Pathology of the Ovary

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Ovarian Neoplasms

- Epithelial
- Sex-cord Stromal
- Germ Cell

- Other
  - lipid/steroid cell
  - mixed
Distribution of *Benign* Ovarian Neoplasms

- Germ cell
- Epithelial
- Stromal

Distribution of *Malignant* Ovarian Neoplasms

Ovarian Cysts & Masses

- epithelial inclusions - up to 1 cm
- cystic follicle < 2 cm
- follicle cyst > 2 cm
  - corpus luteum cyst = luteinized f.c.
- simple cyst
  - no recognizable lining, or
  - 1-2 cells: non-specific or low cuboidal
- cystadenoma > 2.5 cm

lined with granulosa cells
Ovarian Torsion

- Can occur with any ovarian mass
  - functioning cysts
  - benign neoplasms
  - malignant tumors
    - cystic
    - solid
# Ovarian Epithelial Tumors

## Recapitulation of Cöelomic Epithelium

<table>
<thead>
<tr>
<th>Type</th>
<th>Corresponding Tissues</th>
</tr>
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<tbody>
<tr>
<td>serous</td>
<td>tubal lining</td>
</tr>
<tr>
<td>mucinous</td>
<td></td>
</tr>
<tr>
<td>intestinal</td>
<td>gastrointestinal mucosa</td>
</tr>
<tr>
<td>Müllerian</td>
<td>endocervix</td>
</tr>
<tr>
<td>endometrioid</td>
<td>endometrial glands</td>
</tr>
<tr>
<td>Brenner/transitional</td>
<td>bladder (urothelium)</td>
</tr>
<tr>
<td>clear cell</td>
<td>mesonephric (renal cell)</td>
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</tbody>
</table>
Ovarian Epithelial Neoplasms

- Benign

- Intermediate Risk of Recurrence
  - borderline
  - low malignant potential (LMP)

- Malignant
  - carcinoma
Epithelial Ovarian Neoplasms: Serous Prototype

- **endophytic**
  - cyst (<2.5cm)
  - cystadenoma
  - cystadenofibroma
  - adenofibroma

- **exophytic**
  - surface papillary tumors
Serous Tumor of LMP
Serous Tumors of Low Malignant Potential

- architectural complexity (atypia)
- cytologic atypia
- lack of destructive stromal invasion

Psammoma Body
Defining Stromal Invasion

- destructive, infiltrative growth
- altered epithelial-stromal interface
  - dense fibrous
  - myxoid
  - hyaline
Serous Carcinoma
Implants of Serous Ovarian Carcinoma
# Serous Ovarian Neoplasms*

<table>
<thead>
<tr>
<th></th>
<th>Benign</th>
<th>LMP</th>
<th>Carcinoma</th>
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<tbody>
<tr>
<td>% of serous</td>
<td>70%</td>
<td>10-15%</td>
<td>20-30%</td>
</tr>
<tr>
<td>age median</td>
<td>40’s</td>
<td>50’s</td>
<td>40’s-70’s</td>
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<tr>
<td>psammoma</td>
<td>25%</td>
<td>50%</td>
<td>70%</td>
</tr>
<tr>
<td>stage I survival</td>
<td>—</td>
<td>95%</td>
<td>60%</td>
</tr>
<tr>
<td>bilaterality</td>
<td>20%</td>
<td>35%</td>
<td>60%</td>
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</tbody>
</table>

*Elevated CA-125*
Mucinous Ovarian Tumors
Mucinous Ovarian Tumors
Mucinous Cystadenoma
Krukenberg Tumor — Metastatic GI Tract Carcinoma to the Ovaries
Sex-Cord, Stromal Ovarian Neoplasms

- Epithelial (70%)
- Germ cell (20%)
- Sex cord-stromal (6%)
- Other (4%)

Multiple series
Sex Cord - Stromal Tumors

- **Granulosa Cell**
  - Adult
  - Juvenile

- **Thecoma-Fibroma**
  - thecoma
  - fibroma
  - fibrosarcoma

- **Sertoli-Leydig**
Adult Granulosa Cell Tumor

Clinical
- 95% of all Granulosa
- 1-2% of all ovarian
- post-menopausal
- 10% present with acute abdomen
- <5% bilateral
  - 90% Stage I
- slow growth
- late recurrences

- Estrogen production
  - 25% - endometrial hyperplasia
  - 5% - endometrial carcinoma

- Micro
  - Call-Exner Bodies
  - Coffee Bean nuclei
    - nuclear grooves

- Tumor Marker
  - Inhibin
Granulosa Cell Tumor: Histologic Patterns

- **follicular**
  - microfollicular: numerous Call-Exner bodies
  - macrofollicular: large “Graafian follicles”

- **trabecular**
  - chains or chords surrounded by connective tissue

- **moiré (gyriform)**
  - whirls or zig-zag chords
Ovarian Fibroma-Thecoma

Thecoma-Fibroma Spectrum
- typical thecoma
- luteinized thecoma
- fibroma
- cellular fibroma
- fibrosarcoma
Ovarian Fibroma-Thecoma

- 4% of all ovarian tumors
- <10% bilateral
- A Histologic spectrum
- Associations
  - Meigs Syndrome
    - ovarian fibroma
    - pleural effusion
    - ± ascites
Sertoli-Leydig Cell Tumors

- **Sertoli Cell**
- **Sertoli-Leydig**
  - well differentiated
  - intermediate
  - poorly differentiated
  - heterologous
- **Retiform Sertoli**
  - younger ages, more aggressive

- **All ages**
  - 75% <30yo
  - 10% >50yo

☆ Virilization may occur
Frequency of Ovarian Neoplasms

- Germ cell (20%)
- Epithelial (70%)
- Sex cord-stromal (6%)
- Other (4%)

Multiple series
Germ Cell Tumors

- teratomas
- dysgerminoma
- yolk sac tumor (endodermal sinus tumor)
- embryonal carcinoma
- polyembryoma
- choriocarcinoma (non-gestational)
- mixed germ cell
- mixed germ cell–sex cord stromal tumors (gonadoblastoma)
Teratomas

- **Mature**
  - cystic
    - mature cystic teratoma = dermoid
  - solid
- **Monodermal**
  - struma ovarii
  - carcinoid
- **Immature teratoma**
- **Teratoma with malignant transformation**
Mature Teratomas

- Germ cell origin – parthenogenesis
  - All ovarian – Barr body positive
- Ectoderm, mesoderm, and/or endodermal
  - At least two, often three elements
    - Skin, hair, adipose, bone, cartilage, etc.

Homunculus
the “ultimate” teratoma
Mature Cystic Teratomas

- dermoid, dermoid cyst, benign cystic teratoma
- **bilaterality**: 20%
- **clinical presentation:**
  - asymptomatic
  - abdominal distention
  - torsion
- **treatment**
  - cystectomy

Benign Cystic Teratoma

Rokitansky’s Tubercle
Malignant Germ Cell Tumors: Clinical Presentation

- **Symptoms**
  - short duration
  - pelvic or abdominal pain

- **Exam**
  - very large, predominantly solid, pelvic mass
  - rapid growth (weeks)

- **CT Scan**

*representative image*
Dysgerminoma

- most common malignant ovarian germ cell tumor
  - children
  - adolescence
  - pregnancy
  - dysgenetic gonads
Dysgerminoma

- **gross**
  - pink–tan
  - solid, lobulated
  - foci of necrosis & hemorrhage

- **micro**
  - prominent nucleus with large nucleolus
Dysgerminoma

- **age range:** 10–30 years (median 20 yrs)
- **clinical presentation:**
  - asymptomatic ➔ abdominal pain
  - amenorrhea/precocious puberty
  - elevated $\beta$-hcg (5%)
- **treatment**
  - TAH vs. adnexitomy/staging laparotomy
  - radiation
  - chemotherapy for advanced disease

80-100% survival
Endodermal Sinus Tumor (Yolk Sac Tumor)

- usually < 30 years old
  - range 16 mo. to 46 yrs.
- rapidly enlarging abdominal mass (>10 cm)
  - abdominal pain
    - 30% rupture before surgery
  - symptoms avg. 7 days
- elevated serum α-fetoprotein

- treatment
  - conservative vs. aggressive surgery
  - chemotherapy

- prognosis
  - pre-chemo ~10%
  - modern Rx ~85%
Endodermal Sinus Tumor – Histologic Keys

- **Histologic Key**
  - Schiller-Duval Bodies
    - capillary lined by cuboidal or low columnar embryonal epithelial-like cells

- **Tumor Marker**
  - $\alpha$-fetoprotein
Endodermal Sinus Tumor – Gross
Endodermal Sinus Tumor

Schiller-Duval Body
Choriocarcinoma

Gestational Choriocarcinoma
- always associated with an antecedent gestation
  - normal gestation
  - spontaneous AB
  - molar gestation

Non-gestational Choriocarcinoma
- Germ Cell Tumor
- only seen in combination with other malignant Germ Cell elements

Similar Histology: biphasic admixture of malignant trophoblast
Mixed Germ Cell Tumor

Dysgerminoma and Choriocarcinoma
Ovarian Germ Cell Tumors — Conclusions

- benign tumors are common
- malignant tumors are uncommon
- tumor markers aid in diagnosis and follow-up of therapy
- modern chemo- & radiation therapy have had a positive impact on survival in malignant germ cell tumors
# Markers in Germ Cell Tumors

<table>
<thead>
<tr>
<th>Tumor</th>
<th>AFP</th>
<th>hCG</th>
<th>LDH</th>
<th>PLAP</th>
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</thead>
<tbody>
<tr>
<td>Dysgerminoma</td>
<td>−</td>
<td>−/+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Endodermal sinus tumor</strong></td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Immature teratoma</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td><strong>Choriocarcinoma</strong></td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>−</td>
</tr>
</tbody>
</table>

*Multiple Series*