

Pediatric single port transumbilical nephrectomy and nephroureterectomy

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KEY WORDS

SILS ▶ laparoscopic nephrectomy ▶ children

ABSTRACT

Objective. To present seven cases of single incision laparoscopic nephrectomy and nephroureterectomy in children as a recent videoscopic innovation.

Patients and methods. Seven children with nonfunctioning kidneys, three with multicystic dysplastic kidneys, two with end-stage renal nephropathy due to vesicoureteral reflux, and two with giant hydronephrosis were qualified to nephrectomy or nephroureterectomy. The surgery was performed transperitoneally using single incision access laparoscopy. The operative time was in the range of 50–90 min.

Results. There were no intraoperative or postoperative complications. The patients were discharged on the third postoperative day. The incision scars were hidden inside the umbilicus.

Conclusions. Nephrectomy or nephroureterectomy using a single transumbilical port in children is a feasible and efficacious technique. The advantages are shortened convalescence, excellent cosmetic results, and reduction of potential wounds complications. However, clear indication of single site laparoscopic procedures in children remains to be clarified.

INTRODUCTION

Single port access laparoscopy is an element of the natural development of minimally invasive surgery. It is the next step allowing for improved cosmetic effects, potentially faster recovery, reduction of the number of integument incisions, which reduce postoperative pain, and further reduction of morbidity, such as wound suppuration and incision site herniation.

Single access laparoscopy was recommended nomenclature "LESS" (laparoendoscopic single-site surgery on a multispecialty working group meeting [1]. The first reported single access laparoscopic approach for nephrectomy in an adult human patient, which used three traditional 5 mm trocars inserted adjacent to each other through a single incision at the umbilicus, was presented in 2007 by Raman [2]. The next article presented in 2007 by Ponsky employed a GelPort with three trocars inserted through it using only one incision [3]. NOTES (Natural Orifice Translumenal Endoscopic Surgery) is an exciting new approach to minimally invasive surgery; however, significant technical barriers to these techniques have hindered widespread clinical use [4]. However, to date, this type of surgery has not been approved in children [5].

We have been using multi-channel 5–12 mm SILS™ Ports manufactured by Covidien™. To insert the port into the abdominal cavity, a semicircular incision is made below the umbilicus, similarly

as it is done when creating access using the Hasson technique. The classic instruments have been modified to avoid clashing. The modification consists in fitting the instruments with articulating working heads, which prevents clashing of the instruments with the optical system. In this case report we would like to present our initial experience with single port laparoscopic nephrectomy and nephroureterectomy in pediatric patients with left (four patients) and right (three patients) nonfunctioning kidneys. Initial report of single incision surgery appeared in pediatric literature in 1998. Esposito reported 25 consecutive pediatric appendectomy procedures using a single 10-mm subumbilical port [6]. Although transumbilical single access nephrectomies have been reported in adults, to our knowledge there are only three reports on pediatric nephrectomy and one on nephroureterectomy in the published studies. The first reports employing this technique for nephrectomy in a child were published in 2009 by Johnson [7, 8, 9].

PATIENTS AND METHODS

Three patients, aged three, six, and 10 years, were followed up due to a multicystic dysplastic kidney, which did not demonstrate involution. Within the two years before surgery they showed a progressive increase in kidney size with inflammatory markers in urine. The contralateral kidney showed compensatory hypertrophy. The renal scan revealed 100% split renal function on one side and a nonfunctioning kidney on the other side. A left nephrectomy in one patient, and right nephrectomy in the other, were planned.

The next two patients, 6- and 8-year old girls, were referred to our department due to recurrent urinary tract infections. The ultrasound examination showed a small left kidney in both patients with thin, 3 mm parenchyma and dilated calices and pelvis. Voiding urethrocytography revealed grade IV vesicoureteral reflux (VUR) on the left side. The renal scan showed nonfunctioning left kidneys. The patients were qualified for left nephroureterectomy. The next two children 6 and 9-year old were admitted to our department due to giant hydronephrosis. The renal scan revealed 100% split renal function on the other side and nonfunctioning hydronephrotic kidneys.

Under general anesthesia, the patients were placed in the supine position and a urethral Foley catheter was inserted. Subsequently, a semicircular 2.5–3 cm incision was made below the umbilicus, similarly as it is done while achieving access to the peritoneum using the Hasson technique. We have been using multi-channel 5–12 mm SILS™ Ports manufactured by Covidien™. To insert the port into the abdominal cavity we employed two forceps. Following the insertion of the multi-channel port, the insufflator was attached and pneumoperitoneum was achieved to the value of 10–12 mmHg. Subsequently, the patient was placed in the flank position with the kidney to be nephrectomized upwards. A 10 mm 30° telescope was used to visualize the operative field. Mobilization of the left or right colon using a dissector and scissors with articulating working heads (Endo Dissect™ and Endo Shear™, Covidien) allowed for identification of the kidneys and renal hilum (Fig. 2). The kidneys were retracted anterolaterally with the help of a flexible grasper and the hilar vessels were

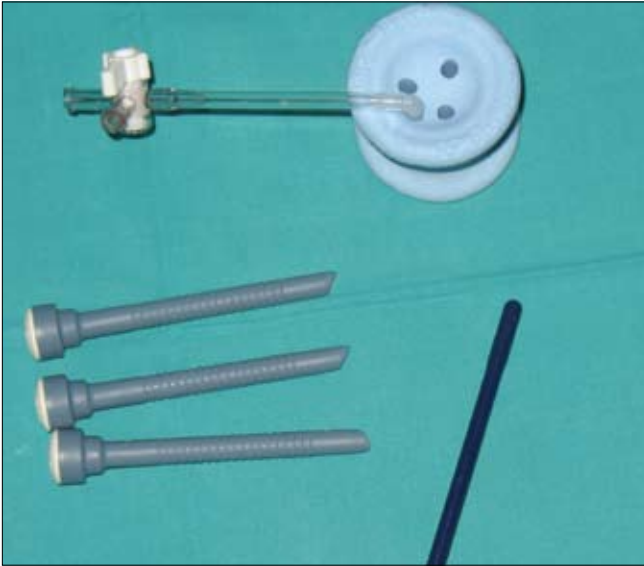


Fig. 1. SILS port.

exposed. After complete mobilization in the three patients with multicystic dysplastic kidneys, the hypoplastic renal artery, renal vein, and ureter were sealed using Liga-Sure™ manufactured by Covidien. In the remaining patients, the vessels were clipped using a 5 mm rigid vascular stapler (Endo GIA™ Vascular, Covidien) and the ureter proximal to the bladder was sealed using Liga-Sure. The ureters were followed to the distal part of the iliac vessels and divided close to the bladder in children with VUR. The blood loss was minimal and no patient required transfusion. There was no bleeding under the 5 mmHg intraperitoneal pressure, hence, it was decided that there was no need for drain insertion in any patient. The kidneys were removed through the infraumbilical incisions using a grasper simultaneously with the SILS port. The fascia and the subcutaneous tissue were sutured with 3-0 Vicryl (Ethicon) and the skin was closed with subcuticular stitches 4-0 vicryl. The skin around the incision was injected with 0.5% solution of bupivacaine in general doses appropriate for weight to achieve local anesthesia. The urethral catheter was left *in situ* until the following day.

RESULTS

All the nephrectomies were successfully performed via a single port within 50-90 minutes with no blood loss. None of the procedures required conversion to open surgery, placement of additional ports or blood transfusion. Oral feeding was started on the first postoperative day; on the second day, the patients were mobilized and they were released on the third day. In all the cases, surgical wounds healed by primary adhesions and were hidden in the umbilicus. There were no long-term complications identified during the follow-up after 4 months. The cosmetic results were excellent. Pathology revealed multicystic renal dysplasia in the three patients, with cysts up to 2.5 cm in diameter. The diagnosis of the next four patients was post-inflammatory kidney destruction due to end-stage reflux nephropathy or giant hydronephrosis.

DISCUSSION

The typical laparoscopic nephrectomy using three to five ports has gained widespread acceptance. Nevertheless, there have been efforts to further reduce its invasiveness and access-related complications. Each additional port increases the potential morbidity

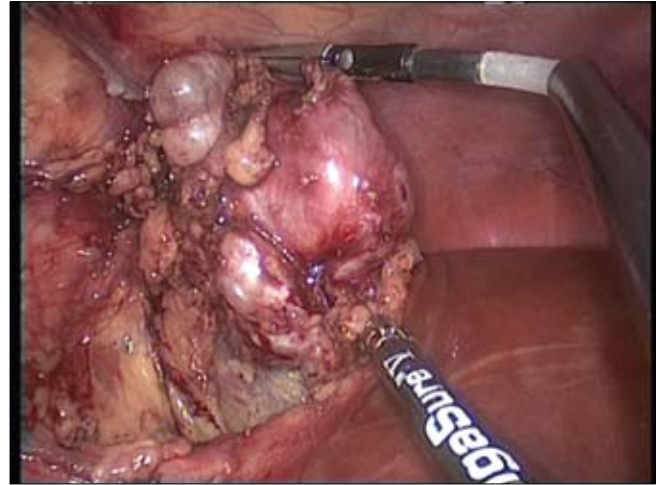


Fig. 2. An internal view while freeing a dysplastic kidney.

from internal organ damage and bleeding from abdominal integument vessels and also increases postoperative pain and the risk of wound infections or herniation in the site of incision [10]. In video-scopic surgery in adults, the search for a method that would allow for minimizing scars has culminated in the development of NOTES, where the surgical procedure is performed through an approach that takes advantage of natural body orifices, e.g. the stomach, rectum, vaginal vault or urinary bladder [11]. However, to date this type of surgery has not been approved in children [12]. Single port access surgery has been successfully used for laparoscopic cholecystectomy, appendectomy, and varicocelelectomy [6, 13, 14]. The first single port nephrectomy in an adult patient by Raman et al. took place in May 2007 [2]. Performing this procedure using the single port technique is quite different from standard laparoscopy and requires a new set of skills. The greatest difficulty in surgeries employing this technique is posed by the small distance between the instruments that are inserted into the abdominal cavity as well as their parallel positioning. Single port surgery involves multiple technical challenges different from classic laparoscopy, including loss of triangulation, challenging work angle, limitation in instrumentation, instrument crowding and clashing, crossing instruments, and obscuring the line of vision [15]. Development of new instrumentation with articulating heads and four channel ports has allowed for performing laparoscopic procedures employing a single incision of the abdominal integument while minimizing its drawbacks. Flexible instruments help overcome the problems during the dissection that arise from the closeness of the tips of the straight instruments. Our surgeon used flexible instruments in one hand because it was easier than either using them in both hands or crossing the instruments in a counterintuitive fashion [9]. However, no complete reduction of clashing of the instruments and the optical system, which hinders tissue dissection or suturing, has been achieved. For this reason, some authors recommended optical system equipped with built-in digital cameras, not only in view of the integration of the camera and laparoscope, which results in the absence of the camera head at the extra-abdominal end of the laparoscope. Very helpful is a scope with a deflectable tip [9]. We try to resolve this problem by keeping the camera as far back as possible during the operation, using the zoom of the camera and a 30° lens. We have observed that these two solutions limit the clashing of the laparoscope and instruments.

We have found only three papers that reported on experiences using the single port access technique in pediatric nephrectomy or nephroureterectomy [7, 8, 9]. No report presented both types of procedures in a single paper.

LESS represents a novel approach to major urological procedure and underscores the evolution to progressively fewer incisions required to perform surgery. Except the aesthetic advantages, it has been proposed that patients may experience less perioperative pain with fewer port site-related complications such as hernia, hemorrhage or healing complications. However, due to lack of comparative studies between these new laparoscopic techniques and standard laparoscopy, it is still under debate [16, 17].

CONCLUSIONS

After using this technique in the simplest urological procedures, such as varicocelectomies, abdominal cavity revision in patients with non-palpable testis syndrome and orchiectomies in patients with dysplastic testis, we employed these procedures for nephrectomy and nephroureterectomy. Compared with classic transperitoneal laparoscopic nephrectomy, we found that the benefits of single-port-access nephrectomy include improved cosmetic effects, reduction in iatrogenic visceral and vascular injuries resulting from port placement, and a lower risk of potential wound healing complications. In order to minimize the drawbacks of this technique we have employed instruments with articulating working heads. The time needed to perform a procedure using single port access is similar to that required by classic laparoscopic surgery. We would like to demonstrate the feasibility and efficacy of this technique in the pediatric population and advantages of this technique. Nevertheless, wide studies are still needed to compare LESS to the classic laparoscopic procedures to determine if there truly may be any real benefit to this approach.

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