



Global minimally invasive pyeloplasty study in children: Results from the Pediatric Urology Expert Group of the European Association of Urology Young Academic Urologists working party

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Keywords

Pyeloplasty; Laparoscopy;
Robot; Children

Received 5 January 2016

Accepted 24 April 2016

Available online 12 May 2016

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Summary

Introduction

Minimally invasive pyeloplasty (MIP) for ureteropelvic junction (UPJ) obstruction in children has gained popularity over the past decade as an alternative to open surgery. The present study aimed to identify the factors affecting complication rates of MIP in children, and to compare the outcomes of laparoscopic (LP) and robotic-assisted laparoscopic pyeloplasty (RALP).

Materials and methods

The perioperative data of 783 pediatric patients (<18 years old) from 15 academic centers who underwent either LP or RALP with an Anderson Hynes dismembered pyeloplasty technique were retrospectively evaluated. Redo cases and patients with anatomic renal abnormalities were excluded. Demographics and operative data, including procedural factors, were collected. Complications were classified according to the Satava and modified Clavien systems. Failure was defined as any of the following: obstructive parameters on diuretic renal scintigraphy, decline in renal function, progressive hydronephrosis, or symptom relapse. Univariate and multivariate analysis were applied to identify factors affecting the complication rates. All parameters were compared between LP and RALP.

Results

A total of 575 children met the inclusion criteria. Laparoscopy, increased operative time, prolonged hospital

stay, ureteral stenting technique, and time required for stenting were factors influencing complication rates on univariate analysis. None of those factors remained significant on multivariate analysis. Mean follow-up was 12.8 ± 9.8 months for RALP and 45.2 ± 33.8 months for LP ($P = 0.001$). Hospital stay and time for stenting were shorter for robotic pyeloplasty ($P < 0.05$ for both). Success rates were similar between RALP and LP (99.5% vs 97.3%, $P = 0.11$). The intraoperative complication rate was comparable between RALP and LP (3.8% vs 7.4%, $P = 0.06$). However, the postoperative complication rate was significantly higher in the LP group (3.2% for RALP and 7.7% for LP, $P = 0.02$). All complications were of no greater severity than Satava Grade IIa and Clavien Grade IIIb.

Discussion

This was the largest multicenter series of LP and RALP in the pediatric population. Limitations of the study included the retrospective design and lack of surgical experience as a confounder.

Conclusions

Both minimally invasive approaches that were studied were safe and highly effective in treating UPJ obstruction in children in many centers globally. However, shorter hospitalization time and lower postoperative complication rates with RALP were noted. The aims of the study were met.

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Introduction

Open surgical dismembered pyeloplasty (Anderson-Hynes procedure) has long been the gold standard treatment for UPJ obstruction in children [1]. With the advent of minimally invasive surgery over the last decades, laparoscopic (LP) and robotic-assisted laparoscopic pyeloplasty (RALP) have gained increased popularity as alternatives to open surgery. The proposed benefits of conventional laparoscopy are: decreased length of hospital stay, improved cosmesis, and reduced postoperative pain [2,3]. A recent meta-analysis in children showed that LP was associated with decreased length of hospital stay and complication rates, but prolonged operative time when compared with open pyeloplasty (OP) [4]. Additionally, both LP and OP had equal success rates in this meta-analysis. Accordingly, The European Association of Urology (EAU)/European Society for Pediatric Urology guidelines on pediatric urology state that in experienced hands, the success rates (90–95%) of minimally invasive pyeloplasty (MIP) are similar to the open classical approach [1]. Robotic-assisted laparoscopic pyeloplasty has the same advantages as LP plus better maneuverability, improved vision, ease in suturing, and increased ergonomics [5]. Despite the advantages of RALP, the cost of the equipment is a major limitation for worldwide adoption of this technology [2–5].

Within the pediatric population, minimally invasive approaches are relatively novel. Thus, there is a paucity of evidence to demonstrate the factors influencing complications of MIP. Moreover, available studies are limited in terms of generalizability as they are reporting single center experiences that are underpowered to capture relevant outcomes. In the present multi-centric study, the primary objective was to identify the factors affecting complication rates of MIP in children. The secondary objective was to compare the outcomes of LP and RALP. It is believed that this is the largest series of MIP in the pediatric population reflecting the outcomes from many centers globally.

Methods

The Pediatric Urology Expert Group of EAU Young Academic Urologists organized this study. Institutional review board approval was obtained prior to the study. Centers with experience in pediatric MIP were invited to submit their data. The overall inclusion period was between 2003 and 2015 (RALP 2010–2015; LP 2003–2015). Demographics and operative data, including procedural factors, were collected from 15 academic centers (13 Europe, two USA) globally. Inclusion and exclusion criteria were applied on the collected data before statistical analysis was performed. Patients with UPJO, <18 years old, and who underwent LP or RALP with an Anderson-Hynes dismembered technique were included. Redo cases and patients with anatomic renal abnormalities (pelvic kidney, horseshoe kidney, duplex systems, etc) were excluded. Children with incomplete follow-up imaging and incomplete surgical data were also excluded from analysis.

Follow-up data included initial and final imaging studies such as US and scintigraphy. Failure was defined as any of the following: obstructive parameters (plateau-shaped

diagram and prolonged T1/2 period when compared with the initial study) on diuretic renal scintigraphy (MAG-3 or DTPA), decline in renal function on DMSA, progressive hydronephrosis on ultrasound (US), or symptom relapse (recurrent febrile UTI, recurrent flank pain) during clinical follow-up. Otherwise, if none of the above was identified during the follow-up period, the procedure was considered as successful.

Statistical analysis

Complications were classified according to the Satava (intraoperative) and modified Clavien (postoperative) systems [6,7]. The potential risk factors that can influence the complications were meticulously identified. Univariate analysis was applied to identify factors affecting the complication rates. Factors identified to be associated with outcomes on univariate analysis were further carried on to a multivariate logistic regression analysis where all covariates were imputed in the model simultaneously. The mean values of all the parameters were compared between LP and RALP using *t*-test or Chi-squared tests, where appropriate. SPSS-16 for Windows (SPSS, Inc, Chicago, IL, USA) was used for statistical analysis, and $P < 0.05$ indicated statistical significance.

Results

Pre-operative characteristics

Of the 783 children from 15 academic institutions, a total of 575 met the criteria, including: 390 LP and 185 RALP. The mean age of the patients was 8.0 ± 5.1 years (range 0–18). Pre-operative characteristics, including sex distribution, laterality, preoperative renal pelvis antero-posterior (AP) diameter and the split functions of the affected kidneys, were comparable between LP and RALP (Table 1).

Complications

The complications were listed and graded according to Satava and Clavien classification systems in Table 2. A total of 72 (12.5%) complications (36 intraoperative and 36 postoperative) occurred with MIP in 575 children. The most common intraoperative complication ($n = 24$, 4.1%) was due to complicated double-J (DJ) stent insertion (inability to place the DJ stent into the ureter). The other complications included bleeding, crossing vessel injury, and spleen injury. The most common postoperative complication was the need for a second procedure ($n = 12$, 2.0%) under general anesthesia due to clot retention obstructing the stent, missed drain, or stent misplacement. The rest of the postoperative complications included urine leak, UTI, pain, and fever. All complications were of no greater severity than Satava Grade IIa and Clavien Grade IIIb.

When looking at the timing of the postoperative complications, urine leak, necessity of blood transfusion and ileus were observed within the first 3 days. When a second procedure was necessitated for clot retention, stent

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