Journal of Complementary Medicine Research, ISSN: 2146-8397 Vol. 14, No. 5, 2023 (pp.454-458)
RESEARCH ARTICLE WWW.JOCMR.COM

Evaluation of Functional Outcome of Open pediatics Pyeloplasty Using Internal Stenting versus Nephroureterostomy Tube

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Abstract
Background: Different types of stents are used in pyeloplasty and those include either an double-J (DJ) or an externalized stents. The aim of this work to explore the outcome of using internal DJ versus external nephroureterectomy tube following open pyeloplasty in children with primary Ureteropelvic Junction Obstruction(UPJO) emphasizing the advantages and drawbacks of its use and the outcome of pyeloplasty with both types of stents.
Methods: This prospective single center comparative interventional study was carried out on 60 patients, pediatric age to 18 years old, with primary UPJO. Patients were divided into two equal groups: Group 1: patients underwent antegrade DJ stent insertion, group 2: patients underwent placement of external stent.
Results: There was a statistically significant difference between groups regarding hospital stay, median stent duration, stent migration, Prolonged drainage, Urinary tract infection symptoms, leakage, split function at 12 months follow upand stent cost. There was no statistically significant difference between groups, regarding median operative time pyelonephritis, urinoma, fever, obstruction, anterior-posterior renal pelvic diameter after 3, 6,12 months, parenchymal thickness at 3,6,12 months, glomerular filtration rate at 6,12 months follow up, split function at 6 months follow up, t1/2 at 6,12 months. Regarding Success rate 28 patients had a succeeded operation in the External stent group, and 27 patients had a succeeded operation among the DJ stenting group.
Conclusions: Both types of stents demonstrated similar success and complication rates,although DJ stent insertion provides a shorter hospital stay than the external stent and external cost less than DJ stent

Keywords:
open pyeloplasty, internal stenting, nephroureterectomy tube, pediatrics, external stent
DOI: 10.5455/jcmr.2023.14.05.45

Introduction:
Ureteropelvic junction obstruction(UPJO) is a well-recognized entity that may present at any time in fetal life, infancy, childhood, or early or late adulthood, As the most common site of obstruction in the upper urinary tract, the UPJ is an area with which urologists should be well familiar, There has been an improved understanding of the pathophysiology of primary congenital UPJO that has been reflected in the evolution of surgical options, from open surgical repair to minimally invasive surgery[1].
UPJO is seen morefrequently in boys than in girls, with up to twice the number of cases in malescompared to females. The left side is as well affected twice as often as the right side, It is the most common cause for antenatally detected hydronephrosis[2].
Although there are a variety of surgical approaches to correction of UPJO, they can be classified into 3 categories: Open surgical procedures, Endoscopic (antegrade or retrograde) procedures, laparoscopic and robotic procedures, While considering these various options, it is important to weight the potential risks and benefits of these approach[3].

Anderson Hynes dismembered pyeloplasty is a very common procedure done in the pediatric urology practice and is considered the standard surgical treatment for ureteropelvic junction obstruction (UPJO). Open approach is still valid in many centers even in the era of laparoscopic and robotic approaches. During pyeloplasty, the use of trans-anastomotic stent drainage remains controversial and depends mainly on surgeon preference and experience[4].

The importance of stent use in pyeloplasty was raised by others. Different types of stents are used in pyeloplasty and those include either a double-J (DJ) or an externalized stent. Both types have been widely used all over the world by pediatric urologists and still there is a continuing debate regarding which one is more advantageous [5]

The internal DJ stents are easy to insert with an intended shortened hospital stay; however, its use carries the risk of migration, stent related lower urinary tract symptoms and its removal needs a second operating room visit with a second general anesthesia. Meanwhile, the external stent does not pass through the ureterovesical junction so no stent related symptoms occur, allow post-operativeantegrade study if needed, and it can be easily removed on outpatient basis without anesthesia; however, its use carries the risk of bleeding when passing through the renal parenchyma, leakage, kinks and obstruction[6].

The aim of this work wasto explore the outcome of using internal DJ versus external nephroureterectomy tube following open pyeloplasty in children with primary UPJO emphasizing the advantages and drawbacks of its use and the outcome of pyeloplasty with both types of stents.

Patients and Methods:

This prospective comparativeinterventionalstudy was carried out on 60 patients,pediatric age to 18 years old, both sexes, with primary Ureteropelvic Junction Obstruction (Dilated antero-posterior diameter of renal pelvis more than 25mm, obstructed renogram). From January 2021 to January 2022.

The study was done after approval from the Ethical CommitteeKafr-Elsheikh University Hospitals. An informed written consent was obtained from the relatives of the patients.

Exclusion criteria were equivocal renogram, age > 18 years, poorly functioning kidney, patient unable or unwilling to comply with follow-up schedule, recurrent UPJO, associated with other congenital anomalies. Patients were divided into two equal groups: Group 1: included 30 patients who underwent antegrade DJ stent insertion, group 2: included 30 patients who underwent placement of external stent.

All patients were subjected to: complete history taking, general examination, laboratory tests (CBC, serum creatinine, C reactive protein, bleeding and clotting time, urine analysis, liver function and prothrombin time and concentration (PC)**)**, vital sign: (Blood pressure , heart rate , respiratory rate and body temperature), imaging**(** abdominal ultrasound, Computed tomography,VCUG, and diuretic renogram was done**)**. All patients were fasting 6-8 hours preoperatively and intravenous (IV) cephalosporins two hours before the surgery.

Surgical technique: Open Anderson-Hynes pyeloplasty was used for UPJO repair. Pyeloplasty was performed via anterior lumbar extra-peritoneal incisions in all patients. The type of stent used was according to the surgeon's preference and stent availability. In case of difficulty in insertion of a DJ stent due to improper size, length, or difficulty to pass through the UVJ, a DJ stent was used instead of DJ stent. For group 1: stent position was confirmed intra-operatively by using methylene blue bladder filling. The size of DJ stent used depended on the patient's age, height, ureter size and retrograde study if done. The stent size ranged from 3 to 6 French and the length between 10 cm and 20 cm. Kidney-ureter-bladder (KUB) X-ray was done next day to confirm the position of DJ stent. The DJ stent was removed cystoscopically under general anesthesia 4-12 weeks post-pyeloplasty. For Group 2: stent passed from the ureteropelvic junction to the skin through the kidney parenchyma (usually the lower calyx). And fixation to the renal capsule used 5/ 0 Chromic or Monocryl sutures to reduce the risk of displacement. The lower end of the stent reached the mid or lower ureter and needed not to pass the ureterovesical junction. Different types and sizes of commercially available PU stents were utilized; the kidney Externalsplint stent (KISS), the Salle intraoperative pyeloplasty stent (Cook Urological, IN) and externalized feeding tubes with manual holes inside the pelvis. The PU stent size ranged from 6 to 8 French. The PU stent was clamped on post-operative day 2, coiled under the dressing and then removed after 1-2 weeks in the outpatient office without sedation.

Post-operative assessment: Perinephric drain was placed intra-operatively, and a Foley catheter in the bladder was kept for 24-48 h and then they were removed consequently before discharge. Persistent leakage from the drain was defined as any leakage of 50 mL or more through the drain beyond the first 48-72 h post-operatively. In case of persistent urinary leakage through the perinephric drain in group 1, a Foley catheter was reinserted for 2-3 additional days until the leakage ceased. While in group 2, we re-opened the stent to be on free drainage and re-clamped it after 2\3 days if failed an antegrade nephrostogram was performed to assess the patency of pyelo-ureteral anastomosis and if there was leakage and non-opacifying of the distal ureter, a retro- grade study was performed with fixation of a DJ stent and removal of the external stent.In case of DJ stent displacement into the proximal urethra, urethral catheter manipulation or exchange was done under fluoroscopic guidance to ensure the proper position of the lower end of DJ stent.Ultrasound follow up of the patients after 3,6 and 12 months to assess the degree of hydronephrosis. Diuretric renogram after 6 and 12 months to assess the renal function.

Statistical analysis

Statistical analysis was done by using statistical package of social sciences (SPSS 26.0, IBM/SPSS Inc., Chicago, IL). Descriptive data were presented asmean and standard deviation (SD) for parametric data or median (range) for non-parametric data. Frequency with percentage (%) was used for presenting qualitative data. One-way ANOVA test was used with parametric data. Friedman's test: Was used with non-parametric data. Both tests were used for continuous data to test for significant difference between dependent groups at more than two different time points. T-test was used to assess parametric data whileWilcoxon-signed rank test for non-parametric data, both tests were used to assess the difference between two dependent groups
were done.A two tailed P value < 0.05 was considered significant.

Results:

The current study initially included 84 cases with UPJO who eligible enrolment were. At the beginning of the study, there were 64 cases who received treatment, but 4 cases of them didn't complete the study (missed follow up) so they were excluded, 8 didn't meet the inclusion criteria, 7 declined to participate so the final analysis included 60 cases. Figure 1

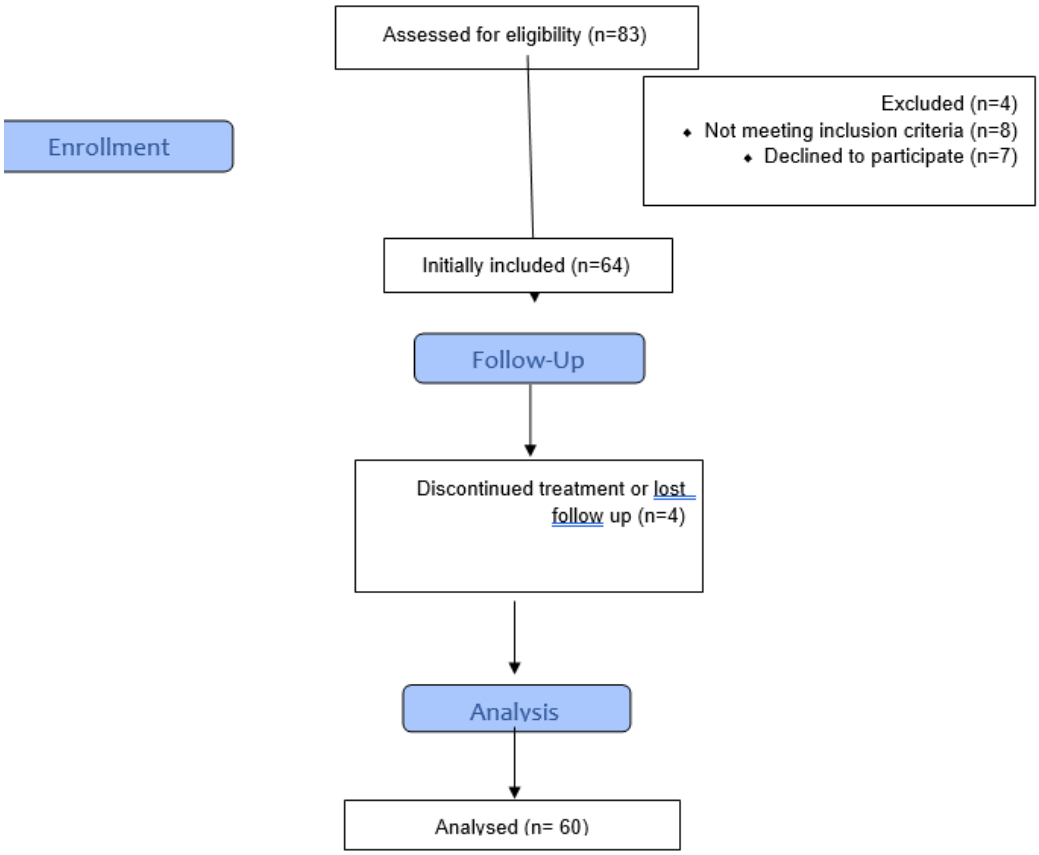

Figure 1: Censor flow chart of the cases in the study

Sociodemographic and Presentation data. Table 1

Table 1: Sociodemographic and Presentation data of UPJOpatients undergoing Open pyeloplasty:

Parameters		Number (N=60)	Overall
Age*[in months]		**60**	52.7 ± 38.7
Gender	**Female**	60	25 (41.7%)
	Male		35 (58.3%)
Side	**Left**	60	44 (73.3%)
	Right		16 (26.7%)
Abdominal Pain		3	(5%)
Fever		8	(13.3%)
Hematuria		2	(3.3%)
Loin pain		9	(15%)
Prenatal		9	(15%)
UTI symptoms		2	(3.3%)
Incidental		27	(45%)

Data are presented as Mean ± SD or Median (%)

Regarding parenchymal thickening, split function assessment, and cost, the external group had a higher initial P and initial t1/2, lower initial split function, and a statistically significant lower cost. There was a statistically significant difference between the two groups regarding hospital stay(DJ stent group had a shorter hospital stay)median stent duration, stent migration, Prolonged drainage, UTI symptoms, leakage and split function at 12 months follow up. There was no statistically significant difference between the two groups regarding median operative time pyelonephritis, urinoma, fever, obstruction, anterior-posterior renal pelvic diameter (APRPD) after 3, 6,12 months, parenchymal thickness at 3,6,12 months, glomerular filtration rate (GFR) at 6,12 months follow up, split function at 6 months follow up, t1/2 at 6,12 months. Regarding Success rate 29 patients (96.7%) had a succeeded operation in the External stent group, and 28 patients (93.3%) had a succeeded operation among the DJ stenting group. Table2

Table 2: Analysis of the UPJOdata before Open pyeloplasty. Analysis of hospital stay, operative time, stent duration, of UPJOpatients undergoing Open pyeloplasty. Complications, Success rate among Ureteropelvic Junction Obstruction patients after Open pyeloplasty. Analysis of APRPD, parenchymal thickening, GFR, SRF, T1/2, the cost of stents in the cases of the study along the duration of follow up:

Variables		External stent group (N=30)	DJ stent group (N=30)	P-Value
APRPD(mm)		29 (17-50)	27 (21-50)	0.883
Parenchymal thickness(mm)		6 (3-9)	6 (3-10)	0.791
GFR Pre(ml\sec)		25 (10-55)	28 (10-58)	0.056
SRF Pre(%)		(12-39) 31%	(17-40) 33%	0.215
T1/2 Pre*(min)		46(23-687)	41(25-691)	0.791
Hospital stay [in days]		5 (5-10)	3 (3-7)	0.028*
Operative time [in minutes]		143 (125-170)	155 (115-180)	P= 0.81
Stent cost		10 (8-15)	400 (280-500)	< 0.001*
Stent duration[in days]		14(14-30)	21 (14-21)	<0.001*
Stent migration		0 (0%)	2 (6.4%)	0.02*
Pyelonephritis		1 (3.2%)	2 (6.4%)	1
Prolonged drainage		2 (6.4%)	0 (0%)	0.05*
Urinoma		1 (3.2%)	2 (6.4%)	0.89
Fever		1 (3.2%)	2 (6.4%)	0.73
UTI symptoms		0 (0%)	4 (12.9%)	0.034*
Leakage		6 (19.3%)	1 (3.2%)	0.05*
Obstruction		2 (6.4%)	2 (6.4%)	1
APRPD	3 months	17.5 (11-32)	16.5 (10-35)	0.721
	6 months	16 (11-28)	16.5 (10-30)	0.688
	12 months	16 (11-19)	15 (10-21)	0.684
parenchymal thickening	3 months	7 (4-10)	6 (3-9)	0.721
	6 months	7.11 (4-10)	8 (4.5-11)	0.688
	12 months	9 (5.5-12)	10 (6-12.5)	0.684
GFR	6 months	21 (11-46)	28 (12-57)	0.045
	12 months	22 (11-45)	26 (12-56)	0.165
SRF	6 months	(12-65) 37%	(17-55) 42%	0.392
	12 months	(12-49) 35%	(17-59) 40%	0.039*
T1\2	6 months	9(5-21)	11(8-25)	0.431
	12 months	9(2-20)	10(3-22)	0.87
Success rate		96.7%	93.3%	

Data are presented as Mean ± SD or Median (%), N: number of the case,Repeated measures ANOVA test/Friedman's test, statistically significant if P ≤0.05.

Discussion

There is an agreement that dismembered pyeloplasty remains the standard treatment of choice as a surgical management for UPJO[5].

In our study, the mean age of the patients in the External stenting group was 54 (15-90) months, while it was 57 (40-80) among the DJ stenting group with no statistically significant difference between the two groups. This comes with the previous literature as age was not significantly different across groupsBraga et al. Chu et al. (Braga et al., 2008, Chu et al., 2018, Sarhan et al.[4, 7, 8].

However, Chu et al.[4], showed that patients in the external stent group were significantly younger than patients in the DJ group.

Regarding to sexthere was no statistically significant difference between groups. This comes in agreement with the previous literature, were both males and females were recruited evenly to avoid bias and control the cofoundersChu et al. Liu et al. Braga et al.[4, 5, 7].

Regarding operative time in both groups, there was a comparable mean operative time with no significant difference. similarly in the meta-analysis done by Liu et al. [5] in which the mean

operative time was 147 min versus 155 min in the DJ versus external stents, respectively.

The mean hospital stay was shorter in favourof DJ stent than external stent with a statistically significant difference. Patients who had DJ stents were discharged earlier than external stents.

The shorter hospital stay was previously reported in some studies after pyeloplasty with DJ stentsLiu et al, Chuet al,Leeet al [4, 5, 9].

Although the DJ stent was associated with significantly shorter hospital stay in this study, in other reports the difference did not reach statistical significance opposite to our findingsBraga et al.,Chu et al., Sarhan et al.[4, 7, 8].

The average hospital stay was reported to be 2.93 days in DJ stent versus 3.8 days in external stents, respectively from 9 studies comprising 940 pyeloplasty patients.

Regarding the stent duration, the median stent duration was bigger in the DJ stenting group with a significant difference between the two groups. This comes in agreement with previous results reported by Sarhan et al.[8], as he reported 42 days. Mean stent duration among the DJ group in contrast to only 9 days among the external stenting group with highly statistically significant results. However, Chu et al.[4], reported median stent duration with no statistically significant difference.

The overall post-operative complication rate in this study was 22.5% and it was comparable between the two studied groupsChu et al. Braga et al. (Chu et al., 2018, Braga et al., 2008, Liu et al.[4, 5, 7].

complications include leakage as it occurred in 19.3% patients among the external stenting group while one among the DJ group developed it, other complications were equally distributed between the two groups. This is comparable to the results of Chu et al.[4] as he reported a 24% leak among the external stenting group with no leak among the DJ group. However, Sarhan et al.[8] reported a non-statistically significant difference between the two groups regarding developing leakage.

The overall success rate after open pyeloplasty in this study was 96%; in DJ stent group was 95.5% versus 97% in external stent group, and the difference was not statistically significant. This was similar to Sarhan et al.[8], were the overall success rate after open pyeloplasty was 96%; in DJ stent group was 90.3% versus 96.7% in external stent group, and the difference was not statistically significant. Braga et al. [7]found the success rates were 95% versus 94.7% for DJ stents and external stents, respectively. Moreover, Liu et al.[5] they found an average success rate of 93.2% and 92.6% for DJ stented and externally stented groups. Regarding the stent cost, the external group had a statistically significantly lower cost, while the DJ stent had a higher cost. Previous studies did not assess the cost of each stent, and this is one of the strength points in this study.

Limitations: Patients visit to the paediatric urology unit for stent symptoms were not recorded properly to be included in the study.always experienced a bed crisis that make the flow of cases slow.

Conclusions:

Both types of stents demonstrated similar success and complication rates. Although DJ stent insertion provides a shorter hospital stay than the external stent, still its removal required a second operating room visit with anesthesia. The surgeon must weigh the risk of second anesthesia for DJ stent removal versus the increased length of stay associated with external stenting and counsel parents accordingly.

Financial support and sponsorship: Nil

Conflict of Interest: Nil

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