Laparoscopic nephrectomy in children: Initial experience

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ABSTRACT

Aims: Our objective was to evaluate the feasibility and efficacy of laparoscopic nephrectomy in infants and children.

Materials and Methods: From 2000 to 2005, 28 children, aged 3 months to 14 years underwent laparoscopic nephrectomy, laparoscopic nephroureterectomy and heminephrectomy. Medical records were reviewed retrospectively for clinically relevant data.

Results: There were no conversions. Mean operating time was 75 minutes and there were no intraoperative complications in our series. Cosmetic results were excellent in all cases. Average hospital stay was 4 days.

Conclusions: Laparoscopic nephrectomy, laparoscopic nephroureterectomy and heminephrectomy may be safely performed in infants and children with minimal morbidity, post-operative discomfort and improved cosmesis.

KEY WORDS: Children, laparoscopic nephrectomy, non-functioning kidney, transperitoneal

INTRODUCTION

Laparoscopic surgery or minimal invasive surgery is a well-established surgical technique in modern day practice. Clayman reported the first transperitoneal nephrectomy. Since then, laparoscopy has complemented if not replaced open procedures. The first report of pediatric laparoscopic nephrectomy was by Kavoussi and Koyle.

Rapid strides in the technological development of instruments and telescope have facilitated inroads of laparoscopic urological procedures in small children and babies.

Conventionally, open urological procedures are done retroperitoneally for its obvious advantages. However, initial laparoscopic urological surgery was conducted transperitoneally because of familiarity of the anatomy, availability of more space. Retroperitoneal approach was developed with the creation of space by the use of a balloon in the retroperitoneum. It has been successful in adults with minimal morbidity. In children in view of limitation in the size of retroperitoneum, friability of peritoneal membrane and restricted space to manoeuvre instruments, the overall experience of the retroperitoneal approach has been limited. However, there have been quite a few series emphasizing the feasibility of retroperitoneoscopic urologic surgeries in children. Our objective was to evaluate the feasibility and efficacy of laparoscopic nephrectomy. We report our experience of 28 cases since 2000.

MATERIALS AND METHODS

From January 2000, we performed laparoscopic nephrectomy or laparoscopic nephroureterectomy and heminephrectomy in 28 children, aged from 3 months to 14 years. Majority of the children were male (20 out of 28). The disease was right-sided in 17 children and left-sided in 11 children. Procedures were performed via transperitoneal route in all except in two patients in whom retroperitoneal route was used. Table 1 outlines the indication for surgery.

Preoperative workup

Patients underwent renal sonography; IVU, MCU and isotope scan (DMSA), as applicable in each case, to establish the diagnosis of non-functioning kidney. Only those patients with a normally functioning kidney on the opposite side were chosen for ablative surgery.
Table 1: Indication for surgery

| Disease                                              | Numbers |
|------------------------------------------------------|---------|
| Non-functioning kidney secondary to VUR (Grade IV-V)  | 13      |
| Dysplastic kidney                                    | 4       |
| Non-functioning duplex moiety (Heminephrectomy)      | 4       |
| Tumors                                               | 4       |
| Bilateral nephrectomy in PRE transplantation         | 1       |
| ESRD                                                 |         |
| Non-functioning kidney secondary to hydronephrosis   | 2       |

Surgical technique

Antibiotic prophylaxis with ceftriaxone (50 mg/kg body weight) was administered before the procedure. After the induction of general anesthesia, patients were placed in a lateral decubitus position with a bolster underneath the opposite side. Routinely stomach and bladder were drained before the procedure [Figure 1].

Our routine is to create pneumoperitoneum using Veress needle, as this creates airtight placement of the telescopic trocar. Telescopic port was placed depending on the size of the patient, at the umbilicus or along a line extending from the umbilicus to the lateral border of the rectus abdominis (in older children). Having inserted the first trocar, it was secured in place by a holding stitch to prevent migration. With the telescope in place and CO₂ pressure of 10 mmHg at 1 lit/min flow rate; secondary trocars were placed in the epigastrium and lumbar region. The colon was reflected along the white line using the monopolar hook cautery till the renal vessels were exposed. In case of difficulty in identifying the kidney, the ureter was identified and traced to the kidney. The renal vessels were cleared of the lymphatics and fat till the vessels are laid bare. Since most of the indications were for dysplastic kidneys, the vessels were small and could be cauterized by bipolar diathermy or by a clip applicator. Once the vessels were divided, the kidney was dissected free from its moorings to the diaphragm and posterior abdominal wall.

In laparoscopic nephroureterectomy, the ureter is traced down to the pelvis up to the point of the bifurcation of the common iliac vessels. With traction on the ureter, the peritoneum was stripped to the bladder and transfixed with absorbable suture. The specimen was delivered to the surface through an inguinal incision.

Identification of the kidney was not difficult except, in those with perirenal inflammation. In such cases, dissection can be commenced from the mid ureter and extended upwards to the hilum. The tissues are dissected with monopolar hook cautery till the renal vessels. Harmonic scalpel is useful in cases where there are dense adhesions.

In patients undergoing heminephrectomy, the dissection began at the midpoint of the dilated ureter and was extended upwards. The dilated ureter was carefully teased away from the normal counterpart up to the hilum of the dilated kidney. At this point the vessels of the upper moiety were clipped and divided. The upper moiety was excised using bipolar coagulation. The raw surface was covered with the surrounding fat. The upper moiety was slipped behind the renal vessels of the lower segment and taken down to the bladder carefully preserving the blood supply to the lower ureter and divided as close to the bladder as possible. The entire specimen was extracted through the enlargement of the right iliac fossa port.

Four children with Wilms’ tumors underwent laparoscopic nephrectomy. They were inoperable at initial presentation, clinically and radiologically. They received anterior chemotherapy (four cycles) following confirmation of the diagnosis by trucut biopsy. Once the reduction of size was seen, a laparoscopic approach was offered. The average size of the tumor was 120 gm. The specimen was bagged and extracted by extending the umbilical port as required. The kidney specimen invariably showed evidence of dense zone of scarred tissue with presence of minimal renal tissue.

All wounds are closed with 3/4- 0 Vicryl sutures.

RESULTS

The operative time ranged from 30-120 minutes (mean of 65 minutes). The average blood loss was 30 ml. There were no trocar related injuries. There were no intra or postoperative complications noted in spite of
transperitoneal approach. No patients required blood transfusions or drainage of the surgical field. Average hospital stay was 4 days.

DISCUSSION

Laparoscopy is gaining popularity for various procedures in pediatric urology with the primary advantages of better visualization due to magnification, decreased post-operative discomfort, hospital stay and improved cosmesis. The first pediatric transperitoneal laparoscopic nephrectomy was reported by Kavoussi and Koyle[5] in 1992 in a six-month-old child. Since then, many centers have begun to report their experience in laparoscopic nephrectomy.

Hamilton[5] et al retrospectively compared laparoscopic nephrectomy performed in 10 children, with 10 consecutive open surgical cases. Their study showed that, laparoscopic renal surgery compared favorably with open renal surgery in similar patients. The parameters used were period of recovery, hospital stay and cosmesis. Few other series have reported similar results.[6,7]

The youngest patient in our series was of 3 months of age. Majority of children in our series were operated for grade IV-V vesicoureteric reflux with non-functioning kidney either secondary to posterior urethral valves or in association with imperforate anus.

Operative approach in our series was transperitoneal in 26 of 28 cases, for obvious advantages of familiarity in creating pneumoperitoneum, ease of identifying structures in the paracolic and prerenal areas. The patient was positioned close to the edge of the table, to optimize instrument mobility.

Recently Robinson[8] et al compared laparoscopic transperitoneal nephrectomy with open surgery and found increased operative time as a disadvantage for laparoscopic technique.

In our series, we did not encounter any difficulty due to prerenal vascular adhesions, since the majority of the cases were for contracted kidney. The renal pedicle was small in diameter and was easily handled by bipolar cautery or 5 mm clips.

In most of the series the parameters used were, operating time, period of recovery, hospital stay and cosmesis. We have used three-trocar technique for laparoscopic nephrectomy. Our operating time ranged from 30 to 120 minutes. With minimal use of ports, we have not experienced any complications or prolongation of the operative time. We believe that, the operating time will continue to decrease at specialized centers with experience.

Four patients underwent heminephrectomy for obstructive hydronephrosis of the upper moiety, which was non-functional on radionuclide, scan. During heminephrectomy the technique remained the same, with emphasis on the preservation of the normal ureter and its vascularity. No complications to the remaining moiety were demonstrated on follow up.

Recent case reports of pediatric laparoscopic heminephrectomy show that laparoscopy can have minimal morbidity, post-operative pain and blood loss as well as better cosmesis and hospital stay.[8-10] The need for lower urinary tract surgery in duplex kidneys is said to be around 5-15%.[11] With traditional open surgery this requires two separate incisions and change of operative positions. Transperitoneal laparoscopy allows the entire procedure to be achieved in one position and unchanged port sites.

Conventional treatment for Wilms’ tumor offers a high survival rate. With such good results, decreasing morbidity without impairing the cure rate is an important concern. Laparoscopy has proved to be safe and effective for diagnosis and staging, but published reports for resection are few.[12] Duarte et al[14] reported two cases of Wilms’ tumor treated laparoscopically. These children were treated according to SIOP protocol and subsequently underwent laparoscopic nephrectomy. Other than the prolonged operating time, they did not encounter any other complications. The tumors were classified as stage I disease. They do suggest anterior chemotherapy, so as to induce fibrosis and to prevent tumor rupture.

Our experience with tumors is limited. The children we treated were initially inoperable. We offered laparoscopy following chemotherapy. Laparoscopic nephrectomy was easy in all cases barring flimsy adhesions. Factors such as influence of CO₂, local and trocar site recurrence still needs to be evaluated.[15]

Anomalous vessels are common occurrence during dissection of the renal hilum. We encountered such anomalous lower pole vessels in four cases, which were easily managed by bipolar cautery. They are to be particularly looked for to avoid brisk bleeding.

Only in two cases we have used the retroperitoneal approach. Retroperitoneal space was entered using a simple balloon. Additional trocars were placed. Psoas muscle was identified; kidney and ureter were dealt with as mentioned previously. Tear in the peritoneum was inconsequential. Gaur et al[3] reported the initial
retroperitoneal laparoscopic nephrectomy in 1993, followed by initial series of Diamond et al. They found it feasible in a select group of patients having small, poorly functioning kidney. This approach has a theoretical advantage of reducing the incidence of intraperitoneal adhesion formation. We intend to investigate this approach and compare with the transperitoneal method.

CONCLUSIONS

The adoption of a novel surgical approach is justifiable only if the new technique equals or surpasses the efficacy and safety of the reference standard. First, laparoscopic nephrectomy may be safely performed in infants and children. Second, the operating time has been considered a major disadvantage in many series, albeit it being due to learning experience. Third and as expected the hospital stay was shorter and with better cosmesis. Fourth, similar approach can be considered for non-functioning, crossed ectopia, pelvic kidney and one half of horseshoe kidney.

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