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Single-incision laparoscopic surgery and conventional laparoscopic treatment of varicocele in adolescents: Comparison between two techniques

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ABSTRACT

Background: Single-incision laparoscopic surgery (SILS) has gained great popularity in paediatric surgery due to its minimally invasive approach and improved cosmetic results. Notwithstanding, reports describing its adoption in children are still fragmentary and some perplexities have been raised by some surgeons. We reviewed our experience with the SILS Palomo varicocelectomy procedure (SIL-V) in children and adolescents, comparing this group with a similar series operated using conventional laparoscopic varicocelectomy (CL-V). **Patients and Methods:** A total of 69 Palomo laparoscopic varicocelectomies were performed in patients aged 11-17 years from January 2011 to January 2013. Indications for surgery included grades II-III varicocele or ipsilateral testicular hypotrophy. The SIL-V procedure was performed in 44 patients with roticulating and conventional 5 mm instruments. Testicular vessels were isolated "*en bloc*," clipped and cut. Operating time, visual analogue scale and post-operative results were compared to a similar group of 25 patients operated with CL-V. **Results:** No patient of the SIL-V group required conversion to conventional laparoscopy, none to open surgery. Mean operative time was 22 min (range: 19-28) in the SIL-V group, not significantly different compared with CL-V (mean 21 min, range: 18-25). All patients experienced a smooth recovery from surgery without any complications, and were discharged on day 1. No difficulties were found in the SIL-V group. The post-operative pain score was significantly better in SIL-V. **Conclusion:** The SIL-V procedure is safe and effective and allows a fast and efficient isolation of the vascular bundle. The use of conventional instruments is technically feasible in SIL-V.

Key words: Palomo, single-incision laparoscopic surgery, varicocele

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INTRODUCTION

The laparoscopic treatment of varicocele is an efficient technique and the complete ligation of the whole vascular spermatic pedicle above the vas deferens offers excellent success, without atrophy.[1]

Although introduced later than adult surgery, single-incision laparoscopic surgery (SILS) in children is gaining popularity and is emerging in a variety of procedures.[2,3] This is also due to the fact that even in this age group the goal of surgery without scars is attractive and stimulating.

However, there are still doubts about the real advantage of the use of SILS in children because of the increased operative time and ergonomics, which reflects the reduced "working space" and post-operative pain, the only counterpart being the good aesthetic results.[4] This is probably due also to the perception that the small scars left by paediatric laparoscopic instruments are acceptable compared with those used in adult patients and because there is a concern regarding the limited manoeuvrability of laparoscopic instruments in the small peritoneal cavity of children.[5]

We reviewed our experience with the SILS Palomo varicocelectomy procedure (SIL-V) in children and adolescents comparing this group with a similar series operated with conventional three-trocar laparoscopic varicocelectomy (CL-V) by the same surgeon (AM).

PATIENTS AND METHODS

A total of 69 patients scheduled for varicocelectomy were recruited for this study from January 2011 to January 2013. They were aged 11-17 years (mean 14.5 years). 25 patients were operated by conventional three-trocar conventional clip ligation and section "*en bloc*" of the vascular bundle (CL-V), and 44 to SIL-V. Group

allocation was concealed in a sealed opaque envelop by a third party (independent researcher) prior to the treatment. There was an exclusion criterion for patients who had a history of previous abdominal surgery to be operated with SILS and CL-V. Indications for surgery included grades II-III varicocele or ipsilateral testicular hypotrophy (16 patients). In order to optimise the results of SIL-V, the first five procedures were not considered in this series. All procedures were performed by the same surgeon (AM). After induction of general anaesthesia, a preincisional local infiltration of 10 mL ropivacaine 7.5 mg/mL, at the level of the umbilical SILS port, or equally distributed at level of the three ports for CL-V,[6] was performed. The patients were placed in a supine position with the surgeon and assistant on the patient's right and left, respectively.

A 20 mm longitudinal incision was made through the umbilicus and the fascia, and peritoneum were opened under direct vision, utilising the natural umbilical defect.

After exploring the cavity with the index finger in order to exclude periumbilical visceral adhesions, the SILS port (Covidien®, Mansfield, Massachusetts, USA) was inserted using one or two curved Rochester-Pean clamps to grasp the inferior portion of the port. Insertion was facilitated by using sterile lubricating gel or simply hot water. The SILS port utilised in this study was a pulley-shaped, single, elastic, and flexible portable to fit through the facial incision without any air leak. This device has been adopted by us because we have confidence with this technique and it is used at our institution, and also for other single-port procedures.

Three 5 mm cannulas were then inserted into the SILS port at different heights to reduced clashes between the cannulas, and insufflation of carbon dioxide gas through the port's device was performed to achieve pneumoperitoneum.

The patients were then placed in the Trendelenburg position and the procedure was performed just utilising one roticulator grasper and other straight conventional 5 mm instruments (scissors, clip applier, and grasper). Usually, the dominant hand utilised the straight instrument and the non-dominant hand the articulating one. The reticulating Maryland grasper was utilised to grasp the peritoneum and a T-incision was made with a standard curved scissor. The vascular bundle was then isolated "*en bloc*," closed with two pairs of titanium clips (two proximally and two distally to the site of the division) and then cut. In some cases, the sigmoid adhesions overlying the cord needed to be dissected [Figures 1a-e].

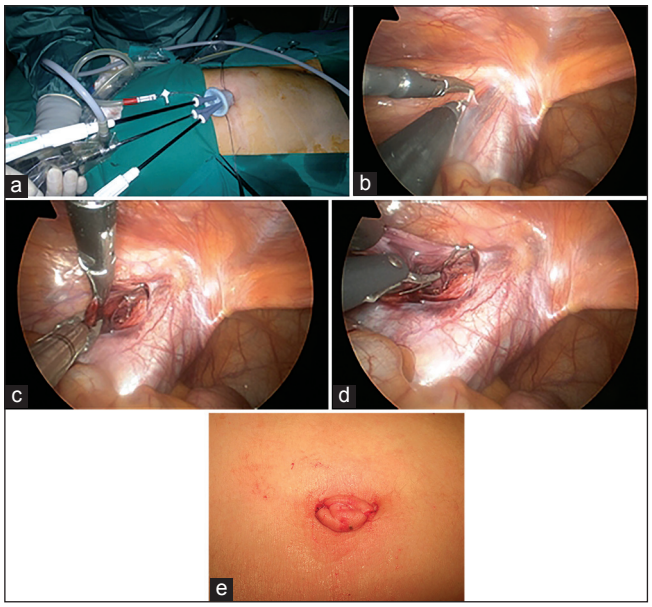


Figure 1: Trans-umbilical single-port laparoscopic (single-incision laparoscopic [SILS] Palomo varicocelectomy). (a) The SILS port was inserted into the umbilical incision (about 20 mm in length). (b) T-incision above the vascular bundle (one articulating instrument and one conventional scissors). (c) Isolation of the bundle and clips application. (d) Cutting of the bundle. (e) Post-operative view of longitudinal umbilical incision

The fascial opening together with the peritoneum defect was carefully closed with three stiches of 2-3/0 polyglactin.

The same procedure was performed in the CL-V group with a first 5 mm trans-umbilical trocar introduced by "open" technique, and two operative, left and right 5 mm trocars. The peritoneum covering the vascular bundle was first incised; the vessels were lifted up with the 5 mm grasping forceps, and isolated with the vascular probe. The 5 mm clip applier was then activated 4 times (twice proximally and twice distally) to ensure closure of the spermatic vessels, which were then divided with laparoscopic 5 mm scissors. In both series, at the end of the procedure, the peritoneal window has been left open. All patients were discharged on day 1.

Peri-operative and post-operative complications were considered. Operating time and pain score, evaluated by visual analogue scale (VAS), were recorded and compared in the two groups by Wilcoxon paired test. $P < 0.05$ was considered as statistically significant considered the small number of patients.

Post-operative pain was measured using the VAS every 3 h for 12 h and the 24 h VAS was graded from 0 to 10.

All VAS scoring was performed by the attending nurse. This study was approved by our Local Ethics Committee, and a pre-operative informed consent for participation in the trial was obtained by the parents.

RESULTS

No patient in either group required an additional port or conversion to open procedure nor post-operative complications including testicular atrophy, wound infection or incision site herniation. One patient of the SIL-V group presented bleeding of the distal end of the cut bundle and required the application of additional clips without any difficulty in utilising a reticulating instrument and the clip applier. The bleeding point was first identified, grasped, and after blood aspiration, two additional clips were applied.

Two patients, belonging to both groups, developed a post-operative hydrocele at 2 and 6 weeks: One patient with diabetes was treated successfully with simple needle evacuation through the scrotum after 4 months; the other patient had a significant sized hydrocele that required scrotal hydrocelectomy 8 months later, after two unsuccessful needle aspirations.

Eleven out of 16 patients recovered testicular size, from a mean pre-operative testicular size of 15.3 mL (range: 9.5-21 mL) to a mean post-operative size of 19.5 mL (range: 12-27 mL), with a mean 4.2 mL increase. The remaining five patients are stable and at present their pre-operative testicular size has not atrophied.

Two patients, belonging to both groups, presented varicocele recurrence from 2 to 4 months after the procedure. They were then reoperated on successfully by microsurgical subinguinal approach according to Goldstein's technique.[7]

Mean operative time was 22 min (range: 19-28 min) in the SIL-V group and 21 min (range: 18-25 min) in the CL-V group. The Wilcoxon test was not significant [Table 1].

Table 1: Comparison between operative time in CL-V and SIL-V in minutes

Total	SIL-V *n* = 44	CL-V *n* = 25	*P* value
69	22 (19-28)	21 (18-25)	>0.05 (not significant)
SD	2.68	2.29	

P value 0.1441 (Wilcoxon test not significant). SIL-V: Single-incision laparoscopic varicocelectomy; CL-V: Conventional laparoscopic varicocelectomy; SD: Standard deviation

Visual analogue scale was significantly better in SIL-V at hours 6 and 9 and 24, but no significant difference was recorded in the survey at 3 and 12 h [Table 2]. Only four patients belonging to the two groups had transient shoulder pain.

DISCUSSION

Surgical repair of varicocele can be achieved by conventional open varicocelectomy, laparoscopic, microsurgical intervention, or transdermal sclerotherapy and embolization of the testicular vein.

Technological progress of the last 20 years has allowed the introduction of a new minimally invasive surgical modality, that is, laparoscopic surgery found to be safe and effective in children and adolescents.[8,9] SILS represents an advance in minimally invasive techniques. It offers nearly perfect cosmesis with avoidance of extra incisions. The relative drawback can be that SILS may be performed by surgeons experienced in advanced laparoscopic techniques. This requires a certain learning curve. However, the learning curve during the actual surgery is also very quick for experienced laparoscopic surgeons, and as noted in our experience, operative times decreased rapidly with every operation.

The first experience with three cases of SIL-V in adolescents was reported by Kaouk and Palmer in 2008, with an operative duration below 1 h for each procedure.[10] Since this report, some authors have described their experience with SIL-V, not specifically, but including these cases in a larger comprehensive case series.

In our experience, the results of SIL-V are very encouraging in terms of safety and easiness once the learning curve is accomplished. Of course, the sword-clashing phenomenon actually occurs, and the ergonomics is not ideal. However, operative time required for this procedure is generally too short to compromise the surgeon's performance.[11]

Furthermore, the sigmoid adhesions overlying the cord were dissected with scissors without any difficulty. In

Table 2: Comparison between VAS score in CL-V and SIL-V recorded at 3, 6, 9, 12, and 24 h

Total 69	SIL-V *n* = 44	CL-V *n* = 25	*P* value
3 h	3.3 (SD: 0.618171)	3.68 (SD: 0.9)	>0.05 (not significant)
6 h	5.3 (SD: 0.88772)	6.08 (SD: 1.07703)	<0.05 (significant)
9 h	4.4 (SD: 0.663134)	5.4 (SD: 0.76376)	<0.05 (significant)
12 h	4 (SD: 0.789399)	4.16 (SD: 0.67409)	>0.05 (not significant)
24 h	2.8 (SD: 0.646801)	3.5 (SD: 0.585947)	<0.05 (significant)

Wilcoxon two-sample test, VAS was significantly better in SIL-V at hours 6 and 9 and 24, but no significant difference was recorded in the survey at 3 and 12 h. SIL-V: Single-incision laparoscopic varicocelectomy; CL-V: Conventional laparoscopic varicocelectomy; SD: Standard deviation; VAS: Visual analogue scale

addition, in case of bleeding of one of the end of bundle the possibility to use two independent instruments is very useful, as this allows to locate the source of the bleeding, grasp, and clip it without any difficulty.

Many centres with modern laparoscopic equipment rapidly expanded the indications of SILS. In children, SIL pyloromyotomy, splenectomy, nephrectomy, inguinal hernia, fundoplication, diaphragmatic hernia repair, and bowel surgery have been described.[12-16] Tormenti *et al*. recently reported a technique for SILS ventriculoperitoneal shunt placement in children with hydrocephalus.[17]

Regarding the postoperative pain after SILS, the topic is currently still debated: Disadvantages of SILS seem to include more post-operative pain due to longer operative time and a larger fascial incision compared to conventional laparoscopic procedures. In some experiences the authors report that there is no improvement in post-operative pain in children.[18,19] Furthermore, in adults, some authors report that pain scores in the 24 h after surgery were higher in patients who underwent SILS appendectomy.[20] A recent randomised controlled trial showed that patients who underwent SIL cholecystectomy experienced less post-operative pain and required fewer analgesics compared to those treated with conventional laparoscopic cholecystectomy.[21] As reported by Bansal *et al*. in their initial experience, the author indicates that the laparoendoscopic single-site varicocelectomy may be more painful in the immediate post-operative period than conventional laparoscopy,[22] whereas, Wang *et al*.[23] in their experience, concludes that compared with conventional laparoscopic technique, laparoendoscopic single-site varicocelectomy may decrease post-operative pain and hide the surgical incision better within the umbilicus.[23]

In our experience, the patients presented a significantly lower VAS at 6, 9, and 24 post-operative hours. Whereas the difference was not significant for measurements made 3 and 12 h following surgery. Our results are also in line with those reported by some authors on varicocelectomy in adults.[24]

Moreover, operating time in the initial experiences[10] was longer than with standard laparoscopy. Whereas, with time and the learning curve, it is now comparable with the standard laparoscopy. This can be also explainable by the fact that usually SILS is performed by a single laparoscopic surgeon with extensive experience. Whether, it can achieve improvement in cosmetic remains to be confirmed.

Lastly, another point of discussion can be related to the ability to perform the laparoscopic varicocelectomy with only two-trocars.[25] In our opinion this technique, though valid, is not comparable because our aim was to consider the results with the use of the classic three-trocar technique and the advantages it offers.

CONCLUSION

The SIL-Palomo procedure is safe and effective and allows a fast and efficient isolation of the vascular bundle. The use of conventional instruments is technically feasible in SIL-V, doing away with the need for special instruments. Considering the better overall post-operative pain evaluation, but the lack of difference in post-operative outcomes compared to CL-V, SIL-V could be advisable in adolescents. Moreover, the use of articulating instruments is just limited to one grasper. Larger studies and prospective randomised trials will be necessary to assess the true benefit of this approach.

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