



DDX of abdominal masses and hernias

Objectives:

- **Umbilicus:** Developmental abnormalities, Umbilical sepsis, Umbilical tumors
- **Disorders of the rectus muscle:** Hematomas, Desmoids tumor
- **Abdominal hernias:** Inguinal hernias, Ventral hernias, Rare external hernias, Internal hernias, Complications of hernias, Management of complicated hernias

Resources:

- Aldhuhayan's handout
- Surgical recall.
- Davidson's

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Once you stop learning
you start dying.

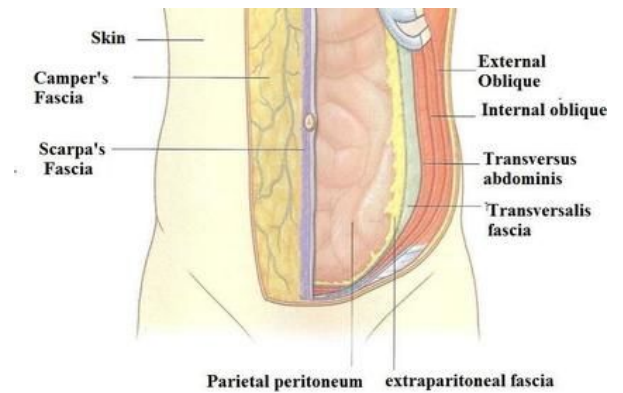
SURGICAL ANATOMY

Basic review:

- **Abdominal wall:**

- **Anterior abdominal wall:**

1. Skin: loosely attached to the underlying structures except at the umbilicus “situated in the linea alba”.
2. Subcutaneous tissue:
 - a. Camper’s fascia: Superficial and fatty,
 - b. Scarpa’s fascia: Deep and fibrous.
3. Rectus abdominis.
4. External oblique muscle: in the groin its aponeurosis forms
 - a. The inguinal ligament
 - b. The External spermatic fascia of the spermatic cord
 - c. Near its medial attachment onto the pupic tubercle it divides to form the superficial or the deep inguinal ring.
5. Internal oblique muscle: forms the lateral part of the inguinal ligament.
6. Transversus muscle: forms the rectus sheath and the linea alba.
7. Transversus fascia: with the descent of the testicle, the transversalis fascia establishes continuity with the internal spermatic fascia of the spermatic cord.
8. Peritoneum.



- **Inguinal canal:**

- ◆ The inguinal canal is an oblique passage in the lower anterior abdominal wall, through which the spermatic cord passes to the testis in the male, or the round ligament to the labium majus in the female.
- ◆ The processus vaginalis traversing the canal is normally obliterated at birth, but persistence in whole or in part presents an anatomical predisposition to an indirect inguinal hernia
- ◆ The openings of the canal are formed by the internal “bounded medially by the inferior epigastric artery” and external “The inguinal canal ends at it” rings.
- ◆ The testis and spermatic cord receive a covering from each of the layers as they pass through the abdominal wall:
 - The internal spermatic fascia: is the innermost layer is derived from the transversalis fascia,
 - The cremasteric muscle and fascia: is the middle layer from the internal oblique muscle
 - The external spermatic fascia: is the outer layer from the external oblique aponeurosis
- ◆ Within the inguinal canal, the spermatic cord is covered only by the cremasteric and internal spermatic fasciae.

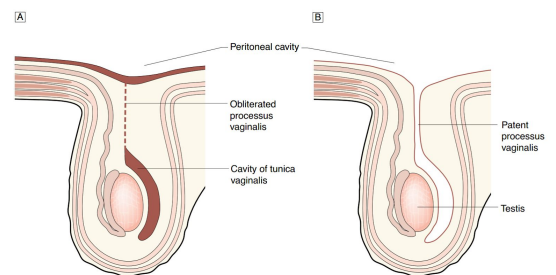
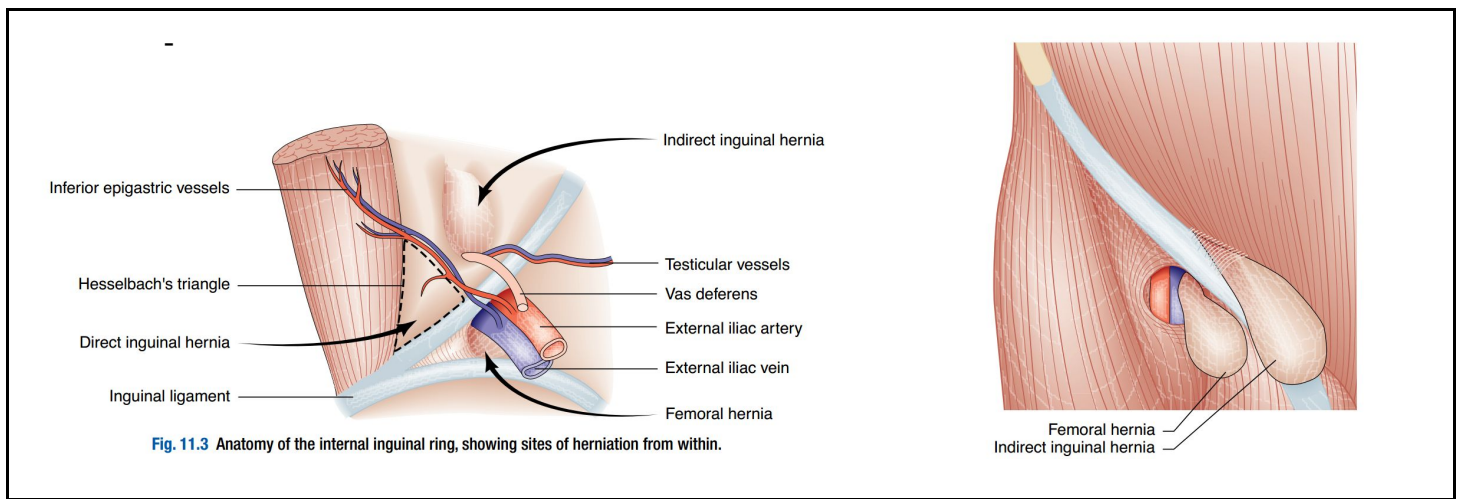


Fig. 11.4 Processus vaginalis testis. [A] Normal obliteration of processus vaginalis. [B] Persistence of patent processus.

- **The spermatic cord:**

consists of:

- the vas deferens, - artery of the vas, - the testicular artery, - the cremasteric artery,
- the pampiniform plexus of veins, - the ilioinguinal nerve, - the genital branch of the genitofemoral nerve and lymphatics.



Incisional hernia - Doctor's Slide

 [Introduction to Direct and Indirect Inguinal Hernia](#)

Definition: bulge or protrusion at or near the area of a surgical incision.

Epidemiology:

- The highest reported incidence is with midline abdominal incisions
- Upper abdominal incisions have a higher risk compared to lower abdominal
- Among patients with SSI¹ 25% will develop an incisional hernia.

Causes:

Are due to Failure of fascial tissues to heal post operatively and close which is related to:

- **Mechanical factors:** Increased intra-abdominal pressure due to chronic cough, constipation, urinary obstruction (BPH) and pregnancy.
- **Patient factors:** Infection, Malnutrition, chronic illness, smoking, obesity, CTD (chemotherapy) and Steroid use.
- **Technical factors:** Technical issues during closure.

¹ surgical site infection

Clinical features

- Bulge at the site of previous incision, the lesion may become large with increased intra-abdominal pressure.
- Aching sensation radiating into the area of incision.
- **No pain or tenderness upon examination**

Incarcerated/ Irreducible	Strangulated ²
<ul style="list-style-type: none"> ● Painful enlargement of the previous hernia. ● Inability to manipulate the hernia ● N/V (if it progresses to obstruction)³ 	<ul style="list-style-type: none"> ● Symptoms of incarcerated hernia. ● The skin overlying the hernia is red, warm to touch and tender, the cough impulse is lost, and there may be increasing evidence of circulatory collapse and sepsis (systemic toxicity).

Investigations

- **Complete blood count (CBC):**
 - Results are nonspecific, but **leukocytosis with left shift⁴** may occur with **strangulation**
- **Electrolyte, blood urea nitrogen (BUN), and creatinine levels:**
 - It is advisable to assess the **hydration status** of the patient with nausea and vomiting.
- **Lactate levels:**
 - Elevation may reflect **hypoperfusion**; a normal level does not necessarily rule out strangulation

Treatment

Indications to perform a hernia repair:

- **Symptoms** such as pain and abdominal enlargement
- **Risk of incarceration** (hernia sacs with a small neck that contain bowel)

open repair of incisional hernias	Laparoscopic incisional hernia repair
<p>The weakened tissue of the abdominal wall is re-incised and a repair is reinforced using a prosthetic mesh</p> <p>Complications:</p> <ul style="list-style-type: none"> ● infection of the incision (A mesh infection requires a complete removal of the mesh and results in surgical failure) ● significant postoperative pain. ● recurrence rates after open repair are up to 20% 	<p>surgical mesh is placed through small incisions to the side of the hernia.</p> <p>Advantages:</p> <ul style="list-style-type: none"> ● minimize the potential for wound complications such as infections ● less painful and speed recovery. ● Cosmotic <p>Disadvantages:</p> <ul style="list-style-type: none"> ● the laparoscopic approach has been criticized <u>for not resecting the hernia sac</u> and not restoring the anatomy, thereby allowing <u>the persistence of abdominal bulging</u>

² The **low-pressure venous drainage** is **occluded first** and then the **arterial supply becomes occluded**, with the **development of gangrene**.

³ Urgent operation is indicated for all obstructed hernias, as one can never be certain that strangulation is not present.

⁴ Immature cells

Doctor's notes:

- Most common hernia in males:
 - In Western world: indirect inguinal hernia
 - In Saudi Arabia: Direct hernia
- Most common hernia in Females:
 - In Western world: femoral hernia
 - In Saudi Arabia: umbilical hernia
- Surgical Correction of hernia may result in ileus and Volvulus.
- Femoral hernia is more common in female than male “possibly because of stretching of ligaments and widening of the femoral ring in pregnancy”
- Shatter mechanism “ a protective mechanism for preventing hernia especially in female” : transverse abdominal muscle + inguinal ligament.
- Inguinal hernia due to: failure of the shatter mechanism “the arch will go up and partially covers the triangle leading to bulging” in the hesselbach triangle.
- Main cause of incisional hernia is “bad surgical technique”
- Epigastric hernia:
 - First it starts as fatty sacless hernia of Linea alba (pseudohernia), Then take years to become (ventral hernia)
- Post Op patients need to avoid anything that can increase intra-abdominal pressure for up to 1 year. allowing time for healing and preventing the recurrence. “ it a cause of recurrence”.
- A hernia may contain any intra-abdominal structure but most commonly contains omentum and/or small bowel.

Davidson's:

- Hernias can be considered as a disease of collagen metabolism.
- A hernia is an abnormal protrusion of a cavity's contents through a weakness in the wall of the cavity, but takes with it all the linings of the cavity
- Hernias of the abdominal wall are common and may exploit natural openings or weak areas caused by stretching or surgical incisions in association with a defect in collagen metabolism
- Abdominal hernias have a peritoneal sac, the neck of which is often unyielding and constitutes a potential source of compression of the hernial contents
- A hernia may contain any intra-abdominal structure but most commonly contains omentum and/or small bowel.
- Hernias may exploit natural openings such as the inguinal and femoral canals, umbilicus, obturator canal or oesophageal hiatus, or protrude through areas weakened by stretching (e.g. epigastric hernia) or surgical incision. In addition to these ‘weak’ anatomical areas, the collagen make up of the tissues, especially the Type I to III collagen ratio is also important.
 - Type I imparts the strength to the tendon or fascia,
 - Type III provides elastic recoil to the tissue.
- Groin hernias account for three-quarters of all abdominal wall hernias, The most common types of groin hernia are indirect inguinal (60%) direct inguinal (25%) and femoral (15%)

Surgical Recall: chapter 36 - Hernias

What is hernia? Protrusion of a peritoneal sac through a musculoaponeurotic barrier (e.g., abdominal wall); a fascial defect

What is the incidence?

5%–10% lifetime; 50% are indirect inguinal, 25% are direct inguinal, and 5% are femoral.

What are the precipitating factors?

Increased intra-abdominal pressure: straining at defecation or urination (rectal cancer, colon cancer, prostatic enlargement, constipation), obesity, pregnancy, ascites, valsalvagenic (coughing) COPD; an abnormal congenital anatomic route (i.e., patent processus vaginalis).

Why should hernias be repaired?

To avoid complications of incarceration/ strangulation, bowel necrosis, SBO, pain.

What is more dangerous: a small or large hernia defect?

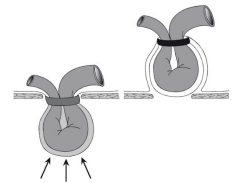
Small defect is more dangerous because a tight defect is more likely to strangulate if incarcerated.

Define the following descriptive terms:

- **Reducible:** Ability to return the displaced organ or tissue/hernia contents to their usual anatomic site
- **Incarcerated:** Swollen or fixed within the hernia sac (incarcerated = imprisoned); may cause intestinal obstruction (i.e., an irreducible hernia)
- **Strangulated:** Incarcerated hernia with resulting ischemia; will result in signs and symptoms of ischemia and intestinal obstruction or bowel necrosis (Think: strangulated = choked)
- **Complete:** Hernia sac and its contents protrude all the way through the defect
- **Incomplete:** Defect present without sac or contents protruding completely through it

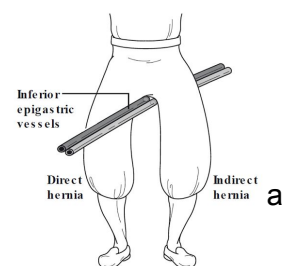
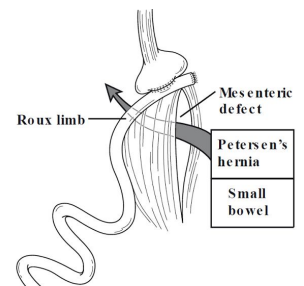
What is reducing a hernia “en masse”?

Reducing the hernia contents and hernia sac (picture)

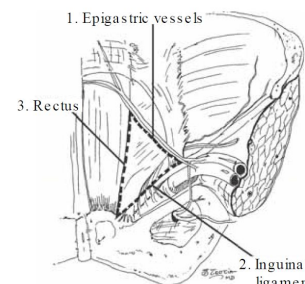
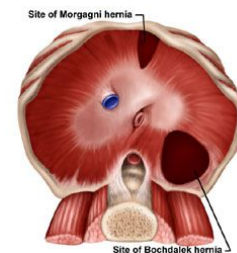


Define the following types of hernias:

- **Sliding hernia:** Hernia sac partially formed by the wall of a viscus (i.e., bladder/cecum)
- **Littre’s hernia:** Hernia involving a Meckel’s diverticulum (Think alphabetically: Littre’s Meckel’s = LM)
- **Spigelian hernia:** Hernia through the linea semilunaris (or spigelian fascia); also known as **spontaneous lateral ventral hernia** (Think: Spigelian = Semilunaris)
- **Internal hernia:** Hernia into or involving intra-abdominal structure
- **Petersen’s hernia:** Seen after bariatric gastric bypass— internal herniation of small bowel through the mesenteric defect from the Roux limb (picture)
- **Obturator hernia:** Hernia through obturator canal (females > males)
- **Lumbar hernia:**
 - **Petit’s hernia:** (Rare) hernia through Petit’s triangle (a.k.a. inferior lumbar triangle) (Think: petite = small = inferior)
 - **Grynfeltt’s hernia:** Hernia through Grynfeltt-Lesshaft triangle (superior lumbar triangle)
- **Pantaloon hernia:** Hernia sac exists as both a direct and indirect hernia straddling the inferior epigastric vessels and protruding through the floor of the canal as well as the internal ring (two sacs separated by the inferior epigastric vessels [the pant crotch] like pair of pantaloons) (picture)
- **Incisional hernia:** Hernia through an incisional site; most common cause is a wound infection
- **Ventral hernia:** Incisional hernia in the ventral abdominal wall
- **Parastomal hernia:** Hernia adjacent to an ostomy (e.g., colostomy)
- **Sciatic hernia:** Hernia through the sciatic foramen
- **Richter’s hernia:** Incarcerated or strangulated hernia involving only one sidewall of the bowel, which can spontaneously reduce, resulting in gangrenous bowel and perforation within the abdomen without signs of obstruction (picture)
- **Epigastric hernia:** Hernia through the linea alba above the umbilicus



- **Umbilical hernia:** Hernia through the umbilical ring, in adults associated with ascites, pregnancy, and obesity
- **Intraperitoneal hernia:** Hernia in which abdominal contents migrate between the layers of the abdominal wall
- **Femoral hernia:** Hernia under inguinal ligament medial to femoral vessels
- **Hesselbach's hernia:** Hernia under inguinal ligament lateral to femoral vessels
- **Bochdalek's hernia** Hernia through the posterior diaphragm, usually on the left (Think: Boch da lek = "back to the left" on the diaphragm)
- **Morgagni's hernia** Anterior parasternal diaphragmatic hernia
- **Properitoneal hernia** Intraperitoneal hernia between the peritoneum and transversalis fascia
- **Cooper's hernia** Hernia through the femoral canal and tracking into the scrotum or labia majus
- **Indirect inguinal** Inguinal hernia lateral to Hesselbach's triangle
- **Direct inguinal** Inguinal hernia within Hesselbach's triangle
- **Hiatal hernia** Hernia through esophageal hiatus
- **Amyand's hernia** Hernia sac containing a ruptured/ incarcerated appendix (Think: Amyand's = Appendix)



What are the boundaries of Hesselbach's triangle?

1. Inferior epigastric vessels
2. Inguinal ligament (Poupart's)
3. Lateral border of the rectus sheath

Floor consists of internal oblique and the transversus abdominis muscle

What are the layers of the abdominal wall?

Skin > Subcutaneous fat > Scarpa's fascia > External oblique > Internal oblique > Transversus abdominis > Transversalis fascia > Preperitoneal fat > Peritoneum

Note: All three muscle layer aponeuroses form the anterior rectus sheath, with the posterior rectus sheath being deficient below the arcuate line

What is the differential diagnosis for a mass in a healed C-section incision?

Hernia, ENDOMETRIOMA

1.GROIN HERNIAS

What is the differential diagnosis of a groin mass?

Lymphadenopathy, hematoma, seroma, abscess, hydrocele, femoral artery aneurysm, EIC, undescended testicle, sarcoma, hernias, testicle torsion.

Direct Inguinal Hernia	Indirect Inguinal Hernia
Hernia within the floor of Hesselbach's triangle, i.e., the hernia sac does not traverse the internal ring (think <u>directly</u> through the abdominal wall)	Hernia through the internal ring of the inguinal canal, traveling down toward the external ring; it may enter the scrotum upon exiting the external ring (i.e., if complete); think of the hernia sac traveling <u>indirectly</u> through the abdominal wall from the internal ring to the external ring
What is the cause? Acquired defect from mechanical breakdown over the years	What is the cause? Patent processus vaginalis (i.e., congenital)
What is the incidence? 1% of all men; frequency increases with advanced age	What is the incidence? 5% of all men; <u>most common hernia in both men and women</u>

What nerve runs with the spermatic cord in the inguinal canal? Ilioinguinal nerve

How is an inguinal hernia diagnosed?

Relies mainly on history and physical exam with index finger invaginated into the external ring and palpation of hernia; examine the patient standing up if diagnosis is not obvious

(Note: if swelling occurs below the inguinal ligament, it is possibly a femoral hernia)

What is the differential diagnosis of an inguinal hernia?

Lymphadenopathy, psoas abscess, ectopic testis, hydrocele of the cord, saphenous varix, lipoma, varicocele, testicular torsion, femoral artery aneurysm, abscess

What is the risk of strangulation?

Higher with indirect than direct inguinal hernia, but highest in femoral hernias

What is the treatment? Emergency herniorrhaphy is indicated if strangulation is suspected or acute incarceration is present; otherwise, elective herniorrhaphy is indicated to prevent the chance of incarceration/ strangulation

Inguinal Hernia Repairs

Define the following procedures:

- **Bassini** Sutures approximate reflection of inguinal ligament (Poupart's) to the transversus abdominis aponeurosis/ conjoint tendon
- **McVay** Cooper's ligament sutured to transversus abdominis aponeurosis/conjoint tendon
- **Lichtenstein** "Tension-free repair" using mesh
- **Shouldice** Imbrication of the floor of the inguinal canal (a.k.a. "Canadian repair")
- **Plug and patch** Placing a plug of mesh in hernia defect and then overlaying a patch of mesh over inguinal floor (requires few if any sutures in mesh!)
- **High ligation** Ligation and transection of indirect hernia sac without repair of inguinal floor (used only in children)
- **TAPP procedure** TransAbdominal PrePeritoneal inguinal hernia repair
- **TEPA procedure** Totally ExtraPeritoneal Approach

What are the indications for laparoscopic inguinal hernia repair?

1. Bilateral inguinal hernias
2. Recurring hernia
3. Need to resume full activity as soon as possible

-----Classic Intraoperative Inguinal Hernia Questions-----

What is the first identifiable subcutaneous named layer? Scarpa's fascia (thin in adults)

What is the name of the subcutaneous vein that is ligated? Superficial epigastric vein

What happens if you cut the ilioinguinal nerve?

Numbness of inner thigh or lateral scrotum; usually goes away in 6 months

From what abdominal muscle layer is the cremaster muscle derived?

Internal oblique muscle

From what abdominal muscle layer is the inguinal ligament (a.k.a. Poupart's ligament) derived?

External oblique muscle aponeurosis

To what does the inguinal (Poupart's) ligament attach? Anterior superior iliac spine to the pubic tubercle

Which nerve travels on the spermatic cord? Ilioinguinal nerve

Why do some surgeons deliberately cut the ilioinguinal nerve?

First they obtain preoperative consent and cut so as to remove the risk of entrapment and postoperative pain

What is in the spermatic cord (6)?

1. Cremasteric muscle fibers
2. Vas deferens
3. Testicular artery
4. Testicular pampiniform venous plexus
5. +/- hernia sac, **made of** Peritoneum (direct) or a patent processus vaginalis (indirect)
6. Genital branch of the genitofemoral nerve

What attaches the testicle to the scrotum? Gubernaculum

What is the most common organ in an inguinal hernia sac in men? Small intestine

What is the most common organ in an inguinal hernia sac in women? Ovary/fallopian tube

What lies in the inguinal canal in females instead of the VAS? Round ligament

Where in the inguinal canal does the hernia sac lie in relation to the other structures? Anteromedially

What is a "cord lipoma"? Preperitoneal fat on the cord structures (pushed in by the hernia sac); not a

real lipoma; remove surgically, if feasible

What is a small outpouching of testicular tissue of the testicle?

Testicular appendage (a.k.a. the appendix testes); remove with electrocautery

What action should be taken if a suture is placed through the femoral artery or vein during an inguinal herniorrhaphy? Remove the suture as soon as possible and apply pressure (i.e., do not tie the suture down!)

What nerve is found on top of the spermatic cord? Ilioinguinal nerve

What nerve travels within the spermatic cord? Genital branch of the genitofemoral nerve

What type of hernia goes through Hesselbach's triangle?

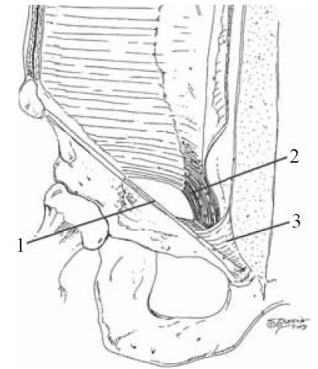
Direct hernia due to a weak abdominal floor

What is a "relaxing incision"? Incision(s) in the rectus sheath to relax the conjoint tendon so that it can be approximated to the reflection of the inguinal ligament without tension

What is a conjoint tendon? Aponeurotic attachments of the "conjoining" of the internal oblique and transversus abdominis to the pubic tubercle

Define inguinal anatomy:

1. Inguinal ligament (Poupart's ligament)
2. Transversus aponeurosis
3. Conjoint tendon



How tight should the new internal inguinal ring be?

Should allow entrance of the tip of a Kelly clamp but not a finger

What percentage of the strength of an inguinal floor repair does an external oblique aponeurosis represent?

ZERO

2. FEMORAL HERNIA:

What is it? Hernia traveling beneath the inguinal ligament down the femoral canal medial to the femoral vessels (Think: FM radio, or Femoral hernia = Medial)

What are the boundaries of the femoral canal?

1. Cooper's ligament posteriorly
2. Inguinal ligament anteriorly
3. Femoral vein laterally
4. Lacunar ligament medially

What factors are associated with femoral hernias? Women, pregnancy, and exertion

What percentage of all hernias are femoral? 5%

What percentage of patients with a femoral hernia are female? 85%!

What are the complications? Approximately one third incarcerate (due to narrow, unforgiving neck)

What is the most common hernia in women? Indirect inguinal hernia.

What is the repair of a femoral hernia? McVay (Cooper's ligament repair), mesh plug repair

-----HERNIA REVIEW QUESTIONS-----

Should elective TURP or elective herniorrhaphy be performed first?

TURP

Which type of esophageal hiatal hernia is associated with GE reflux?

Sliding esophageal hiatal hernia

Classically, how can an incarcerated hernia be reduced in the ER?

1. Apply ice to incarcerated hernia
2. Sedate
3. Use the Trendelenburg position for inguinal hernias
4. Apply steady gentle manual pressure
5. Admit and observe for signs of necrotic bowel after reduction!
6. Perform surgical herniorrhaphy

What is appropriate if you cannot reduce an incarcerated hernia with steady, gentle compression?

Go directly to O.R. for repair

What is the major difference in repairing a pediatric indirect inguinal hernia and an adult inguinal hernia? In babies and children it is rarely necessary to repair the inguinal floor; repair with “high ligation” of the hernia sac

What is the Howship-Romberg sign?

Pain along the medial aspect of the proximal thigh from nerve compression caused by an obturator hernia

What is the “silk glove” sign? Inguinal hernia sac in an infant/toddler feels like a finger of a silk glove when rolled under the examining finger

What must you do before leaving the O.R. after an inguinal hernia repair?

Pull the testicle back down to the scrotum

3.ESOPHAGEAL HIATAL HERNIAS:

Type I: Sliding Esophageal Hiatal Hernia	Type II: Paraesophageal Hiatal Hernia
<p>What is it? Both the stomach and GE junction herniate into the thorax via the esophageal hiatus; also known as type I hiatal hernia</p> <p>What is the incidence? 90% of all hiatal hernias</p> <p>What are the symptoms? Most patients are asymptomatic, but the condition can cause reflux, dysphagia (from inflammatory edema), esophagitis, and pulmonary problems secondary to aspiration</p> <p>How is it diagnosed? UGI series, manometry, esophagogastroduodenoscopy (EGD) with biopsy for esophagitis</p> <p>What are the complications? Reflux, esophagitis, Barrett’s esophagus, cancer and stricture formation; aspiration pneumonia; it can also result in UGI bleeding from esophageal ulcerations</p> <p>What is the treatment? 85% of cases treated medically with antacids, H2 blockers/PPIs, head elevation after meals, small meals, and no food prior to sleeping; 15% of cases require surgery for persistent symptoms despite adequate medical treatment</p> <p>What is the surgical treatment? Laparoscopic Nissen fundoplication (LAP NISSEN) involves wrapping the fundus around the LES and suturing it in place</p>	<p>What is it? Herniation of all or part of the stomach through the esophageal hiatus into the thorax without displacement of the gastroesophageal junction; also known as type II hiatal hernia</p> <p>What is the incidence? 5% of all hiatal hernias (rare)</p> <p>What are the symptoms? Derived from mechanical obstruction; dysphagia, stasis gastric ulcer, and strangulation; many cases are asymptomatic and not associated with reflux because of a relatively normal position of the GE junction</p> <p>What are the complications? Hemorrhage, incarceration, obstruction, and strangulation</p> <p>What is the treatment? Surgical, because of frequency and severity of potential complications</p> <p>What is a type III hiatal hernia? Combined type I and type II</p> <p>What is a type IV hiatal hernia? Organ (e.g., colon or spleen) ± stomach in the chest cavity</p>