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Failed pyeloplasty in children: Is robot-assisted laparoscopic reoperative repair feasible?

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Summary

Objective
In this study we aim to demonstrate that robot-assisted laparoscopic (RAL) reoperative repair is safe and effective and even less technically demanding than open repair for recurrent ureteropelvic-junction obstruction (UPJO).

Study design
A retrospective study was conducted of all cases of failed open pyeloplasties who underwent RAL reoperative repair at our institution between January 2010 and December 2013. The general surgical procedure was the same we previously described for robot-assisted laparoscopic pyeloplasty.

Success was defined as: improvement in the degree of hydronephrosis at ultrasound, improvement of diuretic washout time at postoperative diuretic renogram (<15 min), improvement or at least stable differential renal function and absence of symptoms. These radiographic and symptomatic criteria of success were considered the primary outcomes. Secondary outcomes included complications and length of hospital stay.

Results
Between 2000 and 2013 a total of 153 patients underwent open Anderson-Hynes dismembered pyeloplasty. Of these 9 (6%) had recurrent UPJO. Four patients underwent open redo pyeloplasty. As a result, our study population comprised 5 children who underwent reoperative RALP repair.

Patient characteristics and outcomes are summarized in the table below. Our success rate was 100%.

Discussion
Due to the low failure rate of open dismembered pyeloplasty there is no consensus on the best surgical approach for recurrent obstruction. While endoscopic approaches have been favored in adults, children have shown better success rates with repeat pyeloplasty.

Laparoscopic salvage pyeloplasty for failed open procedures has become more popular and has been shown to result in excellent outcomes while providing the advantages of minimally invasive surgery. To date, the literature regarding the use of RALP for failed open procedures in the pediatric population is scarce. Only 2 pediatric series of robotic reoperative pyeloplasty have been reported by Helmal et al. (9 patients) and Lindgren et al. (16 patients) with a success rate of 100 and 88%, respectively. Although this is one of the first published studies about robot-assisted laparoscopic reoperative repair for failed open pyeloplasty in pediatric patients, we acknowledge the limitations of our study due to the small number of patients, its retrospective nature and limited follow-up time.

Conclusions
The incidence of failed open pyeloplasty is as low as 5% and management remains controversial. As reported by other authors, we believe that crossing vessels play a particularly important role in secondary obstruction and adversely impact the outcome. Redo pyeloplasty, open or minimally invasive, is associated with high success rates (80–100%) and therefore considered the treatment of choice by the majority of authors nowadays. Additionally, RALP for secondary procedures has demonstrated to be safe and even less technically demanding when compared to the open approach, providing the advantages of minimally invasive surgery.

Patient	Age (years)	Weight (kg)	Indication for reintervention	Crossing vessels	Success (obstruction resolved and asymptomatic)	Complications	Follow-up (months)
1	10	32	Obstruction	Yes	Yes	No	19.4
2	18	73	Obstruction/pain	Yes	Yes	No	11.8
3	8	40	Pain	Yes	Yes	No	26.5
4	15	61	Obstruction	No	Yes	No	26.1
5	11	49	Obstruction/decrease renal function	No	Yes	No	38.0

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Introduction

Anderson—Hynes dismembered pyeloplasty is the treatment of choice for ureteropelvic junction obstruction (UPJO) in children, with overall success rates higher than 90% [1—6]. Open dismembered pyeloplasty has been the reference standard for the management of UPJO in children since it was first described by Anderson and Hynes in 1949 [7]. However, since the advent of laparoscopy and the first description of laparoscopic pyeloplasty (LP) by Schuessler these standards have changed, and nowadays LP has been shown to provide similar success rates to open surgery with the advantage of better cosmetic outcomes, shorter hospital stays, and reduced postoperative pain, especially in older children [8—10]. Yet LP remains a technically demanding procedure with a long learning curve that is mainly hindered by the small number of patients available in pediatric surgery [2,9,11]. The introduction of robotic surgery (RS) has partially reduced the limitations of laparoscopy in pediatric urology and has proven to be especially useful for some indications such as reoperations for failed open pyeloplasty [12]. RS offers the means to overcome the main difficulties of laparoscopic surgery, such as intracorporeal suturing and provides an excellent operating field [13].

Consensus on the best approach is lacking due to the low incidence of failed open pyeloplasty in children. Described treatment options are open redo, endourologic, or laparoscopic approach. The aim of this study was to analyze our robot-assisted laparoscopic reoperative repair for failed open pyeloplasty to determine whether this technique is feasible or not and which are the main advantages of RS in this field.

Materials and methods

A retrospective study was conducted of all cases of failed open pyeloplasties who underwent RAL reoperative repair at our institution between January 2010 and December 2013. Age at first intervention, time from first intervention, and the previous performed open surgical approach were collected. All patients underwent a previous standard open dismembered pyeloplasty.

Preoperative imaging studies included renal ultrasound and diuretic renogram. Magnetic resonance imaging (MRI) was performed only in patients with suspected crossing vessels (intermittent flank pain). Indications for reintervention were pain, worsening hydronephrosis/obstruction, or a decrease in renal function. Obstruction was defined as a half-time washout of greater than 20 min.

The general surgical procedure was the same as previously described for robot-assisted laparoscopic pyeloplasty (RALP) [13]. In all cases we performed a transperitoneal approach with placement of four trocars (3 robotic trocars: two 8 mm for the working arms and one 12-mm optic trocar, and 1 conventional 5 mm laparoscopic). We performed a transmesenteric approach on the left side, and on the right side we reflected the right colon. The technique used was the dismembered pyeloplasty Anderson—Hynes type. For the ureteropelvic anastomosis we used a 4-0 barbed synthetic absorbable monofilament running suture. In all patients a double J stent was introduced, once the posterior anastomosis was completed, through the conventional laparoscopic trocar. Prior to placement of the catheter a solution of saline and methylene blue was instilled into the bladder through the urethral catheter. The double J catheter was introduced until the appearance of blue solution through the proximal holes, thus certifying its arrival in the bladder. Four weeks later the catheter was removed under general anesthesia. We did not routinely place drains. The urethral catheter was removed during the first postoperative day.

All the procedures were performed by the same pediatric urologist trained in using the robot.

Success was defined as improvement in the degree of hydronephrosis at ultrasound, improvement of diuretic washout time at postoperative diuretic renogram (at least $<$ 15 min), improvement or at least stable differential renal function, and absence of symptoms. These radiographic and symptomatic criteria of success were considered the primary outcomes. Secondary outcomes included complications and length of hospital stay.

Histopathological findings were collected both from the primary intervention and reintervention in all patients.

Follow-up did not differ from that performed routinely in primary RALP. We performed a renal ultrasonography 3, 6 and 12 months after the procedure and annually afterwards. Diuretic renogram was requested when no resolution or a worsening hydronephrosis was observed on ultrasound, when recurrent symptoms appeared, or in patients with previous renal impairment. Patients are followed up in outpatient pediatric urology clinic until the age of 16 years.

Results

Between 2000 and 2013 a total of 153 patients underwent open Anderson—Hynes dismembered pyeloplasty. Of these nine (6%) had recurrent UPJO. Four patients underwent open redo pyeloplasty. As a result, our study population comprised five children (4 boys and 1 girl) who underwent reoperative RALP repair. None of the patients had a history of endopyelotomy. Patient characteristics are shown in Table 1. One patient had bilateral UPJO and underwent previous bilateral open pyeloplasty. The recurrent obstruction presented on the right side. Mean age at reintervention was 13.83 years (SD 3.36) and mean weight 51 kg (SD 16.35). The salvage RALP procedure was performed at a mean of 10.59 years (SD 1.39) since the recent open UPJ surgery. Preoperative and postoperative imaging studies are summarized in Table 2.

Indications for reintervention were pain in one patient in whom the open pyeloplasty was performed 7 years before through a left flank incision. He was asymptomatic for 6 years and after that he had recurrent episodes of pain on the left side. An MRI scan showed a crossing vessel that seemed to be the cause of the obstruction (Fig. 1) and was probably missed in the first surgery. After RAL repyeloplasty he remains asymptomatic. In four patients indication for reintervention was worsening hydronephrosis and radiologic evidence of obstruction. Two of them had unrecognized crossing vessels demonstrated to be the cause of

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