



Laparoscopic upper pole heminephroureterectomy in children: Seven-year experience

Antonio Marte, Alfonso Papparella, Lucia Pintozzi

ABSTRACT

Background: Minimally invasive surgery is the current approach to perform heminephroureterectomy (HN) in children. This can be obtained through a transperitoneal (TP) or a retroperitoneal approach. Here, we report our experience using a TP approach. **Materials and Methods:** From 2005 to 2014, 22 TP laparoscopic upper poles HN were performed at our institution. There were nine girls and 13 boys aged between 20 months and 6 years (mean age 3.9). Eight patients were diagnosed prenatally, 17 patients presented with urinary tract infection (UTI) and three with vomiting and failure to thrive. The indication for HN was reflux nephropathy and UTI in non-functioning upper pole in 19 patients and cystic dysplasia in 1 patient. The surgical technique involved the following steps: Cystoscopic recognition; positioning of 3-4 trocar (right HN); identification of the kidney (detachment of the colon); isolation and low ligation of the dilated ureter; decrossing from renal vessels; section of the parenchyma by LigaSure; haemostasis with clips and LigaSure; drain. **Results:** The mean operative time was 154 min (range: 81-220 min). All patients were discharged from the 2nd to 4th day. Neither major complication nor conversion was recorded. 1 patient presented leakage of urine for 7 days from the drainage which resolved spontaneously. At ultrasound follow-up, 5 patients showed a secondary perirenal cyst, 2-5 cm diameter that resolved spontaneously. **Conclusion:** The results indicate that laparoscopic upper pole heminephrectomy is the treatment of choice in cases of non-functioning dilated lower segments of duplicated kidneys. The use of laparoscopic approach offers a good working space, a good visual control of the vessels and allows a very low isolation of the ureteral stump which counterbalance the peritoneal violation.

Key words: Duplex kidney, heminephrectomy, infants, laparoscopy

INTRODUCTION

Duplex ureter is one of the most frequent malformations of the urinary tract, which occurs 1 in 125 cases or 0.8% of a non-selected population with female to male ratio of 1.6:1 or 62% of females.^[1]

The upper moiety is frequently obstructed, poor functioning, and can become symptomatic due to urinary tract infection (UTI), flank pain or stone formation.^[2] The anomaly can often go unrecognized until adulthood.^[3,4]

The standard surgical treatment of a non-functioning symptomatic renal moiety is ipsilateral heminephrectomy. Minimally invasive surgery in paediatric patients has made considerable progress in the past decade, so it became the current approach to perform heminephroureterectomy (HN) in children. This can be obtained through a transperitoneal (TP) or a retroperitoneal (RP) approach. Jordan and Winslow performed the first laparoscopic upper pole heminephrectomy in 1993.^[5]

Since then several reports on laparoscopic heminephrectomy have been published describing advantages, disadvantages and complications of the procedure. The aim of this study is to report a 9-year experience of TP upper pole heminephrectomy.

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MATERIALS AND METHODS

From 2005 to 2014, 22 laparoscopic upper poles HN (UHN) were performed at our Institution. There were nine girls and 13 boys aged between 20 months and 6 years (mean age 3.9). Eight patients were diagnosed prenatally, 17 patients presented with UTI and three with vomiting and failure to thrive. Eight patients were operated endoscopically for obstructing ureterocele and febrile UTI during the 1st month of life. One of these patients before the UHN had also had the refluxing ureter injected unsuccessfully with deflux. All patients were evaluated using ultrasounds (USs), voiding cystourethrography, 99mTc-MAG3 scintigraphy. In some patients computerised tomography scan or magnetic resonance imaging was also performed before surgery. The indication for UHN was reflux nephropathy and UTI in the non-functioning upper pole.

The surgical technique involved the following steps: Positioning of 3-4 trocars; the detachment of the colon and identification of the kidney; isolation and low ligation of the dilated ureter; decrossing from renal vessels; haemostasis with clips and LigaSure, as well as the section of the parenchyma; drain.

All operations were executed by the same surgical team.

In details:

1. A cystoscopy was performed before surgery for bladder recognition and to insert a 3-4 CH ureteral probe to protect the healthy ureter during the dissection.
2. Patients were then placed in a 45° lateral position under general anaesthesia.
3. A Hasson trocar was inserted through the umbilicus and pneumoperitoneum induced by the same mean. Under a laparoscopic view, intra-abdominal organs were examined, and two 5-mm trocars were inserted on the anterior axillary line of the upper and lower quadrant. On the right side in the majority of cases a fourth trocar were inserted to lift the liver.
4. The kidney was exposed by mobilising the colon medially from the retroperitoneum. The ureter draining the affected pole was identified and separated from the healthy ureter. Vessels branching to the pole were separated from the healthy branch, ligated, and cut using clips or LigaSure.
5. The UP renal parenchyma was transected using LigaSure and or electrocautery hook. Bleeding of

the transected surface was controlled using vicryl sutures and electrocautery. All ureteral stumps were sectioned and tied with an endoloop as low as possible, whether they were refluxing or not.

When there was a severe dilation in the upper pole ureter, the proximal ureter was cut and then used as a handle to identify and isolate the upper pole. When the ureter was not dilated, and the parenchyma was severely dysplastic, the boundary with the lower pole was marked by using an electrocautery hook, and then the upper pole was lifted upward and resected by using LigaSure. A drain was inserted through the lower 5 mm port site, and the incisions were closed^[6] [Figure 1].

The bladder catheter and the drain were usually removed on day 1 and day 3, respectively.

A histological examination was performed at all home-kidneys removed.

US control was scheduled at discharge, 6 months after surgery and repeated every 6 months in the case of epiretinal cyst. MAG3 scintigraphy was scheduled 6 months after surgery.

RESULTS

The average operative time was 154 min (range 81-220 min). All patients were discharged from the 2nd to 4th day. Neither major complication nor conversion was recorded. In 1 case during the vessel dissection, a clip was mistakenly applied to a marginal efferent vessel to the lower pole that darkened immediately at the level of its boundary portion. The clip was removed easily with the help of a scissors applied on the free branches of the clip [Figure 2].

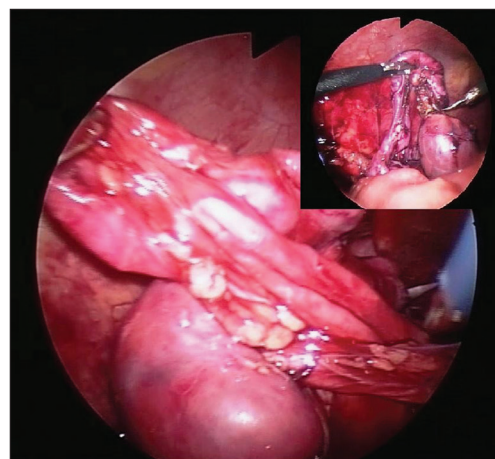


Figure 1: The main steps of laparoscopic upper pole heminephrectomy: Decrossing of the dilated ureter and polectomy

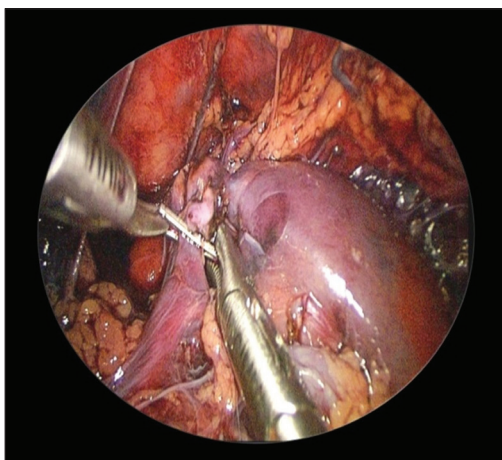


Figure 2: An useful tool to remove the clip applied on the wrong vessel. The clip is opened with the help of the scissors applied on the free branches of the clip

1 patient presented leakage of urine for 7 days from the drainage which resolved spontaneously.

5 patients showed a secondary asymptomatic perirenal cyst, 2-5 cm diameter. Three cysts resolved spontaneously in approximately 24 months. The remaining two cysts, larger than 4 cm, decreased their volume gradually and are barely detectable to US. After a mean follow-up of 5.9 years all patients are well and UTI-free. No loss of surgery unit was detected.

DISCUSSION

The indications for a heminephrectomy in paediatric patients are to remove a non-functioning renal pole in a complicated duplex kidney and a renal pole with ectopic ureter causing urinary incontinence and/or recurrent UTI. Many techniques have been described to perform HN in children: Open technique, TP, RP, and TP/RP robotic assisted.

Each of this technique presents advantages and disadvantages and the surgical skills of the surgeon with the learning curve play a pivotal role.^[7]

Recent advances in minimally invasive surgery have led to the selection of this technique for most urological procedures. Ehrlich reported the first laparoscopic nephrectomy in a child while the first case of a laparoscopic partial nephrectomy was reported by Ehrlich *et al* in 1992 and Winfield *et al.* in 1993.^[8,9]

With further development of the technique, Jordan and Winslow performed the first laparoscopic upper pole heminephrectomy in 1993, while in 1998 retroperitoneoscopic approach was proposed.^[5,10]

Since, then several reports on laparoscopic heminephrectomy have been published describing advantages, disadvantages and complications of the procedure.

In a recent survey by Shukla, the Author reports an analysis of the main report published on the minimally invasive surgery of duplex systems in infants and shows that the loss of functioning moiety of the kidney occurs is 10 units out of 203 (4.9%) in retroperitoneoscopic HN procedures, while it happened only on in 2 units of 83 (2.4%) in the TP procedures. Similarly, also the complications and the conversion rate appear higher in the series of RP interventions: 18 (8.8%) conversion versus 1^[1,2] and the post-operative urinoma: 14 (6.9%) versus 3 (3.6%).

The results appear better with the robotic even if the conversion rate is still higher in RP where the conversion rate results in 4 versus 0.^[11]

In our experience TP UHN resulted safe and effective without major complications: No significant blood loss was recorded, any functional loss of the remaining moiety was also not seen due to the inadvertent injury of lower pole renal artery.

Our results show that TP UHN allows a wider working space, good ergonomics, ideal control of hilar vessels, the possibility of ligating the ureter as low as possible and the optical magnification were overall favourable factors in obtaining these results. The training in paediatric surgery may play a role also in the choice of the technique.^[6]

Regarding the presence of cystic formations on US follow-up detected in some of our cases, these showed a tendency to spontaneous involution [Figure 3].

The exact aetiology of this cystic formation is uncertain. Based on US appearances, the differential diagnosis for these cysts includes lymphocele, abscess, loculated urinoma, haematoma, or even an unchanged duplex kidney with a hydronephrotic moiety. Many of the cysts were simple and anechoic, which in practice excludes an abscess (in an otherwise well child). The vast majority of the children had their US studies as a routine part of their outpatient visit, at which time they were asymptomatic. Perirenal cysts are probably due to urine production from an incompletely removed urothelium, or urine leakage due to the opening of the remnant collecting system. These formations, probably underestimated, were reported in several laparoscopic series and were always asymptomatic.^[12]

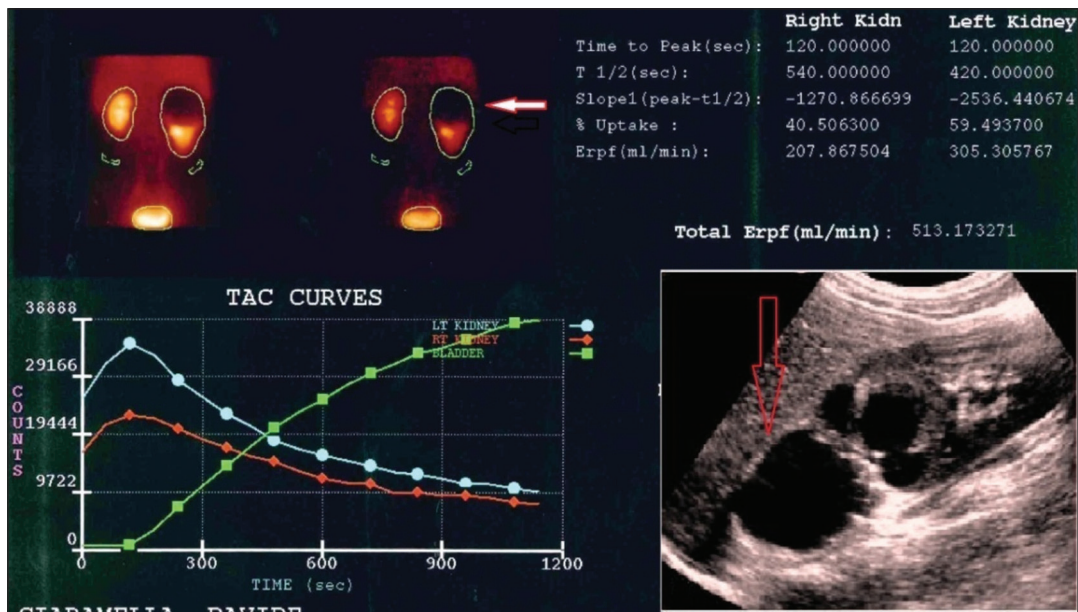


Figure 3: Post-operative epiretinal cyst (ø4 cm): MAG3 renal scan and ultrasound image (red arrows)

According to some authors, the perirenal cyst was frequently found in patients operated with the use of endoloop on the upper pole and although these cysts may vary in size, once identified they could persist unchanged. This hypothesis is not in line with our results because we did not use endoloop to resect the upper pole.^[13]

In our series no children, to date, have required any treatment to resolve the cyst, and they do not require more frequent follow-up than is usual after surgery.

There is also a question that the remnant scarred tissues might leave the patients with a long-term risk of hypertension: In this matter, we believe that although patients are asymptomatic and normotensive, our follow-up is too short for a definitive answer.^[14]

Finally, our results seem to confirm also that primary transurethral puncture of an ectopic ureterocele can be rarely considered a resolutive procedure.^[15]

CONCLUSION

TP approach for UHN in paediatric age resulted in a safe and effective procedure with several benefits. The use of laparoscopic approach offers a good working space with an ideal ergonomics, a simple access to vascularisation and ureter, a short hospital stay and allows a very low isolation of the ureteral stump which counterbalance the peritoneal violation. The perirenal cysts detected at the post-operative US in some cases showed a tendency to spontaneous involution during the follow-up.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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