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Early Experience with Laparoendoscopic single-site pyeloplasty in Children

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Abstract *Objective:* To present our initial clinical experience with laparoendoscopic single-site surgery (LESS) for ureteropelvic junction obstruction (UPJO) in the pediatric age group.
Material and methods: Between January and December 2009, 11 consecutive pediatric patients underwent treatment of primary UPJO via a laparoscopic approach. All patients underwent LESS-pyeloplasty. Radiographic success was defined as improvement of hydronephrosis with a patent UPJ on intravenous urography, or improved drainage on diuretic renal scan.
Results: The mean age of patients was 10 (2—17) years. Crossing lower pole vessel and severe adhesion were found in three (27%) and eight (73%) cases, respectively. The mean operating-room time was 182.5 (160—300) min, and the mean estimated blood loss, including urine, was 97.3 (80—160) mL. Mean hospital stay was 2 (1—3) days. Wound infection at port site and urinary infection occurred in one case each. All parents seem extremely satisfied with postoperative cosmetic outcome. The success rate was 100%.
Conclusion: Preliminary experience with LESS-pyeloplasty in children suggests that outcomes are comparable to conventional laparoscopic surgery but with improved cosmesis; however, a larger study is necessary to confirm these findings and to determine if there are any benefits in postoperative pain or recovery.

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Introduction

Ureteropelvic junction obstruction (UPJO) is one of the most common causes of obstructive uropathy in children. Conventional open dismembered pyeloplasty remained the standard surgical treatment for both adult and pediatric patients until the mid-1980s, when the attendant morbidity of a large incision led urologists to explore minimally invasive surgeries [1]. Since the initial reported experience of laparoscopic pyeloplasty in children in 1995 [2], acceptance of this approach as a minimally invasive technique to correct UPJO in children has grown rapidly [3].

In the field of minimally invasive surgery, there has been a trend toward minimizing the number of incisions and ports required, and this has led to the development of laparoendoscopic single-site surgery (LESS). There are theoretical advantages to this approach including less postoperative pain, a faster convalescence period, and improved cosmetic outcome.

Since the initial report of single-port nephrectomy in 2007 by Rane et al. [4], urologists have successfully performed various procedures in adults using LESS, including donor nephrectomy [5], pyeloplasty [6], and ureterolithotomy [7]. This report is the first to describe LESS for pediatric pyeloplasty. The purpose of the present study was to present our initial experience of LESS-pyeloplasty (LESS-P) in children.

Material and methods

Patient selection

From January to December 2009, a total of 11 children with UPJO were selected for LESS-P. They were suffering from recurrent pyelonephritis, intractable ipsilateral flank pain, hematuria and asymptomatic hydronephrosis with failed expectant management.

The indications for surgery included more than 10% decrease in split renal function, split renal function less than 40% with progressive hydronephrosis, and recurrent pyelonephritis despite prophylactic antibiotherapy. Preoperative work up included 99m Tc DTPA diuretic renal scan, renal ultrasonography and/or intravenous urography (IVU). All patients had surgery after obtaining institutional review board approval from the ethical committee, and informed patient consent.

Surgical procedure

All patients underwent cystoscopy with retrograde ureteral catheterization to define the stricture length and location more precisely and to rule out obstruction distal to the UPJ at the beginning of the procedure. After performing retrograde open-end stent placement cystoscopically, this stent was attached to a Foley catheter inserted into the bladder. All procedures were carried out by the same experienced laparoscopic surgeon (VT).

The patient was placed in a 45° flank position for transperitoneal surgery after induction with general endotracheal anesthesia. A 2-cm semilunar-shaped skin incision was concealed completely within the umbilicus, and deepened to the anterior rectus fascia, where a 2.5-cm median fascial incision was made, the peritoneum was incised, and the SILS™ Port (Covidien, Norwalk, CT, USA) was deployed. Then pneumoperitoneum was established. All LESS-P procedures were performed through this intraumbilical single-access multichannel laparoscopic port. The SILS Port was placed intraperitoneally with the help of a clamp (Fig. 1).

The instruments were inserted through one of the 5-mm channels and the 12-mm channel of the SILS Port. A 5-mm 30° high-definition rigid laparoscope integrating different cameras (Karl Storz, Tuttlingen, Germany and Gimmi, Tuttlingen, Germany) was used along with two working instruments. During the procedure a combination of flexible forceps and scissors (Cambridge Endoscopic Devices, Cambridge, MA, USA and Tyco Healthcare Group Lp, Mansfield, MA, USA) and conventional laparoscopic (straight) instruments (e.g. scissors, ultrasound scissors, bipolar forceps) were used to perform the procedures as necessary.

The dissection was begun with mobilization of the colon on the affected side medially by incising along the avascular line of Toldt. The straight instrument in the left hand was used to dissect the tissue while the peritoneal incision along the line of Toldt was performed with roticulating laparoscopic scissors held in the right hand (Cambridge Endoscopic Devices) (Fig. 2). After Gerota's fascia was opened, dissection was carried down to the level of the kidney. The adventitia around the proximal ureter and UPJ was cleared. After complete laparoscopic mobilization of the UPJ, the renal pelvis and the proximal ureter were brought out to the abdominal wall by hitching the redundant pelvis.

A standard Anderson-Hynes dismembered pyeloplasty was performed. The strictured region was excised sharply. The ureter was spatulated on its lateral aspect, and if necessary the redundant renal pelvis was excised. The excision of the strictured region and the ureteral spatulation were performed using the roticolating scissors. When UPJ obstruction was caused by a crossing vein or small artery, the vessel was dissected free. However, if the crossing vessel was a large arterial branch, the renal pelvis and ureter were transposed to the anterior of the vessel. The anastomosis between the ureter and the renal pelvis was performed with a 4-0 Vicryl suture with an atraumatic

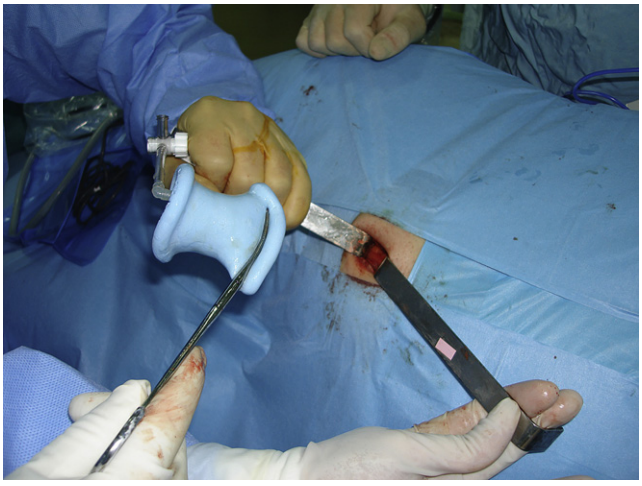

Figure 1 SILS-Port placed intraperitoneally with the help of a clamp.

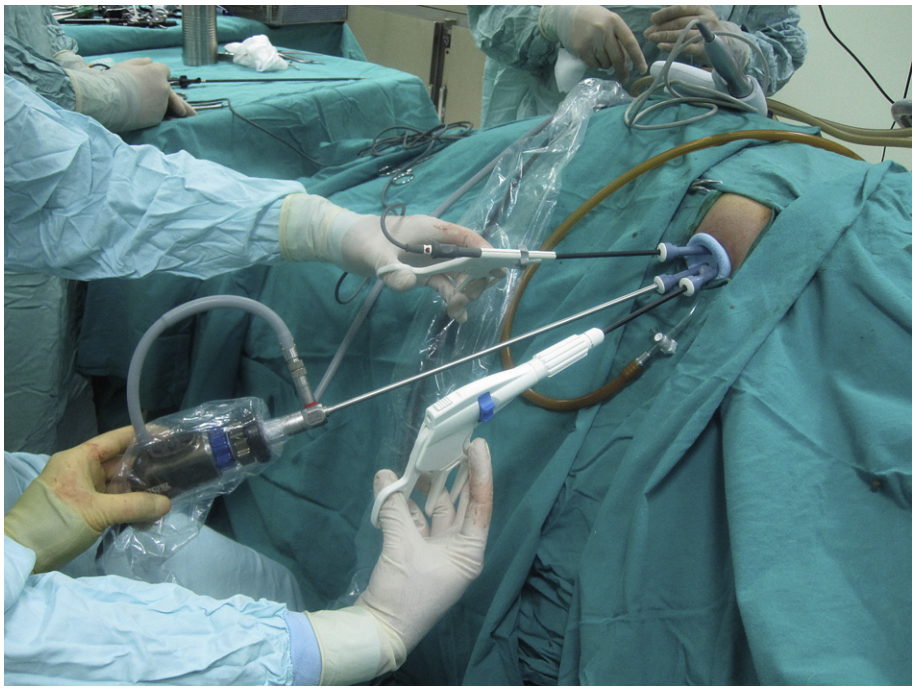

Figure 2 The straight instrument was used in the left hand and roticulating laparoscopic scissors in the right hand.

needle in a running fashion. After completion of the posterior wall anastomosis and before completion of the anterior wall anastomosis, a retrograde double J stent was advanced over the previously placed 0.035-inch guidewire, and the proximal end of the double J stent was passed into the renal pelvis. After the anastomosis was completed, a closed suction drain was placed through the SILS Port site. The pneumoperitoneum was reduced and the port site was closed. A Foley catheter remained in situ in all patients for 24 h after surgery. Prophylactic antibiotics (preoperative single dose of third-generation cephalosporin) were routinely administered to all patients. The medication used for analgesia was meperidine, which was administered intramuscularly as a 50 mg dose each time, when necessary.

The urethral catheter was removed the next day. The closed suction drain was subsequently removed if the drainage output had not increased and was $<$20 mL in 24 h after removal of the urethral catheter. At discharge, all patients were treated with third-generation cephalosporin as prophylactic antibiotic until removal of the double J stent on the 10th day.

Assessment of surgical outcome

Patients were followed after ureteral stent removal with renal ultrasonography and 99m Tc DTPA diuretic renal scan and/or IVU 3 months later. Radiographic success was defined as symptom resolution with hydronephrosis improvement on sonographic evaluation and/or improvement of renal function and drainage of the affected kidney as verified by 99m Tc DTPA diuretic renal scan or IVU.

Results

During the study period, a total of 11 patients (7 male and 4 female) underwent LESS-P. Mean patient age was 10 years (range 2—17 years). The patient characteristics and surgical demographics are presented in Table 1. All procedures were technically successful without conversion to standard laparoscopy or open surgery. No additional port was used for tissue retraction, and all procedures were solely performed through the SILS Port. In two patients an additional prolene mesh was designed as a hammock and attached to the abdominal wall with the help of sutures and Hem-o-lock clips for liver retraction, for right-sided procedures. Sutures for liver retraction were passed transabdominally by 60-mm straight needle (Caprosyn, Covidien).

Anderson-Hynes dismembered pyeloplasty was performed in all patients. Crossing lower pole vessel and severe adhesion were found in three (27%) and eight (73%) cases, respectively (Table 1).

Table 1 Patients and surgical demographics.

No. of patients	11
Age, years	10 (range 2—17)
Sex (M/F)	7/4
Side (L/R)	6/5
No. of crossing vessels	3 (27%)
No. of severe adhesions	8 (73%)
Success rate (improvement on imaging), %	100
Hospital stay, days	2 (1—3)
Follow-up, months	6 (4—8)
Blood loss, mL	97.3 (80—160)
Operative time, min	182.5 (160—300)
Complications	
Wound infection	1 (9%)
Urinary infection	1 (9%)

M; male, F; female, L; left, R; right.

Mean operative time for the procedure, which includes cystoscopy with retrograde ureteral open-end stent placement, was 182.5 min (range 160—300 min). Mean estimated blood loss, including urine, was 97.3 mL (range 80—160 mL). Mean hospital stay was 2 days (range 1—3 days). There was no major complication. The two minor complications, of wound infection at port site and urinary infection, were managed with conservative care.

The mean follow-up period was 6 months (4—8 months). Significant improvement of hydronephrosis on intravenous pyelogram and noticeable isotope material clearance on 99m Tc DTPA scan had occurred in all cases at the 3-month imaging studies. The success rate was 100%.

Discussion

UPJO is the most common congenital malformation of the ureter, and the dismembered pyeloplasty described by Anderson and Hynes [8] is the most widely used procedure, with a success rate higher than 90%. Schuessler et al. [9] first described the Anderson-Hynes dismembered pyeloplasty via a laparoscopic approach. Laparoscopic dismembered pyeloplasty has developed worldwide as the first minimal option to match the success rate of open procedures [10]. It has also several advantages over traditional open surgery, including decreased postoperative pain, improved cosmesis and reduced hospital stay.

Recently, Piaggio and colleagues [11] compared the results of pediatric laparoscopic pyeloplasty and open pyeloplasty, and have indicated that although the transperitoneal laparoscopic pyeloplasty is more time-consuming surgery than open pyeloplasty, it may provide a better outcome with fewer complications and better cosmesis.

Refinement and modification of laparoscopic instrumentation has resulted in a substantial increase in the use of LESS in urology over the past 3 years. Since the initial report of single-port nephrectomy in 2007, various urologic procedures with LESS, including partial nephrectomy, ureterolithotomy, and adrenalectomy, have successfully been performed.

The first clinical experience of dismembered pyeloplasty with LESS was reported by Desai et al. [6]. Recently, a study comparing 14 LESS-P cases with conventional laparoscopic pyeloplasty in an adult population was reported by Tracy et al. [12]. No differences in minor or major complication rate, narcotic analgesic usage, or postoperative hospitalization time were observed between LESS-P and conventional laparoscopic pyeloplasty. But the operative time and the estimated blood loss were significantly lower in patients undergoing LESS-P. In our series, mean operating-room time was 182.5 min, mean estimated blood loss was 97.3 mL, and there were no major complications.

There is evidence to suggest that visible scarring in children can result in reduced self-esteem, impaired socialization skills, and lower self-ratings of problem-solving ability [13]. LESS-P is performed via a single incision through the umbilicus; therefore, there is no psychosocial impact of visible abdominal scarring. LESS-P clearly resulted in excellent cosmesis (Fig. 3). Although our patients and parents seem extremely satisfied with their postoperative cosmetic outcomes, scar satisfaction was not considered in the present study. We have not yet quantified or compared scar satisfaction with a validated questionnaire.

Figure 3 Postoperative appearance (after 2 weeks).

Although improved cosmesis is the most apparent benefit of LESS-P, there may be benefits regarding postoperative pain and the recovery period. In the present study, narcotic analgesic usage and postoperative hospitalization time mirrored that of conventional laparoscopic pyeloplasty. However, the number of patients in this series was inadequate to make any definitive conclusions regarding the effect of LESS-P on pain and recovery, and this is the subject of a future larger, prospective, comparative study.

There is significant controversy regarding the role of aberrant lower pole crossing vessels in the pathogenesis of UPJO. While these crossing vessels are associated in up to 40% of adult patients with UPJO, this association in pediatric UPJO is as low as 15%. We found crossing vessels over the UPJ in three patients (27%). In one of the cases, the UPJO was caused by a crossing vein, and this vessel was dissected free. In the other cases, the crossing vessel was a large arterial branch; therefore the renal pelvis and ureter were transposed to the anterior of the vessel.

The dismembered pyeloplasty is typically associated with a 90%—95% success rate [14,15]. After a 6-month follow-up period, our success rate was 100%, equivalent to that reported by Tracy et al. [12].

Some authors think that the previous insertion of a double J catheter by means of cystoscopy increases the surgical time, but may avoid failure of antegrade placement of a double J catheter intraoperatively. Others do not advocate insertion of a ureteral catheter before surgery because they think that antegrade placement involves no great technical difficulty and having a distended pelvis at the time of surgery facilitates dissection of the UPJ. We think that antegrade placement of the ureteral catheter during LESS-P is technically demanding and time consuming; therefore, retrograde placement of a double J catheter during the LESS-P procedure was performed in all cases. The bladder catheter was left in

for 24 h, with the purpose of ensuring low intravesical and renal pressures, thereby avoiding double J urinary reflux during micturition.

In conclusion, pyleloplasty is a reconstructive procedure typically performed in the younger patient population, where more importance may be placed on the better cosmesis offered by a single incision hidden in the umbilicus. With the advent of single-port and laparoscopic instrument technology, the LESS-P, as a minimal invasive surgery, may take the place of the standard laparoscopic pyeloplasty, and may be a new choice for the treatment of UPJO. This early experience suggests that outcomes are comparable to conventional laparoscopic surgery but with improved cosmesis; however, larger groups of patients are necessary to confirm these findings and to determine if there are any benefits in terms of pain or recovery time.

Conflict of interest/funding

None.

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