

REVIEW ARTICLE

# A Multicentric Comparative Study Between Laparoscopic Pyeloplasty and Open Pyeloplasty in Children with Ureteropelvic Junction Obstruction

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## Abstract

Laparoscopic Pyeloplasty with its pediatric application was first described by (Peters et al.,1995), from that time till now the surgical hand skill has evolved lead to speed up the operation with Laparoscopy continue to show a preference for the transperitoneal approach, but the feasibility of retroperitoneoscopic pyeloplasty has also been demonstrated effective results.

**Aim of the study:** To compare the Laparoscopic and Open Pyeloplasty in the management of Pediatric Patients with Ureteropelvic Junction Obstruction.

**Patients & methods:** Multicentric comparative prospective study concluded from 1st of October 2018 till 1st of October 2020, fifty patients enrolled in the study. 20 patients (12 male,8 female) undergo LP pyeloplasty with mean age is 11.5 years old in Al\_Diwaniya teaching hospital,30 patients (21 male,9 female) undergo OP pyeloplasty with mean age is 4 years old in Al\_Diwaniya teaching hospital and Al\_Sader Medical city.

**Results:** The operative time in the LP group was found longer than the OP group (with a mean difference 30min.), with no organ injury, no conversion to OP pyeloplasty, with comparable hospital stay between two groups, less pain, and better cosmetic's acceptance for LP group.

**Conclusion:** Short-term outcome of LP pyeloplasty is comparable to OP pyeloplasty regarding hospital stay, no organ injury, no conversion, less analgesic requirement, and better cosmetics acceptance, which can consider promising gold standard surgical intervention for the repair of UPJO nowadays particularly in pediatric patients

## Keywords:

Laparoscopic, ureteropelvic junction obstruction, pyeloplasty

## Introduction:

Sir William Osler, challenged surgeons to perpetually refine their craft, stating, "Diseases that harm require treatments that harmless".[1] it has been over the past 25 years, in particular, that the specialty of minimally invasive urology has become predominant. [1]. Laparoscopy in pediatric urology began in 1976 when Cortesi et al. reported diagnostic laparoscopy to evaluate non-palpable testes [2]. Laparoscopic pyeloplasty was first described in 1993 in adult patients concurrently by two groups [3,4] Ureter pelvic junction obstruction define as This obstruction can lead to an increase in back pressure on the kidney, hydronephrosis, and progressive damage to the kidney function. [5] Hydronephrosis (HN): In children defined by an anteroposterior of renal pelvis diameter of 12mm. [6] UPJO consider as the most common cause of antenatal pathologic hydronephrosis also familial inheritance has been reported. [7] The congenital causes may by intrinsic etiology:

1. Failure of transmission of peristaltic waves across the UPJ due

to altered expression of interstitial Cajal cells in obstructed UPJ segment [8] [9]

2. The PUJ is of normal caliber but the proximal ureter is tortuous and kinked. [10]

Or may by extrinsic etiology:

3.Aberrant vasculature, arising from the renal vessels, aorta, vena cava, or iliac vessels that supply the lower pole of the kidney is frequently associated with UPJO [11].

4.Rotational abnormalities such as horseshoe or pelvic kidney and duplex collecting systems may also cause UPJ obstruction. [12] While all of above consider primary UPJO, the secondary include:In children, vesicoureteral reflux can lead to upper tract dilation with subsequent elongation, tortuosity, and kinking of the ureter. [13]

The acquired causes include: stone, fibroepithelial polyps, urothelial malignancy. [13]

In the infant population, hydronephrosis is usually diagnosed prenatally with the use of maternal ultrasonography. [14]



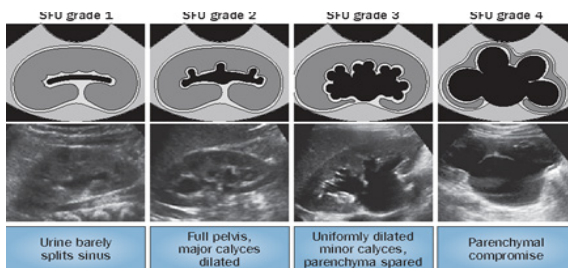
infants with hydronephrosis can also present with an abdominal mass, feeding difficulties, failure to thrive, or sepsis. In older children, presentation is typically characterized by an asymptomatic episode of abdominal or flank pain and nausea and vomiting, called a Dietl's crisis. [15] Recurrent vomiting alone can also be a sign of intermittent UPJO. [15] Less common presentations include Urinary tract infection, hematuria, nephrolithiasis, and rarely hypertension. [15]

**Investigations:**

Ultrasonography (US): The most sensitive time for urinary tract evaluation is 28 wks. [16]

**Table 1** The values of APD according to gestational age. [17]

Hydronephrosis	2 <sup>nd</sup> trimester	3 <sup>rd</sup> trimester
Mild	4 to <7 mm	4 to <9 mm
Moderate	7 to ≤10 mm	9 to ≤15 mm
Sever	>10 mm	>15 mm



**Figure 1:** Society for fetal urology of grading system of postnatal hydronephrosis. [18]

Diuretic Renogram (DR): the following important finding that predicts obstruction: [19]

- 1-A rising or flat washout curve after diuretic administration.
- 2-A half-time more than 20 minutes.
- 3-Differential renal function less than 40%.

Intravenous Urography (IVU): The role of IVP in obstruction such as UPJO is crucial. Collecting system dilatation, with parenchymal changes in the nephrogram and delay in the excretion of contrast medium, is characteristic of obstruction. [20] However, bowel preparation is needed for better visualization, and delayed films, even up to 24 hours, maybe required or longer.[21]

Voiding Cystourethrogram (VCUG): The voiding cystourethrogram helps exclude other causes of upper tract dilation. [22]

Computed Tomography scan (Ct scan): Due to the radiation exposure risk of CT and the relative ease and accuracy of renal ultrasonography makes it not the initial diagnostic tool CT can be beneficial in defining retroperitoneal anatomy, particularly aberrant lower pole crossing vessels to the kidney. When performed with IV contrast. [15]

Other imaging modalities: MRI accurate in detecting the crossing vessel associated with UPJO. [23]

Management: The indications of surgical intervention are:

- 1.Asymptomatic patient with imaging signs of poor drainage (obstructive excretory curve on renography, T1/2 more than 20min.) Renal deterioration (loss of renal function on renography differential renal function less than (40%), progressive HN by follow-up U\S. [24]
- 2.Symptomatic patient. [24] Management: There are different approaches

•Open pyeloplasty:

•Laparoscopic pyeloplasty:

Either transperitoneal or retroperitoneal.

•Endourology:

•Robotics:

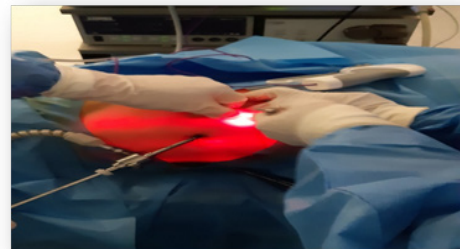
**2. Patients and methods**

Study design:

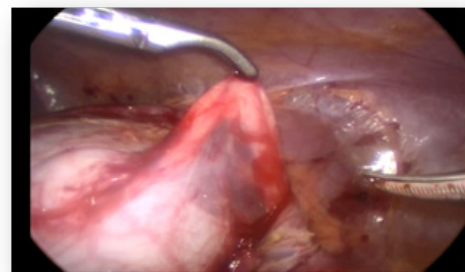
The multicentric comparative prospective study concluded from 1st of October 2018 till 1st of October 2020, with fifty patients enrolled in the study. 20 patients (12 male,8 female) undergo LP pyeloplasty with mean age is 11.5 years old in Aldywania Teaching Hospital,30 patients (21 male,9 female) undergo OP pyeloplasty with mean age is 4 years old in Aldywania Teaching Hospital and ALSader medical city.

Preoperative Workups:

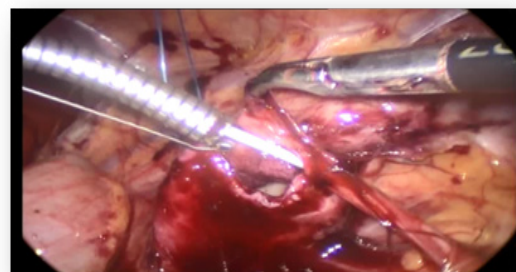
- 1.Laboratory tests: CBP, virology screen, B.urea, S.Creatinine, coagulation profile.
- 2.Urinalysis.
- 3.Chest x-ray (CXR).
- 4.Blood preparation (ABO and crossmatch).
- 5.anesthesiologist assessment of the patient for fitness of general anesthesia.



**Figure 2:** Laparoscope insertion



**Figure 3:** Identification of ureter



**Figure 4:** Laparoscopic ureteric sent guider (LUSG)

3- Result:

Table 2: General characteristics of patients enrolled in the present study

Characteristic	Laparoscopy n = 20	Open n = 30	P
<b>Gender</b>			
Male, n (%)	12 (60.0 %)	21 (70.0 %)	0.456 C
Female, n (%)	8 (40.0 %)	9 (30.0 %)	NS
<b>Site</b>			
Right, n (%)	5 (25.0 %)	7 (23.3 %)	1.000 Y
Left, n (%)	15 (75.0 %)	23 (76.7 %)	NS
<b>Age (years)</b>			
Mean ±SD	11.55 ± 1.64	4.03 ±4.18	< 0.001 I
Range	9 -14	40 days -13 years	HS
≤ 9, n (%)	2 (10.0 %)	21 (70.0 %)	<0.001
> 9, n (%)	18 (90.0 %)	9 (30.0 %)	HS
<b>Indication Of surgery</b>			
Incidental HN, n (%)	1 (5.0 %)	1 (3.3 %)	0.102 C
Symptoms and US, n (%)	19 (95.0 %)	23 (76.7 %)	NS
Prenatal HN, n (%)	0 (0.0 %)	6 (20.0 %)	
<b>Radio assessment</b>			
IVU, n (%)	20 (100.0 %)	30 (100.0 %)	---

Table 3: Operative Characteristics

Characteristic	Laparoscopy n = 20	Open n = 30	P
<b>Type of surgery</b>			
A/H, n (%)	20 (100.0 %)	30 (100.0 %)	---
<b>Operative time (hours)</b>			
Mean ±SD	2.07 ±0.44	1.67 ±0.40	0.002 I
Range	1.3 -3	1 -2.3	HS
2 hours, n (%)	10 (50.0 %)	27 (90.0 %)	0.002 C
> 2 hours, n (%)	10 (50.0 %)	3 (10.0 %)	HS
<b>Finding</b>			
Aberrant vessel, n (%)	7 (35.0 %)	7 (23.3 %)	0.368 C
Stenosis, n (%)	13 (65.0 %)	23 (76.7 %)	NS
<b>Stenting</b>			
DJSI, n (%)	20 (100.0 %)	28 (93.3 %)	0.510 F
Nephrostomy, n (%)	0 (0.0 %)	2 (6.7 %)	NS
<b>Organ injury</b>			
Organ injury	0 (0.0 %)	0 (0.0 %)	---
<b>Conversion to open, n (%)</b>			
Conversion to open, n (%)	0 (0.0 %)	---	---

Table 4: Postoperative characteristics

Characteristics	Laparoscopy n = 20	Open n = 30	P
<b>Hospital stay (days)</b>			
Mean ±SD	2.60 ±0.75	2.87 ±1.07	0.341 I
Range	2 -5	2 -6	NS
2 days, n (%)	11 (55.0 %)	22 (73.3 %)	0.2 C
> 2 days, n (%)	9 (45.0 %)	8 (26.7 %)	NS
<b>Leak, n (%)</b>			
Leak, n (%)	0 (0.0 %)	2 (6.7 %)	0.510 F
<b>Drain</b>			
2 days, n (%)	11 (55.0 %)	28 (93.3 %)	0.004 Y
> 2 days, n (%)	9 (45.0 %)	2 (6.7 %)	HS
<b>Foley</b>			
7 days, n (%)	18 (90.0 %)	27 (90.0 %)	1.000 Y
> 7 days, n (%)	2 (10.0 %)	3 (10.0 %)	NS
<b>Analgesic requirement</b>			
On need, n (%)	20 (100.0 %)	---	---
<b>The U.S improve</b>			
Improvement, n (%)	13 (65.0 %)	23 (76.7 %)	0.368 C
Mild hydronephrosis	7 (35.0 %)	7 (23.3 %)	NS
<b>Surgical site infection (SSI), n (%)</b>			
Surgical site infection (SSI), n (%)	0 (0.0 %)	0 (0.0 %)	---
<b>Symptoms after surgery, n (%)</b>			
Symptoms after surgery, n (%)	2 (10.0 %)	---	---

4. Discussion

In our study, the patients who undergo the laparoscopic procedure are in a narrow range of age (9-14 years) as compare to the open group (40days-13 years) because of the limitation of laparoscopic instruments in young infant and toddler pediatric age group, and with acceptance results and less pain in small flank incision procedure. (Ruiz et al.,2011) [25].

Operative Time:

In this study, the operative time in the LP group consider longer (1.3hrs-3hrs) in the LP group ;(1-2.3hrs) in the OP group with a minimum time difference of approximately 30min. (Polok M et al.,2019)[26] . So that the procedure time in the LP group becomes shorter & reaches the OP group as the surgeon becomes expertise with suturing technique, and with the use of LUSG to eliminate the use of cystoscope for DJSI.

Table 5: Comparative studies regarding operative time

P-value	Time average in OP group (min)	Time average in the LP group (min)	Study
< 0.05	40.-200min	70-225 min	Polok et al.,2019 <sup>[25]</sup>
< 0.01	65.-150min.	100.-228min.	Piaggio et al., 2017 <sup>[27]</sup>
0.002	60.-160min.	90-180min	Our study

The stenotic part of the ureter without aberrant vessel is more common finding 65% As the aberrant vessel per se not the causative for the obstruction as the stenotic part behind the vessel (Richstone et al.,2009) [26].

In our study, we routinely perform DJSI in an antegrade approach intraoperatively by LUSG. There is controversy about the antegrade VS retrograde direction.

In our study, there was no organ injury (0%) of patients, also there is no conversion to OP pyeloplasty (0%) of patients either for difficulties or for organ injury. This reflects the meticulous dissection and adherent to LP guideline, also from feedback knowledge from adult LP surgery that done.

Hospital stays:

In our study, the hospital stay in the LP group is comparable to the OP group ranging in (2-5days VS 2-6 days), respectively

In our study, there are no urine leak postoperatively (0%) patients, regardless of interrupted or continuous suturing. There is no SSI (port site infection) postoperative in the LP group in our study

We routinely use US evaluation in postoperative visits for all patients when there is no significant deterioration in the US finding no necessary for Diuretic renogram (DR) study. [35],[36] in our study, 65% of patients had improvement in HN in follow up visits, and 35% of them still with mild HN, however, this residual HN didn't consider the deterioration of US yet (as it improving from moderate or severely HN to mild HN) this need further follow up evaluation. [31] Patients who experienced symptoms (10%) consist of flank pain (5%), symptoms UTI (5%) needs further evaluation with imagining study to determine whether need 2nd intervention procedure or not. The failure of the procedure means the need for reoperation or re intervention. [31]

All the patients in our study require on need analgesics which reflect a reduced amount of painful procedure, according to the Wong-baker pain scale all patients are recorded as having. Face 1 (hurt little bits) or face 2 (hurt little more). Due to muscle splitting and transaction, even the small incision for the OP group generate more pain than the LP group. [29]

### Conclusion:

The short-term outcome of LP pyeloplasty is comparable to OP pyeloplasty regarding hospital stay, no organ injury, no conversion, less analgesic requirement, and better cosmetics acceptance, which can consider promising gold standard surgical intervention for the repair of UPJO nowadays particularly in pediatric patients.

Limitations of the study:

- 1.Small numbers of cases enrolled in the study due to the COVID19 pandemic.
- 2.Loss of follow-up of some patients.
- 3.Availability of Diuretic renogram due to COVID19 pandemic.

### Recommendation:

- 1.Encouraging urologists to adopt the concepts of the effectiveness of laparoscopic reconstructive surgeries.
- 2.Participation in the work shop and live surgery for more experience.
- 3.Spend many times in laparoscopic simulator courses.
- 4.Retrospective study to demonstrate the long-term efficacy.
- 5.Availability of instruments to infant patients.
- 6.Availability of robotics for such procedure.

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