

# Paediatric Hernias and Hydroceles

## Inguinal hernia and hydrocele

# HISTORY

- Celsus is thought to have performed hernia repairs in 50 AD.
- Galen (129AD ) described the processus vaginalis.

# INCIDENCE

- Approximately 1–5% of all children will develop an inguinal hernia and a positive family history is found in about 10%.
- There is an increased incidence in twins, more frequently in male twins.
- Male-to-female ratio was 5 to 1.
- Right-sided hernias were twice as common as those on the left.
- The mean age at diagnosis was 3.3 years.

- The incidence of an inguinal hernia varies directly with the degree of prematurity.
- The overall incidence of inguinal hernia in premature infants is estimated to be 10–30%.
- Term newborns have a rate of 3–5%.
- The incidence by gender is closer to 1 : 1 in premature infants.

## ASSOCIATIONS

- **Cystic fibrosis:**
  - Patients with cystic fibrosis have an increased risk of an inguinal hernia, with an incidence as high as 15%.
  - This heightened risk may be due to elevated intra-abdominal pressure from respiratory symptoms.
- **Hydrocephalus:**
  - Ventriculoperitoneal shunts (VPS) are associated with an increased incidence of an inguinal hernia as well as increased chance of bilaterality, incarceration, and recurrence.
  - 15% may develop hernia.
  - Bilaterality occurred in nearly 50% in boys and approximately 25% of girls.

- **Peritoneal Dialysis:**

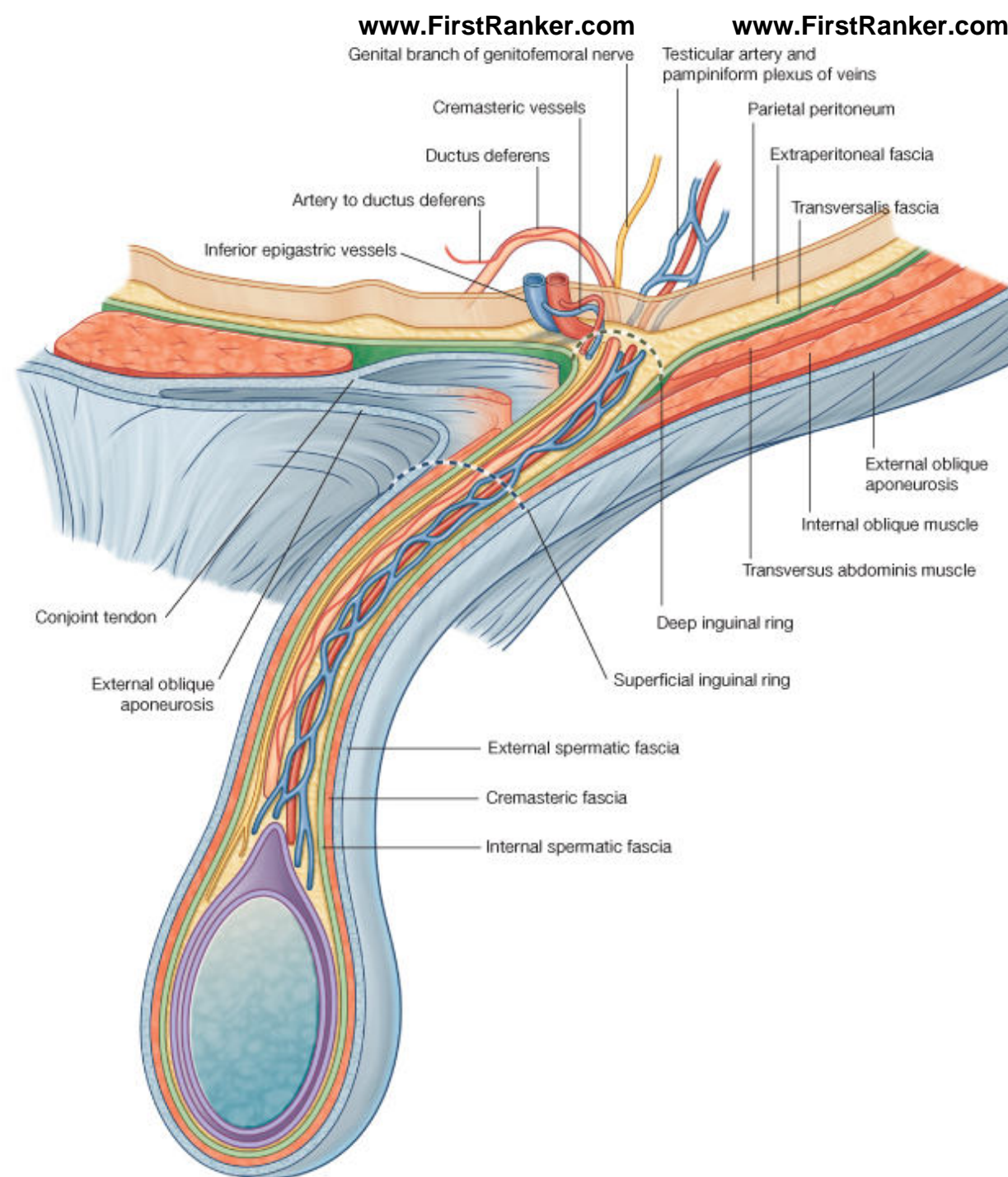
- Patients on long-term peritoneal dialysis also have an increased risk of an inguinal hernia.

- **Others:**

- Cryptorchidism
- Abdominal wall defects
- Connective tissue disorders (Ehlers–Danlos syndrome)
- Mucopolysaccharidoses (Hunter or Hurler syndrome)
- Ascites
- Congenital hip dislocation
- Meningomyelocele

## SURGICAL ANATOMY

- The inguinal canal is a six-sided cylinder.
- The cephalad opening is the internal inguinal ring and the caudal border is the external inguinal ring.
- The cephalad aspect is bordered by the internal oblique, transversus abdominis, and medial external oblique fibers.
- The floor is formed by the transversalis fascia and the 'conjoint tendon.'
- The anterior roof is created primarily by the aponeurosis of the external oblique.
- The inferior wall is composed by the inguinal ligament, lacunar ligament (medial third), and iliopubic tract (lateral third).
- Contents include the ilioinguinal nerve (exiting through the external inguinal ring) and in males, the spermatic cord.
- In females, it contains the round ligament.

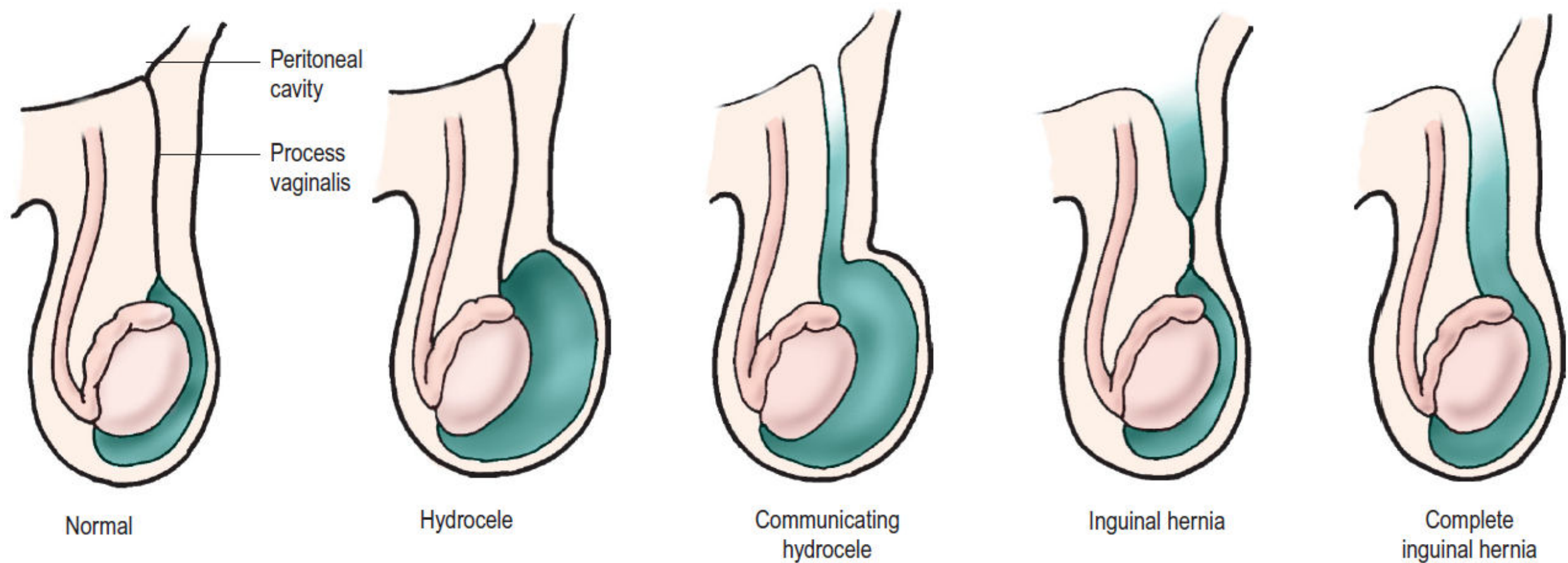


- The layers of the abdominal wall contribute to the layers of the testis and spermatic cord as the gonad descends.
- The internal spermatic fascia is a continuation of the transversalis fascia
- The cremaster muscle derives from the internal oblique.
- The external spermatic fascia originates from the external oblique aponeurosis.
- The processus vaginalis envelops the testis as the visceral and parietal layers of the tunica vaginalis.









## CLINICAL PRESENTATION

- Most hernias are asymptomatic except for inguinal bulging with straining.
- They are often found by the parents or pediatrician on routine physical examination.
- The diagnosis is clinical and rests squarely on the history and physical examination.
- Maneuvers such as having the child raise the head while supine or 'blowing up a balloon' with a thumb in the mouth may be helpful in small children.
- Standing the child upright may also help demonstrate the hernia.
- The differential diagnosis includes
  - retractile testis
  - Lymphadenopathy
  - hydrocele,
  - Prepubertal fat.



- Cell phone picture documentation by the parents has become commonplace.
- A good history is acceptable as an indication for operation.
- Children are often referred for inguinal pain in the absence of any history of bulging or swelling, often with a normal physical examination.
- Other sources such as musculoskeletal strain, gastrointestinal, or genitourinary abnormalities should be excluded before operative intervention.
- Diagnostic transumbilical laparoscopy is useful in a small subset with equivocal examinations or persistent symptoms and no other apparent cause.
- Ancillary findings such as a 'silk glove sign' (feeling the thickened peritoneum of the patent processus as the cord is palpated) or examination under anesthesia are of variable reliability.
- Radiologic diagnostic aids are not generally necessary or helpful.
- Ultrasonography (US) can be used to identify a PPV indirectly via widening of the internal inguinal ring (more than 4–5 mm is positive), but the technique is highly operator dependent and not widely used in children.

- It is not generally necessary to restrict an asymptomatic child's activities until repair is scheduled, but prompt repair may decrease interim incarceration, particularly in the very young.
- Sometimes an incidental PPV is discovered in a child undergoing operation for an unrelated problem.
  - A common scenario is finding a unilateral or bilateral PPV during the course of a laparoscopic appendectomy, or other operation.
- It is probably best not to perform a PPV repair in that setting as the patient is not symptomatic.
- The child and the family should be informed of the findings and instructed to watch for symptoms.

## Hydrocele

- The management of asymptomatic hydroceles in infants is somewhat controversial.
- There is general agreement that a noncommunicating, asymptomatic hydrocele in an infant should simply be followed.
- One recent study found that 89% of 121 infants who were followed resolved by 1 year of age.
- The duration of observation varies by surgeon, with most recommending operation by one or two years of age if the hydrocele fails to resolve or if a clinical hernia is apparent.
- Many authors recommend operation for an infant with a giant hydrocele, although the definition is subjective and variable.
- Most surgeons also repair hydroceles of the cord.
- Excision of the hydrocele sac is not necessary. The fluid should be evacuated, and the distal sac is opened wide.

- Hydroceles in adolescents are often a complication of varicocelelectomy.
- A de novo hydrocele in this age group may represent an inguinal hernia or simply an idiopathic hydrocele.
- A thorough history and physical examination to exclude communication hernia should be performed.
- Also, an ultrasound (particularly if the testis is not palpable, since a reactive hydrocele accompanies about 15% of testicular tumors) should be obtained.
- A trans-scrotal hydrocelectomy is appropriate in adolescents in the absence of signs of hernia or tumor. Otherwise an inguinal approach is best.
- Transumbilical diagnostic laparoscopy for evaluation for a PPV is a good option in equivocal cases.
- An abdominoscrotal hydrocele is an hourglass-shaped collection with both an inguinoscrotal and abdominal component.
  - A combined inguinal and laparoscopic approach may be helpful.

## Incarceration

- The incidence of hernia incarceration is variable and ranges from 12–17%.
- Younger age and prematurity are risk factors for incarceration.
- The mean age of patients with incarceration is significantly lower than that of those who undergo elective repair.
- Symptoms of incarceration are frequently manifested as a fussy or inconsolable infant with intermittent abdominal pain and vomiting.
- A tender and sometimes erythematous irreducible mass is noted in the groin.
- Abdominal distention is a late sign, as are bloody stools.
- Peritoneal signs indicate strangulation.
- Incarceration may be the presenting sign of the hernia, especially in an infant.

- It can be difficult to distinguish a hydrocele of the cord from an incarcerated hernia.
  - A happy infant with no tenderness suggests the former diagnosis.
  - If several examiners have vigorously attempted to reduce the hydrocele, the distinction can be difficult and ultrasound may be helpful.
  
- It has been stated that gangrenous bowel cannot be reduced, but exceptions make this a dangerous rule to rely on.
  - The presence of peritonitis or septic shock is an absolute contraindication to attempted reduction.
  - Symptoms of bowel obstruction are a relative contraindication.
  
- Monitored conscious sedation is used after intravenous access and rehydration. Firm and continuous pressure is applied around the incarceration.
  
- Successful reduction is usually confirmed by a sudden 'pop' of the contents back into the peritoneal cavity.
  - Questionable or incomplete reductions should be explored.

- Reduction en masse, in which the hernia contents are reduced into the peritoneal cavity but the bowel remains incarcerated internally in the hernia sac, is a very rare occurrence but the surgeon should be aware of this possibility.
  - Once an incarcerated hernia is reduced, a delay of 24 to 48 hours to allow resolution of edema is reasonable.
  - Reliability of the family as well as clinical (very difficult reduction) and geographic considerations may dictate the need for admission and observation before definitive repair.
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- Overall, 90–95% of incarcerated hernias can be successfully reduced.
  - In one report, only 8% required emergency operation out of 743 incarcerated hernias.
    - Two children required bowel resection.
  - Urgent operation is necessary if reduction fails.

- The hernia may reduce with induction of general anesthesia.
  - If so, the hernia sac should be opened and inspected.
  - The presence of enteric contents or bloody fluid mandates either open exploration via separate incision or La Roque maneuver (incision in the transversalis fascia through the same inguinal skin incision) or, more commonly, laparoscopic evaluation.
- It may be necessary to open the internal inguinal ring laterally to reduce the bowel.
- Some surgeons approach an incarcerated hernia by transumbilical laparoscopy to both reduce the hernia and evaluate the bowel.
  - There is some evidence that the laparoscopic approach is associated with fewer complications.
- Intestinal injury requiring treatment is rare (1% to 2%), even with incarceration.
- The hernia sac is often quite edematous and friable, and repair of the hernia can be quite difficult.
- The risk of recurrence is significantly increased.

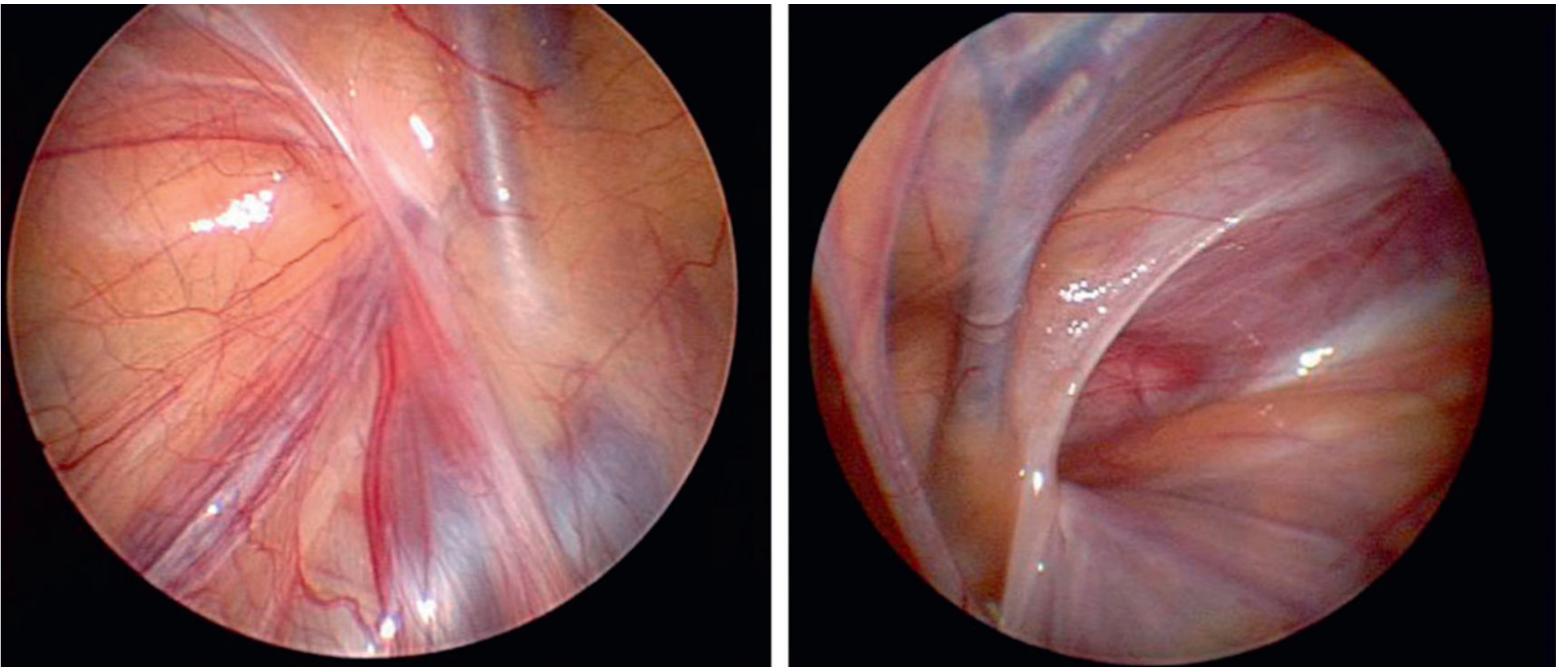


- The testis on the incarcerated side is often edematous and somewhat cyanotic.
  - Unless the gonad is frankly necrotic, it should be preserved.
  - The parents of any boy with an incarcerated hernia should be counselled about the possibility of testicular loss or atrophy, but the incidence of this complication is only 2–3%.
- Incarceration of an ovary in a hernia sac may not always impair its blood supply, but most pediatric surgeons will promptly (but not emergently) repair the hernia in a girl even with an asymptomatic, nontender incarcerated ovary.

## MANAGEMENT

- **Anesthesia:**
  - Usually a general anaesthesia is preferred over local or regional anaesthesia.
- **Timing:**
  - As premature infants have an increased incidence of an inguinal hernia, this is a common diagnosis in the neonatal intensive care unit.
  - The incidence of bowel incarceration in premature infants is significantly increased (three times in one large series).
  - Many institutions use 2 kg as a lower limit for repair in asymptomatic and otherwise relatively healthy newborns.
  - Repair of the hernia is usually done before discharge to avoid the need for readmission for herniorrhaphy and to decrease the risk of incarceration.
  - However, this depends on other comorbidities.

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- The surgical repair of hernias in females is somewhat simpler than in males because there is no need to identify and preserve a spermatic cord.
- The surgical approach to the inguinal canal is the same in both males and females.
- The hernia sac is identified and inspected for contents.
  - Often the ovary, tube, or mesosalpinx is contained within the sac.
- If the sac is empty, it is divided between clamps. The proximal sac is dissected out to the level of the internal ring, twisted and ligated.
- Internal ring with one or two sutures by approximating the transversalis fascia.

- Mesh or prosthetic materials are almost never required in children.
  - One exception may be recurrent hernias in children with connective tissue disorders or mucopolysaccharidoses.

## Laparoscopic Repair Technique

- Herniotomy can be performed laparoscopically also.
- Advantages:
  - Can visualise the contralateral side in the same setting and repair can be done simultaneously if bilateral involvement is present.
- Disadvantages:
  - Learning curve for knotting.
  - Slightly high chances of recurrence in comparison to open repairs.

- **Pain Management:**

- Local anaesthetic application of long acting agents like bupivacaine.
- Anti-inflammatory as NSAIDs.

## COMPLICATIONS

- **Recurrence**

- The risk of recurrence after an elective inguinal hernia repair is less than 1%.
- It is higher in premature infants, in children with incarcerated hernias, and those with associated diseases (e.g., connective tissue disorder, VPS).

- **Injury to the Spermatic Cord or Testis**

- Injury to the spermatic cord or testis is a rare occurrence in elective hernia repairs, with an incidence of approximately 1 in 1,000.
- Testicular atrophy from vascular injury during routine inguinal hernia repair is also uncommon.

- Post-operative development of hydroceles:
  - May need tapping or exploration
- Infection at site
- Pain and paraesthesia due to involvement of the ilioinguinal nerve.

# UMBILICAL HERNIA



- Umbilical hernia is a common disorder in children that pediatric and general surgeons are frequently asked to evaluate and treat.
- Although the fascial defect is present at birth, unlike other hernias of childhood, an umbilical hernia may resolve without the need for an operation.

## Anatomy

- After birth, closure of the umbilical ring is the result of complex interactions
  - lateral body wall folding in a medial direction
  - fusion of the rectus abdominis muscles into the linea alba
  - umbilical orifice contraction which is aided by elastic fibers from the obliterated umbilical arteries.
  - Fibrous proliferation of surrounding lateral connective tissue plates and mechanical stress from rectus muscle tension may also help with natural closure.
- Failure of these closure processes results in umbilical hernia.
- The hernia sac is peritoneum, which is usually very adherent to the dermis of the umbilical skin.
- The actual fascial defect can range from several millimetres to 5 cm or more in diameter.
- The extent of skin protrusion is not always indicative of the size of the fascia defect.
- Frequently, small defects can result in alarmingly large proboscis-like protrusions.
  - Thus, it is important to palpate the actual fascia defect by reducing the hernia to assess whether operative or nonoperative treatment is appropriate.



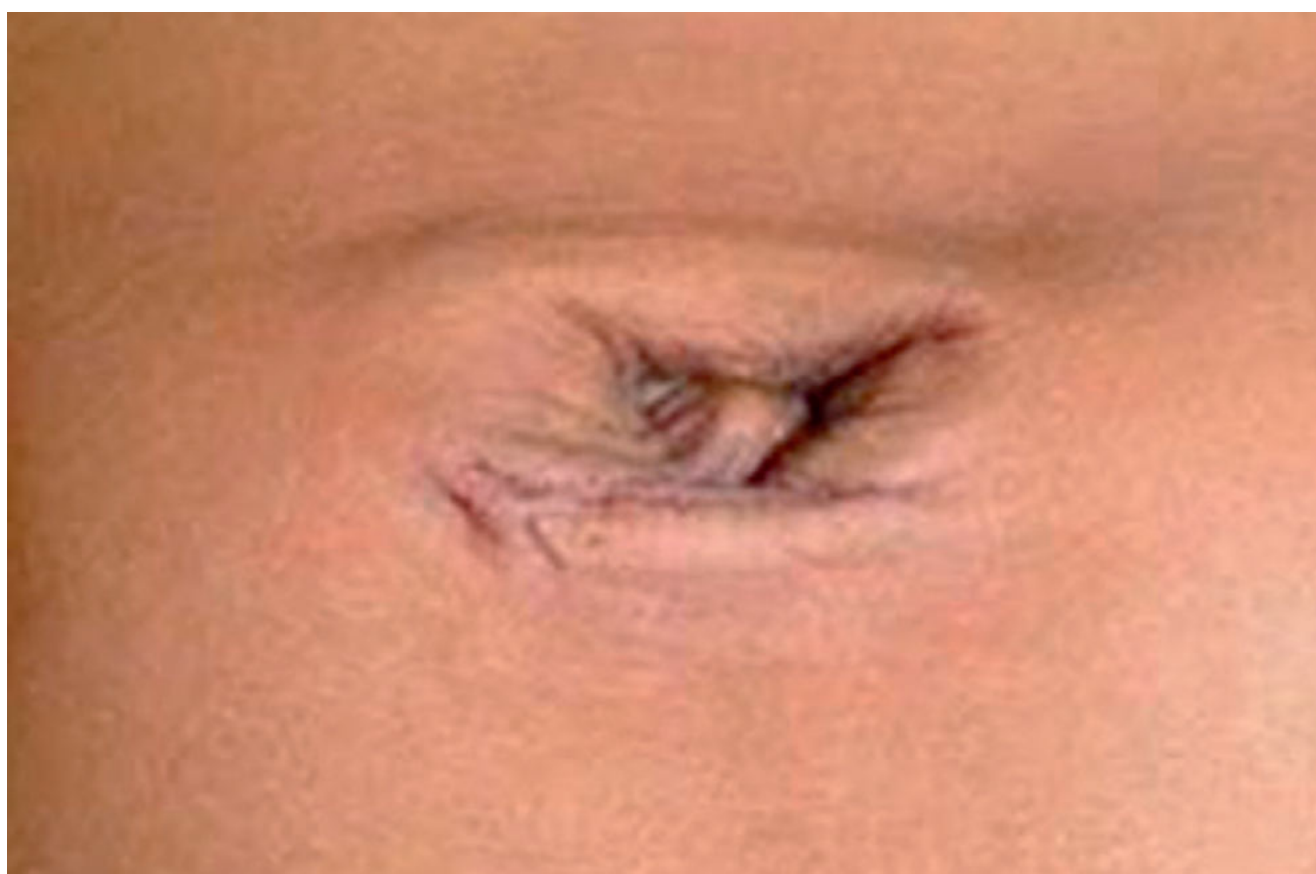
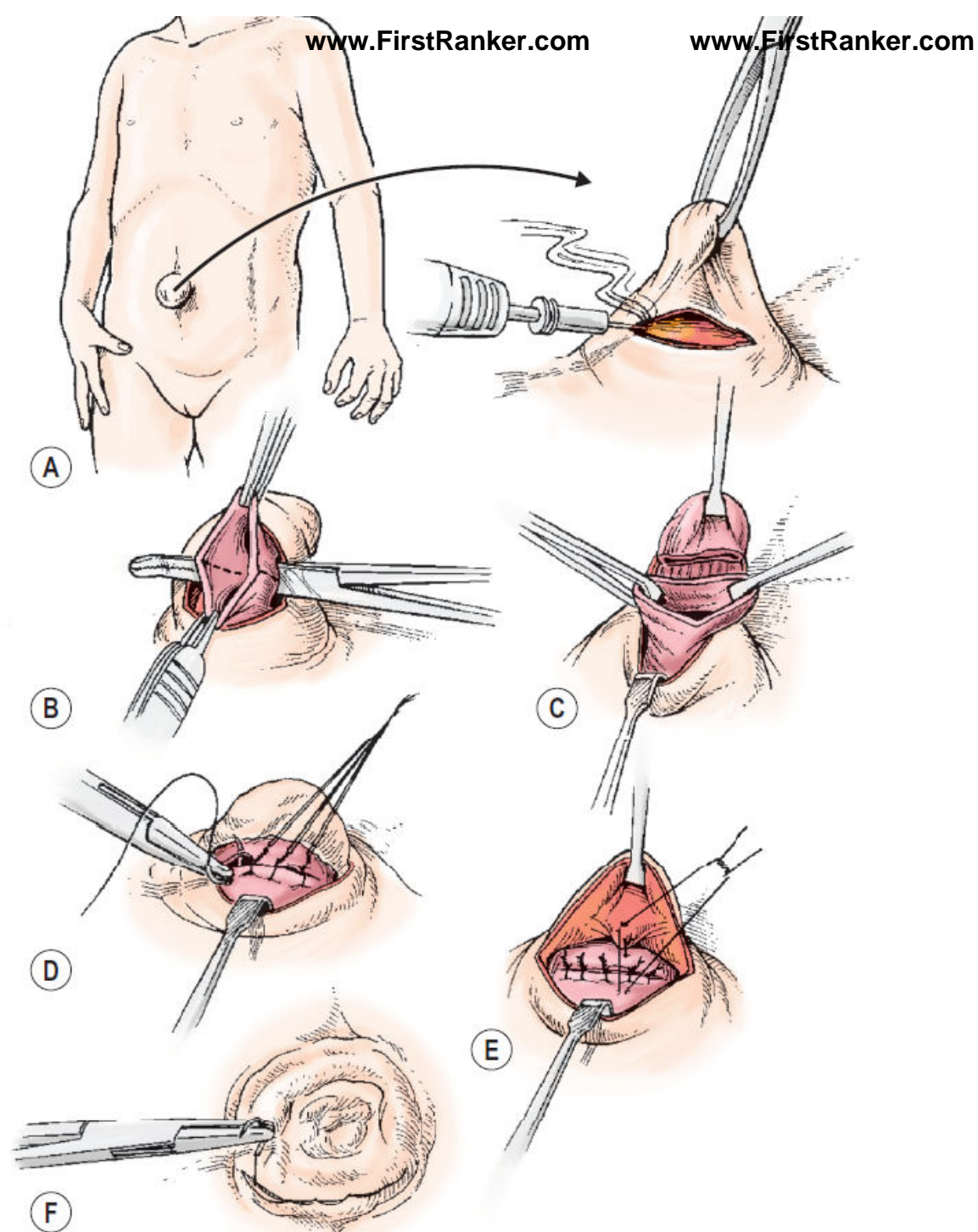
## Incidence

- The incidence of umbilical hernia in the general population varies with age, race, gestational age, and coexisting disorders.
- In the USA, the incidence in African-American children from birth to 1-year-old ranges from 25–58%, whereas Caucasian children in the same age group have an incidence of 2–18.5%.
- Premature and low birth weight infants have a higher incidence than full-term infants.
- Infants with certain other conditions, such as Beckwith–Wiedemann syndrome, Hurler syndrome, various trisomy conditions (trisomy 13, 18, and 21), and congenital hypothyroidism, also have an increased incidence as do children requiring peritoneal dialysis.



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# EPIGASTRIC HERNIA

- Hernias of the abdominal wall through the midline linea alba, also termed epigastric hernias, are common in the pediatric age group.
- These hernias present as small masses, usually with incarcerated properitoneal fat, between the umbilicus and xiphoid process.
- An epigastric hernia should not be confused with **diastasis recti**, which is generalized weakness in the linea alba from umbilicus to xiphoid, and virtually always resolves by age 10 years.
- Incarcerated epigastric hernias can be painful.
- These hernias can also be multiple and associated with an umbilical hernia.
- Epigastric hernias do not resolve and should be repaired.
- A small midline incision over the hernia is generally used, with suture repair of the defect after the contents (properitoneal fat) are reduced or excised.
- Recurrence is not common.

