

# Laparoscopic herniorrhaphy in children

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## Abstract

The authors report their experience in laparoscopic repair of inguinal hernias in children. From May 2010 to November 2013, 122 patients with inguinal hernia underwent laparoscopic herniorrhaphy (92 males and 30 females). Telescope used was 5 mm, while trocars for the operative instruments were 3 or 2 mm. After introducing the camera at the umbilical level and trocars in triangulation, a 4-0 non-absorbable monofilament suture was inserted directly through the abdominal wall. The internal inguinal ring was then closed by N or double N suture. All operations were performed in one-day surgery setting. In the case of association of inguinal and umbilical hernia an original technique was performed for positioning and fixing the umbilical trocar and for the primary closure of the abdominal wall defect. The postoperative follow-up consisted of outpatient visits at 1 week and 1, 3, and 6 months. The mean age of patients was 38.5 months. Of all patients, 26 were also suffering from umbilical hernia (19 males

and 7 females). A total of 160 herniorrhaphies were performed; 84 were unilateral (66 inguinal hernia, 18 inguinal hernia associated with umbilical hernia), 38 bilateral (30 inguinal hernia, 8 inguinal hernia associated with umbilical hernia). Nine of 122 patients (6 males and 3 females) were operated in emergency for incarcerated hernia. A pre-operative diagnosis of unilateral inguinal hernia was performed in 106 cases. Of these patients, laparoscopy revealed a contralateral open internal inguinal ring in 22 cases (20.7%). The mean operative time was  $29.9 \pm 15.9$  min for the monolateral herniorrhaphies, while in case of bilateral repair the mean operative time was  $41.5 \pm 10.4$  min. The mean operative time for the repair of unilateral inguinal hernia associated with umbilical hernia was  $30.1 \pm 7.4$  while for the correction of bilateral inguinal hernia associated with umbilical hernia  $39.5 \pm 10.6$  min. There were 3 recurrences (1.8%): 2 cases in unilateral repair and 1 case a unilateral recurrence in a bilateral repair. No other complications were seen. Laparoscopic repair of inguinal hernia in children performed in this experience resulted a safe and effective procedure.

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## Introduction

In the last years laparoscopic inguinal herniorrhaphy in children gained increased popularity. This technique has been regarded as safe and effective.<sup>1-7</sup> Surgeons performing this technique report many advantages compared to traditional herniotomy.<sup>2,8</sup> We report our experience about this topic with a retrospective evaluation of results.

## Materials and Methods

From May 2010 to November 2013, 122 patients with inguinal hernia (IH) underwent laparoscopic herniorrhaphy (LH) (92 males and 30 females). Parents were informed about the different types of procedures and offered laparoscopic technique for their child if they desired this approach. It was explained that LH was a relatively new technique and parents were allowed to choose the type of operation performed. All laparoscopic procedures were performed with the patient in a supine position under general anesthesia. According to patient's weight, a carboperitoneum from 6 to 10 mmHg was established through the first trocar placed infraumbilically with Hasson's technique for all patients. A 5-mm telescope was used for visualization. For closure of the inner inguinal ring, 3 or 2-mm instruments in triangulation were used. After the trocars were introduced (Figure 1), a 4-0 non-absorbable monofilamentous suture was shortened to 8 or 12 cm, depending on the visualization of a monolateral or a bilateral open internal inguinal ring respectively (Figure 2), and inserted directly

through the abdominal wall next to the internal inguinal ring using a regular open surgery needle holder. The internal inguinal ring was then closed with one stitch in an N or double N-shaped fashion (Figures 3 and 4).<sup>6</sup>

In case of associated inguinal and umbilical hernia an original technique was applied.<sup>9</sup> A semicircular incision was made in the skin immediately below the umbilicus. The subcutaneous layers were dissected to expose the hernial sac and the sac encircled and divided. A purse-string monofilament 3.0 non-absorbable suture with a sliding knot was fashioned 5 mm under the limits of the divided umbilical defect. A 5-mm trocar was placed through the umbilical defect for the 0° optic, and was fixed tightening the purse string with a knot pusher avoiding any possible loss of CO<sub>2</sub>. The LH was then performed as described above. Once the intra-abdominal procedure was completed, we removed first the two 3-mm operative trocars then the umbilical one and by means of the knot pusher and thanks to the sliding knot, we could tighten the previously fashioned purse string suture to close the umbilical defect. The procedure was completed by umbilical plasty.

Trocar incisions were then closed by cyanoacrylate glue.<sup>10,11</sup>

All interventions were performed in one-day surgery setting with following postoperative analgesic scheme: paracetamol 15 mg/kg iv intraoperatively and then subsequently repeated every 6 hours. It was also performed caudal block with 1 mL/kg of levo-bupivacaine 0.25% or alternatively for children weighing more than 15 kg TAP block (transversus abdominal plane block) bilaterally with 0.3 mL/kg of levo bupivacaine 0.25% in the side. In any case it has been provided for rescue doses with ibuprofen per os 5 mg/kg. Moreover, all the patients were treated with dexamethasone 0.1 mg/kg before the insertion of the trocar, such as prevention of post-operative nausea and vomiting.

To assess pain in children under three years was used scale Face, Legs, Activity, Cry, Consolability (FLACC).<sup>12</sup> Children over the age of three years was based on the scale Wong-Baker.<sup>13</sup> Pain assessment was performed at discharge from the operating room, two hours, six hours and at discharge from the hospital. The planned postoperative follow up consisted in outpatient department controls at one week, 1,

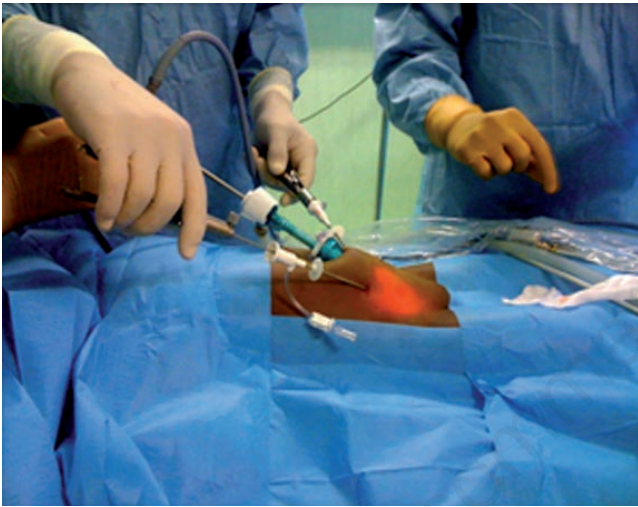


Figure 1. Trocar's disposition for laparoscopic inguinal herniorrhaphy.

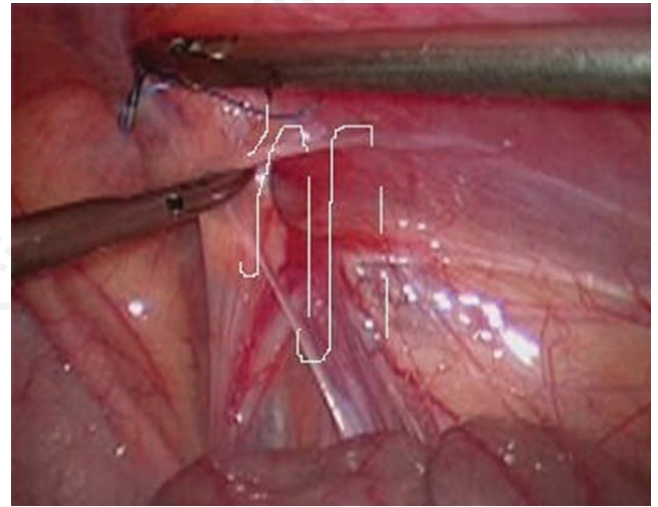


Figure 3. Scheme of a double N-shaped fashion suture.

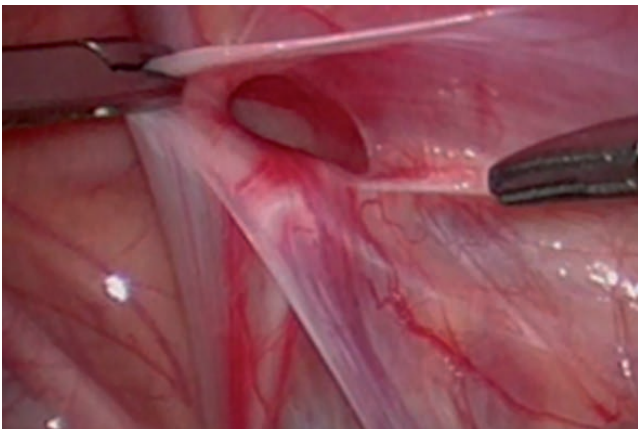


Figure 2. Image of right open internal inguinal ring in a male patient.

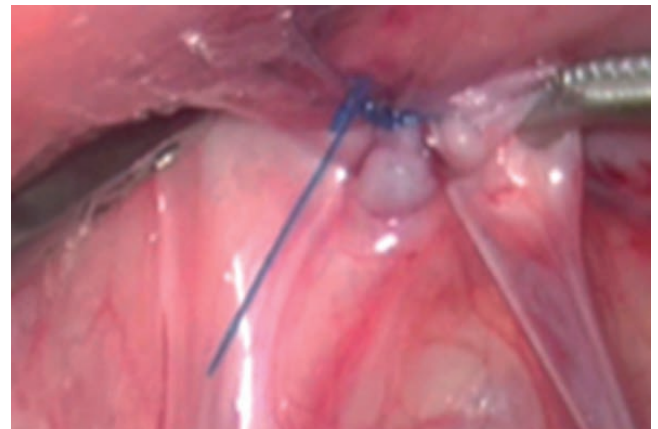


Figure 4. Final aspect of the herniorrhaphy.

3 and 6 months.

## Results

A total 160 LHs were performed in 122 patients. The median age of patients at the date of operation was 38.5 months (range, 1 month - 132 months). Of all patients, 26 were also suffering from umbilical hernia (19 males and 7 females); 84 cases were unilateral (66 IH, 18 IH associated with umbilical hernia) and 38 bilateral (30 IH, 8 IH associated with umbilical hernia). Nine of 122 patients (6 males and 3 females) were performed in emergency for incarcerated hernia. The mean operative time for monolateral repair was  $29.9 \text{ min} \pm 15.9$ ; for bilateral repair the mean operative time was  $41.5 \pm 10.4 \text{ min}$ . The mean operating time for cases of unilateral IH and umbilical hernia association was  $30.1 \pm 7.4$  while for the cases of bilateral IH and umbilical hernia association,  $39.5 \pm 10.6 \text{ min}$ . A pre-operative diagnosis of unilateral IH was performed in 106 cases. Of these patients laparoscopy revealed a controlateral open internal inguinal ring in 22 cases (20.7%).

In all patients the treatment of pain was satisfactory. In 95 patients (77.8%) the pain was less than 4 in all measurements, while in the remaining 27 (22.1%) it was necessary to administer the dose rescue in measuring six hours after the end surgery. There were 3 recurrences in 160 LHs performed (1.8%): 2 cases in unilateral repairs (in the first 10 interventions), and 1 case in a bilateral repair. All recurrences emerged within the first postoperative month after hernia repair. Other post-operative complications such as hydrocele, iatrogenic cryptorchidism, testicular atrophy and wound infection were not seen.

## Discussion

Inguinal hernia repair is one of the most common operations performed in children. Inguinal exploration has a high success rate and a low complication rate,<sup>14</sup> but for some surgeons who support the laparoscopic procedure the open approach is still controversial because there is not possibility to explore the asymptomatic contralateral side, possible complications related to damage of the vas deferens or the spermatic vessels, the possibility to have iatrogenic cryptorchidism related to the herniotomy and the difficulty to identify rare hernias like direct or femoral hernias.<sup>15-17</sup>

For these reasons in recent years, the use of minimally invasive surgery gained increased popularity also for the inguinal hernia repair. The LH has been introduced at the end of '90s with the first reports of European centres.<sup>18-19</sup> As laparoscopic pediatric surgeons performing LH claim, the advantages of this technique are better cosmesis, faster recovery, decreased requirement for oral analgesics, better visualization of the anatomy, detection, and even repair, of a contralateral patent processus vaginalis.<sup>2,8</sup> On the contrary surgeons who do not perform laparoscopy are critical against LH because of high cost and length of operation. In our experience neither was an issue. To allay costs, we used all reusable material, as would be done with the open approach. Also, in our series the operative time was shorter than or similar to that necessary to repair an inguinal hernia using the open inguinal approach.

Concerning the detection and repair of a controlateral open internal ring, our experience showed 20.7% of patients with a preoperative diagnosis of monolateral IH, having a controlateral open internal ring. The repair of the emerged defect had been performed during the same intervention avoiding the possibility of metacronous hernia onset even if it had been argued that only a small percentage of these open internal rings (5.6%-16%) would evolve into clinical hernias.<sup>20,21</sup>

The risk of damaging the vas and vessels is considerably greater in boys under 1 year of age, when such elements are very small and a thin sac is extremely adherent to these structures.<sup>20,21</sup>

In our experience during LH vas and vessels were not touched because only the peritoneum is involved in the suture.

Other risks related to traditional inguinal exploration include iatrogenic ascent of the testis and wound infection.<sup>14</sup> In this experience post-operative complications such as hydrocele, iatrogenic cryptorchidism, testicular atrophy and wound infection were not seen.

The rate of recurrences after IH repair using inguinal exploration has been reported to range from 0.2% to 0.8% and this risk appears to be higher than 2%-3% in boys under 1 year of age.<sup>19,21,22</sup> In Literature the recurrence rate after laparoscopic inguinal herniorrhaphy ranges from 0.6% to 3.4%.<sup>23,24</sup> Our recurrence rate was of 1.8%. However, it seems to have a trend toward reduction of postoperative complications after 10 monolateral procedures. There seems to be a trend toward fewer recurrences.

In our experience we do not have detected rare hernias, but this is another clear advantage of the laparoscopic approach reported in Literature that allows to identify and treat this kind of hernias thanks to the direct laparoscopic vision. Another advantage of the laparoscopic technique is the treatment of complicated inguinal hernias with irreducible bowel or ovary, as occurred in nine cases in our series. The advantage consists in a simple reduction with a combined maneuver (laparoscopic gentle traction and per taxis), with the possibility to check the bowel or ovary condition under direct vision (Figure 5).

Although in this experience we obtained good postoperative cosmetic results with laparoscopic technique using 3 mm instruments, the scars appeared almost invisible adopting 2 mm instruments.

All procedures were performed in one-day surgery setting with equal postoperative analgesic scheme. Compared to the traditional technique, the laparoscopic technique is a trans-peritoneal procedure with all related potential risks. Nevertheless in expert hands these risks this decreases significantly.

To this day, this series has not shown LH to be a better technique than open herniotomy in terms of recurrences but the real benefits of LH seem to be a short operative time for bilateral repair already reported in literature and the detection and repair of a controlateral open internal ring (20.7%) in patients with a preoperative diagnosis

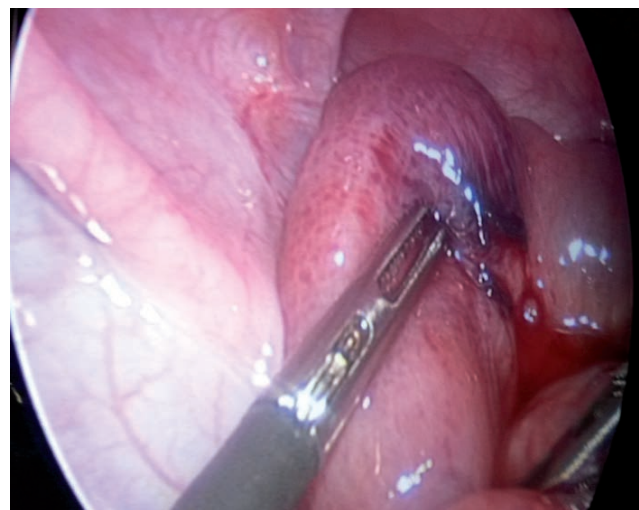


Figure 5. Bowel's check after an incarcerated inguinal hernia reduction.



of monolateral IH.

## Conclusions

Laparoscopic repair of IH in children performed in this experience resulted a safe and effective procedure; it appears superior to open repair with regard to the prevention of contralateral hernia with an acceptable recurrence rate and no risk of cord/testis complications.

## References

- Saranga Bharathi R, Arora M, et al. Minimal access surgery of pediatric inguinal hernias: a review. *Surg Endosc* 2008;22:1751-62.
- Tsai YC, Wu CC, Yang SS. Minilaparoscopic herniorrhaphy with hernia sac transection in children and young adults: a preliminary report. *Surg Endosc* 2007;21:1623-5.
- Liu J, Zhou H, Yu X, et al. Laparoscopic herniorrhaphy combined ligation of the hernial sac and suturation of the internal ring in children with indirect inguinal hernias. *Surg Laparo Endo Per* 2007;17:95-8.
- Schier F. Laparoscopic inguinal hernia repair: a prospective personal series of 542 children. *J Pediatr Surg* 2006;41:1081-4.
- Patkowski D, Czernik J, Chrzan R, et al. Percutaneous internal ring suturing: a simple minimally invasive technique for inguinal hernia repair in children. *J Laparoendosc Adv S* 2006;16:513-7.
- Bertozzi M, Melissa B, Magrini E, et al. Laparoscopic herniorrhaphy in pediatric age group: what about the learning curve? *J Endourol* 2013;27:840-4.
- Lima M, Ruggeri G, Domini M, et al. Laparoscopic treatment of bilateral direct inguinal hernia by using the vesical ligament as an autologous patch. *Pediatr Endosurg Innov Tech* 2002;6:277-9.
- Tsai YC, Wu CC, Yang SS. Is local anesthesia or oral analgesics necessary after mini-laparoscopic functional surgery in children and young adults? A prospective randomized trial. *Surg Laparo Endo Per* 2008;18:344-7.
- Bertozzi M, Magrini E, Appignani A. Preliminary experience with laparoscopic repair of associated inguinal and umbilical hernias in children. *Hernia* 2015;19:617-21.
- Bertozzi M, Appignani A. Applications of cyanoacrylate glue in pediatric urology. *N Am J Med Sci* 2012;7:323-4.
- Prestipino M, Bertozzi M, Nardi N, Appignani A. Outpatient department repair of urethrocutaneous fistulae using n-butyl-cyanoacrylate (NBCA): a single-centre experience. *BJU Int* 2011;108:1514-7.
- Merkel SI, Voepel-Lewis T, Shayevitz, JR, Malviya S. The FLACC: a behavioral scale for scoring postoperative pain in young children. *Pediatric Nursing* 1997;23:293-7.
- Coté CJ, Lerman J, Todres ID. A practice of anesthesia for infants and children. 4th ed. Philadelphia, PA: Saunders Elsevier; 2009.
- Lau ST, Lee YH, Caty MG. Current management of hernias and hydroceles. *Semin Pediatr Surg* 2007;16:50-7.
- Lee SL, DuBois JJ. Laparoscopic diagnosis and repair of pediatric femoral hernia. Initial experience of four cases. *Surg Endosc* 2000;1:1110-3.
- Owings EP, Georgeson KE. A new technique for laparoscopic exploration to find contralateral patent processus vaginalis. *Surg Endosc* 2000;14:114-6.
- Surana R, Puri P. Is contralateral exploration necessary in infants with unilateral inguinal hernia? *J Pediatr Surg* 1993;28:1026-7.
- Schier F. Laparoscopic herniorrhaphy in girls. *J Pediatr Surg* 1998;33:1495-7.
- Montupet P, Esposito C. Laparoscopic treatment of congenital inguinal hernia in children. *J Pediatr Surg* 1999;34:420-3.
- Sparkman RS. Bilateral exploration in inguinal hernia in juvenile patients. *Surgery* 1962;51:393-406.
- Gilbert M, Clatworthy HW. Bilateral operations for inguinal hernia and hydrocele in infancy and childhood. *Am J Surg* 1959;7:255-9.
- Rothenberg RE, Barnett T. Bilateral herniotomy in infants and children. *Surgery* 1955;37:947-50.
- Esposito C, Montupet P. Laparoscopic treatment of recurrent inguinal hernia in children. *Pediatr Surg Int* 1998;1:12-5.
- Esposito C, Montinaro L, Alicchio F, et al. Technical standardization