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Laparoscopic Dismembered Pyeloplasty: Our Experience in 15 Cases

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ABSTRACT

Objectives: To assess the feasibility and effectiveness of transperitoneal laparoscopic pyeloplasty in the treatment of ureteropelvic junction obstruction. Laparoscopic pyeloplasty has been shown to have a success rate comparable to that of the open surgical approach. We report the results of our first 15 cases of transperitoneal dismembered pyeloplasty.

Patients and methods: From August 2006 to September 2007, 15 patients underwent laparoscopic transperitoneal pyeloplasty for ureteropelvic junction obstruction. All patients underwent dismembered pyeloplasty. All patients were followed with diuretic renography (DTPA renal scan) at 3 months and 1year of follow-up and intravenous urography at 1 year follow-up to assess the success of the surgery.

Results: Fourteen of the fifteen procedures were successfully completed. The procedure was converted to open surgery in one patient who had history of recurrent UTI and friable tissues which were not holding the sutures. Crossing vessels were identified in 7 out of 15 patients(46.7%) which required transposition of the ureter and pelvis before anastomosis. Four patients had associated calculus disease and in 3 out of 4 patients the calculus was removed. Average operating time was 3.75 hours (range 3 to 5 hours) and the mean blood loss was 150 ml. Mean hospital stay was 5.5 days. Mean duration of analgesic use was 5.2 days. Postoperative complications included urinary peritonitis in one patient and suture granuloma in 2 patients. 14 out of 15 patients(93.33%) showed definite improvement in renal function and drainage on radiographic evaluation.

Conclusions: Laparoscopic pyeloplasty (LP) is a safe and effective minimally invasive treatment option that duplicates the principles and techniques of definitive open surgical repair.The success rates associated with LP are comparable to those of the gold standard, open pyeloplasty.

Keywords:

INTRODUCTION

Surgical management of PUJ obstruction has recently been revolutionized by the introduction and widespread adoption of minimally invasive techniques as alternative to standard open reconstructive procedures in an effort to reduce the morbidity of the treatment. Initially, minimally invasive approaches included antegrade and retrograde endoscopic endopyelotomy. Although these procedures are associated with relatively few complications, brief hospitalization and little disability, the reported success rates are low(71 to 88%)as compared to an open approach. Also these procedures have an increased risk of hemorrhage (0 to 12%).[1]

Traditional therapy of the obstructed ureteropelvic junction has been open reconstructive surgery(pyeloplasty). The long term success rate of open pyeloplasty has been reported to be greater than 90% in adults and children.[2] Despite the high success rate, open pyeloplasty has the disadvantage of a loin wound and consequent increased morbidity and long convalescence. Laparoscopic pyeloplasty was originally developed in an attempt to duplicate the results of open pyeloplasty while simultaneously decreasing postoperative morbidity. Laparoscopic pyeloplasty was first described in 1993 by Schuessler et al;[3] since then several groups have reported its successful use.[4-7]Although associated with greater technical complexity and a steeper learning curve, in the hands of the experienced laparoscopic surgeons, it has been shown to provide lower patient morbidity, shorter hospitalization and faster convalescence with the reported success rate matching those of open pyeloplasty (90% or higher).

In this study, we present our initial experience with laparoscopic pyeloplasty by transperitoneal approach,including 15 pyeloplasties with an average follow-up of 10.6 months (ranging from 4 to 16 months).

METHODS

Patients

From May 2006 to September 2007, a total of 15 laparoscopic pyeloplasties were performed at our center. Patients included 8 males and 7 females aged 8 to 57 years (mean age 29.8 years). 9 out of 15 patients had right sided PUJ obstruction whereas only 6 patients had left sided lesion. Flank pain was the commonest presentation (9 patients, 60%). Other symptoms were dysuria (6 patients, 40%), fever (2 patients, 13.3%) hematuria (1 patient, 6.6%). One patient (6.6%) was asymptomatic. All patients had radiographic evidence of UPJ obstruction on diuretic renography or HN with delayed function on excretory urography. All patients had primary PUJ obstruction. Four out of 15 patients had stones present in the ipsilateral kidneys. Retrograde pyelography with DJ stenting on the ipsilateral side was done in cases where the pelvis was hugely dilated and if the patients presented with fever and loin pain and when the anatomy was not properly delineated. Radiographic success was defined as improved drainage on diuretic renography. IVP was done at 1 year of follow-up mainly to compare the anatomy of the PUJ preoperatively and postoperatively in our initial cases of laparoscopic pyeloplasty.

PROCEDURE

All patients were kept on liquid diet for 1 day and T. Dulcolax was given in a dose of 2 tablets HS for 2 days. Patients were given parenteral cephalosporin and Amikacin at the time of induction of anesthesia and these antibiotics were continued postoperatively till the time of drain removal. All procedures were performed under general anesthesia. A Foley's catheter was placed in the bladder and a nasogastric tube was inserted to decompress bladder and stomach. All patients were placed in lateral decubitus position with proper padding of pressure areas. The kidney rest was elevated and table flexed to stretch the flank. Compression crepe bandages were applied to legs.

All procedures were carried out by the transperitoneal approach. The access to the peritoneal cavity was obtained with open technique. Pneumoperitoneum was created with an insufflation rate of 5 l/min and the insufflation continued till an abdominal pressure of 15 mm Hg. 30° telescope was used. The first port (10 mm) was introduced at the lateral border of rectus muscle above the umbilicus. The exact level of the port was decided by the configuration of the pelvis and the anatomical position of PUJ and the body habitus of the patient. This port was used for telescope. The second port was placed at the mid spino umbilical line. 5 mm or 10 mm port was used. The third port (5 mm) was placed subcostally so as to make on equilateral triangle with the previous ports and a diamond with the renal angle. The fourth port was placed in the loin at a later time as and when required. The fourth port (5 mm) was used mainly to retract the kidney laterally. The port sites are illustrated in **Figure 1**.

All patients had dismembered Anderson Hynes pyeloplasty The colon was mobilized by incising the peritoneum laterally. The ureter was identified and dissected in cephalad direction to achieve mobilization of the ipsilateral proximal ureter, UPJ and renal pelvis. One trans cutaneous stay suture was taken on the anterior wall of pelvis to spread it which also helped in suturing. The anterior wall of renal pelvis was incised. Spatulation of the ureter was done on the lateral aspect with the posterior wall intact. Subsequently the posterior wall was divided. In cases where direction of the scissors could not be brought in line with the ureter, the spatulation was done after the circumferential transection of the pelvis. In that case, a marking suture was put on the medial aspect of the ureter before complete transaction. Suturing was done intracorporeally with vicryl 4-0 suture on a 20 mm needle. First the posterior half of the uretero pelvic anastomosis was done with a running suture beginning at the apex of the spatulated ureter. Then the DJ stent was placed and then the anterior wall suturing performed. Reduction of pelvis wherever required was done. If a crossing vessel was present, the ureter was transposed anterior to the crossing vessel. Removal of any associated calculus was tried. In case of calyceal calculi, rigid ureteroscope was used through a 10 mm working port. 20 Fr drain was placed through a 5 mm trocar site.10 mm port sites were closed in 2 layers and 5 mm ports were closed with only skin sutures. The steps of surgery are illustrated in **Figure 2**.

Postoperatively, clear liquid diet was initiated on the post operative day 1. The Foley's catheter was removed after 2 days and the drain was removed once it was less than 50 cc. Tramadol was used routinely in the postoperative period for pain relief. Skin sutures were removed on 10th postoperative day.

Cystoscopy and DJ stent removal was done at 6 weeks after surgery. DTPA renogram was done at 3 months and one year. IVP was done at 1 year after surgery to look for patent PUJ, reduction in the grade of hydronephrosis and redundant pelvis and improved drainage. Patients were examined clinically at 3, 6 and 12 months.

RESULTS

Only one out of 15 patients required conversion to open approach where the pelvis and ureter were friable and not holding suture. In rest of the 14 patients the surgery could be successfully completed laparoscopically. Crossing vessels were identified in 7 (46.7%) out of 15 patients, which required

Author pl. provide Figure 1

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transposition of the ureter and pelvis before anastomosis. Reduction of pelvis was required in 11 (73.3%) out of 15 pyeloplasties. Average operating time was 3.75 hours (range 3 hours to 5 hours) excluding one case which was converted to open and took 4 hours. The operative time decreased with surgeons experience. Average operating time for first 7 cases was 4.36 hours and it decreased to an average of 3.14 hours for the next 7 cases excluding 1 case which needed conversion to open. Mean blood loss was 150 ml (range 70-250 ml). None of our patients required any blood transfusion. Average amount of gas used was 230 L (range 127-480 L). The mean duration of analgesic use in our series was 5.2 days (ranging from 3 days to 10 days) excluding 2 patients who required open surgery. Mean hospital stay after surgery was 7.6 days (range 3-23 days). However, if two cases which required open surgery were excluded the mean hospital stay, after surgery was 5.5 days (range 3-9 days).

There was one case of accidental division of upper end of DJ stent during pelvic transection. The upper end was subsequently removed and the rest of the stent left *in situ*. An eight years old child had very fragile pelvic and ureteral tissues and there was repeated cut through of sutures during uretero pelvic anastomosis. In this child, the procedure was converted to open approach and pyeloplasty completed. Removal of associated calculus was done in 3 out of 4 patients but clearance was achieved in only one patient who had a pelvic calculus. Rest of the patients with calyceal calculi which could not be retrieved were advised ESWL postoperatively. Our second patient had postoperative urinary extravasation and urinary peritonitis. She required abdominal exploration with interrupted suturing of anterior suture line and PCN on 7th postoperative day. Subsequently the recovery was uneventful.

Follow-up ranged from 4 months to 16 months. Mean follow-up period was 10.6 months. 4 (26.7%) out of 15 patients continued to complaints of intermittent flank pain inspite of radiological evidence of definite improvement in drainage. One patient had no improvement in symptoms and persistence of radiologic evidence of obstruction. This patient had gross HN with nil cortical thickness preoperatively.

Renogram revealed significant improvement in 12 out of 15 patients at 3 months and in 13 out of 15 patients at 1 year. Out of the remaining 2 patients, one patient had nonobstructive renogram preoperatively and it remained stable in the postoperative period. This patient had definite evidence of obstruction with secondary mobile calculi in kidney on IVP. IVP was done at 1 year of follow-up in 6 patients and revealed significant improvement in all cases. Thus, 14 (93.33%) out of 15 cases showed definite improvement in renal function and drainage on radiographic evaluation. One of them had required conversion to open surgery.Thus the success rate in our initial series of 15 cases of laparoscopic pyeloplasty was 86.66% (13 out of 15 cases). The results of one patient are illustrated in

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Figure 3.

DISCUSSION

Laparoscopic pyeloplasty has developed worldwide as the first minimally invasive option to match the success rates of open pyeloplasty, while achieving the added goals of low morbidity, short hospital stay and convalescence. The success rate of our cohort was 86.66% with a median follow-up period of 10.6 months which compares favorably with other series as shown in Table 1.

The operative time decreased with increasing surgeons experience and standardization of the operative steps. Laparoscopic pyeloplasty allows the surgeon to perform the operative steps similar to those in open pyeloplasties such as dissection, transection and suturing. However, it is a difficult procedure that requires careful ureteral dissection and considerable proficiency in the intracorporeal suturing. [12] Standardization of a surgeons steps and introduction of additional techniques specific for laparoscopic surgery can help to overcome the difficulties and enhance the performance. Towards this end, we placed a transcutaneous suture in the medial edge of the redundant renal pelvis just below the renal vein. We found this step very useful in the transection and suturing as it tends to open up the pelvis and acts as a stay suture holding the anterior and the posterior walls of the pelvis apart. We also tried taking a stay suture on the ureter in our initial cases, but it caused entanglement of the sutures and so to avoid confusion this step was omitted in the subsequent cases.

Crossing vessels were observed in 7 out of 15 (46.7%) patients. The contribution of crossing vessels to the functional obstruction of the PUJ is an area of controversy. There is a higher incidence of crossing vessels as detected by color Doppler ultrasonography, in relation to kidneys with known PUJO (79%) than in kidneys with no PUJO (35%).[13] Crossing vessels are commoner in adult kidneys (50 to 80%) with PUJO than in pediatric kidneys with PUJO (30%) and absent in prenatally detected PUJO.[14] Thus there may be a time dependent relation between the development of adult PUJO and the presence of crossing vessel. The identification of crossing vessels tends to be higher in laparoscopic than in open surgery.[6] The explanation for this difference may lie in the minimal mobilization of the kidney needed during the laparoscopic procedure to acess the PUJ, in contrast to the open pyeloplasty in which the entire kidney needs to be mobilized and rotated medially to expose the pelviureteric segment.[6] Van Cangh et al showed the negative association between the presence of crossing vessel and the success rate of endopyelotomy.[15] Crossing vessels are an important consideration in managing PUJO even though the relative contribution of crossing vessels to the pathophysiology of the individual PUJO will probably always be difficult to quantify as there are subtle differences in vessel size, distance from and relation to the PUJ, degree of hydronephrosis, level of kidney function and the presence of periureteric and perivascular bands and adhesions. Incidence of crossing vessels reported in retroperitoneal series is lower than those reported in most transperitoneal studies. And a retroperitoneal surgeon is less likely to transpose the anterior crossing vessel arguing that the ureter is lying naturally and anatomically as the most posterior structure in the retroperitoneum as evidenced in the series of Eden CG et al. Still there is no apparent difference in the success rate of transperitoneal or retroperitoneal laparoscopic pyeloplasty .Precise plastic repair of the PUJ is most important for the success rate of pyeloplasty with the crossing vessel either transposed or translocated cephalad from the PUJ area, as per the individual case. [4]

The necessity for reduction of the renal pelvis might be controversial. We do not reduce the pelvis when it is small and has active peristalsis. However, in a large pelvis with poor movement, we actively consider reduction, particularly when the reduction in necessary to give the PUJ a funnel like shape.

All patients in our series had primary PUJ obstruction. Laparoscopic pyeloplasty has been used even in patients in whom previous endoscopic and/or open pyeloplasty had failed. Sundaram CP et al[16] reported an overall success rate of 94% in

Table1: Table showing the success rate of laparoscopic pyeloplasty in different series

Study	*N*	*A-H pyeloplasties,n(%)*	*Surgical approach*	*Success rate (%)*	*Follow-up(months)*
Tan HL[11]	16	16(100)	Trans	87.5%	□
Schussler et al[3]	5	5(100)	Trans	80%	□
Jarret et al[7]	100	71(71)	Trans	97%	31
Young et al[9]	60	56(93.3)	Trans	95.7%	19
Simforoosh N et al[10]	37	19(51.35)	Trans	83.8%	16.5
Eden et al[8]	50	50(100)	Retro	98%	19
Soulie et al[5]	55	48(87)	Retro	87%	14
Our series	**15**	**15(100)**	**Trans**	**86.66%**	**10.6**

a series of 36 patients with secondary PUJO. Siqueria et al[18] also reported success in 8 of 9 patients. Jarrett[7] reported 17 laparoscopic pyeloplasties with secondary PUJO, with a success rate of 88%. Notable point recorded in these studies was the longer mean operative time. Soulie et al[5] and Lachkar et al[17] report that any previous retroperitoneoscopic procedure makes a new retroperitoneoscopic pyeloplasty unlikely. So a transperitoneal approach is preferred for such cases over the retroperitoneal approach.

We used transperitoneal approach in all our patients. This approach offers more working space and a better field of view which is important for a reconstructive surgery. However , several disadvantages have been reported for this approach. For access to the retroperitoneum the colon has to be mobilized and separated from the Gerota's fascia. In addition the renal pelvis is not completely exposed as the renal artery and vein cross ventrally. In Rasweiler's experience[19] this approach is also more invasive as reflected by the higher postoperative moribidity rates relative to the retroperitoneoscopic nephrectomy. However, we did not experience any technical difficulty or increased morbidity in the postoperative period in our series of transperitoneal pyeloplasty. 14 out of our 15 patients did not suffer from ileus or distention of abdomen and we started oral sips from the evening of the surgery which was tolerated well by all patients. 1 out of 15 patient developed urinary peritonitis due to leak from the anterior suture line of the ureteropelvic anastomosis and required open exploration. Others have reported shorter operative times(Souli et al,[5]2001) but higher complication rates (Slama et al,[20] 1999) for the retroperitoneoscopic approach. The success rates seem to be better with transperitoneal pyeloplasty (97 to 99%) than with the retroperitoneoscopic approach (87 to 98%).[12]

Long-term outcomes need to be assessed because in rare cases PUJ obstruction can recur a year or more postoperatively. Several investigators recommend assessment of outcome by at least a 1 year follow-up with diuretic renal scan or IVP[12.] Jarrett et al[7] reported the results of 100 laparoscopic pyeloplasties with a mean clinical and radiographic follow-up of 2.7 and 2.2 years respectively. The overall success rate was 96% and no late failure (after 1 year) was observed. We intend to follow all our patients for a period of 1 year after surgery with IVP and DTPA renal scan. At the present time 8 patients are under follow-up and 7 patients have completed the 1 year follow-up and there was only 1 failure.

CONCLUSION

LP is a safe and effective minimally invasive treatment option that duplicates the principles and techniques of definitive open surgical repair.The success rates associated with LP are comparable to those of the gold standard, open pyeloplasty.

Laparoscopic pyeloplasty is associated with significant reductions in overall morbidity, including less discomfort, shorter hospital stay, lower complication rate, and shorter time to convalescence and is cosmetically superior to the open pyeloplasty.Varied surgical anatomy associated with PUJ like the crossing vessels and high insertion of the ureter in the pelvis can be successfully repaired with laparoscopic pyeloplasty which have been shown to compromise the results of other endourological procedures.The disadvantages include the longer operative duration as compared to open pyeloplasty,steep learning curve and requires technical expertise. With the steady increase in worldwide laparoscopic experience and education, LP is indeed emerging as the new gold standard of care for symptomatic UPJ obstruction.

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