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ARTICLE

Role of J stent as a minimally invasive treatment option for ureteropelvic junction obstruction

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Aim: *The aim of this study was to investigate the factors affecting treatment success in children that got either pyeloplasty or J stent placement in ureteropelvic junction obstruction (UPJO).*

Patients and Methods: *The study comprised 126 patients who either J stent placement or pyeloplasty performed by the same physician for UPJO from 2012 to 2022. The criteria for surgical intervention adhered to the European Association of Urology (EAU) recommendations. Symptomatic patients with verified obstruction, with a split renal function (SRF) over 40%, low-grade hydronephrosis (Society of Fetal Urology grade 2), and an obstructive segment measuring less than 1 cm, had Double-J stent placement. Furthermore, in infants exhibiting poor health or development retardation, a J stent was inserted as a temporary measure to alleviate obstruction and maintain renal function, notwithstanding the recommendation for pyeloplasty.*

Results: *The treatment success rate was 43.9% in the J stent group and 88.4% in the pyeloplasty group, with a statistically significant difference ($p < 0.001$). The kind of procedure (pyeloplasty vs. stent) was the sole independent prognostic factor predicting treatment success (HR: 4.77, $p < 0.001$) in the multiple logistic regression analysis. No statistically significant change was observed in preoperative and postoperative SRF (48% vs. 48.5%, $p = 0.923$) among patients with stent failure, confirming a transient preservation of functional advantage.*

Conclusion: *The placement of a stent may have restricted success rates in specific patients with UPJO. Preserving renal function may be advantageous until definitive surgery, particularly in cases where there are hazards associated with anesthesia and invasive procedures.*

Key Words: hydronephrosis, ureteropelvic junction obstruction, treatment

Introduction

Ureteropelvic junction obstruction (UPJO), typically resulting from an aperistaltic segment of the proximal ureter, is the predominant cause of hydronephrosis (HN) detected prenatally, with more than fifty percent of these instances resolving spontaneously.[1,2] Symptoms encompass abdomen or flank pain (sometimes colicky), nausea, vomiting, hematuria, or urinary tract infection (UTI); however, they may remain asymptomatic until maturity. A continuing discussion exists over the definition of obstruction, indications, scheduling of surgery, and the selection of patients likely to achieve functional benefit. Indications for surgical intervention, as per the European Association of Urology (EAU) pediatric urology guidelines, encompass impaired split renal function (SRF) (<40%), a subsequent decline in SRF (>10%) in follow-up studies, inadequate drainage function post-furosemide administration, an increase in renal pelvis anteroposterior diameter (RPAPD), Society

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of Fetal Urology (SFU) grade III-IV dilatation, and symptomatic obstruction.[3] Nonetheless, the evidentiary level is characterized as "weak".[4] The present management and assessment of therapy efficacy rely on sequential examinations of anatomy and function throughout follow-up. In older children beyond the resolution age and adults, the indicators are clearer, including reduced renal function, HN with an obstructive washout curve characterized by a lack of diuretic response, and the development of symptoms such as stone formation. Unlike prenatal HN, blockage associated with aberrant arteries is more frequently documented with advancing age.[5]

The gold standard for surgical intervention is Anderson-Hynes pyeloplasty, which can be executed using open, laparoscopic, or robotic techniques, whilst endoscopic methods (antegrade or retrograde endopyelotomy, balloon dilatation, J-stent implantation) provide minimally invasive options.[6] While novel minimally invasive treatments like mini-laparoscopy and robot-assisted pyeloplasty yield outstanding outcomes, each method introduces distinct difficulties associated with the technique and the requisite learning curve, as well as additional costs.[7] Efforts to diminish morbidity and shorten hospital stays necessitate alternative minimally invasive treatment techniques for UPJO, including in infants.

Like UPJO, conservative follow-up is fundamental in megaureters, with analogous surgical reasons including recurrent UTI, decline in SRF, and severe progressive HN.[4] In lieu of the definitive treatment ureteroneocytostomy, endourologic techniques such as stent placement, balloon dilation, and incision are frequently employed. Endoscopic stent placement is documented as a therapeutic option for symptomatic or progressing primary obstructive megaureter.[8] Stents are advantageous for alleviating symptoms of UTI and pain, facilitating drainage, and preserving renal function until the ultimate repair of UPJO.[5] Preoperative stenting for passive ureteral dilation is particularly favored in little children prior to retrograde intrarenal surgery.[9]

This study aims to investigate the parameters influencing treatment effectiveness in children who underwent pyeloplasty or J stent placement for UPJO and to evaluate the potential of stent insertion as a minimally invasive management option for UPJO.

Patients and Methods

Study design

The study cohort comprised 126 children who underwent treatment for UPJO, either through J stent placement (57 patients) or pyeloplasty (69 patients), utilizing open or robot-assisted techniques by the same surgeon from 2012 to 2022. Individuals having anatomical or neurological anomalies of the lower urinary tract, ureteral dilation with or without vesicoureteral reflux (VUR), and prior interventions for UPJO were excluded from the study. A regular Anderson-Hynes pyeloplasty was done using either an open flank or robot-assisted method, and all patients had a J stent put in during the surgery to help with urine drainage and recovery. In the stent-only group, J stents were placed under anesthesia with fluoroscopic guidance. The study was conducted in accordance with the Declaration of Helsinki and reviewed and approved by the Clinical Research Ethics Committee of Gazi University School of Medicine (No. 919—date: December 19, 2022). All the patients were well informed and consents were taken.

Data collection and definitions

Data regarding clinical factors (age, gender, comorbidities, urinary tract anomalies, and pain), imaging findings (ultrasound assessments of HN severity, renal parenchyma thickness and echogenicity, presence of renal stones, and RPAPD), functional metrics (SRF and $t_{1/2}$ time), and surgical details (side, type of operation, and retrograde pyelography) were retrospectively extracted from patient records. The SFU and Urinary Tract Dilatation (UTD) categorization systems were employed to evaluate the extent of HN.[1,3]

Treatment definitions

The indications for surgical intervention were in accordance with the EAU pediatric urology guidelines: Impaired SRF (<40%), subsequent decline in SRF (>10%) during subsequent studies, obstructive washout curve absence of response with furosemide implementation, increase in RPAPD, SFU grades III–IV dilatation, and presence of UPJO-related symptoms. Patients had pyeloplasty if the initial SRF was below 40% or diminished by 10% during follow-up, in the presence of symptoms or increasing HN as indicated.[4] Retrograde pyelography (RGP) was performed routinely prior to pyeloplasty simultaneously at the operating room under anesthesia in all patients to confirm the anatomy of the ureteropelvic system and identify the length of the obstructive segment.

Our first indication for the placement of a double-J stent was:

1) In infants with compromised health or growth retardation, due to the risks associated with anesthesia and prolonged surgical duration for pyeloplasty,

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a J stent was utilized as a temporary measure to alleviate obstruction and maintain renal function, notwithstanding the indication of pyeloplasty.

Our second indication for the placement of a double-J stent was:

2) Cases beyond infancy, like preschool and school-aged, that sometimes presented with symptoms related to UPJO, like abdominal or flank (sometimes colicky) pain, nausea, vomiting, hematuria, or urinary tract infection. Symptomatic patients exhibiting confirmed obstruction characterized by an obstructive washout curve and lack of response to furosemide, possessing an SRF exceeding 40%, a low degree of HN (SFU grade 2), and an obstructive segment length of less than 1 cm on RGP, underwent J stent placement.

Reduced postoperative SRF, obstructive washout curve with absence of diuretic response, prolonged $t_{1/2}$ time, and lack of symptom relief or exacerbation of HN were deemed indicators of therapy failure. Stent failures were treated with pyeloplasty while pyeloplasty failures were initially approached with RGP and endoscopic measures, including stent placement and endopyelotomy.

Statistical analysis

All statistical analyses were performed with R version 4.0.4 through R Studio version 1.4.1106. For the categorical variables, the statistical difference among the groups was determined using the Chi-square test. For the continuous variables, the statistical difference among the groups was determined using the Mann-Whitney U test. Simple and multiple logistic regression analyses were performed to determine the clinical, functional, radiological or surgical parameters in predicting treatment failure. A significance level of $\alpha = 0.05$ was set for the analysis. A power analysis was conducted prior to the study to determine the sample size required to detect a significant difference in treatment success between the J stent and pyeloplasty groups. Using an effect size of 0.5 and an alpha level of 0.05, the analysis indicated that a sample size of 121 patients would provide 80% power to detect a significant difference in treatment success. The power analysis was performed using the G-Power software (version 3.1.9.7).

Results

Clinical, functional, and radiological characteristics were summarized in Table 1. The median age of all patients was 67 months (range 1.0–201.0), and the median follow-up duration was 75 months (range 16.0–180.0). There were no significant differences between the stent and pyeloplasty groups with respect to age, sex, genitourinary anomalies, laterality, preoperative SRF, $t_{1/2}$, renal parenchymal hyperechogenity, obstructive segment length, flank pain, and renal stone disease.

The preoperative SFU, UTD grades, RPAPD, and renal parenchymal thinning indicative of the severity of HN were markedly elevated ($p = 0.028$, $p = 0.006$, $p = 0.005$, and $p = 0.035$, respectively) in the pyeloplasty cohort.

The treatment success rate was 43.9% for the J stent group and 88.4% for the pyeloplasty group, with a statistically significant difference ($p < 0.001$). Table 2 shows the simple and multiple logistic regression analyses in terms of treatment success. In straightforward logistic regression analyses, prolonged $t_{1/2}$ duration, higher RPAPD, and J stent placement were correlated with a reduced likelihood of treatment success ($p = 0.02$, $p < 0.02$, and $p < 0.001$, respectively). The kind of procedure (pyeloplasty vs. stent) was the sole independent predictive factor indicating treatment success (HR: 4.77, $p < 0.001$) in the multiple logistic regression analysis.

Among the 57 children with J stent placement, 23 of them are infants under the age of 1. The preoperative $t_{1/2}$ has a median of 80 s, preoperative SRF has a median of 48%, and the median affected segment length in preoperative RGP is 4.5 cm. The median duration of the J stent in these infants was 10 weeks. In a follow-up period with a median duration of 36 months, 11 children (47.8%) encountered failure. Of the 11 children, 10 received pyeloplasty during their follow-ups, whereas 1 child did not continue with follow-up treatment. In the cohort of 12 successful children, the median follow-up period was 12 months. In the cohort with failures, it was noted that the preoperative $t_{1/2}$ was markedly prolonged, the preoperative RPAPD and SFU category were considerably elevated, and the duration of J stent retention was dramatically reduced. No notable disparity was seen regarding preoperative SRF (Table 3).

Out of 57 patients who underwent J stent placement across various age demographics, 32 experienced failure. In this cohort of patients, despite the presence of failure criteria, no statistically significant difference was observed in preoperative and postoperative SRF (48% vs. 48.5%, $p = 0.923$). Among the 23 infants under the age of 1 who underwent J stent placement, 11 encountered failure. No statistically significant change was observed in preoperative and postoperative SRF in this patient subgroup (50% vs. 49%, $p = 0.876$).

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TABLE 1. **Baseline characteristics**

	J Stent Placement (N = 57)	Pyeloplasty (N = 69)	*p* value
Comorbodities [n (%)]			
No	48 (84.2)	56 (81.2)	0.653
Yes	9 (15.8)	13 (28.8)	
Gender [n (%)]			
Female	9 (15.8)	14 (20.3)	0.515
Male	48 (84.2)	55 (79.7)	
Age	59	79	0.283
[median (range)] (months)	(1.0–199.0)	(1.0–201.0)	
Age [n (%)]			
<1 year	23 (40.4)	19 (27.5)	0.129
>1 year	34 (59.6)	50 (72.5)	
Genitourinary anomalies			
No	51 (89.5%)	63 (91.3%)	0.728
Yes	6 (10.5%)	6 (8.7%)	
Side			
Right	21 (37.5%)	31 (44.9%)	0.402
Left	36 (62.5%)	38 (55.1%)	
Preoperative split renal function	48	48	0.850
[median (range)] (%)	(43.0–51.0)	(42.0–50.0)	
Preoperative $t_{1/2}$time	45	98	0.132
[median (range)] (minute)	(25.0–180.0)	(29.0–180.0)	
Preoperative Society of Fetal Urology class [n (%)]			
2	11 (19.3)	4 (5.8)	**0.028***
3	22 (38.6)	23 (33.3)	
4	24 (42.1)	42 (60.9)	
Preoperative urinary tract dilatation class [n (%)]			
1	5 (8.8)	0 (0.0)	**0.006***
2	19 (33.3)	14 (20.3)	
3	33 (57.9)	55 (79.7)	
Preoperative renal pelvis anterior-posterior diameter	18	2	**0.005***
[median (range)] (milimeter)	(15.0–27.0)	(18.0–35.0)	
Obstructive segment length	5.5	6.05	0.239
[median (range)] (milimeter)	(4.0–6.850)	(4.375–7.750)	
Preoperative renal parenchymal thinning [n (%)]			
No	26 (45.6)	19 (27.5)	**0.035***
Yes	31 (54.4)	50 (72.5)	
Preoperative renal parenchymal hyperechogenity [n (%)]			
No	44 (77.2)	52 (75.4)	0.810
Yes	13 (22.8)	17 (24.6)	
Preoperative flank pain [n (%)]			
No	49 (86.0)	56 (81.2)	0.471
Yes	8 (14.0)	13 (18.8)	
Preoperative renal stone disease [n (%)]			
No	53 (93.0)	67 (97.1)	0.280
Yes	4 (7.0)	2 (2.9)	

*$p < 0.05$ was considered as statistically significant

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TABLE 2. **Simple and multiple logistic regression analysis in predicting treatment success**

	Simple logistic regression analysis			Multiple logistic regression analysis		
	OR	**CI (95%)**	***p***	**OR**	**CI (95%)**	***p***
Age	1.003	0.997–1.009	0.359			
Gender						
Female	Ref.	Ref.	0.52			
Male	0.716	0.241–1.899				
Side						
Right	Ref.	Ref.	0.523			
Left	0.778	0.355–1.67				
Comorbidities						
No	Ref.	Ref.	0.312			
Yes	0.613	0.239–1.625				
Congenital abnormalities						
No	Ref.	Ref.	0.901			
Yes	0.923	0.272–3.641				
Obstructive segment length	0.976	0.827–1.157	0.776			
Split renal function	1.009	0.98–1.039	0.534	Ref.	Ref.	0.156
$T_{1/2}$	0.994	0.989–0.999	**0.032***	0.995	0.989–1.002	
Society of fetal urology grade						
2	Ref.	Ref.				
3	1.273	0.302–4.699	0.724			
4	0.559	0.143–1.833	0.361			
Urinary tract dilatation grade						
1	Ref.	Ref.				
2	NA	NA-2.160	0.989			
3	NA	NA-2.453	0.988	Ref.	Ref.	0.107
Renal pelvis anterior-posterior diameter	0.963	0.933–0.993	**0.018***	0.972	0.937–1.006	
Parenchyma thickness						
Normal	Ref.	Ref.	**0.09***			
Decreased	0.486	0.203–1.093				
Parenchymal echogenicity						
Normal	Ref.	Ref.	0.122			
Increased	0.512	0.219–1.207				
Pain						
No	Ref.	Ref.	0.732			
Yes	1.197	0.443–3.603				
Presence of renal stone						
No	Ref.	Ref.	0.932			
Yes	0.927	0.173–6.894				
Type of operation						
J stent placement	Ref.	Ref.	**0.001***	Ref.	Ref.	**<0.001***
Pyeloplasty	6.48	2.335–23.082		6.873	2.422–24.931	

*$p < 0.05$ was considered as statistically significant

Complications such as J stent migration, intraureteric stent repositioning, stent encrustation, persistent hematuria, UTI, and fever were noted in 10 patients from the J stent group and 13 patients from the pyeloplasty group. No statistically significant difference in complications was observed between

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TABLE 3. **Operational success in infants under 1 year of age with J stent placed**

	Successful N = 11	**Failed N = 12**	***p* value**
Duration of J stent [median (range)] (weeks)	8 (6–12)	11 (8–30)	**0.033***
Preoperative split renal function [median (range)] (%)	50.0 (19.0–57.0)	47.5 (9.0–56.0)	0.708
Preoperative $t_{1/2}$ time [median (range)] (minutes)	180 (29–180)	35 (13–180)	**<0.001***
Preoperative society of fetal urology class [n (%)]			
2	2 (18.2)	9 (75.0)	**0.006***
4	9 (81.8)	3 (25.0)	
Preoperative renal pelvis anterior-posterior diameter [median (range)] (min)	32 (16–55)	15 (10–27)	**0.001***

*$p < 0.05$ was considered as statistically significant.

the J stent insertion group and the pyeloplasty group ($p = 0.851$).

Discussion

After the introduction of prenatal ultrasound there were a lot of HN patients waiting to be evaluated and treated. Initial enthusiasm for the surgical treatment quickly reversed to a conservative strategy following the understanding that most dilatations were self-limited and disappear in time. For most asymptomatic congenital UPJO patients without diminished SRF, non-surgical management is recommended as the treatment option.[10] However, this was a too simplistic approach and some of the infants had irreversible loss of function. Accordingly, some authors have favored early pyeloplasty for antenatally detected UPJO due to the concern about failure to recover the functional loss during expectant management.[11] Babu et al. reported that early pyeloplasty was beneficial for improvement of SRF in UPJO patients with SFU Grade 3–4 HN compared to delayed treatment.[11]

Stent placement is a minimally invasive method compared to pyeloplasty but it is not an option for all patients with UPJO and this study quotes the role of J stent in the UPJO management. Children who met the criteria for definite surgical indications listed in the "EAU Guidelines" were treated with pyeloplasty. Symptomatic patients exhibiting SRF exceeding 40%, low-grade HN (SFU grade 2), and an obstructive segment length of less than 1 cm on RGP underwent J stent placement. Infants with compromised health or growth retardation were also stented as a provisional measure to alleviate obstruction and maintain renal function, despite the recommendation for pyeloplasty, in order to mitigate the risks associated with prolonged anesthesia and invasive surgery.

Most of our patients were treated by traditional open flank pyeloplasty thus comparison with the robotic could not be made. We did not experience any technical peculiarities in children who were initially treated with JJ stents and then proceeded to pyeloplasty. Open, robotic, and laparoscopic pyeloplasty are the general surgical treatment options for UPJO, with well-defined functional outcomes and complications. Robotic pyeloplasty revealed good success similar to open, while laparoscopic pyeloplasty had lower complication rates reported in the meta-analysis by Uhlig in 2019.[12]

Endourological techniques have been used as an alternative option in treatment of UPJO for more than 30 years, especially in adults with cumulative experience in indications, advantages and disadvantages. Retrograde or anterograde endopyelotomy with lateral full-thickness incision of the stenotic segment and balloon dilatation are well described methods with various success rates due to great variability in patient selection, definition of obstruction and success.[13,14] However, endopyelotomy was less successful in longer strictures with a usual cut off value as 2 cm[15] and higher grades of HN; and unfavorable in presence of crossing vessels (low success rate and risk

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of bleeding).[14] In this respect we adapted and set our selection criteria for the use of J stents in UPJO as: low degree of HN SFU grade 2 and length of obstructive segment less than 1 cm in RGP. Pediatric endopyelotomy is even less well established than adults and given around 70% in a systematic review by Corbett and Mullassery.[16]

We considered J stent placement in cases of UPJO for two reasons. Firstly, similar to megaureter, the J stent placement might serve as a definitive intervention by dilating the stenotic area and maintaining patency, while allowing the healing-maturation to occur around it. Thus, we inserted J stents to our patients in the gray zone in particular. Second the J stent placement may relieve pressure in the system and provide safe time for delayed definitive approach while preserving the renal function. As stated, before there is a concern about permanent functional loss due to delayed treatment especially for higher SFU grade antenatal UPJO,[17] accordingly, we inserted stent to very small babies for whom we saw a risk in administering anesthesia until a definitive treatment decision was made. Bao et al. reported that immediate pyeloplasty can accelerate the recovery in severe HN.[17] In this respect stents might be also beneficial when this is not possible. In our study, no significant difference was found in SRF in both the general group and infants under the age of 1 when the J stent placement met the failure criteria. In a study by Romao et al. that evaluated interventions after failed pyeloplasty, it was observed that there was an improvement in renal function in 6% of the patients following J stent placemen.[18] When evaluating this rate, it should be noted that these patients were not primary patients but rather cases of failed repair. Although the patient group undergoing J stent placement may have been less severe when compared to surgery, we believe that a success rate of 42.9% for such a minimally invasive method is limited but acceptable. The success rates for stents in the treatment of primary megaureter are highly variable.[8]

In straightforward logistic regression analyses, prolonged $t_{1/2}$ duration, higher RPAPD, and J stent placement were correlated with a reduced likelihood of treatment success ($p = 0.02$, $p < 0.02$, and $p < 0.001$, respectively). The kind of procedure (pyeloplasty vs. stent) was the sole independent prognostic factor predicting treatment success (HR: 4.77, $p < 0.001$) in the multiple logistic regression analysis. Though the success rate was significantly lower in the stent group (42.9% in the J stent group vs. 86.9% pyeloplasty) stents offered durable, minimal invasive therapy rather than a temporary solution in above mentioned selected group of patients. Lower rates could be partly attributed to the inclusion of the babies with definite pyeloplasty indications (higher grades of HN).

In our series, higher RPAPD was correlated with a reduced likelihood of treatment effectiveness. The role of RPAPD in UPJO is primarily to guide treatment and follow-up decisions in antenatal HN.[19] Arora et al. reported that an APD of more than 24.3 mm predicted the need for surgery. Although ultrasound is the first-line technique for UPJO evaluation, it may not always provide accurate information about the function of the HN kidney.[20] First, the way in which the RPAPD measurement is taken (full or empty bladder, with or without diuretics, supine or prone position) can affect the results and there also may be inter-observer variabilities. Another issue is that RPAPD may not reflect the degree of HN when calyceal dilation and parenchymal changes are not evaluated. Therefore, it is recommended to use HN classification systems such as SFU and UTD instead of only relying on RPAPD when making evaluations.[1,3] In our study, we used both SFU and UTD classification systems. However, we could not find an independent predictive role in forecasting treatment outcomes.

In addition to the advantage of placing J ureteral stents, such as a short hospital stay, complications such as bladder spasms, hematuria, obstruction, stent migration, and stent displacement-fall may occur, and general anesthesia may be required during stent placement and removal.[21] In our series complications including J stent migration, intraureteric stent repositioning, stent encrustation, persistent hematuria, urinary tract infection, and fever were observed in 10 patients in the J stent group. There was no significant difference compared to the pyeloplasty group including 13 complicated patients. As most urologists would agree, obstruction is more dangerous than sterile reflux. The stented patients in the infantile period receive antibiotic prophylaxis that is routinely used in patients with HN. The median duration of J stent in these infants was 10 weeks. In older children, infection is an uncommon but possible complication. Thus, the duration of the stent should be limited to a maximum of 6 months to avoid long term complications like stone formation and infection. We believe it is hard to predict and confirm the long-term complications of a 3-month stent treatment course. These children will remain with some degree of HN and have inherent factors for infection and stone development even after the treatment. Stent placement is a temporary event.

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Limitation

There are several limitations to this study. First, since this is a retrospective study, there is a possibility of selection bias and inaccuracies in the information. Second, since this is a retrospective study, there may have been changes in surgical indications over time. The lack of proven UTI results in the patients may have contributed to the differences in the results of the study. Nephrostomy was not evaluated among the first-line treatments. In addition, since our data represent results obtained from a single center, they may not be generalizable. Due to the retrospective nature of the study, the results may be affected by excessive or delayed treatment interventions. Considering that we are a reference center for UPJO in our country, the results may not fully cover the various populations and practices observed in alternative healthcare settings due to the high-risk patient ratio.

Conclusion

In conclusion, akin to megaureter, J stent placement may yield restricted success rates in specific patients with UPJO. Preserving renal function may also be advantageous until definitive surgery, particularly in cases where there are hazards associated with anesthesia and invasive procedures. However, as the series is small, further studies with higher numbers of patients would provide convicting evidence on the benefits of stents in UPJO treatment. Pyeloplasty was confirmed as a successful treatment in UPJO as expected.

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Author Contributions

Conceptualization, Serhat Gurocak, Murat Yavuz Koparal, Burak Elmas and Mustafa Ozgur Tan; methodology, Murat Yavuz Koparal, Cihat Aytekin and Burak Elmas; formal analysis, Cihat Aytekin, Burak Elmas and Murat Yavuz Koparal; investigation, Murat Yavuz Koparal, Burak Elmas and Cihat Aytekin; data curation, Burak Elmas and Cihat Aytekin; writing—original draft preparation, Murat Yavuz Koparal, Burak Elmas, Cihat Aytekin, Serhat Gurocak and Mustafa Ozgur Tan; writing—review and editing, Murat Yavuz Koparal, Burak Elmas, Serhat Gurocak, Cihat Aytekin and Mustafa Ozgur Tan. All authors reviewed the results and approved the final version of the manuscript.

Availability of Data and Materials:

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval

The study was conducted in accordance with the Declaration of Helsinki and reviewed and approved by the Clinical Research Ethics Committee of Gazi University School of Medicine (No. 919—date: 19 December 2022). All the patients were well informed and consents were taken.

Informed Consent

Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest

The authors declare no conflicts of interest to report regarding the present study.

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