Pediatric Inguinal Hernia: Controversies and decision making

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ABSTRACT
The pediatric inguinal hernia is the commonest defect the surgeon performs surgery on and is usually indirect. It is believed that these hernias rarely go away, and therefore, virtually all should be repaired. Much has been written about this condition, but the controversy on different aspects of it still exists. This article aims to address the controversies and decision making in pediatric inguinal hernias.

Keywords: Inguinal hernia, controversies, management.

INTRODUCTION
Inguinal hernia repair is one of the most common surgery performed by pediatric surgeons and general surgeons. The incidence of a pediatric inguinal hernia reported throughout the literature has ranged between 0.8% and 4.4% with 30.0% in premies. The male-to-female ratio of 5:1 noted in this article agrees with that quoted in the literature (3:1 to 10:1), as does the higher incidence of right-sided occurrence. Trends in the management of infants and children with indirect inguinal hernias have changed dramatically over the last few decades bringing along with them increasing controversies. This article is aimed at addressing some of the controversies and current understandings of this challenging problem.

Clinical anatomy and features
Throughout the pediatric inguinal hernia literature, the terms funicular process (blind peritoneal sac), patent processus vaginalis, and hernia sac are used interchangeably. For clarification: a funicular process is a tiny protrusion of peritoneum barely into the proximal inguinal canal only seen by opening up the internal ring and is not a hernia; a patent processus vaginalis is a small indirect inguinal hernia sac (some say it has to be >2 cm long, which is not clinically evident. An inguinal hernia appears as a bulge in the inguinal region that extends towards and often into the scrotum. It may be present at birth or may appear until weeks, months or years later. When the child relaxes, the hernia either reduces spontaneously or can be reduced by gentle pressure. The position of the testes must be determined before attempting to reduce the hernia to avoid mistaking the inguinal bulge for a retractile testes lying outside the external ring, the latter usually does not require treatment. However a true undescended testis may coexist with a hernia, in which case orchiopexy is required in addition to hernia repair. In girls the ovary may herniated and has a 27.0% risk of torsion and infarction. Although several authors have stated that “an inguinal hernia does not resolve spontaneously,” a small number (2 per year, 1.0%) of clinically evident inguinal hernias indeed disappear by follow-up, history, or examination. If the parents reported that the hernia (previously seen, examined, and diagnosed by a clinician) had disappeared between the time of diagnosis and scheduled surgery, the child is reexamined by the surgeon, and if he could no longer confirm the presence of the previously diagnosed hernia, the operation is cancelled. In such cases, the theory most agree with states that the inguinal hernia sac can and rarely does become fused and obliterated. These infants and children who present with “false-alarm hernias” fall into 3 distinct groups: (1) lumps and hydroceles by history, but not confirmed by examination; among this small group were a few thin (and usually older) children who presented with groin bulges on coughing that were not considered to be hernias at the time and did not become hernias in follow-up; (2) groin pain usually in older children with a negative examination; (3) lymphadenopathy. Ultrasonography may help to differentiate the two.

Management
An inguinal hernia must be repaired because of the high risk of incarceration, particularly during the first 12 months of life. The management depends on the age of the patient and coexisting morbidities. In most patients elective inguinal hernia repair can be safely done as a daycare procedure. Exceptions are the high-risk newborn infants, older children with cardio respiratory or other disorders that increase the risk of anesthesia, children with ventriculoperitoneal shunts and peritoneal dialysis.

Premature infants
There is an increased incidence of inguinal hernia in premature infants and a bilateral presentation is more common. The rate of incarceration, strangulation, and gonadal infarction in these babies is twice that of the general pediatric age group. There is also a strong evidence of an increased risk of postoperative life
threatening apnea after repair.\textsuperscript{15} These mentioned findings (higher incarceration rate and at a younger age) suggest that once a premature baby has a hernia diagnosed, it should be fixed sooner than later.\textsuperscript{11} Advances in neonatal intensive care have resulted in the survival of many small premature infants who have a high incidence of inguinal hernia. Therefore this high risk category of patients should be referred to a tertiary hospital where intensive care facilities are available.

**Guidelines for premature infants**

The following guidelines are recommended for preterm and seriously ill newborns.\textsuperscript{16,17}

1. Admission and careful monitoring for 12 to 24 hours after operation.
2. Infants already in the hospital are closely observed for irreducibility, and the hernia is repaired before discharge.
3. For ex premature infants who were discharged from intensive care and develop inguinal hernia while at home, early operation is recommended because of the high risk of incarceration.

**Infants with ventriculoperitoneal shunt and dialysis**

The use of the peritoneal cavity for fluid absorptive purposes in hydrocephalus treated by ventriculoperitoneal shunts or peritoneal dialysis for renal failure causes increased intraabdominal pressure and results in the appearance of a previously unrecognized hernia. A large study reported 14.0\% incidence of inguinal hernia, 20.0\% incarceration, and 16.0\% recurrence after repair in patients after insertion of ventriculoperitoneal shunts.\textsuperscript{18} Similarly the risk of inguinal hernia in a patient with long-term dialysis ranges from 7.0\% to 15.0\%.\textsuperscript{19} The theoretical reason for this increase risk is said to be secondary to increased intraabdominal pressure from the cerebrospinal fluid or dialysis fluid shunted into the peritoneal cavity.

**Guidelines for patients with ventriculoperitoneal shunts and peritoneal dialysis**

The guidelines recommend for this group of patients are.\textsuperscript{20}

a. Infants should be closely observed for inguinal hernia after insertion of ventriculoperitoneal shunts.

b. Prompt repair after diagnosis has been made.

c. Contralateral side should be explored in cases of clinically unilateral hernia.

d. Intraoperative herniography to be performed at the time of peritoneal dialysis catheter insertion.

**Is contralateral groin exploration justified in a unilateral hernia?**

The exploration of the contralateral groin in a child with a known unilateral inguinal hernia has been debated by surgeons for more than 50 years.\textsuperscript{21-23} In children with unilateral inguinal hernia the reported incidence of contralateral patent processus vaginalis is 46.0\%.\textsuperscript{24} Reports in the literature quote an overall risk of developing contralateral hernia in the range of 10.0\% to 15.0\%.\textsuperscript{25,26} For quite some time the evidence of patent processus vaginalis had justified the routine exploration of contralateral groin, especially in infants, though the exploration may be negative in 2 out of five infants. The argument made in favor of contralateral exploration has been that it allows closure of patent processus, thereby preventing the development of hernia without increasing mortality and postoperative complications. A major objection to contralateral exploration is that it allows closure of patent processus, thereby preventing the development of hernia without increasing mortality and postoperative complications. A major objection to contralateral exploration is that it allows closure of patent processus, thereby preventing the development of hernia without increasing mortality and postoperative complications. A major objection to contralateral exploration is that it allows closure of patent processus, thereby preventing the development of hernia without increasing mortality and postoperative complications. A major objection to contralateral exploration is that it allows closure of patent processus, thereby preventing the development of hernia without increasing mortality and postoperative complications.

**Guidelines for contralateral exploration in unilateral inguinal hernia**

To reduce the number of unnecessary contralateral explorations with the potential risk of operative injury, strict criteria for contralateral exploration have been recommended.\textsuperscript{28-31}

1. **Contralateral exploration is to be done if the initial hernia is on left side, based on the fact that primary hernias are more common on right side.**
2. **When a second exposure to anesthesia is considered a high risk, as in premature infants with lung disease.**
3. **Girls under 2 years of age with left sided inguinal hernias.**\textsuperscript{32}

**Irreducible Hernia (incarcerated and strangulated) what should we do?**
A benign looking inguinal hernia may take a catastrophic turn to a life threatening incarceration and strangulation. An incarcerated hernia is one in which the contents cannot be easily reduced into the abdomen. A strangulated hernia means a hernia where the bowel faces a threat of gangrene. The incidence of incarceration is approximately 12.0%, and a tense non-fluctuant mass is found clinically. With the onset of strangulation pain intensifies and vomiting becomes bilious or feculent. This is a true surgical emergency.

**Management**

In a stable patient without the evidence of strangulation non-operative management should be tried initially. Reduction by gentle compression may be attempted. Sedation or analgesia of some form may be required before reduction is attempted. Placing the infant in the Trendelenburg position may help in reduction. Seventy percent to 84.0% of incarcerated hernias can be reduced in this manner. Elective repair is undertaken 48 hours later by which time there is less edema and the risk of complications is reduced. Under no circumstances should reduction be attempted under general anesthesia because of risk of bowel injury. When the hernia cannot be reduced or is strangulated, immediate operation is indicated to prevent further damage to the intestine and testes.

**What to do if hernia reduces spontaneously after child is anesthetized?**

Should an apparently irreducible hernia reduce spontaneously after the child has been anesthetized but before the incision is made, the operation should proceed to a formal inguinoscrotal exploration.

**What to tell the parents about the testes in an incarcerated hernia?**

With incarcerated hernia the blood supply to the testes may be impaired. In girls the ovary may herniated and become strangulated or undergo torsion. The anxiety of parents regarding fertility outcome in their child with incarcerated hernia is no exaggeration and completely justified. The operating surgeon is likely to be faced with a question by the parents, “will my son or daughter be able to bear a child in the future”? the answer to which still remains elusive. The incidence of testicular compromise in an incarcerated hernia ranges from 2.6% to 5.0%. The finding of a blue cyanotic testes at emergency is common, approximately 11.0% to 20.0%. The actual incidence of testicular atrophy as indicated by testicular size and histological examination on follow up is much lower, 0 to 19.0%. Therefore it appears that the risk of actual testicular infarction is low and does not impair testicular function at follow up. Unless the testis or ovary is frankly necrotic it should not be removed.

**Recurrence of hernia**

Recurrence of hernia is an embarrassing moment for the operating surgeon, but inevitable if either unfavorable comorbid conditions were present or an imperfect operative technique was followed. The reported recurrence rate for uncomplicated hernias is 0% to 0.8%. Various factors may contribute to recurrence. Incarceration is an important risk factor for recurrence. However, most recurrences are due to faulty operative technique and result from tearing a friable sac, failure to dissect the complete sac, a slipped ligature at the neck of the sac, or failure to ligate the sac at the internal ring. Comorbid conditions, including increased intraabdominal pressure (ventriculoperitoneal shunts), growth failure, prematurity, chronic pulmonary disease, bladder extrophy, connective tissue disorders, cryptorchism, seizure disorder, and malnutrition also contribute to recurrence. Knowledge of the factors contributing to hernia recurrence and perfect surgical technique with reduction of incarcerated hernias and early elective operation should result in fewer recurrences in infants and children. Most recurrences are indirect hernias, however direct hernias may be present if neuromuscular defects are present. Patrnick et al reported no recurrences in his series of 35 teenagers with an indirect inguinal hernia repair using a polypropylene mesh plug inserted in the internal ring and a similar mesh onlay covering the posterior wall. If there is a similarly low recurrence rate in a larger series of teenagers, one may have to adopt this method.

**Iatrogenic injuries**

Iatrogenic injuries to the vas during pediatric inguinal hernia repairs are both upsetting, embarrassing, and should really never occur. Therefore, one wonders about the true incidence reported, especially with the apparent ease of damage when handled at operation. There is also a divergence of opinion as to what should be done at the time of the injury, the long-lasting effects to the male patient, and/or the actual need for a repair (which does not seem all that successful). Therefore, it may be difficult to implicate experience with this procedure for the lack of such an injury in the final 10 years.

**Iatrogenic undescended testes**
An iatrogenic undescended testis is an uncommon but a potential complication of hernia repair. This condition occurs in patients because the testis was not pulled down into the scrotum at the conclusion of hernia repair. Overlooking this minor but important event leads to unnecessary orchiopexy and subsequent loss of faith of the parents in the operating surgeon. Therefore it is mandatory to ensure that the testis is pulled down into the scrotum once the procedure is concluded.

The management of an apparently simple condition such as pediatric inguinal hernia can prove difficult. Deaths have occurred after complications or surgery for inguinal hernia, and most are probably avoidable. Morbidity is common and primarily related to incarceration or to damage to vas or testicular vessels during a difficult herniotomy. Clarity in decision making and following meticulous operative techniques can avoid the complications in a procedure that can be gratifying equally for both the surgeon and the child.

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