International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

Laparoscopic Pyeloplasty: Technique, Morphological and Functional Outcome in Uretero-Pelvic Junction Obstruction

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Abstract: ***Introduction: UPJO is defined as an anatomic or functional impedance of urine flow from the renal pelvis into the ureter. UPJO is caused by a congenital intrinsic narrowing of the lumen or by external compression[1,2].The surgical treatment for UPJO includes laparoscopic pyeloplasty, open pyeloplasty, endopyelotomy, endopyeloplasty and robot assisted laparoscopic pyeloplasty.[6] Laparoscopic Pyeloplasty is now considered a standard treatment for UPJO and has a success rate of about 90% with less invasiveness. [6,7] In some of the studies, success rate of laparoscopic pyeloplasty is approaching 99-100% and so is being considered as Gold standard.[6,18] Aims and Objectives: In the present study,we evaluated the morphological and functional outcomes of laparoscopic dismembered pyeloplasty for the management of unilateral UPJO. Materials and Methods: We retrospectively reviewed the clinical charts of all patients subjected to laparoscopic dismembered pyeloplasty (20 cases) in the department of General Surgery at SMIMER Hospital(Tertiary care Centre),Surat between the period of January 2014 to December 2019. Record of all patients were assessed for demographic profile ,co morbidities ,routine blood investigations, including RFT, urine cytology and culture sensitivity, specialised investigation as X ray KUB,USG KUB,IVP/CT-IVU,DTPA. Results: We performed Laparoscopic dismembered Pyeloplasty in 20 Patients. Mean operative time was 93.2 minutes (60-180). Crossing vessels were found in 5 patients. No complications or conversion to open surgery was seen in any case. There was a 100 % primary overall success rate. In our study, 5 patients were evaluated for DTPA scan preoperatively and same group was evaluated postoperatively after 1 year. The average SFR in such patients improved from 33.2 % to 42.4% in one year. Also, 95% of the renal units showed an improvement, and 5% no change in parenchymal thickness. No post-operative complications were reported. In our study, Anderson Hynes pyeloplasty, via laparoscopic approach, resulted in a success rate of 100% which is comparable to most studies in the literature. Conclusion: Our results show that laparoscopic dismembered pyeloplasty compares favourably with the result achieved by open surgery. We believe that laparoscopic pyeloplasty is a gold standard treatment for management of primary uretero-pelvic junction obstruction.***

Keywords: UPJO: ureteropelvic junction obstruction, WNL: within normal limits

1. Introduction

UPJO is defined as an anatomic or functional impedance of urine flow from the renal pelvis into the ureter. UPJO is caused by a congenital intrinsic narrowing of the lumen or by external compression [1,2]. Ureteropelvic junction obstruction (UPJO) is one of the most common pathologies in paediatric urology. It is the most common cause of hydronephrosis in children. [3]

Several reconstructive procedures have been described for the management of UPJO since Trendelenburg's first description. After Anderson and Hynes described a modified dismembered technique in 1949, open pyeloplasty was reported in large series and became a standard treatment option for UPJO because of its high success rate [1,2]. However, the morbidity associated with flank incision was a serious problem and led to the development of minimally invasive surgery. The surgical treatment for UPJO includes laparoscopic pyeloplasty, open pyeloplasty, endopyelotomy, endopyeloplasty and robot assisted laparoscopic pyeloplasty.[6]

Laparoscopic pyeloplasty was introduced for the treatment of UPJO to decrease operative morbidity and maintain the high success rate of open pyeloplasty. It was first performed in 1993 [4,5], and its rate of use has increased dramatically to overtake open pyeloplasty. It is now considered a standard treatment for UPJO and has a success rate of about 90% with less invasiveness [6,7]. In some of the studies, success rate of laparoscopic pyeloplasty is approaching 99-100% and so is being considered as gold standard.[6,18]

2. Aims and Objectives

In the present study, we evaluated the morphological and functional outcomes of laparoscopic dismembered pyeloplasty for the management of unilateral UPJO.

3. Materials and Methods

We retrospectively reviewed the clinical charts of all patients subjected to laparoscopic dismembered pyeloplasty (20 cases) in the Department of General Surgery at SMIMER Hospital(Tertiary care Centre),Surat between the period of January 2014 to December 2019. Record of all patients were assessed for demographic profile, co morbidities ,routine blood investigations, including RFT, urine cytology and culture sensitivity, specialised investigation as X ray KUB,USG KUB,IVP/CT-IVU, DTPA.

Inclusion Criteria:
Unilateral UPJO with or without renal pelvic stone

Exclusion Criteria:
1) Bilateral UPJO
2) Solitary kidney with UPJO.
3) Recurrent cases
4) Non functional kidney
5) Bleeding and Coagulation disorders
6) Previous laparotomy
7) Previous retroperitoneal surgery

Preoperative Radiological assessment included Renal USG, CT-urography for all patients, and DTPA scan for patients with poor renal function on CT-IVU.

Di-ethylene triaminepentaacetic acid (DTPA) scans were performed preoperatively and 1 year after pyeloplasty to evaluate renal drainage and function (5 patients with poor renal function on CT-IVU).Drainage was classified as good if T1/2 was <20 minutes; fair if T1/2 was >20 min and the drainage curve was descending, or poor if T1/2 could not be counted and there was an increasing drainage curve[9]The patients were followed up clinically and radiologically at regular intervals.

We have followed standard technique of Laparoscopic Trans peritoneal Dismembered Pyeloplasty. Retroperitoneal approach was not followed due to ergonomic problem and anatomical delinent issues.

4. Technical Details

Patient position: 45-60 degree lateral
Anesthesia: General anesthesia

Pneumoperitoneum created with veress followed by first 10mm trocar at umbilicus, followed by placement of working trocars in mid clavicular line, upper one 5.5mm trocar in subcostal region approximately 7 cm above the level of umbilicus and lower one; 10mm trocar at the level of umbilicus , one 5mm accessory trocar was always placed in posterior axillary line below the 12th rib which was used for DJ stenting and Drain placement.

The operative side is inspected,the colon is mobilised with harmonic or hook,so that it falls towards midline,then ureter is dissected and followed up to pelvi-ureteric junction without devascularisation , pelvi-ureteric junction area and hilum of the kidney up to lower border of renal vein is cleared fully,identifying and avoiding injury to abnormal polar vessels if present,anterior surface of the ureter is marked with stay suture,next pelvi ureteric junction is transected 1 cm above the stricture segment obliquely directing scissors downwards.

Stenotic or atretic area of the ureter is transected, followed by posterior spatulation of ureter with scissors,now the first stitch is taken at apex of spatulated ureter with vicyrl 3-0 round body suture outside in followed by bite inside out in the most dependent posterior central pelvis,knot tied outside lumen.

Excess of renal pelvis is removed on the anterior side.

Anastomosis between spatulated ureter and trimmed pelvis is continued taking interrupted stitches above and below the first stitch.

After completing the posterior half of the anastomosis, DJ stent is placed laparoscopically.

Anterior row of sutures are placed to complete the anastomosis, followed by closure of trimmed pelvis, and placement of drain through the port in posterior axillary line.

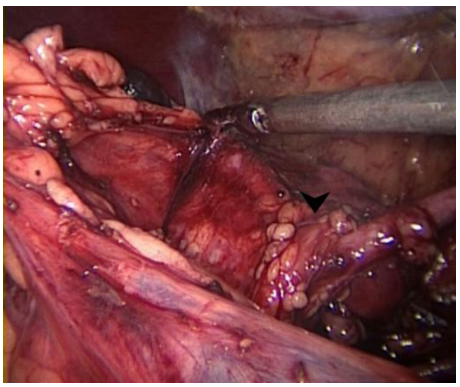

Figure 1: Aberrant vessel marked with arrow

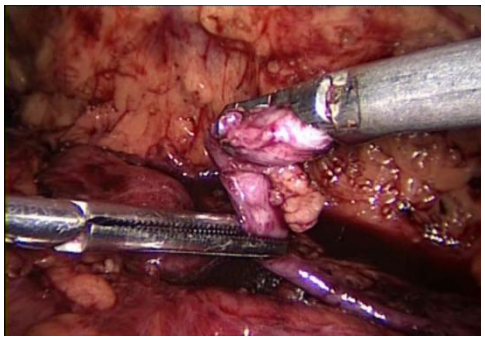

Figure 2: Pelvi-ureteric junction dismembered and spatulation of ureter performed

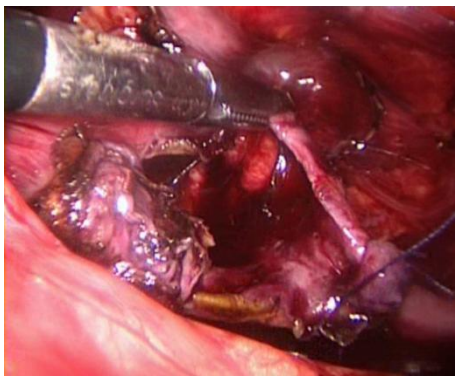

Figure 3: Posterior ureteropelvic anastomosis completed

Figure 4: DJ stent being placed over guide wire

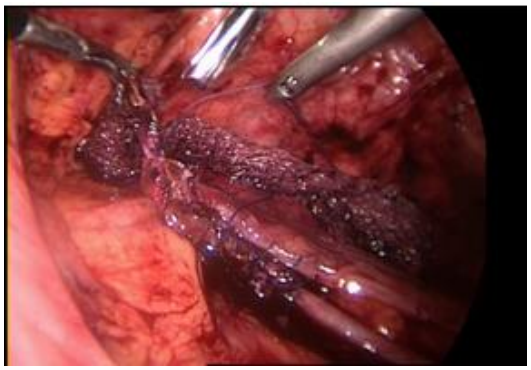

Figure 5: Final suturing at pelvi ureteric junction post stent placement

5. Results

We performed Laparoscopic dismembered Pyeloplasty in 20 Patients. Mean operative time was 93.2 minutes (60-180). Crossing vessels were found in 5 patients. In the total of 20 cases, 5 renal units were subjected to DTPA scan preoperatively (in patients with delayed renal function on CT-IVU) and so were followed by post-operative DTPA scan after 1 year follow up, the parameter taken as split renal function(SRF).No complications or conversion to open surgery was seen in any case. There was a 100 % primary overall success rate.

Profile of patients with Laproscopic Pyeloplasty

		Males	Females
1.	Number of patients	**04**	**16**
2.	BMI	**24.23**	**23.22**
3.	Abdominal operative history	**None**	**None**
4.	Resected segment length (in cm)	**1.2cm**	**1.2cm**
5.	SFR score on DTPA (%)*		**Pre op-33.2% Post op-42.4%**
6.	Hydronephrosis (grade)		
	0	-	-
	1	-	-
	2	-	-
	3	**1**	**4**
	4	**3**	**12**
7.	Aberrant vessel		
	YES		**5 cases**
	NO	**-**	**-**
8.	Operative time (min)	**93.2 min**	**93.2 min**
9.	Calculated blood loss (ml)	**50ml**	**50ml**
10.	Total drained amount	**50ml**	**50ml**
11.	Hospital Stay	**3 days**	**4 days**
12.	Drain Removal	**3 days**	**3 days**

Grading of hydronephrosis[22][proposed by society of Fetal Urology] (used in our study):

Grade	Central renal complex(pelvis)	Renal parenchymal thickness
	intact	
	mild splitting=dilatation	Normal
	moderate splitting, confined to renal border	Normal
	marked splitting, pelvis dilated outside renal border, and calices dilated	Normal
	further caliceal dilatation	Thin

Mild hydronephrosis (grade 1 or 2)
Moderate hydronephrosis (grade 3)
Severe hydronephrosis (grade 4)

***DTPA Report of 5 Patients**

Serial Name Allotted	SFR % (Split Renal Function) Pre-OP	SFR % (Spilt Renal Function) Post-OP
A	32	41
B	36	45
C	31	43
D	30	40
E	37	43

Serial name allotment was based on prior date of admission criteria and kept for confidentiality of patient details.

Follow Up Table

	Age (5-67years)	2 weeks	6 weeks	8 weeks	6 months	1 year	2 years	3 years	5 years
DJ stent removal			Stent removed in 18 cases	2 cases					
Clinical		Symptomatic (4/20) and rest aymptomatic with Normal physical examination.	2/20 cases symptomatic and rest Asymptomatic with Normal physical examination	Asymptomatic with Normal physical examination	Asymptomatic with Normal physical examination	Asymptomatic with Normal physical examination	Asymptomatic with Normal physical examination	Asymptomatic with Normal physical examination	Asymptomatic with Normal physical examination
RFT			WNL	WNL	WNL	WNL	WNL	WNL	WNL
IVP+						Normal (15/20) and Abnormal (5/20)			
DTPA SCAN (SFR)#						42.4%			
USG finding for cortical thickness						Improved in 19/20 cases			

+ CT-IVP was WNL in 15 cases and 5 cases with delayed nephrogram phase with no sign of obstruction.
# Average pre-op SFR of all patients (5/20) was 33.2% and average SFR after 1 year improved to 42.4 %.

6. Discussion

The surgical treatment for UPJO today includes laparoscopic pyeloplasty, open pyeloplasty, endopyelotomy, endopyeloplasty and robot-assisted laparoscopic pyeloplasty. Open pyeloplasty is the standard procedure for UPJO in infants, while Laparoscopic pyeloplasty is the treatment of choice in older children and adults.[4]

The aim of surgical treatment is to improve urinary drainage from the dilated collecting system [5], but also to prevent deterioration of renal function and to relieve the pain [6].

Regarding the effect of presenting symptoms on the outcome of surgery, our study revealed that the outcome of surgery was not affected by presenting symptoms . In one report, there was a significantly higher frequency of functional improvement in symptomatic patients, but the clinical presentation was not a significant predictor [3]. Others confirmed the lack of correlation between presenting symptoms and the functional outcome [7]. Among symptomatic patients, a significant improvement was found in patients presenting with a mass [8], while Calisti et al. found a more significant improvement in patients with crossing vessels. [10].

We found that the outcome of surgery in our study was not affected by the degree of preoperative hydronephrosis . Neither the anteroposterior pelvic diameter [10,14] nor the parenchymal thickness [14] or the degree of dilatation according to the SFU classification [13,15,19] were predictors of functional outcome.

Konda et al. showed that the grade of hydronephrosis correlated with the severity of renal cortical damage measured on DMSA scan, but not with postoperative renal function [8].

Diethylene triaminepentaacetic acid (DTPA) scans were performed preoperatively and 1 year after pyeloplasty to evaluate renal drainage and function. Drainage was classified as good if T1/2 was <20 min; fair if T1/2 was >20 min and the drainage curve was descending; or poor if T1/2 could not be counted and there was an increasing drainage curve.According E.M,Sahil et al study on post operative renography, postoperative SRF improved in 53 patients (63.9%), remained stable in 25 (30.1%), and deteriorated in 5 cases (6%). The degree of SRF improvement ranged from 2 to 23%. [15]. In our study, 5 patients were evaluated for DTPA scan preoperatively and same group was evaluated postoperatively after 1 year. The average SFR in such patients improved from 33.2 % to 42.4% in one year.

According to Harraz et al. the improvement of renal function persisted 3–5 years after surgery and even until puberty [11]. Renal obstruction is usually diagnosed by prolonged drainage on the DTPA diuretic renogram. As for postoperative renal drainage, renal T1/2 improved in 90% of our patients, while the kidney remained obstructed in 10% of the patients. [12].

In our study, 95% of the renal units showed an improvement, and 5% no change in parenchymal thickness. The change in parenchymal thickness did not affect the outcome . Baek et al. reported that renal parenchymal thickness did not significantly change in patients with giant or non-giant hydronephrosis after pyeloplasty [13].

Tal et al. studied 103 cases of dismembered pyeloplasty in children and reported that 31.1% of their patients developed fever and 12.6% had documented urinary tract infection (UTI). Leakage was found in 7.8% of their patients [14]. On the other hand, Sarhan et al., studied 526 cases of primary UPJO subjected to open dismembered pyeloplasty with no reported perioperative complications [15]. Nerli et al. performed 102 laparoscopic pyeloplasties, and postoperative complications including prolonged ileus, prolonged urinary leak, fever, hematuria and recurrent UPJ stenosis occurred in 11.65% of their patients. Recurrent UPJ stenosis occurred in 4.9% of the children, resulting in reoperation [16].

Gupta and Sharma performed 329 open pyeloplasties, and the post-operative complications included slippage of the stent in 11, blockage/non-drainage in 7, difficult retrieval in 4, urine leak in 4, infection in one and urinoma in 3 patients [17]. In our study, no post operative complications were reported.

In our study, laparoscopic dismembered pyeloplasty, resulted in 100% resolution of PUJ obstruction without any significant complication; which is comparable to most studies in the literature. Eskild-Jensen et al. reported that pyeloplasty was successful in treating symptoms, and an improvement of renal dilatation and the excretion pattern was found in up to 95% of their patients [18]. Calvert et al. reported a 96% success rate of laparoscopic pyeloplasty and a 98% success rate of open pyeloplasty in 100 patients [19]. In other reports, the success rates of laparoscopic dismembered pyeloplasty were 95.2% [20, 21]

7. Conclusion

Our results show that laparoscopic dismembered pyeloplasty is better than open surgery. We believe that laparoscopic dismembered pyeloplasty is a gold standard for management of primary uretero-pelvic junction obstruction.

8. Conflicts of Interest

None

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