A Case Study: 
Radiologic Assessment of Complex and Solid Ovarian Masses

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Overview

• Patient Presentation
• Pelvic Anatomy
• Menu of Tests for Evaluating Adnexal Masses
  – Ultrasound
  – MRI
  – CT
• Differentiation between simple and complex cysts
• Features of benign vs. malignant lesions
Patient History

- 26 year-old G0P0 female who presented to the ED with two months of heavy menses and severe pelvic pain. Pelvic pain is greater on right than left and worsens with urination.
- PMH: hx of anxiety, asthma, headaches, and obesity
- Family History
  - Father (deceased): pancreatic cancer, age 50
  - Mother: endometrial cancer, age 49
  - No hx of colon, ovarian, or cervical cancer
Additional History and Initial Work-Up

• Pelvic Exam revealed a displaced cervix and solid nodular mass in the the anterior cul-de-sac on bimanual exam

• Past GYN History:
  – Menarche at age 13, q monthly menses with heavy bleeding and associated pain
  – No history of pelvic infections or abnormal Pap smears

• Initial Work-Up: pelvic ultrasound to evaluate clinically suspected adnexal mass
Findings on Pelvic US included an enlarged 3 x 5.1 x 3.4 cm RT ovary that contained a 2.8 x 2.8 cm mildly heterogeneous, predominantly hypoechoic focus with internal color flow.
Female Pelvic Anatomy
Anatomy of the Ovary

Adnexal Masses

- An *adnexal mass* is any mass present in the ovaries, fallopian tubes, or surrounding connective tissue
- 10% of adnexal masses in women of reproductive age are malignant (1)
- For a woman in the US, there is a 5-10% lifetime risk that she will undergo surgery for a suspected ovarian neoplasm (2)
Ovarian Cancer: Epidemiology

- Each year, 20,000 women in the US develop ovarian cancer
- 8th most common cancer and 5th leading cause of cancer death
- Ovarian cancer causes more deaths than any other cancer of the female reproductive system
- Accounts for 3% of all cancers in women

Risk factors
- Middle aged or older
- Family history of ovarian cancer
- Genetic mutation (BRCA1 or BRCA2)
- History of breast, colon, or cervical cancer
- Endometriosis
Menu of Tests for Suspected Adnexal Mass

- Ultrasound
  - Pelvis Transvaginal
  - Pelvis Transabdominal
  - Duplex Doppler Pelvis
- MRI without and with contrast
- CT pelvis with contrast
Transvaginal Ultrasound (TVS)

- Endovaginal US is the first-line imaging modality.
- With use of Doppler, sensitivity for identifying malignant adnexal masses is 92-99%; specificity 85.9%.
- Can be used to differentiate between cystic, complex, and solid masses.
- Use of Doppler can detect vascularity of the wall.
- When mass is beyond field of TVS, transabdominal is recommended.
This demonstrates a normal left ovary, measuring 3 x 1.9 x 2.2 cm, on sagittal view at the time of initial US. Anechoic foci represent normal ovarian follicles.
This demonstrates an ovarian mass in the patient’s right ovary that demonstrates both a hypoechoic, cystic component and a solid component. The mass measures 2.8 x 2.8 cm. The right ovary is also enlarged.
This image demonstrates increased vascularity within the solid component of the right ovarian mass. Solid masses with increased blood flow raise suspicion for malignancy.
Comparative Patients: Simple vs. Complex Cysts

**Simple Cysts**
- Anechoic lesions
- Posterior acoustic enhancement
- Thin, smooth walls
- No solid components or neovascularization

**Complex Cysts**
- Anechoic lesions with foci of increased echogenicity
- May feature septation
- Regions of cyst wall may be thicker than others
DDX: Complex Ovarian Cyst in Pre-menopausal Women

- Hemorrhagic Ovarian Cyst
- Endometrioma
- Dermoid Cyst (mature cystic teratoma)
- Cystadenoma
  - Mucinous
  - Serous
- Primary or Secondary Ovarian Malignancy
This comparative patient’s ultrasound demonstrates a hypoechoic cystic area with areas of low-level echo. Color Doppler demonstrates an absence of blood flow within the cyst. These features are consistent with a benign lesion.
DDX: Solid Ovarian Mass

• Benign Ovarian Tumors
  – Teratoma
  – Fibroma
  – Thecoma

• Malignant Ovarian Tumor
  – Primary and metastatic

• Torsed Ovary
After initial US, our patient was scheduled for a six-week follow-up and repeat transvaginal US.
Our Patient: Follow-Up Transvaginal Ultrasound Findings

These images demonstrate an area of echogenicity within the ovary, suggesting a solid tumor. Normal ovarian architecture is absent. Vascularization and increased blood flow within the solid mass is also apparent.
MRI

- Valuable for characterizing indeterminate as seen on ultrasound
- In follow-up studies, both US and MRI are highly sensitive for characterizing malignancy, but MRI more specific
  - Women with clinical low risk for malignancy but present with complex on US benefit most from MRI
- Scenarios when MRI is most beneficial when mass
  - Is very large
  - Is located superiorly or laterally in the pelvis
  - Has atypical features on US
  - Is of unclear origin
Our Patient: MRI Findings

**Coronal T2 Post Contrast:** This image demonstrates enlarged right and left ovaries with **heterogeneous enhancement.**

**Axial T2 FS:** This image demonstrates enlarged right and left ovaries with **peripheral follicles.** **Pelvic free fluid** is also apparent.
Sagittal T2 Post Contrast: This image again demonstrates enlarged left and right ovaries with peripheral follicles apparent. Ovaries also demonstrate heterogeneous enhancement.
CT

• Usually reserved to evaluate for spread of ovarian malignancy
• Beneficial for staging primary ovarian cancer or identifying primary cancers in the abdomen that metastasize to ovaries
• Increasing concern for exposure to ionizing radiation
Our Patient: CT Findings

**Axial CT with contrast:** This image shows a hypodense area within the upper pole of the right kidney. Findings also included retroperitoneal lymphadenopathy (not shown).
Bone marrow aspirate and core biopsy was performed, and a diagnosis was made of B-cell Acute Lymphoblastic Lymphoma.
Diagnosis: B-cell Acute Lymphoblastic Lymphoma (B-ALL)

• Accumulation of B-lymphoblasts
• Occurs most frequently in childhood but also seen in adults with median age of 39
• By definition, patients with B cell lymphoblastic lymphoma present with a mass lesion and have <25% blasts in the bone marrow.
• Mediastinal masses are rare, but lymph nodes and extranodal sites are common
• CNS involvement is common
B-ALL: Treatment

• Combination chemotherapy is primary treatment modality
• Most regimens incorporate CNS prophylaxis
• With these regimens, more than 80% of newly diagnosed adults with ALL enter complete remission
• Our patient: Hyper CVAD with intrathecal methotrexate and cytarabine
  – Cyclophosphamide
  – Vincristine
  – Adriamycin
  – Dexamethasone
Summary Slide and Learning Points

• Reviewed relevant female pelvic anatomy
• Define adnexal masses and discussed epidemiology of ovarian cancer
• Reviewed the menu of tests for work-up of adnexal masses- first line: transvaginal ultrasound
• Highlighted differences between simple and complex cysts and differentiated between benign and malignant features
• Discussed B-acute lymphoblastic lymphoma and standard treatment options
References

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