Emergency Abdominal Radiology

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Objectives

• Review of common and uncommon abdominal injuries in the trauma patient

• Review of common causes of acute abdominal pain with an emphasis on mimics and variants.

• We will do this via a case based approach with emphasis on “pearls and pitfalls” and focus on the do not miss diagnoses.
Trauma

• Leading cause of death in men and women under the age of 45
• Large economic impact accounting for over 1/3 of all emergency department visits and over $80 billion in medical costs
• Abdominal trauma responsible for a portion...
• Tendency for non-operative management of abdominal trauma
• Blunt trauma: MVC, fall from height, sports injuries, assault
  • Deceleration injuries, crush injuries and external compression
  • Knowledge of mechanism helps to predict injuries
• Penetrating trauma: stab injuries, gunshot wounds
Splenic Injury

- Most commonly injured organ in blunt trauma
- Parenchymal laceration, hematomas, active extravasation, pseudoaneurysm, AVF
- Sentinel clot: high density clot often without demonstrable splenic parenchymal injury
- Most common grading of Splenic Injury by the American Association for Surgery of Trauma (AAST)***
- Favor non operative management – decision based on degree of injury, age and hemodynamic state
- Risk of delayed splenic rupture
Liver Injury

- Second most common injured organ in blunt trauma
- Lacerations, hematomas, active bleeding, major hepatic venous injury
- Pearl: Injury to the bare area of the liver (superomedial seg VII) often results in retroperitoneal hemorrhage
- AAST grading system***
- Post traumatic complications (5-23%): delayed hemorrhage, pseudoaneurysm, abscess, biloma,
- Favor non-operative management (70-90%)
Mesenteric/Bowel Injury

- Occurs in 2.5-5% of blunt abdominal trauma and is the most commonly missed due to subtlety of findings
- Delayed dx results in marked increase in morbidity/mortality due to peritonitis/sepsis
- Most common location: proximal jejunum/duodenum and distal ileum, followed by colon and stomach
- Majority of bowel injuries have associated mesenteric abnormalities, however can have isolated mesenteric injuries
- Look for combination of findings
- Variable operative vs non-operative management-patients are often rescanned
- Pearl: Hemoperitoneum without solid organ injury is concerning for underlying mesenteric or bowel injury
- Pearl: Significant association between abdominal wall injury and Chance vertebral fractures with mesenteric/bowel injury

Soto J, Anderson S. Multidetector CT of Blunt Abdominal Trauma. Radiology 2012 265:3, 678-693
Pancreatic Injury

- Usually due to AP compressive injury
- Rare (<2%) however associated with high morbidity and mortality
- Pancreatic body (65%) > head > tail
- Almost never isolated injuries, often associated liver, duodenum, vascular injuries
- Often clinically occult and CT findings are often subtle or not present on initial trauma work up, more obvious on follow up imaging (24-48 hours).
- Subtle findings including fluid in peripancreatic fat, fluid separating the pancreas from the splenic vein and thickening of the L anterior pararenal fascia
- Classified as lacerations, contusions, transection (fracture)
- Involvement of pancreatic duct (best eval on ERCP however MRCP can be useful).
- Complications include pancreatitis, fistulas and pseudocysts
## Bladder Injury

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Info</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bladder contusion</td>
<td>Partial tear of bladder mucosa, hematuria, normal imaging</td>
<td>Conservative</td>
</tr>
<tr>
<td>2</td>
<td>Intraperitoneal rupture</td>
<td>10-20% of injuries Direct injury to distended bladder</td>
<td>Surgical repair</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bladder dome due to increased intravesical pressure</td>
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<tr>
<td></td>
<td></td>
<td>Cysto: contrast around bowel loops, mesentery, paracolic gutter</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Interstitial bladder injury</td>
<td>Intramural laceration with intact serosa, rare</td>
<td>Conservative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cysto: intramural contrast w/o extravasation</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Extraperitoneal Rupture</td>
<td>Majority (80-90% of injuries) Penetrating injury or laceration bypelvic fracture in blunt trauma</td>
<td>Non-op:Foley assuming bladder neck is not injured</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A-simple: perivesical space only, Molar tooth sign</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>B-complex: extension into abdominal wall, perineum, retroperitoneum</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Combined type</td>
<td>Both intra and extraperitoneal rupture</td>
<td>Surgical repair</td>
</tr>
</tbody>
</table>
Renal Injury

• Vast majority (80-90%) due to blunt trauma
• Presence of hematuria predictor of injury however not severity
• AAST grading system correlates with clinical outcomes again active bleeding not included in classification
• Look for contusion, hematomas, lacerations, active hemorrhage, urinary extravasation, infarct, vascular injury
• Excretory phase imaging in patients with a deep laceration or perirenal fluid collection
• Majority of injuries non-operative with intervention for some collecting system, active extrav and vascular injuries
• Pearl: UPJ tear (stent) vs avulsion (surgically repaired).
• Pitfall: Laceration and infarct can appear similar sharply demarcated margins in infarct and cortical rim at 6-8 hours post infarct
• Pearl: Global infarct with hematoma c/f renal artery avulsion and without hematoma c/f renal artery thrombosis.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Type of Injury</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal contusion, Hematoma</td>
<td>Microscopic or gross hematuria with normal urologic findings</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Nonexpanding subcapsular hematomas with no laceration</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Superficial cortical lacerations less than 1 cm in depth without collecting system injury</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>Renal lacerations greater than 1 cm in depth without collecting system injury</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Renal lacerations extending through the renal cortex, medulla, and collecting system</td>
</tr>
<tr>
<td>V</td>
<td>Laceration, Vascular injury†</td>
<td>Injuries involving the main renal artery or vein with contained hematoma, segmental infarctions without associated lacerations</td>
</tr>
<tr>
<td></td>
<td>Laceration, Vascular injury</td>
<td>Shattered kidney, ureteropelvic junction avulsions</td>
</tr>
<tr>
<td></td>
<td>Complete laceration (avulsion) or thrombosis of the main renal artery or vein that devascularizes the kidney</td>
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Gallbladder Injury

- Usually MVC with direct blow or shear injury
- Low prevalence - seen in 2-3% in patient who under laparotomy - overall, thought to be under reported
- Protective effect of liver
- Highly associated with other injuries, liver (91%), splenic (54%) and duodenal (54%)
- Most commonly gallbladder followed by extrahepatic then intrahepatic ducts
- Classified into contusion (intraluminal hematoma), laceration which can result in perforation and avulsion
- Treatment: Cholecystectomy however based on symptomatology

CT findings to suggest gallbladder injury
- Decompressed GB in fasting patient
- Abnormal contour/enhancement
- Wall thickening
- Intraluminal/pericholecystic hematoma
- Active extravasation of contrast into lumen
- Pericholecystic fluid
- Avulsion
- Liver lac extending into GB fossa
- Mass effect on duodenum

Traumatic diaphragmatic hernia

- Prevalence of up to 5%-most often young men
- Diagnosis often delayed (can be months to years)
- Due to sudden increase in intraabdominal pressure
- Can be immediate or delayed herniation
- Often missed radiographically (reformats key)
- Vast majority on the left side and usually long defect >10 cm
- CT findings
  - Collar sign-waistlike constriction of herniated contents through diaphragm
  - Dependent viscera sign
  - Diaphragmatic discontinuity or dangling diaphragm-torn free edge curls inward away from chest wall
  - complications include incarceration, strangulation and perforation
- Usually associated with additional severe traumatic injuries
- Differentiate from congenital diaphragmatic hernias, eventration, diaphragmatic slips
- Surgical repair

Dependent Viscera sign-upper third of liver, stomach or bowel loops abut the posterior ribs without interposition of the lungs
Adrenal Injury

- Approximately 2% of blunt trauma
- Usually associated with liver injury
- Majority (75%) are right, (15%) left and bilateral (10%)
- Bilateral hematomas often with resulting adrenal insufficiency
- Focal hematomas, enlargement of gland and ill defined periaudrenal hemorrhage/stranding
- Can be difficult to differentiate between hematoma and preexisting mass-follow up imaging in 2-3 months
Urethral Injury

- Seen in approximately 25% of males with pelvic fractures
- Relatively rare in females-associated with vaginal and rectal injuries
- Clinically inability to void, hematuria, high riding prostate
- Most commonly blunt trauma
  - Posterior urethral injury-crush injury (more common)
  - Anterior urethral injury-straddle injury
- Imaged with retrograde urethrogram
- Blind catherization contraindicated in patients with suspected urethral injury
- Pearl: Approximately 20% of posterior injury have associated extraperitoneal bladder rupture. Anterior injury is usually isolated.
- Treatment: suprapubic catheter decompression, stent placement and reconstruction

<table>
<thead>
<tr>
<th>Type</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stretched posterior urethra</td>
</tr>
<tr>
<td>2</td>
<td>Contrast extrav superior to UG diaphragm. No contrast in perineum.</td>
</tr>
<tr>
<td>3</td>
<td>Contrast extrav surrounding membranous and proximal bulbous urethra into perineum (disruption of UG diaphragm)</td>
</tr>
<tr>
<td>4</td>
<td>Bladder neck injury extending into proximal urethra. IVA (EP bladder rupture that doesn’t extend into bladder neck)</td>
</tr>
<tr>
<td>5</td>
<td>Contrast extrav from anterior urethra</td>
</tr>
</tbody>
</table>

Goldman Classification system-determine if urethra ruptured and if so, site relative to the urogenital diaphragm. Type 3 most common.
Penetrating Trauma

• Injuries depend on trajectory, cannot rely of pattern recognition of blunt trauma
• Typically protected organs such as gallbladder and pancreas or vascular structures such as IVC are more often injured in penetrating trauma vs blunt trauma
• Diaphragmatic injuries are often subtle small defects
• Gastric and colonic injuries often missed
• GSW cause significant internal injury in 80-90%, however can be treated non-operatively pending trajectory/injured organs
• Stab wounds-only 50-75% enter peritoneal cavity and 50-75% of those have an injury requiring repair.
  • Pitfall: Stab wound tracks can be very subtle
• Evaluation of peritoneal penetration: Pneumoperitoneum of limited value as not always present (only present in 35% of patients), most common finding is free fluid (seen in 85% of patients). No free fluid-likelihood of peritoneal violation is very low
• Hollow visceral injury: trajectory leading up to bowel is helpful, secondary signs (bowel wall thickening, hematoma, mesenteric hematoma), direct signs (transmural defect or contrast extrav are rarely seen).
The Acute Abdominal Pain Patient

- Common chief complaint (approx. 5%) in the emergency department
- Large portion of these patients are imaged
- Etiologies are vast
- Review some common pathologies, pearls, pitfalls, variants, mimics and the do not miss diagnosis.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonspecific abdominal pain</td>
<td>798 (23)</td>
</tr>
<tr>
<td>Acute appendicitis</td>
<td>494 (14)</td>
</tr>
<tr>
<td>Bowel obstruction</td>
<td>316 (9)</td>
</tr>
<tr>
<td>Urinary tract disorder</td>
<td>297 (9)</td>
</tr>
<tr>
<td>Acute diverticulitis</td>
<td>271 (8)</td>
</tr>
<tr>
<td>Gastrointestinal disorder non-urgent</td>
<td>211 (6)</td>
</tr>
<tr>
<td>Acute cholecystitis</td>
<td>177 (5)</td>
</tr>
<tr>
<td>Acute pancreatitis</td>
<td>135 (4)</td>
</tr>
<tr>
<td>Malignancy</td>
<td>129 (4)</td>
</tr>
<tr>
<td>Gynecologic disorder</td>
<td>99 (3)</td>
</tr>
<tr>
<td>Inflammatory bowel disease*</td>
<td>67 (2)</td>
</tr>
<tr>
<td>Abscess</td>
<td>56 (2)</td>
</tr>
<tr>
<td>Hepatopancreatobiliary disorders†</td>
<td>46 (1)</td>
</tr>
<tr>
<td>Retroperitoneal or abdominal wall bleeding‡</td>
<td>34 (1)</td>
</tr>
<tr>
<td>Perforated viscus</td>
<td>24 (1)</td>
</tr>
<tr>
<td>Acute peritonitis</td>
<td>23 (1)</td>
</tr>
<tr>
<td>Herniation</td>
<td>21 (1)</td>
</tr>
<tr>
<td>Bowel ischemia</td>
<td>18 (1)</td>
</tr>
<tr>
<td>Extraabdominal disorder§</td>
<td>11 (0)</td>
</tr>
<tr>
<td>Other</td>
<td>213 (6)</td>
</tr>
</tbody>
</table>
| Total                                         | 3440 (100)      

Ruptured abdominal aortic aneurysm

• 13th leading cause of death
• Approx 2-4 % of population >50 have aneurysms. Risk of rupture based on size.
  • 4-5 cm: 1-3% per year
  • 5-6 cm: 11% per year
  • >6:25% per year
• CTA optimal however often imaged with routine PV phase CT due to non-specific abdominal pain.
• CT findings of rupture
  • Most common site of rupture along posterolateral aorta with resulting retroperitoneal hematoma
  • Draped aorta sign (contained rupture)
  • Pearl: Hyperattenuating crescent sign-blood dissecting into wall or thrombus seen on non-contrast images-impending rupture
Acute mesenteric ischemia

• Clinical symptoms: Pain out of proportion to exam
• High mortality rate (50-90%)
• Etiology
  • Arterial: Embolization (SMA occlusion), thrombosis of pre-existing atherosclerotic lesion (acute on chronic), vasculidities, dissection
  • Venous: Thromboses-usually SMV (hypercoag, inf, inflam)
  • Non-occlusive: Hypoperfusion in systemic hypotension
  • Mechanical: Bowel obstruction with strangulation
  • Trauma: Vascular injury
  • Other: Radiation, chemo, drugs (illicit)
• CT findings are not specific, may be subtle and depend on etiology.

Imaging findings
- Bowel wall thickening -edema/hemorrhage/superinf
- Bowel wall hypoenhancement
- Bowel wall dilatation and thinning
- Pneumatosis
- Portal venous gas
- Pneumoperitoneum
- Mesenteric engorgement
- Always look for arterial/venous occlusion***
Necrotizing Fasciitis

• Aggressive rapid soft tissue extension along fascial planes
• Microbial invasion from trauma or direct spread from perforated viscus or urogenital organ. Thrombosis of small vessels-leads to ischemia/necrosis
• Clinical dx however CT can help with extent to help guide surgical approach and margins for debridement
• CT findings: Subq gas (HOWEVER not always present and should not exclude NF from differential), asymmetric fascial thickening, thickening of regional musculature, edema and fluid collections
• Treatment: Emergent surgical debridement. Imaging shouldn’t delay tx. Even with this, high mortality rate (70-80%).
Companion Case: Fournier Gangrene

- Necrotizing fasciitis involving the perineal, genital or perianal region.
- M>>>W, DM
- Bacterial infection originates from skin, rectum/anus or lower GU tract.
- Ultrasound may be initial test as patients may present with scrotal pain.
- US findings: Echogenic foci with “dirty shadowing”. May see scrotal edema.
- CT modality of choice to evaluate extent.
- Treatment: Same. Emergent surgical debridement. Mortality 30-40%.
Perforated Viscus

• Most common cause is perforated gastroduodenal ulcer, followed by diverticulitis.

• Others etiologies include malignancy, ischemia, obstruction, infection, vasculitis, IBD, ingested foreign bodies, rad tx.

• Pearl: Amount and location of gas can help aid diagnosis
  • Gas is often in close proximity to site of perforation
    • Duodenal (along bulb), pelvis (colon or appendix)
    • Large volumes usually colonic or gastric

• Differential dx of pneumoperitoneum
  • Iatrogenic-post op-usually resolves around 7-10 days but can persist longer, and usually in small volume, large volumes or increasing volumes in post op patients is concerning for leak or perforation often with peritonitis and abscess
  • Air tracking from thoracic cavity
Acute diverticulitis

- Most common colonic disease in Western world
- Most often sigmoid colon
- Complicated diverticulitis
  - Microperforation vs gross perforation
  - Abscess
  - Fistulous formation (vaginal, coloenteric, vesical)
  - Infectious thrombophlebitis with resulting liver abscess
- Consider underlying colon cancer
  - Long segment and extensive inflammatory changes favors diverticulitis
  - Colonoscopy often required after resolution of acute symptomatology to exclude underlying malignancy.
Acute Appendicitis

- One of the most common causes of acute abdominal pain
- CT modality of choice (US pediatrics)
- Appendiceal changes
  - >7 mm (some variability, normal appendix up to 1 cm), wall thickening, wall hyperenhancement, mural stratification
  - Pearl: Appendicolith while present in asymptomatic pts, prognostic importance, increases likelihood of perforation
- Cecal changes
  - Focal apical cecal thickening, diffuse less specific
  - Arrowhead sign-contrast pointing towards the inflamed appendix
- Periappendiceal changes
  - Fat stranding, fluid, plegmon, abscess, mild LN enlargement, reactive changes
- Complications
  - Perforation, peritonitis, thrombophlebitis resulting in liver abscess
Companion Case

• Appendiceal neoplasm
  • Can cause secondary appendicitis
  • Usually cecal and appendiceal tumors (carcinoma, carcinoid and lymphoma)
  • Very rare in young patients
  • Nodularity and enhancement can help
  • Look for lymphadenopathy that seems out of proportion to inflammation

• Mucocele
  • Well encapsulated cystic dilatation of appendix by mucin
  • No periappendiceal inflammatory changes
  • Calcification in wall
  • Nodularity/enhancement suggests cystadenocarcinoma
  • Pearl: Look for perforation/loculated ascites to suggest pseudomyxoma peritonei
  • Needs non emergent surgical evaluation
Acute cholecystitis

• Very common cause of acute abdominal pain
• Due to impacted stone within the gallbladder neck
• US modality of choice with HIDA for equivocal cases, (more sensitive and specific than US). CT for complications.
• US findings: gallstones with GB wall thickening (>3mm), GB distention (>5 SA), pericholecystic fluid, sonographic Murphy’s sign
• CT: less sensitive (~75%), pericholecystic inflammatory changes, hyperemic liver, GB wall thickening, +/-gallstones
• Variants
  • Acalculous cholecystitis-critically ill ICU patients due to ischemia and stasis
  • Chronic cholecystitis
  • HIDA useful for both
• Pitfall: GB wall thickening is non-specific (can be seen in hepatis, hypoalbuminemia, CHF, ascites, renal failure

Pearl: CT Tensile GB sign: GB fundal impression on the anterior abdominal wall due to increased GB pressures, fairly specific and can be useful esp when other signs of cholecystitis are not present.
Complications of acute cholecystitis

• Emphysematous cholecystitis
  • Intramural or luminal gas due to gas forming organisms
  • Older male diabetic patients
  • Increased risk of gangrene/perforation

• Gangrenous cholecystitis
  • Also with intraluminal or luminal gas
  • Ischemic necrosis resulting in intraluminal membranes/hemorrhage, discontinuous wall enhancement and often resulting perforation

• Early intervention/high index of suspicion important for both of the above complications due to high morbidity/mortality

• Gallstone ileus
  • Mechanical bowel obstruction secondary to impacted gallstone.
  • Occurs in chronic cholecystitis: Chronic irritation results in formation of adhesion with duodenum/fistula formation and eventual passage of a gallstone into the GI tract
  • CT findings: Classic triad of ectopic gallstone, small bowel obstruction and gas in the biliary tree
  • Most common location of impaction is the terminal ileum

Pearl: Obstruction at the level of the duodenum causing gastric outlet obstruction-Bouveret’s syndrome

Pearl: Obstruction of the common bile duct secondary to cystic duct stone-Mirizzi’s syndrome
Companion Case: Gallbladder Torsion

• VERY rare cause of acute abdominal pain
• Rarely diagnosed preoperatively
• Majority of patients are elderly females and often acalculous in nature
• Mobility of the gallbladder due to long mesentery predisposes to torsion

• Clues to diagnoses
  • Distended, inflamed gallbladder with abnormal inferior orientation of the gallbladder somewhat remote from the gallbladder fossa
  • May see twisting of the pedicle (cystic duct and artery) at GB neck
  • Complete torsion will result in vascular compromise and gangrenous appearance

• Prompt surgical intervention
Case 19: The small bowel obstruction

• Accounts for 12-16% of hospitalizations for acute abdominal pain

• Majority (80%) resolve w/NG tube decompression, however up to 25% mortality if symptoms persist and surgery delayed with 100% mortality for untreated strangulated SBO

• Most common cause is adhesions>hernias>IBD>malignancy

• Qualify grade (partial, complete), identify transition and cause, evidence of ischemia and perforation.

SBO due to adhesions with fecalized loop proximal to transition point
Companion Case: SBO cause by femoral hernia

• 2nd most common cause is hernias
• Inguinal most common, prior case is surgically proven femoral hernia
• Can be difficult to distinguish two
  • Inguinal hernia sac course medial to pubic tubercle, however sac lateral to pubic tubercle is not helpful for discrimination
  • Presence of femoral venous vascular compression typical for femoral hernias.
  • Pearl: Femoral hernias at high risk of strangulation (40%)
• Signs of ischemia
  • Bowel wall thickening, mesenteric edema, bowel wall hypoenhancement, pneumatosis, portal venous gas
  • Look for free air –perforation
  • Findings can be subtle–high index of suspicion
Distal Intestinal Obstruction Syndrome

- Cause of bowel obstruction in cystic fibrosis patients
- Meconium ileus equivalent in adults
- Common complication (approx. 10%) of patients
- Impaction of thick stool due to abnormal intestinal absorption due to pancreatic insufficiency with upstream obstruction
- Look for complications such as ischemia and perforation
- Important as treatment is medical therapy (stool softeners/hydration/enemas)
SBO due to Bezoar

- Ingested foreign materials that accumulate in the GI tract
- Trichobezoar (hair) and phytobezoars (fruit and vegetable fibers)
- Risk factors: Delayed gastric emptying and prior gastric surgery
- Usually form in stomach and can pass to small bowel where they can cause bowel obstruction. Other complications include ulceration and perforation.
- CT appearance of a well defined oval intraluminal mass with air retained within the interstices giving a mottled appearance. May be mobile.
Closed Loop Bowel Obstruction

- Segment of bowel obstructed at two points isolating this segment from the remainder of the GI tract
- Sites of obstruction are adjacent to each other often due to a single constricting lesion
- Most commonly due to adhesive band, can be due to internal hernias often due to iatrogenic defects in the mesentery or omentum
- Isolated segment secretes fluid, dilates and impairs venous return resulting in ischemia. A twist or volvulus can occur increasing risk for ischemia-look for swirling of the mesentery.

- Look for signs of ischemia
- Treatment: Operative

Balloon on a string appearance, radial configuration
SBO in the setting of Roux-en-Y gastric bypass

- Patients with prior Roux-en-Y gastric bypass are at increased risk of SBO due to surgically created rents in the mesentery.
- Most obstructions are due to internal hernias.
- Obstruction of biliopancreatic limb can be due to enteroenteric anastomosis stenosis, kinking at the anastomosis or internal hernia-this is a true closed loop obstruction! Needs surgical intervention.
- Roux limb obstruction.
- Obstruction distal to the anastomosis-distends both limbs.
Gossypiboma (Textiloma)

• Foreign body reaction to sponge/towel left behind after surgery producing an inflammatory mass
• Can present immediately post op versus decades later
• CT: Heterogenous mass, wavy spongiform pattern with mottled gas and linear wavy high density central (representing sponge itself).
• Results in inflammation/adhesions/fibrosis and can cause bowel obstruction
• Mimic tumors, abscess.
Review of Objectives

• Review of common and uncommon abdominal injuries in the trauma patient.
• Review of common causes of acute abdominal pain with an emphasis on variants and mimics.
References

• Dreizin D, Munera F. Multidetector CT for Penetrating Torso Trauma: State of the Art. Radiology 2015 277:2, 338-355
• Knowlton W, Thompson W. Review of Small-Bowel Obstruction: The Diagnosis and When to Worry. Radiology 2015 275:2, 332-342
Thanks!

Any questions? Email: Krupa.K.Patel-Lippmann@Vanderbilt.edu