Research article

DOI: 10.59715/pntjmp.4.3.12

# Surgical outcomes of robot-assisted laparoscopic dismembered pyeloplasty

Do Anh Toan[1,2], Phan Thanh Thong[1]

1 Binh Dan Hospital

2 Department of Urology, University of Medicine and Pharmacy, Ho Chi Minh City

## Abstract

**Background:** Robot-assisted laparoscopic surgery has been applied to adults since November 2016 at Binh Dan Hospital. Robot-assisted laparoscopic pyeloplasty has been performed for a long time. Currently, besides Binh Dan Hospital, several other units have implemented this technique, but there have been no domestic studies reported. Thus, the question arises about the efficacy and safety of robot-assisted laparoscopic dismembered pyeloplasty.

**Objectives:** To evaluate the surgical outcomes of robot-assisted laparoscopic dismembered pyeloplasty.

**Methods:** Data were collected from 55 cases of robot-assisted laparoscopic dismembered pyeloplasty performed at Binh Dan Hospital from January 2017 to June 2024. Patients were followed up for at least 6 months postoperatively to assess effectiveness alongside the safety of the procedure. Key outcomes included perioperative complications and improvements in clinical symptoms as well as radiological and renal function-related outcomes.

**Results:** Among the 55 cases studied, 24 patients (43.6%) had a history of prior ipsilateral ureteral surgery. The mean operative time was 154.69 ± 61.17 minutes, and the mean blood loss was 68 ± 43.14 ml. Clavien-Dindo classification of surgical complications recorded: 47 cases (85.5%) without complications, 6 cases (10.9%) with grade I complications, 1 case (1.8%) with grade II complications, and 1 case (1.8%) with grade III complications. Follow-up with a mean duration of 32.12 ± 9.85 months showed a success rate of 90% (36/40 cases), with one case requiring open revision surgery due to urinary leakage, two cases requiring periodic JJ stenting for recurrent ureteral stricture, and one case requiring nephrectomy due to loss of kidney function.

**Conclusion:** Robot-assisted laparoscopic dismembered pyeloplasty is a promising, safe, and effective method that can serve as an alternative to open surgery in complex or recurrent ureteropelvic junction obstruction cases. Larger studies with long-term follow-up are needed to evaluate the durability of this approach.

**Keywords:** Pyeloplasty, robot-assisted laparoscopic surgery.

Received: 17/02/2025

Revised: 11/3/2025

Accepted: 20/7/2025

Author contact:

Phan Thanh Thong

Email: phanthanhthong2009@gmail.com

Phone: 0987797171

## 1. INTRODUCTION

With advancements in technology, robotic-assisted laparoscopic pyeloplasty has been utilized worldwide to overcome the limitations of conventional laparoscopic surgery. In 1999, Sung et al. reported the first case of robotic-assisted laparoscopic pyeloplasty. Since then, numerous studies have been published, including those by Yohannes [1] (2002), Uberoi [2] (2009), Wang [3] (2019), and Lukkanawong [4] (2022). All these studies concluded that robotic-assisted laparoscopic pyeloplasty is a safe, feasible procedure offering significant benefits to patients.

In Vietnam, the first robotic surgery on an adult patient was performed at Binh Dan Hospital in November 2016 using the da Vinci robotic system. By December 2022, 1,804 robotic surgeries had been conducted. [5] In 2017, Nguyen Phuc Cam Hoang et al. [6] reported seven cases of upper urinary tract reconstruction using robotic-assisted laparoscopy with encouraging outcomes. This study evaluates the results of 20 cases of robot-assisted laparoscopic pyeloplasty performed at Binh Dan Hospital.

## 2. METHODS

### 2.1 Study Population:

From January 2017 to June 2024, 55 patients underwent robot-assisted laparoscopic pyeloplasty at Binh Dan Hospital.

### 2.2 Preoperative Assessment:

Patients diagnosed with ureteropelvic junction obstruction (UPJO) were assessed preoperatively with contrast-enhanced CT urography and renal scintigraphy to confirm functional obstruction and evaluate separate renal function. Obstruction was defined as a T1/2 > 20 minutes after tracer excretion.

Demographic and clinical data, including age, gender, BMI, comorbidities, history of previous surgeries, and intraoperative parameters (blood loss, operative time, hospital stay, and complications), were collected.

### 2.3 Surgical Equipment:

The da Vinci robotic surgical system with four robotic arms was used.

### 2.4 Outcome Evaluation:

Postoperative outcomes were assessed based on retrospective medical record reviews and follow-up evaluations. Success was defined as symptomatic improvement (e.g., resolution of flank pain, absence of recurrent infections) and radiographic evidence of improved hydronephrosis or unobstructed renal scintigraphy. Failure was defined as cases requiring secondary surgery or long-term JJ stenting.

**Figure 1.** Patient Positioning and Trocar Placement in Surgery
A. Patient Position. B. Trocar Placement. C. Docking.

**2.5 Surgical Technique:** A transperitoneal laparoscopic approach with robotic-assisted dismembered pyeloplasty (Hynes-Anderson technique) was performed. If crossing lower pole vessels were present, the ureter was transposed anteriorly. Any concurrent conditions such as renal stones or renal cysts were addressed during the procedure.

Urinary diversion during surgery was achieved using a JJ stent from the renal pelvis to the ureter. The excised ureteral stricture segment was sent for histopathological examination.

**2.6 Outcome Evaluation:** Surgical outcomes included perioperative results based on retrospective medical records and follow-up evaluations up to the present time.

Surgery was considered successful if the patient experienced symptomatic improvement in flank pain or had no recurrent infections. Imaging studies, including MSCT, confirmed reduced hydronephrosis, or renal scintigraphy showed no obstruction or positive response to the Lasix test. Cases requiring secondary surgery or long-term JJ stenting were classified as failures.

## 3. RESULTS

**Patient Characteristics:**

- **Gender:** 26 males (47.3%), 29 females (52.7%).
- **Mean age:** 46.98 ± 17.52 years (range: 17-85).
- **Obesity rate:** 25.5%.
- **Reason for hospital admission:** Flank pain in 48/55 patients (87.3%), incidental detection of hydronephrosis in 6/55 patients (10.9%), and urinary tract infection in 1/55 patients (1.8%).

**Table 1.** History of Previous Ureteral Surgeries in Patients Undergoing Pyeloplasty

| Surgical History | Quantity (n) | Rate (%) |
|---|---|---|
| Ipsilateral Ureteroscopic Lithotripsy with Pyeloplasty | 7 | 12.7 |
| Ipsilateral Endoscopic Ureteral Incision with Pyeloplasty | 5 | 9.1 |
| Ipsilateral Laparoscopic Ureteropelvic Junction Reconstruction | 4 | 7.3 |
| Ipsilateral Laparoscopic Ureteroscopic Stone Removal with Pyeloplasty | 3 | 5.5 |
| Ipsilateral Percutaneous Nephrostomy with Pyeloplasty | 3 | 5.5 |
| Ipsilateral Open Kidney Stone Surgery with Pyeloplasty | 2 | 3.6 |
| **Total** | **24** | **43.6** |

**There were 12 out of 55 patients (21.8%) with previous surgical scars on the same side as the ureteral surgery.** Among them, 4 patients had undergone ureteropelvic junction reconstruction, 3 patients had undergone ureteroscopic stone removal, 3 patients had undergone open kidney stone surgery, and 2 patients had previously undergone nephrostomy.

**Table 2.** Preoperative Hydronephrosis Classification on MSCT

| Degree of Hydronephrosis on MSCT | Quantity (n) | Rate (%) |
|---|---|---|
| No Hydronephrosis | 1 | 1.8 |
| Grade 1 Hydronephrosis | 3 | 5.5 |
| Grade 2 Hydronephrosis | 24 | 43.6 |
| Grade 3 Hydronephrosis | 25 | 45.5 |
| Grade 4 Hydronephrosis | 2 | 3.6 |
| Total | **55** | **100** |

**Preoperative Renal Function:** Serum creatinine: 80.8 ± 20.5 µmol/L; eGFR: 86.8 ± 25 mL/min.

**Preoperative Diuretic Renography (DTPA):** Performed in 26 out of 55 patients (47.27%). Results showed that 14/26 patients (15.38%) had a good response to the Lasix test, 16/26 patients (61.54%) had a poor response, 3 patients did not respond to the Lasix test, and 3 patients had no excretion on DTPA renal scan.

**Table 3.** Associated Abnormalities with Ureteropelvic Junction Obstruction

| Associated Abnormalities with Ureteropelvic Junction Obstruction | Quantity (n) | Rate (%) |
|---|---|---|
| Vascular Anomalies | 14 | 25.5 |
| Renal Stones | 4 | 7.3 |
| Horseshoe Kidney | 2 | 3.6 |
| Complete Duplex Kidney | 1 | 1.8 |
| Renal Cyst | 1 | 1.8 |
| No Abnormalities | 33 | 60 |
| Total | **55** | **100** |

**Table 4.** Surgical technique

| Surgical Methods | Quantity (n) | Rate (%) |
|---|---|---|
| Simple End-to-End Pyeloplasty | 27 | 49.1 |
| Pyeloplasty + Ureteral Transposition | 14 | 25.5 |
| Pyeloplasty + Renal Pelvis Reduction | 8 | 14.5 |
| Pyeloplasty + Kidney Stone Removal | 2 | 3.6 |
| Pyeloplasty + Isthmectomy for Horseshoe Kidney | 2 | 3.6 |
| Pyeloplasty + Renal Cyst Excision | 2 | 3.6 |
| Total | 55 | 100 |

**Perioperative Outcomes**

- **Mean operative time:** 154.69 ± 61.17 minutes (range: 50-330).
- **Trocar usage:** 44/55 patients (80%) had a total of 5 trocars used during surgery. Among them, 42/55 patients (76.4%) used 3 robotic trocars, including 1 light trocar and 2 robotic arms, while 13/55 patients (23.6%) had an additional fourth robotic arm.
- **Mean blood loss:** 68 ± 43.14 ml (range: 10-300). No cases required intraoperative blood transfusion.
- **Urinary catheter removal time:** 3.36 ± 1.13 days (range: 1-6).
- **Drain removal time:** 4.55 ± 1.16 days (range: 2-7).
- **Postoperative hospital stay:** 5.51 ± 2.17 days (range: 2-13).

**Table 5.** Surgical Complications According to Clavien-Dindo Classification

| Clavien-Dindo Classification of Complications | Quantity | Rate (%) |
|---|---|---|
| No Complications | 47 | 85.5 |
| Grade I | 6 | 10.9 |
| Grade II | 1 | 1.8 |
| Grade III | 1 | 1.8 |
| Grade IV, V | 0 | 0 |
| Total | 55 | 100 |

**Postoperative Complications and Follow-Up**

- **Complications:** 47/55 patients (85.5%) experienced no intraoperative or postoperative complications.
- **Postoperative fever:** 5 patients developed fever, of which 2 had positive urine cultures (Pseudomonas and E. coli).
- **Other complications:**
    - 1 patient had renal vein injury.
    - 1 patient developed a postoperative hematoma requiring a blood transfusion.
    - 1 patient experienced urinary leakage, necessitating open revision surgery.

**Postoperative Follow-Up**

- **Mean follow-up duration:** 32.12 ± 9.85 months.
    - 12/40 patients (30%) were followed up for less than 24 months after JJ stent removal.
    - 12/40 patients (30%) were followed up between 24 – 48 months.
    - 16/40 patients (40%) were followed up for more than 48 months.

**Table 6.** Postoperative Follow-Up Outcomes

| Follow-Up Parameters | Pre-operation N=40) | | Post-operation (N=55) | | p |
|---|---|---|---|---|---|
| | **Quantity** | **Rate (%)** | **Quantity** | **Rate (%)** | |
| Flank Pain | 3 | 7.5% | 48 | 87.3% | <0.05 |
| No Hydronephrosis | 8 | 20 | 1 | 2.5 | <0.05 |
| Grade 1 Hydronephrosis | 13 | 32.5 | 2 | 5 | <0.05 |
| Grade 2 Hydronephrosis | 10 | 25 | 18 | 45 | <0.05 |
| Grade 3 Hydronephrosis | 7 | 17.5 | 18 | 45 | <0.05 |
| Grade 4 Hydronephrosis | 2 | 5 | 1 | 2.5 | <0.05 |

**Postoperative Renal Scintigraphy and Success Rate**

- **Postoperative renal scintigraphy** was performed in 16/40 cases (40%). Among them:
    - 10/16 patients (62.5%) showed no obstruction on DTPA renal scan.
    - 4/16 patients (25%) had a positive response to the Lasix test.
    - 1 patient did not respond to the Lasix test.
    - 1 patient had no renal excretion.
- **Success rate:** Based on the clinical resolution of pain and improved hydronephrosis on MSCT or non-obstructed renal scintigraphy, the success rate was **36/40 (90%)**.

## 4. DISCUSSION

**General Characteristics of the Study Population**

Among the 55 cases analyzed, a notable proportion had a history of prior ipsilateral ureteral surgery:

- 24/55 cases (43.6%) had undergone prior interventions.

- 12/55 cases (21.8%) had previous surgical scars on the same side as the reconstructed ureter:
    - 4 patients had undergone ureteropelvic junction reconstruction.
    - 3 patients had undergone ureteroscopic stone removal.
    - 3 patients had undergone open kidney stone surgery.
    - 2 patients had previously undergone nephrostomy.

In these cases, conventional laparoscopy is often challenging due to perirenal adhesions, highlighting the advantage of robotic surgery.

In 2019, Wang et al. [3] compared two groups undergoing reoperative ureteral reconstruction via open surgery versus robot-assisted laparoscopy. They found that robotic surgery had comparable efficacy to open surgery but offered shorter operative times and reduced blood loss.

Additionally, 25.5% of patients in our study were classified as obese, which is a factor that can significantly increase the difficulty of conventional laparoscopic procedures. **Robotic-assisted laparoscopic surgery offers advantages such as high-definition 3D magnification, enhanced dexterity, and wrist-like movements (EndoWrist® technology), enabling more precise suturing and reconstruction.**

Furthermore, a significant benefit of robotic surgery over conventional laparoscopy is the improved **ergonomics**, reducing surgeon fatigue and enabling faster completion of the learning curve.

As a result, while robotic surgery is widely utilized for oncologic procedures requiring radical excision and complex lymphadenectomy, it also provides substantial benefits in **reconstructive urological procedures, particularly in redo surgeries that previously required open approaches.**

**Table 7:** Comparison of Various Studies

| Author, Year | Number of Patients / Kidney Units | Surgical Technique | Operative Time (minutes) | Blood Loss (mL) | Hospital Stay (days) | Complications (Severity, %) | Follow-up Duration (months) | Success Rate (%) |
|---|---|---|---|---|---|---|---|---|
| Palese[7], 2005 | 38 | Hynes-Anderson | 225.6 ± 59.3 | 77.3 ± 55.3 | 2.9 | No | 12.2 | 94.7 |
| Vipul Patel[8], 2005 | 50 | Hynes-Anderson | 122 | 40 | 1.1 | | 11.7 | 96 |
| Wang[3], 2019 | 22, Recurrent Ureteral Stricture | Hynes-Anderson End-to-End Anastomosis | 124.55 | 100 | - | 2/22 (9.09%) | 30 | 85.71 |
| We, 2024 | 55 | Hynes-Anderson ± Kidney Stone Removal, Cyst Excision, Ureteral Transposition, Isthmectomy | 154.69 ± 61.17 | 68 ± 43.14 | 5.51 ± 2.17 | 8/55 (14.5%) | 32.12 ± 9.85 | 90 |

Reports from international authors indicate a high success rate of **84.6% - 96%** for robot-assisted laparoscopic pyeloplasty. Overall, the perioperative outcomes in our study were comparable to those reported in other global studies. Our study results are similar to some authors such as: Zhang et al. [9] (2019): With an average follow-up of 23 months, this study recorded a success rate of 87.7%; Carmona et al. [10] (2022) 84 the success rate was 90.6%; Moretto et al. [11] (2023) the success rate after 3 months was 93.0%; Bersang et al. [12] (2024) the success rate was 92%.

In 2014, Mario [13] conducted a retrospective review of **131 patients** who underwent robot-assisted laparoscopic pyeloplasty. Among them, **17 cases** were classified as complex, including **3 patients with horseshoe kidneys** and **14 patients with previous ureteropelvic junction obstruction (UPJO) surgeries.** The study was divided into two groups: **primary pyeloplasty (Group 1)** and **reoperative pyeloplasty for complex cases (Group 2).**

**Results:**

- The **mean operative time** was **117.36 ± 33.5 minutes** in Group 1 and **153.56 ± 31.1 minutes** in Group 2 (**p = 0.002**).
- The **mean hospital stay** was **5.19 ± 1.66 days** in Group 1 and **5.90 ± 2.33 days** in Group 2 (**p = 0.326**).
- One patient in Group 1 required conversion to open surgery due to technical difficulties.
- At **3 months postoperatively**, the **success rate (clinical and radiographic)** was **93% in Group 1** and **88.2% in Group 2.**

This study confirms that **robot-assisted laparoscopic pyeloplasty is feasible and effective, even in complex cases, with high success rates.**

**Postoperative Follow-Up and Failures**

After surgery, patients were invited for follow-up, revealing:

- **37/40 patients** had complete resolution of flank pain.
- **32/40 patients (80%)** showed reduced hydronephrosis compared to preoperative imaging.
- **4 cases were classified as failures:**

Case 1: Male patient, born in 1995, after surgery the patient had retroperitoneal urine leakage, the patient had a kidney drain to the skin, then bleeding due to the kidney drain, had open surgery to remove blood clots, reconstructed the renal pelvis junction. After removing the JJ, the patient noted a recurrence of ureteral stenosis, the patient had a ureteroscopy to cut the ureteral stenosis, and placed a JJ. The patient was periodically replaced with a JJ. The patient asked to remove the JJ after 1 year, currently the examination noted that the patient had no flank or back pain, the MSCT result showed grade 4 hydronephrosis, the kidney did not excrete.

Case 2: Female patient, born in 1980, on the 1st postoperative day, hematoma around the kidney was noted, the patient received a blood transfusion, and internal medicine treatment was successful. After 1 month, the patient had the JJ removed. After 4 months, the patient had dull pain in the flank and back. MSCT showed a narrowing of the renal pelvis-ureteral junction. The patient underwent an endoscopy and UPR scan, which showed a narrowing of the junction of about 0.5 cm. The JJ was re-inserted until now.

Case 3: Female patient, born in 1949. Before surgery, grade 4 hydronephrosis was recorded and there was no renal scintigraphy. The patient underwent left renal pelvis-ureteral junction reconstruction surgery. After 4 weeks of surgery, the JJ was removed and periodically monitored. After 1 year of JJ removal, a re-examination showed grade 4 hydronephrosis with loss of function and pain in the flank and back. The patient underwent open nephrectomy. In this case, it is possible that the kidney had lost function before reconstruction.

Case 4: Female patient, born in 1989. The patient was diagnosed with recurrent renal pelvis-ureteral junction stenosis. After surgery, the patient had a fever (negative urine culture) and was treated with internal medicine. The patient had the stent removed after 6 weeks and was followed up after 8 months to see a recurrence of the stricture. The stent was placed and replaced periodically.

Through 4 cases of failed surgery, we found that there was a relationship with complications of hematoma, urinary leakage, and postoperative infection. Hematoma or urinary leakage compressing the ureter, causing ischemia leading to recurrent stricture. Postoperative urinary tract infection directly affects the healing of the ureteral tissue. Therefore, during the surgery, it is important to minimize these complications. In addition, in unfavorable postoperative cases, replacing the stent and exploring the ureter afterwards can be considered instead of removing the stent and monitoring. All 4 cases had recurrence of stricture after the stent removal within 1 year, so the patient needs to be closely monitored in the early period after the stent removal. Although the number of 4 cases is not statistically significant, the common characteristics of the failed surgical cases should be noted and lessons learned.

## 5. CONCLUSION

The results from **55 cases** of **robot-assisted laparoscopic dismembered pyeloplasty** demonstrate that this technique is **a promising, safe, and effective alternative to open surgery** for complex or recurrent ureteropelvic junction obstruction.

**Further studies with larger sample sizes and long-term follow-up are necessary to evaluate the durability of this approach.**

## REFERENCES

1. Yohannes P, Rotariu P, Pinto P, Smith AD, Lee BR. Comparison of robotic versus laparoscopic skills: is there a difference in the learning curve? *Urology*. 2002;60(1):39-45.
2. Uberoi J, Disick GI, Munver R. Minimally invasive surgical management of pelvic- ureteric junction obstruction: update on the current status of robotic- assisted pyeloplasty. *BJU international*. 2009;104(11):1722-1729.
3. Wang Q, Lu Y, Hu H, et al. Management of recurrent ureteral stricture: a retrospectively comparative study with robot-assisted laparoscopic surgery versus open approach. *PeerJ*. 2019;7:e8166.
4. Lukkanawong N, Honda M, Teraoka S, et al. A comparison between laparoscopic and robot-assisted laparoscopic pyeloplasty in patients

with ureteropelvic junction obstruction. *Yonago acta medica*. 2022;65(2):126-131.

5. Trần Vĩnh Hưng Kết quả 6 năm ứng dụng phẫu thuật robot tại Bệnh viện Bình Dân: Triển vọng và hội nhập. *Tạp chí Y học Việt Nam*. 2023;(tập 525, tháng 4, số đặc biệt):5-14.
6. Nguyễn Phúc Cẩm Hoàng, Trần Vĩnh Hưng, Đỗ Vũ Phương, Đỗ Anh Toàn và cộng sự. Kết quả bước đầu qua 7 trường hợp được phẫu thuật nội soi ổ bụng với robot hỗ trợ tạo hình đường niệu trên tại bệnh viện Bình Dân. *Tạp chí Y học TP Hồ Chí Minh*. 2017;(tập 21, số 6):51-57.
7. Palese MA, Munver R, Phillips CK, et al. Robot-assisted laparoscopic dismembered pyeloplasty. *JSLS: Journal of the Society of Laparoendoscopic Surgeons*. 2005;9(3):252.
8. Patel V. Robotic-assisted laparoscopic dismembered pyeloplasty. *Urology*. 2005;66(1):45-49.
9. Zhang Y, Ouyang W, Xu H, et al. Secondary management for recurrent ureteropelvic junction obstruction after pyeloplasty: a comparison of re-do robot-assisted laparoscopic pyeloplasty and conventional laparoscopic pyeloplasty. *Urologia Internationalis*. 2019;103(4):466-472.
10. Carmona O, Dotan ZA, Haifler M, Rosenzweig B, Zilberman DE. Laparoscopic versus robot-assisted pyeloplasty in adults—a single-center experience. *Journal of Personalized Medicine*. 2022;12(10):1586.
11. Moretto S, Gandi C, Bientinesi R, et al. Robotic versus Open Pyeloplasty: Perioperative and Functional Outcomes. *J Clin Med*. Mar 28 2023;12(7)doi:10.3390/jcm12072538
12. Bersang AK, Rashu BS, Niebuhr MH, Fode M, Thomsen FF. Robot-assisted laparoscopic Anderson–Hynes pyeloplasty for ureteropelvic junction obstruction. *Journal of Robotic Surgery*. 2024;18(1):355.
13. Chammas Jr MF, Mitre AI, Hubert N, Egrot C, Hubert J. Robotic laparoscopic pyeloplasty. *JSLS: Journal of the Society of Laparoendoscopic Surgeons*. 2014;18(1):110.