

Laparoscopic & Laparoscopic Assisted Pyeloplasty for Repair of Pelvi-ureteric Junction Obstruction in Children

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ABSTRACT

Objectives: The aim of this study is to evaluate our experience in transperitoneal laparoscopic & laparoscopic assisted pyeloplasty in children with pelvi-ureteric junction obstruction.

Methods: The data of all patients undergoing laparoscopic and laparoscopic assisted pyeloplasty at Queen Rania Hospital for Children, King Hussein Medical Center were retrospectively reviewed from prospectively collected data over four years (June 2009-2013). The medical records of 80 children who underwent transperitoneal laparoscopic and laparoscopic assisted Anderson Hynes dismembered pyeloplasty were reviewed.

Results: The sample included 34 females and 46 males; the mean age was 6.4 years (range 2 months to 12 years). Out of the 80 patients, six underwent bilateral pyeloplasty in the same operation, two of whom had bilateral pyeloplasty for crossing vessels. Mean operating time for the totally laparoscopic pyeloplasty was 200 minutes (range 120-400), while for the laparoscopic assisted pyeloplasty was 70 minutes (range 50-95) ($P < 0.05$). Hospital stay ranged from two to five days. There were no peri-operative complications, no conversion to open pyeloplasty. Seventy four patients showed improvement of renal function after removal of JJ stent by ultrasound and diuretic dynamic renogram (MAG3) scan, six patients underwent balloon dilation for anastomotic stenosis three months post-operatively.

Conclusion: Transperitoneal laparoscopic and laparoscopic assisted pyeloplasty in children are feasible, effective and safe techniques with minimal complications and give excellent long-term cosmetic and functional results. The hospital stay and convalescence are short and hence rapid return to normal activity is expected with less analgesia requirements. These procedures should be standardized and practiced in pediatric surgical units under the supervision of expert pediatric laparoscopic surgeons with high experience in pediatric urology to achieve the best outcome and learning curve.

Keywords: Children, laparoscopy, laparoscopic assisted pyeloplasty.

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Introduction

Pelvi-ureteric junction obstruction (PUJO) is the commonest cause of hydronephrosis in pediatric age group causing pain and increased rate of urinary tract infection (UTI), which may lead to

urosepsis. If not treated, serious drop in the renal function will occur which may lead to renal damage.^(1,2) The traditional open Anderson Hynes dismembered pyeloplasty known to be the procedure of choice for primary (PUJO), with success more than 90%.⁽³⁻⁶⁾ Other alternative less

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invasive surgical procedure such as endopyelotomy and balloon dilation has been tried but with suboptimal results.⁽⁷⁻¹⁰⁾

The revolution of minimally invasive reconstructive surgery and urology opened the horizon for this branch to be applicable in children with advantage of less hospitalization, faster convalescence and minimal morbidity.⁽¹¹⁻¹³⁾ In children, laparoscopic pyeloplasty was innovated in 1993 and reported with success rates similar to open surgery with all the advantages of minimally invasive surgery for congenital and acquired (PUJO).⁽¹⁴⁻¹⁷⁾ Although few authors prefer to perform laparoscopic pyeloplasty for children above the age of one year and open pyeloplasty for children less than one year,⁽¹⁸⁾ we perform both laparoscopic and laparoscopic assisted pyeloplasty for the age above three months. For obese children we perform the totally laparoscopic pyeloplasty (Fig. 1), while in slim and younger children we found that laparoscopic assisted pyeloplasty is convenient, simple with significant less operating time with all the steps of the totally laparoscopic pyeloplasty except that we perform the repair through 1-2cm port site incision as in the open technique with satisfactory outcome and good cosmetic results (Fig. 2 & 3). Many surgeons utilize the retroperitoneal laparoscopic approach but we found as other authors with large series^(19,20) that transperitoneal laparoscopic approach is easier, safe, and gives enough space for the mobilization, suturing and vascular control.

A benefit of the transperitoneal approach is the possibility that other laparoscopic procedure can be performed at the same time like contra lateral pyeloplasty, nephrectomy, and ureter reimplantation (Fig. 4 & 5). A few other laparoscopic procedures can be done by laparoscopy as well at the same time like hernia repair, cholecystectomy, and laparoscopic assisted orchidopexy.

In this study we present our experience in transperitoneal laparoscopic and laparoscopic assisted pyeloplasty in children, these being the procedures of choice in our hospital.

Methods

With Institutional Review Board approval, the data of all patients undergoing laparoscopic & laparoscopic assisted pyeloplasty at Queen Rania Hospital for Children / King Hussein Medical Center was retrospectively reviewed from prospectively collected data over 4 years (June

2009-2013). Medical records of 80 patients who underwent transperitoneal laparoscopic and laparoscopic assisted Anderson Hynes dismembered pyeloplasty in children were reviewed. The indications for pyeloplasty were kidney obstruction with deterioration of renal function proved by diuretic dynamic renogram (MAG3) and ultrasound demonstrating hydronephrosis and the degree of dilatation of renal pelvis along with normal ureteric caliber or non visualized ureter. Preoperative evaluation completed by renal function test, urine culture and intravenous urography (IVU) in limited cases. Symptomatic patient with hydronephrosis and renal split function $\geq 10\%$ were considered candidates for pyeloplasty. In our series, Pelvi-ureteric junction obstruction (PUJO) was primary in 75 patients, two patients had secondary stones and three patients had re do pyeloplasty after open surgery.

We perform the procedure under general anesthesia. The patients were placed in a lateral position with three 5mm working ports, one umbilical port for the lens, second port half way between the umbilicus and anterior superior iliac spine. The third port at upper third of linea alba.

In the laparoscopic assisted technique, the third port placed just above the pelvi-ureteric junction point to facilitate delivery of the pelvi-ureteric junction. To avoid mobilization of the colon in the left side pyeloplasty, we innovated the trans-mesocolic approach through a window in the left mesocolon. Mobilization of renal pelvis and upper ureter was done. This was followed by anchoring the renal pelvis to the abdominal wall by percutaneous sutures in order to keep the renal pelvis steady for the reconstruction in the totally laparoscopic cases.

In the laparoscopic assisted cases, delivery of the mobilized renal pelvis and upper ureter was accomplished through the port just over the pelvi-ureteric area by increasing the port incision about 1-2cm through which we completed the repair as in the open technique (Fig. 1).

In right side pyeloplasty, limited mobilization of the ascending colon and reflection medially is achieved to finalize the repair in both techniques.



Fig. 1: Laparoscopic left pyeloplasty scar



Fig. 2: Left laparoscopic assisted pyeloplasty ports and incision at the end of procedure



Fig. 3: Right laparoscopic assisted pyeloplasty scar



Fig. 4: Right laparoscopic pyeloplasty and laparoscopic bilateral inguinal hernia repair



Fig. 5: Left laparoscopic pyeloplasty and right laparoscopic ureter reimplantation

The PUJ was resected and the anastomosis made using 6/0 and 5/0 absorbable sutures. In the first group, laparoscopic assisted pyeloplasty was done in 62 patients, in the second group, 18 patients underwent totally laparoscopic pyeloplasty. Reduction of the renal pelvis was performed in 60 renal units from both groups. Ante grade JJ stent was inserted by laparoscopy and laparoscopic assisted maneuver in 74 renal units from both groups. Perianastomotic drain was placed for two days in 15 patients from both groups. Bladder catheter was inserted in all patients for 24-48 hours to maintain decompression for anastomotic protection. Parameters of operative time, the need for blood transfusion, analgesic requirement, peri-operative complications, hospital stay and

outcome of surgery were evaluated. All patients received intravenous dose of antibiotics at the induction of anesthesia as per hospital protocol (ampicillin+gentamycin) then a prophylactic oral antibiotic (Trimethoprim/sulfamethoxazole) or cephalexin at one third of the therapeutic dose at bed time until removal of the JJ stent to prevent urinary tract infection (UTI). All patients received morphine IV slowly at a dose of 0.1mg/kg 6-8 hourly and 15mg/kg paracetamol suppositories 6-8 hourly for pain management (Table I).

We consider success after improvement of pre-operative symptoms coupled with improvement of drainage on postoperative diuretic dynamic renogram (MAG3) scan as well as decrease in the degree of hydronephrosis by ultrasound.

Table I: Demographic data

Parameters		Values
Age		Mean 6.4 years Range 2 months- 12 years
Patients number:	80	Male 46 Female 34
Laparoscopic pyeloplasty	18	Right 32 Left 48 Bilateral 6
Laparoscopic assisted pyeloplasty	62	
Primary pelvi –ureteric junction obstruction		75
Secondary pelvi –ureteric junction obstruction		2
Re do laparoscopic pyeloplasty		3
Reduction of renal pelvis		60
Peri- anastomotic drain		15
Other laparoscopic procedure		6
Foleys catheter		80
Double J stent		74

Table II: Intra-operative parameters and complications

Parameters	Values
Laparoscopic pyeloplasty operative time	Mean 200 minutes Range 120-400 minutes
Laparoscopic assisted pyeloplasty operative time	Mean 70 minutes Range 50-95 minutes
Blood transfusion	Nil
Crossing vessels	12
Conversion	Nil
Intra-operative complications	Nil
Other laparoscopic procedure (same time)	6

Table III: Post-operative parameters and complications

Parameters	Values
Oral intake (Hours)	Mean 12 hours Range 6-42 hours
Antibiotic used	Gentamycin & Ampicillin IV Cephalexin or Septrin Oral
Analgesia used	Bupivacaine local Morphine infusion Paracetamol rectally
Foley's removal	Mean 2 days Range 1-5 days
Drain removal	Mean 3 days Range 2-6 days
Hospital stay	Mean 3 days Range 2-5 days
Back to normal activity	Mean 5 days Range 4-10 days
Anastomotic stricture & balloon dilatation	6 cases
Follow up (Months)	Mean 12 months Range 6-48 months
Success rate	92.5%

Follow-up included clinical assessment, functional assessment by ultrasound, renal function test and urine culture. Cystoscopic removal of the JJ stent took place eight weeks postoperatively. We requested MAG3 scan at three and six months postoperatively to detect early post operative anastomotic stricture. We performed renal ultrasound every two months to evaluate the degree of hydronephrosis. In the second year postoperatively we repeat the MAG3

scan every six months. Later we do renal ultrasound every six months. When hydronephrosis remains stable, we repeat the ultrasound every year and MAG3 scan when there is increase of hydronephrosis.

Results

Patients included in the study were 34 females and 46 males; the mean age was 6.4 years (range 2 months - 12 years). All patients underwent the

Anderson Hynes dismembered pyeloplasty by laparoscopy or laparoscopic assisted technique. Right sided pyeloplasty was performed in 32 patients while the other 48 patients had left sided pyeloplasty. An aberrant crossing vessel was found in 12 patients. Out of the 80 patients, six patients underwent bilateral pyeloplasty, two of them had the bilateral pyeloplasty for crossing vessels. Three patients underwent re-do pyeloplasty by laparoscopy. Mean operating time for the totally laparoscopic pyeloplasty was 200 minutes (range 120-400), while for the laparoscopic assisted pyeloplasty was 70 minutes (range 50-95) revealing significant differences ($p < 0.05$) using the Chi square test.

In our series, one patient had simultaneous laparoscopic cholecystectomy, one patient had bilateral inguinal hernia repair, one patient had laparoscopic nephrectomy, two patients had contra-lateral extra-vesical ureteric reimplantation and one patient had bilateral laparoscopic assisted orchidopexy. The mean hospital stay for all patients was three days, range from two to five days. There were no intra-operative or post-operative complications. There was no need for conversion to open pyeloplasty. Blood transfusion was not required. There was no anastomotic leak and there were no mortalities (Table II). Seventy four patients showed improvement of renal function after removal of JJ stent by ultrasound and isotope scan, six patients underwent once balloon dilation for anastomotic stenosis three months post-operatively after follow up by MAG3 scan and ultrasound. At a mean follow-up of 12 months (6-48) the overall success rate was 92.5% (Table III).

Discussion

The traditional open Anderson Hynes dismembered pyeloplasty known to be the procedure of choice for primary PUJO, with success more than 90%.⁽³⁻⁶⁾ Other alternative less invasive surgical procedure such as endopyelotomy and balloon dilation have been tried but with suboptimal results.⁽⁷⁻¹⁰⁾ Laparoscopic pyeloplasty is described in adults with favorable results equivalent to open pyeloplasty with minimal complications and decreased morbidity.^(12,13) Many surgeons utilize the retroperitoneal laparoscopic approach but we found as other authors with large series^(19,20) the

transperitoneal laparoscopic approach is easier, safer, gives enough space for the mobilization, suturing and vascular control. Other advantages of the transperitoneal laparoscopic and laparoscopic assisted pyeloplasty is the ability to perform synchronous other laparoscopic or urological procedure when indicated saving the patient other session of anesthesia, admission and cost. Laparoscopic pyeloplasty is less invasive and well established in adults with reported success rate comparable to open pyeloplasty.⁽¹²⁾

Successful reports of pediatric laparoscopic pyeloplasty were not published until large series with long term outcome are available.^(16,21,17) Our series of 80 pediatric laparoscopic & laparoscopic assisted pyeloplasty reflects the effectiveness of this technique as other large series.⁽²²⁾ The transperitoneal approach which we utilized in all our patients is commonly used, although retroperitoneal approach has also been described.^(21,23,24) In the left side pyeloplasty we utilize the Trans-mesocolic approach which proved to be safe and time saving with minimal risk of bowel injury by avoiding the mobilization of the left side colon.^(25, 26) We insert the JJ stent by the antegrade technique successfully in 74 renal units, same technique was described previously.⁽²⁷⁾ Six patients were operated upon without stent. In the first 15 cases we placed peri anastomotic drain for two days. Once we observed no anastomotic leak, we stopped to leave drains. In 12 patients, crossing vessels were encountered, two patients underwent successfully bilateral laparoscopic pyeloplasty for crossing vessels. Few authors reported variable incidence of crossing vessel.^(28,29)

In our study, four patients underwent bilateral laparoscopic assisted pyeloplasty. Other patients had the benefit to receive other synchronous laparoscopic procedures which makes this technique acceptable.

The parameters of estimated blood loss, operative time and hospital stay in our study were comparable to other reports in pediatric age group.^(16,22,30-32) Since we started the laparoscopic assisted pyeloplasty, most of these parameters significantly improved, especially the operating time. In our series, we had no conversions to classical open pyeloplasty which is better than other reports.^(16,22,30-32) In our present study, we had no major or immediate complications

compared to other reports.^(16,22,30-32,33-36)

Our six patients who had late anastomotic stenosis had antegrade balloon dilatation once, making this comparable to other reports. The learning curve for laparoscopic pyeloplasty in children is steeper and longer compared to their adult counterparts. Laparoscopic pyeloplasty in children is challenging and more difficult especially in younger children. Our protocol of follow up is comparable with other series and the success rate of 92.5% is comparable with other pediatric series, which range between 87-100%.^(22,30-32)

Conclusion

Transperitoneal laparoscopic and laparoscopic assisted pyeloplasty in children is a feasible, effective and safe technique with minimal complications. The lengths of hospital stay and the convalescence are short and hence rapid return to normal activity is expected with less analgesia requirements. The laparoscopic pyeloplasty is more difficult and the operative time remains longer than open pyeloplasty, while the laparoscopic assisted pyeloplasty operative time is even less than the open procedure and the operative time could be reduced by experience. Laparoscopic and laparoscopic assisted pyeloplasty technique should be standardized and practiced in pediatric surgical units under the supervision of expert pediatric laparoscopic surgeons with high experience in pediatric urology to achieve the best outcome and learning curve. Follow-up examination verified perfect cosmetic and functional result with excellent patient and family satisfaction.

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