A Cutting Edge Overview of Imaging Ovarian Dermoids

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Agenda

• Background
  – Classification
  – Composition
  – Complications

• Imaging
  – Ultrasound
  – CT
  – MRI

• Index Patient

Courtesy Dr. Romero
Ovarian Dermoids: Classification

**Mature cystic teratomas**
- 58% of all ovarian neoplasms
- Broad age range favoring reproductive years, mean age is 30 years old
- Most often asymptomatic, if symptomatic, abdominal pain or nonspecific symptoms
- Bilateral in 12% of patients; if unilateral 73% occur on the right side
- Slow growing (1.8 mm/year)
- Smaller in size at first diagnosis (7 cm)
- Management: surveillance if less than 6 cm
- Local recurrence following surgical excision is less than 1%

**Immature teratomas**
- Rare (less than 1% of all ovarian teratomas)
- Younger patients (20 years of age)
- Malignant behavior; 36% of ovarian dermoids that become malignant
- Large (14-25 cm), encapsulated masses that are mostly solid, small foci of fat, poorly defined calcifications, hemorrhage
- Serum alpha-fetoprotein increases in 50% of cases

**Monodermal Teratomas** (neural tumors, struma ovarii, carcinoid tumors)

Ovarian Dermoids: Composition

• Fat in the cystic lumen
  – Present in 93% of ovarian dermoids
  – Most specific imaging finding indicative of MCT

• Teeth found in 33%

• Mesoderm 90%

• Ectoderm
  – Skin and neural tissue

• Endoderm
  – Thyroid and gastrointestinal tissue

Ovarian Dermoids: Complications

• **Rupture:** leakage of liquefied sebaceous contents into the peritoneum that causes granulomatous peritonitis (rare, less than 1% of all cases)\(^1\)

• **Torsion**
  – Ovarian dermoids increase in size following torsion \(^1\)
  – More common in pregnancy

• **Ovarian vein thrombophlebitis:** sepsis and thrombosis of inferior vena cava and renal veins

• **Malignant degeneration:**
  – 0.25%-3% risk of MCT progression to carcinoma or sarcoma
  – Most common malignancy is invasive squamous cell carcinoma (80%)
  – Often occur when patients exceed 70 years of age
  – Increased risk among patients greater than 40 years old

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Coronal C- CT

Courtesy Dr. Romero
Ultrasound Imaging of Ovarian Dermoids

- Most common imaging modality
- 58% sensitivity and 99% specificity in the diagnosis of a mature cystic teratoma\(^1\)
- Calcified structures, hair, echogenic sebaceous material, fat-containing Rokitansky protuberance (found in 92% of all ovarian dermoids)

**Advantages:** Confirms presence of mass, identifies organ of origin, and internal structures, use Doppler to assess for flow

**Limitations:**
- Limited by abnormal pelvic anatomy
- Difficult to appreciate cystic quality of these tumors
- Reported false positives:
  - Hemorrhagic cysts with internal blood clots (sound attenuation by MCT, not increased through transmission, which is what clots do)
  - Perforated appendix with appendicolith
  - Cystadenofibroma
  - Echogenic bowel
  - Endometriomas

Companion Patient #1: Ultrasound Images

Hairs: “Dermoid Mesh”

Sagittal ultrasound
Companion Patient #2: Ultrasound Images

Sagittal ultrasound

Rokitansky’s Protuberance

Hair

Fat
Companion Patient #3: Ultrasound Images

Transverse ultrasound

“Tip of the Iceberg” Sign

Courtesy Dr. Brook
Proceed to the next slide to see how CT compares to ultrasound imaging of ovarian dermoids.
CT Imaging of Ovarian Dermoids

- 93-98% sensitivity and 100% specificity in the diagnosis of a mature cystic teratoma\(^1\)
- Fat detection (density less than -20 HU) is diagnostic, gravity-dependent layering with fat-fluid line, palm tree-like protrusion and fat-fluid levels (10%)\(^1\)
- Indicated for staging suspected malignancies

**Advantages:** Excellent at detecting fat

**Limitations:**
- Radiation
- Cost

Companion Patient #4: CT

Coronal C- CT

Fat

Calcification

Courtesy Dr. Romero
Proceed to the next slide to see how MRI compares to ultrasound and CT imaging of ovarian dermoids.
MRI Imaging of Ovarian Dermoids

• **Findings:**
  - T1 Weighted: sebum/fat has very high signal intensity, calcium bone, hair are low
  - T1 Weighted with fat-saturation: suppression of high-signal sebum,/fat is diagnostic
    • Blood products in hemorrhagic cysts should not suppress

• **Advantages:** excellent sensitivity for detecting fat and calcification, useful for detecting organ of origin if ultrasound is nondiagnostic

• **Limitations:**
  - Requires presence of fat or calcifications to have diagnosis
  - Endometriosis¹

Companion Patient #5: MRI

In phase T1 W MRI

Out of phase T1 W MRI

Sebum: high intensity

Sebum: signal drops off

Sebum: high intensity

Sebum: signal drops off
Imaging Findings Typical of Malignancy

• Limited utility of imaging in differentiating benign from malignant tumors
• Size > 5 cm (diameter)
• Composition
  – Malignancy often has greater solid component invading surrounding pelvic tissues
• Border
  – Benign lesions have smooth borders whereas malignancies have an indistinguishable septum and capsule with irregular borders

Tan et al, 2007
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Coronal C- CT
Our Index Patient

**HPI:** 39-year-old woman with past medical history of a left-sided ovarian dermoid and remote left oophorectomy, unexplained infertility status post an unrevealing laparoscopy and unsuccessful infertility treatments, presents with heavy vaginal bleeding and a right-sided mass appreciated on physical exam...

**Family history:** paternal grandmother with ovarian cancer

**Past surgical history:** endometrial ablation, Right-sided laparoscopic ovarian cystectomy, remote left-sided oophorectomy

What is the appropriate approach to imaging this patient with an incidental mass discovered on physical exam?
## American College of Radiology Appropriateness Criteria

### Variant 2:
Reproductive age female (not pregnant) with complex or solid mass detected by pelvic sonography. Follow-up recommendations.

<table>
<thead>
<tr>
<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comments</th>
<th>RRL*</th>
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<tr>
<td>US pelvis transvaginal</td>
<td>9</td>
<td>All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.</td>
<td>O</td>
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<tr>
<td>US pelvis transabdominal</td>
<td>9</td>
<td>All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.</td>
<td>O</td>
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<tr>
<td>US pelvis with Doppler</td>
<td>9</td>
<td>All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.</td>
<td>O</td>
</tr>
<tr>
<td>MRI pelvis with or without contrast</td>
<td>7</td>
<td>If lesion is very large or if origin (uterine vs ovary) is unclear. See statement regarding contrast in text under “Anticipated Exceptions.”</td>
<td>O</td>
</tr>
<tr>
<td>CT pelvis with or without contrast</td>
<td>3</td>
<td>May be appropriate if nongynecologic source of malignancy is suspected and CT is done for staging.</td>
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<tr>
<td>FDG-PET/CT whole body</td>
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<td>Image-guided aspiration or biopsy</td>
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<tr>
<td>adnexal mass</td>
<td>2</td>
<td></td>
<td>Varies</td>
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</tbody>
</table>

**Rating Scale:** 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation Level*
Given the pelvic mass palpated on physical exam, transabdominal and transvaginal ultrasounds are obtained. Proceed to the next slide to view the mass...
Our Patient’s Ultrasound: Year 1

Echogenic Mass
Normal Ovarian follicles

Sagittal Ultrasound
Given the appearance of the mass, it is consistent with a small ovarian dermoid. The mass is screened every subsequent year to assess its size and any characteristic changes. Click to the next slides to see how the mass continues to grow.
Our Patient’s Ultrasound: Year 2

Echogenic Mass

Sagittal Ultrasound
Our Patient’s Ultrasound: Year 3

Echogenic Mass

Sagittal Ultrasound
An MRI is also obtained during this patient’s workup. Proceed to the next slide to see her MRI.
Our Patient’s MRI

In phase T1 W MRI

Sebum: high intensity

Out of phase T1 W MRI

Sebum: signal drops off
The patient’s dermoid continues to be monitored and she underwent a repeated endometrial ablation which has successfully curbed her vaginal bleeding.
References

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