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Laparoscopic transposition of lower-pole crossing vessels: Long-term follow-up of 33 patients at puberty

François-Xavier Madec [a], Sébastien Faraj [a], Thierry Villemagne [a,b], Laurent Fourcade [c], Hubert Lardy [b], Marc-David Leclair [a]

[a]Paediatric Surgery and Urology Department, Children University Hospital, Nantes, France

[b]Paediatric Surgery Department, University Hospital, Tours, France

[c]Paediatric Surgery Department, University Hospital, Limoges, France

Correspondence to: M.-D. Leclair, Department of Paediatric Surgery and Urology, Children University Hospital, 7 Quai Moncousu, F-44093 Nantes, France, Tel.: +33 240 083 585; fax: +33 240 083 546

mdleclair@me.com (M.-D. Leclair)

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Summary

Purpose
Laparoscopic transposition of lower-pole crossing vessels (LPCV) has been described as an effective alternative to dismembered pyeloplasty in selected indications of hydronephrosis, with purely extrinsic vascular PUJ obstruction. We hypothesized that the initial good results of laparoscopic transposition of LPCV in children presenting with pure extrinsic PUJO were sustained at puberty when these children go through statural growth, without inducing significant changes in systemic arterial blood pressure. Hence, we analysed the long-term follow-up of adolescents successfully treated with this technique during childhood, reviewed after they have reached puberty, focusing on the incidence of recurrent symptoms, renal dilatation, and systemic hypertension.

Patients and methods
Early 2015, among a cohort of 70 patients prospectively followed-up since they had undergone laparoscopic transposition of LPCV during childhood (2005–2012), we performed systematic clinical assessment of the 33 adolescent patients (16 years; range 12–22) who had reached puberty age. Assessment focused on clinical examination, arterial blood pressure measurements, and renal ultrasonography (Table).

Results
The median delay since surgery was 67 months (31–113 months).

Arterial blood pressure adjusted for age and height was within normal range in all patients. Three patients had occasional episodes of abdominal pain: two of them had normal US (including during pain episodes), one had persistent extra-renal dilated pelvis with no calyceal dilatation. None of them showed obvious clinical characteristics linking the pain to a renal origin.

Renal US showed residual SFU grade 2 pelvicalyceal dilatation in 2/33 asymptomatic patients; SFU grade 1 extra-renal pelvis dilatation in 3, and was normal in the remaining. When Doppler analysis was performed, there was no evidence of lower-pole parenchyma perfusion defect.

Discussion
In adolescents successfully treated during childhood with transposition of LPCV, there seemed to be no impact of this procedure on systemic arterial blood pressure in adolescents after puberty, nor any evidence of late recurrence of symptoms or hydronephrosis. The main limitation of the present study relies in its retrospective nature, the limited sample size, and the obvious difficulty in adequate selection of candidate patients to this technique. The present experience however reinforces the hypothesis that a vast majority of children can be definitely cured with transposition of LPCV when they represent the sole aetiology of obstruction.

Conclusion
In the long-term follow-up, most adolescents successfully treated during childhood by laparoscopic transposition of LCPV for PUJ extrinsic obstruction remain asymptomatic, with normal arterial blood pressure, and normal renal ultrasound when they reach puberty.

Table 1 Patients characteristics.

Patients	$n = 33$
Age at surgery (years)	9.8 (5.9–16.3)
Delay since surgery (years)	5.6 (2.6–9.4)
Age at assessment (years)	15.8 (12.6–22.8)
Arterial blood pressure (z-score) in males	
Systolic	0.18 ± 1.17
Diastolic	0.29 ± 0.79
Arterial blood pressure (z-score) in females	
Systolic	0.57 ± 0.82
Diastolic	0.46 ± 0.70
Renal ultrasound pelvis anteroposterior diameter (mm)	
Preoperative	33 (16–60)
Postoperative (1 year)	8.5 (4–14)
Postoperative (last follow-up)	9 (4–31)

Quantitative values expressed as median (range). z-Score of arterial blood pressure compared with international norms, adjusted for gender, age, and height.

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Introduction

Pelviureteric junction obstruction (PUJO) is a functional impairment of urinary transport from the renal pelvis to the ureter. It represents a heterogeneous condition with variable aetiologies combining intrinsic and/or extrinsic causes of obstruction [1]. Extrinsic obstruction usually refers to the presence of aberrant lower pole crossing vessels (LPCV), fibrous band adhesions, or kinks in a normal-calibre PUJ [2].

The gold standard surgical technique for PUJO is the dismembered pyeloplasty, as described by Anderson and Hynes [3], which can be performed using either open, laparoscopic, or robot-assisted approaches.

The vascular relocation of LPCV (vascular hitch procedure), which was initially described in 1951 by Hellström et al. [4] is an attractive alternative to the dismembered pyeloplasty in the presence of LPCV without intrinsic obstruction. This procedure, which is easily performed through laparoscopy [5], obviates to open the collecting system and eliminates the need for drainage and ureteral stenting.

The laparoscopic (or robotic-assisted) vascular hitch procedure has been recently reported to be successful in treating a selected group of children with obstructive LPCV, and represents a safe and reliable alternative to standard dismembered pyeloplasty in children with purely extrinsic symptomatic obstruction [1].

We hypothesized that the initial good results of laparoscopic transposition of LPCV in children presenting with pure extrinsic PUJO were sustained at puberty when these children go through statural growth, without inducing significant changes in systemic arterial blood pressure (BP).

Patients and methods

Among a previously reported cohort of patients [1] prospectively followed-up since they had been successfully treated during childhood by laparoscopic transposition of LPCV at three paediatric institutions from 2005 to 2012, all adolescents who had reached puberty age were contacted in January 2015, and were sent a long-term assessment appointment after institutional clinical research board approval.

All patients referred for SFU grade I—II symptomatic hydronephrosis had undergone standard pre-operative imaging procedures, including renal ultrasonography (US) and mercaptoacetyl-triglycine (MAG-3) diuretic renography. All procedures had been performed transperitoneally by senior surgeons trained in minimally invasive surgery, after informed consent had been obtained. The LPCV procedure had been performed by laparoscopy or robot-assisted laparoscopy depending on surgeons preference, according to a previously described technique [1,6]. The patient was placed in a lateral modified position and a laparoscopic transperitoneal approach was performed via a standard three-port technique (5- or 10-mm laparoscope in the umbilicus, and two 5-mm working ports), or using 8-mm working trocars in the robot-assisted cases. Dissection of the LPCV and the anterior aspect of the renal pelvis should allow complete freedom of movement of the pelvis underneath the crossing vessels. Standardized intraoperative IV fluid administration included lactated Ringer solution (Dextrose 1.2%) at the basic maintenance rate with starving deficit compensation, in addition to a bolus of 20 mL/kg at the beginning of pelvic dissection, and a diuretic test with a 0.5 mg/kg furosemide injection at the end of mobilization to stimulate peristalsis and challenge drainage across the PUJ.

Intraoperative criteria for performing a vascular hitch procedure have previously been reported and discussed [1], including a normal-appearance, funnel-shaped dependent PUJ without any apparent stenotic segment, a normal calibre ureter, a decrease in pelvic dilatation at the end of mobilization, and good peristalsis across the PUJ, despite a diuretic challenge test without re-increase in hydronephrosis. If no suspicion of associated intrinsic obstruction was raised after extensive PUJ dissection, LPCVs were slightly displaced cranially and stabilized in a groove in the anterior wall of the pelvis using absorbable sutures.

For the present assessment, clinical examination focusing on frequency of episodes of flank or abdominal pain, urinary tract infections and renal stone disease, measurement of BP, and renal US combined with Doppler evaluation of the kidney were performed.

Success was defined as symptom resolution and considered the main clinical endpoint.

Secondary endpoints were the absence of hypertension or use of antihypertensive medication (hypertension was defined as average systolic BP and/or diastolic BP above the 95th percentile adjusted for gender, age, and height derived from published data [7,8]), persistence of sonographic improvement of hydronephrosis, and homogeneous vascularization of the kidney on the Doppler scan.

The results were expressed as medians and ranges for continuous variables, and as percentages for categorical variables.

For BP z-score was calculated by using BP norms for children [7] and adults [9] adjusted for gender, age, and height.

The pelvis anteroposterior (AP) diameter was analysed by one-way ANOVA (variance analysis) followed by the Bonferroni post hoc test. A p-value <0.05 was considered to indicate statistical significance.

Results

Patients

During the study period, a total of 302 children were surgically treated for PUJ obstruction in the three participating institutions, following surgical modalities that are detailed in the flow chart (Fig. 1). Among them, 70 cases (23%) of laparoscopic transposition of LPCV were performed and prospectively followed up. This cohort has previously been reported with a success rate of 67 out of 70 (96%) after a mean follow-up of 52 months [1]. Among this cohort, 36 out of 70 children who had reached puberty after an initially successful primary procedure were eligible for the present study. Three patients did not respond to the appointment and were not included in the present