**Lumboscopic-Assisted Pyeloplasty: A Single-Port, Retroperitoneoscopic Approach for Children with Pelvi-Ureteric Junction Obstruction**

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**Introduction:** Pelvi-ureteric junction obstruction (PUJO) is one of the most common conditions presenting to a pediatric urologist. As laparoscopic or robotic-assisted pyeloplasty, either transperitoneal or retroperitoneal, involves intracorporeal suturing skills and has a long learning curve, they have not gained popularity among beginners in laparoscopy.

**Objective:** We conducted a study to assess the results of a single-port, retroperitoneoscopic approach to renal access, i.e. lumboscopic-assisted pyeloplasty (LAP), by single surgeon at our institute.

**Materials and Methods:** A retrospective review of all children who underwent LAP from July 2013 to March 2018 was conducted. Patients who presented with PUJO and required surgical treatment were included. A single-port lumboscopy using coaxial telescope was performed in prone position in all patients. The renal pelvis was dissected and retrieved through the port site followed by extracorporeal hand-sewn pyeloplasty over a double-J stent or a nephrostent. The operative time, postoperative pain, surgical complications, duration of hospital stay, follow-up, and cosmesis at 6 months postsurgery were evaluated.

**Results:** A total of 96 children were included (72 males and 24 females), with the age at operation ranging from 3 months to 10 years (mean = 4.9 years). All patients had an uneventful postoperative recovery. Two patients had a superficial wound infection, and one patient was converted to open approach due to excessive bleeding. The average operating time was 80 ± 22.5 min, the median duration of hospital stay was 3 days, and the average scar length at 3 months was 15.6 ± 0.4 mm. Follow-up renogram (diethylenetriamine pentaacetic acid) showed satisfactory postpyeloplasty drainage pattern in 93 children while three showed obstructive drainage curves.

**Conclusion:** LAP can be performed safely with minimal retroperitoneal dissection, excellent cosmetic results, and minimal postoperative pain in children with PUJO. It has a shorter learning curve as compared to laparoscopic pyeloplasty as it involves time tested extracorporeal hand-sewn anastomosis.

**Keywords:** Hydronephrosis, lumboscopic assisted, pelvi-ureteric junction obstruction, retroperitoneoscopic, single-port pyeloplasty
robotic-assisted laparoscopic pyeloplasty (RALP) are comparable to open surgery barring the long learning curve, operative time, duration of hospital stay, and postoperative analgesia requirements. Robotic pyeloplasty requires upfront three if not four-port placements, heavy financial investment, and advanced training which is integral to robotic surgery.

The retroperitoneoscopic access has been commonly used for upper urinary tract surgery in the past. Many surgeons, including the authors, are well versed with the surgical anatomy seen through the lumbotomy incision. Inserting a telescope through a shortened lumbotomy incision led to the lumboscopic approach. Herein, we describe our experience with a hybrid novel technique, which combines the advantages of laparoscopy, does not violate the peritoneum, and utilizes the conventional hand-sewing techniques for ureteropelvic anastomosis. The aim of this study was to evaluate the outcome for children who underwent lumboscopic-assisted pyeloplasty (LAP) by the same surgeon (MB) at our institute.

**Materials and Methods**

A retrospective review of all children who underwent LAP for PUJO from July 2013 to March 2018 was conducted. Ethical clearance for the study was obtained from the institute ethics committee. All patients who underwent LAP were included. This procedure was performed in consecutive PUJO cases by the senior author (MB). Patients with intrarenal pelvis and abnormal renal anatomies such as horseshoe kidneys, malrotated kidneys, and ectopic kidneys were excluded. Data pertaining to the duration of surgery, blood loss, type of stents used, conversion to open, postoperative pain, time to oral feeds, early complications, duration of stay, scar length, and cosmetic satisfaction at follow-up were recorded.

**Operative technique**

Under general anesthesia and endotracheal intubation, the child was first catheterized and then placed in prone position with a roll under the pelvis and a thick pad under the chest and shoulders leaving the abdomen free. The lumboscopy-related landmarks were identified and marked: tip of the 12th rib, vertebral column, lateral border of erector spinae muscle, and the iliac crest [Figure 1]. A small 15-mm incision was made at the renal angle just lateral to the paraspinal muscles. The posterior layer of the dorsolumbar fascia was pierced vertically, and the Gerota’s fascia entered. An indigenously made balloon suction catheter [Figure 2a] was inserted into space, inflated with 200–300 ml of air, and kept in place for about 10 min (50–100 ml in young infants). Once adequate space was created, a 12-mm coaxial port was inserted and fixed [Figure 2b]. Pneumoretroperitoneum was created with a 7–9 mmHgCO$_2$ pressure and a flow rate of 3 l/min. The kidney was approached posteriorly with the telescope, and the pelvis, proximal ureter, and pelvi-ureteric junction (PUJ) identified. The dilated pelvis was decompressed percutaneously using a 23-gauge spinal needle [Figure 2c], and the PUJ was grasped with a forceps and brought out through the port site under vision. As soon as the pelvis is brought out, the sutures are appropriately placed to maintain relative anatomy, identify unwanted rotation, and facilitate pelvic reduction and anastomosis. The sutures placed were (1) ureter – 6.0 prolene and (2) pelvic flaps – different colored sutures – purple (polyglactin) medially, black (silk) laterally, and another stay suture cranially to avoid torsion [Figure 3]. The ureter was then dis-membered, spatulated, and ureteropelvic anastomosis completed over a double-J (DJ) stent using 6.0 polydioxanone interrupted sutures. In the initial cases, a 6 Fr infant feeding tube (IFT) with self-configured fenestrations at the distal one-third was used as a trans-anastomotic tube. After completion, the newly constructed PUJ was re-posted back in the retroperitoneum. The port-site wound was closed in layers after placing a corrugated rubber or a closed suction drain.

The child was started on liquids the same evening and semisolids the very next day. The corrugated drain was removed on day 2 and the Foley catheter on day 3. The postoperative pain was assessed regularly using Wong-Baker FACES pain charts and the amount of intravenous or oral analgesics (paracetamol) administered. After discharge, oral antibiotic prophylaxis was continued until the cystoscopic removal of the DJ stent, 4–6 weeks later. The nephrostent was removed on
the 5th postoperative day. The children were followed up in the outpatient department with ultrasound imaging and diethylenetriamine pentaacetic acid renography 3–6 months after surgery.

**RESULTS**

A total of 96 children, 72 (75.0%) males and 24 (25.0%) females, underwent single-port LAP. The mean age was 4.9 years (range 3 months–10 years). Of these, 63 (65.6%) patients underwent left-sided pyeloplasty, 31 (32.3%) underwent right-sided pyeloplasty, and 2 (2.1%) patients underwent bilateral LAP contemporaneously. The average operating time was 80 ± 22.5 min. The average blood loss was 22 ml excluding one child with excessive bleeding. A tear in the arcuate artery at the hilum leads to 100 ml blood loss in a 6-year-old boy with left PUJO during the surgery. Due to blurring of vision, LAP was converted to OP and the pyeloplasty was completed via the lumbotomy approach. A DJ stent was used in 66 (68.8%) patients and a trans-anastomotic IFT tube in the rest 30 (31.2%).

All children, except one, were started on liquid feeds the same evening and on semisolid food the next day. The postoperative pain was mild to moderate in most cases, and the median FACES score at 30–36 h after surgery was 4. The postoperative pain was easily managed by oral analgesics in all patients except in one child where intravenous analgesics had to be given. Superficial surgical site infection occurred in 5 (5.2%) patients. The mean follow-up duration was 16.2 months (range 1–56). The average length of scar at 3 months was 15.6 mm and ranged from 15 to 22 mm [Figure 4].

The lumbotomy incision scar for the converted case measured 40 mm in length. The follow-up renogram showed a postpyeloplasty pattern with delayed clearance in 93 (96.9%) patients and an obstructive pattern in 3 (3.1%) patients. One of these three underwent redo pyeloplasty by the lumbotomy approach. The rest two are under regular follow-up evaluation for the need of redo surgery. The perioperative and postoperative results are summarized in Table 1.

**DISCUSSION**

Pyeloplasty is the most commonly performed major pediatric urological procedure. In 1995, the first laparoscopic pyeloplasty was performed by Peters et al.\[14\] The procedure still has not become popular among newly graduated pediatric surgical trainees due to long learning curve of laparoscopic intracorporeal. Both the transperitoneal laparoscopic and the retroperitoneoscopic pyeloplasty had shorter duration...
of hospital stay but a longer duration of surgery as compared to the OP. With the advent of RALP, the visualization improved, intricate intracorporeal suturing could be carried out with ease due to the 7° of freedom, and the operative time reached that of laparoscopy with increasing surgeon experience. Apart from the logistics, learning curve, and heavy initial financial investment involved in the robotic approach, all techniques involved the use of multiple ports. However, in our study, the average duration of surgery, duration of hospital stay, and duration of analgesia requirement were comparable to other techniques that too at a lower initial investment cost and a shorter learning curve for the senior surgeon (MB) himself when compared to his experience with laparoscopic pyeloplasty.

It was Lima et al. who first described the one-trocar-assisted-pyeloplasty with a single 10-mm telescope along with a 5-mm working channel and successfully performed retroperitoneoscopic pyeloplasty in 16 children. Caione et al. utilized the above technique and performed one-port retroperitoneoscopic-assisted pyeloplasty (OPRAP) in 28 consecutive children. The average duration of surgery in our study was 80 min, as compared to 95 min as reported in their study. The average hospital stay (3.4 days), postoperative pain, complication rate (1/28; 3.5%), and cosmetic results are comparable to our study. Caione et al. encountered four cases with an aberrant polar vessel which could be easily managed by OPRAP technique. We encountered a similar case, but accidental injury to the arcuate artery resulted in excessive bleeding.

The incidence of reported crossing vessels has increased with better visualization by the robotic approach. The main difficulty encountered is during anterior anastomosis over the crossing vessel. The chances of missing a crossing vessel

| Table 1: Demographic, perioperative, and postoperative data for patients who underwent lumboscopic-assisted pyeloplasty |
|---------------------------------------------------------------|
| **Lumboscopic assisted pyeloplasty**                           |
| **Preoperative**                                              |
| Number of patients                                           | 96 |
| Males (%)                                                     | 72 (75.0) |
| Months of follow-up, mean±SD (range)                         | 14.2±9.3 (1-59) |
| Age (months), mean (minimum-maximum)                         | 58.8 (3-120) |
| Laterality of UPJ obstruction                                 |
| Right                                                         | 31 |
| Left                                                          | 63 |
| Bilateral                                                     | 2 |
| Preoperative grade of hydronephrosis                          |
| II                                                            | 3 |
| III                                                           | 39 |
| IV                                                            | 54 |
| Split renal function at surgery of operated kidney, median (range), (%) | 30.5 (12.5-63)* |
| **Perioperative**                                             |
| Mean operative time (min)                                     | 80±22.5 |
| Estimated median blood loss (ml)                              | 22** |
| Conversion to open (%)                                        | 1/96 (1.0) |
| Duration of analgesic use (days)                              | 2.2 |
| Median Baker Faces Pain Rating Scale score                    | 4 |
| Median duration of hospital stay (days)                       | 3 |
| Type of stent used (%)                                        |
| Transanastomotic IFT as nephrostent                          | 30 (31.1) |
| DJ stent                                                      | 66 (68.8) |
| **Postoperative**                                             |
| Duration of follow-up, mean±SD (months) (range)              | 16.2±9.3 (1-56) |
| Average scar length, mean±SD (mm)                            | 15.6±0.4 |
| Obstructive drainage at follow-up renonogram                  | 3/96 |
| Revision pyeloplasty                                          | 1/29*** |

*Bilateral case excluded, **Excluding the case with arcuate vessel injury, ***Needed for persistent postoperative pain and lump formation with obstructive pattern on renal dynamic scan after 1 year. SD: Standard deviation, UPJ: Uretero-pelvic junction, IFT: Infant feeding tube, DJ stent: Double-J stent, LAP: Lumboscopic assisted pyeloplasty
are less with the LAP approach as compared to the open lumbotomy approach. However, when encountered, a conversion to the open lumbotomy is a safer option. Caione et al. also compared results of OPRAP with OP and reported a significant reduction in the requirement of analgesics, reduced hospital stay, reduced length of the scar, and better cosmetic results. Their initial reported experience with OPRAP technique is with patients younger than 5 years. However, our cohort consisted of a wider age range (3 months–10 years) and LAP was found to be a feasible option in children older than 5 years.

The limitations to the LAP procedure are intrarenal pelvis where it becomes difficult to bring out the PUJ for a hand-sewn pyeloplasty through the small-port size incision, abnormal renal anatomies such as horseshoe kidney and malrotated kidney, and obese children. The retroperitoneoscopical approach via prone position provided easy and direct access to the renal pelvis. As compared to the open lumbotomy approach followed previously for PUJO surgery, smaller incision size, decreased length of surgical scar, and better visualization as with all other laparoscopic procedures proved advantageous. Furthermore, the open lumbotomy approach is contraindicated for adolescent patients and patients with gross hydronephrosis. However, with LAP, pyeloplasty even in adolescent patients or in patients with gross hydronephrosis was not a restriction. With the subcutaneous aspiration of the pelvis, its size reduced and this facilitated the subsequent handling of the renal pelvis and the PUJ; we did not face problems even in cases of gross hydronephrosis. When indicated, bilateral pyeloplasty could be easily performed without changing the position of the patient, like in two of our patients. Both DJ stents and nephrostent were used in our study in different cases. No particular selection criteria were used for choosing the type of stent to be used, except for patient affordability (indigenous nephrostent available free of cost). DJ stent was preferred in patients who required a longer duration of ureteric stenting. On the other hand, a 6-Fr IFT with improvised fenestrations avoided the need for second anesthesia for its removal. Nephrostent can be used if the lower pole is easily accessible through the lumboscopy port site. In the authors’ opinion, the LAP procedure had better cosmesis and patient satisfaction due to the small size and the obscure site of the scar. No scar was visible on the anterior abdominal wall, unlike in open surgery or the transperitoneal laparoscopic or RALP surgery. The post-LAP renography drainage as well as the split renal function showed improvement in the majority of the cases at follow-up after 3–6 months. However, three patients showed an obstructive pattern. One of them was re-operated as he became symptomatic with lump formation.

Song et al. recently compared OP, laparoscopic-assisted extracorporeal pyeloplasty (LEXP), and RALP. They concluded that RALP had a shorter hospital stay (3.2 days) than their OP (6.3 days) and the LEXP (5.8 days), but the RALP group had a significantly longer operative time. Furthermore, they showed that the duration of analgesic use was shorter in the RALP group (1.1 days) as compared to the LEXP (2.4 days) and the OP (3.2 days). However, the mean age of their study cohort was 11 years, and they had a small sample size. Furthermore, LEXP involves a transperitoneal laparoscopic technique; however, our retroperitoneal LAP can replicate results similar to RALP without the hassle of longer operative duration, cost, restricted age group, and robotic surgical expertise.

The limitations of our study are first its retrospective nature; second, absence of comparison of data with our own results of open versus lumbotomy versus laparoscopic pyeloplasty, vis-a-vis LAP; and third, the difficulty encountered during postoperative pain assessment based on the objective FACES pain score and the duration of analgesic use.

**Conclusion**

LAP is a novel laparoscopic approach in patients with PUJO. It involves minimal retroperitoneal dissection, does not violate the peritoneum, has short learning curve, offers minimal postoperative pain, offers short duration of hospital stay, and offers excellent cosmetic results. Barring the limitation of an intrarenal pelvis which cannot be brought out from the lumboscopic incision for hand-sewing, abnormal renal anatomy, and obese children, it can be used in all children with PUJO who require surgery. It is safe even among newly graduated pediatric surgeons with preliminary laparoscopic experience as it involves the time-tested, extracorporeal hand-sewn pyeloplasty.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

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