US Adolescent Female Pelvis

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No Disclosures
Overview

• Normal
• Abnormal
  • Pain
  • Bleeding
  • Amenorrhea
Different from adults

Growth and development
Majority transabdominal US exam
Malignancy less common
Abdominal pain is common with many causes
US interpretation

• Communication with clinicians
• Medical vs surgical management
Technique

• Transabdominal
  • Distended urinary bladder
  • Over distended compress uterus & ovaries

• Transvaginal

• Transperineal
Uterus: Size and shape

Ovaries: Volume

Neonate: ~ 1 cm $^3$

Prepubertal (6-10 yo): 1.2-2.3 cm $^3$

Premenarchal (11-12yo) 2-4 cm $^3$

Postmenarchal: ~ 8 cm $^3$

AJR 1993; 160: 583–586
Follicles: $\leq 9$mm

Immature and mature ovaries

Less common 1-7 yo

$< 7$ yo, $\geq 6$ follicles, volume $> 4$ cm$^3$

$\rightarrow$ premature sexual development
Cysts: 10 to 30 mm

Most spontaneous resolution

Follow up

> 2.5 cm

Septa

Hemorrhage

Solid components

Overview

• Normal

• Abnormal
  • Pain
  • Bleeding
  • Amenorrhea
Ectopic/pregnancy

PAIN

Torsion

Hemorrhagic Cyst
Infection: STI/PID/TOA Tumor
Ectopic/pregnancy

MASS

Appendicitis/
Bowel disease
Urinary tract

Müllerian anomaly with obstruction
Torsion

US not perfect, clinical decision making

Incidence in children similar to testicular torsion
5/100,000 (1-20 yo)

3 times longer to transfer girl to OR than a boy with testicular torsion


Torsion: Gray scale

Meta analysis 26 years

Diagnosis torsion by:
B mode: 716 patients
Doppler: 1021 patients
CT: 107 patients

1 or more features highly predictive of torsion
Blood supply

- Why can torsed ovary have Doppler flow?
  - Dual supply
  - Intermittent
  - Incomplete

- High resistance flow
  - Prepubertal
  - Early follicular (0-7d)
  - Late luteal phase
Blood supply

Doppler

Decreased/absent best when compared to normal
1/3 of normal cases had no blood flow
Torsion: Size

15 yo left abdominal pain

Volume ratio: 5.7
Left > 75mL

Left torsion

Eur J pediatri Surg 2015; 25: 82-86
10 yo girl, 2 day periumbilical abd pain + vomiting

- Normal Doppler
- Prepubertal vol: 1.2-2.3 cm$^3$

Right ovary 6 mL
Left ovary 11 mL
Right ovary 6 mL
Left ovary 11 mL

- Normal Doppler
- Prepubertal vol: 1.2-2.3 cm³

10 yo girl, 2 day periumbilical abd pain + vomiting

Cannot compare ovaries to each other when both abnormal
10 yo girl, 2 day periumbilical abd pain + vomiting

Midline position left ovary
- Edema
- Peripheral follicles
- No central enhancement
- Ovary posterior to uterus
- Tubular structure lateral to left ovary

10 yo girl, 2 day periumbilical abd pain + vomiting

Left tubo-ovarian torsion 360°
Torsion: Follicles

11 yo abdominal pain, vomiting

- Large left ovary
- Peripheral follicles
- Preserved arterial flow

Left ovary 41 mL

Right ovary 9 mL

Left torsion
11 yo, 4 days intermittent left abdominal pain

Normal gray scale and Doppler of left ovary
Cog wheel appearance of fallopian tube

11 yo, 4 days intermittent left abdominal pain
11 yo, 4 days intermittent left abdominal pain

Isolated tubal torsion
Torsion: Whirlpool

Tubo ovarian or isolated tubal torsion
Massive ovarian edema

- Nonspecific clinical symptoms:
  - Intermittent abdominal pain
  - Mass
  - Nausea & vomiting
  - Menstrual irregularities
- Virilization with normal tumor markers
Massive ovarian edema

- Large ovary - tumor like mass
  - Mean diameter 11 cm (5-35.5 cm)
- Follicles widely separated - peripheral
- Stromal edema
- Preserved blood flow

Ultrasound Obstet Gynecol 2000; 16:479-481
15 yo abdominal pain and constipation

- Midline complex cyst
- Left ovary not seen

Hemorrhagic left cyst
Hemorrhagic Cyst

Clinically simulates torsion, ectopic pregnancy, PID, GI causes of pain

Follicular and corpus luteal cysts

Ultrasonography 2015; 34:258-267
Hemorrhagic Cyst

• Characteristics depend on age of hemorrhage
  • Fresh anechoic
  • Subacute echogenic
  • ~96 hours anechoic
Hemorrhagic Cyst

- Fibrin strands: fishnet, reticular pattern
- Retracting blood clot
  - Triangular
  - Curvilinear
  - No internal blood flow
- Short interval follow up can help

## Hemorrhagic Cyst

<table>
<thead>
<tr>
<th>Hemorrhage</th>
<th>Lesion</th>
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</thead>
<tbody>
<tr>
<td><strong>Fibrin strand</strong>: innumerable, discontinuous</td>
<td><strong>Septations</strong>: usually &lt; 20, thick, may have internal blood flow</td>
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<tr>
<td><strong>Retracting clot</strong>: concave margin, less echogenic than wall</td>
<td><strong>Nodules</strong>: convex margin, same or increased echogenicity as wall</td>
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16 yo RUQ and RLQ pain
- Hemoperitoneum
- Left ovary normal
- Right ovary not seen

16 yo RUQ and RLQ pain

Ruptured cyst, right ovary bleed
Pelvic inflammatory disease (PID)/tubo-ovarian abscess (TOA)

Cannot clinically distinguish TOA from uncomplicated PID

20% of 1 million annual cases are in adolescents

Adolesc med 2015, 26: 473-483
14 yo pain, +chlamydia
- Dilated thick walled fallopian tube with debris
- Hemorrhagic cyst of ovary
- Inflammation pelvis

14 yo pain, + chlamydia

Tuboovarian abscess
- Didelphys uterus
- Obstructed/blood filled vagina and left uterine horn

12 yo pain
- Didelphys uterus
- Duplicated vagina
- Obstructed/blood filled left hemivagina and uterine horn

12 yo pain
- Didelphys uterus
- Duplicated vagina
- Obstructed/blood filled left hemivagina and uterine horn

12 yo pain

Hematometrocolpos
12 yo pain

-Absent left kidney
3 years of age

- Absent left kidney

12 yo pain
Amenorrhea

- No menarche
  - by 16 yo
  - > 3 years after adrenarche and thelarche
- No thelarche or adrenarche by 14 yo

US to assess müllerian structures

15 yo irregular menses, acne
17.9 mL
Rt Ovary

17.7 mL
Lt Ovary

- Large polycystic ovaries
- Normal location, blood flow

15 yo irregular menses, acne

PCOS? Normal development?
Polycystic ovarian syndrome (PCOS)

Presence of at least 2 of the 3:

• Chronic anovulation
• Hyperandrogenism (clinical or biological)
• Polycystic ovaries

Many features part of normal adolescent development
PCOS in the Adolescent

Chronic anovulation: hypothalamic pituitary axis immature until 2-3 years post menarche

Hyperandrogenism: acne part of puberty

Polycystic ovaries: common < 17yo
Rotterdam guidelines

- At least 12 follicles (2-9 mm) in the whole ovary or ovarian size > 10mL
- Based on different US technology, transvaginal, adult
- New data and US technology- increase to 25 follicle
- Need different size criteria in adolescent?
- Role for MRI?

Hum Reprod Update 2014;20:334-352
Endocr Pract 2015:21 1291-1300
Summary

• Normal- growth and development
• Etiologies have overlapping clinical presentations
• Help determine surgical or medical management
• Maintain high suspicion for ovarian torsion