

Laparoscopic versus open pyeloplasty: a multi-institutional prospective study

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Introduction To prospectively compare the perioperative and functional outcomes of laparoscopic (LP) and open pyeloplasty (OP) in three academic institutions.

Material and methods Between September 2012 and September 2016, 102 patients with primary uteropelvic junction obstruction (UPJO) underwent pyeloplasty (51 LP and OP for the other 51 patients). Demographic data, perioperative parameters, including operative time, estimated blood loss, complications, length of hospital stay, and functional outcome were compared, and SF-8 Health Survey scoring was recorded for each group.

Patients were followed up by ultrasound (US) and /or intravenous urography (IVU) at 3, 6 and 12 months. A MAG-3 renal scan was performed at 3 months postoperatively.

Results The mean operative time was significantly shorter in the open group (153.2 ±42 min vs. 219.8 ±46 min; P <0.001). Compared to OP, the mean postoperative analgesia (Diclofenac) requirement was significantly less in the LP group (101.1 ±36 mg vs. 459.1 ±123 mg; P <0.001). The median hospital stay was significantly shorter for LP (2.7 ±1.8 days vs. 9.09 ±7.3 days; P <0.001). The median follow-up period was 19.7 months (12–28 months). The success rate was 96.1% in the OP group and 94.1% in the LP group.

Conclusions In spite of being a technically demanding procedure, LP offers faster recovery and higher patient satisfaction. In our hands, OP still has a shorter operative time and relatively lower retreatment rate.

Key Words: ureteropelvic junction obstruction ◊ laparoscopy ◊ pyeloplasty

INTRODUCTION

Since the introduction of laparoscopic pyeloplasty (LP) by Schuessler et al. in 1993, the procedure has gained wide popularity and many centers have compared it to open pyeloplasty (OP), the gold standard for treatment of uteropelvic junction obstruction (UPJO) [1]. Several large case series and nonrandomized comparisons have shown that the success rates of both OP and LP are exceeding 90% [2, 3]. They stated that the morbidity and complications are less with LP with comparable functional outcomes [4, 5].

It progressed from a conventional transperitoneal to a retroperitoneal approach, and recently to the laparoendoscopic single site (LESS) and robot-assisted techniques [6].

Excellent functional and objective outcomes are still obtained by the standard OP techniques especially with miniaturization of the incisions and applied regional anesthesia. Also, LP is technically demanding, and OP is less costly [7, 8]. Herein, we prospectively and contemporarily compare the perioperative and functional outcomes of LP and OP in three academic tertiary institutions.

MATERIAL AND METHODS

Between September 2012 and September 2016, 102 patients with primary UPJO underwent LP (No. 51) and OP (No. 51). Patients with previous failed repairs of UPJO, those with split renal function <15%, and pregnant women were excluded from the study. The preoperative diagnosis included a detailed history, thorough examination with attention to the nature of pain, urinalysis and culture when indicated, ultrasound (US), intravenous urography (IVU), and renal scintigraphy. The study was approved by the institutional ethics committees of the 3 centers.

Under general anesthesia, retrograde pyelogram (RP) and an indwelling ureteral stent (6F in caliber and its length determined according to the patient's height) were performed in the lithotomy position, then the patient was positioned in a 45° modified lateral decubitus position. LP was performed by the transperitoneal approach, where a pneumoperitoneum was created by a Veress needle inserted in Palmer's point or through the umbilicus. A standard 3-trocar technique was utilized. For right-sided cases; an additional 5-mm port was placed in the midline for a liver retractor. The Toldt's line was incised and the ureteropelvic junction was identified. Complete dismembered Anderson-Hynes pyeloplasty with continuous sutures was performed and an intraperitoneal drain was left.

OP was performed through a retroperitoneal flank incision. All cases underwent Anderson-Hynes pyeloplasty on the indwelling ureteral stent with transposition of the aberrant vessel if present. The Foley's catheter was removed usually by the third postoperative day (POD) and the drain by the fourth. The ureteral stent was removed after 4 weeks.

A MAG-3 diuretic renogram was performed 3 months after surgery together with US, and IVU if there was a significantly dilated pelvicalyceal system. The follow up continued at 6 and 12 months with US ±IVU. Success was defined as the absence of or significant improvement of symptoms as determined by SF-8 Health Survey scoring without evidence of obstructed drainage on the MAG-3 diuretic renogram.

We used Student's t-test for comparing continuous data while the Mann Whitney test was used for statistical analysis of asymmetrically distributed variables. A Chi-square test was applied to categorical variables. Fisher's exact test was conducted for nominal variables with small sample size. A P value was considered significant at <0.05 using SPSS version 20 (SPSS Inc., Chicago, IL, USA).

RESULTS

Demographics of the patients are shown in Table 1. Table 2 shows the perioperative results. The mean operative time was significantly shorter in the open group (153.2 ±42 min v 219.8 ±46 min; P <0.001). Postoperative pain was measured using the visual analog scale. Compared to OP, the mean postoperative

Table 1. Patients' demographic data

Item	OP	LP	P value
Number	51	51	
Mean age (years)	38.96	43.16	0.26
Gender:			
Male	27	26	
Female	24	25	
Side:			
Right	22	27	
Left	29	24	
Mean BMI (Kg/m ²)	24.4	25.7	0.099
Indications:			
Renal pain	25	26	
Asymptomatic	14	12	
Hematuria	3	5	
UTI	4	5	
GIT symptoms	5	3	
Mean split renal function	38.68%	39%	0.689

OP – open pyeloplasty; LP – laparoscopic pyeloplasty; BMI – body mass index; UTI – urinary tract infections; GIT – gastro-intestinal tract

Table 2. Perioperative results

Item	OP	LP	P value
OT (min) mean ±SD	153.2 ±42	219.8 ±46	<0.001*
Aberrant vessel	8	11	0.08
Median hospital stay (days)			
Mean ±SD	9.09 ±7.3	2.7 ±1.8	<0.001*
Analgesic requirement (Diclofenac) mg Mean ±SD	459.1 ±123	101.1 ±36	<0.001*
Renal split function improvement (%) Mean ±SD	1.23 ±2.59	0.98 ±2.3	0.6
Retreatment	2	5	0.08

OT – operative time; SD – standard deviation; Hb – hemoglobin; EGP – Egyptian pound

Table 3. Complications in the present series classified according to the modified Clavien system

Grade	Complication	Overall	OP	LP	P value
I	Fever	7 (6.9%)	5	2	0.08
I	Ileus	3 (2.9%)	1	2	0.32
I	Wound infection	3 (2.9%)	3	0	0.08
II	Urinary leakage	5 (4.9%)	2	3	0.32

OP – open pyeloplasty; LP – laparoscopic pyeloplasty

analgesia (Diclofenac) requirement was significantly less in the LP group (101.1 ± 36 mg v 459.1 ± 123 mg; $P < 0.001$). The median hospital stay was significantly shorter with LP (2.7 ± 1.8 days v 9.09 ± 7.3 days; $P < 0.001$). Histopathology of the resected stenotic segment was not routine in our study, for the cases performed showed nonspecific inflammatory cells infiltrate with extensive fibrosis and scanty muscle layer.

The complications in the present series were classified according to the modified Clavien system and summarized in Table 3. Regarding fever, ileus, wound infection and urinary leakage, there was no statistical difference between the two procedures. The cases with urinary leakage were managed conservatively by prolongation of the Foley's catheter together with the drains, and the Catheter was removed one day before the drain.

The standardized quality of life questionnaire (SF-8) data was analyzed and revealed no statistically significant difference between the LP and OP groups. However, when the two SF-8 components' scores (physical component and mental component) were analyzed for each group separately, preoperatively and postoperatively (at 3 and 6 months), there was a statistically significant change with ($P < 0.001$).

Restenosis occurred in 2 and 5 cases in the OP and LP groups respectively ($P = 0.08$). Those after OP were managed by retrograde endopyelotomy (RE). Three cases after LP were managed successfully by RE. Open spiral (Culp-DeWeerd) flap pyeloplasty was performed in the other 2 cases. An aberrant vessel was reported in 8 (15.7%) and 11 (21.6%) cases in the OP and LP groups respectively. The overall success rate was not significantly different between both groups (96.1% in the OP and 94.2% for LP).

DISCUSSION

LP as a treatment option for UPJO has the advantage of reconstruction under magnified vision with low morbidity regarding the postoperative analgesia and shorter hospital stay. However, it is still a more lengthy procedure with higher re-treatment rate as compared to OP. In contrast, OP, especially with mini-incisions, has the advantage of shorter operative time and relatively lesser restenosis rate.

We discuss a debatable topic; the comparison between laparoscopic pyeloplasty, which became the treatment of choice for ureteropelvic junction obstruction in many centers worldwide, and open pyeloplasty, which still has its place in our locality where the facilities and experience may not be present in all centers.

Since its introduction by Foley in 1937 and modified by Anderson and Hynes, OP is considered the stan-

dard treatment for UPJO with success rates of more than 90% [9]. LP, robotic pyeloplasty, and the other minimally invasive endoscopic procedures are introduced to overcome the main complications of OP, mainly the post-operative pain, the lengthy hospital stay and incision site scar [10].

Multiple non-randomized studies compared the standard OP and LP, favoring LP in regards to the incision and its related complications [11, 12]. Other studies performed mini-incision (≤ 8 cm) and showed no significant differences in the wound-related complications and postoperative analgesia [13, 14]. In our study, there was a significantly lower analgesic requirement in the LP group because the mini-incision was not our routine practice.

A recent meta-analysis stated that the restenosis and re-do-pyeloplasty rate were twice more frequent in comparison to OP and they hypothesized that loss of tactile sensation and more tissue trauma at the site of anastomosis are the cause [15]. Our study matches these results as there were 5 cases re-operated in the LP group vs. 2 cases only in the OP group.

According to the literature, a crossing vessel is a frequent finding in UPJO [16]. This is in good agreement with our results since we found an aberrant vessel in 8 OP cases and 11 cases in LP. The magnification of the operating field and the transperitoneal approach that easily detect the ventrally located aberrant vessels are the main reasons for the higher rate in the LP group [17, 18].

Both procedures did not differ in regards to degree of split function improvements postoperatively and the overall success rate (96.1% for OP vs. 94.2% for the LP). This indicates the nearly equal efficacy of both procedures in the treatment of UPJO.

Robotic assistance significantly helped the reconstructive procedures, mainly in LP. A recent meta-analysis of comparative studies of robot-assisted LP (RALP) and the conventional LP stated no significant difference between both techniques regarding the operative time, urinary leakage, and the overall success rates [19].

The limitations of our study are a lack of randomization and the small sample size which was not high enough to reduce the impact of statistical error during the analysis.

LP is still a technically demanding procedure, with comparable results to OP. It carries a better and faster recovery. On the other hand, OP, especially with mini-incision, has a shorter operative time, smaller cost and lower re-treatment rate.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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