

Laparoscopic Transperitoneal Pyeloplasty for Ureteropelvic Junction Obstruction: Preliminary Results from 26 Cases

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Abstract

Background and Objectives: Pyelo-Ureteral Junction Syndrome (PUJS) is the most common obstructive malformation of the upper urinary tract in children and adults. The standard treatment is open pyeloplasty using the Kuss-Anderson technique. Because of the minimally invasive nature of the laparoscopic approach, it has become the approach of choice for the management of this pathology. We present the results of laparoscopic transperitoneal pyeloplasty used in the management of PUJS. **Materials and Methods:** This was a retrospective study from 2015 to 2020, including 26 patients who underwent laparoscopic transperitoneal pyeloplasty for PUJS. **Results:** Twenty-six patients, including 18 (69.2%) men and 6 (30.8%) women, with a mean age of 35.42 ± 13.62 years, were treated. Renal colic was the primary symptom in the majority of the cases (22, 84.6%). The diagnosis was confirmed in all patients through an abdominal CT scan, which revealed that all 26 patients had hydronephrosis. Half of the patients (50.0%) were classified as Valayer-Cendron Type II, and eight (30.8%) patients had associated stones. Seventeen (65.4%) patients had pathologies on the left side, and all patients were treated using the Kuss-Anderson technique with a median operating time of 108.5 (90.0 - 136.0) minutes. The uncrossing of lower pole vessels was performed in 10 patients. The average duration of hospitalisation was 2.23 ± 0.82 days. No conversion was observed, and after an average follow-up of 53.69 days, the success rate was 92.3%. **Conclusion:** Laparoscopic pyeloplasty is a minimally invasive technique of choice for the treatment of pyelo-ureteral junction obstruction. It is dependable, repeatable, and produces good functional outcomes

that are equal to those of traditional surgery.

Keywords

Pyelo-Ureteral Junction, Lower Pole Vessel, Pyeloplasty, Double J Stent

1. Introduction

Acquired or congenital Pyelo-Ureteral Junction Syndrome (PUJS), which is characterized by an impaired flow of urine from the renal pelvis to the ureter due to the narrowing of the junction between the pelvis and the ureter, is one of the most common malformations of the upper urinary tracts [1] [2]. This pathology occurs both in children and adults. It is the most common cause of hydronephrosis in the perinatal period and occurs in 1 in 1000 - 1500 newborns [3]. With the availability of resources, the diagnosis of PUJS can be made during the antenatal period, significantly improving the prognosis through prompt treatment [4]. The clinical presentation of PUJS can be highly variable. It could be asymptomatic and only diagnosed incidentally, or it could present as lower back pain (associated or not with renal colic) or a urinary tract infection.

Open pyeloplasty using the Andreson-Hynes technique, first described in 1949, is the gold standard in the surgical treatment of PUJS [5]. Success rates as high as 97% have been reported in the literature to be associated with open pyeloplasty [6] [7]. The development of minimally invasive surgical techniques is pushing the replacement of open pyeloplasty with laparoscopic or robotic approaches. Laparoscopic pyeloplasty was described for the first time in 1993 by Kavoussi and Peters to obtain the higher success rate seen in open pyeloplasty while decreasing morbidity and eliminating the need for a large skin incision [8]. Over the years, minimally invasive approaches have evolved and produced the same success rates, with aesthetic advantages, low morbidity, and short convalescence compared to open surgery [6] [7] [9]. There are variations in the laparoscopic pyeloplasty surgical technique. The urinary tract could be approached retroperitoneally or transperitoneally, with each approach presenting its own advantages and disadvantages based on comparative studies. Some studies have shown that the transperitoneal approach offers a shorter operative time and higher success rates [10] [11]. In contrast, Qadri *et al.* supported the retroperitoneal approach, stating advantages such as shorter operative time, less dissection needed, a higher sensitivity of detecting crossing vessels, a decreased risk of visceral injury, and an early start of oral feeds [12]. Wu *et al.*, in a meta-analysis of 776 cases, however, concluded that the transperitoneal route was associated with an operative time reduction of about 40 minutes (weighted mean difference -43.85 , 95% confidence interval -58.06 to -27.63 ; $P < 0.00001$) and a significantly lower conversion rate (Relative Risk (RR) 0.39, 95% confidence interval 0.21 - 0.74; $P = 0.004$) compared with the retroperitoneal route. The two approaches were simi-

lar in terms of the presence of a crossing vessel (RR 1.24, 95% confidence interval 0.83 - 1.86; $P = 0.28$), length of hospital stay (weighted mean difference -0.24 , 95% confidence interval -0.75 to 0.26 ; $P = 0.35$), success rate (RR 1.03, 95% confidence interval 0.97 - 1.09; $P = 0.76$), and complications (RR 0.83, 95% confidence interval 0.17 - 1.26; $P = 0.61$) [13].

Because of limited resources in Sub-Saharan Africa, open pyeloplasty is still the mainstay of treatment for PUJS [14] [15] [16]. Our study aims to present the experience of laparoscopic pyeloplasty in the management of PUJS in a single urology centre in Douala, Cameroon.

2. Methods

2.1. Study Design and Participants

This was a 5-year retrospective study between 2015 and 2020 carried out at the *Centre Medico-Chirurgicale d'Urologie*, which is located in Bali, Douala. *Centre Medico-Chirurgicale d'Urologie* is a medical centre that specializes in the surgical management of urological pathologies using innovative minimally-invasive techniques. We studied the medical records of all patients who have undergone laparoscopic pyeloplasty for pyelo-ureteral junction syndrome. We excluded files with incomplete records. Using pre-tested data extraction forms, we collected data on patients' ages, genders, clinical profiles, relevant medical history, degree of pyelocaliceal dilatation, and outcome of surgery. All patients benefited from a preoperative CT scan to localise the obstruction. The Valayer and Cendron classification was used to group patients based on the degree of pyelocaliceal dilatation [17].

Type I: Stasis and localised dilation of the renal pelvis. During this stage, evacuation is delayed and the ureter may be partially opacified.

Type II: Moderate dilatation of the renal pelvis and the calyces. These calyces are balled up and the papillae are erased. Secretion and evacuation are both delayed, but the concentration of the contrast product is still good.

Type III: Stasis and large dilation of the renal pelvis and the calyces. Secretion is impaired, and there is a poor concentration of the contrast product. There is thinning of the parenchyma. The pyelocaliceal cavities are only visualized in late films.

Type IV: Silent kidney.

2.2. Operative Procedures and Follow-Up

The diagnosis of pyelo-ureteral junction obstruction in all patients was made through an abdominal CT scan (**Figure 1**). The surgical technique used in all patients was laparoscopic transperitoneal pyeloplasty performed under general anaesthesia. All 26 patients benefited from an anaesthesiologist consultation and a pre-operative workup that included a full blood count, urea and creatinine, a clotting profile, and urine analysis with culture and antibiotic susceptibility profiling. Two patients who had renal colic complicated by sepsis had a double J stent placed before the operation.

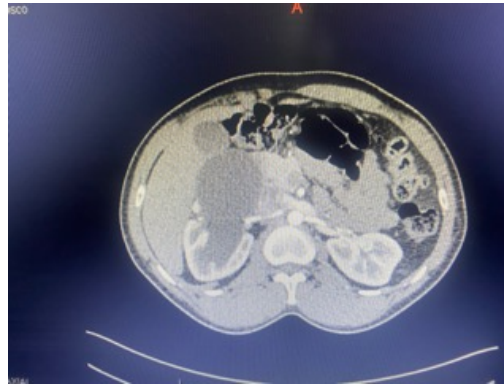


Figure 1. Abdominal CT scan showing a right pyelo-ureteral junction obstruction.

Patients were placed in the lateral decubitus position after inserting a urinary catheter and verifying the pressure points (**Figure 2(A)**). The first optical trocar of 10 - 12 mm was placed 2 fingerbreadths below the costal edge and at the level of the outer edge of the rectus muscle on the anterior axillary line. CO₂ insufflation was performed to obtain a pneumoperitoneum pressure of 12 - 15 mmHg. Placement of 3 other 5 mm trocars followed under visual control, respecting good triangulation of the instruments (**Figure 2(B)**). For surgeries on the left, en bloc mobilization of the left colon and spleen were performed to identify the ureter. For surgeries on the right, mobilization of the right colic angle and dissection of the duodenum (the Kocher manoeuvre) were performed to identify the ureter. The ureter was dissected up to the pyelo-ureteral junction and then sectioned transversely just below the pyelo-ureteral junction. The ureter and the redundant part of the renal pelvis were resected according to the Anderson-Hynes technique. Anastomosis of the posterior wall of the pyelo-ureteral junction was obtained using a continuous 4/0 vicryl suture. A double J catheter was placed via an antegrade approach, and the anterior wall of the pyelo-ureteral junction was sutured using a continuous 4/0 vicryl suture.

During the procedure, all crossing polar vessels identified, as shown in **Figure 3(A)**, were uncrossed and placed behind the anastomosis in a tension-free position, and urolithiasis, when present, was removed using grasping forceps. The peritoneum and the fascia of Gerota were approximated, followed by the placement of a drain at the level of the pyeloplasty suture. At the end of the surgery, the trocars were removed under visual control (**Figure 3(B)**).

All patients benefited from postoperative clinical follow-up and ultrasonography at 1 month and 3 months to verify the resolution of pyelocaliceal dilatation. Ablation of the double J stent was usually performed 3 to 4 weeks after the surgery. The surgical procedure was considered successful when there was a resolution of the pyelocaliceal dilatation associated with the disappearance of the pain.

2.3. Data Management

The extracted data were entered into Microsoft Excel 2016 and then exported to SPSS version 25 for analysis. Continuous data are presented as mean values and



Figure 2. Image showing preoperative placement of the patient in left decubitus position (A) and position of the trocar ports (B).

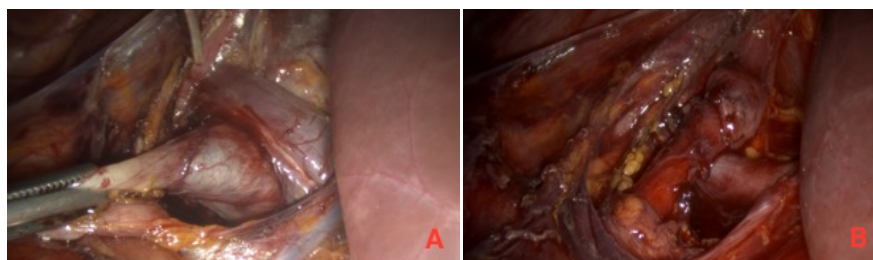


Figure 3. Image showing an intra-abdominal view of a crossing polar vessel (A) and postoperative view of the abdominal cavity following pyeloplasty (B).

standard deviations (for normally distributed data) and medians with interquartile ranges (for skewed data). On the other hand, categorical data are presented as frequencies and percentages. This study was approved by the institutional review board of the Faculty of Medicine and Pharmaceutical Sciences (FMPS) of the University of Douala and by the ethical committee of the *Centre Médico-Chirurgical de Urologie* in Douala, Cameroon. The requirement for patients' informed consent was waived due to the retrospective nature of the study.

2.4. Results

During the study period, a total of 26 patients with PUJS underwent surgery. Of the 26 patients, 18 (69.2%) were men and 8 (30.8%) were women. The ages of the patients ranged from 7 years to 67 years, with a mean age of 35.42 ± 13.62 years. The main presenting complaint was acute renal colic in 22 (84.6%) patients and abdominal pain in 4 (15.4%) patients. In addition to these two main symptoms, 6 (23.1%) patients had associated macroscopic haematuria, 4 (15.4%) patients had dysuria, 2 (7.7%) patients had pollakiuria, and 2 (7.7%) patients had a fever from urinary sepsis.

The pathology was on the left side in 17(65.4%) cases and on the right side in 9 (34.6%) cases. Based on the Valayer-Cendron classification of the degree of pyelocaliceal dilatation, 4 (15.4%) patients were classified as Stage I, 13 (50.0%) patients as Stage II, 8 (30.8%) patients as Stage III, and 1 (3.8%) as Stage IV. The mean serum creatinine level at admission was 11.82 ± 5.24 mg/l, and 8 (30.8%) patients had elevated serum creatinine levels (>12 mg/l). Data on the characteristics of the patients are summarized in **Table 1**.

Table 1. Sociodemographic, clinical, and paraclinical characteristics of patients.

VARIABLES	MALES (%)	FEMALES (%)	TOTAL (%)
Number of patients	18 (69.2)	8 (30.8)	26 (100)
Mean age (SD)	32.11 (12.93)	42.88 (12.82)	35.42 (13.62)
Main presenting symptom			
Acute renal colic	15 (83.3)	7 (87.5)	22 (84.6)
Abdominal pain	3 (16.7)	1 (12.5)	4 (15.4)
Associated symptoms			
Dysuria	3 (16.7)	1 (12.5)	4 (15.4)
Haematuria	3 (16.7)	3 (37.5)	6 (23.1)
Pollakiuria	1 (5.6)	1 (12.5)	2 (7.7)
Fever	1 (5.6)	1 (12.5)	2 (7.7)
Localization			
Left	10 (55.6)	7 (87.5)	17 (65.4)
Right	8 (44.4)	1 (12.5)	9 (34.6)
VC-PCD			
Stage I	4 (22.2)	0 (0.0)	4 (15.4)
Stage II	10 (55.6)	3 (37.5)	13 (50.0)
Stage III	3 (16.7)	5 (62.5)	8 (30.8)
Stage IV	1 (5.6)	0 (0.0)	1 (3.8)
SC			
Normal	12 (66.7)	6 (75.0)	18 (69.2)
High	6 (33.3)	2 (25.0)	8 (30.8)
Mean SC (SD)	11.71 (3.93)	12.07 (7.79)	11.82 (5.24)

SC = Serum Creatinine; SD = Standard Deviation; VC-PCD = Valayer-Cendron Staging of Pyelocaliceal Dilatation.

The surgical technique used in all patients was laparoscopic transperitoneal pyeloplasty. There was a crossing of a lower polar vessel in 10 (38.5%) patients, causing obstruction, while in 16 (61.5%) patients, the obstruction was due to an intrinsic stenosis of the pyelo-ureteral junction. In eight (30.8%) patients, there was associated urolithiasis.

The duration of the surgical procedure ranged from 69 minutes to 210 minutes, with a median duration of 108.5 (90.0 - 136.0) minutes. The duration of hospitalization of the patients ranged from 2 days to 6 days, with a mean duration of 2.23 ± 0.82 days. The estimated blood loss during the intervention ranged from 45 ml to 420 ml, with a mean estimated blood loss of 96.92 ± 71.70 ml. The double J stent was left in place postoperatively for 16 days to 60 days, with a median duration of 21.0 (19.0 - 25.50) days, and patients were followed up for an average of 53.69 days postoperatively. Of the 26 patients, 24 had complete reso-

lution of the pyelocaliceal cavity dilatation, giving a success rate of 92.3%. The details of the surgical procedure and postoperative follow-up are presented in **Table 2**.

3. Discussion

Pyelo-Ureteral Junction Syndrome (PUJS) is a disorder characterized by poor urine flow from the renal pelvis to the ureter. It is one of the most prevalent upper urinary tract abnormalities, and results from the narrowing of the junction between the pelvis and the ureter. PUJS can be congenital or acquired, with the former being the most common aetiology [18]. Ureteral hypoplasia, high insertion of the ureter into the renal pelvis, ureteral entrapment by a crossing accessory renal vessel, most frequently from the lower pole, and kidney malrotation are examples of congenital causes. Acquired causes are either intrinsic (ureteral wall and peri-ureteral scarring, ureteric tumours, iatrogenic following procedures such as ureteroscopy, endopyelotomy, open surgery) or extrinsic (retroperitoneal fibrosis, retroperitoneal lymphadenopathy, retroperitoneal mass, retroperitoneal freely mobile kidney) [18] [19].

Though the gold standard for the treatment of PUJS is still open pyeloplasty, preference has shifted towards more minimally invasive techniques such as laparoscopic and robotic surgery [20]. This study aimed to evaluate the place of laparoscopic pyeloplasty in the management of PUJS and present the results obtained in a single urology centre in Douala, Cameroon. In Sub-Saharan Africa, few hospitals offer laparoscopic urology, and reports of patients treated by laparoscopic

Table 2. Results of the surgical procedure and follow-up.

VARIABLES	MALES (%)	FEMALES (%)	TOTAL (%)
Aetiology of UPJ obstruction			
Crossing of a lower polar vessel	6 (33.3)	4 (50.0)	10 (38.5)
Intrinsic UPJ stenosis	12 (66.7)	4 (50.0)	16 (61.5)
Associated urolithiasis			
Yes	7 (38.9)	1 (12.5)	8 (30.8)
No	11 (61.1)	7 (87.5)	18 (69.2)
MDS (IQR), minutes	102.5 (90.0 - 146.3)	113.5 (87.3 - 132.3)	108.5 (90.0 - 136.0)
MDH (SD), days	2.33 (0.97)	2	2.23 (0.82)
Mean blood loss (SD), ml	103.33 (84.21)	82.50 (28.16)	96.92 (71.70)
MFD (SD), days	55.28 (9.67)	50.13 (3.14)	53.69 (8.50)
Median duration of double J drainage, days (IQR)	23.50 (20.0 - 28.50)	19.50 (18.0 - 21.0)	21.0 (19.0 - 25.50)
Success rate	16 (88.9)	8 (100)	24 (92.3)

MDH = Mean Duration of Hospitalization; MDS = Median Duration of Surgery; MFD = Mean Follow-up Duration; IQR = Interquartile Range; ml = millilitres; UPJ = Uteropelvic Junction.

pyeloplasty are lacking in the literature. Indeed, open pyeloplasty is still the mainstay of treatment in these settings [14] [15] [16]. Compared to open pyeloplasty, minimally invasive pyeloplasty has no significant difference in success rate, complication rate, or analgesic use, but is associated with a significantly shorter length of hospital stay, with a mean of 2.68 fewer inpatient days reported by Autorino *et al.* [21]. Our centre specializes in the minimally-invasive surgical management of urological pathologies. All surgical procedures in our study were carried out by the same surgeon, and our methods and results closely match those in the existing literature.

During the 5-year study period, 26 patients were treated of whom 18 (69.2%) were male and 8 (30.8%) were female. The higher occurrence of PUJS in males found in our study is similar to the results seen in other studies [15] [18] [22].

PUJS is more commonly seen in children rather than adults [4]. In the current study, the mean age of the patients was 35.42 ± 13.62 years and just 15% of the patients were children below 20 years of age. The adult predominance seen in our study does not represent a divergence from the literature and could be explained by the fact that the study setting is primarily an adult urology centre. The average age, however, is consistent with the data found in literature from similar settings [14] [15].

In our study, two-thirds of the patients had the pathology on the left side. This is consistent with other studies showing that the left side is affected twice as often as the right side [23]. Borin reported in a case study that, his patient with uteropelvic junction obstruction, presented with flank pain as one of the main presenting complaints [19]. In the current study, more than 80% of the patients presented with flank pain in the form of acute renal colic. Other complaints included dysuria, haematuria, pollakiuria and fever, similar to findings in other studies [18] [19] [24].

The imaging technique used in the diagnosis of PUJS is essentially ultrasonography, intravenous pyelography, or computed tomography urography. In our study, the diagnosis was made through CT urography. We identified 8 (30.8%) cases with associated lithiasis. Adamou *et al.* reported lithiasis association in 15.4% of patients with PUJS, while Tembely *et al.* reported 17%, and Diao *et al.* reported 10% [14] [16] [25]. Urolithiasis, when present in the current study, was removed using grasping forceps before pyeloplasty.

A majority of the patients in our study had a reasonable renal function in the affected kidney at the time of surgery (69.2% had normal serum creatinine levels and 30.8% had elevated serum creatinine levels). Furthermore, 38.5% of the patients had an inferior polar vessel crossing. During the surgery, all crossing polar vessels identified were uncrossed and placed behind the anastomosis in a tension-free position, similar to the procedure done by Adamou *et al.* and Bentani *et al.* [16] [26]. The manipulation of the inferior polar vessel in our study was done with extreme caution, as the gesture could be dangerous, according to certain authors [22] [27].

The median operative time in our study was 108.5 minutes, which compares well to the time obtained in other studies [28] [29] [30]. The surgeries performed in this study had minimal blood loss (mean blood loss of 96.92 ml). Patients treated in the current study spent an average of 2.23 days in the hospital, consistent with the results obtained by Hanich *et al.* [26]. We registered a success rate of 92.3% after an average follow-up period of 53.69 days. From literature, laparoscopic pyeloplasty has success rates ranging from 90% to 100%, comparable to open pyeloplasty [31] [32] [33].

This study is limited by its retrospective nature. The significance of the results is dependent on the quality of the available records found in the database. The centre has standard operating procedures for recording patients' data that guarantee quality and completeness. The recorded follow-up period ended three months following the surgery, masking the possibility to appreciate the long-term results of the surgery. However, the short-term results allow us to discuss and compare our findings with existing literature.

4. Conclusion

Minimally invasive techniques are replacing open surgery in the management of PUJS, with laparoscopic pyeloplasty being the minimally invasive technique of choice. It is reliable, reproducible, and gives satisfactory functional results identical to conventional surgery and should be strengthened in resource-limited settings.

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Availability of Data and Materials

The data analysed in this study are available from the corresponding author upon reasonable request.

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Ethics Statement

Ethical approval was obtained from the institutional review board of the Faculty of Medicine and Pharmaceutical Sciences and the ethics committee of the *Centre Medico-Chirurgical de Urologie* in Douala, Cameroon. The requirement for informed consent was waived due to the retrospective nature of the study.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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