Retroperitoneoscopic Dismembered Pyeloplasty for Ureteropelvic Junction Obstruction: Modification of the Procedure and Our Experience

Zhen-yu Ou, Jin-bo Chen, Zhi Chen, Min-feng Chen, Long-fei Liu, Xu Zhou, Yang-le Li, Lin Qi, Xiong-bing Zu

Department of Urology, Xiangya Hospital, Central South University, Changsha City, Hunan Province, China.

Corresponding Author: Xiong-bing Zu, MD Department of Urology, Xiangya Hospital, Central South University, Changsha City, Hunan Province, 410008, China.

Tel: +86 731 84327242
Fax: +86 731 84327242
E-mail: whzuxb@163.com

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Purpose: To report a modified retroperitoneoscopic dismembered pyeloplasty technique and its application in the treatment of ureteropelvic junction obstruction (UPJO).

Materials and Methods: From June 2010 to March 2012, retroperitoneoscopic dismembered pyeloplasty was performed in 46 patients with UPJO. Briefly, the renal pelvis was incised in the anterior aspect instead of the lateral aspect, and proximal ureter was spatulated with incision on its posterior wall. After adequately trimming, two layers of ureteropelvic anastomosis respectively lay on left and right side of one laparoscopic plane other than two different planes. In our refined procedure, the difficulty of intracorporeal suturing was greatly decreased. Data from 19 months mean follow-up were analyzed to evaluate the surgical outcomes.

Results: All operations were completed without open conversion. The mean operative time, estimated blood loss, and postoperative hospitalization stay were 108 min (75 to 155 min), 30 mL (15 to 60 mL) and 4 days (2 to 9 days), respectively. No intraoperative complications were occurred. Postoperative complications included 2 cases of minor abdominal wall hematoma and 1 case of transient postoperative anastomotic leakage for 8 days, which all were successfully treated by conservative management. A mean follow-up of 19 months (12 to 36 months) was performed which showed a success rate of 97.8%. One case (2.2%) underwent open surgery for persistence UPJO two months later.

Conclusion: Our modification to the retroperitoneoscopic dismembered pyeloplasty procedure is technically feasible and reliable with low complications. It could be implemented as a useful alternative technique to greatly decrease the difficulty of this procedure.

Keywords: hydronephrosis; surgery; laparoscopy; retroperitoneal space; treatment outcome; ureteral obstruction; kidney pelvis; reconstructive surgical procedures.

INTRODUCTION

A ureteropelvic junction obstruction (UPJO) is an obstruction or blockage at the junction of the kidney and ureter. When a UPJO occurs, the amount of urine produced is more than the amount that can be drained through the ureter causing a 'backup' of urine. In 1949, Anderson and Hynes reported the technique of open dismembered pyeloplasty (Anderson-Hynes technique), and this technique had ever since been the gold standard for the treatment of UPJO with an overall success rate greater than 90%.[1-4]

With the development of minimally invasive surgical techniques, laparoscopic dismembered pyeloplasty through a transperitoneal or retroperitoneal route has been widely accepted by urologists.[5,6] In fact, laparoscopic pyeloplasty (LP) has now emerged as a favored surgical treatment option for surgical correction erson-Hynes technique of UPJO in the last two decades. It has a success rate equivalent to that of the open procedure and has advantages of minimal morbidity and significant reduction of hospital care costs.[7] However, the procedure demands extremely high laparoscopic surgical skills, especially in laparoscopic suturing and knot-tying. The successful rate of LP is still strongly limited by the challenge of the steep learning curve. In the present study, we report our experience with retroperitoneoscopic dismembered pyeloplasty for the treatment of UPJO since 2008, with focus on modifications to this technology.

MATERIALS AND METHODS

Study Subjects

Between June 2010 and March 2012, forty-six consecutive patients underwent retroperitoneal laparoscopic dismembered pyeloplasty at our center. Our hospital is a public, teaching hospital and the largest medical center in our province. This study obtained ethics approval from the ethics committee at Xiangya Hospital, Central South University, Changsha, Hunan Province, China. Also, we obtained informed consent from the adult participants or from the parents of the children participants in study. The informed consent was written and specified in the operative consent. The all procedures were performed by a single, experienced laparoscopic surgeon (Xiong-Bing Zu). The mean age of patients was 21 years (range, 13 to 50 years), and of the 20 women and 26 men, 25 presented UPJO on the right side and 21 on the left side. Thirty-six (78%) cases had suffered from mild to moderate flank pain with a duration of 3 months to 2 years. The other 10 (22%) patients were asymptomatic and the UPJO was discovered incidentally while receiving renal ultrasonography or computed tomography for different reasons. No patients had undergone previous renal operations. All patients were subjected to a preoperative evaluation (renal ultrasonography, diuretic renography, intravenous urography with high-volume contrast medium or computed tomography) to confirm the diagnosis and the degrees of hydronephrosis. The inclusion criteria were: an obstructive pattern on diuretic renal scan and impaired renal function, an increasing degree of hydronephrosis and symptoms such as recurrent urinary tract infection and flank pain.

Operative Technique

All patients received general anesthesia and were positioned in the lateral decubitus position with hyperextension. A four-port balloon-dissecting retroperitoneal laparoscopic approach was used. A 2 cm incision was first made beneath the 12th costal margin at the posterior axillary line. A hemostatic forceps was then used to divide fascia lumbodorsalis and a finger was inserted to separate the retroperitoneal fat and the retroperitoneal space. The creation of a working space in the retroperitoneum was performed by a homemade balloon dilator with 800-1000 mL air infused for 5 minutes. Three ports were guided by index finger and placed at the subcostal anterior axillary line (5 mm trocar for surgeon) , 2 cm above the iliac crest (10 mm trocar for 30° telescope) and midaxillary line at the level of 11th rib (5 mm trocar for assistant), respectively. Also, a 10 mm trocar for surgeon was introduced through the initial incision. Then a CO_2 insufflation was performed at a pressure of 12 mmHg. After completing the retroperitoneal access, the extraperitoneal fat was dissected to reveal Gerota's fascia, which was then incised longitudinally close to the psoas magnum muscle. The perirenal fat was dissected to reveal the posterior surface of the kidney. The lower pole of the kidney was identified. Surrounding fatty and connective tissues were bluntly dissected from the pelvis and upper ureter using the tip of the suction tube. The location of UPJO could be identified after the pelvis and the upper ureter had been fully exposed.

Our technological innovation in the Anderson-Hynes procedure includes the modifications of incision and trim of the pelvis, ureter and intracorporeal suture. The anteriorly visible renal pelvis was incised using an endoscopic scissor. Dilated renal pelvis was cut from proximal part to distal part until exceeding obstructed position. The transection of the ureter was made about 0.5 cm distal to the obstructed position. The proximal ureter was spatulated with a 1.0 cm longitudinal incision on its posterior wall (**Figure 1A and 1B**). The stenotic segment of UPJ and redundant renal pelvis was cut down. Then renal pelvis was cut into a trumpet shape, and bell mouth was towards surgeon, so that the shape resembled the shovel face which is formed by ureter backward (**Figure 1C and 1D**). A single 4-0 absorbable monofilament stitch was placed from the most inferior point of the ureteral spatulation to the most dependent portion on the posterior wall of the trimmed pelvis (**Figure 2A and 2B**).

A double-J ureteral stent (6 French [F] or 7F for adults, 4F or 5F for children) was inserted in an antegrade fashion. This procedure was completed with the help of a suction tube. The surgeon passed the stiff end of a guide wire through a stent pusher (40 cm) and then through the open end of a double-J ureteral stent to straighten the close end of the stent. One artery forceps was applied to clamp the end of the pusher. A suction tube was sent to retroperitoneum through the trocar at the subcostal posterior axillary line. Then, the stent was passed through the suction tube and the stent was allowed to project about 2 cm beyond the tip of the tube. Under direct vision, the surgeon drew ureter with a grasping forceps, and guided stent with suction tube so as

to insert stent into the distal end of ureter across the cut of ureter. The assistant promoted the pusher till the joint of the pusher and stent had only a distance of 1-2 cm from the cut of ureter so that the distal end of stent is ensured to enter bladder. The surgeon clamped the open end of stent with a forceps, and then the assistant extracted the guide wire and pusher. Afterwards, the surgeon drew the proximal end of stent into renal pelvis.

After placing the double-J ureteral stent, interrupted suture was used for the left ureteropelvic anastomosis. The suture was from the distant portion on the anterior wall of the pelvis to anterior surface of the proximal aspect of the ureter. The right ureteropelvic anastomosis was completed using similar suture. After the preceding procedures, two sutured anastomotic stomas were placed respectively on the left and right side in the same plane (**Figure 2C and 2D**). Then, the remaining pyelotomy was closed with a running suture (**Figure 3**). All the sutures were placed and tied intracorporeally, with all knots located outside the lumen. During our procedure, a stick was used through the fourth trocar for minimizing the interference of the surrounding tissue in the operating field. If a crossing vessel was encountered during the dissection of the ureter, it was preserved. The ureter and the renal pelvis were transposed anteriorly to the vessels.

The procedure was completed with a suction drain placed through the trocar above the iliac crest into the retroperitoneum. The Foley catheter was removed on postoperative day 2 or 3. The drain was subsequently removed when the drainage was < 10 mL/24 h after Foley catheter removal.

The patient demographic data and perioperative outcomes were recorded. Patients were followed up for an average of 19 months. Intravenous urography with high-volume contrast medium and diuretic renography were performed after 3 months and yearly thereafter.

Success criteria were defined as adequate renal excretion (T1/2 < 20 min) on diuretic renal scan and improvement or stabilization in function, along with the complete resolution of presenting symptoms.

RESULTS

In the present study, all 46 patients underwent modified retroperitoneoscopic dismembered pyeloplasty successfully without conversion to open surgery. The underlying causes were determined intraoperatively, and included intrinsic UPJ stenosis in 33 cases and crossed vessel compression in 13 cases. The mean operative time was 108 min (range, 75 to 155 min). The mean estimated blood loss was 30 mL (range, 15 to 60 mL) and none of the patients required blood transfusion. No intraoperative complications occurred in the 46 procedures. Mean hospital stay was 4 days (range, 2 to 9 days). An artery vessel crossing on the ventral side of the UPJ was encountered in 13 patients, all the vessels were preserved and the ureter and the renal pelvis are transposed anteriorly to the vessels. The double-J ureteral stent was removed 4 weeks postoperatively by a cystoscope. We observed if any complications happened until the double-J ureteral stent removed. After that, we assessed if late complications happened during follow-up.

Table. Demographic and clinical characteristics of study subjects and operative results.

Variables	Values
Age (mean, range) (years)	21 (13-50)
Gender (male/female)	26/20
Side of obstruction (left/right)	21/25
Symptoms, no. (%)	
Asymptomatic	10 (22)
Flank pain	36 (78)
Operating time (mean, range) (min)	108 (75-155)
Estimated blood loss (mean, range) (mL)	30 (15-60)
Crossing vessels, no. (%)	13 (28.3)
Postoperative hospital stay (mean, range) (days)	4 (2-9)
Intraoperative complications, no. (%)	(0.0)
Postoperative complications, no. (%)	3 (6.5)
Abdominal wall hematoma, no. (%)	2 (4.3)
Urine leakage, no. (%)	1 (2.2)
Follow-up time (mean, range) (months)	19 (12-36)

Minor postoperative complications (Clavien-Dindo classification Grade I)[8] occurred in 3 cases (6.5%). Abdominal wall hematomas occurred in 2 patients which were resolved spontaneously. One patient developed urine leakage which was managed successfully through extending the drainage time up to 8 days. No major postoperative complications were observed.

The mean follow-up in our series was 19 months (range, 12 to 36 months). At the first time of follow-up, 35 of 36 preoperative symptomatic patients reported a complete resolution of symptoms. All 10 preoperative asymptomatic patients didn't have persistent flank pain after surgery. The overall success rate in the present study was 97.8%. Only one (2.2%) patient had persistent flank pain, who presented a persistence of UPJO with T1/2 > 20 min on the diuretic renal scan after treatment with retrograde insertion of a double-J ureteral stent for 2 months. This patient later underwent open dismembered pyeloplasty successfully. The obstruction reason was a fibrotic scar around the UPJ. The patients and operative characteristics are shown in **Table**.

DISCUSSION

For decades, open Anderson-Hynes dismembered pyeloplasty has been regarded as the gold standard for the treatment of UPJO due to its extensive use and high success rate. The development of laparoscopic instruments and refinement of laparoscopic techniques have enabled surgeons to perform technically more complex reconstructive surgery. In particular, the LP has emerged as a feasible and effective treat-

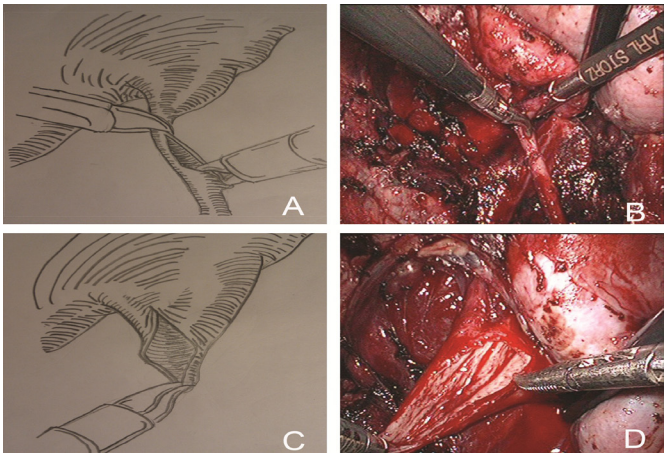

Figure 1. A and B: The proximal ureter was spatulated with a 1.0 cm longitudinal incision on its posterior wall; **C and D:** Dilated renal pelvis was trimmed into a trumpet shape.

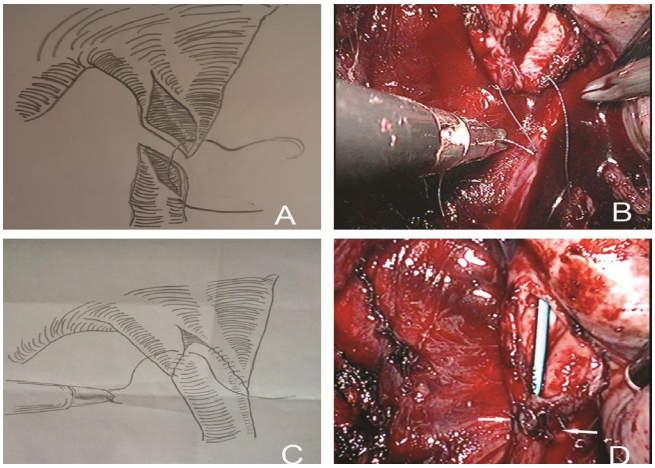

Figure 2. A and B: A single stitch was placed from the most inferior point of the ureteral spatulation to the most dependent portion on the posterior wall of the trimmed pelvis; **C and D:** Two anastomotic stomas which were respectively on the left and right side of the same plane were formed (white arrows).

ment alternative to open surgery, because it demonstrated a success rate similar to, or better than, that of open pyeloplasty but with lower morbidity, minimal invasion, less blood loss, shorter postoperative hospital stay and rapid recovery.[9,10] Some previous series supported the view that LP had superseded open surgery as the new standard surgical management for UPJO, with commensurate results and lower morbidity.[11-13]

However, LP is a technically difficult procedure that needs considerable skills and expertise especially in intracorporeal suturing, and is hampered by its steep learning curve.[14] Traditionally, the intracorporeal suturing has remained the most difficult part of LP. Consequently, we present our personal experience and modifications of retroperitoneoscopic dismembered pyeloplasty to simplify the procedure.

In this study, the authors created some technical innovations to the standard procedure, which included the modification of incising pelvis and ureter and simplification of anastomotic suture. In the new procedure, the renal pelvis is firstly incised in the anterior layer instead of the lateral aspect as described in the standard Anderson-Hynes technique. Then the transected ureter is spatulated on its posterior wall. Two spatulated inclined planes including forward pelvis slope and backward ureter slope, in similar shapes, are formed after trimming redundant pelvis and removing stenosis section. Two left and right lateral anastomotic stomas were formed after suturing endpoints. In this way, we can transfer anterior and posterior anastomotic stomas (seen in standard Anderson-Hynes technique) (**Figure 4**) to bilateral ones so as to greatly decrease difficulty of suturing (**Figure 3**).

Laparoscopic surgery is generally a two-dimensional surgery which is lack of depth perception and spatial orientation in video vision. Under such circumstance, it is very hard to incise and suture precisely two anastomotic stomas (one forward and the other one backward) on different planes. Through our improvement, two edges of incision are placed on left and right side of one laparoscopic plane and bell mouth of renal pelvis is towards the surgeon. As a result, all sutures are completed on one two-dimensional plane. The inconvenience in operation due to the limitation of stereoscopic vision is thus overcome.

In addition, an antegrade fashion for double-J ureteral stent insertion is used in the modified procedure. Under the guidance of suction tube, the direction of stent is easily controlled after it is planted, allowing the stent to enter ureter smoothly. At the same time, the assistant can help push stent forward externally under the monitoring of the screen. Thus, this procedure is easy and simple to carry out. In our procedure we did not have any migration of the ureteral stent in any patient which further demonstrated the effectiveness and reliability of the procedure.

In the previous studies, the overall complication rate for the laparoscopic dismembered pyeloplasty were between 6% and 38%,[10,13,15-19] with most complications being related to hematoma formation or urine leakage. Our overall complication rate in this study was 6.5% which was relatively low. Only three patients presented minor postoperative complications which were resolved by conservative treatment. After the follow-up period of at least 12 months, our success rate was 97.8% which was similar to the previous experiences.[18-20] These results indicate that our innovative techniques are very valuable in en-

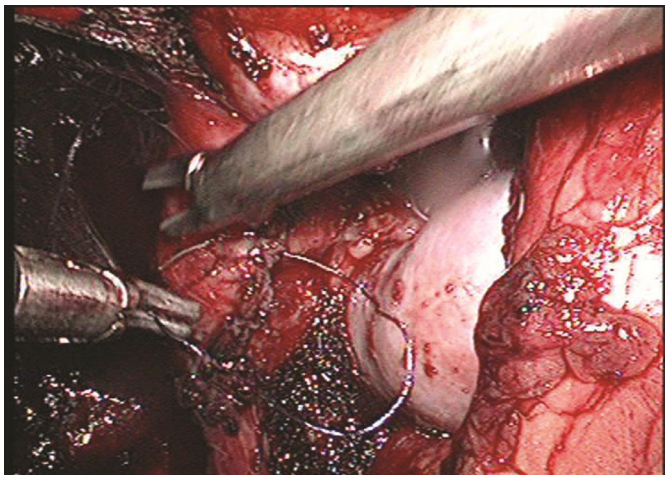

Figure 3. The remaining pyelotomy is closed with a running suture.

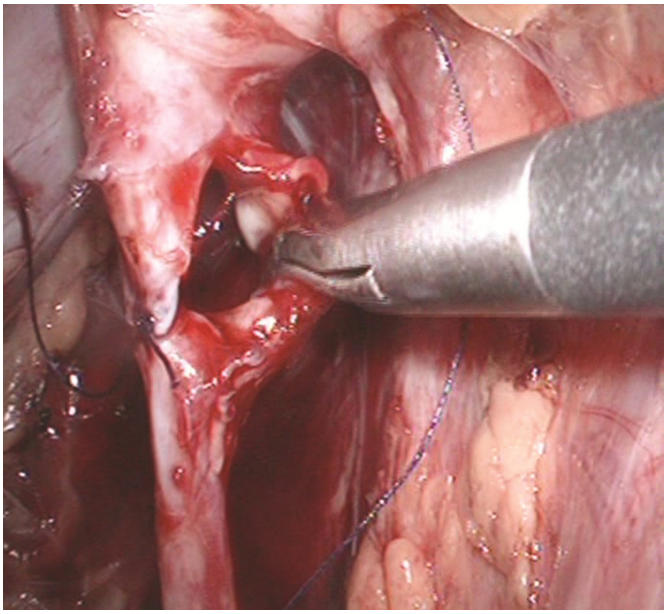

Figure 4. Two anastomotic stomas were respectively on the anterior and posterior plane in the conventional laparoscopic dismembered pyeloplasty.

suring high quality pelvis-ureter anastomosis with an ordinary two-dimensional vision.

No comparison was carried out in this study between standard Anderson-Hynes technique and our modified technique. A full evaluation of our innovation necessitates more studies to compare the operative time, intracorporeal suturing time, complication rate, success rate and other perioperative data between the two procedures.

CONCLUSION

In our experience, our modification to the standard retroperitoneoscopic dismembered pyeloplasty is technically ease and safe. Thus, it might be a useful alternative to greatly decrease difficulty of this procedure.

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Zhen-yu Ou and Jin-bo Chen contributed equally to this work.

CONFLICT OF INTEREST

None declared.

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