World-health organization classification of ovarian sex cord-stromal tumors

I. Granulosa stromal cell tumors
   A. Granulosa cell tumors
      1. Adult granulosa cell tumor
      2. Juvenile granulosa cell tumor
   B. Thecoma/fibroma
      1. Thecoma
         (a) Luteinized thecoma
      2. Fibroma
         (a) Cellular fibroma
      3. Fibrosarcoma
      4. Stromal tumor with minor sex cord elements
      5. Sclerosing stromal tumor
      6. Signet-ring stromal tumor

II. Sertoli stromal cell tumors
   A. Sertoli-Leydig cell tumors
      1. Well-differentiated
      2. Intermediate differentiation
         (a) With heterologous elements
      3. Poorly differentiated
         (a) With heterologous elements
      4. Retiform
         (a) With heterologous elements
   B. Sertoli cell tumor
   C. Stromal-Leydig cell tumor

III. Sex cord-stromal tumors of mixed or unclassified cell types
   A. Sex cord tumor with annular tubules.
   B. Sex cord tumor, not otherwise specified
   (unclassified)

IV. Steroid cell tumors
   A. Steroid cell tumor, not otherwise specified
   B. Stromal-luteinized tumor
   C. Leydig cell tumor
   1. Hilus cell tumor
   2. Leydig cell tumor (unclassified type)
**Adult granulosa cell tumor**

**Definition**
- Granulosa stromal cell tumor with at minimum a 10% component of granulosa cells, often in a fibrothecomatous background.

**Incidence and location**
- 2-3% of primary ovarian tumors
- >95% unilateral

**Morbidity and mortality**
- Propensity for late recurrences
- Association with endometrial neoplasia

**Age distribution**
- First to tenth decade, with a median age of approximately 50 years

**Gross findings**
- <1 to 30 (average 12) cm
- Predominantly solid or solid and cystic
- Rarely uni- or multilocular cyst
- Yellow-white cut surface
- Frequent areas of hemorrhage

**Microscopic findings**
- Proliferation of granulosa cells in a fibrothecomatous background
- Diffuse, trabecular, microfollicular (Call-Exner bodies), macrofollicular, insular, gyral, and watered-silk growth patterns
- Cells with scant cytoplasm and round to oval nuclei with a longitudinal groove
- Minimal cytologic atypia and low mitotic rate (typically <5-10 HPFs)
- Rarely:
  - Bizarre nuclei
  - Extensive luteinization (luteinized granulosa cell tumor)
  - Hepatic differentiation

**Histochemical and immunohistochemical features**
- Reticulin surrounds groups of cells
- Inhibin, calretinin, CD99, CD56, and vimentin positive
- Keratin (CAM 5.2, AE1/AE3), CD10, S-100, WT-1, smooth muscle actin, and desmin can be positive
- EMA and CK7 negative

**Differential diagnosis**
- Endometrial stromal sarcoma (primary/metastatic)
- Undifferentiated carcinoma/transitional cell carcinoma
- Endometrioid adenocarcinoma with sex cord-like differentiation
- Carcinoid tumor
- Thecoma
- Sex cord stromal tumor with annular tubules
- Metastatic breast carcinoma

**Histologic patterns of adult granulosa cell tumor.**
- (a) Trabecular or cord-like pattern.
- (b) Insular or nesting pattern.
- (c) Gland-like pattern.
Non epithelial and metastatic tumor of ovary

13 (a) GCT with microfollicular pattern and Call–Exner bodies.
(b) Disaggregated clusters of cohesive tumors cells.
(c) 'Watered silk pattern', characterized by branching 'rivulets' of tumor.

Granulosa cell tumor.
A. The tumor cells are arranged in sheets punctuated by small follicle-like structures (Call–Exner bodies).
B. Strong immunohistochemical positivity with an antibody to inhibin characterizes these tumors.

Female, 46-year-old, present with right ovarian tumor (S51–7312)

Female, 46-year-old, present with right ovarian tumor (S51–7312)
### Juvenile granulosa cell tumor

**Definition**
- Subtype of granulosa cell tumor almost always found during the first three decades of life, with histologic features that differ from the adult type and resemble the appearance of the granulosa cells of the developing follicle.

**Incidence and location**
- 10% of ovarian tumors in patients <20 years
- 5-15% of all granulosa cell tumors
- 98% unilateral

**Morbidity and mortality**
- High-stage tumors often fatal
- Most recurrences within 3 years of initial surgery

**Age distribution**
- 97% before 30 years (average 13 years)
- 40% in children <1 year
- 3% in adults > 30 years

**Clinical features**
- In prepubertal girls: typically isosexual pseudoprecocity
- In reproductive-age women: abdominal swelling, pain, pelvic mass, and menstrual irregularities
- Rare manifestations: hemoperitoneum secondary to rupture, androgenic manifestation, association with Maffucci syndrome or Ollier disease

**Prognosis and treatment**
- Stage strongest prognostic factor
- >90% survival rate for patients with stage Ia tumors
- Unilateral salpingo-oophorectomy for stage Ia tumors
- Debulking surgery and/or combination chemotherapy for advanced-stage and recurrent tumors
- Serum inhibin levels to monitor recurrences
**Juvenile granulosa cell tumor**

**Gross findings**
- 2.5-32 (mean 12.5) cm
- Solid and cystic most frequent
- Lobulated, gray-white to tan to yellow cut surface
- Occasional hemorrhage and necrosis

**Microscopic findings**
- Diffuse or nodular, and less frequently follicular architecture
- Nodules may be completely hyalinized
- Myxomatous to edematous background
- Irregularly shaped and variable-sized follicles with basophilic or eosinophilic fluid
- Call-Exner bodies rare
- Granulosa cells with moderate to abundant eosinophilic to vacuolate cytoplasm and round, hyperchromatic nuclei lacking grooves

**Immunohistochemical features**
- Inhibin and calretinin positive
- Keratin, WT-1, CD10, S-100, CD56, and smooth muscle actin frequently positive
- EMA focally positive in 25-50% of tumors, in contrast to other sex cord-stromal tumors

**Differential diagnosis**
- Adult granulosa cell tumor
- Thecoma
- Yolk sac tumor
- Small cell carcinoma of hypercalcemic type
- Clear cell carcinoma
- Metastatic and primary melanoma

**Female, 30-year-old, present with abdominal distension for one month ($49-3958)**
Thecoma

Definition
• Stromal tumor composed of lipid containing cells resembling theca cells with a variable fibromatous component.

Incidence and location
• Approximately one-third as common as granulosa cell tumors
• 95% unilateral.

Morbidity and mortality
• Association with endometrial neoplasia.

Gross findings
• Unilateral (except luteinized thecomas with sclerosing peritonitis).
• <1 to 15 cm; most between 5-10 cm.
• Solid and yellow to gray-white and sometimes lobulate cut surface.
• Occasional cystic change, focal calcification, hemorrhage, and necrosis.
• Extensive calcification in young women.

Microscopic findings
• Aggregates of oval to round cells alternating with spindled cells (conventional thecoma). 
  - groups of single lutein cells (luteinized thecoma).
• Theca cells with abundant pale to vacuolated cytoplasm and round to oval nuclei.
• Lutein cells with abundant eosinophilic cytoplasm and large round nuclei.
• Minimal cytologic atypia and rare mitotic figures.
• Hyaline plaques and, less frequently, calcification may be seen.
• Unusual features:
  1. Minor sex cord elements.
  2. Bizarre nuclei
  3. Fatty metaplasia.

Immunohistochemical features
• Inhibin, calretinin, CD10 and vimentin positive.
• EMA and cytokeratin negative.

Ultrastructural features
• Cells with abundant intracytoplasmic lipid, granular endoplasmic reticulum, and mitochondria with tubular cristae.
• Cells lack desmosome and basal lamina are separate by...
**Luteinized thecoma with sclerosing peritonitis**

**Definition**
- Densely cellular tumor composed predominantly of spindle cells admixed with less prominent small lutein cells (steroid hormone-producing cells) typically associated with sclerosing peritonitis.

**Incidence and location**
- Rare
- Typically bilateral but can be unilateral.

**Morbidity and mortality**
- Bowel obstruction and enterocutaneous fistulae secondary to sclerosing peritonitis.
- No recurrence or metastasis.
- Death secondary to surgical complications.

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**Fibroma**

**Definition**
- Benign fibromatous tumor of varying cellularity composed of spindle, oval, or round collagen producing cells.

**Incidence and location**
- <10% of primary ovarian tumors.
- Typically unilateral.
- If associated with Gorlin syndrome, more commonly bilateral.

**Morbidity and Mortality**
- Secondary torsion
- If cellular, may be associated with extraovarian adhesions
Non epithelial and metastatic tumor of ovary

**Fibroma**

**Gross findings**

- 1-21.5 (average 6) cm.
- Firm, white cut surfaces; may be lobulated.
- Soft, white to yellow cut surface if cellular.
- Pedunculated or polypoid growth in up to one fifth.
- Cystic change in approximately one-quarter.
- Hemorrhage and necrosis, particularly with torsion.
- Bilaterality, multinodularity, and calcification if associated with the basal cell nevus syndrome (Gorlin syndrome).

**Microscopic findings**

- Intersecting fascicles or storiform pattern of spindle cells.
- Variable degrees of collagen production with occasional hyaline plaques.

**Microscopic findings**

- Variants:
  1. Cellular (cellularity similar to adult granulosa cell tumor).
  2. Mitotically active (4-19 (mean 6.7) mitoses/10 HPFs).
- Other features:
  1. Sex cord-like differentiation (<10% of tumor)
  2. Intracytoplasmic hyaline droplets.
  3. Bizarre nuclei.
  4. Verocay-like areas.
  5. Prominent edema.

**Immunohistochemical features**

- Vimentin positive.
- Smooth muscle actin often positive; desmin and CD10 negative.
- Focal and weak positivity for calretinin and inhibin.

**Differential diagnosis**

- Conventional fibroma
  - Stromal hyperplasia.
  - Massive ovarian edema/fibromatosis.
  - Thecoma.
- Cellular mitotically active fibroma
  - Luteinized thecoma with sclerosing peritonitis.
  - Diffuse adult granulosa cell tumor.
Non epithelial and metastatic tumor of ovary

48  left ovarian tumor
Negative fat stain
(a) Cellular fibroma. (b) At higher power increased mitotic activity is present (lower middle).
**Sclerosing stromal tumor**

**Definition**
- Benign stromal tumor with cellular areas composed of fibroblasts and lutein cells separated by hypocellular edematous or collagenized areas imparting a pseudolobular appearance.

**Incidence and location**
- 2-6% of ovarian stromal tumors
- <1% of all primary ovarian tumors
- Unilateral

**Morbidity and mortality**
- Rare torsion

**Age distribution**
- 80% of women < 30 years of age

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**Gross findings**
- 1.5-20 cm
- Well-defined border with normal ovarian tissue
- White to yellow and solid, or solid with multiple cystic spaces
- Occasionally large central cyst

---

**Microscopic findings**
- Pseudolobular architecture
- Cellular nodules alternating with hypocellular edematous or collagenized areas.
- Numerous thin-walled vessels, some branched and dilated (hemangiopericytoma-like vascular network)
- Cellular areas with heterogeneous admixture of spindle and round cells
- Round cells with vacuolated to eosinophilic cytoplasm and round nuclei with vascular chromatin and prominent nucleoli
- Minimal cytologic atypia and low mitotic rate

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**Immunohistochemical features**
- Calretinin, ER, PR, vimentin and smooth muscle actin positive
- Variable inhibin and desmin expression
- Keratin and EMA negative

---

**Differential diagnosis**
- Fibroma
- Luteinized thecoma
- Krukenberg tumor
- Carcinoid tumor
Non epithelial and metastatic tumor of ovary

Positive Desmin

Positive Alpha-inhibin

Positive MiB

Positive Smooth muscle actin
Non epithelial and metastatic tumor of ovary

**Sclerosing stromal tumor**

- Negative
  - Calretinin
  - CD34
  - S-100
  - CD117
  - CD10
  - AE1AE3

**Sertoli-Leydig cell tumor**

**Definition**
- Tumors composed of Sertoli cells showing varying degrees of differentiation admixed with variable numbers of Leydig cells

**Incidence and location**
- 1% of ovarian neoplasms
- Most common neoplasm in the category of Sertoli stromal cell tumors
- Most unilateral

**Morbidity and mortality**
- Approximately 12% clinical malignant

**Age distribution**
- Average age 25 years
- Well-differentiated, older age at presentation (average 35 years)
- Retiform variant, younger age at presentation (average 15 years)

**Gross findings**
- 15 cm average size
- Solid, lobulated, yellow cut surface
- Retiform variant and those with heterologous elements more commonly soft and “spongy” or cystic with intracystic papillae and polypoid excrescences

**Microscopic findings**
- Well differentiated
  - Lobules separated by fibromatous tissue
  - Lobules composed of solid or hollow tubules
  - Tubules may resemble endometrioid-type glands
  - Sertoli cells with abundant eosinophilic or pale and vacuolated cytoplasm and round nuclei with small nucleoli
  - Minimal cytologic atypia and absent mitotic activity
  - Leydig cells in between lobules

- Intermediate differentiated
  - Cellular “blue” lobules separated by hypocellular edematous stroma
  - Lobules composed of Sertoli cells with diffuse or tubular (poorly developed), nested or cord-like arrangements
  - Microcystic pattern reminiscent of thyroid tissue
  - Immature Sertoli cells with scant cytoplasm and small round to oval nuclei
  - Leydig cells either admixed with Sertoli cells or peripherally located
**Sertoli-Leydig cell tumor**

**Microscopic findings**

- **Poorly differentiated**
  - Diffuse or sarcomatoid growth of poorly differentiated Sertoli cells
  - Rarely, small areas of poorly formed tubules
  - Sparse to absent Leydig cells

**Immunohistochemical features**

- **Sertoli cells**
  - Vimentin, cytokeratin, inhibin, calretinin and CD56 positive
  - CD99, WT-1, CD10, smooth muscle actin variably positive
  - EMA negative

- **Leydig cells**
  - Vimentin, inhibin, and calretinin positive
  - Melan A, CD10 frequently positive
  - Keratin and smooth muscle actin rarely positive

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(a) Gross appearance of a well-differentiated Sertoli–Leydig cell tumor, typically well circumscribed and yellow in appearance. (b) This Sertoli–Leydig tumor has a red-brown appearance with a homogeneous consistency.

(b) Lipid-rich Sertoli cell tumor.

Intermediate differentiation in an SLCT. Leydig cells are visible amongst tubular or cord-like arrangements of Sertoli cells.

Well-differentiated Sertoli–Leydig cell tumor (SLCT). (a) The Sertoli component is composed of well-defined tubules, separated by small sheets of interspersed Leydig cells. (b) Lipid-rich Sertoli cell tumor.

Poorly-differentiated SLCT. Sertoli cell differentiation is minimal and admixed with a few clusters of recognizable Leydig cells.
Sertoli cell tumor

**Definition**
- Ovarian tumor characterized by a proliferation of hollow or solid tubules composed of Sertoli cells, which may simulate prepubertal testicular tubules of the adult testis; Leydig cells must be absent

**Incidence and location**
- ~4% of Sertoli-stromal cell tumors
- Unilateral

**Morbidity and mortality**
- If associated with Peutz-Jeghers syndrome, risk of other tumors

**Age distribution**
- Reproductive-aged women (mean 30 years)

**Sertoli cell tumor**

**Gross findings**
- Typically unilateral
- Average 9 (4-12) cm
- Solid, lobulated yellow or less frequently, brown, tan or white cut surface

**Microscopic findings**
- Well demarcated from surrounding ovarian parenchyma
- Tubular, cord-like, trabecular, and diffuse patterns
- Tubular growth most common; either solid, hollow, endometrioid-like, or anastomosing
- Tubules lined by bland cuboidal to columnar cells
- Cells with moderate pink or pale vacuolated cytoplasm and round to oval nuclei
- Lipid-rich variant: cells with abundant foamy cytoplasm (folliculome lipidique)
- Oxyphilic variant: cells with abundant and deeply eosinophilic cytoplasm
- Mild cytologic atypia and <4 mitoses/10 HPFs in most tumors
- Variable amounts of stroma may impart a nodular appearance

**Immunohistochemical features**
- Vimentin, keratin (AE1/AE3-Cam 5.2), and inhibin positive
- Calretinin, CD99, CD56, CD10 and WT-1 frequently positive
- Smooth muscle actin, NSE, and S-100 may be positive

**Differential diagnosis**
- Endometrioid carcinoma with sex cord-like differentiation
- Female adnexal tumor of probable wolffian origin
- Well-differentiated Sertoli-Leydig cell tumor
- Carcinoid
- Tubular Krukenberg tumor

Sertoli cell tumor
**Sex cord tumor with annular tubules**

**Definition**
- Sex cord tumor characterized by simple and complex ring-like tubules

**Incidence and location**
- In Peutz-Jeghers syndrome (PJS)
  - Very common
  - Bilateral in two-thirds
  - Without PJS
  - Rare
  - 95% unilateral

**Gross findings**
- In patients with Peutz-Jeghers syndrome (PJS)
  - Incidental finding
  - Multiple and bilateral small ≤ 3 cm yellow nodules
- In patients without PJS
  - 0.5-33 cm
  - Solid yellow cut surface
  - Cystic change, hemorrhage, or necrosis

**Microscopic findings**
- Simple tubules or complex patterns with multiple anastomosing tubules
- Tubules surround central hyaline material, with nuclei oriented both peripherally and centrally, leaving an intervening pale anuclear zone
- In PJS, multiple tumorlets with scattered simple tubules or clusters of tubules associated with calcifications
- Nuclear pleomorphism and ≥ 10 mitoses/10 HPFs in malignant tumors
- Foci of typical Sertoli cell tumor or microfollicular granulosa cell tumor in some cases

**Immunohistochemical features**
- Inhibin and calretinin positive

**Differential diagnosis**
- Gonadoblastoma
- Sertoli cell tumor
- Granulosa cell tumor

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**Sex cord tumor with annular tubules**

**Gross findings**
- In patients with Peutz-Jeghers syndrome (PJS)
  - Incidental finding
  - Multiple and bilateral small ≤ 3 cm yellow nodules
- In patients without PJS
  - 0.5-33 cm
  - Solid yellow cut surface
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**Microscopic findings**
- In PJS, multiple tumorlets with scattered simple tubules or clusters of tubules associated with calcifications
- Nuclear pleomorphism and ≥ 10 mitoses/10 HPFs in malignant tumors
- Foci of typical Sertoli cell tumor or microfollicular granulosa cell tumor in some cases

**Immunohistochemical features**
- Inhibin and calretinin positive

**Differential diagnosis**
- Gonadoblastoma
- Sertoli cell tumor
- Granulosa cell tumor

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**Immunohistochemical features**
- Inhibin and calretinin positive

**Differential diagnosis**
- Gonadoblastoma
- Sertoli cell tumor
- Granulosa cell tumor

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**Immunohistochemical features**
- Inhibin and calretinin positive

**Differential diagnosis**
- Gonadoblastoma
- Sertoli cell tumor
- Granulosa cell tumor
Non epithelial and metastatic tumor of ovary

Sex cord tumor with annular tubules
**Dysgerminoma**

**Definition**
- Malignant germ cell tumor resembling primodial germ cells, morphologically identical to seminoma and extragonadal germinoma

**Incidence**
- Most common malignant ovarian germ cell tumor (50% of all malignant germ cell tumors)
- 1% of all malignant ovarian tumors

**Age distribution**
- More common in 2nd and 3rd decades (median age 22 years)
- 10-20% diagnosed during pregnancy

**Gross findings**
- Solid tumor of variable size (median 15 cm)
- Homogenous, lobulated rubbery white to tan cut surface
- 10-15% grossly bilateral and additional bilateral involvement on microscopic examination
Non epithelial and metastatic tumor of ovary

**Dysgerminoma**

**Microscopic findings**
- Typically sheets and nests, and less commonly, trabeculae and cords
- Monotonous cells with large, polygonal, clear to eosinophilic granular cytoplasm and distinct cytoplasmic borders
- Large, round, central to slightly eccentric nuclei with a slightly squared-off contour, coarse chromatin, and prominent nucleoli
- Brisk mitotic activity

**Immunohistochemical features**
- Abundant PAS positive intracytoplasmic glycogen
- Placental alkaline phosphatase, OCT4, and c-kit (CD117) positive
- Scattered cytokeratin positivity in up to 30%

**Differential diagnosis**
- Yolk sac tumor with solid pattern
- Embryonal carcinoma with solid pattern
- Large cell lymphoma
- Clear cell carcinoma with diffuse pattern
- Sertoli cell tumor

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**8-year-old, unilateral ovarian tumor**

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**20-year-old, unilateral ovarian tumor**

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**20-year-old, unilateral ovarian tumor**
20-year-old, unilateral ovarian tumor

Non epithelial and metastatic tumor of ovary

YOLK SAC TUMOR
Schiller–Duval body, consisting of a central vessel surrounded by primitive cells within a second ill-defined space.

Yolk sac tumor. Scant tumor cells in a myxoid background.

Yolk sac tumor. Attenuated cystic spaces characterize the polyvesicular-vitelline pattern.
YOLK SAC TUMOR

YOLK SAC TUMOR

YOLK SAC TUMOR

YOLK SAC TUMOR
**YOLK SAC TUMOR**

**Non epithelial and metastatic tumor of ovary**

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**Embryonal carcinoma**

**Definition**
- Primitive germ cell tumor morphologically identical to its counterpart in the testis, capable of somatic and extraembryonic differentiation

**Incidence**
- 3% of malignant germ cell tumors

**Age distribution**
- Young female, 50% prepubertal (median age 12 years)

**Clinical features**
- Abdominal or pelvic mass
- Frequent endocrine manifestation secondary to elevated levels of β-HCG
- AFP within normal limits or slightly elevated

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**Gross findings**
- Unilateral, large (average 17 cm) mass
- Solid, white to gray cut surface with areas of hemorrhage and necrosis
**Embryonal carcinoma**

**Microscopic findings**
- Typically solid, sheets or nests
- More differentiated tumors have gland-like spaces and papillary structures
- Very pleomorphic medium to large-size cells with eosinophilic cytoplasm and centrally placed hyperchromatic or vesicular nuclei with prominent nucleoli
- Brisk mitotic activity with atypical mitoses
- Commonly single-cell necrosis (impacting a “dirty” background)
- Syncytiotrophoblast cells present

**Immunohistochemical features**
- PLAP, OCT4, CD30, and cytokeratin positive
- May be positive for c-kit and AFP
- EMA, CEA, and vimentin negative

**Differential diagnosis**
- Dysgerminoma with solid pattern
- Yolk sac tumor with solid pattern
- Poorly differentiated carcinoma

**Polyembryoma**

**Primitive germ cells forming epithelial-lined structures.**

**Syncytial cells in embryonal carcinoma (top).**
Choriocarcinoma

Incidence
-Only 1% of malignant germ cell tumor

Age distribution
-Typically <20 years

Clinical features
- Rapidly growing abdominal or pelvic mass
- Frequent endocrine manifestations secondary to elevate β-HCG
- Hemoperitoneum secondary to extensive hemorrhage into the tumor
- High frequency to distant metastases, particularly in lungs and brain
- Rapid fatal if not treat

Gross findings
- Large, hemorrhagic mass

Microscopic findings
- Syncytiotrophoblast growing over nests or sheets of cytotrophoblast in a plexiform pattern
- Syncytiotrophoblast cells have dense eosinophilic to basophilic cytoplasm with clusters of hyperchromatic or vesicular nuclei with smudged chromatin
- Cytotrophoblast cells are round to polygonal with clear to amphophilic to eosinophilic cytoplasm and one or two nuclei, and conspicuous nucleoli
- Intermediate trophoblast cells are large round to polygonal cells with amphophilic to eosinophilic cytoplasm and one or two nuclei
- Brisk mitotic activity in the cytotrophoblast
- Extensive hemorrhage and necrosis
- Vascular invasion is common
- Absent chorionic villi

Immunohistochemical features
- Cytokeratin positive in all three cell types
- β-HCG and inhibin positive in syncytiotrophoblast
- HPL and inhibin positive in intermediate trophoblast
- PLAP positivity in 50% of choriocarcinomas

Differential diagnosis
- Gestational choriocarcinoma
- Other malignant germ cell tumors with abundant syncytiotrophoblast cells

9 year with precocious puberty

Left ovary - Non gestational choriocarcinoma and embryonal cell carcinoma

Right ovary - Theca lutein cyst

Left ovary - Non gestational choriocarcinoma and embryonal cell carcinoma

B51-5631-E-40x-left ovary
Grading of ovarian immature teratomas

**Three-tiered grading system (2060)**

**Grade 1**
Tumors with rare foci of immature neuroepithelial tissue that occupy less than one low power field (40x) in any slide.

**Grade 2**
Tumors with similar elements, occupying 1 to 3 low power fields (40x) in any slide.

**Grade 3**
Tumors with large amount of immature neuroepithelial tissue occupying more than 3 low power fields (40x) in any slide.

Management of immature teratomas according to grade of primary tumors and/or implants

<table>
<thead>
<tr>
<th>Three-tiered grading</th>
<th>Two-tiered grading</th>
<th>Stage</th>
<th>Combination chemotherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1 ovarian tumor</td>
<td>Low grade</td>
<td>Ia</td>
<td>Not required</td>
</tr>
<tr>
<td>Grade 2 or 3 ovarian tumor</td>
<td>High grade</td>
<td>Ia</td>
<td>Required</td>
</tr>
<tr>
<td>Grade 2 or 3 implants</td>
<td>Grade 0 implants* regardless of ovarian tumor grade</td>
<td>≥II</td>
<td>Required</td>
</tr>
</tbody>
</table>

*Those extratransitional implants that are composed of mature tissue, essentially glia.
Non epithelial and metastatic tumor of ovary

20–year, huge unilateral ovarian tumor (33x29x16cm)
Female, 57-year-old, Left ovarian polycystic mass, 18x10cm.
Female, 57-year-old, Left ovarian polycystic mass, 18x10cm.

Diagnosis

Struma ovarii

Female, 57 year-old with pelvic mass, S51-4289
Female, 57 year-old with pelvic mass, S51-4289

Diagnosis
Teratoma with malignant transformation
(squamous cell carcinoma)

Tumors and related lesions of the rete ovarii

- Rete ovarii adenocarcinoma
- Rete ovarii adenoma

Mixed germ cell-sex cord-stromal tumor of ovary

Gonadoblastoma

Miscellaneous tumor and tumor-like conditions of the ovary

- Small cell carcinoma
- Large cell neuroendocrine carcinoma
- Adenoid cystic carcinoma
- Basal cell carcinoma
- Hepatoid carcinoma
- Malignant mesothelioma
- Gestational choriocarcinoma
- Hydatidiform mole
- Ovarian wolffian tumor
- Wilms tumor
- Paraganglioma
- Myxoma
Lymphomas and leukaemias

Malignant lymphoma
Leukemia
Plasmacytoma

Metastatic tumors to the ovary

Clues to the diagnosis
1. Bilaterally (mucinous and endometrioid-like).
2. Small, superficial, multinodular tumors.
4. Desmoplastic reaction.
5. Extensive, unusual extraovarian spread.
6. Unusual clinical history.

The Distinction Between Primary and Metastatic Mucinous Carcinomas of the Ovary
Gross and Histologic Findings in 50 Cases

Findings that were frequent and strongly favored a metastasis were:
1) bilaterality.
2) microscopic surface involvement by epithelial cells (surface implants).
3) an infiltrative pattern of stromal invasion.

Findings that were less frequent but present exclusively or almost exclusively in metastatic carcinomas were:
1. a nodular invasive pattern.
2. ovarian hilar involvement.
3. single cell invasion.
4. signet ring cells.
5. vascular invasion.
6. microscopic surface mucin.
Distinction of primary and metastatic mucinous tumors involving the ovary: Analysis of size and laterality data by primary site with reevaluation of an algorithm for tumor classification

Am J Surg Pathol volume 32, Number 1, January 2008

52 primary and 142 metastases

• Correct classified 84% of tumors overall (100% of primary and 77% of all metastases)

Distinction of primary and metastatic mucinous tumors involving the ovary: Analysis of size and laterality data by primary site with reevaluation of an algorithm for tumor classification

Am J Surg Pathol volume 32, Number 1, January 2008

52 primary and 142 metastases

• Correct classified 86% of tumors overall (100% of primary and 80% of all metastases)
Non epithelial and metastatic tumor of ovary
Non epithelial and metastatic tumor of ovary

Positive CK7 and CK20

Metastases from stomach

Metastases from stomach-positive CK7

Metastases from stomach-negative CK20
• Fat stains are negative.
• Positive results in S-100, vimentin and HMB-45.
• Focal positive results in CD-68, PLAP, CD-117, AE1/AE3, and inhibin.
• Negative results in tyrosinase, EMA, LMW, HMW, estrogen and progesterone receptor.