



DIFFERENT MODALITIES OF INGUINAL HERNIA REPAIR IN PEDIATRICS

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ABSTRACT

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 incarceration or strangulation. An inguinal hernia in a child usually refers to an indirect inguinal hernia. Laparoscopic inguinal hernia repair (LIHR) has an established role in the management of this condition in children in trained hands. Trends are changing in the management of infants and children with indirect inguinal hernias. Consensus about the optimal management is lacking. Hence, recommendations for clinical practice are needed. This article aimed to review the possible management of pediatric inguinal hernia.

Keywords: Inguinal Hernia Repair; Laparoscopic Herniotomy; Pediatrics

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Introduction

An indirect inguinal hernia occurs when the processus vaginalis remains open and abdominal viscera may enter the inguinal region through a patent processus vaginalis. Depending on the degree of patency of the distal processus, the hernia may be confined to the inguinal region or pass down into the scrotum (1).

A communicating hydrocele occurs when the opening is narrow, allowing fluid but not intestinal structures to pass into the inguinoscrotal region. A vaginal hydrocele occurs when the proximal portion of the processus vaginalis obliterates and the tunica vaginalis fills with fluid. A hydrocele can also occur along the cord because the processus may obliterate proximal and distal to an isolated cystic dilation. In little girls, the processus (canal of Nuck) may remain patent and may fill with fluid or allow the ovary and fallopian tube to enter the inguinal region (2).

Inguinal hernia occurs in 0.8-4.4 % of children, and is unilateral in 75-90%, incidence is higher in premature infants (13% of those <32 weeks gestation) and low birth weight infants (30% in infants <1,000 g) (3).

The incidence is highest during the first year of life and peaks during the first month. The incidence in boys is 3 to 4 times higher than in girls, with the right side being affected more commonly in both sexes. Right-sided hernias are twice as common as those on the left. The right-sided preponderance is related to the later descent of the right testicle and later obliteration of the processus vaginalis. The incidence of bilateral hernias is approximately 10 % in full-term and nearly 50 % in premature and low-birth-weight infants (4).

Co-morbidities such as chronic lung disease associated with prematurity may play a substantial role in the development of a clinically detected inguinal hernia in this population. Other entities associated with an increased incidence of inguinal hernia include cryptorchidism, abdominal wall defects, connective tissue disorders (Ehlers-Danlos syndrome), and mucopolysaccharidoses such as Hunter's or Hurler's syndrome, cystic fibrosis, ascites, peritoneal dialysis, ventriculoperitoneal shunts, congenital hip dislocation, and meningomyelocele (2).

Operative Technique

Open Repair

The open repair of an indirect inguinal hernia (OHR) in children centers on high (internal inguinal ring) ligation of the hernia sac. A transverse inguinal crease incision is used. The

inguinal canal is more lateral than one might expect, a finding made apparent with laparoscopic hernia repairs (5).

The Scarpa fascia is opened, and the external oblique aponeurosis identified. This aponeurosis is opened along the direction of its fibers. Care is taken to identify and preserve the ilioinguinal nerve, which supplies cutaneous sensation to the skin of the anterior thigh. The anteromedial hernia sac is carefully separated from the cord structures in boys (Fig. 1). In girls, it is simply mobilized up to the internal inguinal ring. The sac may extend down into the scrotum in boys. It is clamped after ensuring the absence of the vas and testicular vessels, divided, and followed proximally to the internal inguinal ring, where it is doubly ligated with absorbable suture. The distal sac should be widely opened but need not be removed. If a hydrocele is present, it is evacuated, but excision of the hydrocele sac is not necessary (6).

Bottle procedure

Large or thick sacs may be everted behind the cord. In the case of a blind-ending sac, the entire sac can be resected after high ligation. Formal repair of the floor is rarely necessary in children. If a sliding hernia is present, inversion ligation after placing a proximal purse string suture is relatively straightforward (7).

Contralateral open inguinal exploration

Historically, contralateral open inguinal exploration was common for unilateral inguinal hernias, particularly in younger infants and children. Over the past 20 years, there have been reports describing the use of laparoscopy to evaluate the contralateral inguinal ring at the time of open inguinal hernia repair. A small 70-degree scope can be inserted through a 2-mm port placed through the ipsilateral hernia sac (after insufflation) to look for a contralateral PPV (Figs. 2-4) (8).

There is a small, but definite (1-2%), incidence of developing a contralateral hernia even after a negative evaluation (Fig. 3). The indications (or lack thereof) for contralateral evaluation are controversial, but with the increasing use of transumbilical laparoscopic repair, this may be fast becoming a moot point. More recent studies and meta-analyses tend toward the opinion that contralateral evaluation may not be necessary (overtreatment). At the same time, in one study, when given the options of unilateral repair alone versus unilateral repair with contralateral evaluation, parents overwhelmingly chose contralateral evaluation with laparoscopy (9).



Fig. (1): The salient features with an open inguinal repair. The hernia sac has been separated from the adjacent spermatic cord (8).



Fig. (2): (A) After a right inguinal incision in an infant boy, the sac has been separated from the vas and vessels by grasping the sac and teasing the cord structures away. The hernia sac, located anteromedial to the cord, has been carefully separated from the vas and vessels (vessel loop) and is clamped in preparation for division of the sac. (B) In preparation for diagnostic laparoscopy to evaluate the contralateral internal ring, the sac is opened. A vessel loop is around the cord structures. (C) A cannula has been introduced into the opened hernia sac, and the sac has been tied (solid arrow) to keep the abdomen insufflated. The cord structures (dotted arrow) are retracted with the vessel loop (8).

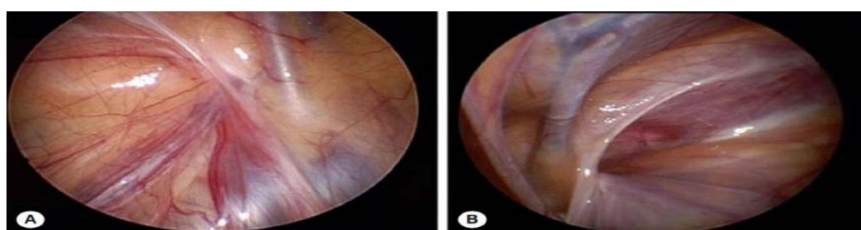


Fig. (3): Laparoscopic evaluation of the contralateral inguinal region is used by many pediatric surgeons. (A) A view of the left internal ring shows the inverted V of the laterally located gonadal vessels and the medial vas. At the apex of the V, the left internal inguinal ring is completely closed. (B) A right-patent process vaginalis is seen in a 7-year-old patient with a known left inguinal hernia (8).



Fig. (4): A) In a small percentage of cases, a veil of peritoneum will cover the contralateral internal ring and obscure the laparoscopic findings such that the surgeon is not completely certain whether a contralateral patent processus vaginalis (CPPV) is present. In this situation, a technique has been reported to retract the veil of tissue. (B) A silver probe is introduced in the contralateral lower abdomen/flank and used to retract the veil medially so that the 70-degree telescope can then look down the possible CPPV. (C) In this patient, a significant CPPV was visualized once the veil of peritoneum was retracted medially (8).



Fig. (4): This laparoscopic view shows evidence of a pantaloon hernia (hernia-enpantaloon) that is composed of a direct (asterisk) and indirect (arrow) hernia on the same side (9).

Laparoscopic Techniques:

The laparoscopic technique has the advantage that it is simple, feasible, and safe. Also, the contralateral internal inguinal ring and other hernia sites such as femoral, obturator, or internal hernia can be diagnosed and treated at same sitting and other occult pathologies may be diagnosed. The risk of injury to the vas deferens and cord structures in this procedure is lesser when compared to the conventional open technique (10).

LIHR in children was first introduced as an alternative to conventional OHR by Montupet in 1993. The proposed advantages of the laparoscopic approach include visualization of a contralateral PPV, identification of less common (direct, femoral, pantaloon) hernias (Fig. 4), diminished postoperative pain, more rapid return to normal function, and improved cosmesis. Potential disadvantages include a possible increase in length of operative time and costs, a definite learning curve, and the need for orotracheal intubation for anesthesia (11).

Most studies of inguinal hernia repair published in the last 20 years are focused on the laparoscopic approach, with many different techniques now used for LIHR. The different repair options can be categorized as either intracorporeal or extracorporeal/percutaneous. Montupet's 1993 report described an intracorporeal technique, with a purse-string suture placed in the periorificial peritoneum at the level of the internal inguinal ring. In 1998, Schier reported using an N-shaped suture on the peri-orificial peritoneum (12).

In 1999, Montupet and Esposito modified two important aspects of the technique: before closing the defect, the periorificial peritoneum around the internal inguinal ring is cut and a nonabsorbable suture is used to repair the hernia defect. The extracorporeal approach involves the placement of a suture circumferentially around the internal ring and tying the knot using percutaneous techniques. Many variations of this approach have been described (12). We can classify the repairs into two categories based on the approach:

A. Intraoperative approaches:**1. Endolooping (laparoscopic inversion ligation): (Fig. 5)**

This method of laparoscopic inguinal repair is widely used in female children. This is a modification of the intracorporeal technique, using three ports and non-absorbable sutures. It is thought that inversion and ligation of sac at the internal inguinal ring would reduce the risk of recurrence (0.8–2.5%). This technique involves grasping the farthest portion of the sac with a grasper placed through the ipsilateral working port and using an endoloop, introduced through the contralateral working port, to ligate the inverted sac, thus achieving high ligation without the use of needles or knotting (13). This technique was applied only in females with congenital inguinal hernia as the cord structures cannot be identified from the tie in males (13).

2. Suturing of the internal ring:

It ensures the ligation of the neck of the PPV, without its division. It involves intracorporeal placement of interrupted or continuous sutures, including only the peritoneum or, at times, some underlying muscular tissue as well (Fig.6) (14).

3. Purse string suture with skipping vas and vessels: (Fig. 7)

This technique uses intracorporeal purse string suture around the internal ring, skipping the vas deferens & spermatic vessels (15). When using the standard three port technique with intracorporeal knot tying or the two ports technique with an assistant port for intraabdominal suturing, the hernial orifice is closed with an N-shaped or purse string suture, which may leave gaps in the peritoneum. These gaps may reduce the formation of peritoneal adhesions to keep the gap closed, and the recurrence may occur if the knots gradually loosen (16).

The purse string suture includes the peritoneum and the underlying fascia lateral to the spermatic cord. Before the knot was tied, the hernia sac was compressed to expel any gas. The peritoneum was completely closed, and the airtightness was confirmed by the absence of hernia sac enlargement when the intraoperative pressure was increased (15).

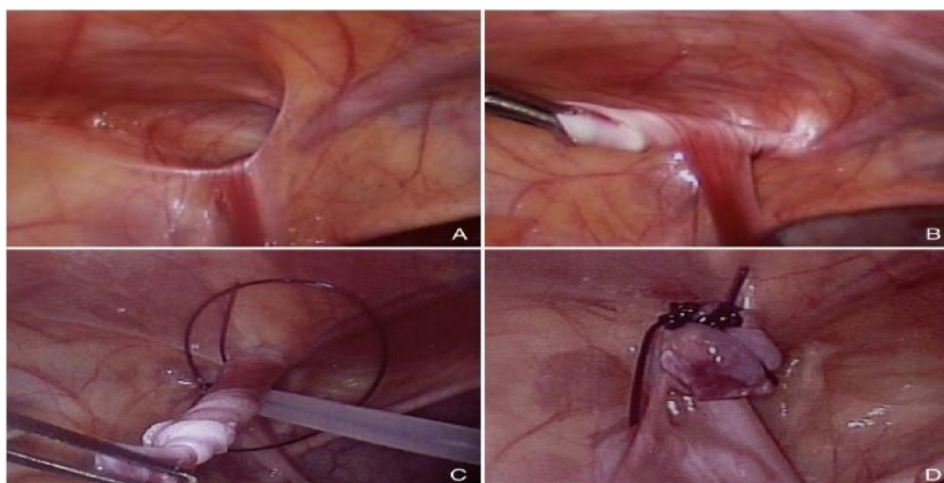


Fig. (5): Laparoscopic inversion ligation: (a) Identification of hernia. (b) Inversion of peritoneum. (c) Twisting and double ligation of sac. (d) Excision of sac (13).

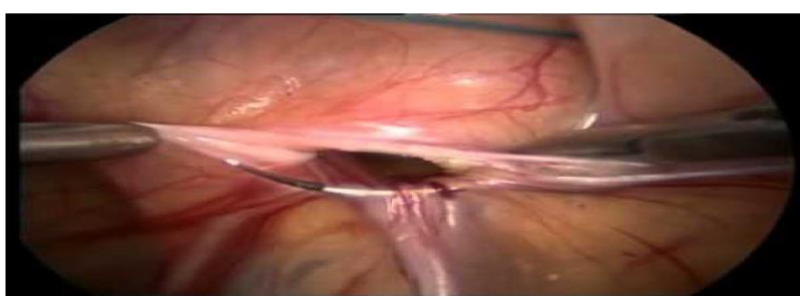


Fig. (6): Intracorporeal suturing of the internal inguinal ring (14).



Fig. (7): Purse string suture (15).

4.Flip-Flap technique:

This technique involves raising a peritoneal flap by dissection and detaching the anterior and lateral hemi circumference of the sac, flipping it over medially to cover the hernial site and anchoring it with an intracorporeally placed suture. This forms a one-way peritoneal valve that prevents abdominal contents from entering the sac while selectively allowing fluid from the distal sac to enter the general peritoneal cavity, thereby preventing postoperative hydrocele formation. Satisfactory results have been noticed by Hassan et al. in a comparative study of this flip-flap technique with the conventional open technique (17).

5. Disconnection of the sac and peritoneal ligation: (Fig. 8)

It involves detachment of the sac with suture obliteration, by laparoscopic division of the PPV at the level of the internal ring followed by its suture intracorporeally. With three ports and no absorbable sutures employed. In this technique, the hernia sac is resected and closed with a purse-string suture at the level of the internal inguinal ring. Becmeur et al. recorded no recurrence with this method. This was done in an attempt to reduce the recurrence (18).



Fig. (8): Peritoneal closure after hernial sac disconnection (18).

6. Disconnection of the sac, no ligation just resection: (Fig. 9)

Here, the hernia sac is resected at the level of the internal inguinal ring and allowed to close spontaneously. This novel technique has been reported in the literature with preliminary results showing satisfactory outcome and no recurrence.

In Riquelme's series, a purse string closure of the ring was done for >10 mm the size of the deep ring. It is logical for the critics to believe that leaving the peritoneum unsutured may invite more recurrences in infants due to a suboptimal sealing mechanism of the conjoint muscle. The method uses three ports and no sutures are employed (19).

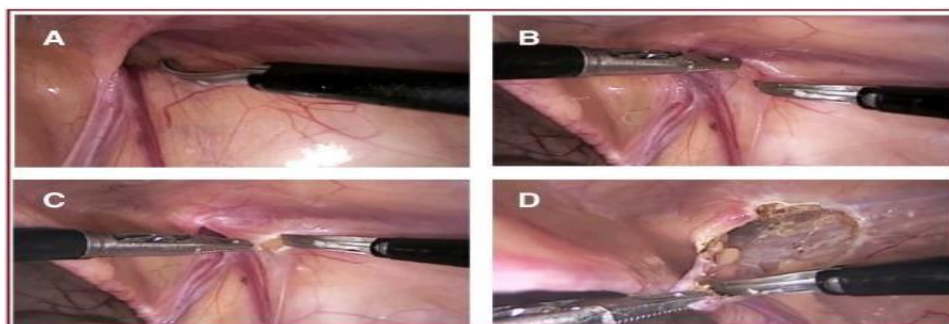


Fig. (9): Resection of the sac without ligation (19).

7. Single instrument intracorporeal knot tying:

Longitudinal transumbilical skin incision was done for insertion of the umbilical port and a 3-mm Maryland forceps. RN was used for insertion of a purse string suture with a single instrument intracorporeal suture tie around the internal inguinal ring. The purse string knot airtightness was stress-tested by raising the intraperitoneal CO₂ pressure to 16–24 mm Hg for about 30 seconds (Fig. 10) (20).

B) Extra peritoneal approaches:

1. Subcutaneous endoscopically assisted ligation (SEAL) (Fig. 10)

The internal inguinal ring is looped under endoscopic control using a 1/0 or 2/0 absorbable suture swaged on a large needle (36–40 mm, curved round body) introduced percutaneous using a strong conventional needle holder. Skipping the vas and vessels and directed to the skin, suture is tied extra corporeally, in females the round ligament could be anchored in the suture (22).

8. Muscular arch repair:

In these techniques a repair of the muscular arch is tried by approximation of muscle arch with pectineal ligament (21).

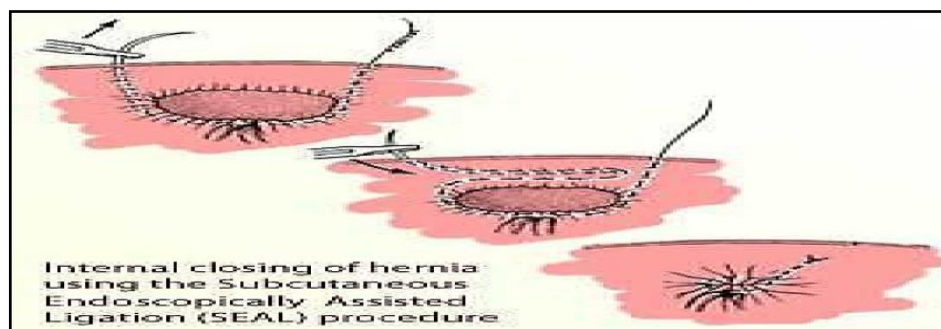


Fig (10): subcutaneous endoscopically assisted ligation (SEAL) (22).

2. Needlescopic hernia repair: (Fig. 11)

Reverdin needle (RN) is a surgical needle with an eye that can be opened and closed with a slide. It essentially modifies the delivery of the suture



Fig. (11): Needlescopic hernia repair (23).

3. Percutaneous internal ring suturing (PIRS): (Fig. 12)

This technique (similar to SEAL) has been used to loop the internal ring extraperitoneally under laparoscopic guidance. In PIRS, an 18-gauge epidural needle with a 3/0 nonabsorbable suture in its barrel replaces the swaged needle. A hollow needle with suture material inside is passed percutaneously under the peritoneum of each half of the internal ring. It allows extracorporeal knot-tying by catching a loop of the suture material and pulling it to the surface. Some intraoperative and postoperative complications were reported. Recurrence was three cases out of 106 children (24).

CONCLUSION:

Laparoscopic inguinal hernia repair (LIHR) has an established role in the management of this condition in children in trained hands. Indeed, it is fast becoming the gold standard for the treatment of inguinal hernia in children.

Laparoscopic repair may be beneficial for children with bilateral hernia and preterm infants may benefit using regional anesthesia and postponing surgery. However, no definite superiority was found and available evidence was of moderate-to-low quality.

NO conflict of interest.**References:**

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material, creating an extracorporeal knot tying. It markedly reduces both operative time and technical difficulty (23).

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