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Recurrent UPJ obstruction following laparoscopic pyeloplasty

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Abstract
Introduction: A dismembered pyeloplasty is the most preferred technique to correct uretero pelvic junction obstruction. The present study was undertaken to identify the reasons for recurrent (Ureteropelvic junction) UPJ obstruction following laparoscopic pyeloplasty and analyse the outcome following repeat surgery.
Materials and Methods: We retrospectively reviewed the outpatient and inpatient records of children ≤ 18 years of age, having undergone surgery for UPJ obstruction and presenting later with symptoms of recurrent obstruction.
Results: A total of 36 children presented with recurrent UPJ obstruction following laparoscopic pyeloplasty. Twenty-one of these were males and the remaining 15 were females. Eight (22.2%) children underwent a repeat laparoscopic pyeloplasty, 23 (63.8%) underwent an Open pyeloplasty and 5 (13.8%) underwent an open ureterocalicostomy. A diuretic renogram repeated 3 months after removal of double J ureteric stent showed significant improvement in the urinary drainage on the affected side leading to improvement in split renal functions. In 17 (47.2%) children the excised UPJ sent for histopathological examination showed complete obliteration with no evidence of patency of the UPJ junction, suggesting a faulty suturing technique to be the cause of the recurrent UPJ obstruction.
Conclusion: Recurrent UPJ obstruction following laparoscopic pyeloplasty is known and can be due to either faulty suturing technique, non-dependent drainage or recurrence of stricture/narrowing at the UPJ. Early diagnosis of recurrent obstruction helps in early salvage of the renal unit and improvement of the renal function.

Keywords: Laparoscopy, hydronephrosis, recurrence, kidney pelvis

Introduction
Ureteropelvic junction (UPJ) obstruction results in inadequate drainage of urine from the renal pelvis, resulting in hydrostatic distention of the pelvis and intrarenal calyces. This combination of increased intrapelvic pressure and urine stasis within the collecting ducts results in progressive damage to the kidney [1]. UPJ obstruction is one of the commonest congenital urinary tract anomalies and has been estimated to occur 1 in 5000 live births. [1,2] The most reliable indications for operation are probably intermittent obstruction and pain, moreover diminished renal function, delayed drainage, progression of pelvic and calyceal dilation onultrasonography (US), and loss of renal function are all potential indicators of obstruction [3].
A dismembered pyeloplasty is the most preferred technique to correct an UPJ obstruction. A successful outcome is achieved with construction of a wide, funnel-shaped, dependent UPJ complex. The open surgical approach to repair of UPJ may still have a role in infants and young children. Minimally invasive procedures such as laparoscopic and robot assisted laparoscopic repairs are rapidly replacing open approaches in all ages. The introduction of robotic surgery with articulating instruments and three-dimensional visualization has made intracorporeal suturing easier and more precise. The success rates of open, laparoscopic, and robot assisted pyeloplasties have been equivalent [4-6]. The benefits of laparoscopic and robotic surgery over an open approach include a shorter length of hospitalization, decreased analgesic requirements, improved cosmesis, and quicker return to normal activity, which likely have increasing benefit with increasing age of the patient.

The common early complications following an UPJ repair are prolonged urinary extravasation and delayed drainage through the anastomosis. In cases of a significant leak, either a ureteric stent (double J) or a percutaneous nephrostomy tube can be inserted. The leak usually ceases within 48 hours following insertion of the stents. Late scarring at the anastomotic site is common. Secondary obstruction or failure of the primary procedure occurs due to scarring or fibrosis, a nondependent anastomosis, ureteral angulation secondary to renal malrotation, or ureteral narrowing distal to the anastomosis. [1] Rassweiler *et al* [7] reported on the complications following laparoscopic pyeloplasty. Intraoperative incidents ranged from 2.0 to 2.3%, mostly without consequences for the patient including ligation of lower pole artery, loss of needle, hyperkapnia, cutting of DJ-stent, colonic injury, and port site bleeding. The conversion rate was mainly due to inability to access UPJ or to accomplish the anastomosis ranging between 0.5 and 5.5%. Postoperative complications occurred between 12.9 and 15.8% in large series. A total of 5.4-10% represented Grade III-complications (Clavien-classification), such as urine leakage, haematoma, colonic injury, and stone formation. Recurrent UPJ-stenosis requiring reintervention was seen in 3.5-4.8%. We retrospectively reviewed our hospital data base for children presenting to us with recurrent UPJ obstruction following laparoscopic pyeloplasty. The objective of the study was to identify the reasons for recurrent UPJ obstruction and analyse the outcome following repeat surgery.

Patients & Methods

We retrospectively reviewed the outpatient and inpatient records of children ≤ 18 years of age, having undergone surgery for UPJ obstruction and presenting later with symptoms of recurrent obstruction. This study was carried out following the approval obtained from the University/Institutional ethical committee (KLESKF/IEC/2021/14), patient consent was obtained prior to the study. Age, gender and other demographic data was obtained and analysed. Details of previous surgery was also collected. Imaging details of all children that included computed tomography (Figure 1a & b)/magnetic resonance/ intravenous urography, diethylenetriamine penta-acetic acid (DTPA) renogram (Figure 2) and retrograde pyelography (Figure 3a) were also noted for further analysis.

The operative and postoperative details were similarly collected. Children were followed up at regular interval with clinical assessment, ultrasonography and DTPA renogram. Failure was defined as persistence or recurrence of symptoms and obstructive drainage pattern noticed on DTPA renogram. Statistical analysis was performed using SPSS (Version 22.0, Armonk NC, USA). $p<0.05$ was considered to be statistically significant.

Results

During the study period Jan 2001 till Dec 2022, a total of 36 children presented with recurrent UPJ obstruction following laparoscopic pyeloplasty. The mean age at presentation was 7 years. Twenty-one of these were males and the remaining 15 were females (Table 1).Pain in abdomen, colicky in nature associated with vomiting was the most common symptom of recurrent UPJ obstruction in these children. Six (16.6%) children gave history of passing turbid urine. The renal function on the affected side was poor as seen on DTPA renogram. Drainage of urine on the affected side was severely affected. The mean age of the children at the time of second UPJ repair was months (Table 2).

Based on feasibility a total of 15 children were taken up for laparoscopic repair of recurrent UPJ obstruction. Due to intra-operative difficulties 7 (19.4%) children needed to be converted to recurrent open pyeloplasty. A total of 23 (63.8%) children underwent open pyeloplasty. It was difficult to approach the UPJ in 5 (13.8%) children due to dense adhesions, hence an open ureterocalicostomy was performed. Three children had severe bleeding leading to fall in blood pressure intra-operatively. Blood transfusion helped in stabilising the blood pressure. No complications were noted in the three months after surgery. The double J ureteric stent was removed 2 weeks after surgery. A diuretic renogram was repeated 3 months after removal of double J ureteric stent. There was significant improvement in the urinary drainage on the affected side leading to improvement in split renal functions. Repeat urine examinations showed on urinary tract infections.

In 31 (86.1%) children the UPJ obstruction could be identified and excised. The specimen was sent for histopathological examination. In 17 (47.2%) children the UPJ was completely obliterated with no evidence of patency of the junction, suggesting a faulty suturing technique to be the cause of the recurrent UPJ obstruction. Non-dependent drainage in 12 (33.3%), and narrowing at the upper ureter/UPJ in 7 (19.4%) were the other causes of recurrent UPJ obstruction.

Discussion

The success of pyeloplasty depends on several factors, and to achieve adequate drainage certain principles need to be followed. The vascularity of the upper ureter and pelvis need to be preserved, the UPJ anastomosis should be dependent, tension free and watertight. In cases of crossing renal vessels, they need to identify and transposed. Urinary extravasation leading to peri-pelvic fibrosis, ischemic injury to the ureter, persistent lower pole crossing vessels are known to be the cause for recurrent UPJ obstruction.

The most difficult part of laparoscopic pyeloplasty (LP) is the intracorporeal suturing and knotting for ureteropelvic anastomosis which is important as well as time-consuming [7-9]. In conventional LP, ureteropelvic anastomosis is performed using polyglactin (vicryl) or polydioxanone in a continuous or interrupted manner. Ureteropelvic anastomosis using the continuous suturing technique has a comparable success rate with that using interrupted suturing. Various methods have been devised in the past to simplify the process of suturing and knot tying such as knot pushers, suture clips, and pretied sutures [7-10]. The knotless self-retaining barbed suture is one such method devised for intracorporeal suturing to ease the process. They have been successfully applied in lower tract reconstruction, whereas there are only few reports of their evaluation for upper tract reconstruction [11-13]. Faulty suturing techniques during LP could also result in recurrent UPJ obstruction. A needle passing through both the walls of the ureter especially while passing the needle at the apex of the spatulated ureter. This could lead to approximation of the ureteric walls inspite of the DJ stent being present.

Rotation of the ureter during UPJ anastomosis could be another reason for recurrent UPJ obstruction. It is important to confirm that the ureter has not rotated during the process

of anastomosis. Nerli *et al* [14] have suggested that it is better to make a small 1.5 - 2 cm pyelotomy near the UPJ initially so as to perform partial dismemberment. The pyelotomy incision is then extended across the UPJ into the proximal ureter so as to spatulate the proximal ureter for a length of about 2 - 2.5 cms. The remaining part of the ureter is still attached to the renal pelvis at this time. The first suture is passed through the apex of the spatulated ureter and through the dependent portion of the pelvis. The DJ stent is passed across the UPJ and a few more sutures are placed. Only after this is the remaining part of ureter dismembered from the renal pelvis. One can also place anchoring sutures on the ureter and pelvis so as to prevent rotation of the ureter.

Swearingen *et al* [15] reported their experience in managing pyeloplasty failures that included laparoscopic nephrectomy in nine, laparoscopic pyeloplasty in three and twenty-nine endopyelotomies. Of 29 secondary endopyelotomies, 10 (34%) were successful. Of the 19 failures after secondary endopyelotomy, 12 patients had tertiary pyeloplasty (5 laparoscopic and 7 open surgical), 5 (26%) underwent tertiary endopyelotomy, and 2 (11%) required nephrectomy. The authors concluded that secondary pyeloplasty was more than twice as successful as endopyelotomy after a failed pyeloplasty. Thomas *et al* [16] reported that open redo pyeloplasty provided excellent results, with reported success rates of 77.8- 100% and they further suggested that it was the first-choice method for repair. Recently several authors have reported excellent success rates with LP for a recurrent UPJ obstruction. [17-19] Chiancone *et al* [17] analyzed their experience with Anderson-Hynes transperitoneal laparoscopic pyeloplasty in 38 patients with recurrent ureteropelvic junction obstruction. Mean operating time was 103.16±30 minutes. The mean blood loss was 122.37±73.25mL. The mean postoperative hospital stay was 4.47±0.86 days. Post-operative renal scan showed radiological failure in one out of 38 (2.6%) patients, relative success in 2 out of 38 (5.3%) patients and total success in 35 out of 38 (92.1%) of patients.

Our study clearly shows that faulty suturing technique is a major cause of recurrent UPJ obstruction following laparoscopic pyeloplasty. Adequate and proper training is important to prevent complications such as recurrent UPJ obstruction. Introduction of laparoscopic surgery has revolutionized surgical training. The ability of both the trainee and the trainer to see the operative field in the same way offers an optimal field of direct teaching. Moreover, low and high-fidelity surgical simulators have been developed using animal organs in a real-time setting (i.e., perfused organs, P·O.P.-trainer) or even displaying the human anatomy as a virtual reality.

Table 1: The pre-operative demographics.

No		Mean±SD (Range)
1	Age of the child at 1st UPJ repair (months)	43.64±33.64 (3-144)
2	Symptoms following 1st UPJ repair Pain in abdomen 22 (61.1%) Vomiting 10 (27.7%) Fever with chills11 (30.5%)	
3	Time to 2nd UPJ repair following recurrence of symptoms (months)	9.00±4.01 (6-20)
4	Split renal function of the affected side prior to 2nd repair (%)	21.9±4.47 (14-28)

Table 2: The details of the surgery

No		Mean±SD (Range)
1	Age at repeat surgery (months)	52.64±36.46
2	Type of repair Laparoscopic pyeloplasty8 (22.2%) Open pyeloplasty23 (63.8%) Open ureterocalicostomy 5 (13.8%)	
3	Blood loss in ml	93.39±38.19
4	Intraoperative complications Bleeding3 (8.33%) Conversion of Lap to Open7 (19.4%)	
5	Early post-operative complications0	
6	Split renal function after 2nd UPJ repair	36.44±8.64

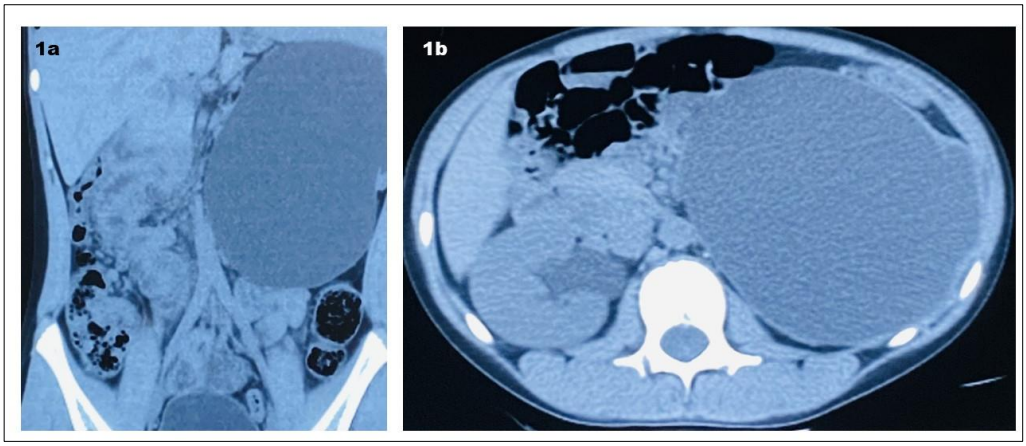

Fig 1a: Coronal section showing CT scan images of dilated left renal pelvis
1b. axial section showing CT scan image of dilated left renal pelvis

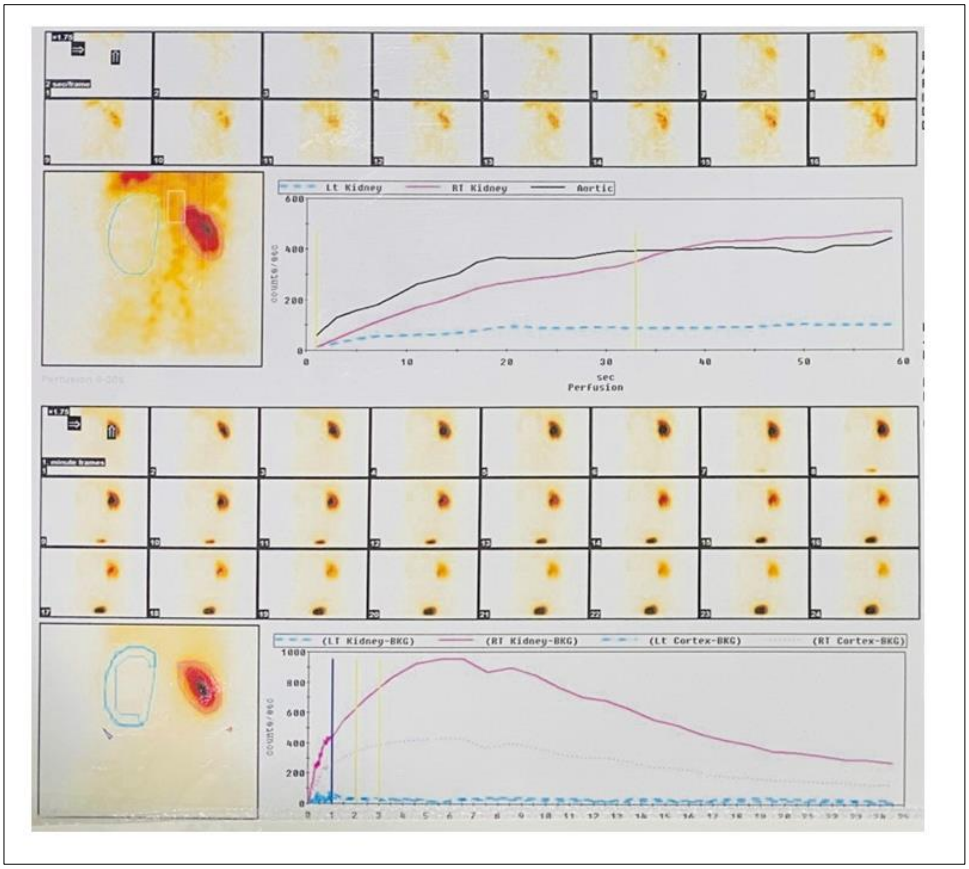

Fig 2: DTPA renogram showing poor left renal perfusion as well as significant tracer retention in the left kidney

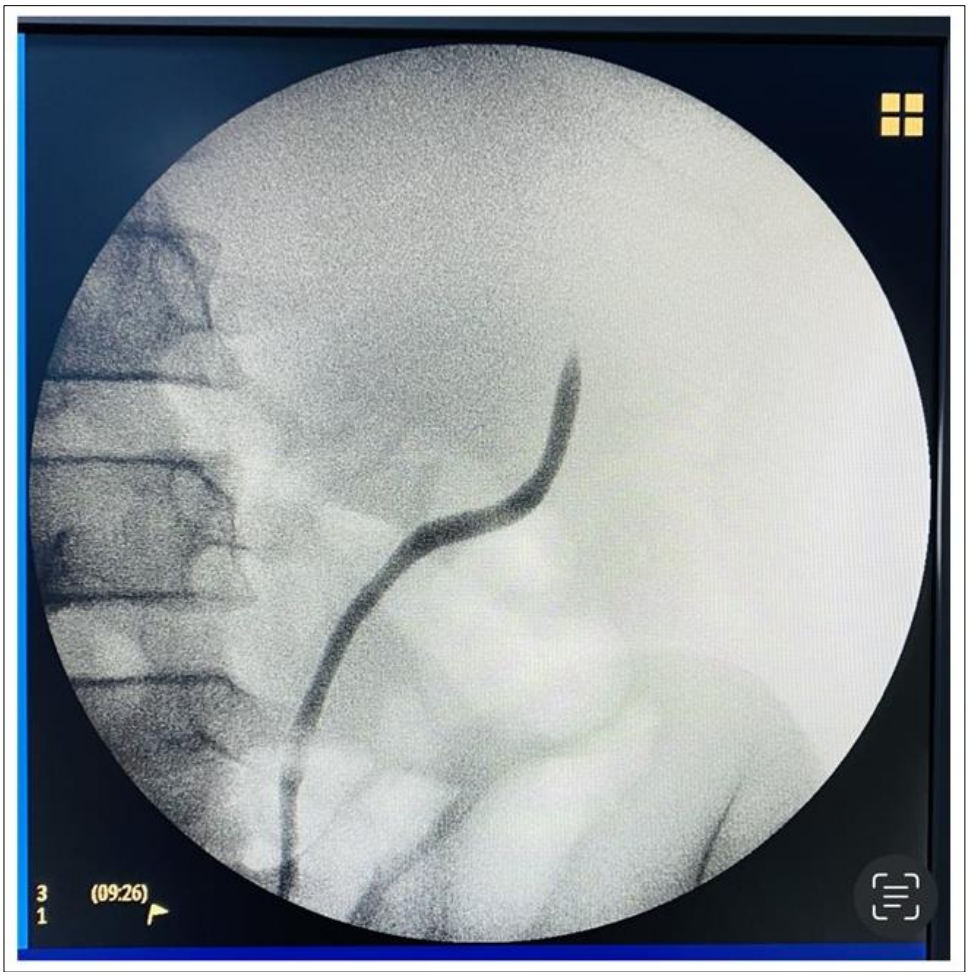

Fig 3: Pre-operative retrograde pyelogram showing complete obliteration of the ureter, with no contrast passing beyond the stricture.

Conclusion

Laparoscopic pyeloplasty has proven to be safe and effective with comparable results to open surgery. Recurrent UPJ obstruction following laparoscopic pyeloplasty is known and can be due to faulty suturing technique, non-dependent drainage or recurrence of stricture/narrowing at the UPJ. Early diagnosis of recurrent obstruction helps in early salvage of the renal unit and improving the renal function.

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