Original Article

Prospective randomized study to evaluate the feasibility and outcome of transmesocolic laparoscopic pyeloplasty and compare it with retrocolic laparoscopic pyeloplasty in pediatric and adolescent patients

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ABSTRACT

Objective: This prospective randomized study was designed to evaluate the feasibility and outcome of transmesocolic laparoscopic pyeloplasty (TMP) and compare it with retrocolic laparoscopic pyeloplasty (RLP) in pediatric and adolescent patients.

Materials and Methods: Between September 2006 to May 2012, data of pediatric and adolescent patients undergoing laparoscopic pyeloplasty were recorded in a prospective manner. Data included age, pelvic volume, presence of stones, aberrant vessels, operative time, analgesics requirement and time to accept oral feeds and drain removal. Patients with left side pelviureteric junction obstruction with any size of pelvic volume, with or without renal stones and aberrant vessels were included in the study. Patients were assigned into two groups by simple randomization technique. A total of 38 TMP and 41 left sided RLP were performed. Median follow-up period for transmesocolic group was 12.5 months (9.5-62 months) and 14 months (8-66 months) for retro colic group. Outcome for this study was adequate drainage on renal scan, improvement in symptom and or resolution of hydronephrosis on ultrasound. Statistical analysis was performed using the Mann-Whitney test.

Results: The mean patient age was 8.73 years in RLP and 7.73 years in TMP. In RLP group the mean operative time was 75.84 min (time from port insertion to pyeloplasty) and 135.4 min (total operative time) while it was 44.82 min and 104.82 min respectively in TMP group. Compared with classic RLP, TMP cases showed a significant reduction in operative time.

Conclusions: The transmesocolic approach for left sided pyeloplasty enables a shorter operative time even in the presence of large pelvis, aberrant vessel and stones without increasing morbidity in comparison to RLP approach.

Key words: Pyeloplasty, retrocolic laparoscopic pyeloplasty, transmesocolic laparoscopic pyeloplasty

INTRODUCTION

Ureteropelvic junction (UPJ) obstruction has been classically treated through the standard open approach with outstanding results. Since Anderson-Hynes (AH) reported the first dismembered pyeloplasty, a great number of authors have published excellent results, with overall success rates of 90-100%.[1-4]

Schuessler *et al.* first described laparoscopic pyeloplasty in 1993.[5] Their technique respected the basic principles of the open classical approach while providing less morbidity and faster recovery. Since then, transperitoneal and retroperitoneal approaches have been described and advocated by several authors, with excellent results.[6,7] In order to ease laparoscopic repair and decrease surgical time, many alternative time saving maneuvers and even robot assistance have been developed.[1,8-10] These alternative techniques helped in bringing the operative time close to that of open surgery and made laparoscopic pyeloplasty a more desirable alternative.

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We evaluated the transmesocolic technique as a way to reduce operative time and facilitate repair by avoiding colon displacement and compare it with conventional retrocolic laparoscopic pyeloplasty (RLP) in cases of left sided ureteropelvic junction obstruction (UPJO).

MATERIALS AND METHODS

Patients and data collection

Between September 2006 and May 2012, a total 130 laparoscopic pyeloplasties were performed. Only left sided pelvi-ureteric junction obstruction were enrolled for study. Patients were assigned into two groups for surgery by simple randomization technique. A total of 38 transmesocolic laparoscopic pyeloplasty (TMP) and 41 left sided RLP were performed. The data were recorded in a prospective manner that included age, pelvic volume, presence of stone [Figure 1a and b], aberrant vessel, [Figure 1b] operative time, analgesics requirement (paracetamol 15 mg/kg body weight for children more than 10 kg of weight and 7.5 mg/kg body weight for children less than 10 kg of weight), time to accept oral feeds, drain removal. A dismembered AH pyeloplasty was performed in all patients. Double J Stent (DJS) was placed in 73.68% of patients in TMP group while 82.92% patients in RLP group. Based on pelvic volume, patients were divided into three groups:

- Group 1: Less than 50 ml (16 patients in RLP and 24 patients in TMP)
- Group II: 50-100 ml (14 patients in RLP and 10 patients in TMP)
- Group III: Greater than 100 ml (11 patients in RLP and 4 patients in TMP).

Pelvic volume measurement was done by ultrasonography. All patients with significant obstruction (obstructed pattern and t1/2 more than 20 min) as per the "well-tempered diuretic renogram" were taken for surgery.[11] Statistical analysis was performed using the Mann-Whitney test. All cases were done by a single surgeon who has experience of more than two hundred laparoscopic pyeloplasty including fifty cases of transmesocolic pyeloplasty. Written consent of all patients was taken. Institutional ethics and review board approval were obtained.

Surgical technique

Under general anesthesia, the patient was placed in the lateral decubitus position. Using Hasson's canula by open technique, pneumoperitoneum up to 8-10 mm Hg was created at umbilicus and a 30° laparoscope was placed through this. Two 3 mm or 5 mm ports were placed subcostally in the midclavicular line and mid-way between spinoumbilical lines respectively.

The first step was the identification of renal pelvis under the mesocolic fat. A mesocolic "window" was opened by dissecting the mesocolon with the Harmonic scalpel. This space was limited medially by the inferior mesenteric vein and laterally by the medial margin of the descending colon. The landmarks were then represented by the inferior mesenteric vein and gonadal vein. A 5 cm incision was then made longitudinally, lateral to the inferior mesenteric and gonadal veins, in between the medial and left colonic artery. This area was free of vessels and the incision frequently enabled direct visualization of the lumbar ureter. Sometimes small branches of the left colonic artery were present and were clipped and sectioned, with no impairment of the colonic vascularization. In this way, we created a peritoneal "window" that allowed a direct access to the renal pelvis. Whenever a wider operative field was necessary, the superior margin of the incision was suspended to the lateral abdominal wall with a suture. Needle aspiration of renal pelvis was done if pelvic capacity was more than 50 ml as to minimize the size of mesocolic window. [Figure 2a]. Further, in larger pelvises, a stay suture passed percutaneously

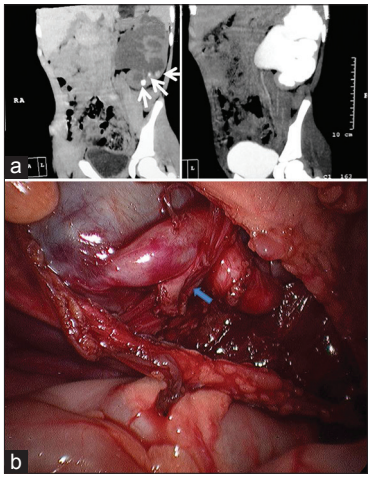

Figure 1: A case of left ureteropelvic junction obstruction with (a) secondary stones managed with transmesocolic approach, (b) crossing vessel (arrow) managed with transmesocolic approach

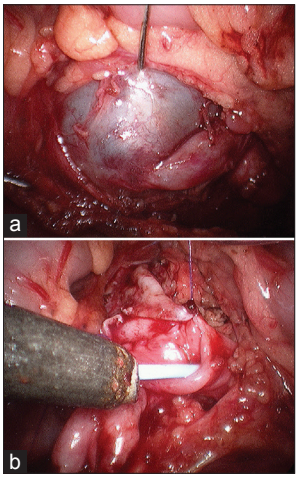

Figure 2: (a) Needle (aspiration) aspiration of dilated pelvis (>50 ml) managed with transmesocolic approach. (b) Antegrade JJ stenting after completion of posterior wall anastomosis

helps in better stabilization of the former. The ureter and renal pelvis were carefully dissected to avoid unnecessary damage to their vasculature, whereas for the same reason, the kidney and ureter were not mobilized. The UPJ was divided proximal to the renal pelvis and the obstructed part was left attached to the ureter. If necessary, the ureter was transposed over any aberrant vessels [Figure 1b]. The ureteral stent was placed by introducing the guide wire through a 16-gauge intravenous catheter sheath placed percutaneously under direct laparoscopic control. Then the ureter was spatulated, and a running suture on a small and half- circle [SH] needle was placed. We used DJS according to age (Length of JJ = age of the child in years + 10 cm). The anterior plane of the anastomosis was completed using the same suturing technique as for the posterior layer. In some cases, we used a 2 mm percutaneous retractor on the anterior flap of the sectioned renal pelvis in order to stabilize the loose pelvis and facilitate the anastomosis. The mesocolic window was usually closed with two or three Hem-O-Lok™ clips or by using a 3-0 polyglactin interrupted suture after placement of the suction tube. The port sites were closed. Perinephric drain was placed in all patients of both groups. Drain was removed when drain output was less than 30 ml/day. Perurethral catheter was put for bladder drainage. Patients were orally allowed after bowel sounds were appreciated. DJS was removed after 6 week.

In RLP group, the procedure began by incising at Toldt's line, dissecting the left colon from Gerota's fascia and reflecting it medially to visualize the renal hilum and UPJ. Rest of the steps was same as TMP group. Median follow-up period for transmesocolic group was 12.5 months (9.5-62 months) and 14 months (8-66 months) for retro colic group. Follow-up included renal dynamic scan, first at 6 weeks after stent removal, then at 3 months and further 2 scans at 6 monthly intervals, resolution of symptom and or resolution of hydronephrosis on ultrasound.[11]

RESULTS

In TMP group, 32 patients were boys and 6 were girls while 36 patients were boys and 5 were girls in RLP group. The mean patient age was comparable in both groups. Patient's characteristic as shown in Table 1. The American Society of Anesthesia score was 1 in all patients. DJS was put in 73.68% patients in TMP group while 82.92% patients in RLP group. In RLP group, the mean operative time was 75.84 min (time from port insertion to pyeloplasty) and 135.4 min (total operative time) while it was 44.82 min and 104.82 min respectively in TMP group. On average, TMP was 30 min shorter than classic RLP (104.8 min vs. 135.4 min; *P* 0.05). There were no intra-operative complications or open conversions. In post-operative period three patients had increased drain output, 1 patient had fever and hematuria, 1 patient had wound infection in RLP group while 1 patient in TMP group had increased drain output.

Complete stone clearance was achieved in all the cases in both groups. Even patients with pelvic volume greater than 100 ml could be safely managed with prior aspiration [Figure 2a].

The mean hospital stay, mean drain removal time, mean time for oral intake and mean analgesic dose requirement was significantly lower in TMP group as compare to RLP. [Table 2]. The success rate was 100% in RLP and 97.3% in TMP. All patients in RLP group had unobstructed drainage with static split renal function while in TMP group, 1 patient who had base line renal function of 10%, had further deterioration in function and needed nephrectomy.

DISCUSSION

In recent years, several minimally invasive procedures for pyeloplasty have emerged in order to decrease the morbidity associated with the classic open approach.[12] At present, gold standard treatment for primary UPJO is dismembered AH pyeloplasty.[1,13] Laparoscopic pyeloplasty has a success rate of 88-100%, which is similar to open surgery.[1,14-16]

Nicol and Smithers first described the transmesocolic approach for the left kidney.[17] These authors described their technique, as a way of easing renal pedicle access and decrease operative time.

Table 1: Patients characteristic

Parameters	Groups	
	TMP%	RLP%
Male:Female	32:6	36:5
Mean age	8.73 years	7.73 years
Crossing vessels	15.78	18.43
Secondary stones	5.26	7.31

TMP=Transmesocolic laparoscopic pyeloplasty, RLP=Retrocolic laparoscopic pyeloplasty

Table 2: Intra-operative and post-operative characteristics

Parameters	Groups	
	TMP	RLP
Time from port insertion to pyeloplasty*	44.82 min	75.82 min
Total operative time*	104.8 min	135.4 min
Mean hospital stay**	4.14 days	5.89 days
Mean drain removal time**	32.21 h	43.89 h
Mean time for oral intake **	14 h	20 h
Mean analgesic dose requirement*	500 mg	542 mg
Success rate (%)	97.3	100

*P<0.001,**P<0.05, TMP=Transmesocolic laparoscopic pyeloplasty, RLP=Retrocolic laparoscopic pyeloplasty

Table 3: Different comparative studies for TMP and RLP

Name of study	Age (years)		No. of patients		Operative time (min)		Analgesics requirement		Time to accept oral feeds (h)		Drain removal (h)		Hospital stay (days)		Follow-up (month)	
Groups	RLP	TMP	RLP	TMP	RLP	TMP	RLP	TMP	RLP	TMP	RLP	TMP	RLP	TMP	RLP	TMP
Shadpour *et al*.[22]	15.8	12.3	34	34	150.4	115.5	-	-	-	-	-	-	3.6	2.6	33	32
Hyan *et al*. [25]	31.8	20.4	9	12	308	242	2.8	4	-	-	-	-	3.6	3.4	12.4	12.1
Romero *et al*.[20]	170	18	52	18	169.9	131	-	-	-	-	-	-	2.6	2.1	22	18.5
Ramalingam *et al*. [24]	-	-	12	26	165	145	-	-	-	-	-	-	3-5	3-5	-	-
Present study	7.7	8.7	41	38	135.4	104	542	500	20	14	44	32	5.9	4.1	17.5	18

TMP=Transmesocolic laparoscopic pyeloplasty, RLP=Retrocolic laparoscopic pyeloplasty

When a transperitoneal approach is chosen for a right-side LP, the access to the UPJ is simple as the surgeon has only to lift up the liver to identify the renal pelvis. Thus, the pyeloplasty can be performed through a small incision in the posterior peritoneum.[15] Conversely, on the left side, mobilization of the descending colon is mandatory to identify the underlying renal fascia and to access the UPJ.[18] However, the descending colon can reduce the width of the operative field, especially in obese patients or when the colon is distended. In these cases, the introduction of a fourth trocar is often required to improve the exposure. To avoid the mobilization of the descending colon and all the inherent problems associated with bowel manipulation, a direct transperitoneal access to the left UPJ is proposed[19] and recently applied in adult urology by Romero *et al.*[20] and Castillo *et al.*,[21] who reported series of 18 and 11 patients, respectively.

Crossing vessels were present in 15.78% patients of TMP group while 18.42% patients in RLP group. As Türk *et al.* stated, TMP is effective even in the presence of a large renal pelvis or abnormal polar vessels.[18]

In our study, on an average, TMP was 30 min shorter than classic RLP with a 22% reduction of operative time. Shadpour *et al.*[22] reported a reduction of 23% and Romero *et al.*[20] reported a reduction of 22.5%, which is similar to our study. The classic RLP approach needs mobilization of the descending colon and its mesentery, which is time consuming.

The mean hospital stay in many studies ranged from 1 to 4 days. Shadpour *et al.* reported 3.6 days and 2.9 days in RLP and TMP group respectively.[22] A study carried out by Braga *et al.*[23] in 2007 coded the mean hospital stay as 2.5 days. Similar results were seen in studies by Romero *et al.*, Ramalingam *et al.* and Hyun *et al.*[20,24,25] The reduction of 19.2% was reported by Romero *et al.* while in our study it was 29.7%.[20] The mean hospital stay in our study was 5.89 days (range 3-17 days) in RLP group while 4.14 days (range 3-6 days) in TMP group. Higher values are due the fact that poor sanitary condition at home and poor wound care would increase infection and morbidity, owing to which discharging of the patient is delayed.

Mean analgesic dose requirement was significantly less in TMP group than RLP group ($P < 0.001$). Manipulation of the colon and adjacent abdominal wall can cause visceral pain. But generally TMP causes less pain when compared to RLP. The longer operative time in RLP group may have caused more muscular pain.[25] However, Castillo *et al.* reported no difference in post-operative pain in either group.[21]

Mean time for oral intake and drain output was significantly less in TMP group than RLP ($P < 0.05$). This is due to ileus, secondary to handling of colon in RLP group. Similar result was found by Khan *et al.*[26]

We compare our data with published literature in Table 3. This data supports the facts that TMP is a feasible and reproducible technique that allows shorter operative times without increasing morbidity.[19,20,22,26,27]

The limitations of this study were high mean age in both groups and no pain score was recorded during the study. However, randomized prospective nature of the study and a substantial number of the cases compared in both arms contributed to the strength of this study. Moreover, inclusion of left sided of UPJO avoided any sidewise bias for the operator.

CONCLUSIONS

Transmesocolic approach for laparoscopic pyeloplasty enables a significant shorter operative time without increasing morbidity with comparable result to that of conventional retrocolic approach even in the presence of large renal pelvis, aberrant vessel and associated renal stones.

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