Toward sutureless laparoscopic inguinal repair in children?

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Abstract

We report our experience with a sutureless technique for laparoscopic inguinal hernia repair in children. Twenty-eight children, 12 girls and 16 boys, aged 3 months to 7 years, underwent sutureless laparoscopic inguinal hernia repair. In girls, we utilized simple cauterization of the internal inguinal ring with a single trocar technique. In boys denudation of the peritoneum was obtained utilizing a three-trocar technique. The peritoneum around the internal inguinal ring was peeled off and detached from the vas and the vessels, and then wrapped around the grasper, resulting in a large area of denudation. No perioperative complications were observed. No recurrences nor testicular damage were noted after a mean follow-up of 18 months (range 6-35 months). The mean operative time was 12 min (range 7-20 min) for girls and 19 min (range 15-30 min) for boys. A 6-year-old girl exhibited a lymphocele. The sutureless technique appears to be easy, safe, and effective, provided that the patients are carefully selected. In boys, special attention needs to be paid to preservation of the vas and the testicular vessels.

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Introduction

Laparoscopic inguinal hernia repair (LIHR) in children is unanimously accepted as one of the best procedures in terms of safety, reliability, ease of execution, and versatility. A laparoscopic approach allows identification of contralateral patency of the *processus vaginalis* and its repair within the same surgical intervention. As indicated by a number of authors, this strategy is likely to be the leading cause of the nearly complete elimination of metachronous contralateral hernia.[1] While many laparoscopic techniques have been developed in recent years for pediatric inguinal hernia, standardization of techniques is still a long way off, and no single technique suits all varieties of hernia irrespective of the gender of the patients. Moreover, there is still the basic question of whether healing of a hernia can be ascribed to the suture itself or to the fact that it leads to sealing of the peritoneum.

Some experimental and clinical reports support this second hypothesis since incision/suture of the peritoneum appears to be more effective than suture alone.[2,3]

A considerable number of laparoscopic techniques have been developed since the first report by Schier.[4] These can be broadly grouped into laparoscopic intracorporeal suture by three-trocar/single-trocar techniques and laparoscopic-assisted extracorporeal suture.[5]

As a further progression of this notion, several authors have more recently proposed sutureless techniques, as these have been reported to yield sustained effective results.[6] Here, we report our preliminary experience with a sutureless technique for laparoscopic inguinal hernia repair in children.

Materials and Methods

Twenty-eight children, 12 girls and 16 boys, aged 3 months to 7 years, underwent sutureless LIHR. Three of these patients exhibited bilateral inguinal hernias, while four had contralateral patent processus vaginalis, one in a girl and three in boys, and these were treated in the same session. All procedures were performed under general anesthesia and by the same surgeon (A.M.). We excluded patients with a recurrent hernia, an internal inguinal ring wider than 1.5 cm, irreducible hernias, previous inguinal surgery and unstable patients in which laparoscopy was contraindicated. Internal ring diameter was measured by the laparoscope from inside by a piece of suture according to Tanta Algorithm;[7] moreover, it can be of help the use of a 3-mm Johanne grasper whose opening is exactly 1.5 cm. According to literature on sutureless technique,[6-9] we considered eligible for the study, patients with age ranging between 1 months and 15 years. After institutional ethics review board approval, prior to surgery, informed consent was obtained from the patients' parents.

In girls, we utilized simple cauterization of the internal inguinal ring according to the Burnia technique.[8]

An operative, 5-mm transumbilical trocar and a 33 mm × 3 mm grasper were used; the sac was inverted into the abdominal cavity and wrapped around the grasper with a *spaghetti maneuver*. The sac was cauterized with the grasper itself, resulting in clear shrinkage of the hernia sac at the time of activation of the coagulation that closed the inguinal ring. In boys, in whom preservation of the testicular vessels and the vas deferens is mandatory, denudation of the peritoneum with the generation of a small peritoneal flap was used. We utilized a three-trocar technique with a transumbilical *open* access and two 3-mm operative instruments introduced in the majority of cases by a simple stab wound (scissors/Maryland).

The peritoneum around the internal inguinal ring was peeled off and detached from the vas and the vessels, and then wrapped around the grasper, resulting in a large area of denudation. In case of minor suffused bleeding, a few drops of fibrin-glue were applied on the surface of the denuded peritoneum (Figures 1-4).

Results

No perioperative complications were observed after the procedures. No recurrences nor testicular damage were noted after a mean follow-up of 18 months (range 6-35 months). The mean operative time was 12 min (range 7-20 min) for girls and 19 min (range 15-30 min) for boys. A 6-year-old girl exhibited a lymphocele of about 1.5 cm at the level of the ipsilateral major labium after 2 weeks that resolved spontaneously, without any treatment, within 6 months. All of the patients resumed their normal activities after a couple of days.

Discussion

Laparoscopic treatment of inguinal hernia in children is still undergoing extensive development. A recent study has shown that

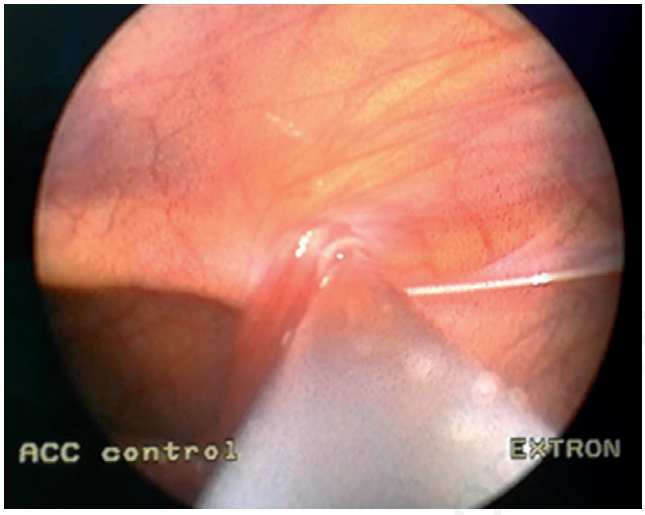

Figure 1. Left inguinal hernia in a 3-year-old girl: Inverted hernia sac by grasper.

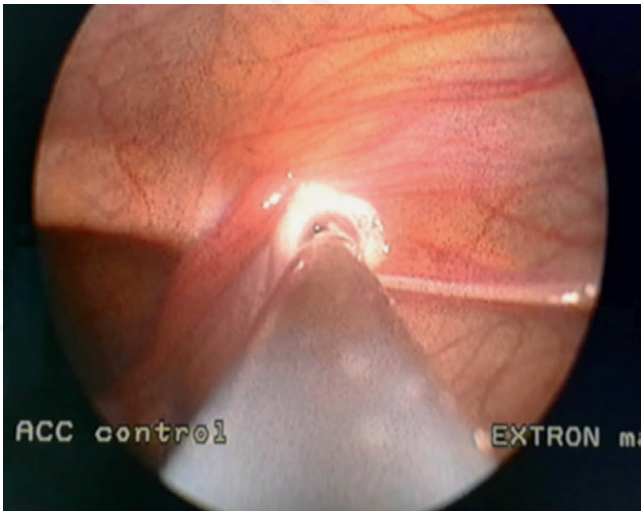

Figure 2. Left inguinal hernia in a 3-year-old girl: Cautery being applied to the inverted sac.

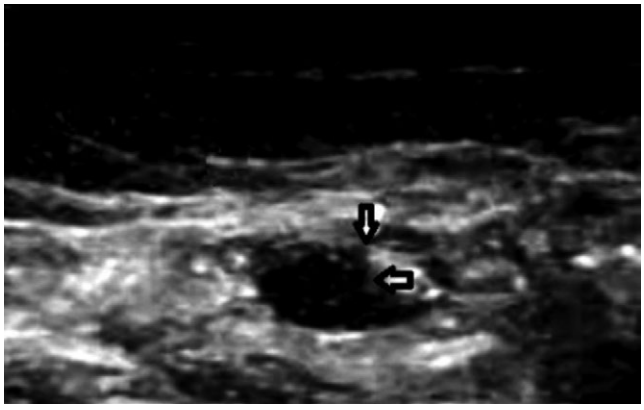

Figure 3. Lymphocele of the right major labium after cauterization of the sac in 4-year-old girl.

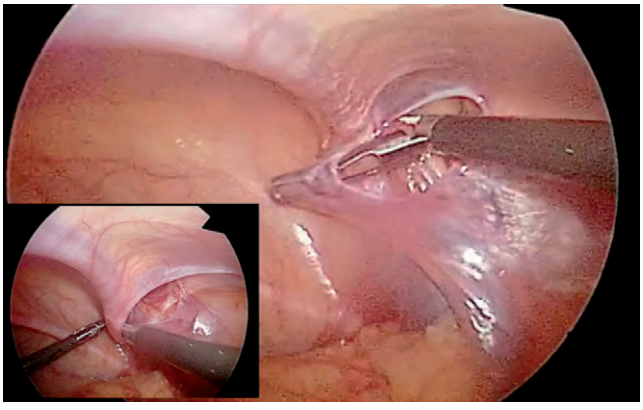

Figure 4. Left inguinal hernia in a 2-year-old boy: the peritoneum around the internal inguinal ring is peeled creating a denuded area of peritoneum preserving vas and testicular vessels.

a considerable number of techniques have been devised for laparoscopic treatment of hernia for the pediatric age group, all of which yield excellent results. The only disadvantage is that they involve a longer learning curve compared to the conventional open method.[1]

The techniques are broadly divided into extracorporeal and intracorporeal approaches. Extracorporeal techniques are basically carried out as a laparoscopic-assisted procedure as they involve the introduction of a needle, under visual control, to create a loopof thread that closes the internal inguinal ring. The intracorporeal techniques, on the other hand, are performed using one or more trocars as well as the use of intracorporeal sutures.[4]

More recently, new techniques of intracorporeal repair have emerged that are based on evidence that hernia healing depends primarily on the lesion/reconstitution of the internal ring peritoneum, while the suture is considered to be subsidiary in the healing process. In 2012, García-Hernández[6] proposed laparoscopic resection of the hernia sac without suture according to the physiopathology of the pediatric inguinal hernia, with a recurrence in only 2 patients (0.53%), both of whom had undergone incomplete resection.

On the other hand, there have been numerous studies in which incision of the peritoneum followed by a suture resulted in a lower rate of recurrence compared to suture alone, thus indicating that the peritoneal lesion has a prominent role.[10] In a previous report, we also showed that incision of the peritoneum lateral to the internal inguinal ring and the W-shaped suture, compared just a W-shaped suture, was significantly more more effective at preventing hernia recurrence.[11] In fact, in 2006, and again in 2007, Schier already suggested that it might be possible to omit the suture, although this was never actually tested in practice.[12,13] Becmeur *et al.* described excision of the peritoneal sac before closure of the hernia with an intracorporeal knot.[14] Esposito *et al.* incorporated this modification in the surgical technique and they reported a significant reduction in the recurrence rate, from 3.4 to 0.6%, with a follow-up of 2 years.[2] Other investigators who created a peritoneal lesion have reported similar reductions in the recurrence rate after inguinal hernia repair.[15] These observations have also been confirmed by experimental studies, such as a report regarding 28 male rabbits that had an open vaginal process to assess laparoscopic repair using two different techniques. In the first group of rabbits, a laparoscopic percutaneous inguinal hernia repair was used, and after removal of the suture, the majority of the repairs failed when the abdomen was insufflated to 35 mmHg. Although the same technique was used in the second group, a peritoneal lesion was created and the majority of the repairs persisted after removal of the suture. The investigators concluded that the creation of a peritoneal lesion can induce a healing process that leads to a more durable repair than a repair comprising only a suture.[3] Further confirmation of the greater importance of the peritoneal lesion than the suture comes from the study of the type of suture: a recent study on the recurrence rate of laparoscopic percutaneous hernia ligation technique demonstrated that the recurrence of a hernia after laparoscopic percutaneous hernia ligation was significantly less with repairs performed with non-absorbable sutures.[16]

From this point onward, the stage of restricting the treatment solely to the lesion/dissection of the internal ring peritoneum was short, and a series of sutureless techniques have been derived from this.

Clearly, the sutureless technique, due to its characteristics, requires different choices for girls versus boys: safeguarding of the vas deferens and the testicular vessels in males requires dissection of the peritoneum from the vas and at the same time the vessels need to be adequately denuded of the surface of the inner ring. Based on our experience, even if limited by the number of patients, we believe that sutureless repair has proven to be effective and safe both in boys and in girls.

In girls, the Burnia technique appears to be one of the most effective and fast methods for making an incision in the peritoneum. This can be achieved with just a transumbilical 5-mm operative trocar and a grasper. To this end, the rolling maneuver of the bag around the grasper serves to make the thermal damage more complete over the entire surface.

The only peculiarity is the need to use a 33-mm instrument since the standard 22-mm length of 3-mm laparoscopic instruments does not fit 5-mm operating optics.

The Burnia technique was first proposed in 2017 by Novotny *et al.* in girls,[8] with excellent results. The authors, in a multicenter report, operated on and repaired eighty inguinal hernias with this technique in 67 girls. The ages and weights ranged from 1 month to 16 years and from 2 to 69 Kg, respectively. There was one conversion to an open approach due to an incarcerated ovary that was too close to the ring. A single umbilical incision was used in 85% of the cases.

In our cases too, monopolar coagulation produced a parietal peritoneal lesion that healed with the reconstitution of the parietal peritoneal cavity, thereby resulting in healing of the patency of the processus vaginalis, which is ultimately the pathophysiological substratum of inguinal hernia in children. As far as the case of lymphocele is concerned, we are inclined to hypothesize a mechanism similar to what occurs in Palomo varicocelectomy, which involves a block of lymphatic drainage.[17]

Conclusions

Sutureless LIHR in children is increasingly being reported in the literature, although a specific technique has not yet been standardized. Based on our experience, the sutureless technique appears to be easy, safe, and effective. In boys, special attention needs to be paid to preservation of the vas and the testicular vessels.

In girls in particular, the technique has proven to be very minimally invasive and easy. In regard to lymphocele, a mechanism similar to that which occurs in Palomo varicocelectomy, when a block of lymphatic drainage occurs, can be hypothesized.

Although the results are encouraging, we believe they are too preliminary and the follow-up too short to draw a definitive conclusion. Moreover, large comparative studies are needed to draw definitive conclusions.

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