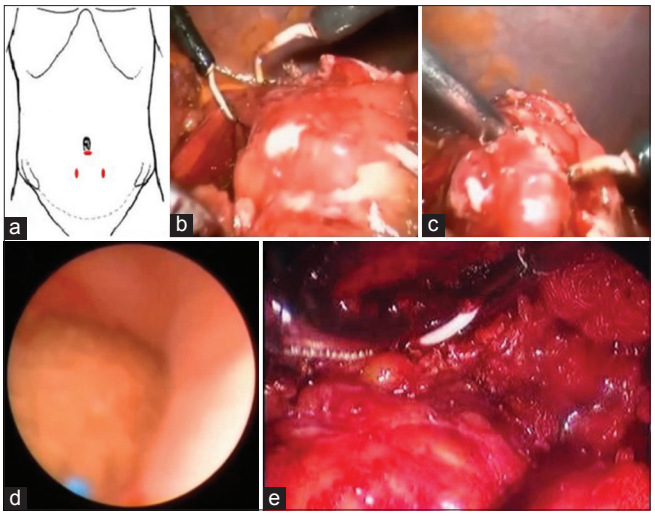

Figure 2: (a) Laparoscopic port placement, (b) ectopic kidney, (c) nephroscope inserted into the ectopic kidney, (d) nephroscopic view of stone being dusted with laser, (e) double-J stent being placed

might have spilled out (where needed, after resuffulation of the abdomen).

Postprocedure

Complete blood count, blood urea nitrogen, and creatinine were repeated the day after surgery. Per urethral catheters were removed 24 h postoperatively, oral feeds started and abdominal drains removed on the 2nd postoperative day. All patients underwent noncontrast computerized tomography of the abdomen after 1-month, prior to cystoscopic DJ-stent removal, to look for the residual stone.

RESULTS

The procedure was tubeless, except in one patient who had a larger stone burden and slightly longer duration of surgery. Postoperation noncontrast computed tomography scan done on postoperation day 2 showed residual calculi in that patient, and the nephrostomy placed was used for re-entry and complete clearance was done by laser dusting using a flexible scope. Median (IQR) duration of the procedure was 90 (40) min. None of the patients had any episode of fever or prolonged pain or ileus. The stone clearance in our series was 88.9%. All other patients had an uneventful postoperation stay. There was no drop in hemoglobin levels in any patients postoperation. DJ-stents were removed after 3–4 weeks. The median (IQR) duration of postoperative hospital stay was 4 (2) days.

DISCUSSION

Ectopic kidney is a common congenital urological abnormality. The abnormal insertion of the ureter, rotation anomalies, and different locations of the kidney make the management of calculi in ectopic kidneys difficult. Open surgery has increased morbidity due to bowel mobilization, larger scar, and increased pain. Laparoscopic pyelolithotomy requires prolonged duration of surgery and risks urine leak from the puncture site, causing morbidity.[6]

ESWL is less effective due to surrounding bone and bowel. The high insertion of the ureter and its accompanying impaired mobility significantly hampers the clearance of stone fragments.[2]

RIRS has become more popular in such patients by avoiding a puncture, but many a times it becomes technically difficult in large stone burden and difficult to negotiate the curves of the tortuous ureter of the pelvic kidney.[5,9] This same problem was encountered in three of our patients in whom we failed to reach the stones; hence, they were taken up for laparoscopic-guided mini PCNL.

In patients with pelvic kidney, PCNL is associated with increased risk of intraabdominal bleeding and/or urine leak owing to the abnormal orientation of the pelvic kidney, the abnormal and unpredictable blood supply of the ectopic kidney and the surrounding bowel loops and mesenteric blood vessels.[10]

Hence, for such patients, laparoscopic assisted PCNL was first described by Eshghi *et al*.[11] Here, the mobilization of the colon, which is needed to perform a puncture in the transabdominal route, is done by laparoscopic graspers under vision. This makes sure that there is no bowel or mesenteric injury during the renal puncture. The need for a nephrostomy catheter and the possible leakage of urine and

blood in the abdominal cavity are possible complications of this procedure.[4,12] These can be minimized by doing a mini PCNL rather than classic PCNL, as the former employs a smaller caliber sheath of about 12-15 F.[7,8]

Many earlier series of both classic PCNL and mini PCNL, employed pneumatic lithotripsy with the removal of fragments. Here too, complete stone fragment clearance is not guaranteed as minor fragments might get left inside due to anomalous insertion of the ureter or abnormal ureteral motility, as commonly seen in ectopic kidneys.[2] This was seen in earlier case series of Ka'abneh and Al-hammouri[13] who were able to achieve a stone clearance in only 72.2% of the patients with malformed or malpositioned kidneys.

Stone dusting with a laser, generally used during RIRS,[14] has good stone clearance during laparoscopic-assisted mini PCNL, which can be easily cleared out by adequate hydration.

This study is limited by its small sample size and being a retrospective study, so a bigger prospective randomized study is recommended.

CONCLUSION

Laparoscopy-assisted Mini PCNL with Laser offers advantages in ectopic pelvic kidneys in achieving good stone clearance, especially in patients with a large stone burden or failed ESWL or RIRS.

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Conflicts of interest
There are no conflicts of interest.

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