Evaluating the Adnexa with Ultrasound: Improving your Preoperative Assessment

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Disclosures

James M. Shwayder, M.D., J.D.
Disclosures: None

Learning Objectives

At the conclusion of this presentation, participants should be able to:
• Discuss the effective use of ultrasound in adnexal evaluation:
  • Diagnosis
  • Patient counseling
  • Procedure planning
  • Discuss case examples
  • Helpful hints

Pelvic Pain

• 27-year-old woman presents to the ER with pelvic pain x 2 days. No associated nausea or vomiting. Had similar pain 3 months ago.
• LMP = 3 weeks prior
• Birth control: None
• hCG = negative

Ultrasound

Right adnexal mass – complex in appearance. Cannot rule out cancer. Consider computed tomography (CT) or magnetic resonance imaging (MRI) for better characterization and surgical intervention.

Evaluation of Adnexal Masses

<table>
<thead>
<tr>
<th>Modality</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transvaginal ultrasound</td>
<td>0.82-0.91</td>
<td>0.68-0.81</td>
</tr>
<tr>
<td>Doppler ultrasonography</td>
<td>0.86</td>
<td>0.91</td>
</tr>
<tr>
<td>Computed tomography</td>
<td>0.90</td>
<td>0.75</td>
</tr>
<tr>
<td>Magnetic resonance imaging</td>
<td>0.91</td>
<td>0.87</td>
</tr>
<tr>
<td>Positron emission tomography</td>
<td>0.67</td>
<td>0.79</td>
</tr>
<tr>
<td>CA 125</td>
<td>0.78</td>
<td>0.78</td>
</tr>
</tbody>
</table>

Agency for Healthcare Research and Quality. AHRQ No. 06-E004. 2006
Diagnostic Classification

Benign  Equivocal  Malignant

Benign  Equivocal  Malignant

Morphologic Evaluation

<table>
<thead>
<tr>
<th>VALUE</th>
<th>Inner Wall Structure</th>
<th>Wall Thickness</th>
<th>Septa</th>
<th>Echogenicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smooth</td>
<td>≤ 3 mm</td>
<td>None</td>
<td>Sonolucent</td>
</tr>
<tr>
<td>2</td>
<td>Irregular</td>
<td>&gt; 3 mm</td>
<td>≤ 3 mm</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Papillation</td>
<td>NA</td>
<td>&gt; 3 mm</td>
<td>Low with echogenic core</td>
</tr>
<tr>
<td>4</td>
<td>NA</td>
<td>Mostly solid</td>
<td>NA</td>
<td>Mixed</td>
</tr>
<tr>
<td>5</td>
<td>Mostly solid</td>
<td></td>
<td></td>
<td>High</td>
</tr>
<tr>
<td>MAX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Morphology
Correct Specific Diagnosis

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>%</th>
<th>CI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endometrioma</td>
<td>80%</td>
<td>72.3-86.7</td>
</tr>
<tr>
<td>Dermoid</td>
<td>84%</td>
<td>74.3-91.1</td>
</tr>
<tr>
<td>Hydrosalpinx</td>
<td>93%</td>
<td>66.0-99.7</td>
</tr>
<tr>
<td>Primary Invasive Cancer</td>
<td>80%</td>
<td>71.3-86.0</td>
</tr>
</tbody>
</table>


CI = confidence interval

Ultrasound
Basic History

- Gravida (G), para (P)
- LMP
- Birth control (BC)
- Prior pelvic surgery

Descriptors

- Unilocular cyst
- Unilocular-solid cyst
- Multilocular cyst
- Multilocular-solid cyst
- Solid tumor
- Not classifiable


IOTA Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>SEPTA</th>
<th>SOLID component</th>
<th>PAPILLATION ≥ 3 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unilocular cyst</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Unilocular-solid cyst</td>
<td>No</td>
<td>Yes &lt; 80 %</td>
<td>or ≥ 1</td>
</tr>
<tr>
<td>Multilocular cyst</td>
<td>≥ 1</td>
<td>No</td>
<td>or ≥ 1</td>
</tr>
<tr>
<td>Multilocular-solid cyst</td>
<td>≥ 1</td>
<td>Yes &lt; 80 %</td>
<td>or ≥ 1</td>
</tr>
<tr>
<td>Solid tumor</td>
<td>Optional</td>
<td>≥ 80%</td>
<td>Optional</td>
</tr>
<tr>
<td>Not classifiable</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

IOTA Group

App Store
www.iotagroup.org
Color Doppler Parameters

Benign
- PI > 1.0
- RI > 0.4
- Peripheral flow
- Diastolic notch

Malignant
- PI < 1.0
- RI < 0.5
- Central flow, unorganized
- "Lakes"
- Changing caliber of vessels
- Absent diastolic notch

Resistance Index (RI) with Ovarian Cancer

<table>
<thead>
<tr>
<th>Epithelial Tumors of Ovary</th>
<th># of patients</th>
<th>Mean</th>
<th>RI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benign ovarian tumor</td>
<td>48</td>
<td>0.695</td>
<td>&lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>Borderline malignancy</td>
<td>6</td>
<td>0.535</td>
<td>&lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>Early-stage ovarian cancer</td>
<td>10</td>
<td>0.485</td>
<td>&lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>Advanced-stage ovarian cancer</td>
<td>29</td>
<td>0.395</td>
<td>&lt; 0.05</td>
<td></td>
</tr>
</tbody>
</table>


CFD and Ovarian Malignancy

- 2 European universities
  - Italy and Spain
- 1997 women
- 2148 pelvic masses
- Doppler: Vessel distribution


CFD and Ovarian Malignancy

<table>
<thead>
<tr>
<th>Doppler study</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doppler vessel distribution</td>
<td>0.95</td>
<td>0.94</td>
</tr>
<tr>
<td>Morphology</td>
<td>0.98</td>
<td>0.89</td>
</tr>
</tbody>
</table>

**CFD and Ovarian Malignancy**

- **Conclusion:**
  Evaluation of vessel distribution by color Doppler sonography increases the diagnostic accuracy of grayscale sonography in the detection of adnexal malignancies


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**Vascularity Score**

- Power Doppler
- PRF = 0.3 kHz
- Velocity scale 3-6 cm/sec
- Balance 220
- Doppler gain < artifact

Vascularity Score

- 1  No flow
- 2  Minimal flow
- 3  Moderate flow
- 4  Strong flow throughout

Logistic regression model

- 3511 patients in the IOTA study
- 21 centers in 9 countries
- Subjective assessment
- RMI (Risk of malignancy index)
- CA 125
- > 40 clinical and ultrasound variables

**Logistic regression model**

<table>
<thead>
<tr>
<th>Category</th>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>3511</td>
<td>100%</td>
</tr>
<tr>
<td>Uncertain benign vs malignant</td>
<td>244</td>
<td>6.95%</td>
</tr>
<tr>
<td>Invasive malignancy</td>
<td>40</td>
<td>1.14%</td>
</tr>
<tr>
<td>Borderline malignancy</td>
<td>33</td>
<td>1.03%</td>
</tr>
</tbody>
</table>

**Logistic regression model**

- The only variable retained to calculate the risk of malignancy was the largest diameter (mm) of the solid component of the mass
  - Benign: 24 mm  p<0.001
  - Malignant: 48 mm
- Conclusion: Logistic regression models were NOT superior to subjective assessment

Ultrasound Basic History

- Gravida (G), para (P)
- LMP
- Birth control (BC)
- Prior pelvic surgery
Infertility - Mass

32-year-old G0 presents for baseline ultrasound for ovulation induction.
Ovarian Cysts

- 38-year-old G2P2002 referred for laparoscopic oophorectomy for persistent ovarian cyst
- Ultrasound (US) reports x 3: persistent ovarian cyst with septum, cannot rule out ovarian cancer

Hydrosalpinx
Pelvic Pain - Mass

- 28-year-old G0 presents for evaluation of pelvic pain and pelvic fullness.
- Exam: Right adnexal mass ~ 5 cm

Endometrioma

- Homogenous, low-level echoes
  - Sensitivity 90%
  - Specificity 97%
- Septations 29%
- Fluid levels 5%
- Color Doppler

*Ubaldi F. Hum Reprod 1998;13:330-3*
Pelvic Pain and Mass

- 42 yo G2P1011 presents with menorrhagia
- EMB = proliferative endometrium
- Failed medical therapy
- Referred for ultrasound prior to hysterectomy, "to make sure nothing else is wrong"
**Right Ovary**

**Pelvic Pain and Mass**
- **Diagnosis:**
  - Probable papillary serous cyst adenocarcinoma vs. LMP
  - Probable endometrial polyp
  - CA 125 = 67
  - CEA = 22
  - Consulted gyn oncology

**ACOG-SGO Referral Guidelines**
- **Premenopausal patients with a pelvic mass**
  - CA125 >200 units/mL
  - Evidence of abdominal or distant metastasis
  - Family history of a 1st degree relative with ovarian or breast cancer


- **Postmenopausal patients with a pelvic mass**
  - CA125 >35 units/mL
  - Ascites
  - Nodular or fixed pelvic mass
  - Evidence of abdominal or distant metastasis
  - Family history of a 1st degree relative with ovarian or breast cancer

Menorrhagia and Pelvic Mass

42 year old

- Laparoscopy
- Peritoneal washings
- Right salpingoophorectomy
  - Frozen: Serous cyst adenofibroma
- TLH + BSO
  - Frozen: Serous cyst adenofibroma

Menorrhagia and Pelvic Mass

Final Pathology

- Uterus
  - Endometrial polyp
  - Proliferative endometrium
- Right ovary
  - Serous tumor of LMP
- Left ovary
  - Serous tumor of LMP arising in a background of a serous cyst adenofibroma

Menorrhagia and Pelvic Mass

Staging Procedure

- Peritoneal biopsies (multiple)
  - Endosalpingiosis with psammomatous calcifications
- Cul-de-sac
  - Serous LMP, non-invasive with psammomatous calcification
- Lymph nodes
  - Benign
- Omentum
  - Endosalpingiosis with psammomatous calcifications

Annual Exam – Adnexal Mass

- 58 yo presents for annual examination
- Exam: palpable right adnexal mass ~ 4-5 cm in size
Size of Unilocular Cystic Tumors

<table>
<thead>
<tr>
<th>Size</th>
<th>Ovarian tumor</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 cm</td>
<td>2245</td>
</tr>
<tr>
<td>3 – 6 cm</td>
<td>971</td>
</tr>
<tr>
<td>6 – 10 cm</td>
<td>40</td>
</tr>
</tbody>
</table>


Screening Protocol - Abnormal

- Repeat TVS in 4-6 weeks
- Abnormal
  - CA-125
  - Color Doppler sonography
  - Complex
- Diagnostic surgery


Follow-up of Unilocular Cysts

<table>
<thead>
<tr>
<th>Finding at follow-up</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>2261</td>
<td>69.4</td>
</tr>
<tr>
<td>Septum</td>
<td>537</td>
<td>16.5</td>
</tr>
<tr>
<td>Solid area</td>
<td>189</td>
<td>5.8</td>
</tr>
<tr>
<td>Persistent unilocular cyst</td>
<td>220</td>
<td>6.8</td>
</tr>
</tbody>
</table>


Malignancy Risk in Unilocular Ovarian Cysts < 10 cm

- 69.4% of simple unilocular cysts < 10 cm in diameter resolve spontaneously
- The risk of malignancy with unilocular cysts < 10 cm = 0.9%


Management of Simple Ovarian Cysts

- Describe in report
  - Reproductive age: > 3 cm
  - Menopause: > 1 cm
- Annual follow-up
  - Reproductive age: > 5 cm
  - Menopause: > 1 cm

Levine et al. Radiology 2010;256:943-954.
82 y.o. G5P3023

- Recent admission for C. Diff and STEMI
- Atrial fibrillation
- Diastolic heart failure
- Coronary arterial disease
- Hypertension
- Chronic kidney disease
- CT
  - Multiloculated fluid collection predominantly located in the right side of the lower pelvis containing small foci of internal calcification and measuring up to approximately 3.0 x 7.5 x 5.4 cm. This is favored to represent an abscess. The origin of his abscess could be secondary to an infectious process in the right adnexa or less likely could be secondary to a walled off abscess collection from a remote episode of diverticulitis.
What's your diagnosis?

**Endometrium**
1. Endometrial carcinoma
2. Endometrial polyp
3. Tamoxifen effect
4. Submucous myoma
5. Other

**Ovary**
1. Papillary serous carcinoma
2. Cystadenofibroma
3. Dermoid
4. Endometrioma
5. Other

**Evaluation**
- **TVS**
  - Right ovary: Probable serous cystadenocarcinoma vs. tumor of low-malignant potential. This could also represent an unusual appearance for a benign ovarian mass, but this is less likely.

- **CA125**

**Surgery**
- **Exploratory laparotomy**
  - Staging and debulking
  - Rectosigmoid and small bowel resection and reanastamosis
- **Pathology**
  - One endometrial polyp with two adjacent foci of serous carcinoma measuring 3 mm and 1.3 mm
  - Right Ovary: Serous papillary carcinoma with foci of necrosis
  - Rectosigmoid: Metastatic adenocarcinoma in the mesentery
  - Stage 3C serous ovarian carcinoma
66 y.o. G1P1001

- Menopausal
- Breast Cancer: HER2 Positive
- Finished chemotherapy 2 weeks ago
- Prior gyn surgery: D&C
What's your diagnosis?
Ovary

1. Papillary serous carcinoma
2. Cystadenofibroma
3. Dermoid
4. Endometrioma
5. Other

Surgical Findings

- Slightly enlarged left ovary
- Removed and placed in an endoscopic bag
- Pathology:
  - Serous cystadenofibroma

36 y.o. G2P2002

History
- Mass on outside ultrasound
• Mucinous cystadenoma
45 y.o. G4P4004

- Menopausal
- c/o Abdominal discomfort
- Abdominal/pelvic mass

45 yo G4P4004

PI = 0.45
RI = 0.38

45 yo G4P4004

CA 125 = 22.5

Differential diagnosis
- Mucinous cystadenoma
- LMP vs. Malignant
- Dermoid
- Endometrioma
45 y.o. G4P4004

- Gyn-Oncology
- Laparotomy
- TAH + BSO
- Staging

Mucinous borderline tumor, intestinal type, with intraepithelial carcinoma
Tumor involves (R) ovarian parenchyma and the ovarian capsule is intact
- Fallopian tube free of tumor
- Appendix: Negative
- Nodes: Negative
- Peritoneal washings: negative
- Stage: pT1a

63 y.o. G3P003

Postmenopausal woman with vaginal bleeding
Ultrasound Interpretation

- Endometrium
  - Indistinct
  - Probable endometrial polyp
  - Must have concern for endometrial cancer
  - Right ovarian mass
  - Granulosa cell tumor

Granulosa Cell Tumor

- Accounts for ~3% of all ovarian malignancies
- The most common (70%) sex cord stromal tumor
- The most common (80%) hormone-producing ovarian tumor

Granulosa Cell Tumor

- Incidence = 0.5–1.5 per 100,000 women per year
- More than 50% in postmenopausal women
- One-third of GCTs occur in premenopausal women
- 5% in the prepubertal period
Granulosa cell tumor
Macroscopic Appearance
- Large, commonly encapsulated tumors
- Smooth or lobulated surface.
- Gray or yellow cut surface
- Solid and cystic areas

Hormonal Activity
- Estrogen production
- Breast growth
- Abnormal bleeding
- 24-80% of patients have endometrial pathology
  - Endometrial hyperplasia 20-65%
  - Endometrial cancer up to 10%

Tumor Markers
- Estradiol
  - Minimal value in premenopausal women
- Inhibin A
- Inhibin B
- CA125 of little value

Ultrasound Diagnosis
- Granulosa cell tumor
  - Probable LMP
  - Endometrial hyperplasia or cancer

Pathology Diagnosis
- Granulosa cell tumor of LMP
- Complex endometrial hyperplasia with atypia

Infertility - Mass
33-year-old G0 presents for baseline ultrasound (day 3) for ovulation induction on Sunday
35 y.o. G4P0040

- Right ovarian cystic mass
- Medical conditions
  - HIV
  - H/O stroke (cocaine)
  - Asthma
  - Hypothyroidism
  - Hearing loss
- CA125 = 20.4
First Examination

- 23-year-old G0 presents for first examination
- Complains of pelvic pressure
- LMP = 3 weeks prior
- Menses regular
- Birth control: none

Annual Examination

- Uterus enlarged ~ 12 weeks, NT
- UCG: negative
- Plan: pelvic ultrasound

Ovarian Masses
Bilateral Tumors

- Serous cystadenomas 25%
- Teratomas 15%
- Mucinous cystadenomas 2-3%

RI = 0.80
PI = 1.58

RI = 0.36
PI = 0.58

Age-Related Risk of Malignancy of an Ovarian Tumor (959 Patients)

<table>
<thead>
<tr>
<th>Age, years</th>
<th>Malignant</th>
<th>Benign</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>&lt; 20</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>21 - 30</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>31 - 40</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td>41 - 50</td>
<td>42</td>
<td>16</td>
</tr>
<tr>
<td>51 - 60</td>
<td>81</td>
<td>30</td>
</tr>
<tr>
<td>61 - 70</td>
<td>68</td>
<td>25</td>
</tr>
<tr>
<td>≥ 71</td>
<td>33</td>
<td>12</td>
</tr>
</tbody>
</table>

Rate of malignancy (RM) Relative risk of malignancy (RR)

Minaretzis et al. Gynecol Obstet Invest 1994; 38, 140-144
Pelvic Mass – 23-year-old G0

- Additional testing
  - CA 125 = 25.1
- Probable diagnosis
- Bilateral papillary serous cystadenomas of low malignant potential
- Preoperative counseling

Pelvic Masses – 23-year-old G0

Laparoscopy
- Peritoneal washings
- Right salpingo-oophorectomy
  - Pathology-frozen
    - Papillary serous cystadenoma – low malignant potential
- Left ovary
  - Ovarian cystectomy
  - Pathology-frozen
    - Papillary serous cystadenoma – low malignant potential
Pelvic Masses – 23-year-old G0

Final pathology
• Peritoneal washings
  • Negative
• Right salpingoophorectomy
  • Papillary serous cystadenoma – low malignant potential
• Left Ovarian cystectomy
  • Papillary serous cystadenoma – low malignant potential

Preoperative Ultrasound

Summary
• More accurate diagnosis
• If surgery is required:
  • Preoperative counseling
  • Select the procedure
  • Select the approach
  • Select equipment
  • Selecting personnel
  • Surgical correlation

Thank You

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