ORIGINAL ARTICLE

Evaluation of Open vs Laparoscopic Pyeloplasty in Children: An Institutional Experience

Vedamurthy Reddy Pogula,[1] Ershad Hussain Galeti,[2] Karthikesh Omkaram,[3] Mallikarjuna Reddy Nalubolu[4]

Abstract

Background: An ureteropelvic junction (UPJ) obstruction is a blockage of urine passage from the renal pelvis to the upper ureter. Back pressure inside the renal pelvis can cause renal damage and function deterioration. In children, the adynamic segment, crossing vessel, ureteral valves, and sticky bands are the most common causes of UPJ obstruction. The surgical rebuilding of the UPJ to drain and decompress the kidney is known as pyeloplasty. The process, benefits, limits, and post-operative results of open and laparoscopic pyeloplasty are examined in this research.

Materials and methods: The study included children diagnosed with pelviureteric junction obstruction in the Urology Department at our institute between January 2016 and December 2019. Ultrasound, micturating cystourethrogram, and diethylenetriamine pentaacetate (DTPA) were used to evaluate them.

Results: Around 45 of the 70 instances involved boys. Twenty-one were discovered prenatally and confirmed postnatally using ultrasonography. The most prevalent kind of presentation was abdominal mass in 44 (42.8%) of the youngsters. There were 35 open and 35 laparoscopic pyeloplasties performed. The laparoscopic pyeloplasty group had a mean total operating time of 99.2 minutes with stent implantation, compared to 80.5 minutes in the open group. The mean glomerular filtration rate (GFR) and differential renal function improved in both groups; however, the difference was not statistically significant ($p > 0.05$). The postoperative analgesic need was much reduced in the laparoscopic group as compared to open pyeloplasty.

Conclusion: The major drawback of laparoscopic pyeloplasty is the length of time it takes to complete the procedure. It necessitates exceptional intracorporeal suturing skills, and the benefit is that it has a lower rate of morbidity, shorter hospital stays, and better aesthetic results than the open technique.

Keywords: Laparoscopy, Open surgery, Pyeloplasty.

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Introduction

Urine flow blockage from the renal pelvis to the upper ureter is referred to as ureteropelvic junction (UPJ) obstruction. Back strain inside the renal pelvis can cause renal damage and degeneration. A primary obstructive lesion in the UPJ is most frequent in youngsters, although it can occur in adults and the elderly as well. Adynamic segment, crossing vessel, ureteral valves, and sticky bands are all etiologies causing UPJ blockage in youngsters. Pyeloplasty is the surgical reconstruction of the UPJ to drain and decompress the kidney. If remaining renal function is acceptable, it is most usually used to treat a UPJ blockage.[1,2] The usual surgical therapy for UPJ blockage is dismembered Anderson-Hynes pyeloplasty. This renal pelvis surgery relieves the obstruction by completely eradicating the stenotic adynamic section of the UPJ and creating a larger conduit from the remaining ureter and renal pelvis tissue.[3] The techniques, advantages, and postoperative results of open pyeloplasty versus laparoscopic pyeloplasty are compared in this study.

Aims and Objectives

The purpose of this study was to compare the procedures used in open and laparoscopic pyeloplasty, as well as the advantages and disadvantages of each treatment. The goal of this study was to compare the outcomes of open and laparoscopic pyeloplasty.

Materials and Methods

The study included children diagnosed with pelvic–ureteric junction (PUJ) blockage at our institute's Urology Department between January 2016 and December 2019. An ultrasound of abdomen, micturating cystourethrogram, and DTPA study were used to assess them. This research is both prospective and retrospective. The research included 70 children with PUJ obstruction, 15 of whom were female and 45 of whom were male. The children's symptoms and signs were assessed. Renal function tests, ultrasonography of abdomen, micturating cystourethrogram, and DTPA were used to accomplish this. The patients were randomized to either open or laparoscopic pyeloplasty. They were assessed for renal function, postoperative pain, and hospital stay both before and after surgery. The inclusion criteria are met by all patients with PUJ obstruction. Cases with concomitant reflux and recurring cases are exclusion criteria. A

[1–3]Department of Urology, Narayana Medical College, Nellore, Andhra Pradesh, India

[4]Citizens Hospital, Nallagandla, Hyderabad, Telangana, India

Corresponding Author: Ershad Hussain Galeti, Department of Urology, Narayana Medical College, Nellore, Andhra Pradesh, India, Phone: +91 8074847997, e-mail: dr.ershadhussain@gmail.com

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thorough history is collected, including age, gender, stomach discomfort, fever, and urinary tract infections. It was also necessary to gather information about one's past and family history.

Procedure

Open Pyeloplasty

It is feasible to perform this procedure through a variety of incisions, but we went with an extraperitoneal flank incision. The restricted UPJ segment is surgically removed, and the renal pelvis is anastomosed to the spatulated upper ureter. Assuming the renal pelvis is extensively dilated; in this case, it was regularly reduced in size by chopping off unneeded tissue. It is then sutured such that it streamlines down toward the anastomosis, and a double J stent and a flank drain are placed across the anastomosis. They were removed 48–72 hours following surgery. If a vascular abnormality is discovered near the UPJ, the anastomosis is done anterior to the vascular.

Laparoscopic Pyeloplasty

The patient was in an ipsilateral kidney position. The camera was implanted by a 10-mm umbilical trocar, and two functioning ports were positioned in the mid-clavicular line. The kidney can be located posterior and lateral to the colon. The kidney was surrounded by the posterior peritoneum, which extends from the higher pole to about 3 cm below the lower pole. It is critical not to separate Gerota's fascia's lateral attachments, as this would enable the kidney to "flip" medially. Because the renocolic ligaments have been detached, the colon can migrate medially and offer exact passive exposure to the UPJ. Following the psoas muscle directly medial to the bottom pole of the kidney, the ureter was found. The ureter differs from the gonadal veins in this it moves peristaltically. The primary treatment for resolving UPJ blockage is Anderson–Hynes repair. To make this repair easier, the pelvis is dissected to allow for better vision and mobility for a tension-free anastomosis with the ureter. At the PUJ, the ureter was then cut using scissors. Prior to doing surgery on a highly redundant pelvis, a reduction must be performed. The ureter was then spatulated on its lateral side. Following a freehand intracorporeal suturing procedure, a Double J stent is inserted.

Results

Pelvic–ureteric junction blockage was detected in 70 children. The majority of the 70 children were under the age of 5 years, with 54 (77%) being under the age of 1 year, and 11 (15%) being under the age of 1 year (Fig. 1).

A 3:1 ratio was found among the 70 children, with 45 (64.2%) male children and 15 (21.2%) female children (Table 1).

Left-sided obstruction affected 40 (57.14%) children, right-sided blockage affected 25 (35.71%), and bilateral blockage affected 5 (7.14%) of the 70 children (Table 1).

Ultrasonography was used to find 21 of the 70 infants antenatally, and postnatal confirmation was obtained. A mass abdomen was the most common presenting symptom (44.8%), followed by a urinary tract infection (UTI; 21.5%), pain (8.4%), and antenatally (21%).

A total of 35 open and 35 laparoscopic pyeloplasties were done, with all of the children in the laparoscopic group having unilateral PUJ obstruction.

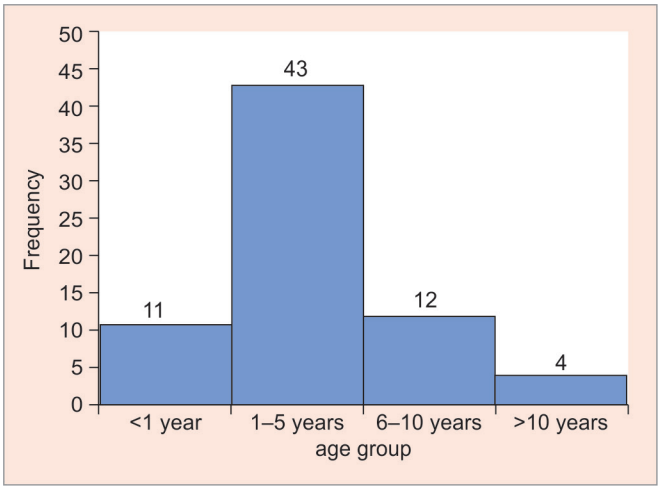

Fig. 1: Histogram of age groups of study subjects

Table 1: Distribution of variables of study subjects in the two groups ($n = 70$)

Variables	*Open procedure*	*Laparoscopy*
Sex		
Male	26	29
Female	09	06
Mass		
Present	15	19
Absent	20	16
UTI		
Present	10	12
Absent	25	23
Pain		
Present	03	05
Absent	32	30
Antenatal detected		
Yes	11	10
No	24	25
Side		
Right	12	13
Left	18	22
Bilateral	05	0
Complications		
Present	02	0
Absent	33	35

In the laparoscopic pyeloplasty group, the mean total operating time with stent installation was 99.2 minutes, compared to 80.5 minutes in the open group.

The mean GFR preoperatively in the open pyeloplasty group was 37.86, with the majority of patients having a GFR between 30 and 50. Five individuals had GFRs ranging from 15 to 20. In comparison, the average postoperative GFR increased to 41.02 (Table 2).

The mean GFR preoperatively in the laparoscopic pyeloplasty group was 38.05; the majority of patients had a GFR between 30 and 50. Three individuals had GFRs ranging from 15 to 20. In comparison, the average postoperative GFR improved to 40.15 (Table 2).

The DTPA renogram demonstrated improved differential renal function in 58 of the 70 patients, 30 of whom were from the laparoscopic group and 28 of whom were from the open group. In 10 patients, 5 from the open group and 5 from the laparoscopic group, the DTPA renogram remained unaltered (Table 2). The remaining two showed just a little drop in differential function. The two patients had pyeloplasty redone. Both were members of the open group. The postoperative analgesic demand was much lower in laparoscopic pyeloplasty compared to open pyeloplasty. The length of analgesic required was also much shorter in the laparoscopic group. The mean hospital stay after laparoscopic pyeloplasty was 3.15 days, which was substantially smaller than the open group's mean of 8.30 days. The average follow-up in available patients was 33.5 months, and 34.5 months in laparoscopic cases. There was just one conversion from laparoscopic to open surgery in the laparoscopic group due to technical difficulties. Owing to a significant decline in differential renal function, two children in the open group had redo pyeloplasty. When compared to the open group, patients in the laparoscopic group had less scarring at the incision site.

Discussion

Among the 70 patients, 21 were found antenatally, accounting for 30% of instances, although, in the literature, approximately 50% of patients have been observed antenatally.[4] Of the 21 individuals, 11 were operated on before the age of 1 year, while the rest were operated on before the age of 5 years. According to our series, left-sided lesions were the most prevalent, accounting for 57.14%, followed by right-sided lesions, which corresponds to the literature study, which offers 66% when compared to the opposite side.[5] Male children are more typically impacted than female by a factor of three, although the literature study revealed a factor of two. According to the symptoms, the majority of the children had a mass abdomen (62.8 %), with other symptoms including UTI and pain being less common. To avoid kidney injury, some studies have advocated early treatment.[6] A small number of studies have found that affected kidneys with acceptable differential renal function at the time of diagnosis are less likely to have renal function deterioration after surgery. Differential renal function did not improve following pyeloplasty, according to previous investigations, regardless of prior renal functional condition.[7]

To distinguish the blocked PUJ, diuretic renography (DTPA) has been frequently used. Few researchers, however, have questioned the interpretation of diuretic renography obstructive patterns to diagnose PUJ blockage. The use of a 20-minute washout after a diuretic challenge to diagnose blockage is effective in symptomatic older children and adults, but assuming the same criteria can be applied to an asymptomatic group of young children has aroused debate.[4] Both the open and laparoscopic groups had a postoperative diuretic renogram to see whether the differential renal function and GFR had improved. Preoperatively, the open group's mean GFR was 38.32. Five individuals had the lowest GFR of 15–20. In comparison, the average postoperative GFR improved by 40.8. Preoperatively, the mean GFR in the laparoscopic group was 39.8, with the majority of patients having a GFR between 30 and 50. Three individuals had the lowest GFR of 15–20. In comparison, the average postoperative GFR improved by 41.2%. There was no significant difference in GFR improvement between the two groups ($p > 0.05$; Table 3). The DTPA renogram revealed improved differential renal function in 58 of the 70 patients, with 30 patients having undergone laparoscopic surgery and 28 had undergone

Table 2: Descriptive statistics of study subjects in the two groups ($n = 70$)

	Group	*N*	*Mean*	*Std. deviation*	*t value*	*p value*
Preop GFR (mL/min)	Open	35	37.86	16	0.049	>0.05
	Lap	35	38.05	16.4		
Preop differential function	Open	35	38.50	10.2	0.072	>0.05
	Lap	35	38.33	9.7		
Postop GFR (mL/min)	Open	35	41.02	14.2	0.925	>0.05
	Lap	35	40.15	11.6		
Postop differential function	Open	35	41.31	9.1	0.136	>0.05
	Lap	35	41.00	9.4		

Preop, preoperative; Postop, postoperative

Table 3: Comparison of means of certain variables between the two groups

	Group	*N*	*Mean*	*Std. deviation*	*t value*	*p value*
Preop GFR (mL/min)	Open	35	37.86	16	0.049	>0.05
	Lap	35	38.05	16.4		
Preop differential function	Open	35	38.50	10.2	0.072	>0.05
	Lap	35	38.33	9.7		
Postop GFR (mL/min)	Open	35	41.02	14.2	0.925	>0.05
	Lap	35	40.15	11.6		
Postop differential function	Open	35	41.31	9.1	0.136	>0.05
	Lap	35	41.00	9.4		

Preop, preoperative; Postop, postoperative

open surgery. In 10 patients, the DTPA renogram remained steady, 5 in the open group and 5 in the laparoscopic group. The differential function of the remaining two decreased. Both of the youngsters who had their pyeloplasty redone were from the open group. The difference in improvement in differential renal function between the two groups was not significant ($p > 0.05$; Table 3).

After pyeloplasty, the postoperative analgesic need was way lower in the laparoscopic group than those in the open group. The period of analgesic usage was also significantly reduced in the laparoscopic group. In the laparoscopic group, the mean postoperative hospital stay was 3.15 days, contrast to 8.25 days in the open group. The average follow-up time for open surgeries was 33 months, whereas it was 34 months for laparoscopic procedures. In the laparoscopic group, there has only been one open surgery conversion. Two individuals in the open group had pyeloplasty redone due to a significant decline in differential renal function. Individuals in the laparoscopic group exhibited less scarring at the incision site than those in the open group.

The success rate of laparoscopic pyeloplasty is extremely high, at 87.98%.[7] We obtained a 97.1% success rate in this study. Conversion to an open method was seen as a failure.

In the published series,[8,9] the sole drawback seems to be the extended operative time. However, Zhang et al.[7] found that the laparoscopic (retroperitoneal) group took less time than the open group. As laparoscopic surgery becomes more ingrained in resident training, more complicated methods, such as intracorporeal suturing, become less intimidating. Furthermore, advanced intracorporeal suturing and knotting skills, as well as the development of new robotic equipment, may minimize operating time.[10] The Da Vinci robot's performance-enhancing function seems to reduce the difficulties of intracorporeal suturing. The total complication rate of laparoscopic pyeloplasty has been reported to range from 4 to 13% in the literature.[7] There were no complications and only one conversion to open surgery in our research.

Conclusion

Laparoscopic pyeloplasty is a safe and effective procedure that follows a well-established procedure. When compared to laparoscopic surgery, open pyeloplasty has a shorter operating time. The sole downside of laparoscopic pyeloplasty over open surgery is that it takes longer and needs a high level of intracorporeal suturing competence. There were no redo instances with laparoscopic pyeloplasty in our research. In comparison to open pyeloplasty, this surgery offers less morbidity, shorter hospital stays, and superior aesthetic results. For PUJ blockage, laparoscopic pyeloplasty has become the gold standard.

Authors Contributions

All authors have read and approved the manuscript.

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