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Comparative Study of No-Touch Technique Combined with Minimal Renal Pelvis Incision in Laparoscopic Pyeloplasty versus Conventional Approach for Pediatric UPJO

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Abstract

Background

Laparoscopic pyeloplasty (LP) is an effective treatment for pediatric ureteropelvic junction obstruction (UPJO). However, evidence regarding the perioperative and follow-up outcomes of LP combining a minimal renal pelvis incision with a no-touch technique remains limited.

Purpose

To compare laparoscopic pyeloplasty with a minimal renal pelvis incision and a no-touch technique versus standard laparoscopic pyeloplasty for treating pediatric UPJO.

Methods

This retrospective cohort study included 120 pediatric patients with UPJO who underwent surgery at the Children's Hospital of Nanjing Medical University between January 2022 and June 2024. Among the 120 patients, 103 were male, 17 were female, and the median age was 68.0 months. One hundred cases were left-sided, and 20 were right-sided. The modified group (MG, n = 63) received laparoscopic pyeloplasty with a minimal renal pelvis incision and no-touch technique, whereas the control group (CG, n = 57) underwent standard LP. There were no significant differences between the groups in terms of sex, age, affected side, or preoperative hydronephrosis severity ($P > 0.05$). Perioperative outcomes, postoperative complications, and follow-up renal pelvis APD were compared.

Results

All procedures were completed laparoscopically without conversion to open surgery. Compared with the CG, the MG had shorter operative time (85.0 vs. 100.0 min; $P < 0.05$), lower intraoperative blood loss (6.0 vs. 10.0 mL; $P < 0.05$), a shorter postoperative hospital stay (5.0 vs. 7.0 days; $P < 0.001$), and shorter postoperative hematuria duration (3.0 days, IQR 1.0–4.0 vs. 3.0 days, IQR 2.0–5.0; $P < 0.05$). D-J tube blockage occurred in one patient (1.59%) in the MG and three patients (5.26%) in the CG. Although this difference did not reach statistical significance ($P > 0.05$), the incidence of D-J tube blockage was numerically lower in the MG than in the CG. At a mean follow-up of 13.0 ± 5.5 months, no significant between-group difference was observed in renal pelvis APD ($P > 0.05$). Redo pyeloplasty was required in one patient in each group, corresponding to rates of 1.59% in the MG and 1.75% in the CG, with no significant difference ($P > 0.05$).

Conclusion

Compared with standard laparoscopic pyeloplasty, modified laparoscopic pyeloplasty using a minimal renal pelvis incision and no-touch technique was associated with improved perioperative outcomes, including shorter operative time, reduced intraoperative blood loss, shorter hospital stay, and shorter postoperative hematuria duration. Redo pyeloplasty rates and follow-up renal pelvis APD were comparable between groups. Although the

incidence of D-J tube blockage was numerically lower in the MG than in the CG, this difference was not statistically significant. These findings suggest that the modified technique is a feasible alternative to standard laparoscopic pyeloplasty for pediatric UPJO, although prospective studies with longer follow-up are needed to confirm its clinical value.

INTRODUCTION:

Pediatric congenital hydronephrosis, typically identified through prenatal ultrasound (US) screening or postnatal ultrasound when symptoms appear, is characterized by dilation of the renal collecting system. ureteropelvic junction obstruction (UPJO) is one of the most common clinically significant causes of hydronephrosis in children and a leading indication for surgical intervention. Since Schuessler first introduced laparoscopic pyeloplasty (LP) in 1993[1], LP has gained widespread clinical adoption and has become an established minimally invasive alternative to open pyeloplasty for pediatric UPJO. LP not only offers comparable long-term success rates to open surgery but also provides advantages such as improved cosmetic outcomes, shorter hospital stays, and faster recovery times, especially in settings where robotic platforms are not widely available [2, 3].

Despite its advantages, LP still presents technical challenges, especially in achieving a safe, tension-free, and well-vascularized renal pelvis-ureter anastomosis. Excessive ureteral handling and oversized renal pelvis incisions remain key risk factors for postoperative complications such as anastomotic stenosis and D-J tube blockage[4]. Based on these considerations, we developed a modified LP technique that combines minimal direct ureteral manipulation, referred to as the no-touch technique, with a limited renal pelvis incision of 1.0–1.5 cm. This approach is intended to reduce iatrogenic tissue trauma and promote faster recovery. However, evidence regarding the clinical value of this combined strategy in pediatric laparoscopic pyeloplasty remains limited. Therefore, this study compared the perioperative and follow-up outcomes of laparoscopic pyeloplasty with the no-touch technique and minimal renal pelvis incision versus standard laparoscopic pyeloplasty for UPJO-related hydronephrosis in children, aiming to evaluate the feasibility and potential advantages of this modified technique.

MATERIALS AND METHODS

1.1 General Information

A retrospective cohort study was conducted on the clinical data of 120 children with UPJO-related congenital hydronephrosis treated surgically in the Department of Urology at the Children's Hospital of Nanjing Medical University, from January 2022 to June 2024. According to the center-specific standardized preoperative examination protocol developed at our center and constrained by the availability of diagnostic equipment, all patients underwent preoperative renal and urinary tract ultrasonography and magnetic resonance urography (MRU). In addition, renal scintigraphy was performed in 95/120 patients when clinically feasible or indicated. The 63 children who underwent laparoscopic pyeloplasty with a minimal renal pelvis incision (≤ 1.5 cm) and no-touch technique were included in the MG, while the 57 children who underwent standard LP (Anderson–Hynes, incision > 1.5 cm) were designated as the CG. Written informed consent for surgery was obtained from the legal guardians of all patients, and the study was approved by the Medical Ethics Committee of Children's Hospital of Nanjing Medical University (Ethics No. 202503017-1).

1.2 Inclusion and Exclusion Criteria

We enrolled children aged 0–16 years who met any of the following criteria: Presence of hydronephrosis-related clinical symptoms (pain, urinary tract infection); Split renal function (DRF) < 35%–40% on initial assessment, with $T_1/_2$ > 20 min; For patients with an obstructive renogram and split renal function > 40%, serial ultrasonographic follow-up was performed: surgical intervention was indicated if repeat renal scintigraphy showed a decrease in DRF of > 5%–10%, worsening hydronephrosis, or persistent hydronephrosis accompanied by renal parenchymal thinning.

The exclusion criteria were as follows: hydronephrosis caused by conditions other than UPJO, such as urinary tract stones, posterior urethral valves, or distal ureteral stenosis; bilateral hydronephrosis; severe underlying disease or concomitant conditions precluding laparoscopic surgery; intraoperative conversion to another surgical approach or technique; and incomplete follow-up data.

1.3 Methods

Surgical procedure in the MG:

The operation was performed via a transperitoneal laparoscopic approach, with a modification of the standard Anderson–Hynes dismembered pyeloplasty technique. Following induction of general anesthesia, a urinary catheter was placed and the patient was positioned in lateral decubitus. A 5-mm trocar was inserted through the umbilicus, and two ports were placed superior and inferior to the umbilicus. The posterior peritoneum was incised with an ultrasonic scalpel. After dissection and exposure of the renal pelvis and ureteropelvis junction (Fig. 2A), two stay sutures were placed to suspend the tissues from the abdominal wall: one suture was anchored to the inferior aspect of the renal pelvis and the lateral wall of the proximal ureter, whereas the other was used to retract the superior aspect of the renal pelvis (Fig. 2B). The renal pelvis was trimmed as necessary, and a 1.0–1.5-cm incision was created for anastomosis, defined as the minimal incision (Figs. 1, Figs. 2C and Figs. 3A). A segment of the diseased proximal ureter was preserved to permit controlled traction during anastomosis, thereby minimizing direct instrumental manipulation of the ureteral wall. Intraoperatively, the incision length was measured using a D-J tube marked with 1 cm grid intervals (Fig. 3A). A longitudinal incision was then made along the lateral wall of the ureter. The most dependent point of the ureteral spatulation was anastomosed to the most dependent point of the renal pelvis incision. The posterior wall was closed with running 5 − 0 absorbable sutures, followed by insertion of a D-J tube (Figs. 2D and 2E). The anterior wall of the ureteropelvis anastomosis was then closed with a running 5 − 0 absorbable suture. The diseased segment of the proximal ureter and any redundant ureteral tissue were subsequently excised, and the residual opening in the renal pelvis flap was closed with a running 5 − 0 absorbable suture. Upon completion, the ureteropelvis junction was confirmed to lie at the most dependent position without torsion. The trocars were withdrawn, and the port sites were closed (Figs. 2F).

Surgical procedure in the CG:

The CG group underwent the same anesthesia, patient positioning, trocar placement, and surgical approach as the MG group. After mobilization and resection of the stenotic segment, a conventional renal pelvis incision approximately 3 cm in length was made for ureteropelvis anastomosis (defined as conventional incision, > 1.5 cm; Fig. 3B). Unlike the MG group, in which the no-touch technique was used, the CG group underwent

conventional direct manipulation, without deliberate restriction of tissue contact with or traction on the renal pelvis and ureter during the procedure. The anastomosis was initiated at the lowest point of the renal pelvis incision. The posterior wall was sutured with 5 – 0 absorbable sutures, after which a D-J tube was inserted and the anterior wall was completed using either continuous or interrupted sutures, as appropriate according to the intraoperative findings. Upon completion, the anastomosis was inspected to ensure that it was tension-free and free of obvious leakage.

1.4 Postoperative Management

Postoperative observation included monitoring for symptoms such as abdominal distension, lumbar pain, hematuria, and urinary difficulties. A urinary catheter was typically retained for 3–5 days before removal. Routine prophylactic antibiotics were administered for 2—3 days. One month after discharge, the D—J tube was removed via cystoscopy.

1.5 Outcome measures and efficacy evaluation

Surgical time (minutes), intraoperative blood loss (millilitres), postoperative hematuria duration (days), and postoperative hospital stay were compared between the two groups. Additionally, the success rate of the procedure and occurrence of postoperative complications (such as urinary leakage, incision infection, fever, and D—J tube blockage) were assessed. All patients underwent ultrasound follow-up 2 months after surgery, with subsequent follow-ups every 6 months. Surgical success criteria included clinical symptom relief, stable or improved renal function, and improvement in the anterior—posterior diameter of the renal pelvis.

1.6 Statistical methods

The data were analysed using SPSS®26.0. Categorical variables were expressed as numbers and percentages; gender and affected side were compared between groups with the Chi-square test, and Fisher's exact test if total sample size < 40 or any theoretical cell frequency < 1, with effect sizes as odds ratios and 95% confidence intervals. Continuous variables were assessed for normality by K-S test, all were nonnormally distributed, expressed as median ranges, and compared between groups using the Mann—Whitney U test, with effect sizes as median differences and 95% confidence intervals. All statistical tests were two-sided, with significance level set at $p < 0.05$.

2.1 Results

This study included 120 children, consisting of 103 males and 17 females, with a median age (interquartile range [IQR]) of 68.0 months (range: 15.0–102.8 months). Among them, 100 cases were left-sided, and 20 were right-sided. Forty-six patients were prenatally diagnosed with asymptomatic hydronephrosis, whereas 74 patients had symptomatic hydronephrosis. The MG included 63 children, with an age range of 1.9–174 months and a median age of 65.0 months (range: 19.0–102.0 months); 52 males and 11 females were included. The CG consisted of 57 children, with ages ranging from 1.4–165 months and a median age of 68.0 months (range: 10.7–105.0 months); 51 males and 6 females were included. There were no significant differences between the MG and CG in terms of sex, age, side of obstruction, or preoperative APD ($P > 0.05$) (Table 1).

Table 1
Comparison of Basic Information Between the Two Groups

Group	Number of Cases	Gender (n)		Age (months)	Side (n)		Preoperative Renal pelvis APD (mm)
		Male	Female		Left	Right	
CG	57	51	6	68.0(10.7,105.0)	45	12	28.0(20.0,39.5)
MG	63	52	11	65.0(19.0,102.0)	55	8	25.0(20.0,37.0)
x^2		1.183			1.504		
P-value		0.277		0.603	0.220		0.774

2.2 Comparison of Surgical Time, Intraoperative Blood Loss, Postoperative hematuria Duration, Postoperative Hospital Stay, and D—J Tube Blockage Rate Between the MG and CG

Compared with the CG, the MG had significantly shorter surgical times, less intraoperative blood loss, shorter postoperative hospital stays, and shorter postoperative hematuria durations ($P < 0.05$). A total of four children across both groups developed lumbar pain, fever, and reduced urination 2–3 days days postoperatively. Ultrasound revealed hypoechoic areas in the renal pelvis, indicative of double-J (D-J) tube blockage. In the MG, one case of D-J tube blockage occurred (1/63, 1.59%), while in the CG, three cases were observed (3/57, 5.26%). Although the difference did not reach statistical significance ($P > 0.05$), the incidence of tube blockage in the MG was markedly lower than that in the CG (Table 2). We replaced the blocked D—J tubes with F6 small gastric tubes, and after exchange, four children exhibited smooth urination, and the clinical signs resolved. The small gastric tubes were removed before discharge, and follow-up ultrasound revealed improved renal pelvis separation with no significant discomfort.

Table 2
Comparison of intraoperative and postoperative data of different surgical methods in children with hydronephrosis

Group	Surgical Time [M(Q1,Q3),min]	Intraoperative Blood Loss [M(Q1,Q3),ml]	Postoperative Hospital Stay [M(Q1,Q3),d]	Postoperative Hematuria Duration[M(Q1,Q3),d]	Postoperative D-J tube blockage(n)
CG(n = 57)	100.0(75.0,130.0)	10.0(5.0,17.5)	7.0(6.0,9.5)	3.0(2.0,5.0)	3
MG(n = 63)	85.0(75.0,95.0)	6.0(5.0,10.0)	5.0(4.0,5.0)	3.0(1.0,4.0)	1
P-value	0.005	0.022	< 0.001	0.036	0.541

2.3 Comparison of Surgical Time, Intraoperative Blood Loss, Postoperative hematuria Duration, Postoperative Hospital Stay, and D—J Tube Blockage Rate Stratified by Preoperative APD Within the MG

Based on preoperative ultrasound, patients in the modified group were stratified for exploratory analysis using a preoperative renal pelvic anteroposterior diameter (APD) cutoff of 25 mm into a lower-APD subgroup (APD < 25 mm, n = 28) and a higher-APD subgroup (APD ≥ 25 mm, n = 35). No significant differences were observed

between the two subgroups in operative time, intraoperative blood loss, postoperative hospital stay, or hematuria duration (all P > 0.05). One case of D-J tube blockage (2.86%) occurred in the higher-APD subgroup 2–3 days postoperatively, presenting with lumbar pain, fever, and oliguria; no blockages occurred in the lower-APD subgroup (0%). The difference in complication rates was not statistically significant (P > 0.05). The blocked tube was replaced with an F6 gastric tube, with symptom resolution and improved renal pelvis separation on follow-up. These results indicate that the no-touch technique combined with a minimal incision is feasible and effective across varying degrees of hydronephrosis severity.

Table 3
Comparison of Intraoperative and Postoperative Data Stratified by Preoperative APD in Children Treated with the No-Touch Technique Combined with Minimal Renal Pelvic Incision

Group	Surgical Time [M(Q1,Q3),min]	Intraoperative Blood Loss [M(Q1,Q3),ml]	Postoperative Hospital Stay [M(Q1,Q3),d]	Postoperative Hematuria Duration[M(Q1,Q3),d]	Postoperative D-J tube blockage(n)
APD<25mm (n = 28)	82.5(75.0, 92.5)	7.5(5.0,10.0)	5.0(4.0,5.0)	3.0(2.5,4.0)	0
APD≥25mm (n = 35)	85.0(75.0, 100.0)	5.0(5.0,10.0)	5.0(4.0, 5.0)	3.0(1.0,4.0)	1
P-value	0.487	0.960	0.918	0.118	1.000

2.4 Follow-up comparison between groups

All 120 patients were followed up, with a mean follow-up duration of 13.0 ± 5.5 months. The postoperative renal pelvis anterior–posterior diameter (APD) was 15.0 (range: 10.0, 21.0) mm in the CG and 12.0 (range: 8.0, 17.0) mm in the MG. No significant difference was found between the groups (p = 0.114, > 0.05). One year after surgery, one patient in each group experienced abdominal pain. Imaging revealed reobstruction, and both patients underwent redo pyeloplasty with good recovery. The redo pyeloplasty rate was 1.59% (1/63) in the MG and 1.75% (1/57) in the CG. The success rate was 98.41% (62/63) for the MG and 98.25% (56/57) for the CG, with no significant difference between the two groups (p = 0.99, > 0.05) (Table 4).

Table 4
Comparison of follow-up effects between the two groups

Group	Postoperative Renal pelvis APD/[M(Q1,Q3),mm]	Surgical Success Rate (%)	Redo pyeloplasty Rate (%)
CG	15.0(10.0,21.0)	98.25	1.75
MG	12.0(8.0,17.0)	98.41	1.59
P-value	0.114	0.99	0.99

Discussion

Advances in surgical instruments and suturing techniques have led to increasing acceptance of laparoscopic surgery for pediatric UPJO, including in infants younger than 3 months of age [5]. In this study, compared with

conventional laparoscopic pyeloplasty, the MG achieved similar outcomes in terms of hydronephrosis improvement and complication rates as the CG, while demonstrating significant advantages in operative time, intraoperative blood loss, postoperative hematuria duration, and length of hospital stay. Previous studies [6] reported a complication rate of 7.7%, mainly including thrombosis, D-J tube blockage, and urinary leakage, whereas the complication rate in our cohort was 1.59%. These findings suggest that reducing tissue manipulation and avoiding unnecessary traction on the ureter may facilitate postoperative recovery without compromising surgical efficacy. Subgroup analysis stratified by preoperative APD showed no significant differences in operative time, intraoperative blood loss, hospital stay, or hematuria duration between children with different degrees of hydronephrosis, indicating that the modified technique is feasible across a broad spectrum of disease severity. Although the incidence of D-J tube blockage was lower in the MG, the difference did not reach statistical significance. Nevertheless, the lower incidence suggests that reduced tissue handling and a smaller incision may help decrease stent-related complications.

These perioperative advantages may be attributable to reduced mechanical injury and a shorter suturing process. Although a larger incision facilitates reconstructive procedures, it may also increase renal pelvic tissue injury, intraoperative bleeding, and suturing time. Based on the principles of minimally invasive surgery and tissue preservation, our technique combines a limited renal pelvic incision with a no-touch approach. We believe that, provided that surgical exposure and anastomotic reconstruction are not compromised, limiting the pyelotomy to 1.0-1.5 cm is generally sufficient for reconstruction and may help reduce tissue injury associated with pyelotomy. During the procedure, we avoided directly grasping the ureteral wall intended for anastomosis, used suspension sutures to provide stable and controlled tissue traction, and temporarily preserved a short segment of the proximal diseased ureter as a traction target before excision. This strategy facilitates exposure of the anastomotic site, improves operative stability, lowers the technical difficulty of intracorporeal suturing, and reduces unnecessary mechanical trauma to the final anastomotic segment and surrounding tissues.

Previous studies have also shown that mini-incision or reduced-manipulation techniques can maintain efficacy while lowering surgical trauma in pediatric pyeloplasty. Dubeux[7]reported comparable outcomes using 3.5-mm microlaparoscopic instruments, and Sharifiaghdas[8]demonstrated the safety of an 18–28 mm retroperitoneal mini-incision without reduction of the renal pelvis. In conventional laparoscopic pyeloplasty, a relatively large renal pelvic incision is usually required to achieve adequate exposure, facilitate anastomotic reconstruction, and ensure urinary drainage[9]. Although a larger incision supports reconstruction, it may increase renal pelvic injury and blood loss and prolong suturing time.

Pathological studies[10]have shown that the infant urothelium contains more elastic tissue, and the obstructed urothelium contains increased elastin, which makes suturing more difficult in pediatric laparoscopic pyeloplasty, particularly at the ureter and renal pelvis. Prolonged laparoscopic operating time and pneumoperitoneum also increase the risk of complications[11]. A minimal renal pelvic incision can shorten suturing time, reduce anastomotic tension, and help prevent scar formation and restenosis. In infants younger than 1 year, adaptation of minimally invasive techniques is particularly challenging because of their smaller anatomical space. A smaller incision provides more working space, improves operative precision, reduces accidental injury, and lowers intraoperative risk. Although postoperative restenosis is uncommon, reoperation is more difficult than the initial procedure[12]. The no-touch technique further minimizes direct contact with the ureter during anastomosis. For example, Radfar MH[13]described partially transecting the ureter while keeping it attached to the renal pelvis to reduce manipulation. This approach may preserve ureteral blood supply, reduce inflammation,

promote recovery, and decrease scar formation and stenosis[14,15]. Suspension sutures help maintain incision stability and facilitate optimal no-touch anastomosis. By contrast, larger incisions often require more clamping, which may be associated with greater tissue trauma and a higher risk of complications.

Postoperative D—J tube blockage is a key factor affecting surgical outcomes, with symptoms such as vomiting, fever, and increased abdominal drainage, which can reduce both surgical success and patient satisfaction[16]. For children who develop markedly decreased urine output, persistent flank or abdominal discomfort, or vomiting after surgery, particularly when ultrasonography demonstrates rapid worsening of hydronephrosis compared with the postoperative baseline, D-J tube blockage should be considered, and further assessment should be performed on the basis of the clinical findings and imaging results. Although D-J tube blockage is uncommon, it may increase the need for additional intervention and complicate subsequent clinical management, potentially adversely affecting the treatment experience and satisfaction of the child's parents or caregivers. The incidence of D-J tube blockage was numerically lower in the MG (1.59%) than in the CG (5.26%), but the difference was not statistically significant ($P > 0.05$).For children with D-J tube blockage, we do not routinely recommend stent exchange. Previous studies have suggested that stent exchange may increase procedural complexity and the risk of recurrent obstruction[17,18]. In all four children in our cohort, the obstructed D-J tube was removed cystoscopically under general anesthesia. A F6 disposable urinary catheter was then advanced into the renal pelvis over a hydrophilic guidewire to establish continuous urinary drainage. Approximately 5 days postoperatively, both the ureteral catheter and the indwelling bladder catheter were removed simultaneously. The 6-Fr catheter was soft and could be inserted smoothly, with no apparent urinary tract mucosal injury observed. All children underwent catheter removal as planned, and no acute re-obstruction occurred during follow-up. Based on these findings, this approach may be considered the preferred drainage strategy after D-J tube blockage. For children with clinically evident recurrent obstruction, percutaneous nephrostomy may be used as an alternative decompressive procedure. It provides direct and effective urinary drainage and can serve as salvage drainage when catheter-based drainage fails. However, its invasive nature may restrict the child's mobility, increase nursing burden, and entail risks of catheter occlusion and dislodgement.

This study has several limitations. As a single-centre, single-surgeon retrospective analysis with a relatively small sample size and limited follow-up, selection bias and restricted generalizability are inevitable. Although a single operator eliminated inter-surgeon variability, the learning curve associated with the no-touch technique and minimal incision may have influenced early surgical performance. Additionally, since the no-touch principle and the minimal renal pelvis incision were implemented concurrently as a unified surgical strategy, their individual contributions to the observed outcomes could not be distinguished. Larger multicentre prospective studies with extended follow-up are warranted to validate the long-term efficacy and clinical utility of this combined approach.

Conclusion

The integration of the no-touch principle with a minimal renal pelvis incision offers a feasible and effective surgical strategy for pediatric UPJO. Short-term perioperative data demonstrate that this combined approach is associated with reduced technical difficulty, attenuated iatrogenic trauma, a lower incidence of D-J tube blockage, improved short-term outcomes, and accelerated postoperative recovery. However, constrained by the inherent limitations of the retrospective design and relatively short follow-up duration, our findings primarily

reflect short-term efficacy. The long-term effectiveness, safety, and durability of this technique warrant further validation through prospective comparative studies with extended surveillance.

Abbreviations

UPJO
ureteropelvic junction obstruction
LP
laparoscopic pyeloplasty
MG
modified Group
CG
control group
APD
anterior-posterior diameter

Declarations

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Author information

Authors' contributions

FYH, YMY and XHC participated in the study design and data collection. JQD performed the statistical analysis. XYL and XJZ contributed to clinical data collection and follow-up. JW and YFG supervised the research and provided critical guidance. YJD and LQH performed the surgeries and drafted the manuscript. All authors read and approved the final manuscript.

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Ethics declarations

Ethics approval and consent to participate

This retrospective study was conducted in accordance with the Declaration of Helsinki and was approved by the Medical Ethics Committee of Children's Hospital of Nanjing Medical University, Ethics No. 202503017-1.Informed consent was waived by the committee due to the retrospective design and use of anonymized medical records, in accordance with China's Ethical Guidelines for Medical Research Involving Human Subjects (National Health Commission, 2016). For participants under 16 years of age, parental/guardian consent was waived as no direct contact occurred and all data were de-identified prior to analysis. All patient data were handled in compliance with relevant data protection and privacy regulations(Clinical trial is not applicable).

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Figures

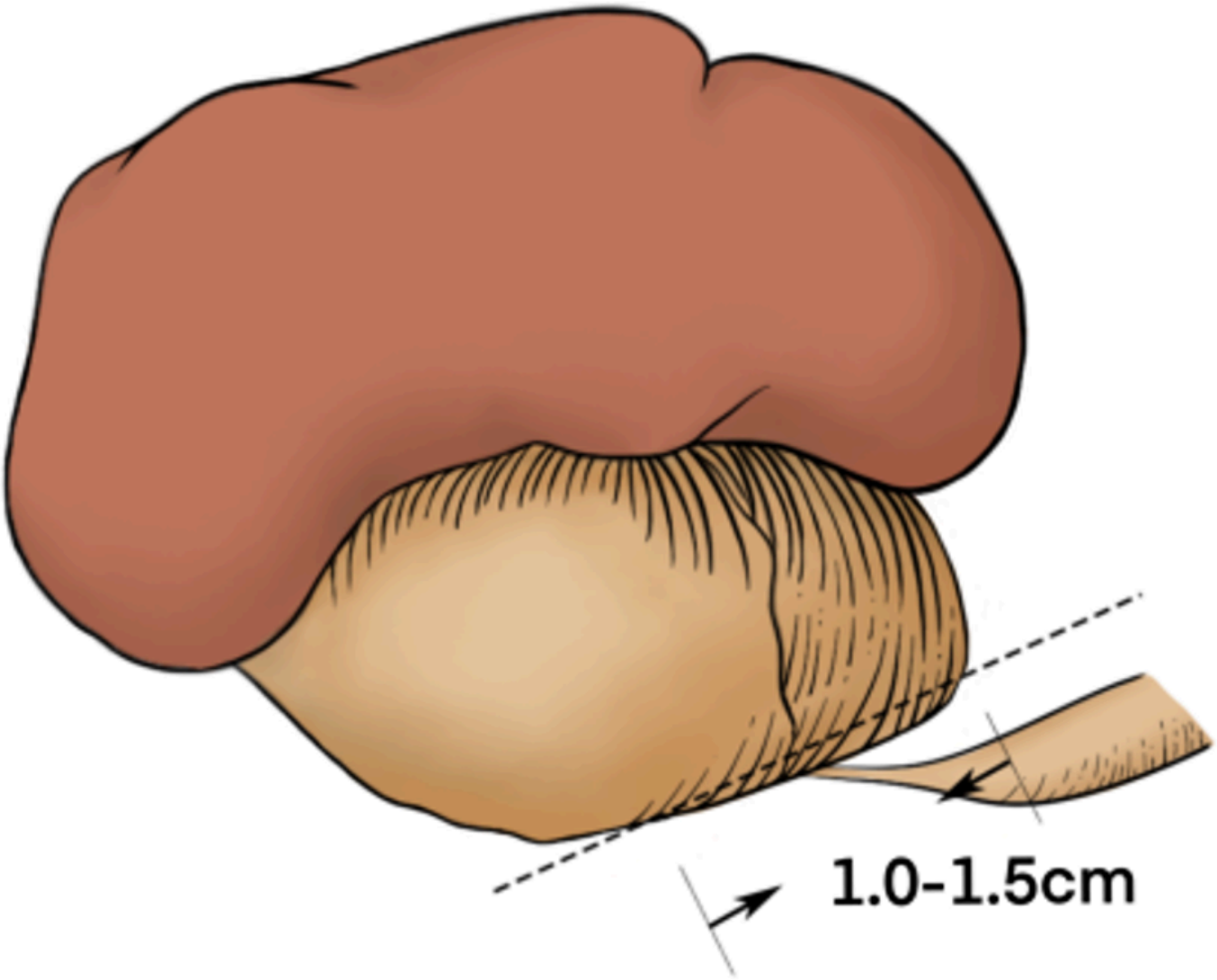


Figure 1

Schematic illustration of the minimal renal pelvis incision technique.

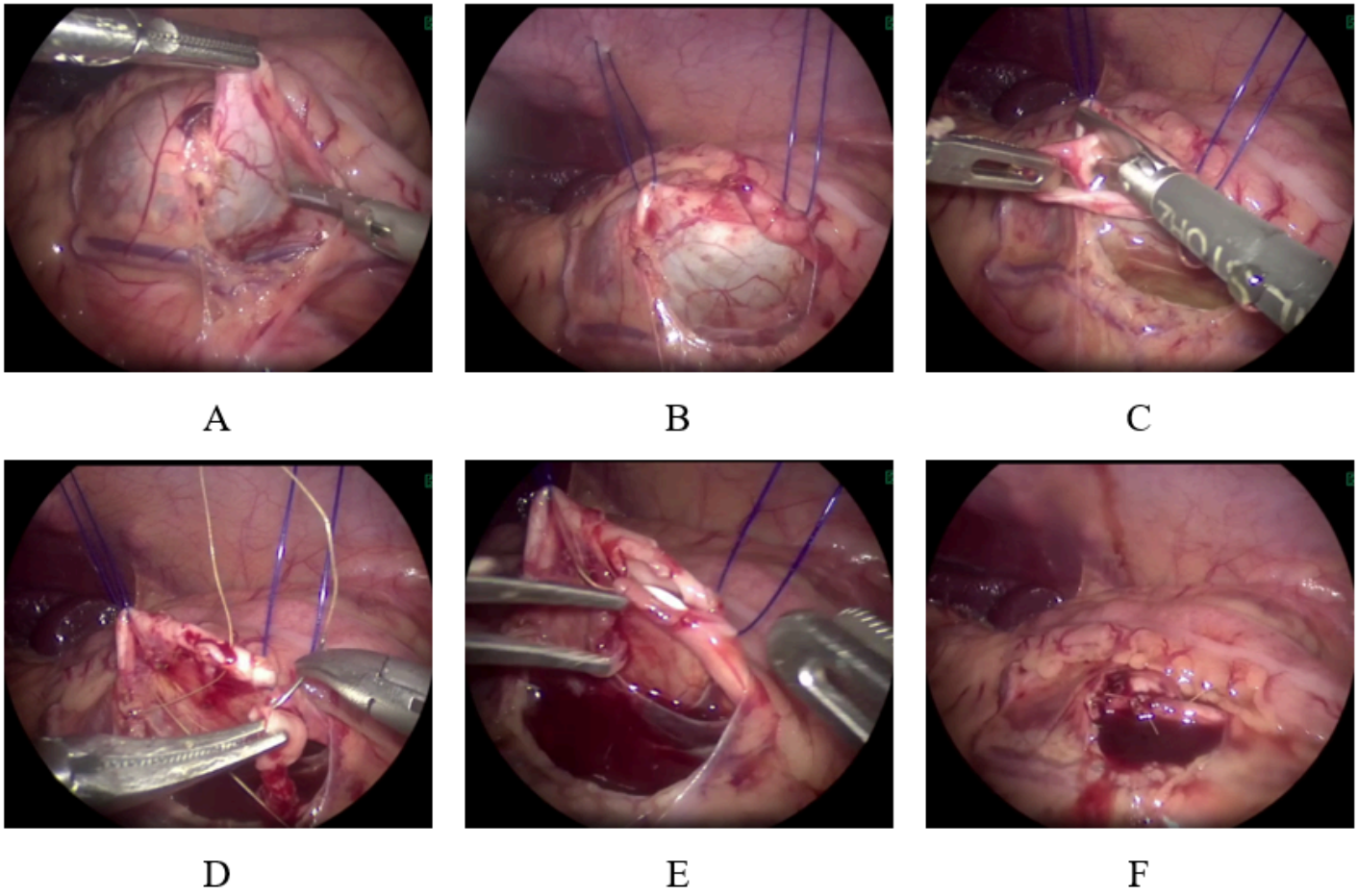


Figure 2

Intraoperative steps of laparoscopic pyeloplasty using the no-touch technique combined with a minimal renal pelvis incision in the modified group.

A: Exposure of the renal pelvis and ureteropelvis junction.

B: Placement of suspension stay sutures.

C: Minimal incision of the renal pelvis.

D: Posterior-wall suturing using the no-touch technique.

E: Insertion of the D-J tube.

F: Completed tension-free ureteropelvis anastomosis

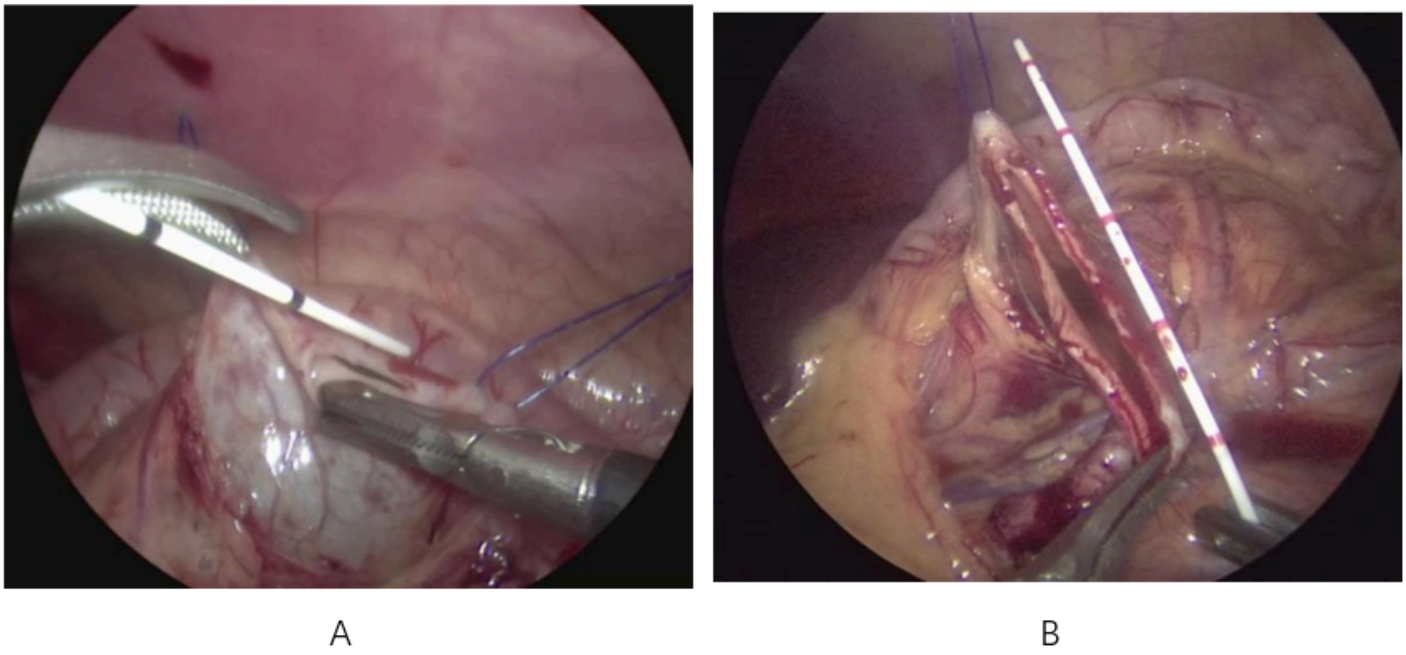


Figure 3

Intraoperative measurement of the renal pelvis incision size using a D-J tube with 1-cm grid markings as a reference scale.

A: The renal pelvis incision size in the MG is approximately 1.0 cm.

B: The renal pelvis incision size in the CG is approximately 3.0 cm.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Table1to4.xlsx