

# One-trocar-assisted pyeloplasty: An attractive alternative to open pyeloplasty

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## ABSTRACT

**Background:** To survey the effects of one-trocar-assisted pyeloplasty (OTAP) in the treatment of ureteropelvic junction obstruction (UPJO) in kids. **Materials and Methods:** Forty-four children ( $\pm 3.5$  years) were submitted to OTAP procedure. A flank incision under the XII rib was made, the Gerota's fascia was achieved and a balloon Hasson trocar with an operative telescope inserted for retroperitoneal access. The renal pelvis and ureter were isolated and exteriorised. Forty-two patients underwent Anderson-Hynes dismembered and one Fenger pyeloplasty. One patient was converted to an open procedure. Two patients presented an aberrant crossing vessel. In all patients, a double J stent was positioned. The operative time and length of stay (LOS) were evaluated. Renal scan and ultrasound (US) were utilised to evaluate the results from 6 to 12 months. **Results:** OTAP was successful in all but 1 patient. Mean operative time and LOS were 128 min and 3,5 days. We had four operative complications (9.09%). The US and a nuclear scan confirmed the resolution of the UPJO in all patients except one with the Fenger pyeloplasty who had an open Anderson-Hynes. **Conclusions:** The combination of retroperitoneoscopic and open procedures for dismembered pyeloplasty offers a simple, time-saving method in a minimally invasive fashion with low morbidity for patients with UPJO.

**Key words:** hydronephrosis, minimally invasive surgery, one trocar surgery, retroperitoneoscopy

## INTRODUCTION

For many years, open pyeloplasty has been the gold standard of surgical treatment of ureteropelvic junction

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obstruction (UPJO), enjoying a long-term success rate exceeding 90%.<sup>[1]</sup>

Minimally invasive techniques have become the preferred method over traditional open surgery for managing many urological diseases because these techniques provide equal or comparable success rates, decrease post-operative pain, and result in a shorter hospital stay. Laparoscopic or retroperitoneoscopic pyeloplasties in children have been considered in the treatment of UPJO with success rates comparable to the results of open approaches.<sup>[1-6]</sup> However, these procedures are technically challenging and require intra-corporeal suturing and knot-tying skills. Retroperitoneoscopic surgery has the disadvantages of a smaller working space, the crowding of trocars and working instruments, and a relative lack of anatomic landmarks. In 2004 and 2005, Farhat *et al.* and Lima *et al.*, respectively, described an innovative video-assisted technique using retroperitoneoscopy to visualise and isolate the UPJ while performing dismembered pyeloplasty extracorporeally.<sup>[7,8]</sup> This procedure was named 'one trocar-assisted pyeloplasty (OTAP)'. We report a retrospective study and the results of our experience of OTAP in the treatment of UPJO.

## MATERIALS AND METHODS

The study group consisted of children aged 4 months to 11 years with UPJO; the mean age was 3.5 years. We

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used this technique to treat 44 children (12 females and 32 males). Twenty-four patients had a prenatal diagnosis. The left/right ratio was 28/16. Exclusion criteria for the study were obese children and patients with previous retroperitoneal surgery.

The main indications for surgery were the following: Symptomatic UPJO (pain, infection, and palpable mass); worsening hydronephrosis; anterior-posterior (AP) diameter of  $>20$  mm with calyceal dilation and split renal function  $<40\%$  at MAG3 nuclear scan; AP diameter of  $>30$  mm.<sup>[9]</sup> Twenty-three patients (52.2%) were symptomatic with recurrent flank pain.

Under general anaesthesia, the patients were positioned in the standard lateral flank position. The Gerota's fascia was bluntly reached and opened through a flank 12 mm incision located 1 cm under the XII rib. A balloon 12 mm Hasson trocar was then inserted, and insufflation was initiated at a flow rate of 1/L per minute and a CO<sub>2</sub> pressure of 8-10 mmHg.

After the creation of the working space with a peanut, using a 10 mm coaxial operative telescope, the renal pelvis and the proximal ureter were inspected, isolated and then exteriorised at skin level with a vessel loop [Figure 1]. The lower pole of the kidney, lying on the psoas muscle, is encountered first, and these two structures serve as the most reliable and important anatomical landmarks. We employed stay sutures on the UPJ: 1 or 2 on the pelvis and 1 on the anti-mesenteric side of the ureter after exteriorising the hydro-nephrosis and during the pyeloplasty to maintain the correct anatomical relationship of the structures [Figure 2]. When the pelvis is very dilated, detention by simple puncture could be very useful in the exteriorisation of the UPJ. The dismembered pyeloplasty was performed as in the open technique, utilising a 5/0-7/0 absorbable (Maxon-PDS) suture with the help of  $\times 2.5$  loupes. After the pyeloplasty, the UPJ was positioned on its side, and a second retroperitoneoscopic look was performed to control the correct disposition of the new UPJ [Figure 3]. This is an important step because, in some patients, the anastomosis could be (twisted) distorted, resulting in ureteral kinking [Figure 3]. Forty-one patients were treated with dismembered pyeloplasty according to the Anderson-Hynes technique and 1 patient underwent Fenger pyeloplasty. Four patients with giant hydronephrosis had an intra-operative emptying injection to increase the retroperitoneal space and mobilise the UPJ. In the patients with aberrant crossing vessels, to pull up the UPJ, attention was paid to mobilise the vessel and the lower pole of the kidney;

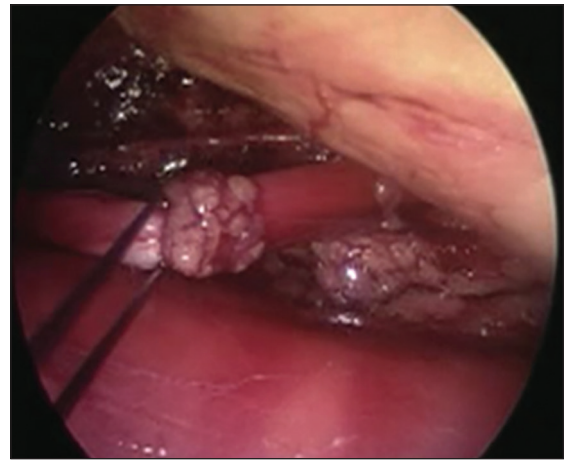


Figure 1: Retroperitoneoscopy: Renal pelvis and ureter exteriorisation

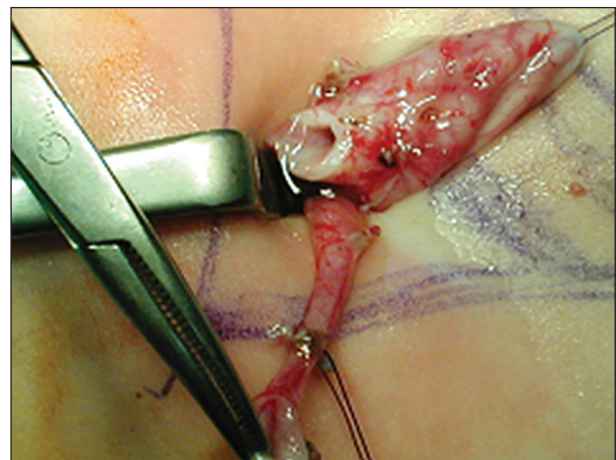


Figure 2: Ureteropelvic junction exposure: Stay sutures on the pelvis and the ureter for pyeloplasty

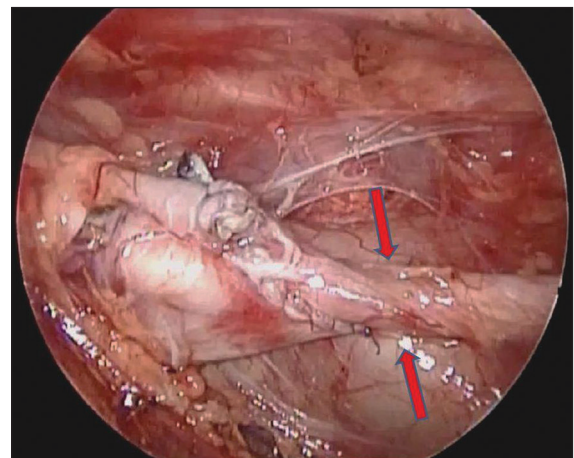


Figure 3: Second retroperitoneal look of pyeloplasty: Kinking of the anastomosis

in these patients, the junction could be divided and the anastomosis could be performed anterior to the vessel. In all patients, a double J stent was positioned as in the open technique and removed 4-6 weeks later. A Foley

bladder catheter was used for 24-48 h. The operative time, length of stay (LOS), and physiologic success rates were evaluated. The follow-up lasted 1-21 months with an ultrasound (US) at discharge and after 3-6-12 months. A renal MAG3 scan 6-12 months after the operation was performed in all of the patients.

## RESULTS

Forty-three procedures were successfully completed by OTAP. The mean operative time was 128 min (range 90-210), and the mean LOS was 3.5 days [Table 1]. All the patients were discharged on day 2-4 post-operatively. Two patients presented an aberrant crossing vessel. No intra-operative complications occurred except in 2 patients. One patient was converted to open procedure because of peritoneal perforation and subsequent difficult access to the retroperitoneal space; 1 patient had an immediate redo due to kinking of the ureter after a second look at the UPJ anastomosis by retroperitoneoscopy [Figure 3]. All the patients received routine antibiotic prophylaxis until the stent were removed. No functional obstructions were visualised using renal scintigraphy at 6-12 months after surgery in 43 of 44 patients. The patient that underwent the Fenger procedure showed a persistent obstructive MAG3 scan, and the patient underwent an open Anderson-Hynes procedure. Thirty-eight patients showed improved function on the scan, and the function remained stable in 5 patients. In all cases, renal US showed a decrease in the severity of hydro-nephrosis by at least 1°. All the symptomatic patients experienced pain resolution. Post-operatively, a small urinoma was recorded, and it spontaneously resolved in 7 days.

## DISCUSSION

In recent years, minimally invasive surgery has been widely used. Laparoscopic or retroperitoneoscopic pyeloplasty appears to be the treatment of choice in many centres because of the equal, or comparable success rates reported with respect to the open technique.<sup>[2,4,5]</sup> Many factors might be considered in the selection of

the best surgical approach such as surgeon experience and skills, patient age, symptoms, expectations, primary versus secondary obstruction, renal function and the degree of hydronephrosis, internal versus extrarenal pelvis, low versus high arterial insertion, kidney location and rotation, presence or absence of stones, stricture length and lower pole crossing vessel. The complete diagnostic studies influence the type of procedure and the expectations and limitations of the surgical procedure. Robot-assisted or single-site, as well as laparoscopic and retroperitoneoscopic pyeloplasty, require advanced technical skills; retroperitoneoscopic pyeloplasty has the disadvantages of a smaller working space, crowding of trocars and working instruments.<sup>[4,6,10-12]</sup> The classical gold standard against which all repairs should be compared is the open dismembered pyeloplasty, originally described by Anderson and Hynes with a success rate over 97%. In our experience, this technique was confirmed to be the gold standard procedure because the only Fenger technique we performed required to be corrected 6 months later with an open Anderson-Hynes due to a recurrence of the obstruction. OTAP is a combination of retroperitoneoscopic and open procedures that offers a simple, time-saving method in a minimally invasive fashion with low morbidity for patients with UPJO. Assuring the quality of repair, the method offers a minimally invasive alternative with good outcomes. The good cosmetic results, short convalescence period and hospital stay are comparable with the total laparoscopic or retroperitoneal pyeloplasty. Our results showed that once the retroperitoneum was accessed, it was not difficult extrapolate the UPJ. The procedure was not more difficult and did not require more time compared with an open operation. The main advantage of using retroperitoneal video surgery is the direct access to the genitourinary organs, with less dissection required to expose the kidney. However, some problems may be encountered with this technique. In obese children and in the intra-renal pelvis, the dissected pelvis may not reach the skin layer; in giant hydro-nephrosis, it may be useful to perform an emptying injection for dissection, although that could be unmanageable because of the small retroperitoneal space. In these cases, the preoperative diagnostic workup is fundamental for the technique application. In the patients with aberrant crossing vessels, the procedure could be easily performed by pulling up the UPJ after a gentle mobilisation of the vessel and the lower pole of the kidney. It is important, according to our experience, to always place stay sutures for the exact position of the UPJ for guiding the procedure.<sup>[13]</sup> In 1 patient, after the final retroperitoneal look [Figure 3], we observed

**Table 1: Operative parameters and surgical outcomes**

Parameters	Result
Conversion or intra-operative complication	2
Aberrant crossing vessels	2
Mean operative time (min) (range)	128 (90-210)
Mean hospital stay (days)	3.5
Post-operative complications	
Urinoma	1
Late recurrent stenosis requiring reoperation	1
Overall complication rate	9.09%

a ureteral kinking with difficult voiding of the pelvis; in this case, we redid the anastomosis. Furthermore, as in all minimally invasive procedures, the learning curve plays a pivotal role. The dismembered pyeloplasty does not differ from the open technique and needs to be performed with a large reduction of the pelvis and a sufficient resection of the hypo-plastic ureter. In our study, a stent or trans-anastomotic drainage was positioned in all patients, although this step is not mandatory, and it depends on the preference of the team.

Many different techniques have been proposed for pyeloplasty: The gold standard open, retroperitoneal, laparoscopic, laparoscopic video-assisted, retroperitoneal video-assisted, one trocar video-assisted, robotic and single-site.

Winfield discussed the subject in his editorial comment 'management of adult UPJO' if 'Is it Time for a New Gold Standard?'<sup>[14]</sup> He explained the diversity of the different surgical techniques available to repair a UPJO. Caution should be used in reporting post-operative success that should be critically evaluated objectively by a nuclear diuretic scan and subjectively (pain-free post-operative). Several series of laparoscopic and robotic repairs of UPJO demonstrated similar success rates. Robotic surgical platforms (da Vinci) have provided surgeons with better visualisation and better ergonomics, helping tremendously with intracorporeal suturing, which plays a primary role in pyeloplasty.<sup>[10,11]</sup> Despite this advantage, the higher price of the device is likely to persist and, therefore, could result in the limitation of this technique.

Laparoendoscopic single-site surgery emerged in 2007 as an option for a single-incision pyeloplasty, but the procedure is technically difficult.<sup>[12]</sup> The loss of instrument triangulation, trouble with the cross-handed operation, instrument clashing and reduced visibility and manoeuvrability associated with the coaxial orientation of instruments relative to the laparoscope make intra-corporeal suturing challenging even for expert laparoscopic surgeons.

Recently, Lima *et al.* discussed the results of this technique in a retrospective review of 88 patients; they concluded that OTAP was safe, feasible and efficacious, with a success and complication rate similar to the open technique.<sup>[15]</sup> In 2010, Caione *et al.* reported a comparative study between open and one trocar retroperitoneal-assisted pyeloplasty. He concluded that the latter is safe and minimally invasive and could represent the treatment of choice in young children.<sup>[13]</sup>

We believe that the combined application of a retroperitoneoscopic and open technique offers an efficient time-saving method with low morbidity for the patients. The vital part of this procedure is performed as in the traditional technique, and good results are obtained with the open procedure, provided that the criteria for obtaining a well-oriented anastomosis are strictly observed. Thus, this type of procedure is worth consideration for future clinical indications and applications.

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## Conflicts of interest

There are no conflicts of interest.

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