



Laparoscopic Transperitoneal Pyeloplasty Outcomes in Adult Patients with Ureteropelvic Junction Obstruction

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Abstract

Background: Ureteropelvic junction obstruction (UPJO) is a frequently observed abnormality in the ureters of children. It has been reported that UPJO is approximately 5 cases per 100,000 infants each year. The obstruction at the ureteropelvic junction can be attributed to factors originating within the ureter itself (intrinsic UPJO). In contrast, cases caused by external factors are uncommon and usually result from abnormal vessels crossing the area crossing aberrant vessels.

Aim of the study: The objective of the research was to assess the results of laparoscopic Tran's peritoneal pyeloplasty in the treatment of ureteropelvic junction obstruction.

Methods: This is a retrospective study, a total of 42 patients were enrolled and analyzed. The study was conducted at the Department of Urology, Shaheed Sheik Abu Naser Specialized Hospital, and Khulna Bangladesh. The study duration was 3 years, from January 2016 to December 2019.

Result: A retrospective study analyzed 42 patients (mean age: 29.5 years) with renal abnormalities. Most had left kidney involvement (59.52%), while 40.48% had right kidney involvement. Clinical features included pain (50%), asymptomatic cases (26.19%), urinary system infections (8), and hematuria (2). The study population comprised 66.67% males and 33.33% females. The pre-operative findings showed an average operation time of 124 minutes, a bleeding amount of 38 ml, and a postoperative hematocrit level of 37.8. Most cases used the colon reflecting approach (92.86%) and the Dismembered technique (90.48%). Postoperative results showed a mean creatinine level of 0.93, a 2- 11 days hospitalization time, and a mean follow-up duration of 44 months. Complications included grade 3 (2.38%) according to Satava and Clavien classifications. Overall, 92.86% of cases were successful, with a 7.14% recurrence rate.

Conclusion: Our study identified that an elevated anterior-posterior diameter of the renal pelvis prior to surgery was associated with a higher likelihood of failure in Tran's peritoneal laparoscopy-assisted pyeloplasty. Despite the need for skilled laparoscopic skills, the procedure can be safely performed and is equally familiar as the traditional open procedure. In UPJ obstruction cases, laparoscopic pyeloplasty is a valuable alternative to open pyeloplasty.

Keywords: Laparoscopy; Pyeloplasty; Ureter pelvic junction; Obstruction

Introduction

Ureteropelvic junction obstruction (UPJO) refers to an obstruction occurring where the ureter meets the renal pelvis. This condition is frequently identified through prenatal ultrasounds and is the leading cause

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of hydronephrosis detected before birth [1]. UPJO affects approximately 1 in every 1500 live births and is more commonly observed in males. Moreover, it involves the left ureter twice as often as the right ureter [2]. In most cases, UPJO obstruction is temporary. It occurs more frequently in males, with a ratio of 2:1 compared to females. The left side affects about two-thirds of patients, and bilateral involvement occurs in 10-46% of cases [3]. In 1949, Anderson and Hynes introduced an open- dismembered pyeloplasty technique as a treatment for UPJO [4]. This technique has since been widely utilized due to its high success rate. However, the traditional lumbotomy approach is associated with increased morbidity, leading to minimally invasive alternatives such as antegrade or retrograde endopyelotomy, balloon dilation, and cause endopyelotomy [5-7]. Despite employing these techniques, their rates of success remain inferior to those of open pyeloplasty [8]. The initial description of laparoscopic pyeloplasty was provided by Schuster et al. during the early 1990s [9]. Over the past decade, laparoscopic pyeloplasty has evolved to deliver comparable outcomes to open surgery while reducing morbidity and complications [10]. This study aimed to assess the effectiveness of laparoscopic Tran's peritoneal pyeloplasty in treating ureteropelvic junction obstruction.

Methodology and Materials

Surgical procedures

To confirm UPJ obstruction, patients underwent cystoscopy with retrograde pyelography. All procedures were performed transperitoneally under intubated general anaesthesia. The patients' positions and trocar sites are shown in figure 1. The Told line was incised, and the colon on the affected side was reflected medially. Gerota's fascia was incised, freeing the ureter and the renal pelvis. The UPJ was cleaned of perirenal fat, and a stay suture was placed in the medial edge of the renal pelvis just below the renal vein (Figure 2a). The suture was pulled out through the abdominal wall using a 3-0 vicryl suture and secured with appropriate tension. In cases of severe hydronephrosis (over 150 mL), the renal pelvis was reduced. The redundant portion of the pelvis, between the stay suture (upper edge) and the UPJ (lower edge), was resected circumferentially with scissors. The pelvis was closed with running 3-0 polyglycolic acid sutures, terminating 1 cm above the lower edge of the incision (Figure 2b). Suturing before transection of the ureter provided tension between the stay suture and the ureter, significantly facilitating the procedure. Subsequently, the stenotic segment of the UPJ was transected horizontally, and the lateral aspect was spatulated longitudinally toward a point 1 cm below the stenotic segment. The ureteropelvic anastomosis was performed using interrupted 4-0 polyglycolic acid sutures (Figure 2c). A suture was passed outside-in at the apex of the

incised renal pelvis and inside- out at the apex of the spatulated ureter and then tied. The ureteric stent was advanced back into the renal pelvis, remaining in the ureter and extending into the urinary bladder. The tip of the proximal ureter and the cephalad edge of the pelvic opening were sutured. The interrupted anastomosis was initiated from the caudal to the cephalad edge, first on the anterior side, then on the posterior side. Maintaining this direction of suturing was essential to ensure reliable stitching at the distal edge of the ureteropelvic anastomosis, which was critical for a successful surgical outcome (Figure 2d). A 5-mm suction drain was inserted through the 5-mm port and removed when the suctioned material decreased to less than 10 mL. A Foley catheter was usually left in place for 48 hours. The double pigtail stent remained indwelling for 4-6 weeks.

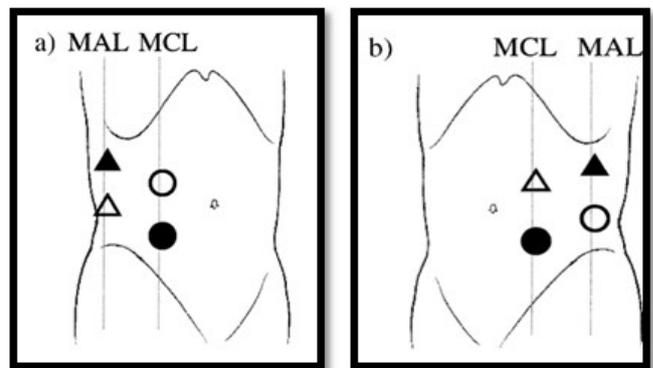


Figure 1: Patients' position and trocar sites for (a) right and (b) left side laparoscopic pyeloplasty. Patient was placed in semilateral position. A camera port (●) was on midclavicular line 3cm below the umbilicus using an open laparoscopic method. ●, 10 mm camera port; ○, 10 mm for surgeon's right hand; Δ, 5 mm port for surgeon's left hand; ▲, 5 mm for assistant; MAL, mid-axillary line; MCL, mid-clavicular line.

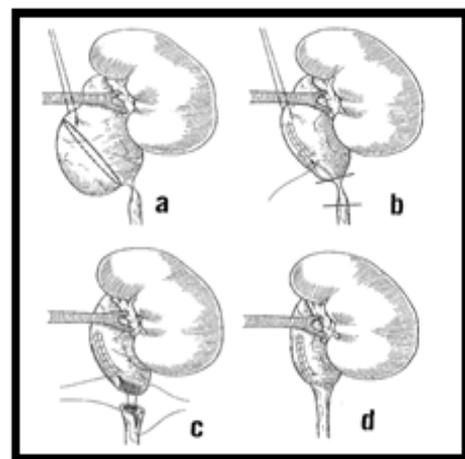


Figure 2: Dismembered Anderson- Hynes pyeloplasty (a) A stay suture and cutting line of redundant pelvis; (b) closure of the pelvis with running sutures. Transection line of narrow segment of the ureter (c) Ureteropelvic anastomosis; and (d) plasty completed.

Assessment of surgical outcome

Patients were scheduled to return for a follow-up visit within 4 to 6 weeks to have their stent removed. Two months after the procedure, a patient underwent an intravenous pyelogram (IVP) or nuclear renography and received semiannual assessments. Patients received clinical examinations every 3 to 12 months depending on their symptoms. Radiographic success was defined as enhanced drainage observed on diuretic renography or the observation of a patent ureteropelvic junction (UPJ) with improved hydronephrosis on IVP.

In all cases, a laparoscopic approach was used. Complications during the operation were classified according to the Satava classification, while postoperative complications were classified using the Clavien classification [11,12]. Postoperatively, patients were monitored based on radiological and laboratory findings. Ultrasonography (US) was performed within the first three months after the operation for assessment purposes, and mercaptoacetyltriglycine (MAG-3) scintigraphy was conducted in the sixth month. The timing of follow-up intervals was planned accordingly. The patients were divided into two groups based on the presence of crossing vessels. Demographic data such as age, age group, gender, affected side, history of previous renal surgery, and presence of kidney stones were investigated in both groups.

Inclusion criteria: This study included an assessment of all patients with UPJO, and solely those who had undergone pyeloplasty were considered.

Exclusion criteria: The following conditions were considered as exclusion criteria: the presence of neurological lesions, anatomical abnormalities in the lower urinary tract (BPH), bilateral hydronephrosis, small bilateral kidneys, horseshoe kidneys, multicystic dysplastic kidney, and vesicoureteral reflux (VUR), as well as chronic renal failure.

All numerical data were organized in appropriate tables or graphs based on similarity. A detailed description accompanied each table and graph to facilitate a clear understanding of the information presented. Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software on a Windows operating system. Mean ± standard deviation (SD) was used to express continuous variables, while categorical variables were presented as frequency and percentage. To compare continuous variables between groups, the student’s t-test was employed. The Chi-Square test was utilized to compare categorical variables. A significance level of 95.0% confidence interval and a p-value less than 0.05 were considered statistically significant in determining the results.

Result

A retrospective study enrolled and analyzed a total of 42 patients. The characteristics and demographical data of the patients are presented in table 1. The patients ranged in age from 19 to 51 years, with a mean age of 29.5 years. The mean levels of HCT and creatinine were 39 and 0.9, respectively, with a range of 26-45 for HCT and 0.5-1.3 for creatinine. Left kidney involvement was observed in most patients (25, 59.52%), while 40.48% had right kidney involvement. Renal abnormalities included crossing vessels (35.71% of patients), kidney stones (14.29% of patients), and one case of horseshoe kidney. Clinical features indicated that 50% of the patients

Table 1: Characteristics of patients and demographic data.

Characteristics	Frequency/ Mean	Percentage/ Range
Age (year)	29.5	19-51
HCT level (preoperative)	39	(26-45)
Creatinine level (preoperative)	0.9	0.5-1.3
Side		
Left kidney	25	59.52
Right kidney	17	40.48
Primer/secondar		
Primer	39	92.86
Secondar	2	4.76
ASA score (mean)	1	2.38
Concomitant renal abnormality		
Crossing vessel	15	35.71
Kidney stone	6	14.29
Solitary kidney	2	4.76
Horseshoe kidney	1	2.38
Clinical features		
Pain	21	50
No symptom	11	26.19
Urinary system infection	8	19.05
Hematuria	2	4.76
Right kidney	17	40.48

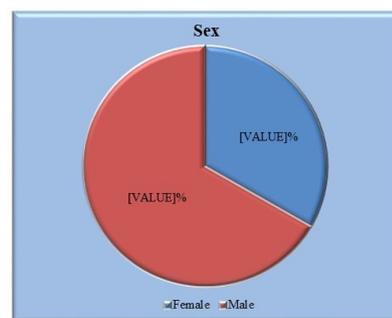


Figure 1: Sex distribution of the study population (N=42)

had pain, 26.19% had no symptoms, 8 had urinary system infections, and two had hematuria (Table 1). The distribution of the study population by sex is illustrated in figure 1, where 66.67% were male and 33.33% were female. Table 2 displays the pre-operative findings, revealing an average operation time of 124 minutes (range: 80-245 minutes), an average bleeding amount of 38 millilitres (range: 22-53 millilitres), and average postoperative hematocrit (HCT) level of 37.8 (range: 26-43). Most cases (92.86%) utilized the colon reflecting approach, while the remaining 7.14% used the Transmesocolic approach. The Dismembered technique was employed in 90.48% of cases, and the Y-V plasty was used in 9.52% of patients (Table 2). Postoperative findings presented in table 3 include the mean postoperative creatinine level of 0.93 (normal range: 0.5-1.3), hospitalization time ranging from 2 to 11 days (average: 3.05 days), and mean follow-up duration of 44 months (range: 12-120 months). The table also reports postoperative complications based on the Satava and Clavien classifications. According to the Satava classification, grade 3 complications were observed in one case (2.38% of total cases). The Clavien classification identified three cases of grade 1 and grade 2 complications, each accounting for 7.14% of the cases and one case of grade 3 complications (2.38% of total cases). Finally, the table summarizes the results, indicating that 92.86% of cases (39 patients) were successful, while 7.14% (three cases) experienced a recurrence.

Discussion

Since its initial definition by Schuster et al. in 1993, laparoscopic management of ureteropelvic junction obstruction (UPJO) has emerged as a favorable alternative to open and endoscopic techniques [9]. The selection among open, laparoscopic, endoscopic, or robotic approaches relies on the surgeon's inclination and expertise and the respective benefits and drawbacks of each technique. The advancements in endoscopic and laparoscopic procedures over the past two decades and recent developments in robotic surgery over the past 5-10 years have led to a growing preference for minimally

Table 3: Per-operative findings of the study population.

Findings	Frequency/ Mean	Percentage/ Range
Creatinine level (postoperative)	0.93	0.5-1.3
Hospitalization time (days)	3.05	02-11
Follow-up (months)	44	12-120
Perioperative complications according to		
Satava classification	1	2.38
Grade 3	1	2.38
Postoperative complications according to		
Clavien classification	3	7.14
Grade 1	1	2.38
Grade 2	3	7.14
Grade 3	1	2.38
Results		
Succeed	39	92.86
Recurrence	3	7.14

invasive techniques among surgeons. Factors such as cost, availability of surgical equipment, and expertise play a crucial role in determining the preferred technique. Studies have shown that open pyeloplasty generally has a shorter operative time than laparoscopic pyeloplasty. However, laparoscopic pyeloplasty has become the gold standard therapy in some centres due to the advantages of shorter hospitalization and reduced need for pain medication [13,14]. In our investigation, we utilized the laparoscopic method for treating all cases. We attained a success rate of 93.1%, which aligns with the outcomes documented by skilled laparoscopic surgeons in the existing literature [15-17]. The most common symptom in adults with UPJO is pain, which may be accompanied by urinary tract infections or hematuria. However, UPJO can also be incidentally discovered during diagnostic tests for unrelated issues, even without symptoms [18]. In our study, 50% of the patients presented with pain, 18.1% had urinary tract infections, 5.2% had hematuria, and 26.7% were asymptomatic. Nearly 30% of the patients had a crossing vessel at the UPJ [19]. In our study, 41 (35.3%) patients had a crossing vessel, 17 (14.6%) had a kidney stone, 4.3% had a solitary kidney, and 2.5% had a horseshoe kidney anomaly. The relationship between the presence of a crossing vessel and UPJO and the impact of vascular transposition or ligation on the outcomes of pyeloplasty is a topic of debate. Some studies have found crossing vessels in approximately 20% of patients with a normal UPJ, while patients with UPJO are more likely to have crossing vessels than the general population [20,21]. In our study, 35.3% of the patients had a crossing vessel, and there was no statistically significant relationship between the presence of a crossing vessel and any demographic feature. Dismembered pyeloplasty is the

Table 2: Per-operative findings of the study population.

Findings	Frequency/ Mean	Percentage/ Range
Operation time (min)	124	80-245
Bleeding (mL)	38	22-53
HCT level (postoperative)	37.8	26-43
Approach		
Colon reflecting	39	92.86
Transmesocolic	3	7.14
Technique		
Dismembered	38	90.48
Y-V plasty	4	9.52

most commonly preferred surgical technique [22]. It offers the advantage of removing the narrowed segment but is technically more challenging than non-dismembered pyeloplasty because the ureter needs to be divided [9]. In non-dismembered pyeloplasty, the ureter is not divided, allowing the first suture to be placed without tension and reducing the anastomosis time. However, more scientific evidence is needed to determine which method is superior for patients. In our study, 82% of the patients underwent dismembered pyeloplasty. While the Anderson-Hynes dismembered pyeloplasty is the most commonly used technique, various techniques can be applied depending on the pelvic anatomy. Foley Y-V plasty is the most commonly used non-dismembered technique, mainly when there is a need for high ureteral access. However, this technique may not be suitable when the lower pole vessel needs to be transposed. It is worth noting that crossing vessels are not always responsible for UPJO [23]. Moreover, the success rate of Y-V plasty applied in the presence of a crossing vessel is comparable to that of Anderson-Hynes plasty [16]. In our study, 1 out of 10 patients undergoing Foley Y-V plasty had a crossing vessel. In these cases, it was determined that the crossing vessels were not responsible for the external compression since they were localized proximal to the UPJ. Additionally, the Y-V plasty technique moves the UPJ further away from the crossing vessel. Our study, which presents our 14-year experience with laparoscopic pyeloplasty, confirms the shift from Y-V plasty to predominantly using dismembered pyeloplasty. Similar trends have been observed in other studies reporting their first 100-case experiences [15-17]. However, these studies did not specify when and to what extent the Y-V technique was used during the learning curve. The presence of a kidney stone does not hinder the laparoscopic technique for UPJO. In 2002, Ramakumar et al. published a series of 20 cases where simultaneous pyelotomy was performed laparoscopically. Similarly, in our study, the preoperative assessment revealed stones in 17 (14.6%) cases, leading to the application of laparoscopy-guided simultaneous pyelolithotomy. While a horseshoe kidney may pose a challenge for the laparoscopic approach, a few studies have reported successful outcomes [24-26]. In our study, laparoscopic pyeloplasty was performed in 3 (2.5%) patients with horseshoe kidney anomalies. Therefore, laparoscopic pyeloplasty has been proven to be a thriving option for patients with renal anomalies. Laparoscopic pyeloplasty can also be effectively performed in patients with recurrent UPJO who have previously undergone surgery. However, creating a favourable surgical space and performing ureter dissection can be more challenging due to adhesions resulting from the previous surgery. Advanced laparoscopic skills are required to achieve tension-free anastomosis [27]. In our study, 8 (6.9%) patients had a history of open pyeloplasty. Among them, 6 (5.2%) did not experience recurrence during follow-

up, while 2 (1.7%) patients developed recurrent obstruction. One (0.8%) patient underwent endopyelotomy; the other (0.8%) had a failed procedure and required nephrectomy. The trans mesocolic approach was utilized in our study's 8 (6.9%) patients. For left-sided UPJOs, the transperitoneal approach, which involves incision and dissection through the Toldt line for colon mobilization, can limit laparoscopic visibility due to bleeding and fogging, thus prolonging the operating time. For this reason, specific centres prefer the trans mesocolic approach for left-sided UPJOs. Other studies have reported shorter operating times with the trans mesocolic method than the transperitoneal approach [28,29]. However, the trans mesocolic technique is not widely preferred as it is suitable mainly for younger, lean patients with low mesenteric adipose tissue [30]. Only 8 (6.9%) patients underwent the trans mesocolic approach in our study. Due to the limited number of patients with this approach, no comparison was made. Some series in the literature have reported performing pyeloplasty without using a double-J stent [31,32]. These studies suggest that stentless pyeloplasty is a safe and feasible technique. In 2007, Shalhav et al. published the outcomes of 5 patients in whom they performed laparoscopic stentless pyeloplasty [33]. However, in our study, all patients who underwent laparoscopic pyeloplasty had a double-J stent placed. The stents were typically removed one month after the surgery. During the perioperative period, 1 (0.8%) patient experienced a grade 3 complication according to the Satava classification. In the postoperative period, 2 (1.7%) patients had grade 1 complications, 7 (6%) patients had grade 2 complications, and 1 (0.8%) patient had a grade 3 complication according to the Clavien classification (Table 2). One patient (0.8%) suffered a left colon injury during port insertion, which was repaired laparoscopically without further complications. The overall postoperative complication rate was 8.6%. Two (1.7%) patients experienced high fever (grade 1), 3 (2.6%) patients had prolonged extravasation of urine (grade 2), and 5 (4.3%) patients developed paralytic ileus (grade 2). These patients showed improvement during postoperative follow-up with medical treatment. In one case (0.8%), a percutaneous nephrostomy catheter was inserted due to extravasation of urine (grade 3 complication). The average follow-up time was 44 (12-120) months, and the specific follow-up intervals were determined based on ultrasound (US) at 1-3 months postoperatively and MAG-3 scintigraphy at 6 months postoperatively for assessment purposes. During the follow-up period, 8 (6.9%) patients experienced recurrent obstruction. Endopyelotomy was performed in 7 (6.1%) patients to address the recurrence. Among these cases, 2 (1.7%) were tertiary cases that underwent laparoscopic pyeloplasty following open pyeloplasty. One patient (0.8%) ultimately required a nephrectomy. The rate of complications in our study is consistent with those reported in the literature [15-17].

Limitations of the study

This study presents the outcomes and complication rates of adult patients who underwent LTP at our centre. The findings of this study indicate that LTP can be successfully performed in adult patients with UPJO. However, it is essential to acknowledge the limitations of our study. The data collection was conducted over time and verified retrospectively, which may have introduced some errors. Additionally, our study did not include a comparison with open surgery, although we followed the general principles of open surgery during the LTP procedure. Notwithstanding these limitations, our results indicate that LTP is a safe and viable treatment option for managing UPJO. In order to address these limitations, future studies should be designed prospectively.

Conclusion and Recommendations

LTP proves to be a reliable and secure method for performing surgery on adult patients diagnosed with UPJO. It can serve as a primary treatment option due to its minimal complication rates, suitability for patients with anatomical differences, and the advantage of a brief hospital stay.

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