Pediatric Pelvic Masses

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Objectives

• Review normal anatomy
• Discuss causes and imaging features of common pelvic masses
• Correlate with pathologic findings

"To recognize the abnormal, one must first know the normal”

J. Caffey

Normal Maturation: Growth
**Ovarian Maturation: Morphology**

- Prepubertal ovary
  - Homogeneous or heterogeneous due to presence of primordial follicles (< 1cm)
- Pubertal ovary
  - Usually heterogeneous
    - Reflects presence of primordial follicles & functional follicles (1-3 cm)

**Normal Maturation**

- 10 follicles stimulated each cycle
- 1 becomes dominant
- Grows to 15 to 30 mm

**Ovarian Morphology: Key Point**

- Presence of cysts is normal in infants & children
- Represent follicles
- Do not confuse for pathology
- Ovarian cysts should be considered normal follicles unless mean diameter is >1 cm in prepubertal girls or >3.0 cm in pubertal girls

**Normal Prepubertal Ovary: US**
Normal Pubertal Ovary: US

Size is distinguishing feature

Doppler US

Normal Ovary: CT and MR

Prepubertal

Adolescent

Uterine Morphology: Maturation

- Prepubertal uterus
  - tubular shape
  - fundus = cervix
  - endometrial canal seen in neonates
  - not in infants and children
- Pubertal uterus
  - fundus > cervix
  - endometrial canal again seen
Pelvic Mass Lesions

- Anterior Pelvis
  - Ovarian
  - Bladder and lower genital tract
- Posterior Pelvis (Presacral)
  - Neurogenic tumors
  - Teratomas

Ovarian Masses

- Cystic
  - Follicular cysts
  - Paraovarian cysts
  - Cystic teratoma
  - Cystadenoma
- Solid
  - Malignant germ cell tumors
  - Sex cord-stromal tumors
Ovarian Tumors
First Key Point

- Epithelial tumors are extremely rare in the 1st two decades
  - Put them low on the list
- THINK SIMPLE CYSTS, GERM CELL TUMORS, OR STROMAL TUMORS

Follicular Cysts

- Occurs when follicle fails to rupture or involute
- Uncomplicated cyst:
  - homogeneous
  - unilocular
  - thin-walled
  - 3 to 8 cm
  - adnexal location
  - usually regresses if < 5 cm

Functional Ovarian Cyst: US/CT

- Intraovarian or exophytic
- Imperceptible or thin wall

Functional Ovarian Cyst CT/MR

- Findings are those of a simple cyst
Complicated (Hemorrhagic) Ovarian Cysts

- Corpus luteum
- Complex on US/CT

Functional Cysts

More Points

- Most regress within 2 cycles
- If the cyst remains for > 3 cycles, likely not functional
  - Suspect paraovarian cyst or neoplasm
- >3 and ≤5 cm, do not need follow up
- Cysts > 5 cm should be followed
  - More likely not to involute, may not be a cyst

DDX: Follicular Cysts

- Paraovarian cysts
- Mature teratoma
- Cystadenoma

Paraovarian cysts

- Located in broad ligament or fallopian tube
- Average size: 8 cm
- Imaging:
  - Simple cyst adjacent to and separate from ovary
- Adnexal location
- No cyclic changes
- Do not regress
Paraovarian Cysts (Fallopian Tube)

Suspect paraovarian cyst when a cystic lesion is separate or adjacent to the ovary.

Paraovarian Cyst

Cystic Ovarian Teratoma

- Most common ovarian neoplasm
  - 95% of tumors
- 90% benign
- 75% asymptomatic
  - 25% pain due to torsion
- Bilateral 8% to 15%
- Usually adolescent girls

Cystic Teratoma: Path & Imaging

- Large, mean size 15 cm
- Cystic mass
  - Sebaceous material
- Has peripheral nodule containing foci of fat, Ca++, bone, or teeth
Cystic Ovarian Teratoma: US

Tip of iceberg

Multiple Benign Teratomas: CT

Ex: Mature Teratoma: MRI

T1W and FS-T1 images: bilateral fat containing masses. Fat suppress except for the Rokitansky mural nodule

Teratoma
15 yo girl with abdominal distention
Ovarian Cystadenoma
- Epithelial tumor
- < 5% neoplasms, benign
- Mucinous >> serous
- 4 to 20 cm diameter

Mucinous Cystadenoma
- Contains gelatin-like contents
- Large
- Cystic, thin-walled
- Usually multilocular

Serous Cystadenoma
- Contains watery contents
- Large
- Cystic, thin-walled
- Usually unilocular
- May have papillary projections

DDX: Cystic Abdominal/Pelvic Masses
- Ovarian tumors
  - Teratoma
  - Cystadenoma
- CSF pseudocyst
- Lymphangioma
  (mesenteric cyst)
Lymphangioma (Mesenteric Cysts)
- Malformation of the lymphatic system
- Most common in small bowel mesentery, but may arise in the omentum, mesocolon & retroperitoneum

Ovarian Malignancies
- Germ cell tumors (85%)
- Stromal tumors (15%)
- Epithelial tumors

Malignant Germ Cell Tumors
- 10% of germ cell tumors
- Affect pubertal girls
- Common tumors
  - Dysgerminoma
  - Malignant teratoma
  - Endodermal sinus tumor (yolk sac)
  - Embryonal cancer

Malignant Germ Cell Neoplasms: Path and Imaging
- Large, mean 15 cm
- Solid or complex
  - > 50% soft tissue
- Thick, irregular walls
- Mets to lymph nodes, liver
  - (rarely to peritoneum)
Dysgerminoma: US/CT

Malignant Teratoma

Clue: Predominantly Solid Mass

Endodermal Sinus Tumor (Yolk Sac Cancer)

Sex Cord-Stromal Tumors (15%)

- Prepubertal girls
- Granulosa theca cell & Sertoli-Leydig
- Hormonally active
  - Estrogens (Granulosa-Theca)
  - Androgens (Sertoli-Leydig)
- Many are low-grade malignancies
  - Spread to peritoneum and liver
Sex Cord-Stromal Tumors

- Both tumors are predominantly solid with varying size areas of necrosis and hemorrhage
- US/CT/MRI: Heterogeneous mass

Granulosa-theca cell

Sertoli-Leydig tumor

Granulosa-theca Cell Tumor

5 yo girl with breast development & vaginal bleeding

Granulosa-theca Cell Tumor

5 yo girl with precocious puberty

Sertoli-Leydig cell tumor

6 yo girl with virilization
Ovarian Cancer

- Rare lesion in pediatric population
- Epithelial origin
- Imaging
  - Solid mass
  - Often necrotic
  - Smaller in size than germ cell tumors
  - Spreads to mesentery and omentum

Which Ovarian Tumor?

- Cystic with mural nodules?
  - Teratoma
- Cystic with septations?
  - Cystadenoma
- Solid with cystic elements?
  - Malignant germ cell tumors, stromal tumors
- Older age (pubertal)?
  - Germ cell tumors, Cystadenoma
- Younger age?
  - Stromal tumors
**Uterine Masses**

- Cystic
  - hydrocolpos
- Solid
  - rhabdomyosarcoma

**Hydrocolpos**

- Vaginal obstruction
  - due to stenosis or membrane
- Result is pelvic/abdominal mass
- Imaging
  - Fluid-filled midline mass
  - Internal debris or blood
  - (hemato- or hematometrocolpos)

**Hydrocolpos—Hematocolpos**

**Hydrocolpos: CT & MRI**
Rhabdomyosarcoma

- Most common pelvic tumor
- Bimodal age distribution:
  - 2 to 6 and 14 to 16 years
- Embryonal cell type

Rhabdomyosarcoma: Female Pelvis

- Arises in vagina/cervix
- Vaginal bleeding
- Imaging findings
  - soft tissue mass
  - enlarged pelvic nodes
- Mets to liver, lung, node and bone

Vaginal Rhabdomyosarcoma

- 16 yo girl with menorrhagia
Vaginal Rhabdomyosarcoma

Rhabdomyosarcoma: Bladder & Prostate
- Bladder
  - Trigone or bladder base
  - Polypoid mass
- Prostate gland
  - Solid mass
  - Deforms base of bladder

Prostatic Rhabdomyosarcoma

Prostatic Rhabdomyosarcoma

T1 WT

T2 WT

Gd
Bladder Rhabdomyosarcoma

Which Lower Genital Tract Tumor?
- YOU DON'T NEED CLUES
  Rhabdomyosarcoma
- Solid, infiltrative?
  Rhabdomyosarcoma

Presacral Masses
- Cystic
  - benign teratoma
  - meningocele
- Solid
  - malignant teratoma
  - neuroblastoma

Sacrococcygeal Teratoma
- CA++: 60%
- Malignant: 10% newborn
  90% > 2 months
- Location:
  45% external
  45% external & internal
  10% presacral
- Bony defect: very low frequency
- Arise from coccyx
- Do not invade spinal canal
Benign Sacrococcygeal Teratoma: Imaging

- Contain predominantly fluid or fat
  - sometimes Ca++
  - may have septa
- Fed by sacrococcygeal and iliac arteries
**Anterior Meningocele**

- Herniation of spinal contents through a congenital defect in a vertebral body
- Scimitar shaped sacrum
- CT/MR
  - absent sacral elements
  - +/- tethered cord
  - meningocele communicates with subarachnoid space

**Malignant Presacral Masses**

- Cystic
  - benign teratoma
  - meningocele
- Solid
  - malignant teratoma
  - neuroblastoma

**Malignant SC Teratoma**

- 13-year old girl, constipation
- Solid tumor
Malignant SC Teratoma

Neuroblastoma

Which Presacral Tumor?

- Cystic Mass, normal spine?
  Teratoma
- Cystic mass, abnormal spine?
  Anterior meningocele
- Solid with normal spine
  Malignant teratoma
- Solid with spinal canal invasion
  Neuroblastoma
Top 10 Pelvic Lesions
What you really need to know

- Functional ovarian cyst
- Cystic teratoma
- Cystadenoma
- Malignant germ cell tumors
- Sex cord stromal tumors
- Hydrocolpos
- Rhabdomyosarcoma
- Sacrococcygeal teratoma
- Anterior meninogoecele
- Presacral neuroblastoma

Lateral Pelvic Masses

- Adenopathy & neurofibroma
- Usually don’t present as large palpable mass
- Seen during surveillance imaging

Thanks for your attention