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Laparoscopic transperitoneal pyeloplasty in children from age of 3 years: Our clinical outcomes compared with open surgery

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Abstract *Objective:* To report clinical outcomes for laparoscopic pyeloplasty (LP) in children compared with open pyeloplasty (OP) and literature findings.
Patients and methods: In a prospective study, the outcomes of 57 consecutive transperitoneal LP in children from the age of 3 years were analyzed and compared with a matched historic control group of OP and with series of LP in the literature. Successful result was defined as resolution of symptoms, no conversion or re-operation, improved hydronephrosis, and/or improved renographic drainage.
Results: Mean operative time was 177 (SD 50.5) min in the LP group and 108 (SD 25.6) min in the OP group ($p < 0.001$). Mean hospital stay was 1.2 (SD 0.46) days in the LP and 6.7 (SD 1.2) days in the OP group. Improvement in renographic drainage was observed more often after LP than after OP (98% vs 83%; $p = 0.010$). A successful result was reported in 56 (98%) LP and 54 (95%) OP ($p = 0.298$) patients. Our LP series demonstrates a high success rate compared to literature data.
Conclusions: Our LP has a similar success rate and more often improved renographic drainage in comparison to OP. Furthermore, our LP demonstrates a shorter hospital stay and favorable outcomes compared to the literature. We thus regard LP as standard treatment for repair of ureteropelvic junction obstruction in children from the age of 3 years.

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Introduction

Ureteropelvic junction (UPJ) obstruction is the commonest cause of hydronephrosis in children [1]. This obstruction may lead to deterioration of renal function and symptoms such as pain and infection. Open dismembered pyeloplasty (OP), described by Anderson and Hynes in 1949 [2], has proved over time to be a safe procedure for repair of UPJ obstruction with a success rate of around 90% [3—13]. This therefore is the gold standard against which any new technique must be compared.

Laparoscopic pyeloplasty (LP) in a child was first reported in 1995 by Peters et al. [14]. To date, around 30 centers worldwide have reported LP outcomes: the success rate ranges from 59% to 100% [4,5,8,9,11,13,15—44]. The reported advantage of LP over OP is that it causes less postoperative pain resulting in a shorter hospital stay and a more rapid recovery to normal activities [3—5,8,9,11,13,43]. However, LP is considered a challenging operation in children because it involves precise laparoscopic suturing of the pyelum to the small pediatric ureter. Consequently, LP has a marked learning curve and a longer operative time compared to OP [8,9,11,13,43]. Besides, complications requiring re-operation/re-intervention after LP are reported in up to 35% and conversion in up to 18% [16,34]. Training with a model for laparoscopic anastomotic suturing in LP may reduce the operative time, conversion rate and complications [45—48].

In 2006, we introduced LP in our clinic as a new treatment for UPJ obstruction in children from the age of 3 years. We developed and used a simple and inexpensive model to train and improve our LP anastomotic suturing performance. Before adopting LP as a standard treatment in our clinic, it must demonstrate outcomes at least equal to those of conventional OP combined with a clearly short hospital stay. The objective of our study was to report outcomes of LP in children in comparison to open surgery and the literature findings.

Patients and methods

Outcomes were prospectively evaluated in a study group consisting of 57 consecutive dismembered Anderson—Hynes LP procedures in children from the age of 3 years with UPJ obstruction (without other abnormalities of the kidney or ureter) between April 2006 and December 2010 (LP group; 3 bilateral). These outcomes were compared with results in a matched historic control group of children who underwent Anderson—Hynes OP from 1995 through 2005 (OP group). Matching criteria were age (within 3 years), gender, preoperative renographic relative function (within 10%), preoperative pain and aberrant crossing vessels. The indications for surgical repair were identical in the two groups: symptoms and/or renographic relative function $<$40% and/or antero-posterior diameter $>$4 cm on ultrasound, or progressive dilatation and/or strong caliceal dilatation.

The key elements of the Anderson—Hynes LP technique are a transperitoneal approach, camera port at the umbilicus, two 5-mm working ports, pneumoperitoneum at a pressure of 6 mmHg, mobilization of the colon (in 2 left LP, a transmesenterial approach) and spatulation of the ureter. A double-J stent is passed over a guidewire through the abdominal wall into the ureter. We used a hitch stitch for fixation and presentation of the renal pelvis (see Fig. 1). This stitch is placed through the abdominal wall just below the costal margin, passed through the renal pelvis, passed back through the abdominal wall and secured by a hemostat. After the stenotic UPJ is excised the anastomosis is sutured with three pairs of interrupted (6-0 or 5-0) poliglecaprone 25 (Monocryl Visi-Black®) sutures and a running polyglactin 910 (Vicryl®) 5-0 is used (Fig. 1). In the case of crossing lower pole vessels, we mobilize the crossing vessels and perform an ureteropelvic anastomosis anterior to the crossing vessels. No drain is left behind. The double-J stent is removed by cystoscopy 3—4 weeks later under brief anesthesia in daycare. All LP procedures were performed by the first and last authors. Previously, these pediatric urologists had only laparoscopic experience in diagnostic laparoscopy for impalpable testis.

We developed and used a home-based LP model to train and improve our intracorporeal anastomotic suturing performance. This training model includes a laparoscopy box, high-definition videocamera (manual focus) and monitor. Use was made of the same laparoscopic needle-holders, scissors, double-J catheter and suture material as applied in LP. The rubber valve of a bicycle tyre served as an ureter imitation; the fingertip of a domestic rubber glove as a pyelum (Fig. 2). Besides simulation of the ureteropelvic anastomosis, this model allows testing for watertightness and patency of the anastomosis and assessing the quality of suturing (Fig. 2e and f).

The key elements of the Anderson—Hynes OP are a retroperitoneal approach through a lumbotomy incision, excision of the UPJ, anastomotic suturing with interrupted and/or running with Monocryl (Visi-Black) 5-0 or 6-0 according to the surgeon's preference. A nephrostomy catheter is inserted and optionally an anastomotic stent. On the 5th or 6th postoperative day, the patency of the anastomosis is tested by clamping the nephrostomy catheter after flushing it with a blue dye. All OP had been performed or supervised by experienced pediatric urologists, including the four authors.

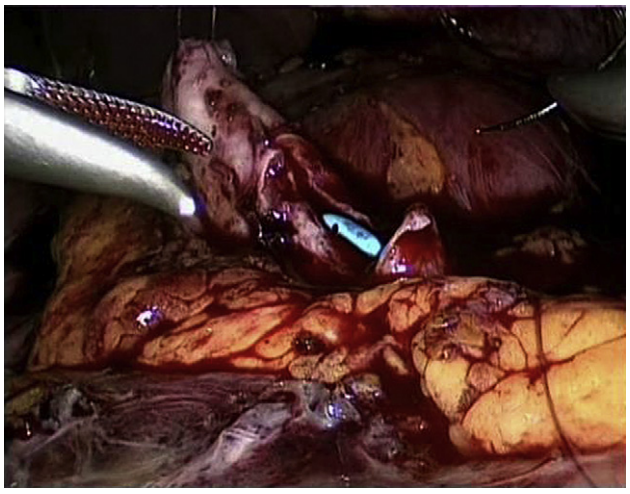

Figure 1 Laparoscopic pyeloplasty.