CT Evaluation of Abdominal and Pelvic Pain: Gynecologic Etiologies

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Objectives

- Review CT findings in common causes of acute pelvic pain
  - Ovarian torsion
  - Ruptured hemorrhagic ovarian cyst
  - Endometriosis
  - Pelvic inflammatory disease
  - Fibroids
  - Post-partum, postsurgical complications
  - Pitfalls, pearls, case examples
Acute Pelvic Pain

- Ultrasound initial study of choice if GYN abnormality is suspected
- CT may be performed if GYN etiology is not suspected
- CT may also be performed if US findings are equivocal
  - Less operator dependent than US
  - Larger field of view
- MRI useful for problem-solving but often not available in the emergent setting

- Pregnancy must always be excluded in women of reproductive age!
History of trauma: CT follow-up for hepatic laceration

Always Exclude Pregnancy!!

6 week IUP!!
CT performed for abdominal pain

β-hCG found to be positive after the CT scan was performed!

Ruptured Ectopic Pregnancy!
Ovarian Torsion

- <3% ♀ with pelvic pain
- US imaging modality of choice
- Variable findings: early, partial, intermittent
- Enlarged ovary with peripheral follicles (> 5 cm)
- Ovarian cyst or mass
- Abnormal position of ovary
- Thickened, twisted pedicle
- Abnormal Doppler flow (late feature—may be unreliable!)
- Doppler findings may be normal in 45-61%
Infarcted ovary: no flow
Ovarian Torsion: Follicular Ring Sign

- Concentric perifollicular hyperechoic ring
- Stand out against hypoechoic stroma
- Areas of hemorrhage and edema surrounding the follicles
- Seen in 12 of 15 cases
- Early finding
- Not seen if necrosis

Sibal, M. J Ultrasound Med 2012; 31: 1803-1809
41 yo acute onset right pelvic pain

Large complex cystic mass located anterior to the uterine fundus.

TV scan shows edematous ovary around the mass.

Note preservation of arterial and venous flow.
Whirlpool sign: most specific finding for ovarian torsion

Best seen by scanning out from the uterine cornua towards the adnexa

Surgery: borderline mucinous tumor of right ovary with torsion
### Ovarian Torsion - CT Findings

- adnexal mass
- enlarged ovary with peripheral follicles
- abnormal location
  - high in the pelvis, anterior to the uterus, opposite side of pelvis, cul de sac
- lack of contrast enhancement (infarction)
- deviation of uterus to the twisted side
- twisting and engorgement of vascular pedicle
- thickened/dilated fallopian tube
- associated inflammatory change/fluid

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22 yr old RLQ pain

Torsion of right ovary: viable at surgery
26 yr old RLQ pain

Path: right paratubal cyst with torsion; infarcted ovary and fallopian tube
Ovarian Dermoid with Torsion

Thickened tube

Enlarged ovary
Case

26 yr old with right flank pain
Renal stone protocol CT requested
Normal Kidneys
Surgery: RT ovary twisted once around infundibulopelvic ligament, viable
Companion case

Rule out appendicitis
CT Whirlpool sign
50 yr old woman with pelvic pain for 2 days

Prior history of hysterectomy for uterine prolapse
Abscess drainage attempted
Surgery: large hemorrhagic infarcted mass in the pelvis-torsion of RT tube and ovary

Path: 6 cm hemorrhagic RT ovary with infarction
Ovarian torsion should always be excluded in the setting of pain and a pelvic mass if normal ovaries are not identified.
Prevalence of abnormal CT findings in patients with proven ovarian torsion


- CT obtained in 33% of 167 patients with surgically proven ovarian torsion
- All had enlarged ovary, ovarian cyst, or adnexal mass
- Abnormal ovaries at CT or failure to visualize necessitates further evaluation
- CT with well-visualized normal ovary excludes torsion
Ovarian torsion: Case-control study comparing the sensitivity and specificity of ultrasonography and computed tomography for diagnosis in the emergency department.
Swenson DW, et al Eur J Radiol 2014; 83: 733-738

- Retrospective study of 20 pts with ovarian torsion and 20 controls, all with both US and CT within 48Hrs
- Two readers reviewed images
- Ultrasound: sensitivity 80% for both readers, specificity 95% reader 1 and 85% reader 2
- CT: sensitivity 100% reader 1 and 90% reader 2, specificity 85% reader 1 and 90% reader 2
- Conclusion: when CT demonstrates ovarian torsion, additional imaging likely of no added value
- Normal ovaries at CT effectively excludes torsion but an abnormal ovary should be considered suspicious
30 yr old with left pain r/o ureteral calculus
Hemorrhagic Ovarian Cyst
Ruptured Hemorrhagic Ovarian Cyst

- Abrupt onset of pain
- Hemorrhage into a corpus luteal or follicular cyst
- Echogenic clot in adnexa-no Doppler flow
- Complex free fluid compatible with hemoperitoneum
- Make sure β-hCG negative!
Ruptured Hemorrhagic Ovarian Cyst: CT

- High attenuation adnexal mass
- Contrast enhancement in irregular cyst wall
- Fluid/fluid level
- Contrast pooling if active bleeding
- Sentinel clot in pelvis
- Hemoperitoneum
25 yr old with pelvic pain

Ruptured hemorrhagic ovarian cyst
Pelvic ultrasound immediately following MDCT in female patients with abdominal/pelvic pain: is it always necessary?


- CT and US exams in 70 pts (performed within 48 hrs) reviewed by 3 readers
- 10 cases of normal CT followed by normal US
- Ruptured ovarian cysts all correctly diagnosed at CT by experienced readers

Ruptured hemorrhagic corpus luteum
Ruptured Dermoid

25 yr old with abdominal pain, fever
Ruptured Dermoid
Endometriosis

- Ectopic endometrial glands and stroma located outside the endometrium and myometrium

- Imp’t cause of chronic pelvic pain and infertility
Endometriosis: CT Findings

- Nonspecific appearance on CT
- Complex cystic or solid adnexal mass
- Septation, thickened wall
- High density focus
- May be bilateral
Endometriosis:
small bowel obstruction
Endometriosis:
Acute Appendicitis
Endometriosis: Mucocele
Endometriotic implant involving the cecum initially interpreted as mass
Ruptured Endometrioma
34 yr old with fever, pelvic pain

Infected endometrioma
Bilateral Infected Endometriomas
Endometriosis: abdominal wall implant

- involves the skin/subcutaneous tissues/rectus muscle in area of surgical scar (C-section) or umbilicus
- often no history of pelvic disease
- cyclical abdominal pain
- enhancing soft tissue mass

Hensen JH, Van Breda Vriesman AC, Puylaert JB. Abdominal wall endometriosis: clinical presentation and imaging features with emphasis on sonography. AJR 2006; 186:616–620
Endometriosis:
abdominal wall implant

Patient with remote history of laparoscopy for ectopic pregnancy

Endometriotic implant in abdominal wall at trocar site confirmed at surgical resection
32 year old with periumbilical pain

Path: endometriosis
Pelvic Inflammatory Disease

- Ascending infection and inflammation
- Mixture of anaerobes and aerobes
- Usually bilateral

- Endometritis
  - Salpingitis/Pyosalpinx
  - Tuboovarian complex
  - Tuboovarian abscess
Pyosalpinx
Tuboovarian abscess
PID: Pyosalpinx
PID: Thickened Endosalpingeal Folds
PID: Bilateral TOA
PID: Bilateral TOA

Coronal Oblique Reformat
35 yr old with pelvic mass

Chronic TOA
Pitfall: Acute Appendicitis
Acute Appendicitis: TV US

right ovary

appendix

appendix
1 week postpartum with RLQ pain

Pyosalpinx vs appendicitis??
Pyosalpinx

Normal appendix
Pelvic Pain: evaluate for PID
Acute appendicitis
PID vs perforated appendicitis ?
Perforated appendicitis

Fluid in cul de sac

Normal right ovary

Inflamed appendix

Inflamed appendix
Differentiation between right tubo-ovarian abscess and appendicitis using CT - A diagnostic challenge


- Thickened cecal wall, peri-cecal fat stranding, extraluminal air favored appendicitis
- Abnormal ovary, peri-ovarian fat stranding and thickening of the rectosigmoid favored TOA
- Non-visualized appendix: 45.8% TOA, 15% appy
Atypical Organisms: Actinomycosis

- *Actinomycosis israelii* - invasive organism leading to chronic suppurative infection
- Complication of IUD
- Pelvic organs become massively indurated and fibrotic
- Difficult to distinguish from neoplasm
Actinomycosis
Genitourinary Tuberculosis

- Hematogenous spread from pulmonary or other nongenital tract foci
- Fallopian tubes and endometrium most common sites
- May be associated with tuberculous peritonitis and ascites
- May be difficult to distinguish from carcinomatosis
Tuberculosis
Tuberculosis
Postoperative/Postpartum Complications

- Abscess
- Ovarian vein thrombosis/thrombophlebitis
C-section scar dehiscence/pelvic abscess
6 days post C-section: Endometritis with Abscess
Hemostatic Bioabsorbable Agents (Surgicel/Gelfoam) may mimic an abscess

- Tightly packed air collection at operative site
- May see air pockets for up to 38 days post-op
- Should not see surrounding fluid, air/fluid levels or rim enhancement
- When in doubt, may need to follow or aspirate to exclude infection

Young, T.Y. et al AJR 1993; 160: 275
Sandrasegaran, K. et al AJR 2005; 184: 475
Gossypiboma: retained surgical sponge

Imaging of gossypibomas: Pictorial review
Manzella, A., et al. AJR Integrative Imaging 2009; 193
Ovarian Vein Thrombosis/Thrombophlebitis

- Etiology
  - Postpartum: venous stasis, increased circulation of clotting factors, compression of vein by uterus
  - PID
  - After pelvic surgery

Predilection for right sided involvement: multiple incompetent valves, absence of retrograde flow

If untreated, may extend into renal veins or IVC and result in PE
The right ovarian vein drains into the IVC inferior to the renal vein.

The left ovarian vein drains into the left renal vein.
Ovarian Vein Thrombophlebitis
Pyelonephritis, Ovarian Vein Thrombophlebitis
Bilateral Ovarian Vein Thrombosis

Pitfall: dilated ureter

Delayed scan
CT evaluation of endometrium: Normal or abnormal?

? Fluid-filled, thickened endometrial cavity

Sagittal reformat helpful for assessing the endometrium
Performance of multidetector CT in the evaluation of the endometrium: Measurement of endometrial thickness and detection of disease
Kang, S.K., Giovanniello, G., Kim, S., Bedell, S., Babb, J.S., Bennett, G.L.
Clin Rad 2014

- 79 women with MDCT and TVUS in 48hrs
- 3 readers reviewed axial and sagittal reformatted images
- TVUS reference standard
- Excellent interobserver agreement for endo thickness and agreement with ultrasound
- Mean difference between CT and US measurements of less than 3 mm
- For dx of abnormally thickened endometrium, accuracy of CT was 92-94.7 % with NPV of 99.5-100%, PPV 66.7-100%
Is this fluid in the endometrial cavity?

Degenerating intramural fibroid
Variable patterns of uterine contrast enhancement observed at CT


- **Type I** - subendometrial band of enhancement-thin or thick, sometimes with outer myometrial enhancement-more common in premenopausal, menstruating women, transient

- **Type 2** - absence of subendometrial enhancement-diffuse-seen in pre and postmenopausal pts

- **Type 3** - faint, diffuse enhancement- seen in postmenopausal pts

*From Yitta, S., Mausner, E., Hecht, E.M., and Bennett, G.L. RadioGraphics, 2011*
Basal layer of endometrium

Inner myometrium/ junctional zone
Cervical zonal contrast enhancement

Seen in patients with Type 1 and 2 myometrial enhancement:
- early submucosal band of enhancement with delayed stromal enhancement

Submucosal band
Delayed enhancement of the cervix: may be mistaken for mass
Fibroids: Acute Problems

- degeneration
- infarction
- torsion
- bleeding
35 yr old with pain, abd/pelvic masses

subserosal, pedunculated fibroids with acute hemorrhagic degeneration
38 yr old with abd/pelvic pain
Path: Benign leiomyoma with cystic and hemorrhagic degeneration

? Left adnexal mass
45 yr old with acute onset pelvic pain

Rule out ovarian torsion
Pedunculated Fibroid with Torsion/Infarction

- Left ovary
- Right ovary

Measurements:
- 9.69cm
- 6.61cm
75 yr old woman with RLQ pain: Infarcted/Infected Pedunculated Fibroid
What is the origin of this pelvic mass?
Dysgerminoma arising from the left ovary

Enlarged left ovarian vein

Ovarian vascular pedicle sign
Lee, J.H. et al AJR 2003
35 yr old with pelvic pain and vaginal bleeding
Vascular Pedicle
Prolapsing Submucosal Fibroid

6 MONTHS EARLIER
38 yr old with pelvic pain/bleeding
Prolapsing fibroid: vascular pedicle
Prolapsing submucosal fibroid

Kim et al  Clin Imaging 2008
Prolapsing Submucosal Fibroid

Cervical cancer
Pelvic pain, vaginal bleeding, fever s/p TAB

? Blood clot vs retained products
Retained Products of Conception
Conclusions

- Always exclude pregnancy when acute pelvic pain in reproductive age female patient
- US remains the imaging modality of choice
  - Use both TA and TV!!
- GYN abnormality may not always be suspected
- Knowledge of the CT findings in these disorders is equally essential!!
- Familiarity with CT findings will enable prompt diagnosis and may eliminate need for further imaging
- Use the MPR images!!