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Laparoscopic pyeloplasty in infants: Single-surgeon experience

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Summary

Introduction
Although laparoscopic pyeloplasty (LP) is popular in children, its role in infants is less well defined. It is presumed that infant LP is technically challenging, with a higher failure rate.

Objective
To consider the hypothesis that LP can be safely and successfully performed in infants.

Methods
The records of 111 infants that underwent LP from March 2009 to December 2013 with at least 1 year of follow-up, were retrospectively reviewed. The results of pre- and postoperative imaging studies (ultrasound (US) and diuretic renogram (DR)), operative details and complications were noted. Pre- and postoperative parameters were compared using statistical software.

Results
The details are given in the Table. Laparoscopic pyeloplasty was successfully completed using three ports in all children without any open conversions. There were complications in 14 children (12%); 13 did not require a second intervention and the final outcome was not affected. One child (1%) had a re-obstruction with worsening hydronephrosis (HDN) 2 months after stent removal; she underwent successful redo LP. Median follow-up was 2 years; LP was successful in relieving the obstruction in 115 kidneys (99%); all had follow-up US, while 76 children had follow-up DR. The tests showed significant reduction in HDN (mean pre-operative anteroposterior diameter (APD) of renal pelvis, 34.4 mm (SD 13.4) versus mean post-operative APD 10.6 mm (SD 5.7), $p < 0.001$) and improved drainage in all kidneys. In unilateral cases, there was significant improvement in mean split renal function (SRF) of the operated kidneys (pre-operative 22.1% (SD 8.6) versus post-operative 35.6% (SD 11.4), $p < 0.001$).

Discussion
Over the past 6 years, all pyeloplasties at our unit have been performed by laparoscopy, irrespective of the age or weight of the child. In this large retrospective series, it is demonstrated that infant LP is a safe and successful operation; pyeloplasty in this age group not only resulted in significant reduction of hydronephrosis, but also in significant functional improvement. The results are comparable to published series comparing open pyeloplasty to laparoscopic and robotic-assisted laparoscopic pyeloplasty, which report success rates ranging from 70 to 96%, and complication rates ranging from 0 to 24% for open pyeloplasty.

Table Summary of data from 111 patients who underwent laparoscopic pyeloplasty (116 kidneys) Data given as *n* (%), or mean/median (range).

Sex (male)	92 (83)
Prenatal diagnosis	96 (86)
Left side	71 (63)
Bilateral	5 (4.5)
Surgical age (months)	3.8 (1–12)
Surgical weight (kg)	5.3 (3–10.5)
Surgical time (minutes)	106 (65–145)
Double J stent	109 (94)
Length of stay, median (days)	2 (2–8)
Intra-operative complications	2 (1.7)
Postoperative complications	12 (10.3)
Success of pyeloplasty	115 (99)
Failure requiring reoperation	1 (1)

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Introduction

Pyeloplasty is a common operation in paediatric urology. With the increasing use of antenatal ultrasound, many babies are being diagnosed with severe hydronephrosis requiring surgery at an early age, even before they become symptomatic. The first use of laparoscopic dismembered pyeloplasty (LP) for pelviureteric junction (PUJ) obstruction in children was reported in 1995 by Peters et al. [1]. This minimally invasive approach, as well as robot-assisted LP has slowly emerged as a safe, effective alternative to the gold standard, open pyeloplasty [2–6]. However, the situation is different in infants; limited working space and small ureteral calibre make LP in infants challenging. Additional concerns are the increased technical difficulty and a higher susceptibility to bowel injury, given the limited space of the infant abdominal cavity [7]. In an early series of laparoscopic pyeloplasty in 16 paediatric patients Tan observed two failures due to anastomotic stenosis in patients who were 3 months old at surgery [8]. While subsequent reports demonstrated feasibility irrespective of patient age and weight, reports of laparoscopic pyeloplasty in the infant population are limited to rather small series [7,9–12]. In our unit, infant LPs have been carried out since 2009, after experience had been gained with LP in older children for over 2 years. The results of a 4.9-year experience with LP in a large group of children younger than 12 months, with a minimum postoperative follow-up of 1 year, are reported.

Patients and methods

One hundred and eleven infants (116 kidneys) that underwent LP by a single surgeon from March 2009 to December 2013 and completed at least 1 year of postoperative follow-up are included in this retrospective review. Nine infants that underwent LP during the same period but were lost to follow-up are excluded. Data regarding patient details, preoperative and postoperative imaging studies, details of surgery and postoperative hospital course were noted and analysed.

Pre-operatively, all children underwent ultrasound (US) and a diuretic renogram (DR). Micturating cystourethrography was only performed in children with bilateral hydronephrosis (HDN) and in those children who presented with urinary infection. The parameters studied were: grade of HDN (according to Society of Fetal Urology (SFU)), anteroposterior diameter (APD) of the affected renal pelvis on US and split renal function (SRF) on DR using Tc99m diethylenetriamine pentaacetic acid (DTPA). Indications for surgery included loss of renal function in the context of obstruction on diuretic renography, worsening hydronephrosis with loss of renal cortex on serial US, and febrile urinary tract infection with evidence of obstruction on DR. In general, for unilateral hydronephrosis (HDN), an SRF $<$40% with an APD $>$20 mm or SFU grade 4 HDN was considered an indication for pyeloplasty. In bilateral obstruction, the more severely affected kidney was operated first. The contralateral kidney was operated later if the HDN worsened during follow-up.

The technique used for transperitoneal LP is as follows; some of the technical details have already been published by us previously [13]. The baby is placed in a 60-degree modified lateral decubitus position with the affected side up. All pressure points are padded, and the table remains flat, without flexion. Three ports are used; a 3 or 5 mm umbilical telescopic port and two 3 mm ports in the epigastrium and hypogastrium. It has been our observation that in most babies with gross hydronephrosis, the PUJ is close to the midline; hence the ports are placed close to the midline. The PUJ is usually approached by reflecting the hepatic flexure of the colon on the right side; a transmesocolic approach is preferred on the left side. The PUJ is dissected; a hitch stitch is placed to stabilize the renal pelvis and the PUJ is dismantled along with a cuff of renal pelvis which is used to handle the ureter during the rest of the procedure; the normal ureter itself is never grasped with any instrument. Except in a very large pelvis (APD $>$50 mm), no attempt is made to trim the dilated pelvis. The ureter is spatulated with straight scissors on its lateral aspect. Pelviureteric anastomosis is then performed with two running 6/0 or 5/0 polyglycolic acid sutures for the anterior and posterior walls. A round-bodied needle is preferred for suturing. After the completion of the posterior wall suturing, a 3F double J stent is placed in an antegrade fashion; the stent is removed by cystoscopy after 4–6 weeks. In some small babies, even a 3F stent may not go across the VUJ; in such a situation, a nephrostomy (10F Foley catheter) and a transanastomotic external stent (3F ureteric catheter) are used; these remain in place for 5–7 days before they are removed in the clinic. The same technique of dismembered pyeloplasty is followed even in the presence of a lower pole crossing vessel; the pelviureteric anastomosis is performed anterior to the vessel. A transurethral catheter is placed at the end of surgery; it is left in place for 48 h, after which it is removed and the child is sent home. Low-dose antibiotic prophylaxis (cephalexin) is continued for 2–3 months after the surgery.

During follow-up, renal US is done 3–6 months after the surgery, and DR 3–6 months later, especially if the preoperative function was compromised. After this, a yearly follow-up with US is advised. Outcome measures included operative time, hospital stay and resolution on follow-up US and/or DR. Treatment failure was defined as inability to complete the intended procedure, persistent radiographic evidence of obstruction and/or the need for definitive adjunctive procedures. Statistical analysis was done using statistical software; pre- and postoperative parameters were compared using Student's *t*-test and $p < 0.05$ was considered significant.

Results

One hundred and six children underwent unilateral LP, while five underwent bilateral LP; in bilateral pelvi-ureteric junction obstruction, the worst kidney was operated on first followed by the contralateral kidney 2–6 months later. Table 1 lists patient demographics. Preoperatively, all kidneys had SFU grade 3 (37%) or 4 (63%) HDN and all (except one) had a renal pelvic anteroposterior diameter $>$20 mm; all kidneys had unequivocal obstruction (post-lasix $t_{1/2}$