

### Mini-laparoscopic Pyeloplasty in Adults: Functional and Cosmetic Results

Eyyup Sabri Pelit<sup>1\*</sup>, Halil Ciftci<sup>1</sup>, Bülent Kati<sup>1</sup>, Ismail Yagmur<sup>1</sup>, Eser Ordek<sup>1</sup>, Erkan Arslan<sup>1</sup>, Ercan Yeni<sup>1</sup>

**Purpose:** The study objective was to evaluate the safety and efficacy of mini-laparoscopic pyeloplasty (mLP) in an adult population and to demonstrate the functional and cosmetic results.

**Methods:** Data for 29 patients (19 men and 10 women) undergoing mLP for ureteropelvic junction obstruction (UPJO) from May 2014 to December 2016 in Turkey were collected in this prospective study. Inclusion criteria were age  $\geq 18$  years, body mass index (BMI)  $\leq 30$  kg/m<sup>2</sup> and primary UPJO, and no previous surgery on the affected kidney or previous abdominal surgery. Postoperative Visual Analogue Scale scores and the Patient Scar Assessment Questionnaire (PSAQ) were used. Demographic data, perioperative parameters, complications, and postoperative functional and cosmetic results were recorded.

**Result:** Twenty-nine adults with a mean age of  $29.4 \pm 10.2$  years (19–38 years) were included. The patients' mean BMI was  $22.4 \pm 4.3$  kg/m<sup>2</sup> (a range of 16–29 kg/m<sup>2</sup>). Mean operative time was  $119 \pm 28.5$  minutes (85–144 minutes). Major complications were not observed, as per the Clavien-Dindo classification of surgical complications (grades IV–V). The mean VAS score was  $1.2 \pm 0.2$  points. Functional obstruction was reported in one patient on renal scintigraphy at 12 months postoperatively. The success rate of mLP was 97%. The minimum and maximum PSAQ scores at month 3 postoperatively were 24 and 86, respectively. All the patients were satisfied with the intervention and with their cosmetic results.

**Conclusion:** mLP is a safe, effective and feasible treatment method for UPJO in adult patients. This treatment modality offers excellent cosmetic and functional results following treatment for UPJO.

**Keywords:** laparoscopy; pyeloplasty; ureteropelvic junction obstruction

#### INTRODUCTION

Ureteropelvic junction obstruction (UPJO) is the most common congenital abnormality of the kidney and is responsible for flank pain, recurrent urinary infections, hydronephrosis and the loss of renal function.<sup>(1)</sup> Until recently, open pyeloplasty (OP) was the standard surgical treatment modality for UPJO.<sup>(2)</sup> However, with the development of laparoscopic devices and surgical technology, laparoscopic pyeloplasty (LP) has become the standard surgical treatment method globally. LP is a safe and effective, minimally invasive method for the treatment of UPJO.<sup>2</sup> Parallel to the improvement in surgical techniques, minimally invasive methods have evolved to reduce surgical trauma and obtain better cosmetic results. Schuessler and Kavoussi described the first case of laparoscopic dismembered pyeloplasty in 1993.<sup>(3,4)</sup> Mini laparoscopy procedures are defined as the use of instruments with a diameter of  $\leq 3$  mm. Mini-laparoscopic pyeloplasty (mLP) is used in numerous surgical procedures in urology and other surgical branches.<sup>(5-7)</sup>

The objective of the current study was to demonstrate the safety and efficacy of mLP in an adult population and to report on the functional and cosmetic outcomes. To the best of our knowledge, this study is one of the largest series of mLP performed in overweight adult population.

#### METHODS

A prospective study was conducted of 29 adult patients (19 men and 10 women) undergoing mLP for UPJO at a referral tertiary institution between May 2014 and December 2016 in Turkey. This study was approved by the ethic committees of Harran University, and written informed consent was obtained from all the participants. Inclusion criteria were age  $\geq 18$  years, body mass index (BMI)  $\leq 30$  kg/m<sup>2</sup> and primary UPJO (no prior surgical interventions for obstruction), and no previous surgery on the affected kidney or previous abdominal surgery.

A complete blood count, serum biochemistry, and urine analysis and culture was performed for the patients prior to surgery, in whom a sterile urine culture was determined preoperatively. Urinary tract infections were treated according to the biosensitivity of the urine culture. The patients were evaluated with renal ultrasound, non-contrast computed tomography or intravenous pyelogram (IVP), and diethylenetriaminepentaacetic acid scintigraphy with a diuretic preoperatively. All patients had the T1/2  $>20$  min (obstructive pattern) in renal scintigraphy. The patients received intravenous antibiotic prophylaxis an hour before undergoing surgery.

The patient demographic data, perioperative parameters such as operation and anastomosis time, crossing vessel and transmesocolic approach percentage and complications, as well as functional and cosmetic re-

<sup>1</sup>Harran University Faculty of Medicine, Department of Urology.

\*Correspondence: Haran Üniversitesi Tıp Fakültesi Üroloji Anabilim Dalı, Osmanbey Kampüsü 61080/Şanlıurfa/Türkiye

Tel:+90 506 388 3186. E-mail: dreyyupsabri@hotmail.com.

Received December 2017 & Accepted September 2018

**Table 1.** Demographic data and preoperative parameters of the patients.

Mean age (years), SD	29.4 (10.2)
Male/Female	19/10
Mean BMI, SD	22.4 (4.3)
Mean ASA score, SD	1.4 (0.4)
Laterality L/R, n/%	17/12 (58.6%/41.4%)
Hydronephrosis on CT or IVP	
Grade 3 n/%	24 (82.7%)
Grade 4 n/%	5 (17.3)
Flank pain n/%	21 (72.4%)
Recurrent UTI n/%	4 (13.6%)

sults postoperatively, were recorded. The study participants routinely received intravenous paracetamol (1 g) postoperatively. Any additional analgesic requirements were recorded. The Visual Analogue Scale (VAS) was employed to measure the amount of pain experienced by the patients postoperatively, where a score of 1 was representative of the absence of pain and a score of 10 was indicative of the most unbearable pain imaginable. The VAS scores were determined at 4, 12 and 24 hours postoperatively, and then daily from day 1 postoperatively until discharge.

Anderson-Hynes transperitoneal LP (three port) was performed by the same surgeon. The patient was placed in a 45–60° lateral decubitus position under endotracheal anaesthesia. A Veress® needle was used to obtain pneumoperitoneum using 12–14 mmHg of intra-abdominal pressure. The first 5 mm camera port (Karl Storz, Tuttlingen, Germany) was set 2 cm lateral to the umbilicus, depending on the patient anatomy. Two 3 mm ports (Karl Storz) were placed under direct vision along the midclavicular line (Figure 1). Toldt's fascia was incised and the standard colon retracting approach was used. However, when possible, in the case of a left UPJO, a transmesocolic approach was used. The ureteropelvic junction (UPJ) was identified and the dilated renal pelvis was carefully dissected down to the proximal ureter. The pelvis was cut with "cold" scissors through the lowermost trocar. If anterior crossing vessels are present, in all of the cases the ureter and the renal pelvis was transposed ventrally to the vessels for completion of the anastomosis.

The UPJ was left attached to the ureter for manipulation during spatialisation, suturing and double J stent insertion. A guidewire was sent from the proximal ureter to the bladder from the uppermost trocar, under the guidance of a 6 F Amplatz dilator. A 4.7 F 24/26 cm DJ stent was then advanced over the guidewire in an antegrade manner. The redundant pelvis was extracted. Sutures were inserted into the abdomen from 5 mm camera port. The dependent portion of renal pelvis was anastomosed to the apex of the spatulated ureter using the interrupted suturing technique (4-0 or 5-0 Vicryl® sutures) (Ethicon, Somerville, USA). Subsequently, anastomosis was completed using a continuous suture

**Table 2.** Perioperative parameters of the patients.

Mean Operative time (min), SD	96 (18.5)
Mean Time to complete anastomosis (min), SD	18.9 (5.6)
Mean Blood loss (ml), SD	-
Crossing vessels n/%	9 (31.04%)
Transmesocolic approach on the left side	7 (41.1%)
Conversion to hybrid procedure	-
Conversion to open procedure	-
Peroperative complications	-

**Table 3.** Postoperative and functional results of the patients.

Mean VAS score 4 h after the surgery, SD	1.6 (0.1)
Mean VAS score 12 h after the surgery, SD	0.7 (0.2)
Mean VAS score 24 h after the surgery, SD	0.4 (0.1)
Mean VAS score POD 1 to discharge, SD	1.2 (0.2)
Extra analgesic requirement, n/%	4 (13.7%)
Mean catheter removal time, days, SD	2.8 (0.8)
Mean drain removal time, days, SD	2.3 (0.4)
Mean hospitalisation time, days, SD	3.3 (0.7)
Mean DJ stent removal time, days, SD	30 (4.5)
Hydronephrosis on IVP at postoperative 6. Month	
Grade 1 n/%	12 (41.3%)
Grade 2 n/%	4 (13.7%)
Grade 3 n/%	-
Grade 4 n/%	-
T 1/2 < 20' at renal scintigraphy, n/%	28 (96.5%)
Symptom (pain/UTI) relief after surgery, n/%	25 (100%)
Minor (Clavien I-III) complications, n/%	3 (10.3%)
Major (Clavien IV-V) complications, n/%	-

technique. Excised segment of ureter was removed from 3 mm port. A 10 F drain was inserted on completion of the surgery. One separate suture closure was required at the camera port sites and a small, single adhesive strip was used at the other port sites.

The patients were re-evaluated as outpatients on day 15 postoperatively. The DJ stents were removed one month postoperatively. A standard scoring system used by plastic and reconstructive surgeons, the Patient Scar Assessment Questionnaire (PSAQ), was administered to the patients at three months postoperatively.<sup>(8)</sup> It is considered to be a reliable and valid measure of patient perceptions of scarring and consists of four subscales. The score for each question ranges from a minimum of 5 to a maximum of 36 points.

IVP and renal scintigraphy (RS) were performed postoperatively at six and 12 months, respectively. The procedures were deemed to be successful following the resolution of symptoms and radiographic evidence of T 1/2 on renal scintigraphy ( $\leq 20$  minutes) at the one year follow-up appointment.

All statistical analyses were conducted by using SPSS statistical software (version 15.0; SPSS, Inc., Chicago, IL, USA). A probability value ( $p$  value) of  $< 0.05$  was considered statistically significant.

## RESULTS

Twenty-nine adult patients (19 men and 10 women) with a mean age of  $29.4 \pm 10.2$  years (a range of 19–38 years) were included in this study. The mean BMI of the patients was  $22.4 \pm 4.3$  kg/m<sup>2</sup> (a range of 16–29 kg/m<sup>2</sup>). The procedures were performed with the use of three ports. The mean operative time was  $119 \pm 28.5$  minutes (85–144 minutes). The mean time to perform pelviureteral anastomosis was  $21.7 \pm 3.6$  minutes (3.1–8.6 minutes).

A transmesocolic approach was used for the left mLP in 7 patients (41%). The mean VAS score for the period from on day 1 postoperatively to discharge was  $1.2 \pm$

**Table 4.** Cosmetic results of the patients.

Cosmetic Results, mean (SD)	
Total PSAQ	27.6 (1.7)
Appearance	9.8 (0.6)
Consciousness	5.1 (0.8)
Satisfaction with appearance	6.7 (0.5)
Satisfaction with symptoms	6 (0.2)



**Figure 1.** Port placement for a right transperitoneal pyeloplasty.

0.2 points. The mean time taken to remove the catheter was  $2.8 \pm 0.8$  days (a range of 2–6 days). The mean hospitalisation duration was  $3.3 \pm 0.7$  days (2–6 days). The success rate of mLP that is defined as radiographic evidence of T 1/2 on renal scintigraphy ( $\leq 20$  minutes) during the follow-up was 97% (in 28 of the 29 patients) and clinical resolution of the symptoms was observed in the same number of patients. Significant hydronephrosis ( $\geq$  grade II) was not observed on IVP at six months.<sup>(9)</sup> The minimum and maximum PSAQ scores at month 3 postoperatively were 24 and 86, respectively. Major complications were not observed, as per the Clavien-Dindo classification of surgical complications (grades IV–V).<sup>(10)</sup> None of the patients required a blood transfusion. Urine leakage from drainage catheter was observed in two patients. Spontaneous resolution was seen to have occurred at the follow-up on day 5 in one patient, while the urine leakage ceased after the replacement of the 4.7 F 24/26 cm DJ stent with a 6 F 26 cm DJ stent in another study subject. One patient developed a urinary infection and was treated according to antibiogram test result for the urinary culture. Another study subject underwent laser endopyelotomy with flexible ureteroscopy due to secondary UPJO at the follow-up in the 12th month. The demographic and clinical characteristics of the patients, including the preoperative, intraoperative and postoperative findings, and the PSAQ scores, are summarized in **Tables 1–4**.

## DISCUSSION

Globally, LP dramatically overtook OP as the standard treatment option for UPJO following the first LP that was carried out in 1993 by Schuessler et al.<sup>(3)</sup> Parallel to technological developments and the miniaturisation of medical devices, pyeloplasty techniques continue to evolve with a view to ensuring reduced surgical trauma and better functional and cosmetic results. The National Surgical Quality Improvement Program<sup>®</sup> database of prospectively collected data from 2.3 million surgical procedures, performed in 374 participating American institutions, shows that since 2008, 80% of pyeloplasty procedures have been performed using laparoscopic

and robotic techniques. Robotic-assisted pyeloplasty (RAP), laparoendoscopic single-site (LESS) pyeloplasty, retroperitoneoscopic pyeloplasty, endopyelotomy, standard laparoscopic pyeloplasty (sLP) and mLP are minimally invasive methods that have recently been used to treat UPJO.<sup>(11, 12)</sup>

The advantage of retroperitoneoscopic pyeloplasty is that theoretically, there is no risk of bowel injury and contamination of the intra-abdominal organs with urine. It was shown in a recent meta-analysis that retroperitoneoscopic pyeloplasty was more advantageous in terms of reduced postoperative pain and duration of hospital stay when compared with the transperitoneal approach. However, the operating time was shorter using the transperitoneal approach.<sup>(13)</sup> In 2011, Pini et al. described a novel retroperitoneal mini-laparoscopic approach; referred to as the small-incision access retroperitoneoscopic technique (SMART), and compared this technique with sLP. They reported statistically significant advantages with the use of SMART over that of sLP in terms of cosmetic outcome.<sup>(14)</sup>

Another minimally invasive treatment method, LESS, has attracted attention as it has the benefit of a single skin incision. A difference in hospitalization duration and postoperative pain was not established between sLP and LESS. However, greater blood loss was demonstrated with the use of LESS pyeloplasty.<sup>(15)</sup> Differences between sLP and LESS have not yet been determined in terms of cosmetic outcome in any study to date. Since the post-operative cosmetic appearance is one of the main anxieties that considerably have an impact on the patients satisfaction, many surgeon have tried performed less-invasive laparoendoscopic surgery. Hong Mei et al. compared transumbilical multiport (TUMP) and standard laparoscopic pyeloplasty in children and they found that TMLP had the better cosmesis and greater patient satisfaction rate evaluated by client satisfaction questionnaire-8 and 2 procedures had similar functional results.<sup>(16)</sup>

Initially, sLP did not gain acceptance because the operating time was lengthy and advanced laparoscopic skills were needed to perform it. However, with the increase in surgical experience gained, the operating times were reduced and it is now widely performed worldwide. Various approaches can be used in sLP. Turk et al. reported on the use of 49 LP procedures. They noted that the long-term success rate of this procedure was 98%, which was comparable with that achieved using OP.<sup>(17)</sup> Inakagi et al. reviewed 147 laparoscopic transperitoneal pyeloplasties performed using various techniques such as Anderson-Hynes dismembered (106), Y-V<sup>(28)</sup> and Fenger pyeloplasty<sup>(11)</sup>, based on the intraoperative findings. They stated that sLP had a comparable rate of success with OP.<sup>(18)</sup> It was also found in comparative studies that sLP pyeloplasty was associated with less morbidity, a shorter hospitalisation duration and almost the same surgical success rate, compared with open surgical repair.<sup>(19, 20)</sup>

Although many minimally invasive treatment methods for UPJO have been described, the role of mLP in the adult population has not been adequately discussed. Porpiglia et al. reported the one-year results of 10 adult patients who underwent mLP. They evaluated the patients using VAS scores for postoperative pain and using PSAQ scores for the cosmetic results, and did not observe a functional obstruction on renal scintig-



raphy at the one-year follow-up. The patients in their series were reported to be satisfied with the surgery and cosmetic outcomes<sup>(21)</sup>. In 2012, Fiori et al. published a study in which the use of mLP and sLP were compared in adult patients. A statistically significant difference between the two groups was not found in terms of the analgesic requirements, VAS scores, operating time and blood loss. However, the hospitalisation duration for the sLP group was significantly longer than that for the mLP group. The PSAQ results demonstrated that the cosmetic results of mLP were superior to those of sLP (22). Although Simforoosh et al. compared sLP and mLP in children younger than 1 year of age in terms of functional and cosmetic outcomes, the surgical principle was same as the adult population. They found that mean appearance score in the mLP and sLP groups was 10.2 and 16.6, respectively ( $P = 0.0001$ ). The mean consciousness score in the mLP and sLP groups was 7.8 and 14.2, respectively ( $P = 0.0001$ ). According to these results they concluded that mLP is more cosmetically pleasing and less invasive than sLP, and has similar functional outcomes.<sup>(23)</sup> In our cohort, postoperative VAS scores, PSAQ scores in relation to the cosmetic results and the success rate were similar to those reported in these studies. However, a difference was that overweight patients (BMI of 25–30 kg/m<sup>2</sup>) were included in our study. We experience difficulties with port placement in overweight patients, especially in cases of central obesity, owing to the short length of the ports (3 mm). Thus, we concluded that mLP could be performed in select overweight patients with a relatively low waist circumference. Besides, generally, we do not experience any further challenges during the procedure after the port has been placed. In addition, extra tools for pyeloplasty, such as bariatric-length laparoscopic instruments, are not required. Not performing a comparison between mLP and standard laparoscopic techniques was a major limitation of this study, as was the relatively small sample size and the limited clinical information obtained. Further randomized prospective comparative studies, with a high number of patients, are warranted before generalization of the study findings can be applied to the general population.

## CONCLUSIONS

mLP in adult population is feasible and seems to be safe and effective to manage UPJO. It has a high success rate, with reports of high satisfaction with the cosmetic results by adult patients. This method of treatment can be performed without major complications, even in overweight patients, by skilled surgeons at technologically advanced health centers. A relatively short duration time and low postoperative analgesic requirements are key advantages of this procedure.

## CONFLICT OF INTEREST

The authors report no conflict of interest

## REFERENCES

- Williams B, Tareen B, Resnick MI. Pathophysiology and treatment of ureteropelvic junction obstruction. *Curr Urol Rep.* 2007;8:111–7
- Kapoor A, Allard CB. Laparoscopic pyeloplasty: The standard of care for ureteropelvic junction obstruction. *Can Urol Assoc J.* 2011;5:136–8.
- Schuessler WW, Grune MT, Tecuanhuey LV, Preminger GM. Laparoscopic dismembered pyeloplasty. *J Urol.* 1993;150:1795–9.
- Kavoussi LR, Peters CA. Laparoscopic pyeloplasty. *J Urol.* 1993;150(6):1891–4.
- David G, Boni L, Rausei S, et al. Use of 3 mm percutaneous instruments with 5 mm end effectors during different laparoscopic procedures. *Int J Surg.* 2013;11 Suppl 1:61–3.
- Liao CH, Lai MK, Li HY, Chen CS, Chueh SC. Laparoscopic adrenalectomy using needlescopic instruments for adrenal tumors less than 5 cm in 112 cases. *Eur Urol.* 2008;54(3):640–6.
- Tan HL. Laparoscopic Anderson-Hynes dismembered pyeloplasty in children using needlescopic instrumentation. *Urol Clin North Am.* 2001;28:43–51.
- Durani P, McGrouther DA, Ferguson MW. The Patient Scar Assessment Questionnaire: a reliable and valid patient-reported outcomes measure for linear scars. *Plast Reconstr Surg.* 2009;123:1481–9.
- Fernbach SK, Maizels M, Conway JJ. Ultrasound grading of hydronephrosis: introduction to the system used by the Society for Fetal Urology. *Pediatr Radiol.* 1993;23:478–80.
- D. Dindo, N. Demartines, P.A. Clavien Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg.* 2004;240:205–13.
- Hanske J, Sanchez A, Schmid M, et al. Comparison of 30-day perioperative outcomes in adults undergoing open versus minimally invasive pyeloplasty for ureteropelvic junction obstruction: analysis of 593 patients in a prospective national database. *World J Urol.* 2015;33:2107–13.
- Oberlin DT, McGuiere BB, Pilecki M, et al. Contemporary national surgical outcomes in the treatment of ureteropelvic junction obstruction. *Urology.* 2015;85:363–7.
- Wu Y, Dong Q, Han P, et al. Meta-analysis of transperitoneal versus retroperitoneal approaches of laparoscopic pyeloplasty for ureteropelvic junction obstruction. *J Laparoendosc Adv Surg Tech A.* 2012;22:658–62.
- Pino G, Goetzen AS, Shulze M, et al. Small incision access retroperitoneoscopic technique (SMART) pyeloplasty in adult patients: comparison of cosmetic and post-operative pain outcomes in a matched pair analysis with standard retroperitoneoscopy: preliminary report. *World J Urol.* 2012;30:605–11.
- Brandao LF, Laydner H, Zargar H, et al.

- Laparoendoscopic single site surgery versus conventional laparoscopy for transperitoneal pyeloplasty: a systematic review and meta-analysis. *Urol Ann.* 2015;7:289–96.
16. Mei H, Zhao X, Li D et al. Comparison of transumbilical multiport and standard laparoscopic pyeloplasty in children: Mid-term results at a single center. *J Pediatr Surg.* 2017 Mar;52:473-7.
  17. Türk IA, Davis JW, Winkelmann B, et al. Laparoscopic dismembered pyeloplasty – the method of choice in the presence of an enlarged renal pelvis and crossing vessels. *Eur Urol.* 2002;42:268–75.
  18. Inagaki T, Rha KH, Ong AM, Kavoussi LR, Jarrett TW. Laparoscopic pyeloplasty: current status. *BJU Int.* 2005;95 Suppl 2:102–5.
  19. Boylu U, Basatac C, Turan T, Onol FF, Gumus E. Comparison of surgical and functional outcomes of minimally invasive and open pyeloplasty. *J Laparoendosc Adv Surg Tech A.* 2012;22:968–71.
  20. Simforoosh N, Basiri A, Tabibi A, et al. A comparison between laparoscopic and open pyeloplasty in patients with ureteropelvic junction obstruction. *Urol J.* 2004;1:165–9.
  21. Porpiglia F, Morra I, Bertolo R et al. Pure minilaparoscopic transperitoneal pyeloplasty in an adult population: feasibility, safety, and functional results after one year of follow-up. *Urology.* 2012 Mar;79:728-32.
  22. Fiori C, Morra I, Bertolo R et al. Standard vs minilaparoscopic pyeloplasty: perioperative outcomes and cosmetic results. *BJU Int.* 2013 Mar;111(3 Pt B):E121-6.
  23. Simforoosh N, Abedi A, Hosseini Sharifi S et al. Comparison of surgical outcomes and cosmetic results between standard and mini laparoscopic pyeloplasty in children younger than 1 year of age. *J Pediatr Urol* 2014 10:819–23.