Learning Objectives

Participants should be able to:
- Classify masses based on updated terminology
- Differentiate benign from malignant masses, applying risk assessment tools
- Discuss the effective use of ultrasound in adnexal evaluation:
  - Diagnosis
  - Patient counseling
  - Procedure planning

Ultrasound Basic History

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

Timing of Studies

Ultrasound in the Evaluation of Adnexal Masses

James M. Shwayder, MD, JD
President and CEO
Shwayder Consulting, LLC
Venice, Florida

Disclosures: GE Ultrasound - Consultant

Infertility - Mass

32-year-old G0 presents for baseline ultrasound for ovulation induction.
Left Ovary

- How is it described?
- How much vascular flow is there to the mass?
- Combining the findings, what is the risk of malignancy?
**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>No</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>

**Unilocular Cyst**

<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>
</tbody>
</table>

**Multilocular Cyst**

<table>
<thead>
<tr>
<th>Classification</th>
<th>SEPTA</th>
<th>SOLID component</th>
<th>PAPILLATION ≥ 3 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multilocular cyst</td>
<td>≥ 1</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Multilocular-solid cyst</td>
<td>≥ 1</td>
<td>Yes &lt; 80 %</td>
<td>or ≥ 1</td>
</tr>
</tbody>
</table>

**Solid Tumor**

<table>
<thead>
<tr>
<th>Classification</th>
<th>SEPTA</th>
<th>SOLID component</th>
<th>PAPILLATION ≥ 3 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid tumor</td>
<td>Optional</td>
<td>≥ 80%</td>
<td>Optional</td>
</tr>
</tbody>
</table>
O-RADS Classification

- Parallels IOTA classification
- Standardizes terminology and lexicon


IOTA: Ovarian Lesion – 5 major categories

Neovascularization

- Pregnancy
- Corpus luteum
- Malignancy

CFD and Ovarian Malignancy

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doppler study</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>

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>0.86</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>0.82-0.91</td>
<td>0.69-0.81</td>
</tr>
<tr>
<td>Doppler ultrasonography</td>
<td>0.77</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>0.76-0.79</td>
<td>0.74-0.89</td>
</tr>
<tr>
<td>Simple Doppler visualization</td>
<td>0.89</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td>0.82-1.00</td>
<td>0.30-0.94</td>
</tr>
</tbody>
</table>


CFD and Ovarian Malignancy

Evaluation of vessel distribution by color Doppler sonography increases the diagnostic accuracy of grayscale sonography in the detection of adnexal malignancies.


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


Risk Assessment Models
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>&lt; 3 mm</td>
<td>None</td>
<td>Sonolucent</td>
</tr>
<tr>
<td>2</td>
<td>Irregular &gt; 3 mm</td>
<td>&gt; 3 mm</td>
<td>None</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Papillation &gt; 3 mm</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>&gt; 3 mm</td>
<td>Mixed</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Mostly solid</td>
<td></td>
<td>High</td>
</tr>
<tr>
<td>MAX</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>


Sassone and Pelvic Mass Score

<table>
<thead>
<tr>
<th>Index</th>
<th>Value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA125</td>
<td>&gt; 35</td>
<td>Malignant</td>
</tr>
<tr>
<td>Vasculation status</td>
<td>Normal vasculation</td>
<td>Normal vasculation</td>
</tr>
<tr>
<td>Resistance index (RI, Doppler mode)</td>
<td>Normal</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Risk
Low = 4 - 7
Int = 8 - 9
High > 10

Sassone and Pelvic Mass Score

IOTA Simple Rules

• If 1 or more B, and no M = Benign
• If 1 or more M, and no B = Malignant
• If both M and B = Not classifiable
• If neither M or B = Not classifiable

Timmerman et al. Ultrasound Obstet Gynecol 2008; 31: 681-690

IOTA - LR1 and LR2

<table>
<thead>
<tr>
<th>Index</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR1</td>
<td>0.5027347346012</td>
</tr>
<tr>
<td>LR2</td>
<td>0.325765396296</td>
</tr>
</tbody>
</table>

LR1 = 50.3%
LR2 = 32.6%
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


<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>0.94%</td>
</tr>
</tbody>
</table>


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”
Pelvic Pain and Mass

• Diagnosis:
  • Probable papillary serous cyst adenocarcinoma vs. LMP
  • Probable endometrial polyp
  • CA 125 = 67
  • CEA = 22
  • Consulted gyn oncology

IOTA Simple Rules

- If 1 or more B, and no M = Benign
- If 1 or more M, and no B = Malignant
- If both M and B = Not classifiable
- If neither M or B = Not classifiable


Adnex Model

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


ACOG Referral Guidelines

Elevated Risk Index
• Multivariate index assay
• Risk of malignancy index
• Risk of Ovarian Malignancy Algorithm
• Ultrasound based scoring system
  • IOTA LR2
  • IOTA Adnexa

Menorrhagia and Pelvic Mass

42 year old

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

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
- Ovarian
- Omentum
  - Endosalpingiosis with psammomatous calcifications
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 1.0 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

What's your diagnosis?
Ovary

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

Evaluation

- TVS
  - Uterus: Probable endometrial polyp. Cannot rule out cancer based on ultrasound appearance alone.
  - 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 118
Surgery

- Exploratory laparotomy
- Staging and debulking
- Rectosigmoid and small bowel resection and reanastomosis
- 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
IOTA Simple Rules

• If 1 or more B, and no M = Benign
• If 1 or more M, and no B = Malignant
• If both M and B = Not classifiable
• If neither M or B = Not classifiable

Timmerman et al. Ultrasound Obstet Gynecol 2008; 31: 681–690

Adnex Model

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

Infertility - Mass

33-year-old G0 presents for baseline ultrasound (day 3) for ovulation induction on Sunday
32 y.o. G0P0

- Family history of cancer
  - Ovary: 2 maternal cousins (30’s)
  - Breast: Maternal aunt (40’s)
  - Colon: MGF
- Weight loss = 20# x 1 year
- Surgery: none
- Contraception: None
Surgical findings

- Stage IV endometriosis
- Bilateral endometriomas
- 3 cm endometrioma – bladder
- Obliterated cul-de-sac
- TAH + BSO
- Partial bladder resection

26 y.o. G0P0
Pelvic Pain

Exam
- Uterus: Anteverted, fixed
- Ovaries: Non-mobile, tender
- Rectal-vaginal: No definite nodules

Uterine Sliding Sign

Uterine Sliding Sign

Uterine sliding sign
Negative (no sliding)

<table>
<thead>
<tr>
<th>Author</th>
<th>N</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hudelist et al.</td>
<td>117</td>
<td>85</td>
<td>96</td>
<td>91</td>
<td>94</td>
<td>93.1</td>
</tr>
<tr>
<td>Reid et al.</td>
<td>100</td>
<td>83.3</td>
<td>97.1</td>
<td>92.6</td>
<td>93.3</td>
<td>93.0</td>
</tr>
</tbody>
</table>


Sliding Organ Sign
**Sliding Organ Sign**

**Ovarian Sliding Sign – Adhesions**

<table>
<thead>
<tr>
<th></th>
<th>No adhesions</th>
<th>Adhesion</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive sliding sign</td>
<td>77</td>
<td>2</td>
<td>79</td>
</tr>
<tr>
<td>Negative sliding sign</td>
<td>3</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>27</td>
<td>107</td>
</tr>
</tbody>
</table>

Data are given as n.

- **Sensitivity = 99.5**
- **Specificity = 80.6**

PPV = 96.3

NPV = 96.7

Pelvic Pain

Findings
- Stage IV endometriosis
- Left ovary: endometrioma
- Dense adhesions: Bilaterally
- Obliterated cul-de-sac

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%

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

<table>
<thead>
<tr>
<th>Age, years</th>
<th>Malignant N</th>
<th>Benign N</th>
<th>RM (%)</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20</td>
<td>14 (5)</td>
<td>446 (24.1)</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>21 - 30</td>
<td>12 (4)</td>
<td>133 (7.8)</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>31 - 40</td>
<td>21 (8)</td>
<td>106 (6.1)</td>
<td>5.2</td>
<td></td>
</tr>
<tr>
<td>41 - 50</td>
<td>41 (16)</td>
<td>138 (7.9)</td>
<td>10.3</td>
<td></td>
</tr>
<tr>
<td>51 - 60</td>
<td>81 (30)</td>
<td>15 (0.8)</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td>&gt; 71</td>
<td>33 (12)</td>
<td>5 (0.3)</td>
<td>6.1</td>
<td></td>
</tr>
</tbody>
</table>

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

Minardakis 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

IOTA Simple Rules

- If 1 or more B, and no M = Benign
- If 1 or more M, and no B = Malignant
- If both M and B = Not classifiable
- If neither M or B = Not classifiable

Timmerman et al. Ultrasound Obstet Gynecol 2008; 31: 681–690

ADNEX Model

Timmerman et al. Ultrasound Obstet Gynecol 2008; 31: 681–690
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

Final pathology
- Peritoneal washings
  - Negative
- Right salpingo-oophorectomy
  - Papillary serous cystadenoma – low malignant potential
- Left Ovarian cystectomy
  - Papillary serous cystadenoma – low malignant potential

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
Hydrosalpinx – 3D

Consensus Panel

- # of surgeries/malignancy
- Europe
  - 5.9 – general centers
  - 2.3 – oncology centers
- United States
  - 9.1

First International Consensus Report on Adnexal Masses

Management Recommendations

Phyllis Glanc, MD, Bertel Rosendal, MD, Tom Bewes, MD, PhD, Douglas Brown, MD, Beverly G. Coleman, MD, Christopher Crow, MD, Jason Duke, MD, Deborah Levine, MD, Edward Pridk, PhD, Dick Timmersma, MD, PhD, Frederick R. Ueland, MD, Wendy Wolfman, MD, Steven R. Goldstein, MD

Glanc et al. J Ultrasound Med 2017;00:00-00.
Consensus Panel

- **Benign**
  - Simple unilocular cyst
  - Thin (< 3 mm) septation
  - Wall irregularity < 3 mm
- **Malignant**
  - Tumors > 10 cm
  - ≥ 4 papillations

Consensus Recommendations

- **Clearly benign**
  - Serial ultrasound examinations
  - 3 month follow-up
  - If stable or smaller
    - q12 months x 5 years
- **Indeterminate**
  - Refer to an Expert Sonologist
- **Clearly malignant**
  - Refer to a Gyn Oncologist

Diagnostic Classification

- Benign
- Equivocal
- Malignant

Learning Objectives

- Updated terminology
- Risk assessment tools
- Discuss the effective use of ultrasound in adnexal evaluation:
  - Diagnosis
  - Patient counseling
  - Procedure planning

Thank You