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Original research article

A prospective study comparing open vs. laparoscopic pyeloplasty for pelvic-ureteric junction obstruction

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Abstract

Background: Open pyeloplasty has been the gold standard for surgical treatment of ureteropelvic junction (UPJ) obstruction. However, with the advent of minimally invasive procedures, which provide a better cosmetic effect, shorter duration of hospital stay, and faster resuming of social life, many such procedures were developed, amongst which laparoscopic pyeloplasty has shown promising results similar to open pyeloplasty.

Materials and methods: A total of 56 patients with UPJO who were admitted for surgery in the Department of Urology, NIMS, Hyderabad were selected with their consent, after they fulfilled inclusion criteria. 28 patients were operated via open pyeloplasty and 28 patients via laparoscopic pyeloplasty.

Results: The demographic data, operated side, and pre-operative parameters were similar in both groups. However, the post-operative VAS score and duration of hospital stay were lower in the laparoscopic group than in the open group.

Conclusion: Laparoscopic and Open pyeloplasty are equally effective in treating PUJO, with comparable patient-reported outcomes. Laparoscopic pyeloplasty is preferable to open pyeloplasty, due to better cosmetic effect, decreased postoperative pain and morbidity, and decreased hospital stay with early recovery. However, it requires an experienced surgeon with technical expertise.

Keywords: Laparoscopic pyeloplasty, pelvic-ureteric junction

Introduction

Ureteropelvic junction obstruction (UPJO) describes a functionally significant impairment of urinary transport from the renal pelvis to the ureter. Although most cases are congenital, the problem may not become clinically apparent until much later in life [1]. Flank pain, hematuria, and abdominal mass are the most common symptoms. UPJO causes hydronephrosis and progressive renal impairment may ensue if left uncorrected [2]. The optimum surgical correction of UPJO has been a great challenge for over a century [3]. Open pyeloplasty originally described by Andersen and Hynes [4] remains the gold standard enjoying a long-term success rate exceeding 90% [5]. A muscle incision is required in this procedure that is associated with some degree of morbidity. This has led to the development of minimally invasive approaches to UPJ repair.

Over the last two decades, the treatment approach to UPJ obstruction has evolved from open pyeloplasty to various minimally invasive procedures like endopyelotomy, acucise catheter incision, balloon dilatation, and laparoscopic pyeloplasty. However, these options are reported to be less successful than open pyeloplasty [6].

Schuessler *et al.*, first described Laparoscopic pyeloplasty in 1993. Now, it has been developed worldwide as the first minimally invasive option to match the success rate of open pyeloplasty. Only one randomized study to compare Laparoscopic and open pyeloplasty has been done by Turk *et al.*, in 2002 [7].

Aims and Objectives of the study

This study aims to compare the success rates, advantages, disadvantages, and post-operative outcomes of open vs. laparoscopic pyeloplasty.

Materials and Methods

A total of 56 Patients with pelvic ureteric junction obstruction, who were admitted to the Department of

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Urology, Nizam's Institute of Medical Sciences, Hyderabad for undergoing Laparoscopic or Open pyeloplasty, from January 2022 to April 2023 were selected. Patients with reflux disease, Single functioning kidney, Duplex system, Differential function <20% in DTPA, Previously operated PUJO, Presence of renal stones, & age <12 years were excluded from the study.

After ethical committee approval and informed consent, patients were preoperatively evaluated by history, clinical examination, relevant blood profile, and urine investigations. Diagnosis of PUJO was based upon the findings of ultrasound KUB, NCCT KUB, Intravenous Pyelography (IVP), and a DTPA Renogram scan. Micturating cystourethrogram (MCUG) was performed in selected cases to rule out our vesicoureteric reflux (VUR) disease.

After the confirmation of PUJO, patients were counseled regarding surgery and were given two options to opt for open or laparoscopic pyeloplasty.

In both techniques, dismembered Anderson-Hyne's pyeloplasty was performed. Care was taken to address a crossing aberrant lower pole vessel by repositioning the ureter ventrally. Anastomoses were done with 4–0 Vicryl. After completion of the posterior layer, a DJ stent was placed and then anastomosis was completed. Drain was inserted adjacent to repair and a Foleys catheter was left in the bladder for three days.

The visual analogue scale (VAS) was used to assess the severity of pain. In both procedures, the urethral catheter was ideally removed on the third postoperative day and the abdominal drain was removed before discharge when output was deemed insignificant.

In the immediate postoperative period, patients were evaluated regarding renal function and the success of surgery. All patients started oral feeding on the first postoperative day.

The DJ stent was removed after 6 weeks from the day of surgery in most cases.

Follow-up USG KUB is done after 3 months from the day of surgery.

Follow-up DTPA Renogram is done after 6 months from the day of surgery.

All patients were followed up for 3 months to 1.5 years postoperatively in the study period.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software, version 23.0 the p-value for statistical significance was kept at 0.05 with a confidence interval of 95%. Statistical tests for the comparison between the open and laparoscopic procedures were divided into continuous and categorical variables, for continuous variables a two-tailed independent t-test and Mann-Whitney U-test were performed whereas, for the categorical variables, a Chi-square test and Fischer exact tests were performed.

Results

50% of the population i.e.; 28 patients underwent open pyeloplasty and the rest 50% underwent Laparoscopic Pyeloplasty.

Parameters	**Open pyeloplasty group (n = 28)**	**Laparoscopic pyeloplasty group (n = 28)**
Age	15-60 years.	15-53 years
Males: females ratio	1.5: 1	1.8:1
Pre-operative symptoms	Flank pain in all 28 patients	Flank pain in all 28 patients
Operative side	12 patients on the right side & 16 patients on the left side	11 patients on the Right side and 17 on the left side
Pre-operative serum Creatinine (mg/dL)	0.24 - 1.27mg/dl Mean = 0.80 mg/dl.	0.45- 1.24 mg/dl Mean = 0.86 mg/dl.
Pre-operative GFR (mL/min)	11.34 - 52 ml/min. Mean GFR (mL/min) = 28.6 <20 GFR (n) = 11 patients	11.08 - 56.6 ml/min Mean = 33.85 ml/min <20 GFR (n) = 10 patients
Pre-Operative differential Renogram Function (%)	21-49.6%. Mean Function = 31.63%. <25% function (n) = 9	21.2 - 57.1%. Mean Function = 37.76% <25% function (n) = 6
Pre-operative ultrasonography (N = 28)	Gross HUN = 20; Mod HUN = 7; Mild HUN = 1	Gross HUN = 12; Mod HUN = 14; Mild HUN = 2
Pre-operative CT Urogram	(n= 24) Gross HUN = 9; Mod = 14; Mild = 1	(n= 25) Gross = 20; Mod = 7; Mild = 1
Pre-operative IVP	(n = 4); gross HUN = 3; moderate HUN = 1	(n = 3); gross HUN = 2; mild HUN = 1
Intra-operative crossing vessel causing PUJO	(n = 6);	(n = 6);
Post-Operative Pain assessment by VAS score	3-6 Mean VAS score = 4.75	1-6 Mean VAS score = 3.14
Duration of hospital stay	5-8 days	2-6 days
DJS removal after 6 weeks	28 patients	28 patients
Post-operative ultrasonography was done after 3 months	Mod HUN = 15; Mild HUN = 13	Gross HUN = 1; Mod HUN = 5; Mild HUN = 21; Normal = 1
post-operative GFR (mL/min) done after	7.4-50.5 ml/min	12.6 - 58.2 ml/min

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6 months	<20 GFR (n) = 5	<20 GFR (n) = 2
post-operative differential Renogram Function (%) done after 6 months	12.2 - 50.4% <25% function (n) = 3	22.3 - 58.44%. <25% function (n) = 2
Post-operative complications	1 patient had a non-functioning kidney on the operated side in the functional DTPA renogram done after 6 months	Nil

Discussion

Pyeloplasty is the surgical reconstruction of the ureteropelvic junction to drain and decompress the kidney. Most commonly it is performed to treat a ureteropelvic junction obstruction.

Dismembered Anderson-Hynes pyeloplasty is the Gold standard surgical treatment for ureteropelvic junction obstruction. This revision of the renal pelvis treats the obstruction by excising the stenotic adynamic area of the ureteropelvic junction and creating a more capacious conduit using the tissue of the remaining ureter and renal pelvis.

Several studies have demonstrated that adults with UPJO treated with pyeloplasty as minimally invasive surgery have a lower risk of complications, transfusions, prolonged hospital stay and cosmetic outcomes and generally lower morbidity compared to patients that had open surgery [8, 9].

Our study focuses on the indications, techniques, advantages, disadvantages, and postoperative outcomes of open pyeloplasty and laparoscopic pyeloplasty.

A total of 56 pyeloplasties were done of which 28 were open pyeloplasties and 28 were laparoscopic pyeloplasties. Patients in both groups underwent detailed examination using the proforma attached and were observed for pre-operative and post-operative renal function, postoperative pain, postoperative complications, and recovery. Data is collected and the results are compared and analyzed in both groups.

In our study, patients of both groups were similar in demographic data and operation side. Mohamed Badreldin, Tarik M. Abdul Elbaky *et al*., [10] also observed similar findings in their study.

All patients (100%) in both study groups presented with flank pain. None of the patients had presented with a mass abdomen. In a study by R.C Calvert, M.M. Morsy [11] *et al*., about 90% of the open group and 92% in the laparoscopic group presented with loin pain.

In our study and the study done by Mohamed Badreldin, Tarik M. Abdul Elbaky *et al*., [10], almost all the patients had normal S.creatinine levels pre-operatively and There was no significant difference between the two groups in terms of distribution of pre-operative USG, IVP, and CT Urogram.

Simforoosh N, Basiri A, Tabibi A, *et al*., [12] observed that most background variables such as weight, degree of hydronephrosis, aberrant vessels, or the involved renal unit did not impact the patient selection and the outcome. In the present study as well, There was no significant difference between the groups in terms of the presence of intra- operative Crossing Vessel.

In our study Post- Operative Pain (VAS) was significantly higher in the open pyeloplasty group. A similar finding was observed by Omer Farooq Rehman, Musab Umair, *et al*., [13].

In the present study and study done by Omer Farooq Rehman, Musab Umair, *et al*., [13], the Duration of hospital stay was significantly longer in the open group.

There was no statistically significant difference between the groups in terms of the distribution of postoperative complications in our study. Only 1 patient in the open pyeloplasty group was diagnosed with a complication of a non-functioning kidney of the operated side in the functional DTPA renogram done after 6 months from the day of surgery. In a study by Sunil Krishna M. *et al*., [14] only 1 patient in the open pyeloplasty group had post-operative complications which settled conservatively. Though no statistical test is possible in this case, the authors see that both procedures are relatively safer.

There was a decrease in the degree of HDN in post-operative USG done after 3 months from the day of surgery in both the groups and there is no significant statistical difference. In a study by Omer Farooq Rehman, Musab Umair, *et al*., [13] Follow-up ultrasound at six months and 12 months scan showed an equivalent pattern of improvement in hydronephrosis among the open and laparoscopic pyeloplasty groups.

There is an improvement in the post-operative mean GFR value compared to pre-operative values in both the open and laparoscopic groups. Also, there is an improvement in the post-operative mean differential function of the operated side in the DTPA renogram compared to pre-operative values in both groups.

In a study by Omer Farooq Rehman, Musab Umair, *et al*., [13] there was an increase in the mean differential renal functioning after the first six months of surgery and also they did not find any statistically significant difference in MAG3 scan improvement between the two treatment groups (p=0.467) at 12 months.

Conclusion

Laparoscopic and Open pyeloplasty are equally effective in treating PUJO, with comparable patient-reported outcomes.

Laparoscopic pyeloplasty is a safe and effective minimally invasive treatment option that duplicates the principles and techniques of definitive open surgical repair with less pain, cosmetic advantages, no long

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incision, and outcome comparable with open surgery.
The laparoscopic technique merits open surgery with faster rehabilitation, a decreased postoperative pain experience and a shorter time to convalescence with a shorter hospital stay and is cosmetically superior to the open pyeloplasty.
The renal function is mainly preserved or improved in both laparoscopic and open pyeloplasty with no significant difference.
Similar to open pyeloplasty, varied surgical anatomy associated with PUJO like the crossing vessels and high insertion of the ureter in the pelvis can be successfully repaired with laparoscopic pyeloplasty.
As per the present study, both procedures had very less postoperative complications. The results of laparoscopic pyeloplasty were similar to open pyeloplasty, Hence, Laparoscopic pyeloplasty cannot be considered inferior.
However, laparoscopic pyeloplasty is preferable to open pyeloplasty, considering cosmesis, decreased postoperative pain and morbidity, and decreased hospital stay with early recovery due to comparable results but it requires an experienced surgeon with technical expertise.

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