Original Article

An assisted suspension fixation technique in transperitoneal laparoscopic pyeloplasty for infants and young children with ureteropelvic junction obstruction: a retrospective cohort study

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Background: Anderson-Hynes pyeloplasty is a classic and highly effective technique for treating congenital ureteropelvic junction obstruction (UPJO). Laparoscopic minimally invasive surgery (MIS) has become the preferred approach for infants and young children. However, a small working area and the complexity of reconstruction procedure pose significant challenges. This study aims to evaluate the efficacy and safety of four-point suspension fixation technique in laparoscopic dismembered pyeloplasty (LDP) for infants and young children with UPJO.

Methods: This retrospective cohort enrolled 37 infants and young children diagnosed with UPJO and underwent transperitoneal LDP between 2014 and 2020. The 37 cases were divided into two Groups based on whether suspension fixation was applied during the transperitoneal LDP. Clinical characteristics and follow-up data of these cohorts were retrospectively collected and analyzed. Continuous variables with a normal distribution were expressed as mean ± standard deviation (SD) and analyzed using independent sample *t*-tests. Non-normally distributed continuous variables were reported as interquartile range (IQR) and analyzed with the Mann-Whitney *U*-test.

Results: In Group A, 21 cases underwent conventional LDP without suspension fixation, while in Group B, 16 cases underwent "suspension fixation" LDP. The operative time (237.9±63.0 *vs.* 186.4±52.3 min, P=0.01), anastomotic suturing completion time (125.2±21.6 *vs.* 75.9±12.1 min, P<0.001), and postoperative hospital stay duration [6.0 (4.0, 7.5) *vs.* 4.5 (3.0, 6.5) days, P=0.04] were significantly shorter in Group B than in Group A, and the intraoperative blood loss [15.0 (5.0, 21.0) *vs.* 7.5 (5.0, 10.8) mL, P=0.04] in Group B was significantly lower than that in Group A. There were no significant differences between the two Groups in preoperative and anteroposterior renal pelvic diameter (APD), postoperative days to drainage tube removal, and postoperative days to removal of double J (D-J) sent. In Group A, one case developed anastomotic stenosis during follow-up, which improved after ureteral balloon dilation. In Group B, one case developed recurrent febrile urinary tract infection (UTI) within two months of D-J stent removal and was ultimately cured with antibiotic treatment during follow-up. The success rates were 95.2% (20/21) in Group A and 93.8% (15/16) in Group B. Other cases who were followed up showed no recurrence of stenosis, urine

leakage, or recurrent UTI.

Conclusions: The use of assisted suspension fixation in transperitoneal LDP is safe and efficient for infants and young children, helping to reduce operative time, overcome the small laparoscopic operating area, and address the steep learning curve, making it a valuable approach.

Keywords: Ureteropelvic junction obstruction (UPJO); infants and young children; transperitoneal laparoscopic pyeloplasty; suspension fixation

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Introduction

Ureteropelvic junction obstruction (UPJO) is characterized by a blockage in the flow of urine from the renal pelvis to the ureter. It is the most common cause of hydronephrosis in infants, an estimated incidence of 1 in 1,000 live births (1). Open Anderson-Hynes pyeloplasty (OP) is widely regarded as the gold standard for treating UPJO, with a long-term success rate exceeding 95% (2). With the advent of the minimally invasive era, surgical approaches for treating UPJO, in addition to OP, now include minimally invasive surgery (MIS) techniques such as laparoscopic pyeloplasty, robot-assisted laparoscopic pyeloplasty, and others (3). In adult, laparoscopic and robot-assisted laparoscopic procedures have achieved outcomes comparable to those of open surgery, with the added benefits of reduced pain, shorter hospital stays, and smaller incisions (4). These methods are widely recognized by experts and are increasingly adopted in clinical centers for large-scale use (5).

In infants and young children, there has been some doubt about performing MIS in these patients, while the advantages of the MIS approach seem to be more evident in children over 2 years of age (6). In recent years, however, subsequent studies have demonstrated that MIS is both safe and feasible in infants (2,7,8). Nevertheless, limited space for port placement and a small working area in infants continue to pose significant challenges for surgeons, especially for novices performing reconstructive procedures that require extensive intracorporeal suturing (9). This creates a steep learning curve that is especially pronounced in infants and children (10). For this reason, we designed an assisted suspension fixation method and added an additional 3-mm trocar along the umbilicus in transperitoneal laparoscopic dismembered pyeloplasty (LDP). This modification aims to reduce suturing difficulty, shorten operative time, and minimize the adverse effects of anesthetic drugs on infants and young children. In our previous study, we confirmed the effectiveness and safety of the assisted suspension fixation technique in retroperitoneal LDP for older children under 14 years old with UPJO (11). However, the effectiveness and safety of this technique in

Highlight box

Key findings

- An assisted suspension fixation technique in transperitoneal laparoscopic dismembered pyeloplasty (LDP) can significantly reduce suturing difficulty, operation time, and intraoperative bleeding. The surgical success rate is comparable to traditional transperitoneal LDP, making it a safe and effective technique.

What is known and what is new?

- Infants and young children often prefer laparoscopic minimally invasive surgery due to its precision and reduced complications. LDP presents specific challenges, including the confined operative space and the complexity of ureteropelvic junction anastomosis. Previous suspension techniques, such as single-line and double-line suspension, have been employed to enhance surgical visibility and facilitate the anastomosis. However, these methods have limitations, such as inadequate exposure and increased risks of tissue damage and vascular injury.
- This study introduces the four-point suspension technique for transperitoneal LDP in infants and young children, highlighting its advantages over traditional methods. The technique enables tension-free anastomosis, reduces surgical and anastomotic time, and minimizes intraoperative bleeding and tissue damage. Additionally, it improves surgical efficiency, lowers the risk of complications, and shortens postoperative recovery time, offering a novel solution to address the challenges of pediatric pyeloplasty.

What is the implication, and what should change now?

- It simplifies the complex laparoscopic anastomotic suturing process within the confined operating space, thereby reducing both operative time and surgical difficulty. As a result, encouraging the adoption of this technique, particularly for novice surgeons, is highly recommended.

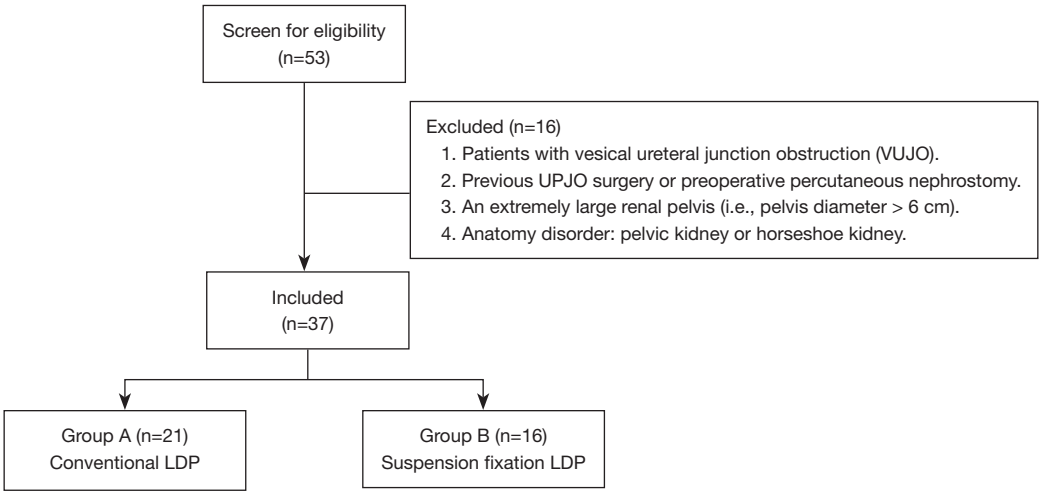

Figure 1 Flowchart depicting the selection and grouping process. LDP, laparoscopic dismembered pyeloplasty; UPJO, ureteropelvic junction obstruction.

infants and young children, particularly in the context of narrow operative spaces, remain unknown.

In this study, we aim to further investigate the effectiveness and safety of this technique in infants and young children (age ≤5 years) undergoing transperitoneal LDP by conducting a retrospective analysis. We present this article in accordance with the STROBE reporting checklist (available at https://tau.amegroups.com/article/view/10.21037/tau-2024-722/rc).

Methods

Study population

In this retrospective analysis, 53 infants and young children with congenital UPJO who underwent transperitoneal LDP between 2014 and 2020 at The Third Affiliated Hospital and The Sixth Affiliated Hospital of Sun Yat-sen University were included in the study. The inclusion criteria were: (I) patients aged ≤5 years; (II) patients who underwent transperitoneal LDP for UPJO with complete follow-up data. The exclusion criteria were: (I) patients with vesical ureteral junction obstruction (VUJO); (II) history of previous UPJO surgery or preoperative percutaneous nephrostomy; (III) an extremely large renal pelvis (i.e., pelvis diameter >6 cm); (IV) anatomy disorder: pelvic kidney or horseshoe kidney. Based on the inclusion and exclusion criteria, a total of 37 infants and young children were eventually enrolled in this study. The sample size is determined by the number of eligible cases that meet the above criteria. The case selection process, as detailed in *Figure 1*, was carefully designed to maintain data integrity.

Study design

All subjects underwent multiple ultrasonography, and/or preoperative computed tomography urography (CTU), renal scintigraphy. The indications for surgical intervention included hydronephrosis reaching classification issued by Society for Fetal Urology (SFU) grade III–IV, recurrent febrile urinary tract infection (UTI), CTU with obvious obstruction, and a radionuclide symmetrical differential renal function of 40% or less. For each patient who displayed such symptoms, we chose one of two types of operation that have shown comparable abilities to protect kidney function. Then, 37 infants and young children were divided into two Groups based on whether suspension fixation was applied during the transperitoneal LDP.

Data were collected on the patient's age, side of obstruction, SFU grade, glomerular filtration rate (GFR), indications for surgery, preoperative and postoperative anteroposterior renal pelvic diameter (APD), operative time, time to complete anastomosis, intraoperative blood loss, postoperative days to D-J stent removal, postoperative days to drainage tube removal, length of postoperative hospital stay, and any postoperative complications. All the data were obtained from the Hospital Information System (HIS), and potential sources of bias were addressed through strict inclusion criteria and a retrospective data analysis approach.

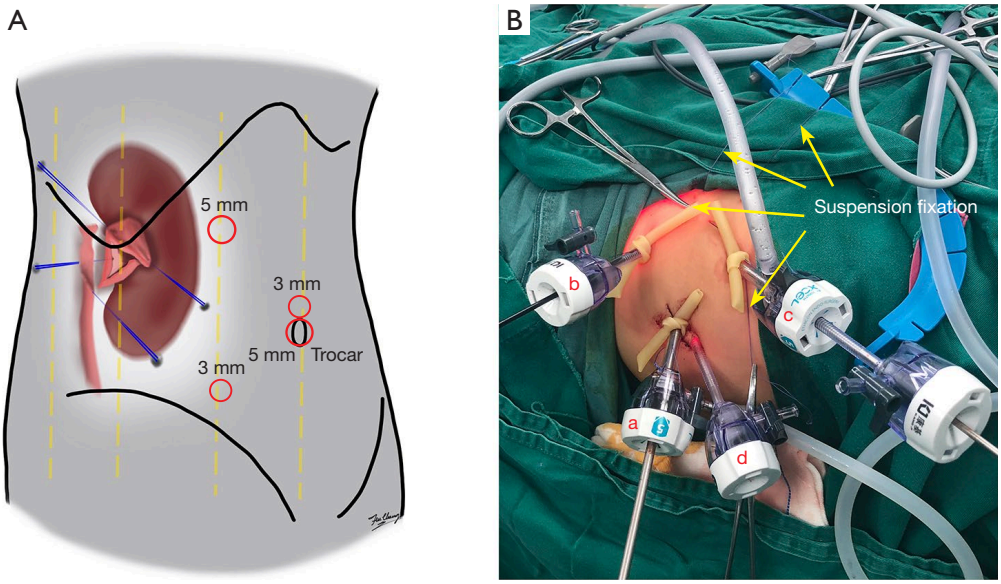

Figure 2 Assisted suspension fixation in transperitoneal LDP for infants and young children. (A) Schematic diagram showing the locations of the suspension fixation points. First point: positioned at the uppermost part of the renal pelvis, about 2 cm away from the renal sinus; second point: placed at the lowest part of the ureter, where it connects with the lowest point of the renal pelvis; third and fourth points: situated at the midpoints of the anterior and posterior walls of the renal pelvis. (B) Schematic diagram of the trocar placements. (a) Camera port for laparoscopy. (b,c) Manipulation port for the surgeon. (d) Assisted ports. LDP, laparoscopic dismembered pyeloplasty.

Patients were generally followed up every 3 months during the first year, and then annually. For patients who were unable to attend in person, follow-ups were carried out via telephone. Surgical success was defined as improved drainage, assessed through ultrasound or renal scintigraphy, and the absence of UTI. If functional imaging showed persistent obstruction or if further postoperative treatment was required, the surgery was considered a failure.

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the institutional review board of The Third and The Sixth Affiliated Hospital of Sun Yat-sen University (Nos. II2024-382-01 and 2024ZSLYEC-714) and individual consent for this retrospective analysis was waived.

Study endpoints

The primary endpoint was the time to complete anastomosis; secondary endpoints included the duration of surgery, intraoperative estimated blood loss, and postoperative hospital stay. The third endpoint was the timing of complications.

Surgical procedures

The children were placed in a lateral position, and general anesthesia with tracheal intubation was administered. All surgeries were performed by an experienced surgeon. Prior to surgery, a disposable cannula piercing needle (18 G, 45 mm; B. Braun Medical Inc., Melsungen, Germany) was preloaded with a folded 2-0 Tee polymer pledget (Ethibond Excel, Ethicon Endo-Surgery Inc., New Brunswick, USA).

In Group A, 3 trocars were located as showed in *Figure 2*. The procedures were as follows: A 5-mm skin incision was made in the umbilical region. Pneumoperitoneum was established by Veress needle puncture, and a 5-mm trocar (7.5-mm length, Ethicon Endo-Surgery, Inc., New Brunswick, USA) was introduced through an optical port. Insufflation was maintained at 6–12 mmHg, adjusted according to the patient's age and weight. A second 3mm trocar was inserted under direct vision at one-third of the distance between the anterior superior iliac spine and the umbilicus, near the midclavicular line. A 5-mm trocar was placed 1 finger's breadth below the lower edge of the affected side of the costal arch, along the midclavicular line.

A 5-mm 30-degree high-definition laparoscope (Olympus, Inc., Tokyo, Japan) was then introduced, along with CO_2 insufflation and operating instruments. All infant in this Group underwent conventional LDP as previous study (12).

In Group B, intraoperative assisted suspension fixation was applied, while the placement of the three trocars was the same as in Group A. Additionally, a fourth 3-mm trocar was placed along the umbilicus (*Figure 2*). The UPJ of both Groups was dissected at the inferior pole of the kidney, and the dilated renal pelvis and ureter were identified. The ureteropelvic junction stenosis was released, and the normal blood supply to the ureter and renal pelvis was preserved. The lowest point of the free renal pelvis was determined by comparing the direction of the renal axis and renal pelvis. A 4-0 Vicryl suture was placed at the highest point of the renal pelvis, 2 cm from the renal sinus (*Figure 3A*). The suture tails were pulled out *in vitro* using a suture-loaded cannula needle. The two tails were then lifted, and the fixed upper renal pelvis was tightened (*Figure 3B*). This constituted the *first point of suspension fixation* at the midaxillary line. Next, further dissection exposed most of the renal pelvis and its connection to the ureter and upper ureter (*Figure 3C*). After removing the stenosis, the tension in the upper ureter and renal pelvis was assessed, and the distal ureter was further released to alleviate the anastomotic tension. The ureteral sheath was preserved to maintain blood supply, and the extent of the stenosis resection was determined. The renal pelvis was then opened obliquely from the middle, sparing the lowest point to prevent complete detachment of the renal pelvis. Scissors were placed inside the ureter, and the ureter was incised from the outside. If the ureter lumen was atretic, the pelvic incision was extended 1 cm further along the normal part of the ureter, obliquely and parallel to its direction. The lowest point of the ureter and the lowest point of the renal pelvis were sutured together, and a sufficient length of suture tail was retained (for cases in Group A, the fixed suspension technique was not used). The suture tails were then passed through the abdominal wall using a suture-loaded cannula needle, and the tail was tightened outside the body with a forcep (*Figure 3D*). This created the *second point of suspension fixation* at the anterior axillary line. Two sutures were placed at the midpoint of the anterior and posterior walls of the renal pelvis for suspension anastomosis, corresponding to the anterior axillary line and midaxillary line, respectively (*Figure 3E*). The suture tails were fixed outside the abdominal wall using the same method, resulting in two additional fixed sutures (*third and fourth suspended fixation point*). The anastomosis site was secured with these four suspended fixation points, allowing for a tension-free anastomosis (external panorama view, as shown in *Figure 2B*).

In both Groups, a semi-continuous, precise anastomosis of the posterior wall was performed (*Figure 3F*), and a 4.7-F D-J stent was placed. Then, a semi-continuous anastomosis of the anterior wall and the remaining renal pelvic incision was performed (*Figure 3G*). Finally, a transperitoneal drainage tube was inserted at the suture site after ensuring that there was no urine leakage. The UPJ stenosis was removed and sent for pathological examination (*Figure 3H*), and the incision was closed.

Postoperative management

Based on drug susceptibility results, intravenous antibiotics and anti-inflammatory drugs were administered for 3 days, followed by oral cephalosporins. The catheter was removed on the first postoperative day. Drains were removed on the first postoperative day if the drainage was less than 20 mL/day. One month after surgery, the D-J stent was removed using a ureteroscope. At 1, 3, and 6 months, as well as 1 year after surgery, ultrasound was performed to measure the APD, and urinary habits were recorded. If the APD increased after the operation, magnetic resonance imaging (MRI) was performed.

Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 11.0 (SPSS Inc., Chicago, IL, USA). For continuous variables, Student's *t*-test, Wilcoxon test, and Mann-Whitney *U*-test were used, while Fisher's exact test and the Chi-squared test were applied to categorical variables. A P value of <0.05 was considered statistically significant.

Results

Baseline patient characteristics

A total of 37 patients were enrolled in the study, with 21 in Group A and 16 in Group B. Baseline patient characteristics are summarized in *Table 1*. There were no significant differences between the two groups in terms of age, gender distribution, side of obstruction, SFU grade, GFR, or preoperative APD.

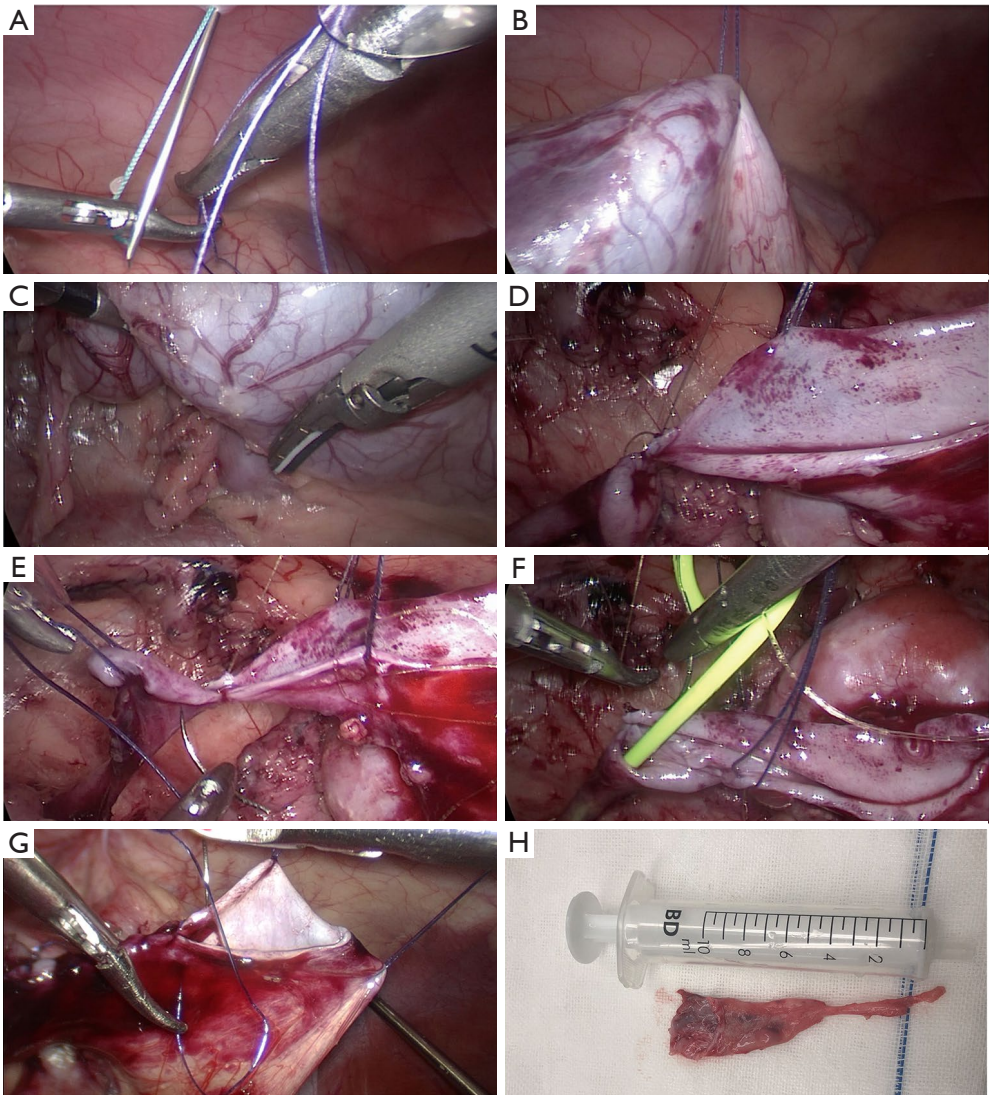

Figure 3 Intra- and post-operative images. (A) A 4-0 Vicryl suture was placed at the highest point of the renal pelvis. Both ends of the suture were pulled out *in vitro* using a threaded cannula. (B) Suspension of the uppermost part of the renal pelvis, approximately 2 cm from the renal sinus. (C) The renal pelvis was fully exposed, revealing its connection to the ureter and upper ureter. (D) After anastomosing the ureter to the lowest point of the renal pelvis, the tails of the first suture were sufficiently retained by passing them through the abdominal wall using a threaded cannula. (E) Two additional sutures were placed at the midpoints of the anterior and posterior walls of the renal pelvis for subsequent suspension anastomosis. (F) A semi-continuous, precise anastomosis was performed between the ureter and the posterior wall of the renal pelvis. (G) Completion of the renal pelvis incision anastomosis through suspension. (H) The specimen of the removed UPJ stenosis. UPJ, ureteropelvic junction.

Perioperative clinical parameters

All cases successfully underwent LDP without any unplanned reoperations. Group B demonstrated a significantly shorter duration of surgery compared to Group A (186.4±52.3 *vs.* 237.9±63.0 min, P=0.01). The time for completing the anastomosis was also significantly reduced in Group B (75.9±12.1 *vs.* 125.2±21.6 min, P<0.001). Additionally, Group B experienced less intraoperative blood loss compared to Group A [7.5 (5.0, 10.8) *vs.* 15.0 (5.0, 21.0) mL, P=0.04]. Postoperatively, Group B showed expedited recovery, reflected in a shorter hospital stay [4.5 (3.0, 6.5)

Table 1 Baseline characteristics of the cohorts in the two groups

Variates	Group A (n=21)	Group B (n=16)	P value
Age (year)	0.8 (0.5, 4.5)	0.6 (0.3, 2.8)	0.15
Gender			0.42
Male	19	13	
Female	2	3	
Preoperative APD (mm)	30.5±10.3	30.0±11.1	0.89
GFR (%)	26.4±10.0	23.9±8.6	0.44
Side of UPJO			0.79
Left	14	10	
Right	7	6	
SFU grade			0.60
3	11	7	
4	10	9	
Indications for surgery			
UTI	2	4	
Hematuria	2	3	
Postnatal hydronephrosis	4	3	

Group A, without suspension; Group B, suspension fixation. Data are n, mean ± standard deviation or median (interquartile range). SFU Grade 3 (moderate): moderate dilation of the renal pelvis and calyces; blunting of fornices and flattening of papillae; mild cortical thinning may be seen. SFU Grade 4 (severe): gross dilation of the renal pelvis and calyces, which appear ballooned; loss of borders between the renal pelvis and calyces; renal atrophy seen as cortical thinning. APD, anteroposterior renal pelvic diameter; GFR, glomerular filtration rate; SFU, Society for Fetal Urology; UPJO, ureteropelvic junction obstruction; UTI, urinary tract infection.

vs. 6.0 (4.0, 7.5) days, P=0.04]. No significant differences were found between the two groups regarding preoperative APD and the time to drainage tube and D-J sent removal. The surgical parameters for both groups are summarized in *Table 2*.

Both groups of patients were followed up for at least one year, with a median follow-up time of 15 months in both groups. Postoperative APD was assessed using ultrasound in both groups, and this value remained consistently low during the follow-up period. No statistically significant differences were observed in the reduction of APD between the two groups (11.8±3.4 *vs.* 13.6±3.2 mm, P=0.12). A 4.7 F D-J stent was placed in all cases, and the stent was successfully removed via ureteroscopy one month later. In Group A, one case developed hydronephrosis after the removal of the D-J stent, suggesting anastomotic stenosis. Ureteral balloon dilation was performed three months postoperatively, resulting in an improvement in the stenosis. In Group B, one subject experienced multiple episodes of postoperative febrile UTI after D-J stent removal, which was successfully treated with antibiotics. Overall, the remaining patients had no urine leakage, UTI or recurrence of stenosis during follow-up. The success rate of the surgery was 95.2% (20/21) in Group A and 93.8% (15/16) in Group B, respectively.

Discussion

Surgical correction of UPJO is recommended for patients with significantly impaired renal drainage, deterioration of renal function, recurrent UTI, pain, hematuria, or accompanying renal calculi (13). For many infants who have been prenatally diagnosed with hydronephrosis due to UPJO, the necessary of surgery remains controversial due to the uncertainty of surgical outcomes, as well as the challenges posed by anesthesia and the complexity of the procedure (14,15). A recent study has suggested that conservative management of some antenatally detected UPJO may result in greater loss of renal function, which cannot be recovered even after surgery (16). A study by Bao *et al.* also revealed that early surgery for severe UPJO in infants leads to a more promising recovery of renal function (17). In our study, all cases were diagnosed with moderate to severe hydronephrosis (SFU grade ≥3) or had a radionuclide symmetrical differential renal function of ≤40%. Hence, all patients underwent surgical intervention based on strict adherence to surgical indications.

Anderson-Hynes pyeloplasty has been the gold standard for the treatment of UPJO in children for many years (18,19). Other methods, such as endopyelotomy and balloon dilation, may have some effectiveness but offer a long-term cure rate of only 47% to 65%, with the potential for postoperative UPJO stenosis to recur in children (20,21). Since the first successful LDP was performed by Peters in 1995, this technique has become the preferred treatment for UPJO in children (3,22-25). Its effectiveness has been shown to be close to that of open surgery, and the procedure is minimally invasive, resulting in less pain, a less disfiguring incision, and other advantages (26). In children, particularly in infants and young children, the laparoscopic operating area is much smaller compared to older children.

Table 2 Surgery-related parameters of the cohorts in the two groups

Variates	Group A (n=21)	Group B (n=16)	P value
Postoperative APD (mm)	11.8±3.4	13.6±3.2	0.12
Operative time (min)	237.9±63.0	186.4±52.3	0.01
Anastomosis time (min)	125.2±21.6	75.9±12.1	<0.001
Intraoperative blood loss (mL)	15.0 (5.0, 21.0)	7.5 (5.0, 10.8)	0.04
Postoperative hospital stays (days)	6.0 (4.0, 7.5)	4.5 (3.0, 6.5)	0.04
Postoperative days to removal of the drainage tube (days)	2.0 (1.0, 2.0)	1.0 (1.0, 2.0)	0.81
Postoperative days to removal of the double J tube (days)	30.0 (28.5, 30.5)	29.5 (28.0, 31.8)	0.95
Follow-up			
Time (months)	15 (12, 18)	15 (15, 18)	0.37
Urine leakage	0	0	
Stenosis	1	0	
UTI	0	1	

Group A, without suspension; Group B, suspension fixation. Data are n, mean ± standard deviation or median (interquartile range). APD, anteroposterior renal pelvic diameter; UTI, urinary tract infection.

Laparoscopic pyeloplasty via a transperitoneal approach offers the advantages of a relatively larger working space and easily identifiable anatomical landmarks, making it the preferred choice in infants and young children (27).

The challenges of pediatric LDP lie in the confined operative space and the complexity of the ureteropelvic junction (UPJ) anastomosis. To address these difficulties, suspension techniques have been widely employed to enhance surgical exposure and the quality of anastomosis. The initial single-line suspension technique was first described by Tan *et al.* in 1996, primarily for pediatric LDP (28). This method is straightforward in its approach. However, due to the limitation of a single suspension line, it increases tensile stress on the renal pelvis and provides insufficient exposure of the pelvic structures, which negatively impacts precise localization of the anastomosis and the stability of surgical operations (29,30). Building upon this foundation, the double-line suspension technique was introduced to improve upon these limitations. By increasing the number of suspension lines, this method enhances the fixation of the renal pelvis and ureteral anastomosis, facilitating tension-free anastomosis. However, during the procedure, there is a risk of rotation along the suspension axis, and insufficient exposure of the pelvic structures may occur. Additionally, when performing pelvic incision closure, the use of clamps and traction can increase the risk of vascular injury (31-33).

In our previous study, we reported the application of a four-point suspension technique in retroperitoneal LDP, demonstrating that this method enables tension-free anastomosis to be completed in a shorter time, thereby improving surgical efficiency and reducing intraoperative adjustment and waiting times (11). In this study, we are the first to report the technical advantages of this technique in transperitoneal LDP for infants and young children. The extracorporeal suspension fixation is easily achieved by using a suture-loaded cannula needle, as we previously reported, and the tension of the suspension can be adjusted externally with forceps (34). Through the second and fourth suspended fixation points, ureteral rotation can be avoided, making the anastomosis of the posterior renal pelvis and ureter more efficient, as well as simplifying the insertion of the D-J stent. With traction from the first, third, and fourth suspension points, we can quickly suture the renal pelvis incision without clamping the renal pelvis wall, avoiding tissue damage. Moreover, this approach can also reduce bleeding from the renal pelvis wall. Using this method allows the surgeon to perform tension-free suturing and reduces the difficulty of suturing. Based on the data, this technique significantly reduced both overall surgical time and anastomosis time, effectively addressing the challenges of performing surgery in infants and young children. Additionally, the postoperative hospital stay was also shortened, likely attribute to reduced intraoperative

bleeding and milder postoperative edema, which promote faster recovery.

In this cohort, patients were followed up for at least one year. In Group A and Group B, one case developed anastomotic stricture and one case developed febrile UTI, respectively. Postoperative APD improved significantly, with no statistical difference between the two groups. No other complications were observed, and the surgical success rate was greater than 90% in both groups, consistent with previous literature reports (35). These data indicate that this technique is not only effective but also safe. However, the current follow-up period may be insufficient to capture late complications, and the long-term safety and efficacy require further evaluation.

There are several limitations in this study. Its retrospective design restricts causal inference, as retrospective analyses are prone to biases and confounding factors. The surgeon's expertise and patient-specific characteristics may have influenced the choice of surgical approach, which means that the two groups were not randomly assigned. Additionally, the small sample size may limit the generalizability of the results, and attrition further impacted the study, partly due to a small number of patients being lost to follow-up. The long-term efficacy of the treatment still requires further investigation. Therefore, moving forward, we plan to conduct a large-scale, multi-center, long-term randomized controlled trial (RCT) to provide strong, consistent, and generalizable evidence for a wider population.

Conclusions

In this study, we first introduce an assisted four-point suspension fixation during transperitoneal LDP in infants and young children. This technique helps to overcome the steep learning curve and challenges associated with the procedure. It facilitates the complex laparoscopic anastomotic suturing process within the narrow operating space, reducing surgical difficulty. Therefore, promoting this technique, especially for young surgeons, is warranted.

Acknowledgments

None.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://tau.amegroups.com/article/view/10.21037/tau-2024-722/rc

Data Sharing Statement: Available at https://tau.amegroups.com/article/view/10.21037/tau-2024-722/dss

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://tau.amegroups.com/article/view/10.21037/tau-2024-722/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the institutional review boards of The Third and The Sixth Affiliated Hospital of Sun Yat-sen University (Nos. II2024-382-01 and 2024ZSLYEC-714) and individual consent for this retrospective analysis was waived.

References

1. Piaggio LA, Noh PH, González R. Reoperative laparoscopic pyeloplasty in children: comparison with open surgery. J Urol 2007;177:1878-82.
2. Masieri L, Sforza S, Cini C, et al. Minilaparoscopic Versus Open Pyeloplasty in Children Less Than 1 Year. J Laparoendosc Adv Surg Tech A 2019;29:970-5.

3. Chen Z, Xu H, Wang C, et al. Robot-assisted surgery versus laparoscopic surgery of ureteropelvic junction obstruction in children: a systematic review and meta-analysis. J Robot Surg 2023;17:1891-906.
4. Tanaka ST, Grantham JA, Thomas JC, et al. A comparison of open vs laparoscopic pediatric pyeloplasty using the pediatric health information system database--do benefits of laparoscopic approach recede at younger ages? J Urol 2008;180:1479-85.
5. Abdulfattah S, Mittal S. Pediatric Robot-Assisted Laparoscopic Pyeloplasty: Where Are We Now? Curr Urol Rep 2024;25:55-61.
6. Ortiz-Seller D, Panach-Navarrete J, Valls-González L, et al. Comparison between open and minimally invasive pyeloplasty in infants: A systematic review and meta-analysis. J Pediatr Urol 2024;20:244-52.
7. Sun L, Zhao D, Shen Y, et al. Laparoscopic versus robot-assisted pyeloplasty in infants and young children. Asian J Surg 2023;46:868-73.
8. Bansal D, Cost NG, DeFoor WR Jr, et al. Infant robotic pyeloplasty: comparison with an open cohort. J Pediatr Urol 2014;10:380-5.
9. Buffi NM, Lughezzani G, Fossati N, et al. Robot-assisted, single-site, dismembered pyeloplasty for ureteropelvic junction obstruction with the new da Vinci platform: a stage 2a study. Eur Urol 2015;67:151-6.
10. Apelt N, Featherstone N, Giuliani S. Laparoscopic treatment of intussusception in children: a systematic review. J Pediatr Surg 2013;48:1789-93.
11. Li K, Hu C, Huang W, et al. A modification with threading cannula needle-assisted 4-point suspension fixation for retroperitoneal laparoscopic pyeloplasty in children with ureteropelvic junction obstruction: a cohort study in single center. Int Urol Nephrol 2019;51:193-9.
12. Singh O, Gupta SS, Hastir A, et al. Laparoscopic dismembered pyeloplasty for ureteropelvic junction obstruction: experience with 142 cases in a high-volume center. J Endourol 2010;24:1431-4.
13. Esposito C, Valla JS, Yeung CK. Current indications for laparoscopy and retroperitoneoscopy in pediatric urology. Surg Endosc 2004;18:1559-64.
14. Wang X, Xu Z, Miao CH. Current clinical evidence on the effect of general anesthesia on neurodevelopment in children: an updated systematic review with meta-regression. PLoS One 2014;9:e85760.
15. Passoni NM, Peters CA. Managing Ureteropelvic Junction Obstruction in the Young Infant. Front Pediatr 2020;8:242.
16. Subramaniam R, Kouriefs C, Dickson AP. Antenatally detected pelvi-ureteric junction obstruction: concerns about conservative management. BJU Int 1999;84:335-8.
17. Bao Q, Ma W, Zhang X, et al. Outcome analysis of immediate and delayed laparoscopic pyeloplasty in infants with severe ureteropelvic junction obstruction. Front Pediatr 2022;10:1022836.
18. Sarhan O, Helmy T, Abou-El Ghar M, et al. Long-term functional and morphological outcome after pyeloplasty for huge renal pelvis. BJU Int 2011;107:829-33.
19. Chang SJ, Hsu CK, Hsieh CH, et al. Comparing the efficacy and safety between robotic-assisted versus open pyeloplasty in children: a systemic review and meta-analysis. World J Urol 2015;33:1855-65.
20. Sugita Y, Clarnette TD, Hutson JM. Retrograde balloon dilatation for primary pelvi-ureteric junction stenosis in children. Br J Urol 1996;77:587-9.
21. Kim EH, Tanagho YS, Traxel EJ, et al. Endopyelotomy for pediatric ureteropelvic junction obstruction: a review of our 25-year experience. J Urol 2012;188:1628-33.
22. Fuchs GJ. Milestones in endoscope design for minimally invasive urologic surgery: the sentinel role of a pioneer. Surg Endosc 2006;20 Suppl 2:S493-9.
23. Peters CA, Schlussel RN, Retik AB. Pediatric laparoscopic dismembered pyeloplasty. J Urol 1995;153:1962-5.
24. Wood TC, Raison N, El-Hage O, et al. Robot-assisted laparoscopic pyeloplasty: a single-centre experience. Surg Endosc 2018;32:4590-6.
25. Harrow BR, Bagrodia A, Olweny EO, et al. Renal function after laparoendoscopic single site pyeloplasty. J Urol 2013;190:565-9.
26. Cestari A, Buffi NM, Lista G, et al. Feasibility and preliminary clinical outcomes of robotic laparoendoscopic single-site (R-LESS) pyeloplasty using a new single-port platform. Eur Urol 2012;62:175-9.
27. Ellerkamp V, Kurth RR, Schmid E, et al. Differences between intrinsic and extrinsic ureteropelvic junction obstruction related to crossing vessels: histology and functional analyses. World J Urol 2016;34:577-83.
28. Tan HL, Roberts JP. Laparoscopic dismembered pyeloplasty in children: preliminary results. Br J Urol 1996;77:909-13.
29. Li J, Chen J, Jia J, et al. Comparison of robot-assisted single-port-plus-one pyeloplasty vs. laparoscopic single-port pyeloplasty in the treatment of ureteropelvic junction obstruction in children. Front Pediatr 2024;12:1371514.
30. Mandelia A, Haldar R, Siddiqui Y, et al. Optimising working space for laparoscopic pyeloplasty in infants:

Preliminary observations with the SGPGI Protocol. J Minim Access Surg 2022;18:105-10.
31. Pérez-Marchán M, Pérez-Brayfield M. Comparison of laparoscopic pyeloplasty vs. robot-assisted pyeloplasty for the management of ureteropelvic junction obstruction in children. Front Pediatr 2022;10:1038454.
32. Zhao P, Wang C, Mao K, et al. Comparative study of different surgical approaches for treatment of UPJ obstruction according to the degree/severity of hydronephrosis factor. Front Pediatr 2022;10:966292.
33. Szavay P. Laparoscopic Pyeloplasty for Ureteropelvic Junction Obstruction. J Laparoendosc Adv Surg Tech A 2021;31:1214-8.
34. Wang DJ, Qiu JG, Fang YQ, et al. Laparoscopic extraperitoneal repair of symptomatic hydrocele in children: a single-center experience with 73 surgeries. J Endourol 2011;25:1221-5.
35. Chen JC, Zhang QL, Wang YJ, et al. Laparoscopic Disconnected Pyeloplasty to Treat Ureteropelvic Junction Obstruction (UPJO) in Children. Med Sci Monit 2019;25:9131-7.

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