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Comparison of transumbilical multiport and standard laparoscopic pyeloplasty in children: Mid-term results at a single center

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ABSTRACT

Objective: To compare the efficacy of transumbilical multiport (TMLP) and standard laparoscopic pyeloplasty (SLP) for the treatment of congenital ureteropelvic junction obstruction in children.
Methods: Forty-eight patients were included in this matched-pair study. The TMLP applied three transumbilical incisions for one 5-mm and two 3-mm ports, whereas SLP was undertaken with traditional three-port technique. The demographic, perioperative, and follow-up data were retrospectively compared between TMLP ($n = 24$) and SLP ($n = 24$) groups.
Results: Two groups were matched according to patient's age, gender, laterality, weight, and surgical indication. TMLP and SLP were successfully performed in all patients, without conversion to open procedure. There was no significant difference between both groups in intraoperative blood loss, time to oral feeding, time to normal activities, pain scores, or complication rates. Longer mean operative time (125.4 ± 21.6 vs. 112.2 ± 25.2 min; $P = 0.012$) and better patient satisfaction (30.4 ± 4.5 vs. 24.6 ± 3.4; $P = 0.026$) were noted in TMLP group than those in SLP group. Mid-term follow-up indicated no significant difference in postoperative alleviation of hydronephrosis or improvement of renal function.
Conclusion: TMLP is a feasible and efficient procedure for the management of congenital ureteropelvic junction obstruction in children, with comparative outcome and better cosmetic results than SLP.

Ureteropelvic junction obstruction (UPJO) is a common urological condition, and the current gold standard surgery for management of this disease is the Anderson-Hynes dismembered pyeloplasty [1]. With the advent of minimally invasive treatment options, the first application of laparoscopic pyeloplasty in adult population was reported by Schuessler et al. [2] and Kavoussi and Peters [3]. Two years later, Peters et al. first demonstrated the feasibility of this procedure in pediatric setting [4]. Since then, laparoscopic pyeloplasty has been widely implemented as an ideal alternative for the treatment of UPJO [5].

Since standard laparoscopic pyeloplasty (SLP) requires at least three abdominal ports through separate wounds, it may result in potential incision complications and cosmetic shortcomings. Many pediatric urologists have tried to introduce the concept of laparoendoscopic single site surgery (LESS) into urology [6]. In 2008, laparoendoscopic single site pyeloplasty was first proved to be feasible [7]. During this procedure, the laparoscopic instruments were introduced through a single incision at the abdominal wall, usually at the umbilicus [7]. Nevertheless, the LESS approach requires specific multichannel laparoscopic ports [8] and articulating or pre-bent instruments [9], limiting its wide use in pediatric patients [10], especially in developing countries.

In an attempt to reduce the invasiveness of standard laparoendoscopic surgery and gain better cosmetic outcome, we have successfully performed various transumbilical multiport laparoscopic procedures using the usual instruments in children, including orchiopexy [11], nephroureterectomy [12], and pyeloplasty. Transumbilical multiport laparoscopic pyeloplasty (TMLP) has been shown to be feasible in pediatric population [13], although the efficacy of this technique and outcome of patients remain to be determined. Herein, based on the mid-term follow-up data from our center, we aimed to compare the perioperative parameters, procedural efficacy, and clinical outcome between TMLP and SLP for the treatment of congenital UPJO in children.

1. Patients and methods

1.1. Patients

After obtaining the approval from the institutional review board, a total of forty-eight pediatric patients with congenital UPJO were

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retrospectively evaluated. These patients underwent a minimally invasive pyeloplasty by either the SLP ($n = 24$, selected from matched patients at the duration ranging from January 2010 to July 2012) or TMLP techniques ($n = 24$, from April 2012 to December 2013) at the Department of Pediatric Surgery, Union Hospital, Tongji Medical College, China. Since April 2012, the potential benefits and limitations of both techniques were preoperatively introduced to the patients and their families, and the type of surgery was subject to patient's preference. Informed consent was obtained from all patients. Patients unfit for a laparoscopy and those with horseshoe kidney, lower pole crossing vessels, or bilateral pathologies were excluded from the study. All surgical procedures were performed by the same surgeon (Tong Q) using routine laparoscopic instruments, with different entrances through the abdominal wall.

All patients were submitted to renal ultrasound scan, magnetic resonance urography, and renal scintigraphy. The renal pelvis anteroposterior diameter, renal length, glomerular filtration rate, renal transit time, and differential renal function were determined by two experienced radiologists, and compared before and after pyeloplasty. Surgical correction of UPJO was indicated, if ultrasonography had revealed increasing dilatation of renal pelvis (anteroposterior diameter >20 mm) and/or MAG3-diuretic nephrography demonstrated a differential renal function <40% and/or an obstructive curve with a prolonged $T_{1/2}$.

1.2. Surgical procedures

1.2.1. TMLP technique

After the induction of general anesthesia, the patients were secured to the operating table, and placed in supine position with the affected side elevated to 30–45°. A transurethral bladder catheter was placed to decompress the bladder during port placement, and oral-gastric tube was routinely applied. Although the antegrade placement of double J stent during the procedure was a bit technically difficult, preoperative retrograde stenting was not necessary. The surgeon and camera assistant stood to the contralateral side of patients.

Three ports were transumbilically placed at different positions (Fig. 1A). The first 5-mm port was inserted for the camera by an open Hasson technique, at the contralateral aspect of the umbilical wound, and secured with a skin suture. Pneumoperitoneum was created using carbon dioxide to a maximum pressure of 10–12 mmHg, and was maintained at 8–10 mmHg. A rigid, 5-mm, and 30° telescope was introduced into the abdomen for an initial survey. During this procedure, one 3-mm working trocar was placed through the periumbilical incision for the dissecting instrument or needle holder, while the other 3-mm working trocar was usually applied for a grasper for retraction. In our series, one 3-mm working trocar was inserted at the right side of primary camera port, and the other 3-mm trocar was placed on the left side (Fig. 1B). During the insertion of two working ports, the trocars were laterally placed along subcutaneous planes before penetrating the peritoneum, resulting in longer intraabdominal distance between two instruments and wide triangulation of operating trocars. The assistant was always keeping the camera above or in the middle of two working instruments.

The following surgical steps were essentially the same as conventional laparoscopic pyeloplasty. The distended renal pelvis and UPJ were identified by reflecting the colon medially or through a transmesenteric window (Fig. 2A). The mesentery and Gerota's fascia were carefully incised, and the underlying UPJ was mobilized. The renal pelvis was stabilized with a traction suture or a “hitch stitch” by passing a needle percutaneously, and the dilated part was excised. Spatulation of ureter should be sufficiently long to cross the healthy and non-hypoplastic ureter (Fig. 2B). A “hitch stitch” of the ureter was not always essential. However, if needed, it could be easily placed. In our series, the anastomosis was started between the vertex of spatulated ureter and the most dependent part of renal pelvis (Fig. 2C). The anastomosis of posterior wall was accomplished using 5/0 or 6/0 polydioxanone continuous suture. Then, a double J stent was introduced percutaneously over a guidewire and placed between the renal pelvis and bladder (Fig. 2D). After anastomosis of the anterior wall, a portion of redundant renal pelvis was excised (Fig. 2E), and the remainder of anastomosis was then completed (Fig. 2F). The mesenteric window might be closed with sutures, which was not essential. A drainage tube was not routinely placed. After removal of the ports and evacuation of the pneumoperitoneum, the abdominal fascia at all ports was carefully closed with a 2-0 absorbable suture to prevent wound dehiscence or umbilical hernia development, and the transumbilical incisions were conglutinated by tissue adhesive glue.

1.2.2. SLP technique

The patients were similarly positioned in a lateral decubitus position with the affected kidney superior, and placed to the edge of operating table, which might facilitate the free movement of instruments without hindrance from the table. Access to the peritoneal space was achieved by an open Hasson technique in the region of umbilicus, and a 5-mm port was placed for camera. Under direct vision, two 3-mm working ports were inserted under the costal margin and in the ipsilateral iliac fossa, respectively. The techniques of SLP and TMLP in the abdominal cavity were similar. Further steps were in accordance with the TMLP.

1.3. Data collection

The ethics committee of Tongji Medical College granted approval for this study. The demographic and perioperative data of patients were collected, including additional ports, operative time, intraoperative blood loss, time to oral feeding, duration of hospital stay, time to ambulation, pain score assessed by visual analogue scale (VAS), patient satisfaction score assessed by Client Satisfaction Questionnaire (CSQ-8), perioperative complications, and success rates. The postoperative evaluation included urinalysis or urine culture, ultrasound examination, and renal scintigraphy. Renal ultrasonography was undertaken in all patients at one month after surgery, and was repeated 6 months

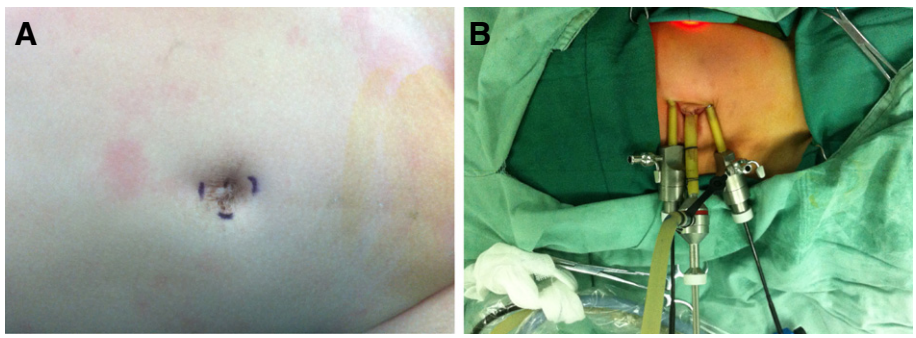

Fig. 1. Placement of transumbilical ports for TMLP (left side). **A.** Preoperative design of transumbilical port position for TMLP. **B.** One 5-mm port at the contralateral aspect and the 9 o'clock position of umbilicus for the camera, and two additional 3-mm working ports inserted through the periumbilical skin incision at the 6 and 12 o'clock position, respectively.