



# Laparoscopic pyeloplasty as treatment modality for congenital pelvi-ureteric junction obstruction in children with pelvic kidney: case series

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## Abstract

**Purpose** CAKUT is a spectrum of renal and urinary tract anomaly noted at birth. Ectopic kidney results from failure of renal ascent into the lumbar position. The most common location is pelvis. This study describes the application of minimal access surgery to correct pelvi-ureteric junction obstruction in pelvic kidney.

**Methods** A retrospective study was done between 2016 and 2021 and data were collected from two independently working paediatric urologist in India. Children with a significant pelvi-ureteric junction obstruction in a pelvic kidney who had undergone laparoscopic non-dismembered pyeloplasty with Double J stent insertion were included. The stents were removed at 4–6 weeks following surgery and they were followed with ultrasonogram and renogram.

**Results** We had a sample size of 10 with 7 boys and a median age of 5 years at presentation. Seven (60%) children presented with a urinary tract infection. They showed significant improvement after surgery.

**Conclusion** Laparoscopic pyeloplasty is a safe alternative to open surgery in children with pelvic kidney and results were comparable to open procedure. It reduces the procedure time and aids an early recovery and discharge.

**Keywords** Pelvic kidney · CAKUT · Paediatric · Pelviureteric junction obstruction · Laparoscopic pyeloplasty

## Introduction

Pelvic kidney is encountered in 1 in 2500 live births [1]. It occurs due to failure of renal ascent and rotation during early embryogenesis. It can be associated with duplication anomaly, pelvi-ureteric junction obstruction (PUJO), or multicystic dysplastic kidney. 25–35% of children with pelvic kidney have associated PUJO. Child with PUJO can present with antenatal hydronephrosis, or recurrent UTI, abdominal pain and vomiting with failure to thrive postnatally

[2]. While there is considerable literature on laparoscopic/robotic correction of classical PUJO there are only few case reports on laparoscopic correction of PUJO in pelvic kidney. In this series. We share our experience in laparoscopic management of PUJO in pelvic kidney.

## Methods

This is a retrospective study of patients operated during 2016–2021. The data were collected from surgical case records of two independently working paediatric urologists in India. All patients underwent voiding cystourethrogram to exclude reflux and a diuretic renogram to assess PUJO detected on ultrasonogram. An indwelling bladder drainage was kept during renogram. All patients had anatomical delineation with contrast CT scan or MR urogram (Fig. 1a and c). The indications for surgery were grossly dilated pelvicalyceal system with thinning of cortex, along with obstructive pattern of drainage and split renal function of < 40% on renogram. All children who underwent a laparoscopic pyeloplasty for PUJO in pelvic kidney were included.

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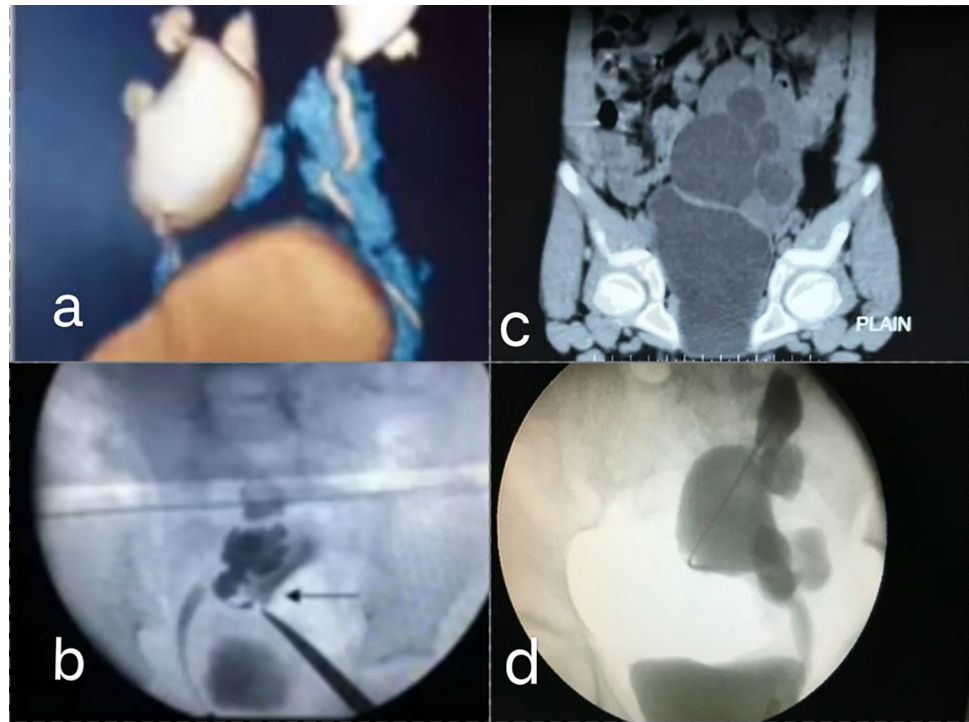
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**Fig. 1** Role of RGP **a** contrast CT reconstruction with **b** retrograde pyelogram (RGP) in the same patient with right pelvic kidney; **c** non contrast CT scan with **d** RGP in the same patient with left pelvic kidney



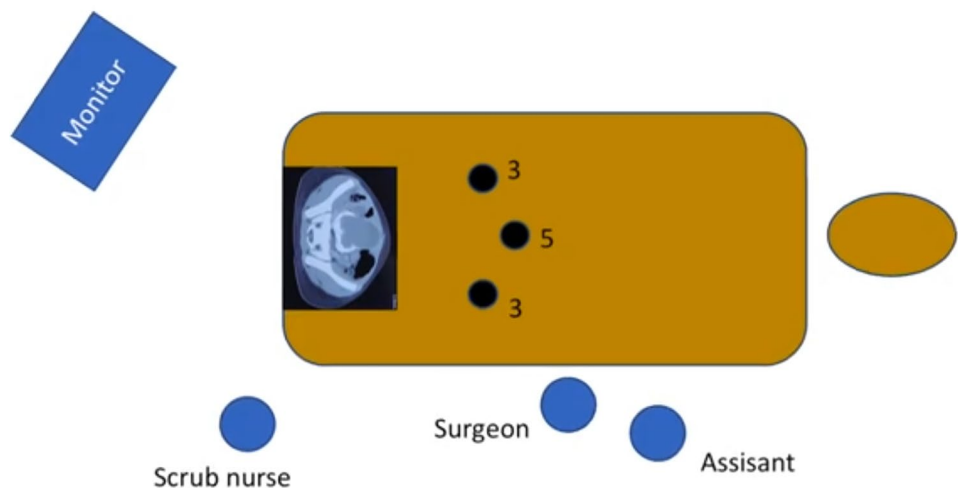
The data collected included the patient demography, initial symptoms and diagnosis, radiological parameters, procedure time (from start to end of pneumoperitoneum), and complications after the procedure.

### Technique for laparoscopic dismembered pyeloplasty

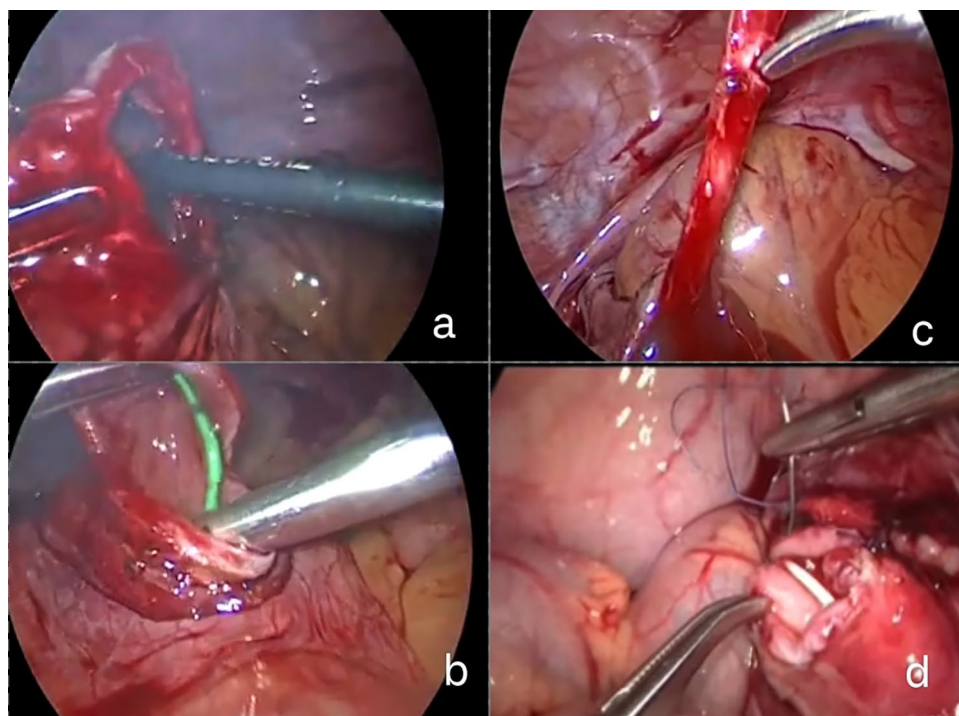
All patients underwent a cystoscopy and retrograde pyelogram under fluoroscopy guidance to confirm the diagnosis and position of renal pelvis (Fig. 1b and d). A ureteric

catheter was inserted into the ureter to help identification during the procedure. Following this, the patient was placed in supine position with 15 degree head down to enable bowel moving out of pelvis. Indwelling urinary catheter was kept to keep the bladder empty. A 5 mm supra-umbilical camera port was placed using open technique and pneumoperitoneum created. Following this two 3 mm right and left lower quadrant were placed under guidance facing the pelvis (Fig. 2). In patients older than 3 years, 10 mm umbilical and 5 mm iliac fossa ports were used. The surgeon stood on the left side facing the foot end of the patient while the monitor was kept at the foot end

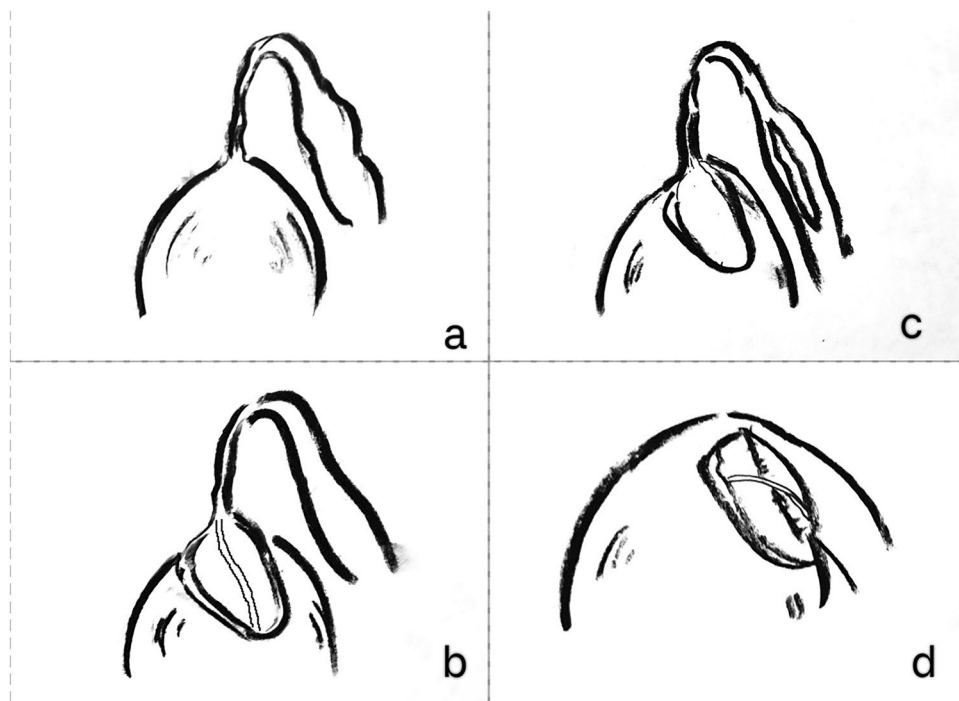
**Fig. 2** Patient, surgeon and port positions for laparoscopic pyeloplasty in pelvic kidney



**Fig. 3** Operative steps of laparoscopic pelvic kidney pyeloplasty **a** anteriorly placed pelvic and PUJ; prior ureteric catheter placement helps in dissection **b** pelvis has been opened exposing the ureteric catheter. **c** Ureter being spatulated posteriorly facing the pelvis. **d** Posterolateral wall has been anastomosed; stent has been placed; ready for completion of anteromedial wall of pyeloplasty



**Fig. 4** Diagrammatic representation of steps of pelvic kidney pyeloplasty: **a** anteriorly placed pelvic and PUJ; prior ureteric catheter placement helps in dissection, **b** pelvis has been opened exposing the ureteric catheter. **c** Ureter being spatulated posteriorly facing the pelvis. **d** Posterolateral wall has been anastomosed; stent has been placed; ready for completion of anteromedial wall of pyeloplasty



(Fig. 2). Often these cases have anteriorly placed pelvis and the peritoneum over the PUJ was incised. A hitching suture was omitted as we felt hinders with ureter spatulation or handling of sutures deep in pelvis. Figure 3 shows operative photos of the steps and Fig. 4 the diagrammatic representation of steps. The ureteric catheter placed during RGP helped aids in identification of PUJ and ureter [3].

The ureter was spatulated on the posterior wall since the pelvis faces anteriorly. Pyeloplasty was performed using 5–0 polyglactin continuous suture starting from the heel of the pelvis (dependent portion). Posterolateral wall anastomosis was performed first. A DJ stent of shorter length (appropriate for the age/length of ureter) was inserted antegradely before closure of the anteromedial wall. Feeds

were started within 4–6 h post procedure. The urethral catheter and drain tube were removed on POD1 and POD2, respectively. Patients were discharged on POD2 and reviewed at 4–6 weeks for cystoscopic removal of Double J stent as an outpatient procedure. Patients were followed up 3–6 months during the first year and yearly thereafter. A repeat ultrasonogram with renogram was performed at 6 month–1 year after surgery.

## Results

Our study included 10 children (Table 1) between the age group of 6 months to 10 years (median age: 4 years) with male predominance (70%) and right sided anomaly (60%). Six (60%) children presented with urinary tract infection; two (20%) came with antenatally diagnosed pelvic kidney

with hydronephrosis while 2 (20%) children presented with recurrent lower abdominal pain. The procedure was completed laparoscopically in all patients with no conversion. The mean procedure time was 100 min ( $\pm 18$  min). None of the patients had any adverse event in the immediate post-operative period. On routine follow-up, no new episodes of urinary tract infections were documented. A repeat ultrasonogram showed a reduction in the antero-posterior pelvi-calyceal system diameter and grade of hydronephrosis in all patients (Table 1). Renogram at follow up showed improved drainage/mild improvement of split renal function; no patient had drop in function. In the two symptomatic patients there was no recurrence of symptoms.

**Table 1** Patient details along with diagnosis, surgery, and follow-up status

	Age at diagnosis	Sex	Diagnosis	Follow-up	Outcome APD	Outcome DRF
1.	6months	M	Antenatal Rt HN	5 years	32 → 21	30 → 38
2.	7 months	M	Antenatal Rt HN	4 years	30 → 24	25 → 34
3.	2 years	M	UTI	6 years	35 → 20	35 → 43
4.	7 years	F	UTI	3 years	28 → 20	44 → 48
5.	10 years	F	UTI	2 years	30 → 24	32 → 36
6.	5 years	M	UTI	6 years	38 → 30	24 → 28
7.	6 years	M	UTI	11 months	32 → 18	30 → 45
8.	6 years	M	Pain abdomen and mass	3 years	50 → 38	25 → 28 pain resolved
9.	2 years	F	UTI	2 years	35 → 28	40 → 43
10.	3 years	M	Pain abdomen with UTI and hematuria	3 years	37 → 30	28 → 30 pain, UTI resolved

## Discussion

The ureteric bud arises from mesonephric duct and divides to form the renal pelvis, calyces and the collecting duct [1, 2]. Mesonephros gives rise to the foetal kidneys at 6–8 weeks of gestation and invagination of mesonephric duct into the metanephric blastema leads to the ultimate development of kidneys [2]. Kidneys initially develop at the level of the sacral spine and subsequently ascend while rotating antero-medially to reach its normal lumbar position. Failure of this ascent gives rise to an ectopic pelvic kidney [1]. 25–35% of children with pelvic kidney have associated PUJO. These children can be asymptomatic, diagnosed antenatally on ultrasound or present later with recurrent infection, abdominal pain, lower abdominal mass, failure to thrive or hypertension [4].

Asymptomatic PUJO with mild to moderate dilatations are often managed conservatively. The decision for surgical intervention is generally made when there are localizing symptoms, increased calyceal dilatation on ultrasonogram with thinning of renal parenchymal and/or an obstructive pattern on diuretic renogram with dropping differential renal function. Historically an open pyeloplasty is performed via a Pfannenstiel incision in the setting of pelvic kidney and PUJO. There have been isolated case reports in journals that suggest a positive outcome with laparoscopic pyeloplasty for management [3, 5] of PUJO in pelvic kidney [3].

In this series, we found a favourable outcome with laparoscopic approach to pelvic kidney pyeloplasty. While prior anatomical delineation of details with MRI scan or contrast CT is often sufficient, we feel that RGP and cystoscopic placement of ureteric catheter helps a lot in locating the PUJ and ureter intra-operatively. Laparoscopy helps delineate the complex renal anatomy, provides better access to renal pelvis with minimal mobilization of surrounding structures and helps create an adequate tension free anastomosis [6]. Placement of instrument ports in both lower quadrants with supra umbilical camera port provides good triangulation for ergonomic convenience. The procedure time is short and offers cosmetically superior outcome with minimal morbidity. All the patients had a successful outcome in the present study.

## Conclusion

Pelvic kidneys with PUJO are very much amenable to management via minimally invasive surgery [3]. Laparoscopic pelvic kidney pyeloplasty is a safe alternative to open surgery and enables early recovery.

**Funding** None to declare.

**Data availability** The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Conflict of interest** None to declare.

**Ethical approval** Not required.

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