Laparoscopic Retroperitoneal Versus Open Nephrectomy in Children:
A Comparative Study

Morsi HA, Abu ElFetouh HI, Daw MA

Departments of Pediatric Urology, Cairo University Children’s Hospital, Cairo - Egypt

Background/Purpose: Nephrectomy, nephroureterectomy and heminephroureterectomy for congenital anomalies are common procedures in the pediatric urological practice. The use of laparoscopy in such procedures is claimed to be an excellent alternative to the classical open technique, and is rapidly becoming the gold standard. Laparoscopy could be performed through either a transperitoneal or a retroperitoneal approach. The aim of this study was to compare the laparoscopic retroperitoneal nephrectomy technique in children with its open counterpart.

Materials and Methods: Between August 2003 and August 2005; 13 cases (mean age 4.5 years [range 2-14 years]) were operated upon in our department using the laparoscopic retroperitoneal technique: four heminephroureterectomies (double system with or without ureterocele), four nephroureterectomies (two posterior urethral valves and two vesico-ureteric reflux cases) and five simple nephrectomies (one multicystic dysplastic kidney, one neglected uretero-pelvic junction obstruction, one pyonephrosis and two refluxing non-functioning kidneys). The procedure was performed using a 3-port technique (two 5mm & one 10 mm ports). This peri and postoperative data of this group was compared retrospectively to a similar group of 10 patients who underwent open nephrectomies during the same period.

Result: The mean follow up was 9 months (range 4-18 months). In the laparoscopic group, the mean operative time was 145 minutes (range 90-180 minutes) and no blood transfusion was needed. There was no need for intravenous analgesia except in one patient. Bowel movement was recovered between 6 and 8 hours (mean 7 hours) postoperatively. The drain was removed after 12 to 16 hours (mean 12 hours) and children were discharged after 24 to 36 hours (mean 24 hours). One heminephroureterectomy was converted to an open technique (due to technical problems). Two cases were completed by the transperitoneal route (one nephrectomy with previous percutaneous nephrostomy and one heminephroureterectomy) due to difficulty to create/loss of the laparoscopic retroperitoneal space. In the open surgery group, the mean operative time was 105 minutes (range 60-130 minutes) and no blood transfusion was needed. Intravenous analgesia was necessary in 8 children. Bowel movement was recovered 12 to 18 hours postoperatively (mean 12 hours). The drain was removed 48 to 120 hours postoperative (mean 72 hours) and children discharged after 3 to 5 days (mean 3 days).

Conclusion: Laparoscopic retroperitoneal nephrectomy, nephroureterectomy & heminephroureterectomy in children are feasible, safe and provide an excellent alternative to open surgery. The retroperitoneal approach may even be superior to the transperitoneal approach; however, large numbered studies are needed to confirm this.

Index Words: Laparoscopy, retroperitoneal, nephrectomy, nephroureterectomy, heminephroureterectomy
INTRODUCTION

In the pediatric population, nephrectomy, nephroureterectomy & heminephroureterectomy are commonly performed for congenital renal anomalies. Nephrectomy is also widely performed in adulthood for diseased kidneys. Worldwide experience with laparoscopic simple nephrectomy in adults had been favorable and it has become a standard procedure at many institutions. Several large series of laparoscopic resection of renal malignancies are now accumulating.1,2

Experience with laparoscopy in pediatric urology has also been accumulating. The first pediatric laparoscopic nephrectomy was performed by Kavoussi and Koyle in 1992, as reported by Figenshau et al.3 In 1992 Ehrlich et al described their initial experience with laparoscopic nephrectomy in children.4 In 1993 Jordan and Winslow described the first pediatric laparoscopic partial nephrectomy with ureterectomy.5 Against the reservations of many authors, the rapidly growing evidence suggests that pediatric urological laparoscopic surgery can be safe and effective.

Laparoscopic nephrectomy may be performed by the transperitoneal or the retroperitoneal techniques. The retroperitoneal approach was described by El Ghonimi et al., in 1998 as the upcoming new gold standard of nephrectomy in the pediatric age.6 He also concluded that laparoscopic renal surgery is even superior to open approach in certain circumstances, especially when ureteric removal (nephroureterectomy) is mandatory.7 The former suggestion was supplemented by another study in this age group, where the retroperitoneal laparoscopic nephrectomy technique was found reliable in the experienced hands with operative time that rivaled that of the open technique. Fewer complications and shorter recovery period in and out of hospital were also reported.8

The aim of this study was to compare the laparoscopic retroperitoneal nephrectomy technique in children with its open counterpart.

PATIENTS AND METHODS

This is a retrospective comparative study, where data of 13 patients (8 males & 5 females, mean age 4.5 years [range 2-14 years]), operated upon in the period between August 2003 and August 2005, using the laparoscopic retroperitoneal technique, was compared to a group of 10 (6 males & 4 females, mean age 3 years [range 6 months-12 years]) consecutive open nephrectomies (through subcostal lumbar incisions), operated upon in the same period.

The laparoscopy group comprised four heminephroureterectomies (double system with or without ureterocele with non functioning upper pole as proven by radioisotopic scans), four nephroureterectomies (two posterior urethral valves & two cases of vesico-ureteric reflux) and five simple nephrectomies (one multicystic dysplastic kidney, one neglected uretero-pelvic junction obstruction, one pyonephrosis and two refluxing non functioning kidneys). Two patients had previous interventions (both had per-cutaneous nephrostomy [PCN] tubes for drainage of hydropyonephrosis). This series represented our initial experience with pediatric laparoscopic renal surgery. In the open surgery group, simple nephrectomy was performed in 7, nephroureterectomy (ectopic ureter) in one and heminephroureterectomy in two patients (double system). Open procedures were performed by two surgeons, while laparoscopy was performed by a single surgeon.

As per our protocol, urine analysis & culture, serum creatinine & electrolytes, complete blood count, bleeding profile, abdominal & pelvic ultrasound, PUT & intra-venous urography, cystourethrography, and Dimercaptosuccinic acid (DMSA)/ Diethylene triamine pentacetic acid (DTPA) radioisotopic scans were performed preoperatively. Also, follow up urine analysis, serum creatinine & electrolytes, ultrasonography, DMSA & DTPA radioisotopic scans (in case of partial nephroureterectomy) were performed.

The retroperitoneal procedure was performed using a 3-port technique: Two 5mm ports for the instruments & a 10 mm one for the O° lens. Insufflation of the retroperitoneal space was done under direct visual control with progressive gentle lens movement. Specimen was retrieved easily from the 10 mm trocar incision and a drain was left behind.
When the transperitoneal procedure was resorted to (in one patient), a similar 3-port technique was used. Compared data included: operative time, blood loss, length of hospital stay and incidence of postoperative complications. A simple pain scale was used to evaluate postoperative pain, and analgesic consumption was also compared. The mean follow up was 9 months (range 4-18 months) in both groups.

**RESULTS**

**In the laparoscopic group:**

The mean operative time was 145 minutes (range 90-180 minutes), and no blood transfusion was needed intra or postoperatively.

Smooother postoperative course was observed. Only one patient needed intravenous (IV) analgesia (severe pain, with pain score > 7). Bowel movement was restored by 6 to 8 hours postoperatively (mean 7 hours). The drain was removed after 12 to 16 hours (mean 12 hours) and children were discharged after 24 to 36 hours (Mean 24 hours).

Technical faults (absence of the harmonic scalpel and a sudden malfunction of the bipolar diathermy apparatus) lead to conversion of one case to an open technique (open heminephroureterectomy). Two patients needed a switch to a transperitoneal approach. In one case, previous PCN lead to failure of development of the retroperitoneal space and transperitoneal nephrectomy was contemplated in another heminephroureterectomy, rents in the peritoneum with subsequent loss of the retroperitoneal operative space. We have noticed a shorter hospital stay & earlier oral intake in patients underwent the retroperitoneal access in comparison with the transperitoneal access.

No major perioperative complications were observed. Only minor complications were recorded in this group (postoperative fever in two patients, which were managed conservatively).

**In the open surgery group:**

The mean operative time was 105 minutes (range 60-130 minutes), no blood transfusion was needed in this group too. IV analgesia was necessary in 8 children.

Bowel movement was restored 12 to 18 hours (mean 12 hours) postoperatively. The drain was removed 48 to 120 hours (mean 72 hours) and children were discharged home after 3 to 5 days (mean 3 days).

Only minor complications were recorded in this group: postoperative fever in 3 children with no evidence of urosepsis, and one case with wound infection.

**DISCUSSION**

Laparoscopic nephrectomy in adults has been widely reported since its initial description in 1991 by Clayman et al.9 For simple nephrectomy, it may become the standard of care because it may be performed reliably in the experienced hands with operative time that approaches open surgical time, few complications and a shorter recovery period in and out of hospital.10

In the pediatric population there has been more cautious acceptance of this approach for several reasons. Children recover more quickly than adults from most open surgical procedures, and thus, it may appear that these patients have less to gain from a minimally invasive approach. Young children are not gainfully employed and time lost during recovery cannot be assigned a monetary value. In addition, there are concerns about potential injury during laparoscopy in smaller patients, particularly while gaining access to the peritoneum.11

Although the number of patients is relatively small in both groups, the results of our study demonstrate some important key points. There were no major perioperative complications in the laparoscopic group and the estimated blood loss was minimal. There were also no access related injuries. Laparoscopic renal surgery can, therefore, be performed safely in the pediatric population.

Laparoscopic procedures required more operative time. This, however, should be evaluated against the fact that our groups were not exactly matching. In the laparoscopic group there were more nephroureterectomies, which required more operative time than simple nephrectomies. In addition, these laparoscopic cases represented our initial experience and were affected by the early learning curve.

Hospital stay was definitely shorter for patients who underwent laparoscopic than open nephrectomy.
Laparoscopic nephrectomy generally required only oral analgesics, while all patients who underwent open nephrectomy (8 out of 10 patients) received parenteral medication. Which may explain the extended hospital stay in this group.

Another advantage of the laparoscopic approach is the ability to dissect the ureter down to the bladder by using the same access ports. Since pediatric nephroureterectomy is virtually never performed for transitional cell carcinoma, excision of the intravesical ureter is unnecessary and the ureter is divided as it enters the detrusor muscle. This maneuver eliminates leaving the potentially problematic ureteral stump. Because the existing ports are being used, laparoscopic nephroureterectomy may even require less time than a two incision open approach. Such finding could not be observed in our study thanks to the small study number.

The harmonic scalpel is a valuable tool for laparoscopic renal surgery that has allowed us to perform partial nephrectomy for nonfunctioning upper pole moieties. Kidney dissection is done in standard fashion, exposing the upper pole. Usually there is a noticeable cleavage line delineating this atrophic cap of tissue. We use the harmonic scalpel to divide the thin rim of parenchyma with adequate hemostasis. The only case converted to open surgery was due to absence of the harmonic scalpel (and a technical fault in the bipolar diathermy apparatus), stressing the importance of this tool.

Lastly, the laparoscopic approach less parietal scars, which is worthwhile advantages for these children who may need many hospitalizations and surgical procedures.

CONCLUSION

Laparoscopic retroperitoneal nephrectomy, nephroureterectomy & heminephroureterectomy in children are feasible, safe and provides an excellent alternative to the classic open surgery. It enjoys a better profile with regard to the postoperative pain, convalescence & hospital stay.

Retroperitoneal approach may even be superior to the transperitoneal approach, although the small number in our study make it difficult to draw hard conclusions.

REFERENCES