Inguinal hernia in infancy and childhood

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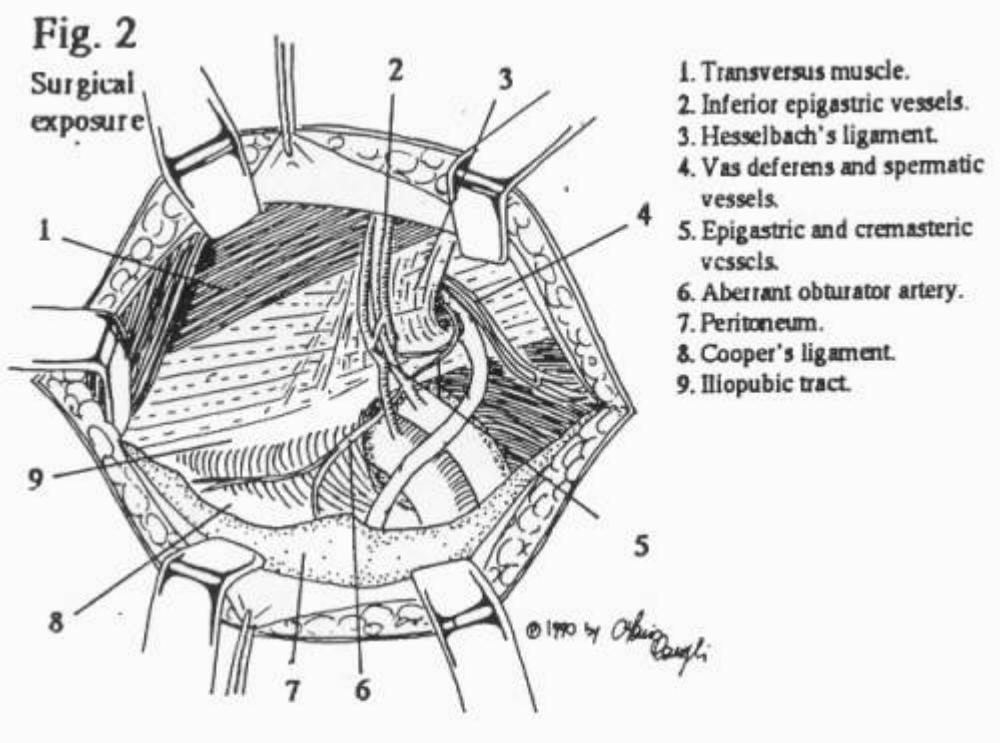
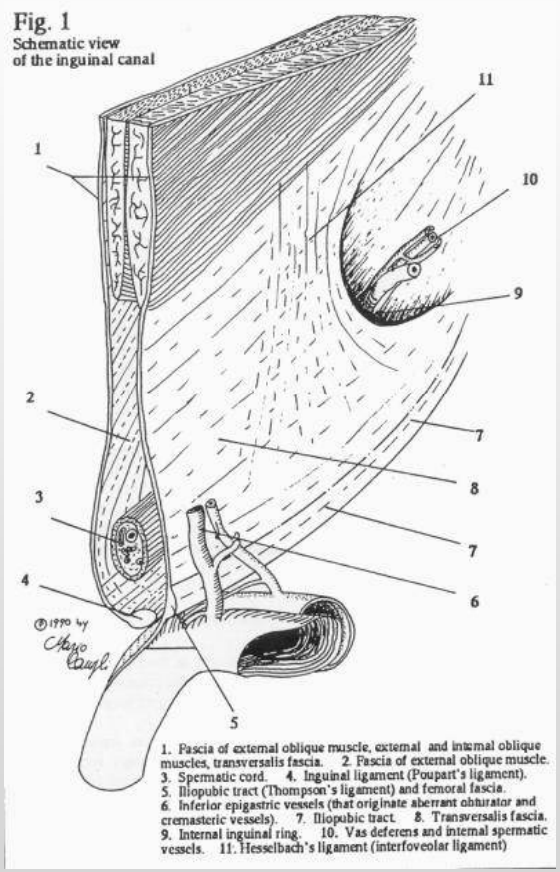
Today, inguinal hernia repair is one of the most common pediatric operations performed.



Inguinal hernia is a type of ventral hernia that occurs when an intra-abdominal structure, such as bowel or omentum, protrudes through a defect in the abdominal wall.

Most hernias that are present at birth or in childhood are indirect inguinal hernias.

Other less common types of ventral hernias include umbilical, epigastric, and incisional hernias.



Anatomically speaking, indirect and direct inguinal hernias differ in that the direct hernia bulges through the inguinal floor medial to the inferior epigastric vessels and the indirect hernia arises lateral to the inferior epigastric vessels.

Either hernia may cause fullness or a palpable bulge in the inguinal region

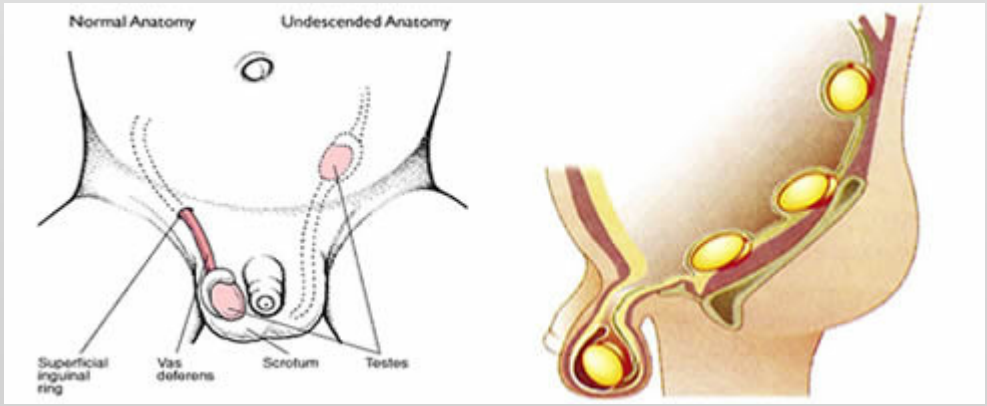
The clinician may assume, until proven otherwise, that the pediatric patient with an inguinal hernia has indirect inguinal hernia.

Pathophysiology

The processus vaginalis is an outpouching of peritoneum attached to the testicle that trails behind as it descends retroperitoneally into the scrotum.

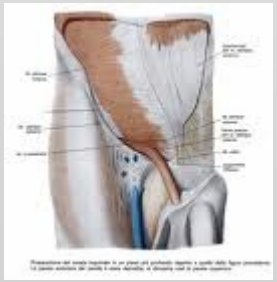
When obliteration of the processus vaginalis fails to occur, inguinal hernia results.

As the testes begin to descend at about 28 weeks' gestation, an outgrowth of gubernaculum from the inguinal region grows toward the scrotal area, and as the testis passes through the inguinal canal, this portion of the gubernaculum comes in contact with the scrotal floor.

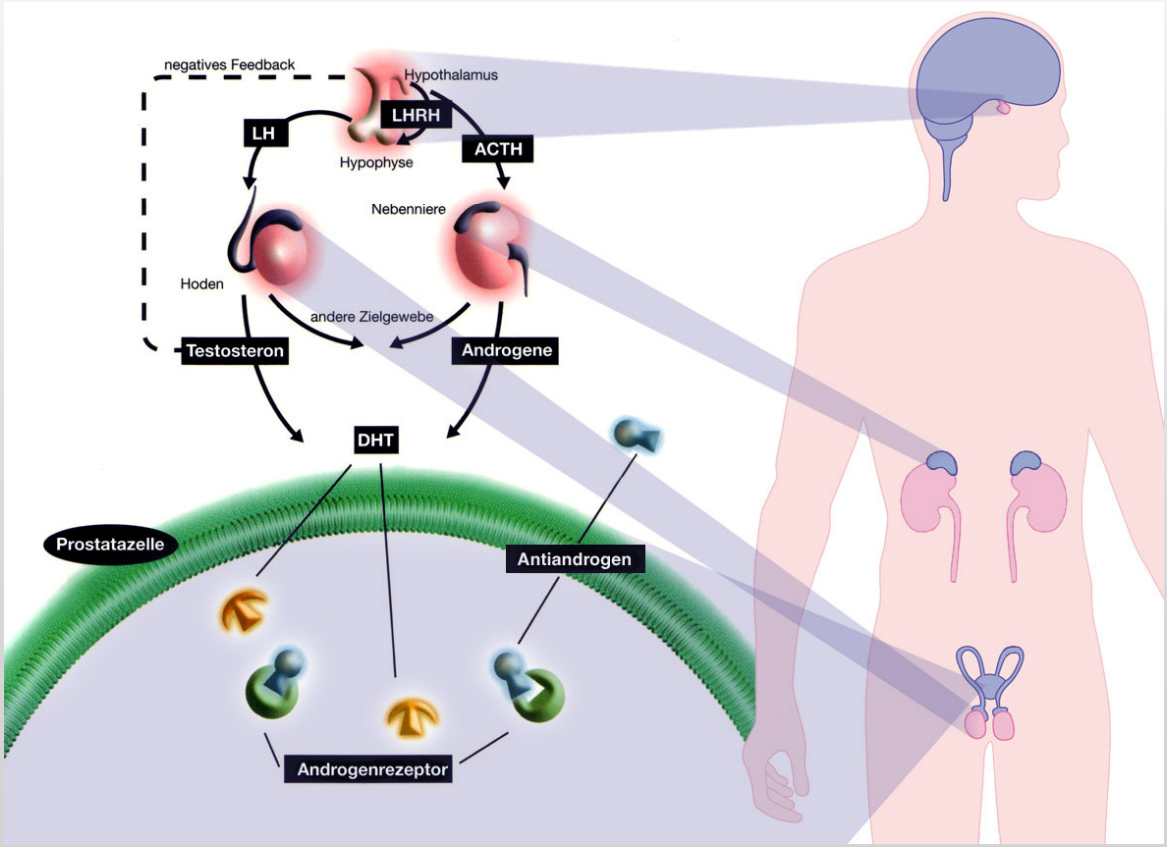


During this time, the peritoneum of the coelomic cavity is forming an evagination on each side of the midline into the ventral abdominal wall.

This evagination, known as the processus vaginalis, follows the path of the gubernaculum testis into the scrotal swellings and forms, along with the muscle and fascia, the inguinal canal.



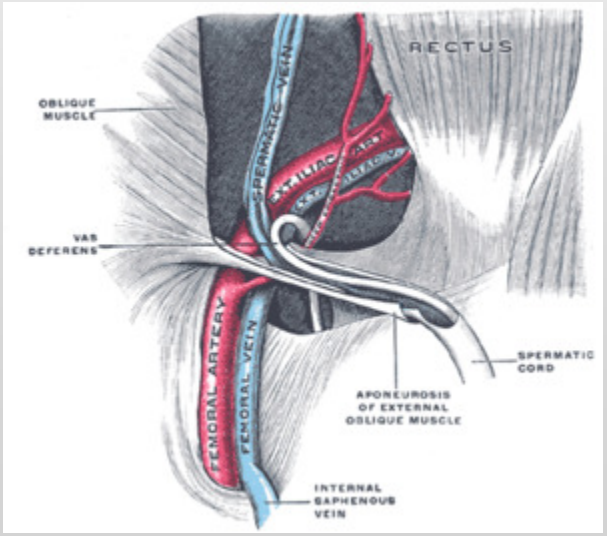
The descent of the testes through the inguinal canal is thought to be regulated by both androgenic hormones produced by the fetal testis and mechanical factors resulting from increased abdominal pressure.



As each testis descends, the layers of the abdominal wall contribute to the layers of the spermatic cord.

The internal spermatic fascia is a reflection of the transversalis fascia, the internal oblique muscle helps form the cremaster muscle, and the external spermatic fascia results from the external oblique aponeurosis.

A reflected fold of the processus vaginalis covers each testis and becomes known as the visceral and parietal layers of the tunica vaginalis.



Before birth, the layers of the processus vaginalis normally fuse, closing off the entrance into the inguinal canal from the abdominal cavity.

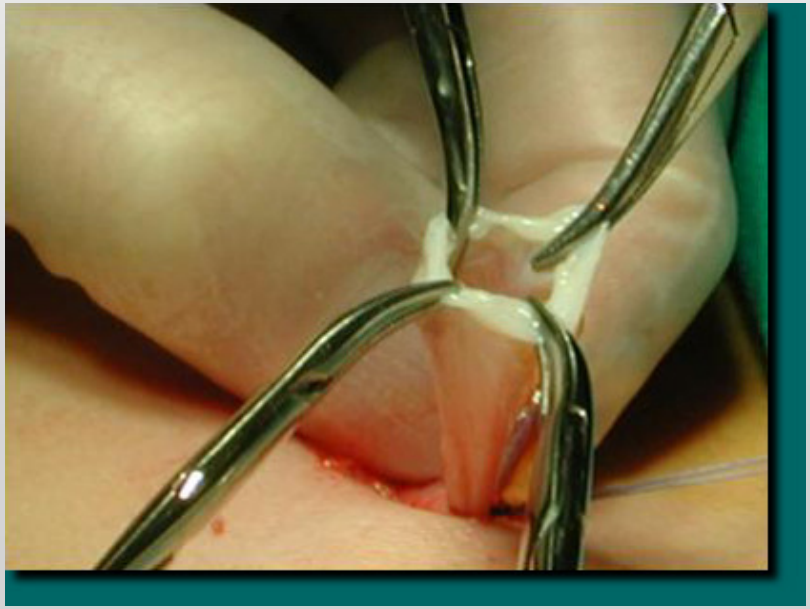
In some individuals, the processus vaginalis remains patent through infancy, into childhood, and possibly even into adulthood.

The precise cause of the obliteration of the processus vaginalis is unknown.

When luminal obliteration fails to occur, a ready-made sac is present where abdominal contents may herniate.

Even when the processus vaginalis is patent, the entrance may be adequately covered by the internal oblique and transverse abdominal muscles, preventing escape of abdominal contents for many years.

Failure of fusion can result not only in an inguinal hernia, but also in a communicating or noncommunicating hydrocele.



Frequency

The reported incidence ranges from 1-5%.

Sixty percent of hernias occur on the right side.

Premature infants are at increased risk for inguinal hernia, with incidence rates of 2% in females and 7-30% in males.

Approximately 5% of all males develop a hernia during their lifetime.

Sex

Inguinal hernias are much more common in males than in females.

The male-to-female ratio is estimated to be 4-8:1.

Age

Premature infants are at an increased risk for inguinal hernia, with the incidence ranging from 7-30%.

Most pediatric ventral and inguinal hernias are detected in the first year of life.

Occasionally, hernias may remain asymptomatic and unnoticed by the parents until later in life.

Clinical History

The infant or child with an inguinal hernia generally presents with an obvious bulge at the internal or external ring or within the scrotum.

The parents typically provide the history of a visible swelling or bulge, commonly intermittent, in the inguinoscrotal region in boys and inguinolabial region in girls.

The swelling may or may not be associated with any pain or discomfort.

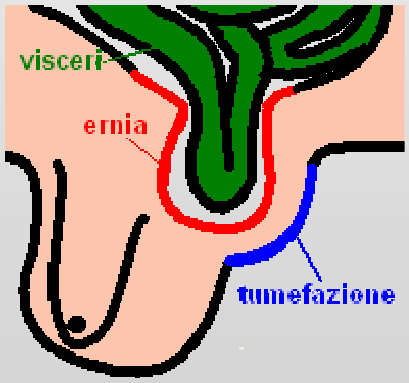
The bulge commonly occurs after crying or straining and often resolves during the night while the baby is sleeping.

Indirect hernias are more common on the right side because of delayed descent of the right testicle. Hernias are present on the right side in 60% of patients, on the left in 30%, and bilaterally in 10% of patients.

Physical

Examine the patient in both supine and standing positions.

Physical examination of a child with an inguinal hernia typically reveals a palpable smooth mass originating from the external ring lateral to the pubic tubercle.



The mass may only be noticeable after coughing or performing a Valsalva maneuver, and it should be reduced easily.

In girls, feeling the ovary in the hernia sac is not unusual; it is not infrequently confused with a lymph node in the groin region.

In boys, palpation of both testicles is important to rule out an undescended or retractile testicle.

Cause

The cause of inguinal hernia in children can be termed an abnormality of embryologic development of the fetus.

In this type of hernia, weakness of the inguinal floor is present, which allows for protrusion of viscera from the abdominal cavity. The hernia sac is composed of the peritoneal fold that contains the hernia.

The following are associated with an increased risk of inguinal hernia:

- Prematurity and low birth weight (Incidence approaches 50%.)

- Urologic conditions
  - ✓ Cryptorchidism
  - ✓ Hypospadias
  - ✓ Epispadias
  - ✓ Exstrophy of the bladder
  - ✓ Ambiguous genitalia

- Patent processus vaginalis, which may be present because of increased abdominal pressure due to ventriculoperitoneal shunts or ascites

- Abdominal wall defects
  - ✓ Gastroschisis
  - ✓ Omphalocele
  - ✓ Family history
  - ✓ Meconium peritonitis
  - ✓ Cystic fibrosis

- Connective tissue disease
  - ✓ Mucopolysaccharidosis
  - ✓ Congenital dislocation of the hip
  - ✓ Ehlers-Danlos syndrome
  - ✓ Marfan syndrome
  - ✓ Cloacal exstrophy
  - ✓ Fetal hydropes

Other Problems to Be Considered

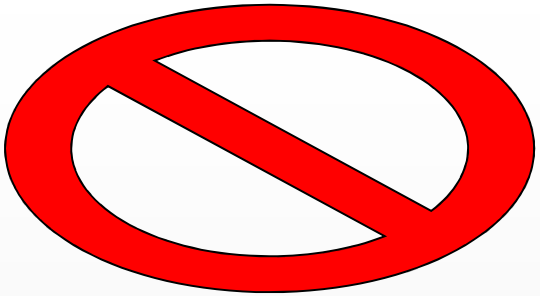
- Inguinal adenitis
- Femoral adenitis
- Psoas abscess
- Saphenous varix
- Hydrocele
- Retractile testis
- Varicocele
- Testicular tumor
- Undescended testis

Imaging Studies

Ultrasonography can differentiate between a hydrocele and an inguinal hernia.

Ultrasonography is capable of finding a fluid-filled sac in the scrotum, which would be compatible with a diagnosis of hydrocele.

However, if the patient has an incarcerated inguinal hernia, ultrasonography may not be sensitive enough to differentiate between the two conditions.



An enlarged inguinal lymph node can mimic an incarcerated inguinal hernia, and surgical exploration may occasionally be necessary to confirm the diagnosis.

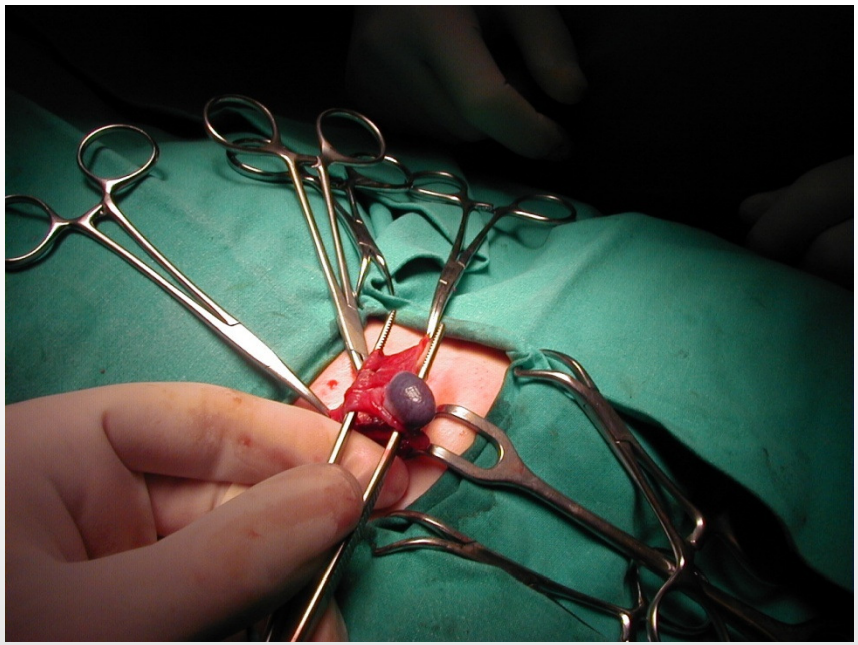
Thus, this study is rarely helpful in the treatment of a pediatric patient with a suspected inguinal hernia.

Treatment

Although adult surgical procedures for correction of inguinal hernias are numerous and varied, only 3 procedures are necessary for the surgical repair of indirect inguinal hernias in children:

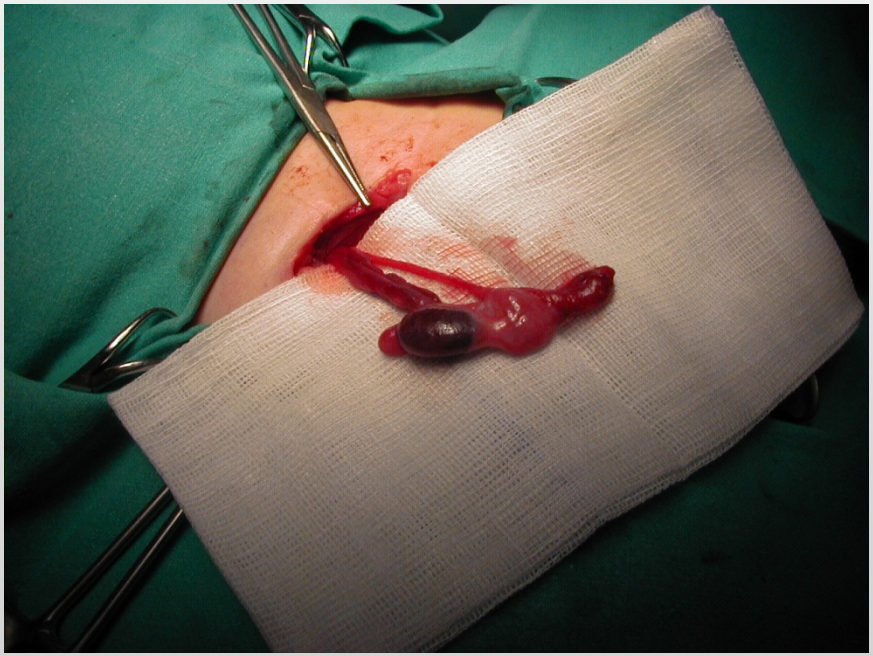
(1)high ligation and excision of the patent sac with anatomic closure
(2)high ligation of the sac with plication of the floor of the inguinal canal (the transversalis fascia)
(3)high ligation of the sac combined with reconstruction of the floor of the canal.

Each procedure can be accomplished with an open or laparoscopic technique.



The first procedure, high ligation and excision of the patent sac with anatomic closure, is the most common operative technique. It is appropriate when the hernia is not very large and has not been present for long.

The second procedure, high ligation of the sac with plication of the floor of the inguinal canal (the transversalis fascia), is necessary when the hernia has repeatedly passed through the internal ring and has enlarged the ring, partially destroying and causing weakness in the inguinal floor.



The third procedure, high ligation of the sac combined with reconstruction of the floor of the canal, is occasionally necessary in small children with large hernias or when the hernia is long-standing.

Inguinal hernia surgery and testicular or vas anomalies

An undescended testis discovered during herniorrhaphy should be repaired, even if the infant is younger than 1 year.

This repair avoids the complications of incarceration, strangulation, and testicular infarction, while increasing potential fertility.

If surgery reveals an absent vas deferens, cystic fibrosis or ipsilateral renal agenesis is present.

Complications

Few complications result from operative repair of an inguinal hernia.

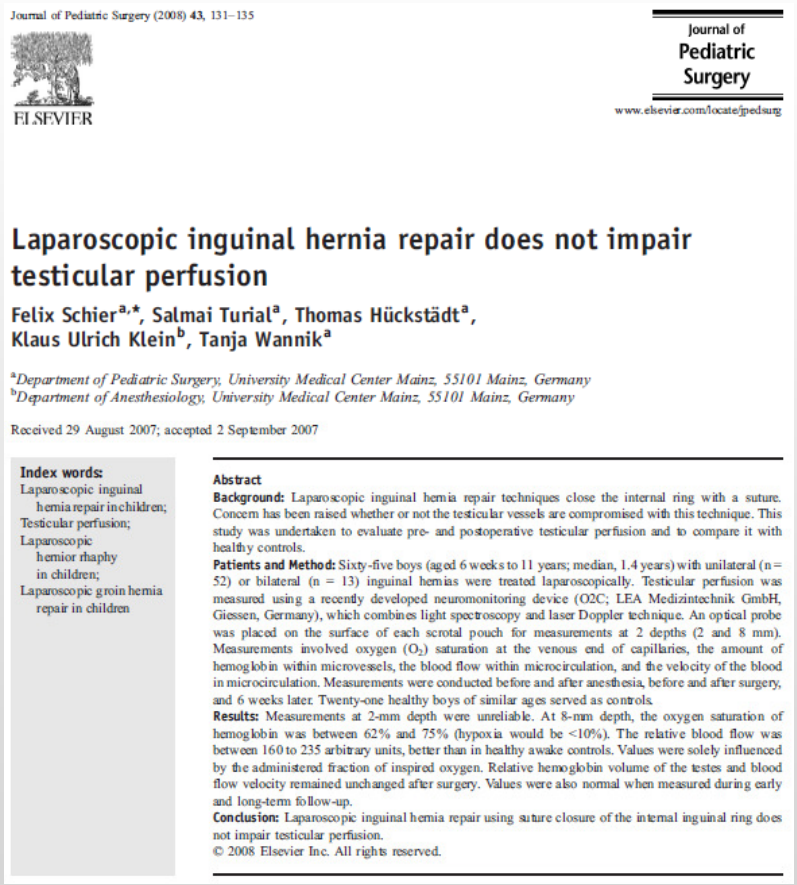
Possible consequences of hernia repair include decreased testicular size (≤ 20% of patients), testicular atrophy (1-2%), vas injury (<1%), and development of sperm-agglutinating antibodies.

The risk of gonadal injury in females is low.

The incidence of wound infection is 1-2%.

Hernia recurrence rates are around 1%.

The vas deferens and ilioinguinal nerve occasionally may be injured.



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Laparoscopic inguinal hernia repair does not impair testicular perfusion

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Index words:
Laparoscopic inguinal hernia repair in children;
Testicular perfusion;
Laparoscopic hernior rhaphy in children;
Laparoscopic groin hernia repair in children

Abstract

Background: Laparoscopic inguinal hernia repair techniques close the internal ring with a suture. Concern has been raised whether or not the testicular vessels are compromised with this technique. This study was undertaken to evaluate pre- and postoperative testicular perfusion and to compare it with healthy controls.

Patients and Method: Sixty-five boys (aged 6 weeks to 11 years; median, 1.4 years) with unilateral (n = 52) or bilateral (n = 13) inguinal hernias were treated laparoscopically. Testicular perfusion was measured using a recently developed neuromonitoring device (O2C; LEA Medizintechnik GmbH, Giessen, Germany), which combines light spectroscopy and laser Doppler technique. An optical probe was placed on the surface of each scrotal pouch for measurements at 2 depths (2 and 8 mm). Measurements involved oxygen (O_2) saturation at the venous end of capillaries, the amount of hemoglobin within microvessels, the blood flow within microcirculation, and the velocity of the blood in microcirculation. Measurements were conducted before and after anesthesia, before and after surgery, and 6 weeks later. Twenty-one healthy boys of similar ages served as controls.

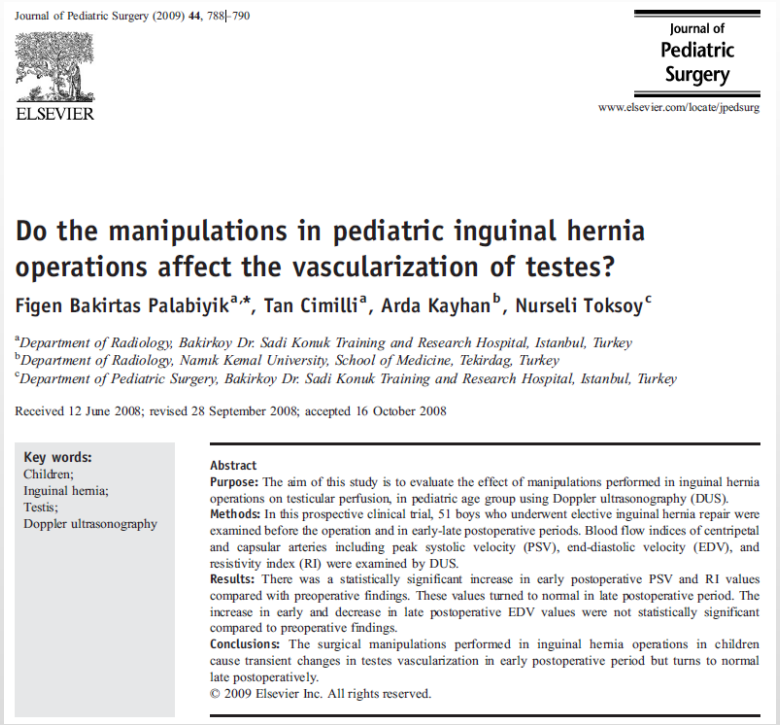
Results: Measurements at 2-mm depth were unreliable. At 8-mm depth, the oxygen saturation of hemoglobin was between 62% and 75% (hypoxia would be <10%). The relative blood flow was between 160 to 235 arbitrary units, better than in healthy awake controls. Values were solely influenced by the administered fraction of inspired oxygen. Relative hemoglobin volume of the testes and blood flow velocity remained unchanged after surgery. Values were also normal when measured during early and long-term follow-up.

Conclusion: Laparoscopic inguinal hernia repair using suture closure of the internal inguinal ring does not impair testicular perfusion.

This study evaluates pre and postoperative testicular perfusion and comparing it with healthy controls

The measurements demonstrate that testicular is not influenced by the laparoscopic procedure

Laparoscopic inguinal hernia repair using suture closure of the internal inguinal ring does not impair testicular perfusion.



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Do the manipulations in pediatric inguinal hernia operations affect the vascularization of testes?

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Key words:
Children;
Inguinal hernia;
Testis;
Doppler ultrasonography

Abstract

Purpose: The aim of this study is to evaluate the effect of manipulations performed in inguinal hernia operations on testicular perfusion, in pediatric age group using Doppler ultrasonography (DUS).

Methods: In this prospective clinical trial, 51 boys who underwent elective inguinal hernia repair were examined before the operation and in early-late postoperative periods. Blood flow indices of centripetal and capsular arteries including peak systolic velocity (PSV), end-diastolic velocity (EDV), and resistivity index (RI) were examined by DUS.

Results: There was a statistically significant increase in early postoperative PSV and RI values compared with preoperative findings. These values turned to normal in late postoperative period. The increase in early and decrease in late postoperative EDV values were not statistically significant compared to preoperative findings.

Conclusions: The surgical manipulations performed in inguinal hernia operations in children cause transient changes in testes vascularization in early postoperative period but turns to normal late postoperatively.

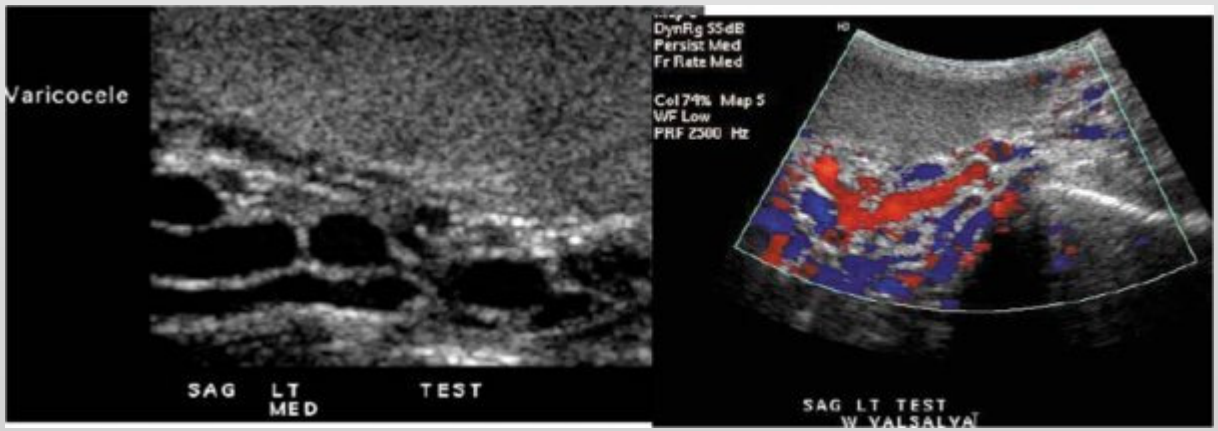
In this prospective study, they evaluated the effect of manipulations performed in open inguinal hernia repair on testicular perfusion in pediatric age group

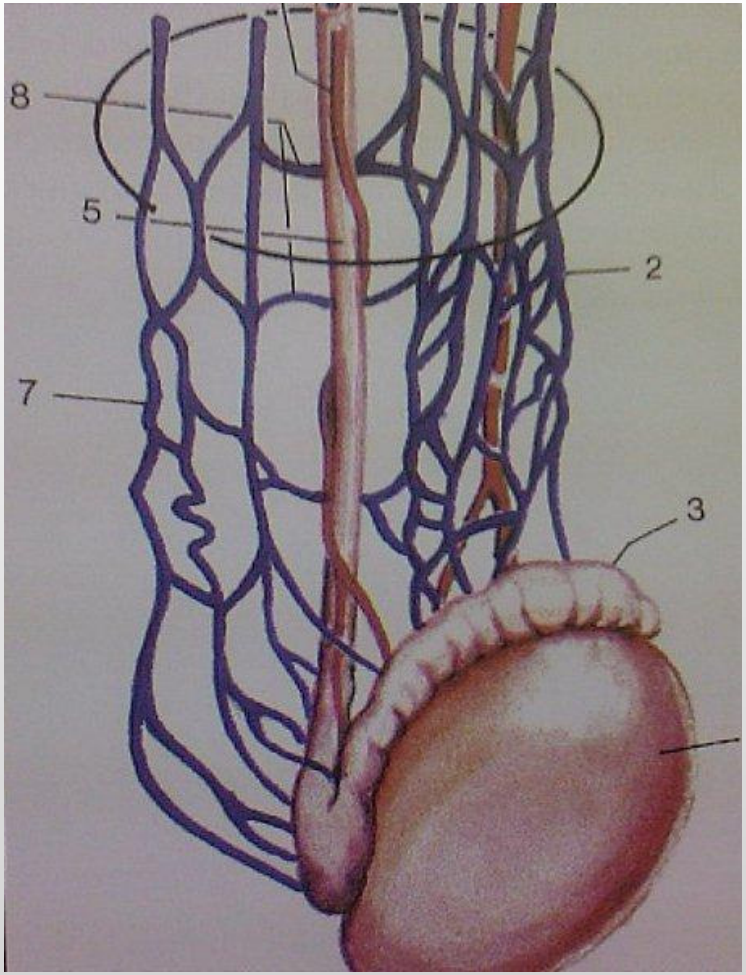
In boys, the vascular structures of testes together with the ductus deferens are found to be adherent to the hernial sac.

Because of the manipulations, there may be a risk of injury to the vascular structures of testes during the operation.

There are various studies performed by Doppler US related to testes vascularization and infertility after hernia operations in adult population

Some researchers reported that all the parameters were affected in early postoperative period while they turned to their initial values in late postoperative period, and there was no pathologic finding in spermatogenetic function





They demonstrated that postoperative changes in open inguinal hernia repair did not affect the testes vascularization and they state that the surgical manipulations in inguinal hernia repair causes only transient changes in testes vascularization in children.

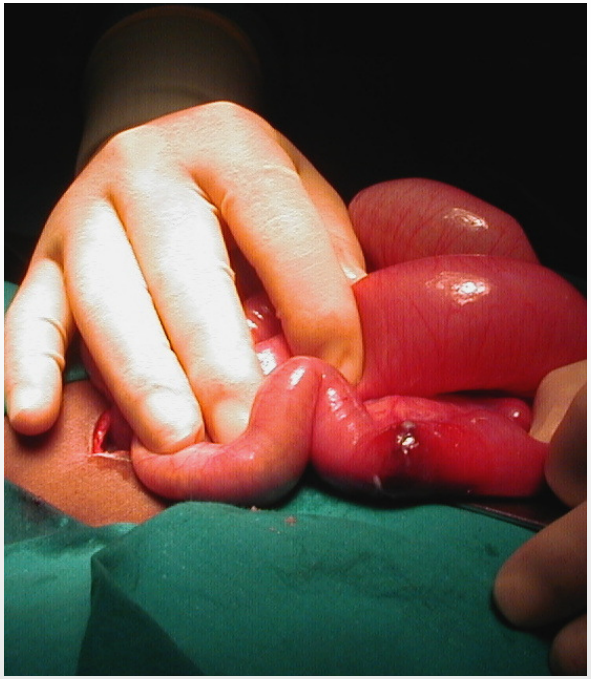
Testicular Fate After Incarcerated Hernia Repair and/or Orchiopexy Performed in Patients Under 6 Months of Age

By L. Walc, J. Bass, S. Rubin, and M. Walton
Ottawa, Ontario

● This study assessed testicular viability after 476 inguinal procedures performed in 338 infants under 6 months of age, between 1974 and 1993. One hundred twenty-one elective hernia repairs (contralateral explorations) were compared with 355 hernia repairs complicated by incarceration and/or orchiopexy. Clinical examination of 323 testes in the early postoperative period showed 20 atrophic testes. Since January 1994, 71 of the 338 patients have had testicular measurements obtained through ultrasonography (US). An additional 13 atrophic testes were found during US examination. Of these, nine were believed to be normal during early postoperative examination. Assuming that US examination will confirm atrophy in the 20 atrophic testes noted early in the postoperative clinical evaluation, and that all other testes not yet scanned are found to be normal, the minimal atrophy rate (MAR) would be 9.3% (33 of 355). Neither operative nor early postoperative testicular assessment correlates with ultimate testicular survival. Testicular pathology may become more evident after puberty, and the real incidence of atrophy may increase.

INDEX WORDS: Testicular atrophy, incarcerated inguinal hernia, orchiopexy, ultrasonography.

This study assesses testicular viability in infants under 6 months of age who underwent incarcerated inguinal hernia repair and/or orchiopexy.



Vascular compromise of the testis resulting in ischemic orchitis is a known complication of incarcerated hernias.

Other factors predisposing to gonadal damage during surgery are prematurity, young age, and early orchiopexy.

This ischemic insult may resolve completely without testicular damage or may result in testicular atrophy.

However, in the Ultra Sound testicular
volume assessment, the incidence was 20%

The final postpubertal incidence of atrophy in testes after IH and IHO in infancy
may be greater, and therefore they recommend
long-term follow-up for such cases.

Inguinal Hernia Repair Protects Testicular Function: A Prospective Study of Open and Laparoscopic Herniorraphy

Peter Beddy, MRCS, Paul F Ridgway, MD, AFRCS, Tony Geoghegan, FFRRCSI, Colin Peirce, MB, Pradeep Govender, MRCS, Francis BV Keane, MD, FRCSI, William C Torreggiani, FFRRCSI, Kevin CP Conlon, MD, FRCSI, FACS

BACKGROUND: Despite the frequency of open and laparoscopic herniorraphy the effect of the hernia and subsequent repair on testicular function is unknown. Our objective was to determine if there is an association between inguinal hernia and hernia repair on testicular function.

STUDY DESIGN: Thirty-seven men aged 18 to 70 years were enrolled in a prospective internally controlled cohort study. They underwent Doppler ultrasonography and serum testicular hormone analysis pre- and post- either open Lichtenstein's repair or laparoscopic totally extraperitoneal hernioplasty. These surrogates of testicular function were measured up to 6 months postrepair.

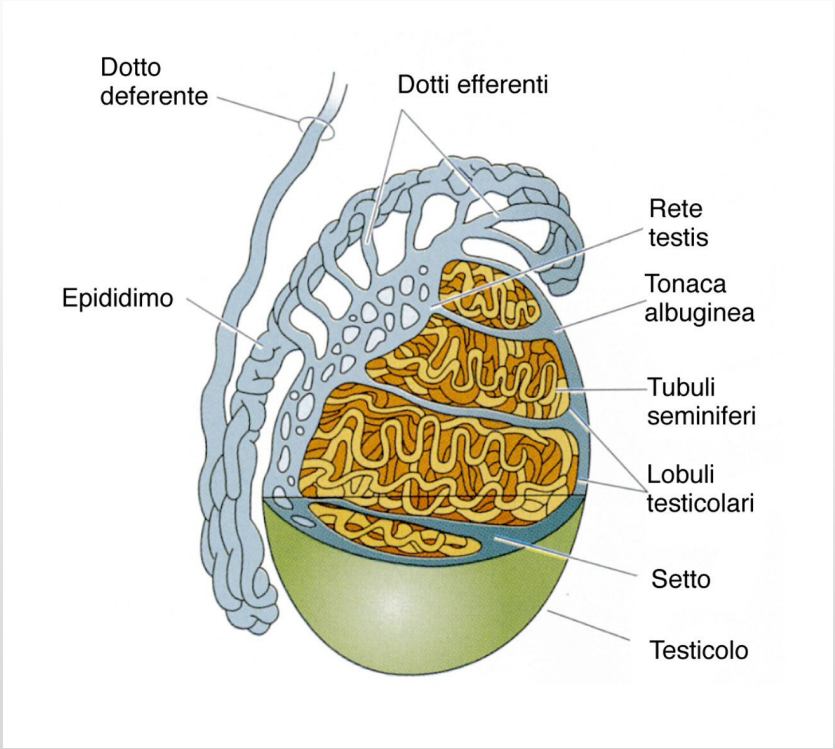
RESULTS: Thirty-seven consecutive patients underwent either Lichtenstein (n = 17) or totally extraperitoneal hernioplasty (n = 20) hernia repair as per surgeon preference. Preoperatively there was a significant elevation in the sonographic resistive index (RI) in the affected (hernia) side compared with the normal side (0.601, 0.569; $p < 0.001$). This elevation in RI was reversed posthernia repair at a median followup of 6.1 months. Inguinal hernia or repair did not affect testicular volume. The choice of either Lichtenstein or totally extraperitoneal hernioplasty hernia did not significantly alter the testicular function.

CONCLUSIONS: Patients with inguinal hernia have an elevated testicular vascular resistance, which is reversed after repair. The choice of laparoscopic or open herniorraphy did not affect reversal of this surrogate of testicular function. (J Am Coll Surg 2006;203:17–23. © 2006 by the American College of Surgeons)

They investigated testicular function surrogates in patients with a unilateral inguinal hernia.

The purpose of the study was to determine whether the presence of an inguinal hernia or herniorraphy resulted in an alteration in testicular function.

Secondary analysis was carried out on whether either type (open or laparoscopic) herniorraphy occasioned derangement of these surrogates.



Patients with an inguinal hernia appear
to have elevated testicular vascular resistance on the affected side, which is reversed after hernia repair.

Both open and laparoscopic repair resulted in similar improvements in testicular perfusion.

Thank You