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Use of double-J ureteric stents post-laparoscopic pyeloplasty to treat ureteropelvic junction obstruction in hydronephrosis for pediatric patients: a single-center experience

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Abstract

Objectives: We aimed to investigate the safety concerns associated with placing double-J ureteric stents post-laparoscopic pyeloplasty surgery for congenital ureteropelvic junction obstruction (UPJO) and hydronephrosis.

Methods: A total of 1349 patients with postoperative double-J stent placement at our center were included. Clinical variables for enrolled patients were collected by two independent authors. We compared clinical variables and the efficacy of stenting post-laparoscopic pyeloplasty.

Results: The mean age of the patients was 4.23 ± 2.39 years. A total of 58.49% of patients were diagnosed with left UPJO with hydronephrosis and 33.95% were diagnosed with right UPJO. Furthermore, 7.56% of patients had bilateral UPJO. In all cases, 96.96% of indwelling double-J stents were successfully removed 4 weeks post-surgery. A total of 3.04% of the patients still required further management, including stent migration to the renal pelvis (0.37%), stent migration to the bladder (0.30%), prolapse of the stent through the ureter (0.15%), blockage of stents (1.85%), and fouling of stents (0.37%).

Conclusions: Double-J ureteric stents used after laparoscopic pyeloplasty for treating UPJO in hydronephrosis for pediatric patients is a safe, feasible, and beneficial method, which can be

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recommended for routine procedures. However, caution should be practiced for follow-up and removal using this method.

Keywords
Double-J ureteric stent, ureteropelvic junction obstruction, hydronephrosis, laparoscopic pyeloplasty, pediatric patient, urinary tract infection

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Introduction

Hydronephrosis, which is defined as distension and dilation of the kidneys, is generally caused by obstruction to free flow of urine from the kidneys, such as ureteropelvic junction obstruction (UPJO).[1] Congenital UPJO serves as a prime indicator during the pathogenesis of hydronephrosis, which is an ailment that is twice as common in boys than in girls.[2] Moreover, hydronephrosis caused by UPJO can lead to progressive renal impairment and further renal failure if left untreated.[3]

Open pyeloplasty (OP) is considered the gold standard treatment for UPJO with a $>90\%$ success rate.[4] Since the first report of successful laparoscopic pyeloplasty (LP) in 1993, this procedure has proven to be efficient and safe for OP.[5] However, the use of ureteral stenting during LP has resulted in controversy.[6] Additionally, use of ureteral stenting is associated with the incidence of urinary tract infection (UTI) and fibrosis.[7] In contrast, some studies have shown that ureteral stenting can cause less urinary leakage, thus preventing the likelihood of urinary infections.[8,9]

We conducted a retrospective study to investigate the safety regarding the placement of double-J ureteric stents, which is the most common type of ureteral stenting in pediatric urology, post-LP surgery for treating congenital UPJO in hydronephrosis at our center.

Methods

Ethics statement and consent to participate

The local ethics committee of the Children's Hospital of Nanjing Medical University approved the protocols followed in this study. Written informed consent was obtained from pediatric patients and their legal guardians. All procedures that were performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Patients

This study included patients who had undergone LP surgery for congenital UPJO and hydronephrosis, as well as postoperative double-J stent placement, during January 2008 to December 2017 at our center (Department of Urology, Children's Hospital of Nanjing Medical University). All patients enrolled in this study were confirmed to be suffering from primary hydronephrosis via an ultrasound and/or nuclear scan. Moreover, clinical variables of the enrolled patients, such as age, sex, weight, operating side of UPJO and hydronephrosis, hospital stay, duration of surgery, and complications in double-J stent placement,

were collected and independently reviewed by two authors (Haobo Zhu and Jun Wang). The inclusion criteria for the patients were as follows: (1) patients diagnosed with congenital unilateral or bilateral UPJO with severe hydronephrosis (Grades II, III, and IV) as confirmed by ultrasound and/or nuclear scan; (2) patients aged between 0 and 17 years; (3) patients who had undergone LP procedures and insertion of double-J stents post-surgery; and (4) patients who volunteered to be included in this study.

Surgical procedures

All LPs were trans-peritoneal incisions on the kidneys in the lateral position. In this process, four trocars were inserted for dissection, retraction, and identification of UPJO. Depending on the anatomical findings at the time of dissection, either a dismembered or non-dismembered procedure was performed. Reduction pyeloplasty was conducted in case of a redundant pelvis. Once the operation on the posterior layer was completed, double-J stents (SDTE®; KANG SHUN "IN" Medical Instrument Co., Ltd., Jinan, China) were placed anterogradely, mainly above the renal pelvis and ureteric anastomosis. After penetrating the abdominal wall by a venipuncture needle core removal device (Ethicon, Blue Ash, OH, USA), a double-J stent zebra guide wire (Boston Scientific, El Coyol, Costa Rica) was inserted into the ureter by venipuncture. Once the back end of the visible urinary bladder stream was observed, the guide wire was removed while the proximal end of the double-J stent was looped in the pelvis. Additionally, a drainage bag was placed for repair adjacent to a Foley catheter (CLINY®; CREATE MEDIC International Trade Co., Ltd., Dalian, China) that remained in the bladder for 2 or 3 days. On the next day, the drainage bag was extracted if drainage output did not increase. Additionally, the indwelling double-J stent was removed after 4 weeks in case no complications were observed. For patients with failure of LP surgery, Hynes–Anderson pyeloplasty or pyelostomy was performed, depending on the status of patients and the degree of hydronephrosis.

Follow-up

Most of the patients were discharged from the hospital within 2 to 3 days post-surgery and prescribed oral antibiotics. In all patients with indwelling double-J stents, renal ultrasound was performed before discharge to visualize double-J stents and to evaluate the degree of hydronephrosis. For regular cases of double-J stents, the stents were removed after 4 weeks through cystoscopy in the outpatient clinic.

Primary and secondary outcomes

The primary outcome of this retrospective study was the success rate of removal of the double-J stent in pediatric patients with UPJO. Moreover, patients who required further management were recorded and the management for each patient was considered as a secondary outcome. Additionally, secondary outcomes were mainly associated with complaints and resultant symptoms during indwelling of double-J stents, such as UTIs, gross hematuria, and lumbar pain.

Statistical analysis

Data are shown as mean ± standard deviation, whereas categorical data are shown as absolute rates and percentages. Statistical analysis was performed using SPSS version 19.0 (IBM Corp., Armonk, NY, USA).

Results

A total of 1349 pediatric patients (843 boys and 506 girls) were investigated in this study. The baseline demographics of the

participants are shown in Table 1. The mean age of the patients was 4.23 ± 2.39 years. The youngest patient was 6 months and the oldest was 12 years old. Moreover, 58.49% of the patients were diagnosed with left UPJO in hydronephrosis and 7.56% suffered from bilateral UPJO. No blood transfer was required. The median hospital stay of the patients was 3 days and the median duration between surgery and removal of the double-J stent was 29 days.

Among all cases, 96.96% of indwelling double-J stents were successfully removed post-surgery. Among these successful cases, the removal time ranged from 24 to 33 days. However, 3.04% of patients required further management, including stent migration to the renal pelvis (0.37%), stent migration to the bladder (0.30%), prolapse of the stent through the ureter (0.15%), blockage of stents (1.85%), and fouling of stents (0.37%). With regard to these stent-related complications, we did not observe any severe symptoms associated with stent-related complications. Only mild symptoms, including mild lumbago and hematuria, were observed. Further information about the time of stent removal and concurrent management is shown in Table 2. With regard to complaints and resultant symptoms, UTIs were confirmed by urine culture and approximately 10% of patients suffered from lumbar pain. Additionally, cases of gross hematuria were recorded (Table 2). The median time of UTI diagnosis was 22 days post-surgery, and the time of diagnosis ranged from 15 to 27 days.

Table 1. Baseline demographic data of the enrolled patients.

Variables	Values
Number of patients	1349
Age (years), median (IQR)	4 (2, 10)
Sex (%)	
Boys	843 (62.49)
Girls	506 (37.51)
Side (%)	
Left	789 (58.49)
Right	458 (33.95)
Bilateral	102 (7.56)
Grade of hydronephrosis	
I	0 (0)
II	42 (3.11)
III	816 (60.49)
IV	491 (36.40)
Duration of stent insertion (minutes), median (IQR)	26 (22, 35)
Hospital stay (days), median (IQR)	3 (2, 4)
Placement of double-J stent (days), median (IQR)	29 (26, 41)

Abbreviation: IQR, interquartile range.

Discussion

The present study is based on a single-center evaluation of LP for pediatric patients who suffered from UPJO. In this study, we found that all double-J stents were successfully inserted into the ureter during the surgical procedures of LP and 96.96% of the stents were successfully removed. Additionally, no severe complications were observed, and UTI was considered as the most common complication during stenting. Our study indicates that double-J stents in LP surgery for pediatric patients suffering from UPJO are feasible and safe.

OP is the gold standard in surgical treatment of UPJO. However, minimally invasive therapies have become increasingly common as alternative procedures to OP in pediatrics. In canonical procedures in OP or LP surgery for pediatric patients suffering from UPJO, placement of a double-J stent is not routinely required. In our center, attenuating the short-term and long-term complications is highly recommended. Moreover, the double-J stent is widely applied for treating UPJO. Osman et al.[10] reported a suitable effect of double-J stents for treating adult patients

Table 2. Outcomes of indwelling double-J stents after laparoscopic pyeloplasty.

Outcome	Number of patients, n (%)	Time (days), median (IQR)	Management
Outcome		*Time of removal*	
Removal of the stent	1308 (96.96)	28 (26, 31)	No treatment
Stent migration			
To the renal pelvis	5 (0.37)	21 (19, 21)	Removal of the stent or readjustment of the position of the stent by ureteroscope
To the bladder	4 (0.30)	22.5 (20, 23)	Readjustment of the position of the stent by ureteroscope
Prolapse of the stent through the ureter	2 (0.15)	16.50*	No treatment; follow-up in the outpatient clinic
Blockage of the stent	25 (1.85)	15 (13, 19)	Replacement of the stent
Fouling of the stent	5 (0.37)	21 (18.5, 23.25)	Advance removal of the stents and treatment of fouling in the ureter
Symptoms		*Duration*	
UTI	238 (17.64)	22 (18, 26)	Urine culture and antibiotic administration according to a drug sensitivity test
Gross hematuria	20 (1.48)	5 (2, 8)	Advance removal of the stent and hemostatic therapy
Lumbar pain	168 (12.45)	5 (1, 9)	Advance removal of the stent and analgesic treatment

Abbreviations: UTI, urinary tract infection; IQR, interquartile range.
*Because of the limited number of cases, we failed to calculate the IQR.

with UPJO, which could significantly relieve loin pain. Importantly, application of externalized double-J stents in infants with UPJO was studied and no severe complications were observed, along with a relatively shortened operative time.[11] Because placement of double-J stents is still controversial in UPJO treatment, one clinical study focused on adult patients and compared stented and stentless techniques after LP surgery.[12] Stentless LP is more feasible than LP with stents, but it requires more experienced surgeons and it has more complications. Therefore, stentless LP is not recommended for wide application. Insertion of stents is still recommended for new platforms or complicated techniques, such as pediatric LP surgery.[13–16] A recent network meta-analysis compared the efficacy and safety of double-J stent placement with stent-less procedures for pediatric pyeloplasty.[17] After systematically analyzing the pooled results in operative time, operative success, hospital stay, and overall complications, the authors of this meta-analysis suggested that there was no significant difference in operative-related variables between the two methods. Notably, the double-J stent was suggested to be more beneficial for pediatric pyeloplasty, which is consistent with the main outcomes in our study.

Potential unfavorable conditions have been reported during follow-up of double-J stent placement in pediatric patients, such as an increased risk of renal damage, bleeding, UTI, and reduced quality of life.[18–20] In our study, we found a rate of 17.64% for UTI episodes and 12.45% for lumbar pain, which are the two most common complications of double-J stent placement. Nevertheless, we failed to compare the

incidence rate in stent-free patients because of the study design. However, several studies have reported positive results that are consistent with our results.[21–25] Recently, Nagdeve et al.[26] concluded that double-J-stented patients were more symptomatic than unstented patients in the postoperative period, but no significant difference was identified. Considering the relatively low expense and advantages in follow-up for double-J stents, we still suggest double-J stent placement during LP in pediatric patients with UPJO as a safe, feasible, and beneficial method.

Moreover, we routinely provided pediatric patients with double-J stent antibiotics to prevent UTI episodes. Additionally, for children with a high risk of UTIs, such as diabetes, congenital abnormalities, and preexisting infections, we prolonged the treatment period of antibiotics from 3 days to 5 to 7 days, depending on the patient's condition. Stentless procedures are associated with less urine leakage and less flank pain than stented procedures.[27–29] Therefore, we prefer the double-J stent to an external stent because the double-J stent is believed to lower the risk of urine leakage. For flank pain, patients were encouraged to drink more water to relieve the flank pain, combined with the low-dosage analgesics only under conditions of unbearable lumbar pain.

Our study has several limitations as follows. (1) Our study design lacked a control group (stentless pediatric patients). Therefore, we could not compare the efficacy and safety of double-J stents with other procedures. (2) The number of patients in our study was relatively limited and a large-scale study is required in the future. (3) Our study was mainly designed to investigate the safety of double-J stent placement in LP procedures for pediatric UPJO, and there was a lack of investigation of efficacy of stenting.

Our experience on double-J stenting in LP procedures for pediatric patients with UPJO showed a high success rate of the operation and shortened hospital stay. However, this conclusion still needs to be confirmed prospectively because of the limitations mentioned above. Furthermore, our center has carried out a large-scale, prospective, case–control clinical trial to confirm our findings. Additionally, we still strongly recommend double-J stenting in LP procedures for pediatric patients with UPJO who suffer from recurring UTI before surgery, a significantly prolonged operation, or complicated surgical methods.

Conclusion

Double-J stenting in LP procedures for pediatric patients with UPJO represents a high operative success rate and short hospital stay. During follow-up, UTI and lumbar pain are the two most common complications for patients with double-J stents. In conclusion, double-J stent placement during LP in pediatric patients with UJO is a safe, feasible, and beneficial method. However, our results should be extensively validated by a well-designed, large-scale, case–control study.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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