

A Comparative Study between Open and Laparoscopic Pyeloplasty

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Abstract:

Background: Historically “open pyeloplasty” has been regarded as the gold standard for the surgical management of ureteropelvic junction obstruction (UPJO). The treatment of this condition has evolved greatly over the past twenty years resulting in new surgical approaches. One of these approaches is laparoscopic pyeloplasty, this technique aimed to achieve similar results as open surgery, with lower rates of morbidity complications.

Aim of the study: to compare the “operative time”, “hospital stay”, analgesic use, “perioperative complications” and “success rate” between laparoscopic and open pyeloplasty in Al Diwaniya Teaching Hospital.

Patients & Methods: forty patients (26 males and 14 females) with ureteropelvic junction obstruction who had been presented to the urology ward of Al Diwaniya Teaching Hospital, were enrolled in this study. The patients included on the basis of standard indications for PUJO repair.

The patients were divided into 2 groups. Twenty patients underwent transperitoneal laparoscopic pyeloplasty and 20 patients operated upon by open surgery. We compared the “operative time”, “complications rates”, hospital stay and “success rate” of the two groups.

Results: Mean operative time was 2 hours and 3 hours in open & laparoscopic pyeloplasty groups, respectively. Mean hospital stay was shorter (24 hours) in the laparoscopic group and (48 hours) in open group. Mean follow-up period was 9 months. Postoperative complication rates were 45 % and 55 % in laparoscopic & open pyeloplasty groups, respectively. Success rates were 95% and 90 % for open and laparoscopic pyeloplasty groups, respectively. Redo surgery was needed in 2 patients of laparoscopy and 1 of open surgery groups due to recurrence of stricture.

Conclusions: The “safety and efficacy” of “laparoscopic pyeloplasty” is comparable to that of open pyeloplasty, with better cosmetic results and shorter hospital stay, therefore laparoscopic pyeloplasty can replace open surgery and may be considered the gold standard technique for managing of “ureteropelvic junction obstruction” in expert hands.

Key word: open pyeloplasty; Laparoscopic pyeloplasty; Ureteropelvic junction obstruction.

INTRODUCTION:

“Ureteropelvic junction obstruction” (UPJO) is a disease in which urine flow from the renal pelvis to the proximal ureter is hindered. [1, 2] UPJO may be diagnosed incidentally or presented with *palpable flank mass* or with *antenatal hydronephrosis*. *Oliguria may occur* in some newborns with bilateral PUJO. Intermittent abdominal or *loin pain and vomiting* are the most common presenting symptoms; loin pain correlated to periods of excess fluid intake or ingestion of food with diuretic action, promoting the “*Dietl's crisis*”. The patients may present with complications of UPJO as hematuria and recurrent *urinary tract infection, calculi*, trauma to the hydronephrotic kidney, *azotemia* or rarely *hypertension*. [4-10] Diagnosis usually confirmed by renal **ultrasonography, excretory urography** and **diuretic renal scintigraphy**. [8, 11, 12]

Conservative treatment of UPJO involve prophylactic antibiotic and close follow up of the degree of hydronephrosis and renal function. [15, 16] **Surgical treatment** is usually indicated for the following conditions:

- (1) Differential renal function less than 40% in diuretic renal scintigraphy.
- (2) Washout half-time greater than 20 minutes in diuretic renal scintigraphy.
- (3) A “decrease of split renal function of > 10% in subsequent studies”.
- (4) Contralateral hypertrophy or increased A-P diameter on US.

- (5) Patients who are symptomatic with pain, hematuria or hypertension. [17, 18]

Although there are many surgical options for managing of “UPJ obstruction”, they can be assigned into: open, endoscopic (antegrade or retrograde) and laparoscopic procedures. [19]

In the present era of laparoscopic surgery, virtually all open urological procedures have been reproduced laparoscopically. Laparoscopic pyeloplasty is not an exception. [20, 21] It was first described by “Schuessler et al” in the early 90s and has been performed all over the world as the first “minimally invasive” alternative to UPJO repair with comparable the “success rate” of open pyeloplasty. [22]

The main benefits over open pyeloplasty are:

- (1) Less invasive with regard to wound size.
- (2) Less postoperative pain.
- (3) Reduced hospital stay.
- (3) Better cosmetic results.
- (4) The possibilities of less patient morbidity and reduced hospital stay may lower the hospital costs.
- (5) The minimal invasion of the abdominal wall reduce incisional hernia formation and respiratory complications [23, 24, and 25]

Nevertheless, the disadvantages seems to be:

- (1) Longer operative time.
- (2) Technically difficult and required a “steep learning curve”. [26, 27, 28]

In fact “laparoscopic pyeloplasty” as a minimally invasive procedure is now considered the standard procedure for the

treatment of “ureteropelvic junction obstruction” with similar success rates as classical pyeloplasty. [29] In this article we aimed to compare the “operative time, hospital stay, analgesic use, perioperative complications and success rate” between laparoscopic & open pyeloplasty in Al Diwaniya Teaching Hospital.

PATIENTS AND METHODS:

From October 2014 to October 2016, 40 patients (26 males and 14 females) with “ureteropelvic junction obstruction” who had been admitted to the urology unit of Al Diwaniya Teaching Hospital, were enrolled in this study. Their ages ranged from 10 to 44 years with a mean age of 24 years. Eighteen patients had right sided PUJO and 22 patients had left sided one. The patients were selected on the basis of standard indications for PUJO repair.

The patients were divided into 2 groups; laparoscopic and open pyeloplasty groups. Each group contain 20 patients. The choice between the two types of operation was selected according to surgeon's preference. Preoperative evaluations were done using abdominal ultrasound and IVP. Laboratory tests included urinalysis, urine culture, blood urea, and serum creatinine. Blood group was determined and 1 unit of compatible blood was prepared.

The laparoscopic group

An informed patient consents for a laparoscopic pyeloplasty was obtained which include the special complications of laparoscopic surgery, as conversion to open procedure. A single dose of intravenous third generation cephalosporin used as prophylaxis antibiotics.

The patient is positioned in a modified lateral decubitus position. The entire flank and abdomen were prepared with Povidone iodine.

Pneumoperitoneum was established using a Veress needle technique inserted through a cutaneous incision made at the lateral border of rectus muscle at the level of the umbilicus. “Pneumoperitoneum was created with an insufflation rate of 5 L/min and the insufflation continued till an abdominal pressure of 12-15 mm Hg”.

After establishment of pneumoperitoneum, a trocar for the telescope is inserted via the same incision. The second (5 mm or 10 mm) port was inserted subcostally at the mid clavicular line. The third (5mm) port was placed in the iliac fossa about two finger breadth from iliac crest. Using Harmonic scalpel, the posterior **peritoneum is divided** from the upper pole of the kidney to 3 cm below the lower pole. Then the renocolic ligaments were cut in order to reflect the colon medially and make a plane between Gerota's fascia and colon which provide clear exposure of the UPJ. (Figure 1).

“**The Gerota's fascia is incised** at the level of the lower pole of the kidney for the dissection of the ureteropelvic junction, (or the ureter can be identified inferior to the lower pole of the kidney and followed up to the ureteropelvic junction)”. After wide dissection of the renal pelvis & UPJ, a **stitch passed around the proximal part of the ureter** in order to retract it from outside the peritoneal cavity, avoiding the need for another trocar. (Figure 2) when we got an adequate length of the

ureter for anastomosis, we cut the ureter near “pelvi-ureteric junction”. “**The ureteropelvic junction is incised**, and the redundant pelvis is excised. The ureter was incised longitudinally and “spatulated for about 1.5 to 2.0 cm along its lateral side”. (Figure 3).

After that, the ureter and renal pelvis were aligned and anastomosed using 4-0 Vicryl .Anastomosis started with the posterior aspect where watertight running suture in a cephalad direction was performed. After that, JJ catheter introduced. A straight tip guidewire was usually inserted via the working 11-mm port “into the ureter and down to the urinary bladder”. A “6 Fr **JJ stent was inserted in an antegrade fashion** over the guidewire into the bladder, and following removal of the guidewire, the proximal part of the stent was placed into the renal pelvis”. (Figure 4).



Figure 1: reflection of the colon by ncising the white line of toldt



Figure 2:: retraction of the ureter by a stitch



Figure 3: ureteral spatulation of the ureter



Figure 4: antegrade placement of DJ stent

Anastomosis of the anterior aspect was then performed using a 4-0 Vicryl suture in watertight cranially oriented running suture. A tube drain was passed through the 11-mm port and positioned near the anastomosis. The skin incisions were closed with 2-0 silk suture. The tubedrain was stitched by 1-0 silk suture and dressing applied. The urethral catheter maintained till postoperative day 2, where it removed with the surgical drain if its output remains negligible

The ureteral stent is removed in 4-6 weeks and an ultrasound or preferably IVU is obtained two months post-operatively if the patient is asymptomatic or immediately if he is symptomatic. "Serial renal imaging is recommended for the first year after surgery and should be continued less frequently thereafter if the results become normal".

The open Pyeloplasty group a standard Henderson-Hynes procedure is usually performed.

RESULTS:

The mean operative time in laparoscopic group was 180 min (140 –240 min) incomparision to 120 min (90 –140 min) in open pyeloplasty group. The laparoscopic operative time reduced with increased experience. The mean post-operative hospital stay in laparoscopic group was (24 hours) which was significantly less than open surgery group (48 hours). The post-operative analgesic requirement and its duration was significantly less in laparoscopic group. The time to have a normal dietary intake was the same between the two groups, but the time to regain normal daily activities was significantly lower in the laparoscopic group (5 days) versus (14 days) in the open group. Table (1).

Table 1: Comparison of laparoscopic and open pyeloplasty

	Open pyeloplasty	Lap. Pyeloplasty	P value
Mean operation time (min)	120	180	< 0.01
Mean hospital stay (hours)	48	24	< 0.01
Mean analgesic dose (mg of diclofenac sodium)	800	200	NS
Mean duration of analgesic use (hours)	96	48	NS
Time to normal diet (hours)	48	48	NS
Time to normal life activities (days)	14	5	NS

The mean follow-up time was 9 months. The follow up was performed by clinical assessment, ultrasonography, IVU, CT scan and nuclear scan. In the laparoscopic group, the follow-up assessment revealed a resolution of symptoms and reduction of hydronephrosis in 18 patients and no improvement in 2 patients with persistent hydronephrosis (success rate 90%). While in the open surgery group, the follow-up assessment revealed that 19 patients had

resolution of the symptoms and improvement of hydronephrosis documented by imaging studies, while one patient had no clinical improvement with persistent hydronephrosis (success rate 95%). (Table (2)).

Table 2: Patients follow up

	Open pyeloplasty	Lap. Pyeloplasty
Mean follow-up period	9 months	9 months
Follow-up studies		
Clinical assessment	20	20
Sonography	20	20
Urography	6	10
CT scan	1	2
Scintigraphy	0	1
None	-	-
Follow-up results		
Resolution	19	18
No resolution	1	2
Follow-up not completed	2	3
Success rates	95%	90%

"The postoperative complications" encountered in the laparoscopy group included: "urinary tract infection" in 15%, prolonged drainage of urine in 10%, and perinephric collection in 5%. Five percent experienced an episode of respiratory tract infection that was treated with bronchodilators, physiotherapy and oxygen therapy. Fortunately, conversion to open surgery didn't happened in our series, but reoperation rate was 10%.

In the open surgery group the complications reported included: an episode of acute retention of urine following removal of urethral catheter in 10 %, urinary tract infection in 10% and minor wound infection in 10%. The reoperation rate was 5%. There was no mortality in either group.

Table 3: Perioperative complications

	Open pyeloplasty		Lap. Pyeloplasty	
	No.	%	No.	%
Urinary tract infections	2	10%	3	15%
Anastomoses leak	1	5%	2	10%
Perinephric Collections	0	0%	1	5%
Recurrent PUJO	1	10%	2	10%
Respiratory tract infection	2	10%	1	5%
Acute urine retention	2	10%	0	0%
Surgical site infection	2	10%	0	0%

DISCUSSION

The definitive treatment of UPJO is surgical, and the ideal surgical procedure would have the highest success rate, be capable of removing coexisting renal calculi, be capable of correcting all forms of UPJO, and a minimally invasive.[24,30]

“Open pyeloplasty was considered the gold standard approach for UPJO with high success rate and acceptable outcome”. [31]

Recently, the laparoscopic pyeloplasty is providing a viable alternative to open pyeloplasty. In reality, it reproduces all the steps of open pyeloplasty including dissection of ureter, excision of the stenotic segment, ureteral spatulation and anastomosis.[32] Nowadays laparoscopic pyeloplasty is regarded as the most preferable treatment modality because of its advantages of improved visualization, less postoperative pain, decreased blood loss, quicker recovery and better cosmeses. [33]

In this comparative study we compare “the operative time, hospital stay, analgesic use, perioperative complications and success rate” between laparoscopic and open pyeloplasty in Al Diwanayah Teaching Hospital.

There is a contradictory results regarding the **Operative time** in laparoscopic and open pyeloplasty. Bonnard A. et al revealed that laparoscopic pyeloplasty is a demanding procedure and requires a longer operative time.[34] In the other hand, Mei H. et al identified no significant difference in the duration of surgery for Laparoscopic versus open pyeloplasty.[35] However, operative time was shorter in laparoscopic than open group of Zhang et al article.[36] Our study revealed that the operative time of laparoscopic pyeloplasty is longer than the operative time of open pyeloplasty by about one hour in average, and this difference was statistically significant. Literatures support this finding because laparoscopic pyeloplasty is a technically demanding procedure and required a steep learning curve and demands technical expertise compared to open surgery. [27, 37, 38]

In our study,” the mean **hospital stay**” was 48 and 24 hours for open and laparoscopic pyeloplasty groups respectively. The less hospital stay for laparoscopic group may be due to the less postoperative pain, quicker recovery. [37, 39, 40]

The **analgesic** dose and duration required in this study was significantly less in the laparoscopic compared to open pyeloplasty group (50 mg diclofenac sodium x2 for 4-5 days vs 100 mg diclofenac sodium x2 for 10-14 days). The same finding was reported by Zhang et. [36]

The perioperative complications encountered in our study (urinary tract infections, anastomoses leak, perinephric collections, recurrent PUJO, respiratory tracts infection, acute urine retention, wound pain) were significantly less in the laparoscopic pyeloplasty group (45% versus 55%) which may be due to avoidance of the loin wound[37,40,41]

The success rate (defined as clinical improvement based on the patient's subjective reduction in pain or other symptoms and radiological comparison before and after surgery was comparable between the two groups with little statistical difference (90% versus 95%). This rate was also comparable to that reported by other studies which confirms that laparoscopic pyeloplasty has a similar success rate of open pyeloplasty, but with the benefits of being a minimally invasive procedure. [25, 42, 43]

In our study, **the failure rate** was 10% and 5% for laparoscopic and open pyeloplasty respectively.

Simforosh N. et al report a failure rate of 11% and 3.5% for laparoscopic and open pyeloplasty respectively. [41] In the immediate postoperative period, those patients complained of prolonged urine leak through the drain tubes. Later (after removal of JJ stent), the patients started to complain of the same preoperative symptoms. Diagnosis of failure (recurrence of UPJO) is usually suggested by sonography and proved by excretory urography. In our center, these cases were treated with laser endopyelotomy. In addition to the previously discussed benefits of laparoscopic over classical pyeloplasty, “the cosmetic outcome of laparoscopic pyeloplasty is clearly better than open surgery”. [44]

CONCLUSIONS:

“The safety and efficacy” of laparoscopic pyeloplasty is comparable to that of open pyeloplasty, with better cosmetic results and shorter hospital stay, therefore laparoscopic pyeloplasty can replace open surgery and may be considered the gold standard technique for the treatment of “ureteropelvic junction obstruction” in expert hands.

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