Female Pelvic Masses
and mimics

Govind Chavhan

Disclosure

• Nothing to disclose
Outline

• Common adnexal masses
  ✓ Ovarian neoplastic masses
  ✓ Ovarian non-neoplastic processes
  ✓ Tubo-ovarian lesions
  ✓ Other mimics - uterine anomalies, bowel, urinary

• Illustration of common lesions

• What pediatric gynecologist/surgeon want to know?

• Imaging algorithm

• Added value of MRI

• Benign vs Malignant

• Summary

Numbers

• Ovarian masses - most frequent gynecologic abnormality in children

• Ovarian cancers account for <2% of all pediatric cancers

• 7-20% of ovarian masses in children are malignant
Ovarian neoplasms

- 4 categories
  1. Germ cell tumors - 60-80%
  2. Sex cord-stromal tumors - 10-20%
  3. Surface epithelial tumors - 15-20%
  4. Miscellaneous - mets, lymphoma, gonadoblastoma, small cell carcinoma

Germ cell tumors

<table>
<thead>
<tr>
<th>Tumor Type</th>
<th>Other/Lab</th>
<th>Imaging feature</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysgerminoma</td>
<td>&lt;15% b-HCG</td>
<td>Lobulated solid mass, enhancing fibrovascular septa</td>
<td>5YS - 95% (early) Late-50%</td>
</tr>
<tr>
<td>Seminoma</td>
<td>b-LDH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yolk Sac tumor</td>
<td>EmbCa &amp; Yolksac-a-FP</td>
<td>Large heterogeneous, irreg margins, necrosis, bleed</td>
<td>Poor (less sensitive to Chemo/RT) EmbCa - 35%</td>
</tr>
<tr>
<td>Embryonal sarcoma</td>
<td>Chorio- b-HCG</td>
<td></td>
<td>Chorio-&lt;1yr surv</td>
</tr>
<tr>
<td>Choriocarinoma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teratoma</td>
<td>&gt;2 germ layers</td>
<td>Fat and Ca+</td>
<td>Mature- benign variable</td>
</tr>
<tr>
<td>Mature/benign</td>
<td></td>
<td>Large solid compo, scattered fat, Ca+</td>
<td></td>
</tr>
<tr>
<td>Immature/malignant</td>
<td></td>
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<td></td>
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</tbody>
</table>

- Cystic mature teratoma is the commonest ovarian neoplasm!
**Germ cell tumors:** mature teratoma

- Majority of dermoid cysts are unilocular

- Can be multilocular and complex

- Keratinized substance/sebum can show diffusion restriction
Germ cell tumors: mature teratoma

- Can be very large in size
- Papillary projections

Germ cell tumors: immature teratoma

- Predominantly solid with only scattered foci of fat, scattered small irregular calcifications, hemorrhage, several small cysts
- Not unusual to find a small microscopic focus of immature/malignant tissue on histology in otherwise cystic mature teratoma
Germ cell tumors: **dysgerminoma**

- Solid lobulated vascular mass with fibrovascular septa
- Elevated LDH

Germ cell tumors: **yolk sac tumor**

- Heterogeneous, mixed solid cystic, highly vascular
- Hemorrhage, necrosis
- Elevated AFP
Germ cell tumors: mixed GCT

- 65% dysgerminoma; 35% yolk sac tumor

Sex cord-stromal tumors

- 10-20% of pediatric ovarian neoplasms
- Have >1 cell types and derived from -
  - sex cords (granulosa and sertoli cells) and
  - stromal cells (fibroblasts, theca cells and Leydig cells)
- Most are benign or low grade malignant
- Most common- juvenile granulosa cell tumor and Sertoli-Leydig cell tumors, rarely Thecoma-Fibroma
Sex cord-stromal tumors: **Granulosa cell tumor**

- Solid-cystic ‘sponge-like’
- Estrogen secreting functional tumors
- 10% of all precautious puberty cases

**Sex cord-stromal tumors: Sertoli-Leydig tumor**

- Complex solid-cystic mass
- 30-40% have virilization
- Association- DICER1
Epithelial tumors

- 15-20% of pediatric ovarian neoplasms
- **Serous, mucinous**, endometrioid, clear cell, transitional and epithelial stromal cells
- Can be benign, borderline or malignant

Epithelial tumors

- Very large tumors
- Mucinous versus Serous

![Mucinous](image1.png)  ![Serous](image2.png)
Non-neoplastic ovarian masses

- Hemorrhagic ovarian cyst
- Endometrioma

Non-neoplastic ovarian masses

- Ovarian torsion
Tubo-ovarian lesions

- Tubo-ovarian torsion
- Pelvic inflammatory disease
- Paraovarian cysts

Tubo-ovarian lesions: tubo-ovarian abscess

- PID, complication of STD
- *Chlamydia trachomatis*, *N. gonorrhoeae* and others
- TOA is a form of PID
- Not uncommon in adolescent girls
- Fluid-filled distended tortuous tubular structure and inflammatory changes
- DD: perforated appendicitis
Tubo-ovarian lesions: paraovarian cysts

- Can be mesothelial, paramesonephric or mesonephric in origin
- Most unilocular and simple
- Fallopian tube stretched over the cyst

- 16-yrs-old with RLQ pain
Tubo-ovarian lesions: paraovarian cysts

- Can cause isolated tubal torsion without ovarian torsion

What pediatric gynecologist/surgeon want to know?

- 60% ovarian lesions treated surgically, >50% laproscopically
- *Malignant*: different approach and oophorectomy
- *Benign*: minimally invasive, ovarian sparing ‘cystectomy’
- Small number who undergo oophorectomy found to have benign lesions.
- *Origin* and *Nature* by imaging influence referral pathways and treatment stratification
Imaging Algorithm

• US - initial modality and sufficient in many cases e.g. dermoid cyst, hemorrhagic cyst, torsion.
• MRI is next choice, required especially if Sx is planned
• MRI shown to lead to more conservative management in adult studies

* MRI protocol and Biomarker tables provided in the syllabus last slides

Added value of MRI

• Our study*.
• MRI changed management in 10 of 32 girls with adnexal lesions (p=0.032)
• Change in surgical vs conservative in 5
• Change in laparotomy vs laparoscopy in 2
• Change in oophorectomy to cystectomy and change in incision in 3

• Based on additional information by MRI on likely nature of mass in 8 and correct origin in 2 cases

Benign vs Malignant

General and MRI

- Size >8cm
- Age 1-8 yrs
- Presentation with precocious puberty / virilization versus acute symptoms
- Lab Markers- elevated β-HCG and α-FP nearly diagnostic of malignant germ cell tumor
- Rapid and avid enhancement of solid components

Benign vs Malignant

Ultrasound

- US predictors of malignancy include solid component (nodular or papillary), thick septations (2-3 mm), flow within solid areas or septation and free fluid*
- Ovarian crescent sign@
- Ueland’s Morphology Index @

@ Stankovic ZB et al. J Pediatr Adolesc Gynecol 2017; 30:405-412
Summary

- US plays important role in the diagnosis of most pediatric gynecologic abnormalities including masses and guides further management.

- It should be the first line imaging modality for all conditions.

- MRI adds value by better assessment of origin of the mass and nature of the mass as compared to US.

- MRI is recommended in all cases preoperatively as it changes management

Our protocol

<table>
<thead>
<tr>
<th>Table 1. Sample MRI protocol for pediatric adnexal mass evaluation.</th>
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<tbody>
<tr>
<td><strong>Sequence</strong></td>
</tr>
<tr>
<td>Pre-contrast</td>
</tr>
<tr>
<td>Coronal T2 Single shot BH</td>
</tr>
<tr>
<td>Axial T1 TSE</td>
</tr>
<tr>
<td>Axial DWI (b0, 100, 600-800)</td>
</tr>
<tr>
<td>Axial T2-FS TSE</td>
</tr>
<tr>
<td>Sagittal T2-FS TSE</td>
</tr>
<tr>
<td>Axial T1 in-phase/out-of-phase</td>
</tr>
<tr>
<td>Coronal 3D T1-FS GRE BH</td>
</tr>
<tr>
<td>(VIBE/THRIVE)</td>
</tr>
<tr>
<td>Post-contrast</td>
</tr>
<tr>
<td>Coronal 3D T1-FS GRE BH</td>
</tr>
<tr>
<td>dynamic (4 runs)</td>
</tr>
<tr>
<td>Sagittal T1-FS TSE</td>
</tr>
<tr>
<td>Axial T1-FS TSE</td>
</tr>
<tr>
<td>Optional</td>
</tr>
<tr>
<td>Coronal STIR</td>
</tr>
<tr>
<td>Axial T2-FS PROPELLER</td>
</tr>
<tr>
<td>(BLADE/MultiVane)</td>
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</tbody>
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### Table 3: Serologic biomarkers for ovarian tumors

<table>
<thead>
<tr>
<th>Biomarker</th>
<th>Associated tumors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta-human chorionic gonadotropin (β-hCG)</td>
<td>Malignant germ cell tumors (choriocarcinoma and embryonal carcinoma)</td>
</tr>
<tr>
<td>Alpha-fetoprotein (α-FP)</td>
<td>Malignant teratoma</td>
</tr>
<tr>
<td></td>
<td>Yolk sac tumor</td>
</tr>
<tr>
<td></td>
<td>Embryonal carcinoma</td>
</tr>
<tr>
<td>CA125</td>
<td>Malignant ovarian epithelial neoplasms</td>
</tr>
<tr>
<td>Lactate dehydrogenase (LDH)</td>
<td>Dysgerminoma</td>
</tr>
<tr>
<td>Inhibin</td>
<td>Juvenile granulosa cell tumors</td>
</tr>
</tbody>
</table>