Pediatric inguinal and scrotal conditions

Objectives:

- Introduction.
- Embryology
- Inguinal hernia.
- Hydrocele.
- Undescended testis.
- Acute scrotum.

Resources:

- **Davidson's.**
- **Slides**
- **Surgical recall.**
- **Raslan's notes.**

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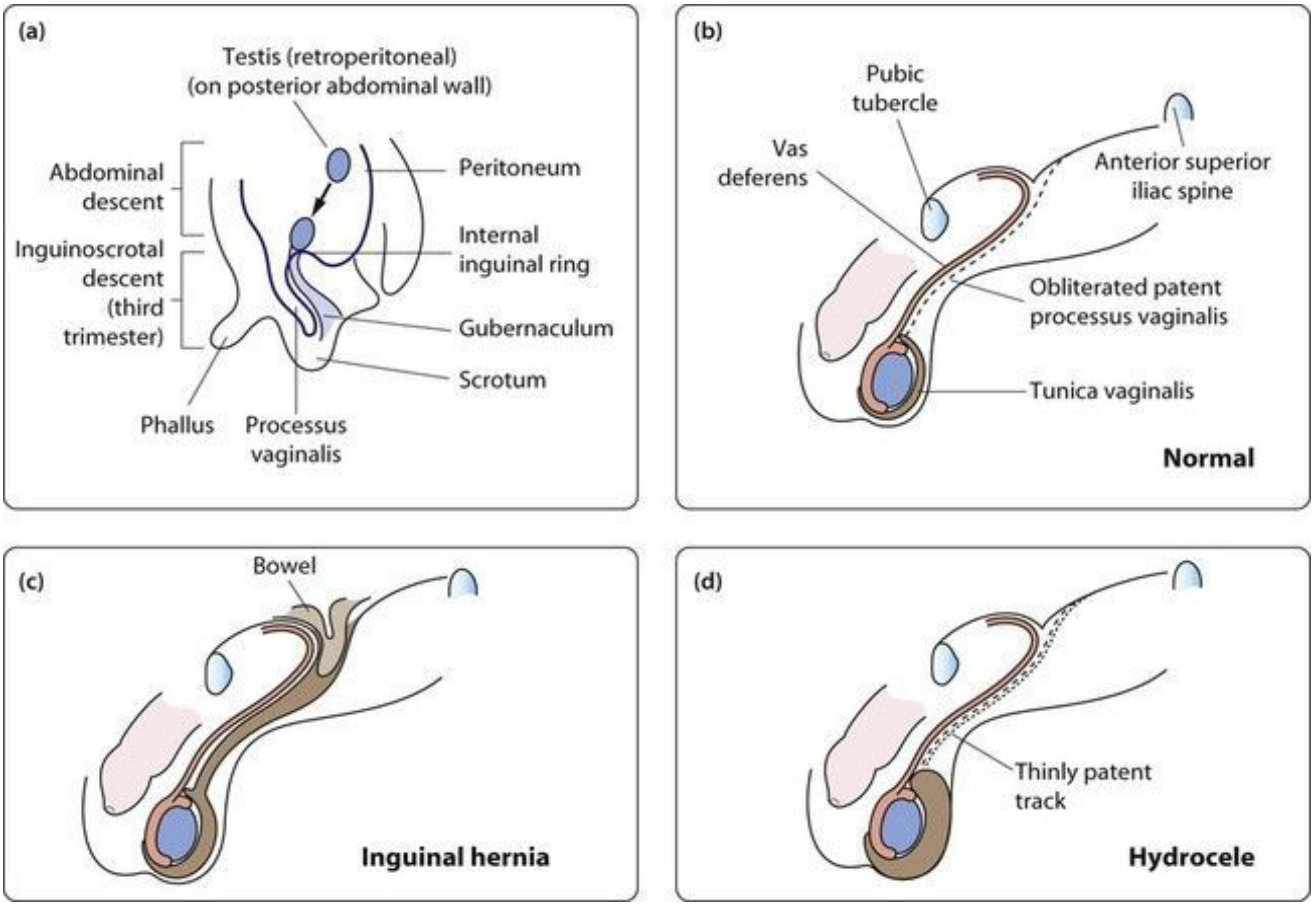
Once you stop learning you start dying.

Introduction:

- Inguinal hernia, hydrocele and undescended testis are common groin conditions in infants and children.
- They share the same embryological origin.
- They may present in isolation or combination (more than one) in the same patient.
- Accurate clinical distinction is very important as the management and outcome is different in each condition.

❖ What is processus vaginalis (PV)? (V imp)

It's outpouching of peritoneum at deep ring that extends through inguinal canal down to scrotum, associated with normal descent of testis. At 36-40 of gestation the testis reaches the scrotum and PV gradually obliterates.



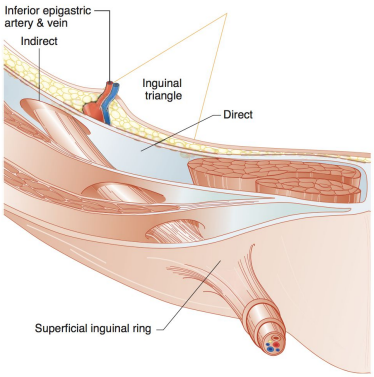
- What if Processus Vaginalis persists:

- Inguinal hernia (PV is wide allowing bowel to descend)
  - 90% of undescended testes cause hernia.
  - because undescended testes prevent PV from obliteration leading to hernia.

● Hydrocele (PV is thin allow only the fluid to descend). If PV persist it might cause inguinal hernia (bigger in size) or hydrocele (smaller in size).

INGUINAL HERNIA (IH)

- **Hernia** is the protrusion of an organ or the fascia of an organ through the wall of the cavity that normally contains it.
- **Inguinal hernia:** extension of the perineum (and usually its contents-small intestine) through the inguinal canal.
- **It has two subtypes:**
    1. Indirect: infantile form, more common, follows the tract through the inguinal canal.
    2. Direct: adult form, usually occurs due to a defect or weakness in the transversalis fascia area hesselbach's triangle.



- In children, 99% of groin hernias are indirect inguinal hernia

Hernia in children is not associated with muscle weakness as in adults. (indirect)

❖ Inguinal canal anatomy:

It extends from the deep inguinal ring which is the connection between peritoneal cavity and the groin to the external ring, Boundaries:

- Anterior: external oblique muscle.
- Posterior: transversalis fascia.
- Inferior wall: inguinal ligament.
- Superior ligament (roof): internal oblique and transversus abdominis.

Position of the epigastric vessels is the landmark to differentiate between direct and indirect inguinal hernia.

- The deep ring is lateral to the inferior epigastric vessels this indicates an indirect inguinal hernia.
- If it's bulged to the medial to the inferior epigastric vessels the it's direct.

Intra-abdominal contents pass within a patent processus vaginalis (PPV), through:

1. the deep inguinal ring, inguinal canal, superficial inguinal ring and potentially into the scrotum (male).
2. the canal of Neck to the labium (female).

● Incidence :

- Approximately 1-5% of all children will develop IH.
- Newborns incidence 3-5%
- Overall incidence in premature infants 10-30%. More common and important (Because infants are born earlier than the closure of PV.)
- Positive family history in about 10%.
- More common in boys than girls (5:1).
- In boys, right sided found in 60% ,left sided in 30% and bilateral in 10%. because the right side descends later than the left side.
- In girls , laterality is equal. 50% to 50% in girls its called inguinal hernia canal of nuck.

- **Risk Factors:** PV is persisted since birth but these risk factors bring the clinical presentations earlier.
    - Prematurity. (high chance of hernia)
    - connective tissue disorders.
    - ventriculoperitoneal shunt (VP shunt).
    - peritoneal dialysis (PD).
    - Ascites (any conditions cause increase intra-abdominal pressure).
    - Undescended testis. (important)

- **Clinical presentation:**
    - Most hernias are asymptomatic except for intermittent inguinal bulging (swelling) with straining (crying, coughing, defecation, etc.), It is Painless Until it gets complicated
    - They are often found by parents
    - On examination, often the hernia is reduced and no bulge is seen. Especially in children, So do provocative manoeuver such as standing (due to the effect of gravity) ,coughing and laughing or jumping are required to elicit it and disappear when lying down.
    - Examination should include scrotum and testes. (sometimes you may have other pathologies) "cocktail"
    - The hernia forms a swelling in the inguinal canal, which may extend into the scrotum. (Causes hydrocoele).
    - The hernia often reduces spontaneously when the patient lies down, or it may be reduced by gentle pressure applied in an upward and lateral direction.
    - bowel sounds can often be heard within the hernia on auscultation. (Davidsons: 140-142)

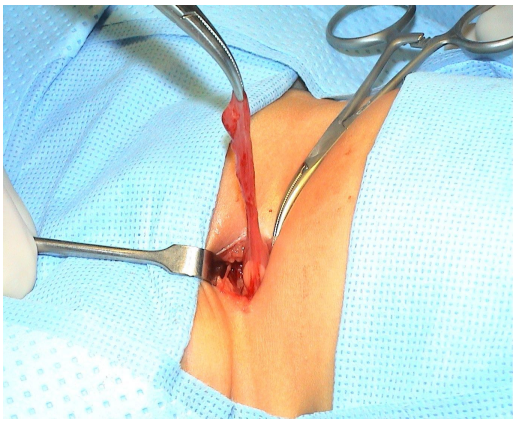
- **Complications:**

1. **Incarceration /Irreducibility.** It also means obstruction. **If the contents of the hernia become trapped in the weak point in the abdominal wall .**
    - The incidence ranges from 12-17 %. It an emergency, very painful.
    - Younger age (less 6 months) and prematurity are risk factors. (High chance of incarceration).
    - Presents as fussy infant with intermittent abdominal pain and vomiting..
    - **On examination,** the infant is usually irritable, in pain, with tender erythematous groin mass which cannot be reduced with gentle pressure. Sometimes it is the first presenting sign of hernia.
    - Incarceration will result in bowel obstruction and if not treated will progress to strangulation (bowel ischemia and it's extremely rare in children).
2. **Strangulation**
    - Severe pain , prolonged incarceration (can cut off blood flow to part of the intestine) ,fever, tachycardia, and vomiting are suggestive of strangulation (rare presentation)
    - It is life threatening and requires immediate surgery.
3. **Obstructed bowel.**
4. **Testicular atrophy :** due to compression of the blood vessels

- **Management:**

Uncomplicated IH	Incarcerated IH
• IH will not resolve spontaneously & surgery is the only treatment. • Open inguinal herniotomy (more common approach). • Laparoscopic herniotomy (less popular) • Preterm babies usually have their hernias repaired before discharge from nursery to avoid incarceration. • Infants & children less than 6 months should have their surgery done within weeks (OR availability).	• The presence of peritonitis or septic shock is an absolute contraindication to attempted reduction. b/c it has been stated that gangrenous bowel cannot be reduced • Intravenous access and rehydration. • Monitored conscious sedation. • Firm and continuous pressure is applied around the incarceration. • Successful reduction is usually confirmed by sudden pop of contents back to abdominal cavity. • Over 90-95% of incarcerated IH can be successfully reduced. • Urgent operation (Herniotomy) is necessary if reduction fails. • Once hernia is reduced, a delay of 24-48h is allowed before herniotomy (resolution of edema & inflammation)

Inguinal hernia and bilateral hydrocele



CONGENITAL HYDROCELE

Its an abnormal collection of fluid in the process virginals which fails to obliterate resulting in swelling in the scrotum and groin. It's like a tube.

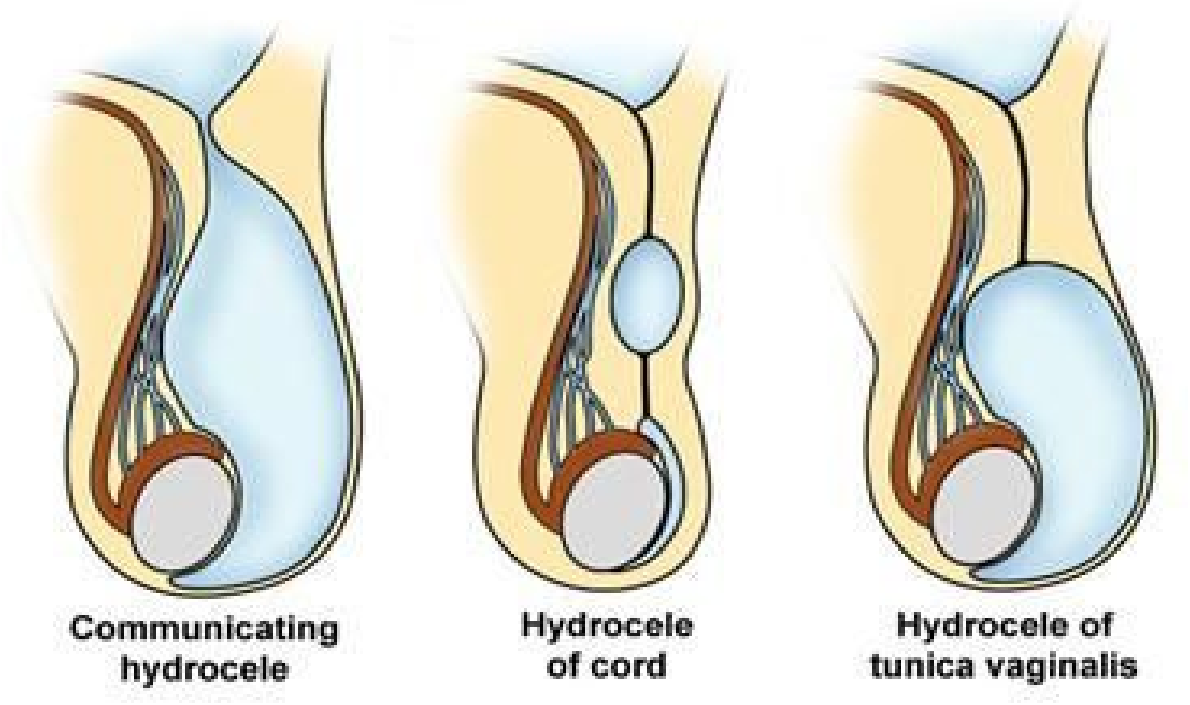
- Differs from adult hydrocele which is more likely due to infection (epididymo-orchitis, TB), malignancy or idiopathic.
- Approximately 5% of boys have hydrocele at term.
- Less common in girls and known as a hydrocele of the canal of nuck. (rare)

❖ Etiology:

- Same as IH, patent processus vaginalis
- The opening is smaller than IH, so only the fluid comes through
- If the abdominal end of the PV remains open but " too small " to permit herniation of intestine peritoneal fluid passes into patent processus vaginalis forming a hydrocele of the testis.

❖ Types of Hydrocele:

1. Communicating hydrocele: the fluid flows back and forth between the scrotum and the abdomen (you can squeeze the fluid back to the peritoneum cavity). The most common. Associated with indirect inguinal hernia.
2. Non-communicating hydrocele or Hydrocele of tunica vaginalis : the fluid stays around the testicles and is not absorbed
3. Hydrocele of the spermatic cord: the fluid is located in the spermatic cord between the scrotum and the abdomen. Rare-painless
    a. Encysted hydrocele: no communication with the peritoneum or tunica vaginalis
    b. funicular type: communicates with the peritoneum and doesn't surround the testis



❖ Clinical presentation:

- Classical history of communicating hydrocele: when he wakes up, the scrotum is empty. Then during the day it becomes full of fluid. (because it goes back by gravity while sleeping)
    - Non reducible Painless scrotal or groin swelling (indicates hernia), but mostly scrotal. (Usually from birth) which feels like a water balloon.
    - It could be unilateral or bilateral

- On examination, scrotal swelling, tense, overlying skin often has a blue tinge. Not reducible, transilluminate, difficult to palpate the testis separately. With normal spermatic cord.
    - It's more likely to be associated with an inguinal hernia.
    - If there is any doubt about the diagnosis, then ultrasound should be performed.
    - It is important always to seek this physical sign and also to examine the neck of the scrotum carefully to exclude an inguinal hernia as the cause of the swelling. (Davidsons:422)

❖ Management:

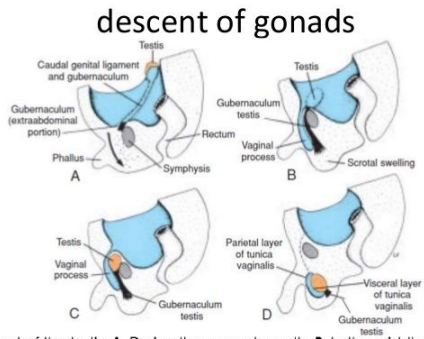
- Expectant management (observation) in the first two years of age.
- By the age of 2 years 90% of hydrocele will have resolved. Under the age of 2 years: only observation
- Surgery (hydrocelectomy/high ligation of PPV) is indicated if the hydrocele fails to resolve by age of 2 years.
- Aspiration alone does not cure an idiopathic hydrocoele and the tunica soon refills. It is possible to obliterate the sac by injecting a sclerosant after aspiration, but surgical excision and eversion is associated with a much lower recurrence rate.
- if the hydrocoele fluid becomes infected, incision and drainage of the pus is necessary. Similarly, a haematocoele may require treatment by incision and drainage. Davidsons (454).
    - Clinically there is no difference between the types of the management.

UNDESCENDED TESTIS (CRYPTORCHIDISM)

Embryology	• Normal testes develop in posterior abdominal wall from gonado-nephric ridge (testes and kidney come from the same structure, testes descend and kidneys ascend).
	• Normal testes descend across the abdomen to deep inguinal ring between 8-15 weeks of gestation under control of AMH (anti-mullerian hormone).
	• Second phase of descent, the testes move through the inguinal canal into the scrotum (25-35 weeks of gestation) under control of **androgens** (testosterone).
	• Testicular development and descent depend on interaction among endocrine, paracrine, growth and mechanical factors (anterior and posterior abdominal walls contract against each other and squeeze testes down through the opened deep ring which is a potential space).
	  ○ What make testis goes down? We don't know the exact reason it's multifactorial.
	  ○ This explanation come from children with Prune belly syndrome (congenital absence of the abdominal muscles) they have bilateral undescended testes.
	• the gubernaculum[1] aids in the descent of the gonads (a lot of researches going on)

[1] Fibrous band

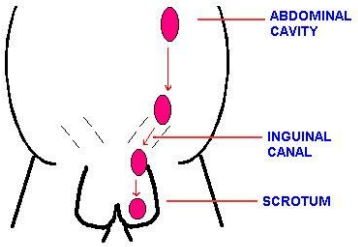
- Extra information
- In males:
  - The upper part of the gubernaculum degenerates.
  - The lower part persists as the gubernaculum testis ("scrotal ligament").This ligament secures the testis to the most inferior portion of the scrotum, tethering it in place and limiting the degree to which the testis can move within the scrotum.
- In females:
  - The gubernaculum has two vestigial remnants in females, the ovarian ligament and the round ligament of the uterus (ligamentum teres uteri) which respectively serve to support the ovaries and uterus in the pelvis.



Descent of the testis. **A**. During the second month. **B**. In the middle of the third month. Peritoneum lining the coelomic cavity evaginates into the scrotal swelling,where it forms the vaginal process (tunica vaginalis). **C**. In the seventh month. **D**. Shortly after birth. *"langman Medical Embrology"*

Terminology (you should differentiate)

★ **Undescended testis (UDT):** is arrested along its normal path of descent. (never in scrotum).
- In abdomen = abdominal testes, In inguinal canal = canalicular testes



★ **Retractile testes** (النطاطة): is a testicle that may move back and forth between the scrotum and the groin. can be manipulated into scrotum where it remains without tension. (very common up to 20% of pediatric population due to strong cremasteric reflex involuntary, it present up to age 5 - 6 years as normal phenomena, it resolved by itself).

(p:421) Retractile testis:
Normally, both testes are in the scrotum by 6 months of age. However, they may be excessively mobile and readily retract towards the external inguinal ring, even into the inguinal canal, especially when the patient is examined in a cold room. Such retractile testes may easily be misdiagnosed as being incompletely descended. Care must be taken to examine the baby in a warm room or after a bath.True undescended testes are of two types:
1. Incomplete: Such a testis is arrested in its normal pathway to the scrotum. Usually this is within the inguinal canal, more rarely within the abdomen.
2. Ectopic: An ectopic testis has developed normally, but after passing through the external inguinal ring its further descent is impeded. It either remains in the superficial inguinal pouch (common) or is transposed to perineal, femoral or prepubic sites (rare).

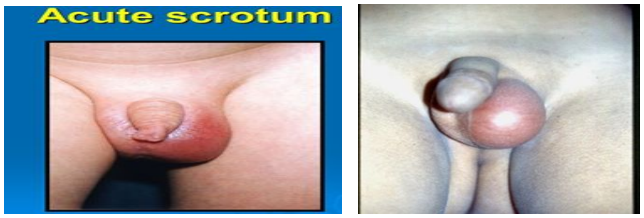
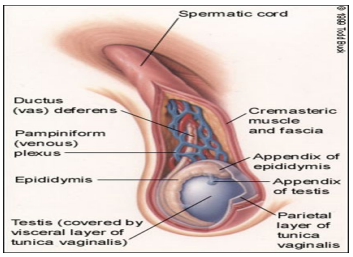
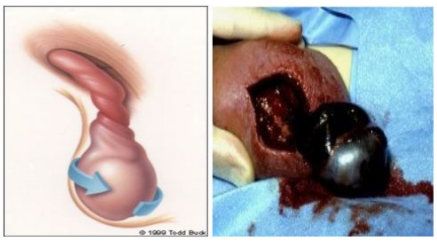
★ **Ectopic testis (rare):** is located outside of normal path of descent (it already pass through normal channel).
- It goes medial side of the thigh or preineum or root of penis and others

Incidence:
- UDT occurs in approximately 1-3% of term infants and 33-45% of premature infants.
- Occurs on the right side in 50% , left 35%, bilateral 10-15%.

Clinical presentation	• Empty scrotum. • Absence of one or both testes. • Swelling in the groin (testis or hernia). • On examination, hemi-scrotum is underdeveloped/hypoplastic. • Testis is palpable in the groin (inguinal canal) and fails to come down to scrotum in 80% of cases. • Testis is impalpable/non-palpable in the remaining 20% of cases (intra-abdominal ,atrophied[2] or agenesis "extremely rare").
Management	➔ **Hormonal treatment:** useless ◆ The role of hormonal therapy is controversial. ◆ LHRH and HCG are used with varying degrees of success. ➔ **Surgical treatment** (orchidopexy)[3] the treatment of choice. • The best timing is between 6-12 months of age (because before 6 ms the tiny structure might be damaged during surgery and not after 12ms b/c the testes might be damaged under high temperature of inguinal canal > cause infertility and hormonal deficiency). (MCQ) • Palpable unilateral or bilateral → orchidopexy. • Impalpable/ nonpalpable: ○ Radiographic imaging (US,CT,MRI) ■ is rarely helpful in locating nonpalpable testis. ○ Diagnostic laparoscopy (the best and it is diagnostic and therapeutic) is the preferred approach ■ If testis is intra-abdominal → Lap assisted orchidopexy. ■ If atrophic → inguinal exploration and excision. ■ if agenesis (vanishing testis)→ nothing to be done during laparoscopic procedure, there is one thing indicates the agenesis of testis > absence of blood vessels b/c it shares the same origin of testes, and we can find the vas deference in agenesis ❖ **Indication for surgery:** (benefit of orchidopexy) ✓ To optimize fertility. (Very important) if you leave it --> it will atrophied ✓ To potentially reduce malignancy rate (controversial) ✓ To place testis in examinable position to detect malignancy early. ✓ To reduce risk of torsion. ✓ To reduce risk of trauma. ✓ To optimize hormonal function. ○ two function fertility and hormone production from leydig cell which is testosterone ✓ To repair the associated hernia (90% of UDT). ✓ For cosmetic and psychological reasons.

[2] نزلت لكن صار لها torsion و ماتت.
[3] Orchido=testicle "تثبيت الخصية"

ACUTE SCROTUM

Definition	Acute scrotal pain with or without swelling and erythema. 
Anatomy	Anatomy of the normal (right) testis and spermatic cord. 
DDx of an acute scrotum	• **Torsion of the testis.** (The commonest cause and only surgical cause in children) (MCQ) book:(p:421)  Torsion of the cord can occur where the visceral layer of the tunica vaginalis completely covers the testis so that it lies suspended within the parietal layer. The patient, usually a teenager, presents with sudden onset of testicular pain and swelling. There may be a history of minor trauma, or previous episodes of pain due to partial torsion. On examination there is a red, swollen hemiscrotum that is usually too tender to palpate. Misdiagnosis of the swelling as epididymoorchitis, which is rare in teenagers, is a serious error. Torsion of the testis is a surgical emergency; if the blood supply is not restored within 12 hours, the testis infarcts and must then be excised. If at operation the testis is found to be viable, it is sutured to the parietal tunica to prevent recurrence.As the underlying abnormality of the tunica is bilateral, the other testis must be fixed at the same time. • **Torsion of the appendix testis** (70% in normal population) /appendix epididymis • **Epididymitis / orchitis.** • Idiopathic scrotal edema (dermatitis, insect bite) • Inguinal hernia (incarcerated). • Trauma /sexual abuse. • Vasculitis (Henoch-schonlein purpura). • Cellulitis. • Others.
Approach to acute scrotum:	- Ask yourself torsion or not because if torsion the treatment emergency surgery (u have 4-6 hours) if not it's medical. - Early recognition and prompt management are very important. Because of the

	possibility of testicular torsion, as the etiology, to cause permanent damage to the testis. ➔ **History :** neonatal and 16yo ◆ Timing (time of onset and length) ◆ Pain character, onset and course (sudden vs gradual, constant vs intermittent) ● Torsion sudden , epididimo-orchitis gradual ◆ Location (testes usually , scrotum or abdomen) ◆ Quality (sharp, dull) ◆ History of trauma. ➔ **Examination:** ◆ Overall inspection of patient and comfort level ◆ Abdominal, inguinal, and genital exam required ◆ Test the cremasteric reflex first. ● Absence of reflex may be most sensitive indicator of torsion of the testes ◆ Begin with the unaffected side ◆ Palpate testes, spermatic cord, epididymis and inguinal region. ◆ Evaluate the position (high lying-hori, size, masses and mobility of testis. ➔ **Investigations:** ◆ Done when testicular torsion is difficult to diagnosis. ◆ Urine analysis. (UTI) ◆ US with color flow Doppler. (sensitivity 90% specificity 99%). (more important) ◆ radio-nuclear imaging (Sensitivity 90-100%) ★ Imaging studies should not delay scrotal exploration (midline scrotal incision) when there is high suspicion of torsion. ○ If you could not diagnosed him clinically and these tests are available and you can do them within 30 min then go, if it's gonna take more time then no. take him to OR immediately.
Management	★ **Testicular torsion:** (the only surgical cause): ○ Testicular torsion is a clinical diagnosis. ○ Imaging studies usually are not necessary and ordering them may waste valuable time when the definitive treatment is surgical. ○ Timing is critical 4-6 H. ○ Scrotal exploration if any doubt. ○ If testis is viable untwist anticlockwise (medial to lateral) and fix both sides. 50% chance to have a torsion in the second testes. ○ **If a testis is not viable, excision and fixing the other side is needed.** ○ **Fixing contralateral testis to reduce the torsion in the future.** ★ **Other causes:**(non-surgical) ○ Epididymo-Orchitis: Antibiotics. ○ Torsion of appendix testis[4]/epididymis :self limiting condition , if discovered before exploration can be treated conservatively ,but if found at exploration needs excision. ○ Idiopathic scrotal edema: Self limiting condition treated with analgesia

[4] Sever pain mistaken by testicular torsion

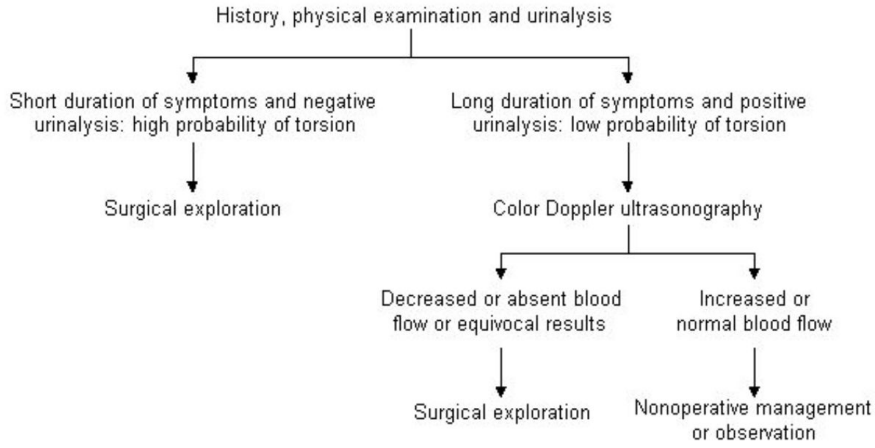
and observation. Some says it due allergic reaction, it's affect the skin testis is intact

- painless and usually bilateral the testes normal and healthy.

- Traumatic orchitis: conservative treatment. (you can see Bruises)

- **Always when you have suspicion of torsion explore, if you did not find torsion it is ok just close and treat the other cause.**

Protocol for the diagnosis and treatment of the acute scrotum:



Recall:

What is hernia?
(L. rupture) Protrusion of a peritoneal sac through a musculoaponeurotic barrier (e.g., abdominal wall);a fascial defect.
Why should hernia be repaired:
To avoid complications of incarceration/ strangulation, bowel necrosis, SBO,pain.
What is incarcerated hernia?
Swollen or fixed within the hernia sac (incarcerated = imprisoned); may cause intestinal obstruction (i.e., an irreducible hernia).
Differences between complete and uncomplete hernia?
Complete: Hernia sac and its contents protrude all the way through the defect.
Uncomplet: Defect present without sac or contents protruding completely through it.
What is hydrocele?
Clear fluid in the processus vaginalis membrane.
What is communicating hydrocele?
Hydrocele that communicates with peritoneal cavity and, thus, gets smaller and larger as uid drains and then re-accumulates.
What is noncommunicating hydrocele?
Hydrocele that does not communicate with the peritoneal cavity; hydrocele remains the same size.