Inguinal Hernias: Not Always Run-of-the-Mill

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Learning Objectives

• To provide an overview of inguinal hernia anatomy & treatment
• Case-based discussion of imaging findings of emergent & uncommon inguinal hernia complications
• Demonstrate post-operative appearance following hernia repair
Inguinal canal

An oblique canal in the anterior abdominal wall that conveys structures from the pelvis to the perineum

Orifices:

1. **Deep inguinal ring:**
   - Round opening in the transversalis fascia
   - Superior to inguinal ligament
   - Lateral to inf epigastic arteries

2. **Superficial inguinal ring:**
   - V-shaped opening in the external oblique aponeurosis
   - Superomedial to pubic tubercle
Inguinal canal

- **Boundaries:**
  - **Roof:** Internal oblique muscle
  - Transversus abdominis muscle
  - **Anterior wall:** External oblique aponeurosis
  - Internal oblique aponeurosis
  - **Posterior wall:** Tranversalis fascia
  - Conjoint tendon
  - **Floor:** Inguinal ligament
Inguinal canal

• Contents
  ▪ Male: spermatic cord (its contents); ilioinguinal n.
  ▪ Female: round ligament; ilioinguinal n.

Normal left inguinal canal anatomy:
Deep inguinal ring (green ring),
Superficial inguinal ring (orange ring), Spermatic cord (white arrow),
Inferior epigastric vessels (red circle); Note, right inguinal hernia mesh repair
Inguinal hernia

- Lifetime prevalence\textsuperscript{1,3}:
  - 27% male
  - 3% female
- Male to female ratio of approximately 10:1
- Two types:
  - Indirect inguinal hernia
  - Direct inguinal hernia
Indirect Inguinal Hernia

- Arises superolateral to inf. egigastric vessels & follows course of the inguinal canal
- In males enters canal anterior to spermatic cord
- In females follows round ligament
- More common than direct IH\(^1\) (5:1)
- Higher risk of strangulation\(^1\)

Indirect IH with peritoneal contrast
Direct Inguinal Hernia

- Directly protrudes through a weakness in posterior wall of inguinal canal, medial to inf. Epigastic vessels
- Increase in incidence with age
- Low risk of strangulation\(^1\)
- Often managed conservatively

Direct IH containing loop of sigmoid colon
Inguinal Hernia & Imaging Role

• Physical exam is not reliable to differentiate two types of inguinal hernia and also from femoral hernia\(^1\)

• Indirect IH & femoral hernia usually managed surgically as opposed to direct IH (often managed conservatively)\(^1\)

• Uncommon contents of inguinal hernia may pose surgical dilemma and may result in organ injury, if not diagnosed beforehand\(^3,4\)
Inguinal Hernia & Imaging Role

• Cross sectional imaging and specifically CT is the mainstay of diagnosis

• CT is very helpful in risk stratification and treatment planning

• CT can differentiate among different types of hernia and diagnose unusual contents\textsuperscript{1,3}

• MRI has a problem-solving role
CT and Inguinal Hernia

• Important landmarks
  ▪ Inferior epigastric vessels
  ▪ common femoral vein

• Suzuki et al showed >50% of inguinal hernias became reduced when supine CT was performed\textsuperscript{5}

• Prone imaging has not proved beneficial in improving the diagnosis\textsuperscript{1,6}

• Some suggested Valsalva maneuver to maximize diagnostic yield, although added value still uncertain\textsuperscript{7}
Burkhardt et al proposed “lateral crescent sign” as an useful sign of an early direct IH detection

- Compressed & laterally stretched normal inguinal canal contents and fat by hernia, resembles a moon crescent
- Less useful in very large hernias
Inguinal Hernia Case-based Approach

- Emergency Cases
- Uncommon Cases
- Postoperative Cases
Strangulated Hernia and Bowel Obstruction

81 YM w abdominal distention, RLQ pain & not passing gas or stool

Axial and coronal CT images:
Incarcerated right inguinal hernia, herniated bowel loop wall thickening & enhancement, free fluid in hernia sac, intramural gas and omental stranding, cw bowel ischemia & strangulated hernia. Multiple dilated small bowel loops proximally cw bowel obstruction. Nonviable bowel loop was confirmed at surgery.
Strangulated Hernia & Bowel Obstruction

- Two of the most common emergency complications of inguinal hernias
- Strangulated hernia requires urgent exploratory laparotomy
- On CT, strangulated hernia manifests as:
  - Oral contrast extravasation
  - Bowel wall edema
  - Bowel wall enhancement
  - Bowel wall discontinuity
  - Severe fat stranding and engorged mesenteric vessels
Amyand Hernia & Inguinal Bladder Hernia

51 YM w H/o inguinal hernia c/o worsening pain, & nausea/vomiting

Axial & coronal MPR CT images:
Indirect right inguinal hernia containing appendix (red arrow) & anterior wall of the bladder (open arrow);
Inf. epigastric vessels (white arrow)
Amyand Hernia

- Indirect IH containing appendix (normal or inflamed)
- Uncommon with incidence of 0.28 to 1%\(^2\)
- Often misdiagnosed clinically
- Acute appendicitis occurs in 0.1% of all cases\(^3,4\)
- In appendicitis cases, appendectomy and hernia repair is performed without a synthetic mesh
- In case of non-inflamed appendix, addition of appendectomy to hernia repair is controversial.
- CT is extremely useful in preoperative diagnosis
Inguinal Bladder Hernia

- Uncommon, seen 1-3% of IH\(^2,4\)
- Often asymptomatic & usually not diagnosed preoperatively
- More common in direct IH & on right side
- < 7% of bladder hernias are diagnosed preoperatively\(^1\)
- High risk of bladder injury during herniorrhaphy\(^4\)
- Associated higher incidence of GU cancers
- Can be readily diagnosed by CT
Indirect IH Containing Ovary

44 y F with painful right inguinal hernia

CT: Right inguinal hernia containing a 2.5 x 1 cm soft tissue structure with a cystic component (white arrow). Right ovary was confirmed at surgery.
Ovarian & Tubal Content of IH

• Rare in adult female (2.9%) vs. 71% in children\(^2\)
• Often associated with GU anomalies\(^4\):
  ▪ Vaginal atresia,
  ▪ Bicornuate uterus
  ▪ Renal anomalies
• Treated with reduction of the hernia content if no complications such as ovarian or tubal abnormality, torsion or salpingitis coexist\(^4\)
• Gonadal veins are CT landmarks to identify ovaries
Androgen Insensitivity Syndrome

48 y F born with ambiguous genitalia c/o severe pain in the right groin radiating down her thigh

Axial & coronal CT images: Right indirect IH containing small fluid (white arrow) & soft tissue mass (red arrow) within canal, representing an undescended testicle or ovary.
Androgen Insensitivity Syndrome

Subsequent axial & coronal MRI:
2 x 2 x 5 cm T2 hyperintense & T1 isointense mass within right inguinal canal with avid enhancement. Uterus was absent.
Androgen Insensitivity Syndrome

Tc99m-TcO4 Testicular scan: Focal increased blood flow in right inguinal region with persistent increased uptake on delayed images
Androgen Insensitivity Syndrome

- Patient underwent gonadectomy
- Surgical pathology:
  - Testicular atrophy with Sertoli cell only tubules, and diffuse Leydig cell hyperplasia, consistent with androgen insensitivity. Benign Leydig cell tumor.
- Blood chromosomes analysis showed 46, XY
- Presence of pubic, axillary hair & enlarged clitoris
- Constellation of findings consistent with partial androgen insensitivity syndrome (AIS)
Androgen Insensitivity Syndrome

- Rare with an incidence of 1/20,000 - 1/60,000\textsuperscript{8,9}
- Graded as complete, partial, or mild based on the level of androgen resistance
- Risk of malignant transformation in AIS, increases by age (33% after 50y)\textsuperscript{8,9}
- Gonadectomy must be performed in AIS after spontaneous termination of puberty\textsuperscript{8}
- MRI is gold standard diagnostic imaging to evaluate for Müllerian abnormalities & malignant transformation\textsuperscript{8}
Inguinal Hernia Repair

48 y M  s/p right inguinal hernia mesh repair (arrow)

41 y M  s/p bilateral Prolene plug (arrows) inguinal hernia repair
Inguinal Hernia Repair

- Herniorrhaphy is one of the most common surgical operations
- Mesh repair diagnosed as linear high-density material at the site of repair
- Nonabsorbable material such as a polypropylene (Prolene, Bard) plug can also be used to fill hernia orifice
- On cross-sectional imaging (ultrasound, CT, MRI), Prolene plugs may resemble focal masses/lymph nodes\textsuperscript{10}
- On CT they appear as smooth or slightly nodular mass iso- to slightly hypodense compare to adjacent muscle, located anterior to iliac vessels\textsuperscript{10}
Summary & Clinical Implications

- Inguinal hernias are common
- Types and contents of inguinal hernias are not reliably identified by physical exam
- Uncommon contents of inguinal hernia may pose surgical dilemma and may result in organ injury during surgery
- Imaging, specifically CT is very helpful to diagnose different types and content of IHs, and emergency cases
- Imaging also plays a key role in planning treatment and surgical approach
- Radiologist should be aware of the postsurgical imaging appearance to avoid misdiagnosis
References


References


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