

# Single-port laparoscopic surgery in children: A new alternative in developing countries

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## ABSTRACT

**Background:** Single-incision laparoscopic surgery (SILS) is a technique in laparoscopic surgery, which is based on the idea that all the laparoscopic trocars are inserted through a single umbilical incision. This paper documents a single-centre experience, which performed the single-port surgery in children using an improvised trans-umbilical glove-port with conventional rigid instruments. **Materials and Methods:** We prospectively studied the outcomes of SILS procedures between January 2013 and June 2014. Materials required making our homemade trans-umbilical port consisted on: A flexible ring, a rigid larger ring, one powder-free surgical glove, a wire-to-skin and standard standards laparoscopic trocars. **Results:** A total of 90 consecutive procedures had been done in our institution: 15 girls and 75 boys (mean age: 7.5 years). We used SILS on 59 appendectomies with an average operative time of 48 minutes. We needed conversion to conventional surgery in three cases (two with perforated appendicitis and one for difficulty to mobilize the appendix). SIL cholecystectomy was performed for four patients with symptomatic cholelithiasis; mean operative time was 60 min. All patients were discharged on postoperative day 2. Eighteen boys with non-palpable testis were explored and treated. Other procedures included: Varicocelectomy ( $n = 2$ ), intra-abdominal lymph node biopsies ( $n = 2$ ), ovarian cystectomy ( $n = 1$ ), ovarian transposition ( $n = 1$ ), aspiration of renal hydatid cyst ( $n = 1$ ), explorative laparoscopy in research to Meckel's diverticulum ( $n = 1$ ) and intestinal intussusceptions ( $n = 1$ ). No post-operative complications were seen in all cases. **Conclusions:** SILS in the paediatric population using conventional rigid instruments is feasible, safe and effective. It may be an alternative to the costly commercially available single-port systems especially in a developing country like Tunisia.

**Key words:** Single-incision laparoscopy, children, rigid instruments

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## INTRODUCTION

Single-incision laparoscopic surgery (SILS) is a technique in laparoscopic surgery, which is based on the idea that all the laparoscopic trocars are inserted through a single umbilical incision.<sup>[1]</sup> However, this technique requires specialised instruments, which are very costly and not affordable by the majority of the population in a developing country like Tunisia.

We present in this paper our single-centre experience that performed the single-port surgery in children using an improvised trans-umbilical glove-port with conventional rigid instruments.

## PATIENTS AND OPERATIVE TECHNIQUE

To make the trans-umbilical glove port, we require a flexible ring (FR), a rigid larger ring (RR), one powder-free surgical glove, a wire-to-skin and standard laparoscopic trocars [Figure 1].

These two rings are made of a silicone product that had Food and Drug Administration certification. They are issued after testes made in USA and are guaranteed for life.

At the beginning of the procedure, the fingertips of the glove are cut-off where the trocars are inserted and fixed by a vicryl 3/0 ligature wire. Then, the open end of the glove is passed through the FR and turned around it in the middle of the glove [Figures 2 and 3]. Afterwards, a 2 cm skin incision at the level of the umbilicus and peritoneum opening are generally sufficient to introduce the FR covered by the glove into the abdominal cavity [Figure 4]. The open end of the glove surrounds then closely the RR. Pneumoperitoneum could be created by carbon dioxide insufflations through one of the trocars. Conventional laparoscopic instruments and a 0° laparoscope are also introduced into the abdominal cavity through these trocars [Figure 5]. At the end of the operation, the specimen is pulled out. We close then the

muscle fascia by vicryl 2/0 sutures and the umbilical skin using the rapid vicryl sutures [Figure 6].

All cases were performed in Hedi Chaker University School of Medicine, Department of Paediatric

surgery, between January 2013 and June 2014. All patients were evaluated prospectively, and data concerning the following were collected: Operative time, postoperative hospital stay, operative and postoperative complications. Operative time is



Figure 1: Materials required for construction of transumbilical glove-port

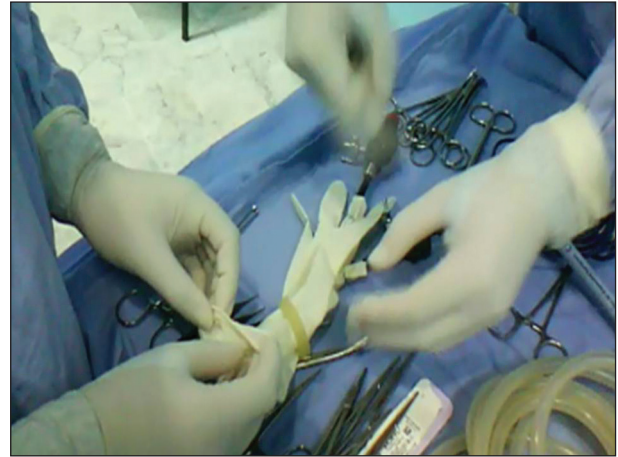


Figure 2: Open end of the glove passed through the flexible ring

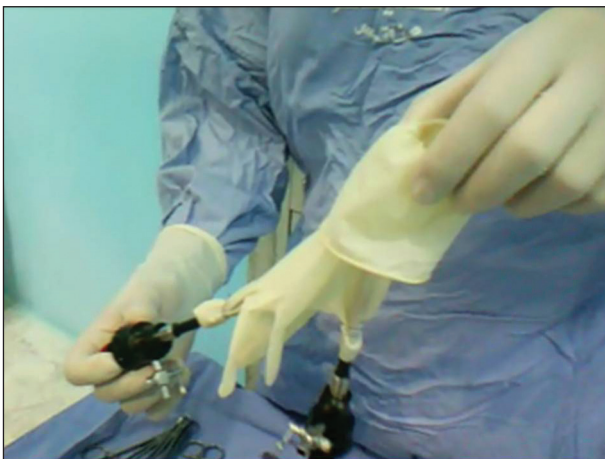


Figure 3: Glove port ready for insertion



Figure 4: Flexible ring introduced through the umbilical incision



Figure 5: Open end of the glove being wrapped around the towel ring and pneumoperitoneum creation



Figure 6: Postoperative photograph showing umbilical incision after a single-port appendectomy

considerate to be the time between the skin incision and closure.

## RESULTS

A total of 90 consecutive procedures had been done in our institution: 15 girls and 75 boys. The mean age of the patients was 7.5 years (ranged from 6 months to 13 years).

We used SILS on 59 appendectomies. Average operative time was 48 min. We needed conversion to conventional surgery in three cases (two with perforated appendicitis and one for difficulty to mobilise the appendix).

Single-incision laparoscopic cholecystectomy was performed for 4 patients with symptomatic cholelithiasis. Neither conventional conversion nor additional ports have been needed in all cases. Mean operative time was 60 min. All patients were discharged on postoperative day 2.

We explored in this work 18 boys with non-palpable testis. In eight cases, the spermatic vessels and the vas deferens were engaged in the inguinal ring, and the testis was just atrophied. We performed Fowler Stephens technique in four cases and one-stage orchidopexy for six patients with intra-abdominal testis. Mean operative-time was 35.9 min.

Single-incision laparoscopic varicocelectomy was made for 2 boys. They had respectively 8- and 10-year-old. Mean operative time was 30 min.

We performed 2 intra-abdominal lymph node biopsies that loaded to tuberculosis in one case and lymphoma in the other case.

Ovarian cystectomy was achieved for one girl in 70 min. Right ovarian transposition was accomplished

to another 12-year-old girl with advanced Hodgkin lymphoma requiring a pelvic radiotherapy. The operation lasted 60 min.

We also treated one 5 cm renal hydatid cyst by SIL aspiration, without incidents. There was no recurrence during 1 year of postoperative follow-up.

Single-incision laparoscopic surgery permitted the exploration of the abdominal cavity in research of Meckel's diverticulum in a 2-year-old infant with recurrent rectal bleeding. All the small intestine was checked in 20 min.

Finally, the younger patient who underwent SILS in our series was a 6-month-old infant with intestinal intussusception. Conversion to conventional surgery was needed for intestinal perforation.

No postoperative complications were seen in all cases.

Table 1 demonstrates the procedure outcomes [Table 1].

## DISCUSSION

Single-incision laparoscopic surgery has been widely performed for most paediatric surgical procedures.<sup>[1]</sup> Then, many paediatric experiences have been reported highlighting the feasibility and the safety of this mini-invasive laparoscopic surgery in children.<sup>[2]</sup> They included abdominal operations such as appendectomies,<sup>[3-5]</sup> cholecystectomies,<sup>[6-8]</sup> splenectomies<sup>[9]</sup> and intestinal surgery.<sup>[10]</sup> Urologic procedures have also been reported: Pyeloplasty,<sup>[11]</sup> nephrectomy for ureteropelvic junction obstruction or multicystic dysplastic kidney<sup>[12]</sup> and varicocelectomy.<sup>[13]</sup>

The commercially multichannel single-port devices are very costly, and ALEXIS® wound retractor is not available; two arguments that limited the use of classic

**Table 1: Outcomes of single port laparoscopic surgery using surgical glove port**

Procedure	Number	Conversion to conventional surgery	Mean operative time (min)	Mean length of hospital stay (days)	Complication rate (%)
Appendectomy	59	3	48	2.76	0
Cholecystectomy	4	0	60	2	0
Non-palpable testis exploration	18	0	35.9	1	0
Varicocelectomy	2	0	30	1	0
Lymph node biopsy	2	0	25	1	0
Ovarian cystectomy	1	0	70	2	0
Ovarian transposition	1	0	70	2	0
Renal hydatid cyst aspiration	1	0	110	3	0
Intestinal intussusceptions	1	1	50	5	0
Explorative laparoscopy	1	0	20	1	0



SILS in developing countries like ours. The homemade single-port system that we use in our department costs only around 30 Euros, which is approximately the 1/10 of the classic single laparoscopic surgery port expenditure. Port implantation is relatively easy and safe, and it provides increased mobility of hand tools.

However, it needs a significant coordination between the surgeon and the camera holder. The instruments are usually crossed at the access port into the abdominal cavity.

Decreased postoperative pain, as theoretical benefit of SILS, requires further investigation. Recently Zani *et al.* reported that SILS seems to be associated with more postoperative pain than standard laparoscopy.<sup>[14]</sup> However, a meta-analysis described by Saldaña and Targarona showed similar pain scores in both techniques.<sup>[15]</sup>

In this study, postoperative pain score were not analysed because this score did not correlate with requirement of additional analgesics. All patients were very satisfied with the cosmetic result.

To our knowledge, this technique has been previously used by only two authors in adults. Khiangte *et al.* performed a series of 40 single port surgeries including cholecystectomies, appendectomies, and ovarian cystectomies.<sup>[16]</sup> Uday and Bhargav used the same technique in appendectomies.<sup>[17]</sup>

According to our initial experience, SILS in the paediatric population with conventional rigid instruments is feasible, safe and effective. It may be an alternative to the costly commercially available single-port systems especially in a developing country like Tunisia.

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