

Laparoscopic Nephrectomy in Pediatrics: Experience from a New Pediatric Urology Department

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Abstract

Purpose: To determine efficacy and safety of initial experience of laparoscopic nephrectomy in pediatric age group for removal of kidneys for benign conditions. In past few years laparoscopic mode of surgery has penetrated most of the specialties in adult age group. However recently, with modifications of these adult laparoscopic methodologies in pediatric age group have led to successful application of laparoscopic mode of surgery even in children. Aim of this study was to share initial experience in children with this newly adopted minimally invasive surgery.

Methods: Retrospective analysis of the data was done in pediatric patients who underwent laparoscopic nephrectomy at Shifa International Hospital from 2015 till 2017. Data regarding age, gender, indication for surgery, laterality, mean operative time, hospital stay and complications was collected by urology residents and recorded on specified proforma. Data was analyzed on SPSS version 16.

Results: Total of 13 children were followed after laparoscopic nephrectomy procedure for removal of nonfunctioning kidney. Mean weight was 27.5 kg and height ranged from 67-137 cm (mean: 99.4 ± 17.7 cm). There were 5 boys (38.4%) and 8 girls (61.6%). Their mean age was 9.78 years. Mean operative time was 173 minutes while mean hospital stay was 3.4 days. One case was converted to open surgery.

Conclusion: Laparoscopic nephrectomy for benign conditions can be safely adopted in new centers of pediatric urology with minimal morbidity and satisfactory outcomes.

Keywords: Laparoscopic nephrectomy, children, Complications.

1. INTRODUCTION

Laparoscopy is a new mode of surgery that has successfully been adopted in last few years. Moreover, its use has been witnessed gradually over a wide range of urologic procedures in adults.

It has helped in reductions in the morbidity due to surgical incisions and longer length of hospital stay. At first, description of diagnostic

laparoscopy was given by Cortesi et al in year 1976 for the diagnosing and palpable undescended testis. Since then, laparoscopy has been frequently adopted for various procedures in pediatric urology [1-3]. In past few years laparoscopic mode of surgery has penetrated most of the specialties in adult age group. However recently, with modifications of these adult laparoscopic methodologies in pediatric age group have led to successful application of

laparoscopic mode of surgery even in children. Now, it has been tried for a wide variety of procedures such as laparoscopic nephrectomy, pyeloplasty and partial nephrectomy [2, 4, 5].

Despite this, the adoption and progressive development of minimally invasive surgical techniques has been lagging behind in pediatric patients to that in the adult age patients. One reason for this might be safety and long-term success rates of open surgical interventions witnessed in past in pediatric population. [3, 6, 7]. Other reason might be the limited supply and availability of laparoscopic equipment, which are mostly used for adult patients in most of the centers. Mostly these adult instrument size are not ideally adapted to be used for the smaller working spaces in pediatric surgery [8-10]. Thirdly, significant learning curve associated with laparoscopic pediatric procedure might hinder its use by most of the pediatric surgeons as they were trained in past for doing open surgeries in pediatric patients. Aim of this study was to share the outcomes and complications of laparoscopic nephrectomy in a new pediatric urology center.

2. METHODS

Between 2015 and 2017, 13 laparoscopic nephrectomies were performed by a single pediatric urology surgeon. The data included children of age range 2-18 years of age. Their data was collected from chart reviews. Parents were counseled about the laparoscopic procedure and the outcomes.

On operating table, the child position was made in a semi-lateral fashion. A bolster was placed underneath the side to be operated so as to raise it at an angle of about 45°. Child position was secured by strapping to the operating table. Pressure points were padded during position making. After making an infra-umbilical curved incision by open technique, an umbilical port (10 mm size) was inserted through kin. Pneumoperitoneum was created by insufflating carbon dioxide (CO₂) at a pressure of 7-10 mm

Hg and flow rate of 2-3 litres/min. Two other working ports of 5 mm size were introduced under camera vision, in the epigastric region (point midway between the umbilicus and xiphisternum) and other one placed in mid-clavicular line just beneath the level of the umbilicus on the ipsilateral side of surgery. On some times if need was felt another 5 mm port was also placed. An internal inspection of intraabdominal structures was done to take a general view. Then ipsilateral colon was identified and an incision along the white line of Toldt was made. Colon was mobilized and splenic flexure was mobilized in case of left sided nephrectomy while hepatic flexure mobilized in exploring the right sided kidney. Later on, Gerota's fascia was incised and dissected and opened. The renal vascular pedicle was isolated and artery and vein were separately ligated. The ureter was traced downward close to the bladder, taking care of vas deferens/ gonadal vessels in males. Ureter was ligated and cut. Child was then placed back to the supine position and the surgical area was irrigated using normal saline to see any bleeding points. After achieving hemostasis a drain was placed in renal bed area. Renal specimen was drawn out through the umbilical port (camera port) site. The sheath in wound sites were closed with interrupted 3-0 Vicryl. Skin was closed with Vicryl Rapide 4/0. In absence of ileus children were allowed orally in a day after the surgery. Drain was removed in case of less than 20 ml of drainage fluid in 24 hours. Antibiotics were given on induction of anesthesia and later on for 2-3 days intravenous switching to oral antibiotics for 5 days at discharge from hospital.

Data regarding age, gender, intra-operative findings, post-operative complications, hospitalstay course and follow up outcomes were recorded from the charts review. Data was entered in spss version 16. Quantitative data was portrayed as mean and standard deviation while categorical variables were represented as frequency/percentage.

Table1: Demographics of patients

Children number	13
Male	5 (38.4%)
Female	8 (61.6%)
Mean age (years)	9.7±5.1years.
Left Sided stone	6/13 (46.1%)
Right Sided stone	7/13 (53.9%)
vesicoureteral junction reflux	7/13 (53.9%)
Shrunken kidneys	2 (15.2%)
posterior urethral valve	1 (7.6%)

Table2: Procedure outcomes and complications

Variables	Results
Mean operative time	173 ± 41.3 minutes
Hospital stay	3.4±0.6 days
Drain used	13 (100%)
Per-operative bleeding	2 (15.2%)
Iatrogenic injury other organs	None (0%)
Incisional hernia	None (0%)
Transfusion	1 (7.6%)
Conversion to open surgery	1 (7.6%)

3. RESULTS

Between 2015 and 2017, 13 laparoscopic nephrectomies were performed in children, having age range of 2-18 years (mean: 9.78 years). Mean weight was 27.5 kg and height ranged from 67-137 cm (mean: 99.4 ± 17.7 cm). There were 5 boys (38.4%) and 8 girls (61.6%). There were 6/13 nephrectomies on left side while 7/13 on right side in this series.

Three patients had neglected pelviureteric junction obstruction leading to loss of kidney function, 7 patients had vesicoureteral junction reflux leading to renal function loss due to repeated infections and hydronephrosis, 2 patients had shrunken kidneys due to repeated infection history in past and one patient had posterior urethral valve leading to loss of right sided kidney function. Renal function was assessed by doing DMSA scan of all children before undergoing nephrectomy. It was Zero % in 3 patients, between 1-10 % in 7 patients while 11-15% in 5 patients. Two patients presented with flank pain, 9 patients with recurrent urinary tract infections and two patients were asymptomatic in this series. One patient had hypertension at time of presentation.

Mean operative time ranged from 106-237 minutes (mean: 173 ± 41.3 min. One case was converted to open due to bleeding that needed conversion to achieve hemostasis. All renal specimens were easily removed through the umbilical port. Only 3 cases required extension of the incision by 1-2 cm owing to relatively larger size of the kidney to be retrieved. Only one patient needed blood transfusion in this series. No immediate postoperative issues were recorded in these children. They were allowed liquids and soft diet orally on the day of procedure and then they were put on regular diet after surgery in case of absence of ileus. Mean hospital stay was 3 days. All children had good recovery. There was one case of prolonged ileus leading to hospital stay of 6 days and managed with nasogastric tube. All of these children had resolution of presenting symptoms. No case of incisional hernia was noted in these children.

4. DISCUSSION

Nephrectomy is one of the commonly used ablative surgeries performed in field of urologic surgery. There is not only the psychological trauma of losing a kidney but the patient often also undergoes significant disfigurement and discomfort due to the larger surgical incision involved in open nephrectomy . In past the traditional approaches required an extensive skin and muscle cutting incision to make the kidney reachable and retrievable. In past there was no choice but to undergo this mutilating procedure in order to attain the ultimate result. However in last few years there is a change in this trend as Laparoscopic mode of surgery has been tried in different specialties in surgery departments [11-12].

Initially laparoscopy was pioneered mainly as a diagnostic tool in the 1970s. However, with marked technological progression, minimally invasive surgery (MIS) has gained popularity leading to increase in its use in pediatric surgery [13-14]. With passage of time, Pediatric urologists too gained the confidence to embrace MIS due to the technological innovation, making it easier to adopt this new mode of surgery. It has totally altered the course of the current urological surgical practices in modern world. Nowadays MIS is a viable option for many of the urinary tract procedures in pediatric population [15-16].

In early phase of its adoption by urologists, Laparoscopic nephrectomy has been consolidated as the standard of care for taking out the benign nonfunctional kidneys (NFKs). [17] Various studies in modern world have depicted the safe outcomes of laparoscopic nephrectomy in children, even in those children who weighed less than 10 kg. [17] In a series by Prema et al. 6 children were of age less than 1 year and they weighed less than 10 kg [18]. They deduced from their study that age and lower weight didn't add to the rate of intra-operative complications so long as the anesthetist and surgeon take extra care especially in regard to

the inflation rate and the carbon dioxide pressure inside peritoneal cavity. In our series three children were of age 2-3 years. They didn't encounter any per-operative or immediate post-operative complications. They had good recovery and were discharged after 4 days of hospital stay. On further follow up for 1 year they didn't have any incisional hernia or intraabdominal adhesions that could lead to intestinal obstruction.

Laparoscopic nephrectomy is accompanied with minimal morbidity, relatively lesser stress response, less frequency of post-operative pain, comparatively shorter hospital stay and better cosmetic outcomes, when compared to the open surgical technique. Hence it has been considered a superior option according to some of the authors [19-20]. Blood loss and perioperative complication rates are equivalent to those of the open techniques. Transient fever of one day was seen in one child in the present series. There was no iatrogenic injury to the surrounding structures such as liver, colon, spleen and small gut. Some authors are of the view point that mean operative times might be longer initially in a center where the laparoscopy procedure is newly adopted. [18,20] In one series mean operative time dropped down with passage of time and experience, similarly the conversion rates also dwindled markedly after finishing the initial ten cases. In the present series the mean operative time was 173 ± 41.3 minutes. As it was our initial experience with pediatric laparoscopic nephrectomies it took longer time to operate by this mode on the children. In one series mean operative time was 138.0 ± 48.9 min [18]. In another series in Pakistan mean operative time of 140 was recorded. In two other studies it was 153 minutes [21] and 154 minutes [22] in a contemporary open surgical experiences series [23]. Gill et al. reported complication rate of 16% and conversion to open in 6% of their patients [24]. Fahlenkamp [25] reported complication rate of 8.3% and conversion to open surgery in 10.3% of patients in a German multi institutional experience of procedures in 2407 patients. Keely [26] performed 100 laparoscopic nephrectomies and identified various risk factors for complications, he reported 18% complications and 10.3% rate conversion to open surgery.

We strongly believe that if some technical points are adhered to in detail, then the complications can be avoided such as placement of the trocars by method of direct vision, paying attention to the basic surgical principles,

meticulous attention in terms of maintaining the hemostasis to avoid even the minor bleeding during procedure as blood is an enemy for the surgeon in the field obscuring their vision badly. Furthermore, adequate retraction and exposure is key to safe completion of laparoscopic procedure [27]. In addition, conversion to open surgery should be decided in time in case of difficulty to progress to avoid unnecessary delays, complications and frustration associated with difficult surgery especially in initial experience of a center in laparoscopy.

5. CONCLUSION

In new pediatric urology centers laparoscopic nephrectomy can be a challenging task. However, it can be adopted safely with satisfactory outcomes in carefully selected patients having nonfunctional kidney. Initially there may be longer operative time as compared to the well experienced established centers of laparoscopic surgeries in pediatric population. Lower threshold of conversion to open surgery should be kept in mind to avoid unnecessary complications.

REFERENCES

- [1] Cortesi N, Ferrari P, Zambarda E, Manenti A, Baldini A, Morano FP. Diagnosis of bilateral abdominal cryptorchidism by laparoscopy. *Endoscopy* 1976;8:33-4.
- [2] Docimo SG, Peters CA. Pediatric endourology and laparoscopy. In: Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA, editors. *Campbell-Walsh urology*. 9th ed. Philadelphia: Saunders; 2007; 3907-29.
- [3] Sweeney DD, Smaldone MC, Docimo SG. Minimally invasive surgery for urologic disease in children. *Nat Clin Pract Urol* 2007; 4:26-38.
- [4] Hasan A, Iqbal N, Khawaja MA, Yousuf A, Masood A, Malik Y. Managing a Large-Size Adrenal Cyst by Hand-Assisted Laparoscopic Surgery in a Young Male. *J Coll Physicians Surg Pak*. 2018;28:S28-S30.
- [5] Norris RD, Ost MC. Evolution of laparoscopy in pediatric urology. *Expert Rev Med Devices* 2009; 6:689-98.
- [6] Casale P, Kojima Y. Robotic-assisted laparoscopic surgery in pediatric urology: an update. *Scand J Surg* 2009; 98:110-9.
- [7] Kim C, McKay K, Docimo SG. Laparoscopic nephrectomy in children: systematic review of transperitoneal and retroperitoneal approaches. *Urology* 2009; 73:280-4.
- [8] Mahomed AA, Hoare C, Welsh F, Driver CP. A two-center experience with the exclusive use of laparoscopic transperitoneal nephrectomy for benign renal disease in children. *Surg Endosc* 2007; 21:1532-6.

- [9] El-Ghoneimi A, Abou-Hashim H, Bonnard A, Verkauskas G, Macher MA, Huot O, et al. Retroperitoneal laparoscopic nephrectomy in children: At last the gold standard? *J Pediatr Urol* 2006; 2:357-63.
- [10] Duarte RJ, Dénes FT, Cristofani LM, Odone-Filho V, Srougi M. Further experience with laparoscopic nephrectomy for Wilms' tumour after chemotherapy. *BJU Int* 2006;98:155-9.
- [11] Poulsen EU, Eddy B, Poulsen J. Laparoscopic nephrectomy. *Scand J Urol Nephrol*.2005; 39: 138-42.
- [12] Nadu A, Mor Y, Chen J, Ramon J, Soter M, Golomb J. Laparoscopic nephrectomy: initial experience in Israel with 110 cases. *Isr Med Assoc J*.2005; 7:431-4.
- [13] Georgeson KE, Owings E. Advances in minimally invasive surgery in children. *Am J Surg*. 2000; 180:362-4.
- [14] Albersen M, Cartwright R, Choyke P, Goldenberg SL, Goldman H, Lawrentschuk N, et al. Looking forward, looking back-10 years in urology. *Nat Rev Urol*. 2014; 11:649-55.
- [15] Firilas AM, Jackson RJ, Smith SD. Minimally invasive surgery: the pediatric surgery experience. *J Am Coll Surg*. 1998; 186:542-4.
- [16] Traxel EJ, Minevich EA, Noh PH. A review: the application of minimally invasive surgery to pediatric urology: upper urinary tract procedures. *Urology*. 2010; 76:122-33.
- [17] Castillo OA, Foneron-Villaruel A, López-Fontana G, Bolufer E, Rodríguez-Carlin A. Laparoscopic nephrectomy in children. *ActasUrol Esp*. 2011; 35:195-9.
- [18] Menon P, Handu AT, Rao KL, Arora S. Laparoscopic nephrectomy in children for benign conditions: indications and outcome. *J Indian AssocPediatr Surg*. 2014; 19:22-7.
- [19] Sekhon V, Menon P, Arora S, Rao KL. Nephrectomy in children: Comparison of stress response to laparoscopic and open methods. *J Indian AssocPediatr Surg*. 2013;18:53-7.
- [20] Scafuri AG, Miranda EP, Dénes FT, Castilho LN, Mitre AI, Arap S. Comparison of videolaparoscopic versus open surgery for benign renal diseases in children. *ActasUrol Esp*. 2009; 33:1115-21.
- [21] Oak SN, Parelkar SV, Akhtar T, Joshi M, Pathak R, Viswanath N, et al. Minimal access surgery in children - 5 years institutional experience. *J Minim Access Surg*. 2005; 1:121-8.
- [22] Gupta AR, Gupta R, Jadhav V, Sanghvi B, Shah HS, Parelkar SV. Minimal access surgery in children: An initial experience of 28 months. *Afr J Paediatr Surg*. 2009; 6:93-7.
- [23] Saravanan K, Kumaran V, Rajamani G, Kannan S, Mohan NV, Nataraj M, et al. Minimally invasive pediatric surgery: Our experience. *J Indian AssocPediatr Surg*. 2008;13:101-3.
- [24] Gill IS, Kavoussi LR, Clayman RV, Ehrlich R, Evans R, Fuchs G, et al. Complications of Laparoscopic nephrectomy in 185 patients: A multiinstitutional review. *J Urol*. 1995; 154: 479-83.
- [25] Fahlenkamp D, Rassweiler J, Fornara P, Frede T, Loening SA. Complications of laparoscopic procedures in urology: Experience with 2,407 procedures at 4 German centers. *J Urol*.1999; 162: 765-70.
- [26] Keely FX, Tolley DA. A Review of our first 100 cases of laparoscopic nephrectomy: Defining risk factors for complications. *Br J Urol*.1998; 82: 615- 8.
- [27] Mirza B. Pediatric laparoscopic surgery in Pakistan. *APSP J Case Rep*. 2016; 7:1.

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