OB/GYN Ultrasound Symposium 2018

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Abnormal Uterine Bleeding
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Course Director
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Sonographic Evaluation of Pelvic Pain

Acute-
Adnexal torsion-ovarian/tubal
Appendicitis
Bowel infarction
Ectopic Pregnancy
Ureteral Calculus

Chronic-
Endometriosis
Adenomyosis
Pelvic Congestion Syndrome
Pelvic Inflammatory Disease

Objectives/Disclosures
• Give perspective on TV/CDS in adnexal torsion, acute and chronic pelvic pain
• This is not me scanning, but wouldn’t it be “cool”?
• I receive grant funding from NIH/NCI and compensation as a consultant to Philips Healthcare

Quiz*
Which is Earth? Which is Mars?

*concerning perspectives, pattern recognition
A random thought...

- Science is no more than an investigation of a miracle we can never explain, and ART is an interpretation of that miracle—Ray Bradbury, the Martian Chronicles

Art F. @ AL. Space Ctr, c. 1976

It’s 3:37 am and you’re reading TVS of “r/o torsion” in the ED

Perspective of the Imaging Specialist

(c/o B. Saltaformaggio, MD)

or U are asked to scan a patient with pelvic pain....
KEY CONCEPTS: NOT ALL SOURCES OF PAIN ARE DIAGNOSABLE. NOT ALL ANATOMIC ABN ASSOC WITH PAIN.
ADNEXAL TORSION
- Anatomy -
  - Venous drainage
  - Weight of ovary to elevate, hemorrhage or mass
  - Extensive mobility or stretched ligaments, torsion, necrolysis

ADNEXAL TORSION
- Treatment -
  - Laparoscopy/laparotomy
  - Oral contraceptives
  - Oophorectomy, if viable
  - Salpingo-oophorectomy, if non-viable
  - Caution in untwisting pedicle due to possible release of thrombus

TV-CDS of ADNEXA
TV-CDS of NORMAL OVARY/MATURE FOLLICLE

Tv-aCDS of functioning CORPUS LUTEUM

CLINICAL SUSPICION OF TORSION

OVARIAN INFARCTION 2/2 TORSION
Ovarian disorders that can contribute to torsion

- Increased interstitial fluid/edema
  - ? 2/2 reduced venous drainage-
    - OVARIAN V THROMBOSIS?
    - TWISTED PEDICLE
    - OVARIAN MASS
    - HEMORRHAGIC MASS
    - LAX SUPPORT

Case presentations

Non-viable ovaries

KF, 18 year old female

- 3rd episode RLQ pain; nausea/vomiting
- US—5 cm solid right adnexal mass; slow adjacent arterial flow
- CR—adnexa twisted 2X; tube/ovary purple/black
- Rx—salpingo-oophorectomy
Torsed Ovary

HERNIATED OVARY thru PROCESSUS VAGINALIS
TORSED OVARY with retained INTRAOVARIAN ARTERIAL FLOW

INTERSITITIAL HEMORRHAGE

VG, 50 year old female
- prior hysterectomy, 3 days RLQ flank pain
- US—12 cm cystic/solid mass, no flow; arterial flow in adjacent tube
- OR—non-viable twisted mass
- Rx—salpingo-oophorectomy
Absent (reversed) diastolic flow
AND
Normal flow in area of R tube

HEMORRHAGIC/INFARCTED CYST

INTERSTITIAL HEMORRHAGE-VENOUS THROMBOSIS
29 yo with pelvic pain x 2 hrs

Torsed R dermoid and tube

(Viable ovaries)

(No gross path-imaging correlation available, sorry)
JA, 28 year old female

- 2 weeks intermittent LLQ pain
- US—6 cm adnexal mass; no central flow; peripheral venous and arterial flow
- OR—torsed viable ovary; hemorrhagic cyst
- Rx—ovarian cystectomy

arterial and venous intraovarian flow

f/u 1 yr later—
Arterial & venous flow
EW, 10 year old female

- 2nd episode LLQ pain
- US—large left ovary, midline; no flow T/A; peripheral color TV
- OR—torted visible ovary
- Rx—decoyed

Ovarian Edema

Twisted Pedicle Assoc with 3rd Trimester IUP
(c/o M Warner, MD)
TORSED INFARCTED LEFT OVARY CYSTADENOMA-
Normal left ovary
(c/o M Warner, MD)

Twisted x 7.2/2 cyst

25 y.o. with acute pelvic pain
Dermoid (with 1st tri IUP)-resected—then when untwisted—reperfused

**Dx Adnexal Torsion**
- Potentially viable -
  - TVS: Enlarged ovaries
  - Echogenic central area
  - Immature follicles in periphery
  - CD6: "Spiky" arterial flow
  - Minimal venous flow

**Dx Adnexal Torsion**
- Probably non-viable -
  - TVS: Enlarged ovaries
  - Echogenic central area
  - Immature follicles in periphery
  - CD6: Absent or reversed diastolic arterial flow
  - No venous flow
SOME REPRESENTATIVE CASES

24 yo f with acute (3 hr) onset of pelvic pain

Contrast enhanced CT - 9/28/15 3:50 pm

TVS sag-9/29/15-3:18 pm
c/o persistent pain-repeat TV-CDS 17 d later…

c/o continued pelvic pain-repeat TV-CDS 17 d later…

ditto--17 d later….
ditto--17 d later….

CT/US--Path
- 9/28/15-(7:30 pm)
- 9/29/15 (7:40 am)
- ceCT-r ov- cyst,
  - L ov-? PCO
  - rec pelvic US
- 9/29/15 3:18 pm
- TA and TV-CDS-
  - r ov-? tumor,
  - l ov-? PCO
  - (Torsion not mentioned)

- 10/15/15-TA/TV-CDS
- R ov-enlarged ("L=R")
- intermittent torsion-
  - l ov-normal
- (Trace cul-de-sac fluid)
- Immediate Laparoscopy-
  - R salpingo-
    oophorectomy
- Path: R ov-Edema
  - R tube-vascular
    congestion

HK: 19 YOF. C/O BLQ PAIN. DX WITH
MT OV CYST LAST NIGHT AT OSH.
CANNOT SEE CTX UNTIL MID NEXT
WK. DECIDED TO COME HERE DUE TO
SEVERE ABD PAIN.
+ PREG TEST PER PT
Continued
Severe pain-
Repeat TVS
6 HOURS later

f/u

- No torsion
- Hemorrhagic cyst
35 yo with Crohn’s dz c/o pelvic pain

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c/o pelvic pain, Hx of Crohns

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c/o pelvic pain, Hx of Crohns

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c/o pelvic pain

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c/o pelvic pain

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At laparoscopy…

- Inflammatory bowel disease (Crohn’s disease)
- Hemorrhagic ovarian cyst, not torsed
- Peritoneal cyst

Case 1: 28 yo, 6 wk IUP with vaginal bleeding and LLQ pain

Case 1 (cont.): 28 yo, 6 wk IUP with vaginal bleeding and LLQ pain
Case 1 (cont.): 28 yo, 6 wk IUP with vaginal bleeding and LLQ pain

Pathology: mature teratoma, benign Brenner tumor

Case 1 Questions

• (True or False) Heterotopic pregnancy is in the differential

• What increases the risk of heterotopic pregnancy?
  – A: prior spontaneous abortion
  – B: male fetus
  – C: unilateral salpingo-oophorectomy
  – D: assisted reproductive technology
Case 2: 31 yo, 6 days postpartum, acute severe abdominal pain

Path-

• Torsed luteinized cyst of pregnancy
Case 3: 26 yo, acute onset severe RLQ pain

Surgery/Pathology: enlarged edematous ovary with hemorrhage, complete torsion (x4)
Case 3 Question

- Which of the following would rule out a diagnosis of ovarian torsion in this patient?
  - A: absence of free fluid in the pelvis
  - B: demonstration of flow within both ovaries on color Doppler
  - C: RLQ pain has resolved
  - D: all of the above
  - E: none of the above

Teaching Points

- Enlarged ovary with follicles pushed peripherally-dilatation, hemorrhagic ovary
- Echogenic areas representing internal hemorrhage
- Fluid in cul-de-sac
- Ovarian masses can predispose to torsion esp PM women
- Color Doppler US findings are variable!!! Not as simple as +/- flow
  - Presence of flow does not exclude
    - Abnormal and reverse flow may be absent, brisk, or normal
    - This with and without color Doppler
  - Also reflects constrictions of twisted pedicle
  - Look for "torsed pedicle" sign

Reference

35 yo with L flank pain
35 yo with L flank pain

35 yo with acute left flank pain

- Path-Bilateral torsed cystadenomas

- c/o Sandeep Aurora, MD

Sonographic findings of torsion

- An enlarged edematous ovary or “complex” ovarian mass is the most common finding

- Doppler findings vary depending on degree and chronicity of “twist”.

- Lack of Doppler flow enables confident diagnosis but ovarian arterial and venous color Doppler signal has been reported in a third of surgically proven cases of ovarian torsion.*

*Shadinger L et al, RSNA 2000
Ovarian (Adnexal) Torsion

- Compromised lymphatic and venous drainage causing congestion and edema with loss of perfusion (?role for CE-US)

- Risks: “heavy” (hemorrhagic/edematous) ovarian masses (usually benign), ovulation induction (ovarian hyperstimulation), pregnancy, hypermobile adnexa

- 2 populations: menarchal girls (think edema, lack support), post-menopausal women (ovarian epithelial tumors)

- Right sided predominance (don’t know Y)

TUBAL TORSION

INFARCTED TORSED TUBE
Gangrenous Torsed Tube

Intraovarian Hemorrhage

Hemorrhagic Corpus Luteum
HEMORRHAGIC OVARY: No torsion seen

Hemorrhagic infarction
? 2/2 intermittent torsion

Post op hematoma

Hemorrhagic ovary
TUBO-OVARIAN ABSCESS (TOA)

ENDOMETRIOSIS

ENDOMETRIOMA(s)
Same endometrioma - luteal vs follicular phase (several weeks later)

3DUS of Endometriotic implant
On bowel (ascites is also present)
B aware of Deeply Infiltrative Endometriosis (DIE)

Case 4-

• 28 year old 17 weeks pregnant with right lower quadrant pain.
Decidualized endometrioma

- Can have lots of vessels with low impedance
- Can be an US mimic of ovarian cancer

ADENOMYOSIS

TV-CDS  T2 MRI
40 yo female for evaluation of fibroids

T2W

T1W contrast - T1W contrast +

3/10
Differential Diagnosis

1. Fibroids
2. Focal Adenomyosis
3. Diffuse Adenomyosis
4. Both 1 & 3

Adenomyosis
Sonographic Features

• Irregular myometrial cystic spaces
• Enlarged uterus
• Linear striations in the myometrium
• Poor delineation of the endometrium is seen with endometrial pseudowidening
MR Imaging of Adenomyosis

- Best seen on T2 weighted images
- Abnormal myometrial signal intensity- low signal intensity (hyperplastic smooth muscle) with areas of high signal intensity (heterotopic glands)
- Thickening of the junctional zone >11mm
- Poor definition of the endometrial-myometrial junction

MR Imaging of Adenomyosis

- Abnormal myometrial signal intensity- low signal intensity (hyperplastic smooth muscle)
- Thickening of the junctional zone >11mm

MR Imaging of Adenomyosis

- Focal adenomyosis is often low signal on pre & post contrast T1W sequences
- Leiomyomas enhance post contrast
Post ablation tubal sterilization syndrome
Hematometria s/p ablation

Submucosal fibroid
Submucosal fibroid
INFARCTED FIBROIDS

1 y. hs of menometrorrhagia
pre-embolization

Pre-UAE 1 d post UAE
1 yr. hx of menometorrhagia pre-embolization.

Pelvic Congestion Syndrome
- Middle aged, multiparous women
- Dull, aching pain with sharp exacerbations, esp with ↓ in posture, palpation
- Pain may worsen on palpation
- Dx by pelvic ultrasonography
- Vaginal or retrograde infusion of contrast
- Most patients respond to hormonal therapy

Imaging of Ovarian Vein
- Ax measured 10 mm proximal to origin
  - 7.8 mm (competent valve)
  - 5.5 mm (incompetent valve)
- Upper Normal: > 8 mm, R > L

Kennedy, A. Br J Hospital Med 40,38, 1990
Distended parauterine v
TV-CDS in Ectopic Pregnancy

1. Enhances visualization of chorionic villi ring
2. Excludes normally vascularized choriondeflum within uterus

“RING OF FIRE”

“Ring of fire” = corpus luteum
Tubal unruptured ectopic
Positive pregnancy test
LLQ pain
Differential Diagnosis:

1. Intrauterine pregnancy
2. Ectopic pregnancy (interstitial)
3. Ectopic pregnancy (tubal)
4. Ectopic pregnancy (ovarian)
Interstitial (cornual) pregnancy
Sonographic Features

Interstitial line sign

Paucity of myometrium around gestational sac
interstitial ectopic

APPENDICITIS

APPENDICITIS
TA-CDS of acute appendicitis

Peri-APPENDICEAL ABSCESS

Ab wall HERNIA
No "sliding organ"

adhesion

**TVS of Ovarian Remnant Syndrome**
- seen in SP oophorectomy pt.
- cystic hemorrhage mass
- may be associated with arterial obstruction
In summary…

• Adnexal torsion Dx-enlarged ovaries with irregular areas, decreased intra-ovarian flow
• Also consider bowel disorders, specifically appendicitis, endometriosis, renal calculi, fibroid infarction
• Use TVS to probe for sources of pelvic pain
• If TVS is inconclusive, use adjunctive modalities-MR, CT
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