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# Laparoscopic Pyeloplasty: Our New Gold Standard

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## Abstract

***Background and Purpose:*** Laparoscopic pyeloplasty has developed as a successful minimally invasive alternative to open surgery for management of ureteropelvic junction obstruction (UPJO). Reported medium-term success rates match those of open surgery at more than 90%. We present our complete experience to date with the laparoscopic pyeloplasty procedure.
***Patients and Methods:*** A retrospective review of all patients who have undergone laparoscopic pyeloplasty at our institution was performed.
***Results:*** Between July 2001 and March 2008, 118 patients underwent laparoscopic pyeloplasty. Mean operative time was 205 minutes, and mean hospital stay was 4.7 days. A crossing vessel was found in 33 patients, and 9 patients needed pyelolithotomy for concomitant stone disease. There were no major complications. Mean follow-up was 12.38 months (range 3–60 mos) with 94.5% free of obstruction on radiologic imaging.
***Conclusions:*** Laparoscopic pyeloplasty is a safe and effective management option for UPJO with excellent short- to medium-term results. It is a versatile operation, applicable to most cases of UPJO. Laparoscopic pyeloplasty has now superceded open surgery in our center as the gold standard surgical management for UPJO.

## Introduction

Although open surgery has stood the test of time for successful management of ureteropelvic junction obstruction (UPJO) with success rates of more than 90%,[1–3] the past 25 years in urology have seen a major shift toward more minimally invasive techniques. Technologic advances in instrumentation provided the foundation for endourologic and, more recently, laparoscopic techniques for addressing the obstructed pelviureteral junction.

Laparoscopic pyeloplasty was first described in 1993 by Schuessler and associates.[4] It soon became established as both a safe and effective technique in expert laparoscopic hands. The main advantage of a laparoscopic approach to UPJO over other minimally invasive alternatives such as endopyelotomy is the ability to replicate each step of the open surgical procedure. Thus, laparoscopy provides a combination of the excellent success rates of open surgery with the advantages of decreased pain, improved cosmesis, short hospital stay, and an early return to full activity for the patient. The first laparoscopic pyeloplasty was performed at our center in July 2001. We present our retrospective experience of this procedure to date.

## Patients and Methods

At our institution, 118 patients have undergone laparoscopic pyeloplasty for primary or secondary UPJO. Patients were evaluated preoperatively with ultrasonography, diuretic renography, and/or excretory urography. All patients underwent cystoscopy, retrograde pyelography, and placement of a 3F to 5F ureteral or pigtail catheter immediately before pyeloplasty. The latter facilitates identification and dissection of the ureteropelvic junction (UPJ) as well as allows retrograde filling of the pelvis for anastomotic assessment.

Our standard laparoscopic approach is transperitoneal; only one patient has undergone retroperitoneal laparoscopic pyeloplasty. The transmesocolic approach to the UPJ on the left side was taken if there was minimal mesenteric fat and an extrarenal large pelvis was easily visualized through a conveniently vascularized mesocolon.

The reconstructive procedure undertaken in each patient depended on the anatomic findings at the time of UPJ dissection. Anderson-Hynes dismembered pyeloplasty is most commonly performed, but in suitable cases we have also undertaken nondismembered Foley Y-V pyeloplasty and rotational flaps.

After completion of the anastomosis, a drain was placed, and the UPJ was retroperitonealized by replacing and clipping the colon to the lateral wall, or closing the mesocolic window. The pigtail catheter was retrogradely exchanged for an appropriately sized Double-J (DJ) stent after port closure. Operative time was measured from initial cystoscopy to placement of the DJ stent. Patients were reviewed

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Table 1. Patient Characteristics and Operative Results

| *Laparoscopic pyeloplasty* | |
|---|---|
| Total patient number | 118 |
| Mean age in years (range) | 22.6 (1–59) |
| Sex: *n* (%) | |
| Male | 81 (68.6) |
| Female | 37 (31.4) |
| Operative side: *n* (%) | |
| Right | 62 (53) |
| Left | 55 (47) |
| Presentation: *n* (%) | |
| Pain | 75 (64.1) |
| Infection | 8 (6.8) |
| Pain and infection | 13 (11.1) |
| Hematuria | 1 (0.9) |
| Incidental | 13 (11.1) |
| Antenatal | 4 (3.4) |
| Posttrauma | 3 (2.6) |
| Concomitant stone disease *n* (%) | 9 (7.6) |
| Mean preoperative creatinine in mg/dL (range) | 0.78 (0.4–1.4) |
| Preoperative renal decompression: *n* (%) | |
| Percutaneous nephrostomy | 15 (12.7) |
| DJ stent | 7 (5.9) |
| Operative approach: *n* (%) | |
| Transperitoneal retrocolic | 94 (79.7) |
| Transmesenteric | 21 (17.8) |
| Retroperitoneal | 1 (0.8) |
| Crossing vessel present *n* (%) | 33 (28) |
| Reconstructive procedure undertaken: *n* (%) | |
| A-H dismembered pyeloplasty | 94 (79.7) |
| Y-V nondismembered pyeloplasty | 18 (15.3) |
| Rotation flap nondismembered pyeloplasty | 5 (4.2) |
| Mean operative time in minutes (range) | 205.4 (85–390) |
| Mean Hb drop in g/dL (range) | 1.07 (0–3.5) |
| Complications: *n* (%) | |
| Intraoperative | 2 (1.7) |
| Needle lost and retrieved 1, | |
| DJ stent retracted into ureter necessitating retrieval 1 | 12 (10.2) |
| Postoperative | |
| Infection 4, anastomotic leak 5, hematoma 1, hematuria 2 | |
| Mean hospital stay in days (range) | 4.7 (3–11) |

DJ = Double J; A-H = Anderson-Hynes; Hb = hemoglobin.

postoperatively at 1 month for stent removal and then at 3, 6, and 12 months routinely.

We evaluated patient demographic data, preoperative investigations, operative details, hospital course, and complications for all 118 patients. When evaluating operative success, only those patients with at least 3 months of postoperative follow-up were included in the analysis. Any patient who did not attend for follow-up (11 patients) or had undergone laparoscopic pyeloplasty in the 3 months before the study (34 patients) was excluded from the analysis, because these patients lacked any objective measure of operative success. Objective success was determined by the absence of obstruction on ultrasonography and diuretic renography and/or excretory urography.

## Results

Of the 118 patients, 117 patients had primary and one patient had secondary UPJ obstruction. Table 1 summarizes all demographic and operative results. Mean patient age was 22.6 years, with a male predominance of 68.6%. All patients underwent urinalysis; in nine patients, culture was positive necessitating preoperative culture-specific antibiotic administration. Twenty-two (18.6%) patients needed preoperative decompression of the pelvicaliceal system for either infection, pain, or capacious pelvis. Nine patients had concomitant stone disease that required stone extraction at the time of pyeloplasty.

Dense adhesions secondary to previous blunt trauma and urinoma in one patient prevented full mobilization of the UPJ necessitating a Y-V pyeloplasty. In one further patient with previous trauma and one with a previous endopyelotomy, full mobilization of the UPJ was successfully achieved. Minor operative and postoperative complications occurred in 2 (1.7%) and 12 (10.2%) patients, respectively. No major operative or postoperative complications occurred in our series.

Seventy-three patients completed at least 3 months of postoperative follow-up. Mean follow-up for these patients is 12.38 months (range 3–60 mos). Of these, 69 (94.5%) patients had no evidence of obstruction on ultrasonography, diuretic renography, or intravenous urography. One patient had infection necessitating percutaneous nephrostomy placement and subsequently underwent balloon dilatation of the UPJ. Three patients had persistent obstruction demonstrated on renography, although two were asymptomatic. The third patient only presented at 1 year postoperatively for DJ stent removal; subsequent renography showed deterioration of renal function, and the patient underwent nephrectomy.

Table 2. Comparative Analysis of Transmesenteric and Retrocolic Approaches

| *Variable* | *Transmesenteric (n = 21)* | *Retrocolic (n = 94)* | *Significance* |
|---|---|---|---|
| Age (range) | 15.1 (1–40) | 24.2 (2–59) | $P = 0.002$ |
| % Male | 85.7 | 64.9 | $P = 0.061$ |
| % Left side | 100 | 37.2 | $P = 0.000$ |
| Operative time in minutes (range) | 198.42 (105–360) | 206.09 (85–390) | $P = 0.593$ |
| Hb drop | 0.92 SD 0.63 | 1.11 SD 0.86 | $P = 0.614$ |
| Hospital stay (range) | 4.43 (4–6) | 4.70 (3–11) | $P = 0.951$ |
| Intraoperative complications | 5.3% | 1.1% | $P = 0.397$ |
| Postoperative complications | 5.3% | 9.6% | $P = 0.861$ |

Hb = hemoglobin; SD = standard deviation.

Table 3. Literature Comparison of Large Laparoscopic Pyeloplasty Series

| *Series* | *Procedures (n)* | *Approach* | *Mean operating time in minutes (range)* | *Mean hospital stay in days (range)* | *% Success rate* | *Follow-up in months (range)* | *Complications* | *Imaging modality used to define success* |
|---|---|---|---|---|---|---|---|---|
| Romero[6] | 170 | Transperitoneal | 175.9 (64–345) | 2.7 (2–14) | 94.1 | 22 (2–73) | 0% conversion, | Preop: NA<br>Postop: Renogram or IVU |
| Chammas[7] | 100 | Robotic trans | Gp 1 122 (60–330)<br>Gp 2 127 (80–210) | 1.1<br>5.8 | 100 | Gp 1 17.5 (6–36)<br>Gp 2 40.4 (21–60) | 0% conversion,<br>0% complication<br>2% conversion,<br>6% complication | Gp 1: preop and postop renogram<br>Gp 2: Preop IVU + CT/postop IVU |
| Rassweiler[8] | 143 | Retroperitoneal | 125 (37–368) | 5 (3–10) | 94.4 | 63 (3–137) | 0.7% conversion,<br>6.3% complication | Preop: IVU + USS + renogram + RGP Postop: IVU + renogram |
| Moon[9] | 170 | Extraperitoneal | 140 (58–290) | 3 (2–14) | 96.2 | 12 | 0.6% conversion,<br>7.1% complication | Preop: RGP (acute cases) and renogram<br>Postop: Renogram |
| Davenport[5] | 66 | Transperitoneal | 224 (110–340) | 3.6 (1–14) | 92 | 15 (3–38) | 0% conversion,<br>15% complication | Preop: NA<br>Postop: Renogram |
| Madhani[10] | 93 | Transperitoneal | 179.4 (80–350) | 4 (2–7) | 93.3 | 12 (3–27) | 6.4% conversion,<br>18.4% complication | Preop: USS + IVU + renogram<br>Postop: Renogram |
| Janetschek[11] | 67 | Retro/Trans | 119 (90–210) | 4.1 (2–7) | 98.5 | 25 (4–60) | 1.5% conversion,<br>1.5% UTI | Preop: NA |
| Current series | 118 | Transperitoneal | 205.4 (85–390) | 4.7 (3–11) | 94.5 | 12 (3–60) | 0.8% conversion,<br>11.9% complication | Preop: USS + IVU + renogram<br>Postop: USS + renogram |

NA = not available; IVU = intravenous urography; Gp = group; preop = preoperative; postop = postoperative; CT = computed tomography; USS = ultrasonography; RGP = retrograde pyelogram; UTI = urinary tract infection.

Table 4. Comparative Analysis of Adult and Pediatric Procedures

| *Variable* | *Adult = > 16 years* (N = *82*) | *Pediatric = < 16 years* (n = *36*) | *Significance* |
|---|---|---|---|
| Operative time in minutes (range) | 215.96 (105–390) | 182.70 (85–360) | $P = 0.005$ |
| Hemoglobin drop | 1.13 SD 0.832 | 0.92 SD 0.83 | $P = 0.28$ |
| Hospital stay | 4.68 (3–11) | 4.58 (3–8) | $P = 0.880$ |
| Intraoperative complications | 1.2% | 2.8 | $P = 0.382$ |
| Postoperative complications | 8.5% | 13.9% | $P = 0.531$ |
| Transmesocolic | 12.2% | 30.6% | $P = 0.055$ |
| A-H dismembered | 78.1% | 83.3% | $P = 0.311$ |
| % Success ($n = 72$) | 93.5 ($n = 47$) | 95.8 ($n = 25$) | $P = 0.766$ |

SD = standard deviation.

All other patients had their DJ stents removed 1 month postoperatively.

## Discussion

Laparoscopic pyeloplasty can be performed via both a transperitoneal and a retroperitoneal route. The preferred approach is usually dictated by the training of the surgeon involved, but many urologists find that the increased working space and the more familiar anatomy provided by the transperitoneal approach gives it a distinct advantage. Davenport and colleagues[5] found that despite initial extensive training in retroperitoneal laparoscopy, the results using this approach were lower than expected, leading them to adopt the transperitoneal approach after 17 cases. We do perform retroperitoneoscopy in our center, but like most other urologists find the transperitoneal approach more satisfactory for laparoscopic pyeloplasty.

In the transperitoneal approach, the UPJ can be accessed in either a retrocolic or a transmesenteric fashion. Romero and coworkers[6] state that the solitary indication for transmesenteric access to the UPJ in their hands is recognition of the renal pelvis and/or ureter through a relatively transparent descending colonic mesentery. In a retrospective review of cases, they found that the transmesenteric route was more commonly applied in younger persons and males, and for pathologic conditions on the left side and malrotated kidneys. The technique was found to decrease operative time by a mean of 22.5% without an increase in complications.

Table 2 demonstrates comparative data for the transmesenteric and retrocolic approaches in our series. In keeping with the findings of Romero and associates,[6] we used the transmesenteric approach more commonly in young male patients. We found no significant decrease in our overall operative time, however. This is probably because our recorded operative time includes both initial retrograde study and postanastomotic DJ stent placement.

Table 3 summarizes the currently available English language literature on laparoscopic pyeloplasty for series with 60 or more patients.[5–11] In terms of outcome, the success rates shown by these series vary from 92% to 100%. The most common complications are bleeding, anastomotic leakage, and stricture formation. The conversion rate to open surgery varies from 0% to 6.4%. Our experience is fully in keeping with the reported results from other authors. Comparisons between such series, however, remain dependent on the completeness of the data reported; vigilance for perioperative complications, as well as the definition of a complication, may vary between institutions and surgeons.

A further complicating factor when comparing individual published series of laparoscopic pyeloplasty may be the patient mix in relation to adult and pediatric cases. Mandhani and colleagues[10] presented a comparative analysis of 69 adult and 24 pediatric renal units, showing a 95.3% success rate in the adult group, but aslightly lower success rate of 87% in the pediatric group. Other series have not separated adult from pediatric cases for comparison.

We looked for differences in outcome between adult and pediatric cases (Table 4). There was a significantly shorter operative time in our series for pediatric patients. Success was again calculated only for those patients with objective follow-up at 3 months. No significant difference in the success rates in adults and children was found.

The versatility of the laparoscopic approach to the obstructed UPJ has now decreased the indications for other minimally invasive techniques, including percutaneous endopyeloplasty, at our center. Crossing vessels, long stenotic segments, a large renal pelvis, and concomitant stone disease can all be adequately managed laparoscopically. Before successful laparoscopic pyeloplasty at our center, endopyeloplasty was more commonly performed. This technique is

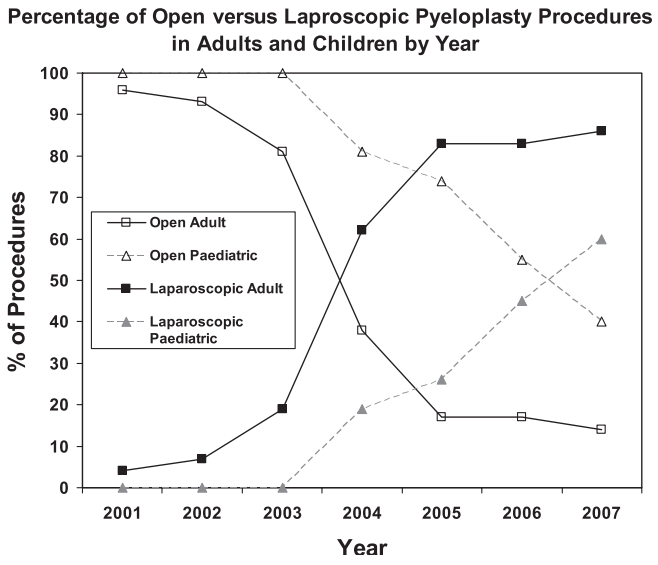


**FIG. 1.** Percentage of open versus laparoscopic pyeloplasty procedures in adults and children by year.

indicated only in patients with a small renal pelvis and a short UPJ stenosis. It also remains useful in patients with a significant stone burden associated with their UPJ obstruction.

In reviews of the surgical management for UPJO, one of the criticisms leveled at laparoscopic pyeloplasty has been the absence of long-term follow up.[3,12] It will certainly be some years before any series of laparoscopic pyeloplasty matches the mean 10-year follow-up demonstrated by O'Reilly and colleagues[1] in their series of open pyeloplasties. Jarrett and coworkers[13] show that failures after laparoscopic pyeloplasty, however, tend to occur within the first year, and Davenport and colleagues[5] showed that the mean time to failure was 4.6 months (range 3–11 mos). Mean time to failure in our patients was 5.6 months (range 2–9 mos), in keeping with the findings of other authors.

In a large series, Dimarco and associates[14] recently found that the long-term success rates of both open and laparoscopic pyeloplasty as well as endopyelotomy were not as high as has been published elsewhere. In this study, the 10-year success rate of pyeloplasty was only 75% in comparison with 85% at 3 years. Yet, even in this series, it was noted that the majority of failures in both groups occurred within the first 2 years. Thus, it can now be argued that the current literature of large reviews, where the minimum mean follow-up is 5.6 months and the maximum mean is 61.4 months, is certainly valid for comparison with the long-term success rates of open surgery.

## Conclusion

Laparoscopic pyeloplasty is a safe and effective modality for the correction of both adult and pediatric UPJO. We have shown, in keeping with other authors, that laparoscopic pyeloplasty does provide an excellent success rate in short- to medium-term follow-up. The procedure is highly versatile and applicable to most obstructions. In addition, it allows the surgeon to deal with secondary stone disease concurrently. Although a steep learning curve is inherent in laparoscopic pyeloplasty, necessitating perseverance and patience from the laparoscopic surgeon, once mastered, it is a highly satisfactory management for both primary and secondary UPJO.

As our confidence and competence in this procedure has grown, laparoscopic pyeloplasty has evolved as the new gold standard for the surgical management of UPJO at our center. As a result, the percentage of laparoscopic pyeloplasties we performed overtook that of open pyeloplasty in adults in 2004 (Fig. 1) and in pediatrics in 2007. We believe our experience and that of other authors demonstrates that laparoscopic pyeloplasty should now be universally accepted as the procedure of choice for UPJO.

## Disclosure Statement

No competing financial interests exist.

## References

1. O'Reilly PH, Brooman PJ, Mak S, Jones M, Pickup C, Atkinson C, Pollard AJ. The long-term results of Anderson-Hynes pyeloplasty. BJU Int 2001;87:287–289.
2. Brooks JD, Kavoussi LR, Preminger GM, Schuessler WW, Moore RG. Comparison of open and endourological approaches to the obstructed ureteropelvic junction. Urology 1995;46;791–795.
3. Manikandan R, Saad A, Bhatt RI, Neilson D. Minimally invasive surgery for pelviureteral junction obstruction in adults: A critical review of the options. Urology 2005;65:422–432.
4. Schuessler WW, Grune MT, Tecuanhuey LV, Preminger GM. Laparoscopic dismembered pyeloplasty. J Urol 1993;150:1795–1799.
5. Davenport K, Minervini A, Timoney AG, Keeley FX Jr. Our experience with retroperitoneal and transperitoneal laparoscopic pyeloplasty for pelvi-ureteric junction obstruction. Eur Urol 2005;48:973–977.
6. Romero FR, Wagner AA, Trapp C, Permpongkosol S, Muntener M, Link RE, Kavoussi LR. Transmesenteric laparoscopic pyeloplasty. J Urol 2006;176:2526–2529.
7. Chammas MF Jr, Hubert J, Patel VR. Robotically assisted laparoscopic pyeloplasty: A transatlantic comparison of techniques and outcomes. BJU Int 2007;99:1113–1117.
8. Rassweiler JJ, Subotic S, Feist-Schwenk M, Sugiono M, Schulze M, Teber D, Frede T. Minimally invasive treatment of ureteropelvic junction obstruction: Long-term experience with an algorithm for laser endopyelotomy and laparoscopic retroperitoneal pyeloplasty. J Urol 2007;177:1000–1005.
9. Moon DA, El Shazly MA, Chang CM, Gianduzzo TR, Eden CG. Laparoscopic pyeloplasty: Evolution of a new gold standard. Urology 2006;67:932–936.
10. Mandhani A, Kumar D, Kumar A, Kapoor R, Dubey D, Srivastava A, Bhandari M. Safety profile and complications of transperitoneal laparoscopic pyeloplasty: A critical analysis. J Endourol 2005;19:797–802.
11. Janetschek G, Peschel R, Frauscher F. Laparoscopic pyeloplasty. Urol Clin North Am 2000;27:695–704.
12. Bush WH, Mayo ME. Editorial Comment III. Braz J Urol 2000;26:84–85.
13. Jarrett TW, Chan DY, Charambura TC, Fugita O, Kavoussi LR. Laparoscopic pyeloplasty: The first 100 cases. J Urol 2002;167:1253–1256.
14. Dimarco DS, Gettman MT, McGee SM, Chow GK, Leroy AJ, Slezak J, Patterson DE, Segura JW. Long-term success of antegrade endopyelotomy compared with pyeloplasty at a single institution. J Endourol 2006;20:707−712.

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**Abbreviations Used**

DJ = Double-J
UPJ = ureteropelvic junction
UPJO = ureteropelvic junction obstruction