

# Laparoscopic-assisted percutaneous internal ring ligation in children

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**Aim** To evaluate the feasibility and safety of laparoscopic ligation of internal ring in congenital inguinal hernia in children.

**Patients and methods** Laparoscopic percutaneous ligation of internal inguinal ring has been performed on 97 children with 133 hernias. The age ranged between 6 months and 11.5 years. The procedure was carried out under general anesthesia, through skin puncture opposite to the lateral edge of the internal ring. The needle was passed under direct vision to encircle the internal ring without touching the vas or testicular vessels. The heel of the needle is backed through the subcutaneous tissue and out of the original stab puncture. The contralateral side was examined and the internal ring was closed if it was patent.

**Results** All children were subjected to a follow-up schedule for 1 year to evaluate both efficacy and reliability of the technique. The mean operative time in our series was 15 ( $\pm 3$ ) and 20 ( $\pm 5$ ) min for bilateral cases, without anesthesia time. Of 133 hernias repaired, two hernias recurred at 1 and 2 months postoperatively. Conversion rate was 0% in our hands. Five (3.8%) cases developed

minimal extraperitoneal hemorrhage during surgery. Six (4.5%) cases developed mild hydrocele, which was successfully treated conservatively.

**Conclusion** Laparoscopic percutaneous ligation of internal inguinal ring repair of congenital hernia is proved to be a safe, simple, and easy procedure and can be performed routinely. The procedure has better cosmetic effect because we use a single umbilical port only. The high safety of the procedure we devised is because the cord contents remained untouched during the procedure. *Ann Pediatr Surg* 7:66–69 © 2011 Annals of Pediatric Surgery

*Annals of Pediatric Surgery* 2011, 7:66–69

**Keywords:** extracorporeal, inguinal hernia, laparoscopy, subcutaneous ligation

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Received 26 December 2010 Accepted 3 February 2011

## Introduction

Inguinal hernia repair is one of the most common pediatric operations performed. All pediatric inguinal hernias require operative treatment to prevent the development of complications, such as inguinal hernia incarceration or strangulation.

The reported incidence of indirect inguinal hernia in infant and children ranges from 1 to 5%. Sixty percent of hernias occur on the right side of the body. Inguinal hernias are much more common in male individuals than in female individuals. The male-to-female ratio is estimated to be 4–8 : 1. It is generally present with an obvious bulge at the internal or external ring or within the scrotum.

We performed a PubMed review of the literature. We found that in pediatric surgery, laparoscopic procedures have been gaining popularity because they are minimally invasive and, therefore, are associated with less pain and a more rapid return to normal functional status, in addition to excellent visual exposure, minimal dissection, and an improved cosmetic results when compared with the traditional open approach [1,2]. Laparoscopic inguinal hernia repair in children has become a popular alternative to the conventional open procedure [3] with majority of parents demanding for the procedure.

The most commonly used techniques for laparoscopic hernia repair are the use of two needle holders to close the internal inguinal ring (IIR) and the percutaneous

insertion of a purse-string suture from outside under laparoscopic guidance by different methods [2]. Herein, in this study, we present our experience with laparoscopic-assisted percutaneous internal ring ligation for repair of congenital inguinal hernia in children.

## Patients and methods

Laparoscopic-assisted percutaneous IIR ligation was performed on 97 children, with 133 hernias, ages ranged from 6 months to 11 years (mean age of 5.87 years). There were 88 boys with 108 hernias (20 bilateral), and nine girls with 15 hernias (six bilateral). The procedure was carried out from December 2006 to September 2009 at the General Surgery Department and Pediatric Surgical Unit, Faculty of Medicine, Assiut University.

Exclusion criteria were strangulated or incarcerated hernias. We included all other patients, even children with a recent history of irreducibility in which gentle reduction under sedation was performed; then, they were admitted to the hospital for 1 day before operation to decrease the cord edema.

The preoperative diagnosis of bilaterality was made in seven boys and four girls. Other bilateral (15 patients) cases were diagnosed intraoperatively. All children, subjected to the procedure, were booked to the operative lists, after performing simple routine laboratory investigations, such as complete blood count and prothrombin time and concentration. All parents signed a well-informed

written consent and the Hospital Ethics Committee approved the study. Children above 1 year were sent home at the end of the day. Children below 1 year remained for 23 h (37 patients) as most of our patients were coming from a far-off and distant area, and therefore there is a difficulty to reach the hospital if there is any problem.

All children received a single dose of third-generation cephalosporin (50 mg/kg) with induction of anesthesia and postoperative analgesia in the form of paracetamol suppositories.

### Procedure

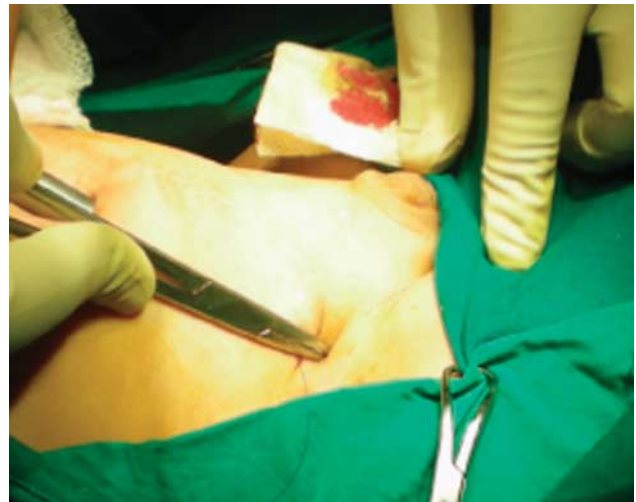
Children were kept nil by mouth for 4 h before the operation. The procedure was carried out under general endotracheal anesthesia with muscle relaxation in supine position. Pneumoperitoneum was established with the Hasson technique, and the pressure was kept at 8–10 mmHg. The patient was placed in Trendelenburg position. The 5 mm 30° telescope was used to examine the whole abdominal cavity and pelvis. Then, the site of internal ring was recognized internally and defined externally by finger indentation.

The technique was performed, as described by Ozgediz *et al.* [4], by performing a very small skin puncture over the site of IIR, and a curved needle threaded with a 2/0 nonabsorbable suture mounted on a needle holder was inserted through the anterior abdominal wall under direct vision (as in Fig. 1). The needle manipulated to encircle the sac at the IIR preperitoneally, starting from the lateral side (as in Figs 2–4) bringing only the tip of the needle out through the skin on the other side near the previous skin puncture. Care was taken to avoid injury of the vas and vessel in a U-shaped manner. The tip of the needle is then grasped in a needle driver and the heel of the needle is backed through the subcutaneous tissue and out of the original stab incision. The needle is then cut and the suture is secured, thus ligating the IIR subcutaneously (Fig. 5a–c).

### Results

The mean operative time in our series was 15 ( $\pm$  3) min for unilateral cases and 20 ( $\pm$  5) min for bilateral cases. However, the mean operative time decreased gradually with gaining more experience. The mean operative time was calculated without anesthesia time. All cases were completed laparoscopically without any conversion. The results were satisfactory, with no scars at the inguinal area and an invisible umbilical scar; there was some small extraperitoneal hemorrhage (in five cases, at the beginning but it never occurred after we gained experience), which was self-limited and did not need any interference. Six (4.5%) cases developed mild hydrocele that improved by conservative treatment. All children were subjected to a follow-up schedule every month for 3 months and then every 3 months for 1 year to evaluate recurrence rate, efficacy, and reliability of the technique. Recurrence occurred in two (1.5%) boys at the time of 1 and 2 months postoperatively. They were surgically repaired by

Fig. 1



Manipulating the needle.

Fig. 2



The needle passing from the lateral side of the inguinal ring.

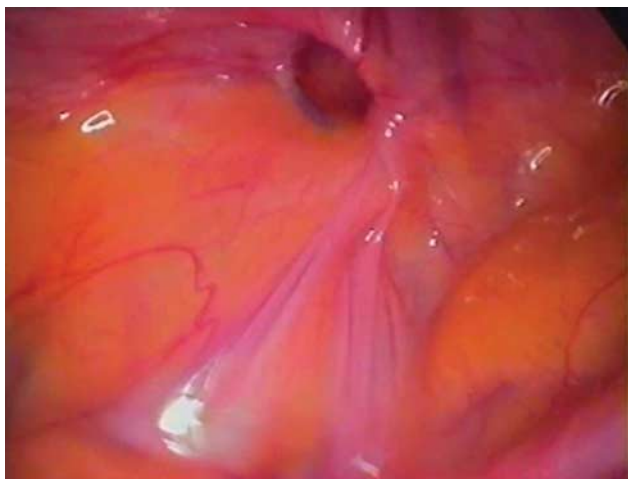
the open traditional procedure. The open repair in these cases was easy because the cord remained untouched.

### Discussion

Congenital inguinal hernia in infants and children is a result of a failure of the closure of processus vaginalis [5]. It always requires surgical treatment for definite occlusion of the orifice [6]. Hernias occur in 1–4% of all infants; the incidence may reach 30% in premature infants, and one third of all children with hernias present before 6 months of age. Congenital inguinal hernia is the most common surgical procedure faced by the pediatric surgeons [5]. Once diagnosed, an inguinal hernia should be promptly repaired on an elective basis, because unrepaired hernia is as high as 31% (usually in the first few months of life), posing significant risk to the bowel and testicle [2]. Actually, traditional open surgical

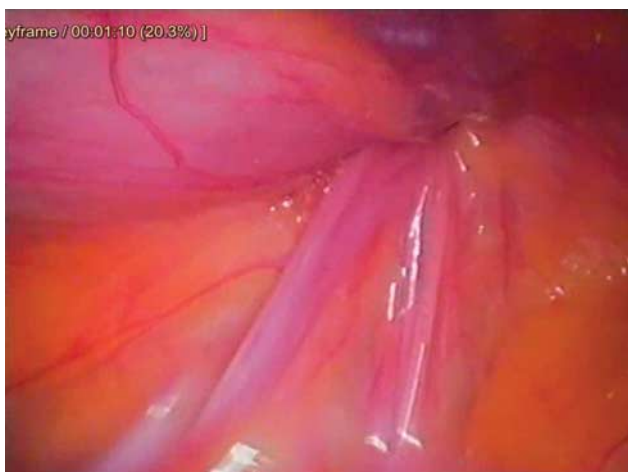
procedure was the only approach for repair; however, laparoscopic approaches have appeared recently. The initial use of laparoscopy in a patient with pediatric hernia was to examine the contralateral groin, either through a remotely placed port or the opened processus vaginalis, during open, unilateral hernia surgery [7].

Fig. 3



Processing the needle underneath the peritoneum.

Fig. 4



The needle encircling the internal inguinal ring.

Fig. 5



(a) The heel of the needle after coming out through the same skin puncture. (b) The two threads come from the puncture and are tied subcutaneously. (c) Invisible puncture and umbilical port.

In 1997, El-Gohary [8] reported a series of 28 patients, all girls, in whom herniorrhaphy was accomplished laparoscopically using one or more endoscopic loops placed at the base of the inverted hernia sac.

The laparoscopic closure of the IIR was usually accomplished through a three-port access [9]. These procedures require more experience in dealing with intra-abdominal suturing laparoscopic needle holders. Then, some investigators developed the technique by using two ports only [10,11]. However, a recent report used two-port and three-port procedures as a comparative study and the investigators did not obtain any significant difference between the two procedures [12].

The most commonly used techniques for laparoscopic hernia repair are the use of two needle holders to close the internal inguinal ring by either purse-string or Z-shaped suture and the insertion of purse-string suture from outside percutaneously under laparoscopic guidance by different methods (Prasad's curved stainless steel awl, Endoneedle, Reverdin needle or conventional needle with needle holder, and subcutaneous endoscopically assisted ligation of the internal ring) [2].

In 2008, Schier *et al.* [13], stated that laparoscopic inguinal hernia repair using suture of the internal ring does not impair testicular perfusion and this encouraged us to use laparoscopic procedure amenably. In our procedure of laparoscopic-assisted percutaneous internal ring ligation, the internal ring is closed by passing the tip of the needle around the peritoneum in the preperitoneal space without touching the vas deference or the testicular vessel. It was performed easily, rapidly, and without difficulty because we used a single port (umbilical port), and a working instrument (needle holder mounting the needle) from outside. The technique did not require any intracorporeal suturing and knot tying. It had less possibility of intra-abdominal organ trauma because of the absence of intra-abdominal working instruments. This single-port procedure gave the technique better cosmetic effect and decreased the operative time. The operative time is approximately 15 min in unilateral hernia and 20 min in bilateral cases, less than that of others (two-port or three-port techniques), because of one-port procedure and extra-corporeal ligation. The laparoscopic procedures avoid trauma to the ilioinguinal nerve; in addition, we observed a decrease in the need for postoperative analgesia.

Intracorporeal suturing and knot tying have become popular among pediatric surgeons, and results of large series have been reported by different investigators with recurrence rates varying from 0.4 to 4.1%. The variation in the recurrence rates, however, has raised the concern of the effectiveness of laparoscopic repair. Recurrence may be related to the skip areas during placement of purse-string sutures as well as the tension resulting from intracorporeal knotting, particularly in closure of large defects. Technical modifications, including injection of saline to lift up the peritoneum and the placement of single suture in N-shaped manner, have been proposed to reduce the recurrence rates [3,14,15]. In our series, the recurrence rate was 1.5% and is comparable with the recurrence rates obtained by other investigators.

In our laparoscopic approach of the lower circumference of the IIR (toward the great vessels), the techniques include only the peritoneum, to avoid injury of vessels and nerves. This would result in a loose knot at least at the lower segment. At the upper circumference of the internal ring (at the abdominal wall), more fascia and muscle tissue are included into the knot, with the intention of providing more mechanical stability as recommended by Schier *et al.* [13]. The results of our series, regarding complications, are comparable with that mentioned in recent studies and have less operative time.

### Conclusion

Laparoscopic percutaneous ligation of IIR repair of congenital hernia is a safe, simple, and easy procedure, which can be performed routinely. The procedure has better cosmetic effect and comparable recurrent rate with open surgery.

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