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Original research

TRANSPERITONEAL LAPAROSCOPIC PYELOPLASTY FOR THE TREATMENT OF URETEROPELVIC JUNCTION OBSTRUCTION IN CHILDREN: EXPERIENCE FROM HUE CENTRAL HOSPITAL

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ABSTRACT

Objectives: *This study aims to evaluate the safety and effectiveness of transperitoneal laparoscopic pyeloplasty in treating ureteropelvic junction obstruction (UPJO) in children.*

Methods: *This was a prospective study, including pediatric patients aged ≤16 years who underwent transperitoneal laparoscopic pyeloplasty from June 2021 to June 2024. Recorded parameters included operation time, blood loss, intraoperative and postoperative complications, hospital stay, and surgical outcomes. Success was defined as improvement in symptoms and/or resolution of obstruction on postoperative renal scintigraphy.*

Results: *We performed transperitoneal laparoscopic pyeloplasty using the Anderson-Hynes technique on 30 patients. The mean age was 30.2 ± 8.6 months, with male-to-female ratio of 2.75. The average operative time was 122.38 ± 21.11 minutes, with minimal blood loss. The average postoperative hospital stay was 4.76 ± 1.34 days. One patient experienced a postoperative fluid collection. The average follow-up duration was 14.7 ± 4.2 months (ranging from 8–18 months). The overall success rate was 100%.*

Conclusion: *Transperitoneal laparoscopic pyeloplasty is a safe, effective, and minimally invasive surgical method for children with ureteropelvic junction obstruction. This technique provides favorable long-term outcomes with a low complication rate.*

Keywords: *Transperitoneal laparoscopic pyeloplasty, ureteropelvic junction obstruction.*

I. INTRODUCTION

Ureteropelvic junction (UPJ) obstruction is defined as a blockage of urine flow from the renal pelvis to the proximal ureter. Pyeloplasty is an effective surgical treatment to improve urinary drainage and preserve or enhance renal function [1]. Surgical outcomes are typically based on clinical symptoms improvement, renal function recovery on scintigraphy, or reduced hydronephrosis on ultrasound and computed tomography [2].

For decades, open Anderson - Hynes pyeloplasty - first reported in the literature in 1949 - has been considered the gold standard for the treatment of UPJ obstruction, with a reported success rate of up to 95% [3]. However, this open approach requires a large incision, carries risks of prolonged postoperative pain, longer recovery time, and prominent scarring, which is a major concern in pediatric patients.

With the evolution of minimally invasive techniques in modern medicine, laparoscopic pyeloplasty has emerged as a promising alternative [4]. Laparoscopic pyeloplasty in children was first described by Peters in 1995, and Tan H.L. and colleagues (1996) were the first to report a successful laparoscopic repair of UPJ obstruction in pediatric patients [5]. As a minimally invasive procedure with superior cosmetic outcomes, reduced pain, and shorter hospital stays, many studies have supported laparoscopy as the preferred treatment for UPJ obstruction in children - especially where robotic-assisted surgery is limited to advanced medical

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centers due to high costs. Several studies have also shown that laparoscopic outcomes are comparable to those of open surgery [5].

At Hue Central Hospital, transperitoneal laparoscopic pyeloplasty has become a routine procedure with promising results. Therefore, we conducted this study to present our experience with transperitoneal laparoscopic pyeloplasty for the treatment of UPJ obstruction in pediatric patients.

II. MATERIALS AND METHODS

2.1. Patient selection

In this prospective study, pediatric patients (≤ 16 years) diagnosed with primary UPJ obstruction were enrolled for transperitoneal laparoscopic pyeloplasty at Hue Central Hospital between June 2021 and June 2024. Patients were selected based on comprehensive clinical and radiological evaluations - including ultrasound, CT scans, laboratory tests, and renal scintigraphy confirming the presence of obstruction obstruction (according to the 2023 guidelines of the European Association of Urology) [6]. The study included both symptomatic patients, who presented with pain, recurrent urinary tract infections, palpable renal enlargement, or hematuria, and asymptomatic patients identified through prenatal or postnatal screenings that revealed evidence of obstruction and reduced renal function (less than 40% on scintigraphy). In addition, patients who experienced failure of conservative treatment, demonstrated by either a decline in renal function of more than 10% on follow-up scintigraphy or an increase in renal pelvis diameter with hydronephrosis grade III or IV within 3 - 6 months, were also included in the study.

2.2. Study design and data collection

This descriptive prospective study systematically recorded comprehensive data across multiple stages of patient care. Demographic information, including age, sex, affected kidney, and presenting symptoms, was collected alongside detailed preoperative imaging findings such as pelvic diameter, renal parenchymal thickness, CT scan classifications according to Valayer and Cendron, and renal scintigraphy results. During surgery, intraoperative parameters - including the underlying cause of UPJ obstruction, operative time, blood loss, and any complications - were documented, while postoperative data encompassed the duration of drainage and JJ stent placement, any complications, clinical outcomes, and the length of hospital stay. Follow-up evaluations were conducted at intervals of 1 month, 3 - 6 months, 6 - 12 months, and 12 - 18 months, incorporating laboratory tests, ultrasound examinations, CT urography, and repeat renal scintigraphy to monitor progress and outcomes.

2.3. Surgical technique

Preoperative preparation began with a bowel regimen, including the administration of a rectal enema (Microlax, 1 ampoule) the day before surgery, followed by a fasting period of at least 6 hours. General endotracheal anesthesia was then induced, with some patients receiving combined spinal anesthesia to help reduce both intraoperative and postoperative pain.

The procedure utilized a high-definition laparoscopic system along with various sizes of JJ stents (3F, 4F, 5F) and absorbable sutures (PDS 5.0/6.0 and Vicryl 4.0/2.0). Patients were catheterized and positioned in a 45 - 60° lateral decubitus position, supported transversely at the level of the 12th rib. The surgeon operated from the anterior side of the patient while the laparoscopic monitor was positioned behind, as illustrated in Figure 1.

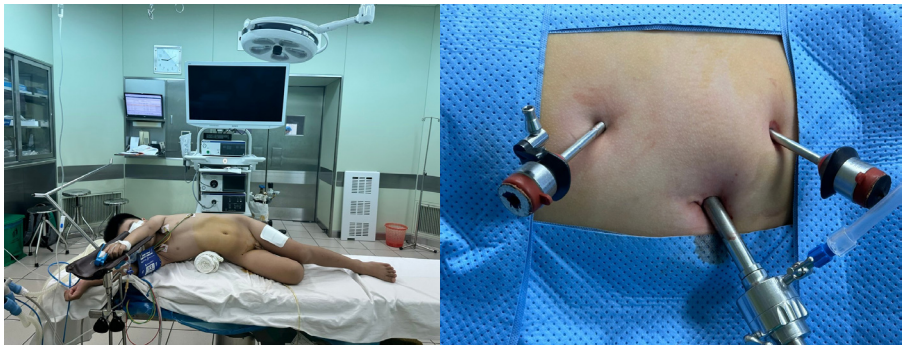

Figure 1: Pediatric Patient Positioning and Trocar Placement

Access to the surgical site was achieved through the placement of three trocars: a 10-mm trocar at the umbilicus for the camera, a 5-mm (or 3-mm, depending on the patient's size) trocar in the anterior axillary line below the costal margin, and another 5-mm (or 3-mm) trocar in the pelvic region. Pneumoperitoneum was maintained at 8–11 mmHg, adjusted according to the patient's age. To access the renal pelvis, the colon was mobilized by either lowering the hepatic/splenic flexure or traversing the mesocolon.

Once the operative field was established, the hydronephrotic renal pelvis and ureter were exposed and mobilized to clearly visualize the site of UPJ narrowing, as shown in Figure 2. The renal pelvis was then suspended to the abdominal wall to improve exposure, and the precise site for transection was marked using electrocautery. A dismembered pyeloplasty following the Anderson–Hynes technique was performed with continuous suturing using either Vicryl 6.0 or PDS 5.0. During the procedure, a JJ stent was inserted in an antegrade fashion to ensure proper drainage, as depicted in Figure 3. Finally, a drain was placed in the renal fossa when indicated, and the peritoneum was closed with PDS 4.0 sutures; the postoperative imaging confirming peritoneal closure and early recovery is demonstrated in Figure 4.

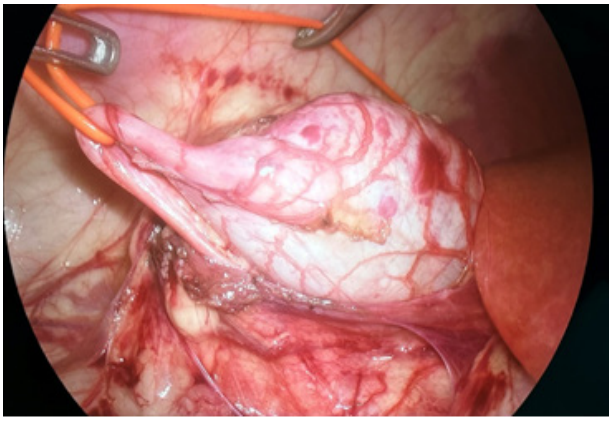

Figure 2: Image of the Ureteropelvic Junction Stenosis

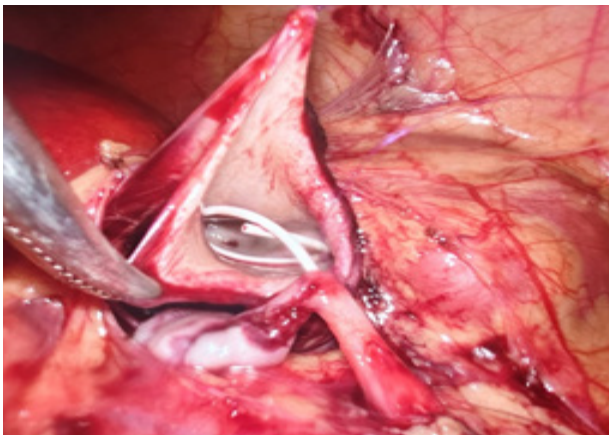

Figure 3: Placement of the JJ Stent and Ureteropelvic Anastomosis

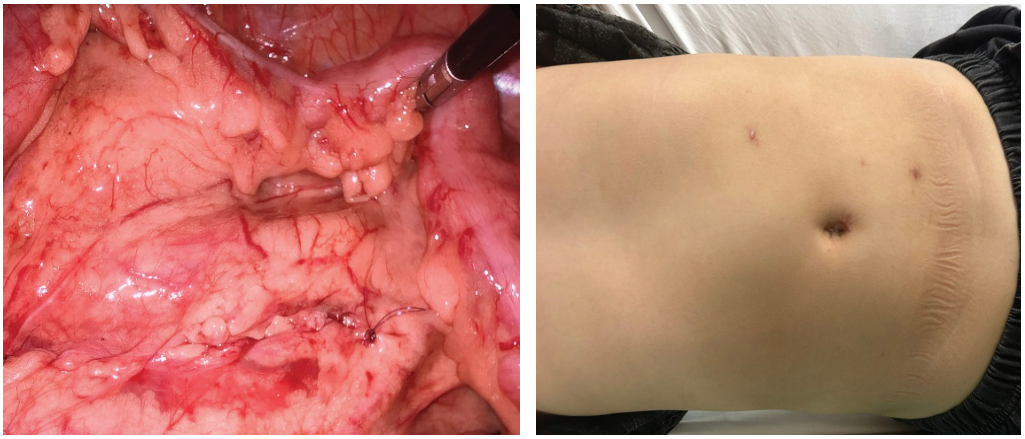

Figure 4: Peritoneal Closure and One-Month Postoperative Image

2.4. Statistical analysis

Data analysis was performed using standard statistical methods. Continuous variables were expressed as mean ± standard deviation and ranges, while categorical variables were presented as frequencies and percentages. Statistical comparisons were made using appropriate tests, such as paired t-tests for normally distributed data or non-parametric tests when necessary, with a significance level set at $p < 0.05$. All analyses were

conducted using established statistical software to ensure rigorous evaluation of the study outcomes.

III. RESULTS

From June 2021 to June 2024, a total of 30 pediatric patients underwent transperitoneal laparoscopic pyeloplasty. The mean age was 30.2 ± 8.6 months (4.5 to 94 months), with a male-to-female ratio of 2.75:1. 11 right-sided kidneys and 19 left-sided cases.

Table 1 summarizes the changes in renal pelvic diameter and parenchymal thickness at various follow-up intervals. Table 2 illustrates the improvements noted on renal scintigraphy. Flank pain was the main reason for admission (76.6%). In 23.4%, prenatal hydronephrosis progressed postnatally with reduced renal function. All had primary UPJ obstruction; 3 also had secondary kidney stones. The most common clinical symptom was flank pain (83.4%). During surgery, crossing lower polar vessels were found in 3 patients. All patients had antegrade JJ stents placed during the procedure. Average operative time was 122.38 ± 21.11 minutes (range: 90 to 180 minutes).

Longer operative times were associated with stone-related procedures, e.g irrigation and stone removal. Average intraoperative blood loss was minimal. Mean post-op hospital stay was 4.76 ± 1.34 days (range: 3 - 6 days). No patients required blood transfusions. Paracetamol was administered 15 mg/kg/dose as needed, for an average of 4 days postoperatively (range: 3 - 6 days). It was given intravenously on 1st day , and orally thereafter once the patient resumed eating. One case of postoperative edema and fluid collection was managed conservatively. The average follow-up period was 14.7 ± 4.2 months (range: 8 - 18 months). Ultrasound imaging showed changes in AP diameter and renal parenchymal thickness before and after surgery.

Table 1: AP Diameter and Renal Parenchymal Thickness Before and After Surgery

Parameters	Pre-op	Post-op			
		1 Month (n=30)	3-6 Months (n=30)	6-12 Months (n=23)	12-18 Months (n=17)
AP diameter of renal pelvis (mm)	32.2 ± 8.6	28.7 ± 3.9	26.5 ± 4.2	18.3 ± 3.2	14.5 ± 3.4
Renal parenchymal thickness (mm)	5.4 ± 2.3	6.0 ± 1.8	6.8 ± 1.5	7.3 ± 1.2	9.2 ± 2.4
p-value		< 0.05	< 0.05	< 0.05	< 0.05

Renal scintigraphy was performed before surgery and during follow-up for all 30 patients. At the 3 - 6 month follow-up, 26 patients showed significant improvement in urinary drainage. The remaining 4 improved more slowly at later follow-up visits.

Renal function improved clearly in 27 patients, and slightly improved or remained stable in 3 patients. No cases of renal function deterioration were observed after surgery.

Table 2: Renal Scintigraphy Results Before and After Surgery

Parameters	Pre-op	Post-op		
		3-6 months (n=30)	6-12 months (n=23)	12-18 months (n=17)
Function of the hydronephrotic kidney (%)	35 ± 15.2	36 ± 11.2	39 ± 8.6	40 ± 7.3

IV. DISCUSSION

In 1995, Peters reported the first successful laparoscopic pyeloplasty in children. Since then, this minimally invasive technique has become the first to achieve success rates comparable to open surgery worldwide.

With the development of robotic surgery, robot-assisted pyeloplasty has also shown similar success and complication rates. However, this technique is not widely available due to high costs. Therefore, laparoscopic pyeloplasty remains the preferred option in many centers because of its low complication rate, short hospital stay, fast recovery, and good cosmetic outcomes [7].

Most children with UPJ obstruction present with lumbar pain or recurrent urinary tract infections. In some cases, the condition is detected incidentally through imaging. In our study, 76.6% of patients had flank pain. According to Demirdağ et al., 50% of patients presented with pain, 18.1% had urinary tract infections, 5.2% had hematuria, and 26.7% were asymptomatic.

Previous studies have shown that in surgical cases of hydronephrosis, crossing vessels were found in 25 - 30% of patients. The rate of kidney stones in UPJ obstruction ranges from 16 - 30%. In our study, flank pain was the most common symptom (83.4%). Among the 30 patients, 3 (10%) had crossing vessels, and 3 (10%) had kidney stones. Although our sample size was small, the clinical characteristics were similar to previous reports.

There are two main laparoscopic approaches to pyeloplasty, each with advantages and disadvantages. The transperitoneal approach is more commonly used. It provides more working space, easier suturing, and familiar anatomical landmarks. The retroperitoneal approach may be preferred in patients with prior abdominal surgery or obesity. Both techniques have shown low complication rates and high success rates (94.1 - 100%) in studies with sample sizes over 100 patients [8].

In this study, we used the transperitoneal approach and applied the Anderson-Hynes dismembered technique for all patients. The success rate was 100%, comparable to other studies.

Laparoscopic pyeloplasty has a steep learning curve, mainly due to the difficulty of suturing - especially in children, where working space is limited and size is small. However, operative time tends to decrease with increased surgical volume and experience.

In a study by Bansal et al., the average operative time for 28 cases was 244.21 ± 41.73 minutes. A more recent study with 27 patients reported an average time of 180 ± 72 minutes. In our study, the average was 122.38 ± 21.11 minutes. The shorter duration may reflect improved laparoscopic suturing skills.

We had no conversions to open surgery. No patients required blood transfusion. One patient developed a small fluid collection at the lower renal pole, which was treated conservatively and classified as Clavien grade I. In a study by Ansari M.S., two intraoperative complications were reported (Satava grade I): localized subcutaneous emphysema and hypercapnia. Postoperatively, there were three complications: two urinary tract infections and one case of ischemic hepatitis. One patient developed partial bowel obstruction due to a urinary leak, classified as Clavien grade II. The total postoperative complication rate was 17.3%, with no major complications reported [9].

Laparoscopic pyeloplasty avoids the large incision required in open surgery. As a result, recovery is faster and cosmetic outcomes are better. In Demirkıl's study, the length of hospital stay for transperitoneal laparoscopic pyeloplasty ranged from 2.7 to 5.1 days [10]. A recent comparative study also showed a significantly shorter hospital stay for laparoscopy (2.7 ± 1.8 days) compared to open surgery (9.09 ± 7.3 days) [4]. In our study, the average hospital stay was 4.76 ± 1.34 days (range: 3 - 6), consistent with other reports.

The mean follow-up time was 14.7 ± 4.2 months, with an initial success rate of 100%, similar to other pediatric series, which report success rates ranging from 87% to 100% [2]. In comparison, the study by Ansari had a longer follow-up of 24.58 months (range: 4 - 45 months), the longest reported follow-up for pediatric laparoscopic pyeloplasty to our knowledge, with an overall success rate of 93.75% (9,11).

The main limitation of our study is the small sample size, which makes generalization difficult.

However, it provides insight into our surgical experience and may help other centers adopt and routinely perform laparoscopic pyeloplasty in children with UPJ obstruction.

V. CONCLUSION

Laparoscopic pyeloplasty is an effective and minimally invasive treatment for children with ureteropelvic junction obstruction. Despite some technical challenges and longer operative times, its advantages - especially in terms of cosmetic outcomes and faster recovery - make it a preferred option in pediatric urology. It is the standard approach in many centers and will likely remain so, unless the cost of robotic surgery decreases significantly.

Ethics approval

This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Hue Central hospital.

Competing interests

The authors declare that they have no competing interests.

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