Laparoendoscopic Single-Site (LESS) Surgery in Pediatric Urology: A 4-Year Experience

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### Abstract

**Objective:** The aim of the study was to assess the feasibility and outcomes of pediatric urological laparoendoscopic single-site (LESS) surgery. **Materials and Methods:** We retrospectively collected charts of all patients who underwent LESS procedures in our department from January 2013 to December 2016. Data included demographic characteristics, type of procedures, intraoperative details, hospital stay, and complications. The umbilicus was used as the surgical site in all cases. All procedures were performed with a homemade glove port and standard straight 3- or 5-mm laparoscopic instruments. **Results:** Seventy-three patients (55 males, 18 females) were identified. Procedures included 46 orchidopexies, 21 pyeloplasties, 8 varicocelectomies, 3 nephrectomies, 3 nephroureterectomies, 3 orchietomies, and 1 renal hydatid cyst treatment. Median operative time for the entire cohort was 47 min (range 26–156 min). There was no significant intraoperative blood loss. No conversion to conventional laparoscopy or open surgery was needed. All patients required paracetamol postoperatively. The mean follow-up was 18 months. Two patients had testicular atrophy after a Fowler-Stephens procedure and 1 patient had testicular re-ascension. Cosmetic results were excellent. Forty-five (62.5%) patients were discharged on the day of surgery. **Conclusion:** Our study demonstrated that LESS surgery using our glove port technique and conventional laparoscopic instruments is a feasible and safe technique for the surgical management of various pediatric urological conditions.
The aim of this study was to investigate the feasibility and the safety of LESS surgery in pediatric urological practice. Our hypothesis is that LESS surgery using our glove port technique and conventional laparoscopic instruments is a feasible and safe technique for the surgical management of various pediatric urological conditions.

Materials and Methods

We retrospectively collected charts of all patients who underwent LESS procedures in our department from January 2013 to December 2016. Data included demographic characteristics, type of procedures, intraoperative details, hospital stay, and complications. Operative times were obtained from anesthesia records and began at the start of the surgical incision and ended when the skin incision was closed.

The same surgeon did all the procedures. The improvised glove port was introduced through a 20-mm longitudinal transumbilical skin incision. This glove port was composed of a flexible ring, a rigid larger ring, and a powder-free surgical glove (fig. 1). The flexible ring covered by the glove was placed over the abdominal cavity. Then, the open end of the glove closely surrounded the rigid ring. Standard straight laparoscopic instruments were introduced through the fingers of the glove port (fig. 2).

A transperitoneal approach was used for all patients. LESS procedures included orchidopexy, orchietomy, varicocelectomy, nephrectomy, pyeloplasty, and treatment of a renal hydatid cyst. Patients were in a supine position for varicocelectomy and undescended testis, and in a semi-flank position for other procedures.

Management of undescended testes was based mainly on the length of the gonadal vessels. The testis was drawn toward the opposite inguinal canal as a rough indicator of adequate vascular length. The testicle was then dissected and adequately mobilized until it reached at least the contralateral internal ring. Then the testis was fixed in a subdartos pouch as for an inguinal orchiopexy. In children with short gonadal vessels, first stage Fowler-Stephens (FS) orchiopexy was done and subsequently LESS second stage FS orchiopexy was done after 6 months. Orchietomy was done only if the testis was atrophied.

In children with a varicocele, the testicular vein was dissected. Then surgical clips were applied and the testicular vein was transected.

LESS nephrectomy was done in 3 children with multicystic dysplasia and LESS nephroureterectomy was done in 3 patients with a non-functioning kidney secondary to end-stage reflux nephropathy. The kidneys were externalized through the umbilical incision.

LESS pyeloplasty was performed in 21 children. A “hybrid procedure” was used. After dissection and mobilization of the ureteropelvic junction, a sterileatraumatic cord was placed around the ureter and used to tract it up in order to facilitate dissection. The obstruction site was clearly identified, a 1-cm flank incision was made, and ureteropyeloplasty was performed under direct vision (fig. 3). Resolution of a ureteropelvic junction obstruction was confirmed by improvement in ultrasound and diuretic renography.

Treatment of renal hydatid cysts using the LESS procedure was feasible. The cyst was demonstrated and completely exposed by blunt dissection. Then the cyst was isolated on all sides by packing it off using gauze pieces soaked with 10% povidone iodine, to minimize the spillage of the hydatid contents. A trocar was inserted into the cyst under vision, with due care taken to avoid spillage. The contents of the cyst were aspirated using an aspiration needle, and hypertonic saline was instilled for 10 minutes. The extraction of all the hydatid membrane was realized under protection by Endobag.
Results

Seventy-three patients (55 males, 18 females) underwent 85 transperitoneal LESS procedures. The median age was 4.6 years (ranging from 9 months to 14 years). Six different types of procedures were performed. LESS procedures, median age, median operative time, intraoperative and postoperative complications, and median hospital stay are shown in Table 1. Twelve out of 46 (26%) orchidopexies were staged FS procedures. Five bilateral orchidopexies and 1 bilateral varicocelectomy were performed. During the follow-up, 2 patients had testicular atrophy after a FS procedure and 1 patient had testicular reascension. No other complications were detected during LESS procedures.

The median operative time for the entire cohort was 47 min (range 25–156 min). There was no significant intraoperative blood loss. No conversion to conventional laparoscopy or open surgery was needed. All patients required paracetamol postoperatively. The mean follow-up was 18 months. Cosmetic results were excellent. Forty-five (62.5%) patients were discharged on the day of surgery.

Discussion

In the field of pediatric surgery, single port surgery using a transumbilical approach has gained popularity during the last few years [7–12]. This technique is based on the idea that all laparoscopic trocars are inserted through a single umbilical incision. Since the first description of LESS surgery in the pediatric urological population [13], various authors have shared their experiences and results. However, most of the reports were case reports and initial small case series [14–19]. To our knowledge, we report the largest case series of LESS surgery in pediatric urology that includes 73 children who had 85 LESS procedures.

The evolution of single port devices, articulating and pre-bent instruments, and flexible laparoscopes has contributed to the application of LESS surgery. Many single-port devices have been used to perform LESS procedures such as the Olympus TriPort access, Covidien SILS access port, and GelPOINT access with articulating instruments [20–22]. However, these commercial devices are very expensive and not available in many centers especially in developing countries. In our report, we used a low-cost homemade glove port and conventional laparoscopic instruments.

Table 1. Different LESS procedures, median age, median operative time, intraoperative and postoperative complications, and median hospital stay

| Procedure                      | Number of procedures | Number of patients | Median age, months (range) | Median operative time, min (range) | Postoperative complications | Median hospital stay, days (range) |
|--------------------------------|---------------------|--------------------|---------------------------|-----------------------------------|-----------------------------|----------------------------------|
| Orchidopexy                    | 46                  | 36                 | 38 (9–68)                 | 34 (28–61)                        | 3                           | 1                                |
| Varicocelectomy                | 8                   | 6                  | 168 (148–182)             | 28 (25–38)                        | 0                           | 1                                |
| Nephrectomy                    | 3                   | 3                  | 53 (47–68)                | 98 (66–115)                       | 0                           | 1 (1–2)                          |
| Pyeloplasty                    | 21                  | 21                 | 44 (26–62)                | 118 (88–156)                      | 0                           | 2 (2–3)                          |
| Renal hydatid cyst treatment   | 1                   | 1                  | 148                       | 65                               | 0                           | 1                                |
| Orchietomy                     | 3                   | 3                  | 42 (18–87)                | 26 (22–33)                        | 0                           | 1                                |
| Nephro-ureterectomy            | 3                   | 3                  | 48 (42–55)                | 108 (77–122)                      | 0                           | 1 (1–2)                          |

Fig. 3. LESS pyeloplasty steps.

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Probably the major advantage of LESS surgery compared to conventional laparoscopy is the superior esthetic result [21], which is of even greater value in the pediatric population, given that a surgical scar is expected to enlarge along with the growth of the child. Till et al. [23] recently published a review of literature on minimal invasive approaches to pediatric nephrectomy and heminephrectomy and found that conventional laparoscopy represents the method of choice for any age group compared to robot-assisted surgery and LESS surgery. However, they recommended further larger studies to investigate the cosmetic benefits of LESS surgery. In our review of recent literature, we found that most studies comparing multi-port surgery to LESS surgery in children demonstrated that LESS surgery is a feasible and safe approach with comparable operative outcomes [20–22, 24–27]. LESS surgery offers excellent cosmetic results and decreases the risk of intra-abdominal injury secondary to additional port placements [20, 21, 26].

Other benefits using LESS technique were reported including decreasing morbidity, lower blood loss, short recovery, cosmetic improvement, and lower risk of wound healing complications [20, 21, 28–30]. However, LESS has not been broadly adopted into mainstream urological practices because of technical challenges including limited triangulation, limited working space, crossing of instruments for wider retraction, and a laparoscopic view in line with the instruments [28, 29, 31].

Despite the inherent challenges, we were able to perform LESS surgery in the pediatric population using standard pediatric instrumentation. We did not require use of articulating instruments. Extra-corporeal sutures during pyeloplasty facilitated reconstruction. The exteriorisation of the ureteropelvic junction through another mini incision was feasible using straight instruments. We suggest that surgeons should not hesitate to introduce additional mini-laparoscopic instruments through miniports or stab wound incisions in order to control possible bleeding and safely complete a procedure. During LESS procedures, instruments must be in line and move together in unison to avoid clashing.

Despite being more difficult, the maneuverability of instruments with one port may be overcome through the learning curve. Therefore, the European Association of Urology recommends that LESS should be performed only by experienced laparoscopic surgeons [32].

Moreover, compared to adult patients, in the pediatric population the distance from the umbilicus to the target organ is shorter, visceral fat is minimal, and target organs are smaller, factors that may facilitate the performance of LESS [33, 34].

Our study has several limitations. There was no control group of open surgical or a conventional laparoscopic approach. Pain management was not standardized. Although patients seemed satisfied with their postoperative cosmetic outcomes, scar satisfaction was not assessed with a validated questionnaire. Furthermore, the number of patients in some indications was small and more patients are required to give solid conclusions and detect possible complications.

**Conclusion**

Our study demonstrates that LESS surgery using our glove port technique and conventional laparoscopic instruments is a feasible and safe technique for the surgical management of various pediatric urological conditions. Therefore, our homemade glove port laparoscopic system provides a simple, cost-effective approach to LESS surgery, and will probably make laparoscopic procedures using conventional instruments easier.
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