An Ultrasound Review of PELVIC PATHOLOGY

Judi M Bender MD January 20, 2016

Pathology to be covered

- Uterus
- Cervix
- Ovary
- Adnexa
- Appendicitis
- Interesting Cases

Pathology not covered

- Pelvic pathology related to pregnancy, congenital or childhood abnormalities or normal variants
- Pelvic pathology related to non gynecological problems
- Limited review of normal anatomy

Myometrial Pathology

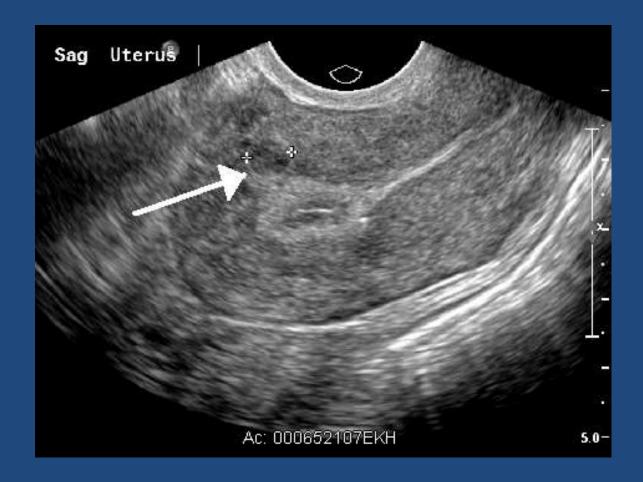
- Leiomyoma
- Lipoleiomyoma
- Leiomyosarcoma
- Adenomyosis
- Arteriovenous Malformations

Leiomyomas (Fibroids)

- Most common uterine neoplasm seen in up to 30% of woman over 30
- More often seen in Afro-Americans
- Usually multiple
- Often asymptomatic but may present with pain/ uterine bleeding
- Composed of spindle shaped muscle cells and fibrous connective tissue

- Estrogen dependent and may increase in size in anovulatory cycles, during pregnancy, with Tamoxifen and in post menopausal woman on hormone replacement.
- Most stabilize or decrease in size after menopause

- Location
- Intramural
- Submucosal
- Subserosal
- •
- Appearance
- Enlarged heterogenic uterus
- Hypoechoic/heterogenic lesion
- Acoustic attenuation
- Focal calcifications/ calcified rim
- Degeneration/necrosis



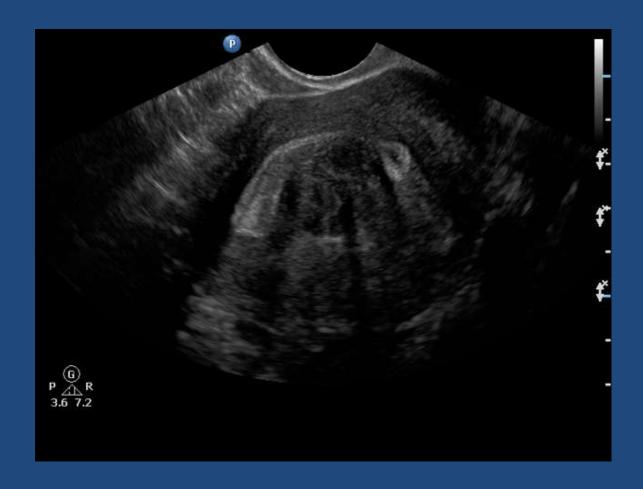
Intramural Fibroid

Confined to myometrium



Submucosal Fibroid

Projecting into the endometrial cavity

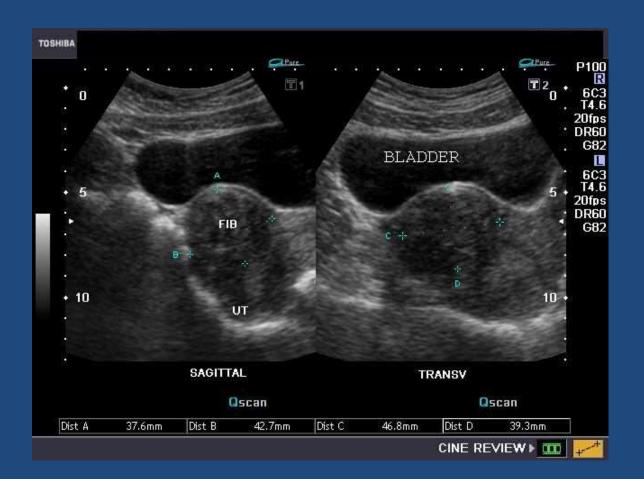


Submucosal Fibroid



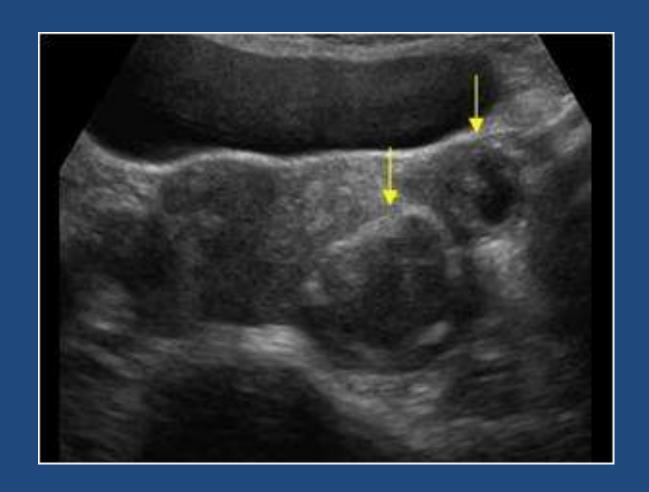
Subserosal fibroid

Projecting from the peritoneal surface

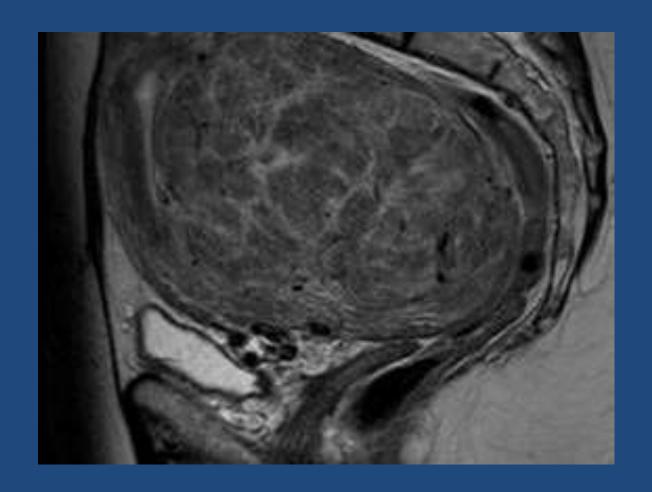




Pedunculated Fibroid



Enlarged diffuse leiomyomatous





Fibroid with acoustic attentuation



Calcified fibroid



Calcified fibroid



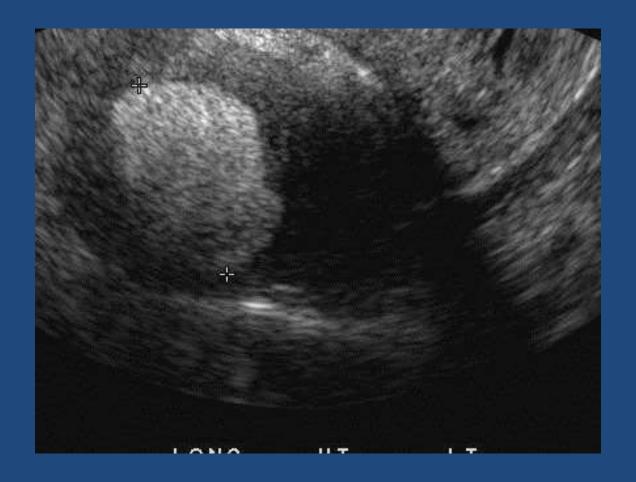
Calcified fibroids on plain films



Degenerating Fibroid

Lipoleiomyomas

- Very rare benign tumors
- Consist of variable amounts of lipocytes, smooth muscle and/or fibrous tissues
- Appears as echogenic, attenuating mass with no flow on color Doppler
- Usually asymptomatic and do not require surgical removal



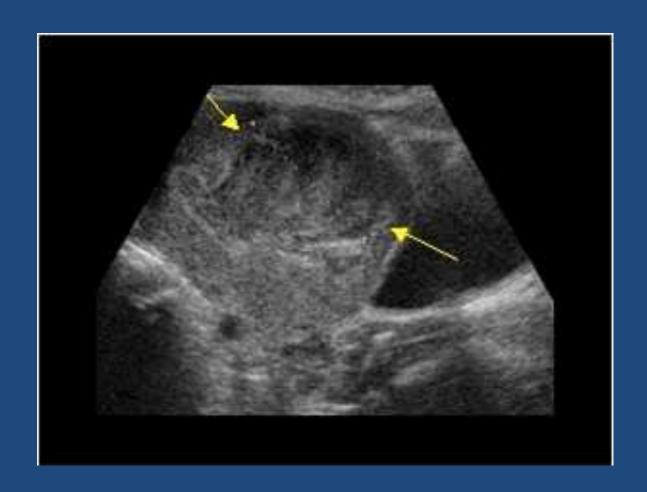
Lipoleiomyoma

Leiomyosarcomas

- Very rare malignancy which accounts for less than 2% of uterine cancers
- It may arise from a preexisting leiomyoma
- Frequently asymptomatic; uterine bleeding may occur
- Has the ultrasound appearance of a rapidly growing or degenerating leiomyoma with local invasion or distant metastases

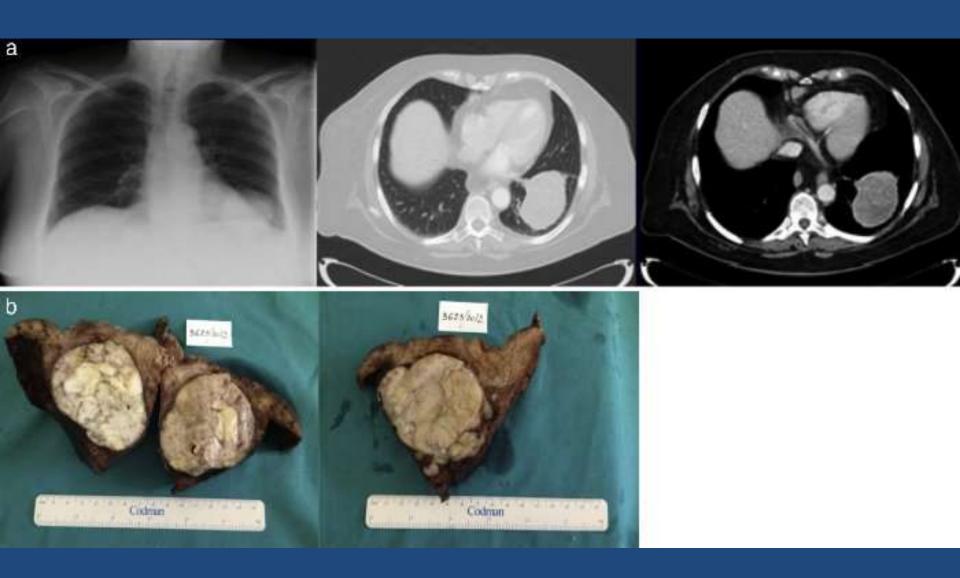


Leiomyosarcoma





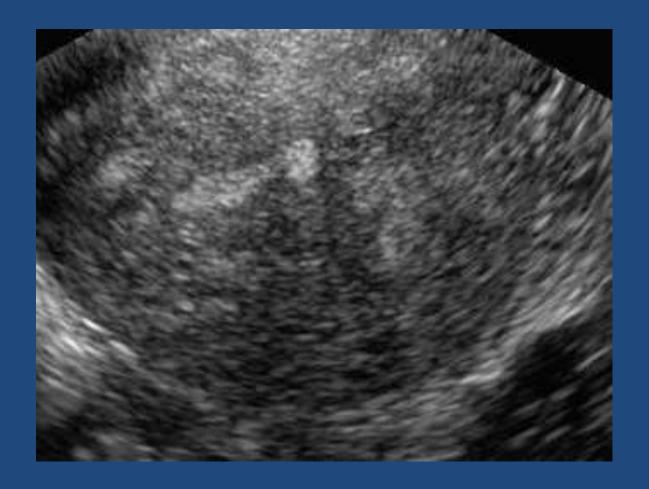
CT of a leiomyosarcoma



Adenomyosis

- The presence of endometrial glands and stroma within the myometrium
- Diffuse form characterized by an enlarged uterus with a diffusely heterogenic myometrium
- Nodular form compose of nodules (adenomyomas)
- May present with pelvic pain, dysmenorrhea or menorrhagia

- Asymmetrically thickened myometrium
- Subendometrial cysts, echogenic linear striations or echogenic nodules
- Ill defined endometrial border

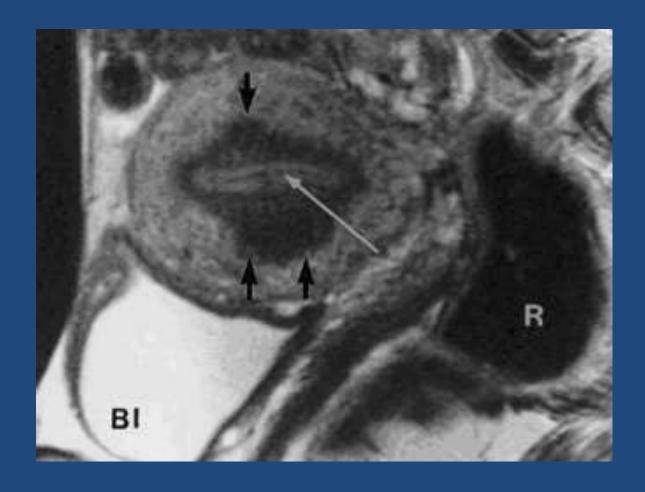


Adenomyosis

Echogenic nodule



Subendometrial cysts with indistinct endometrium

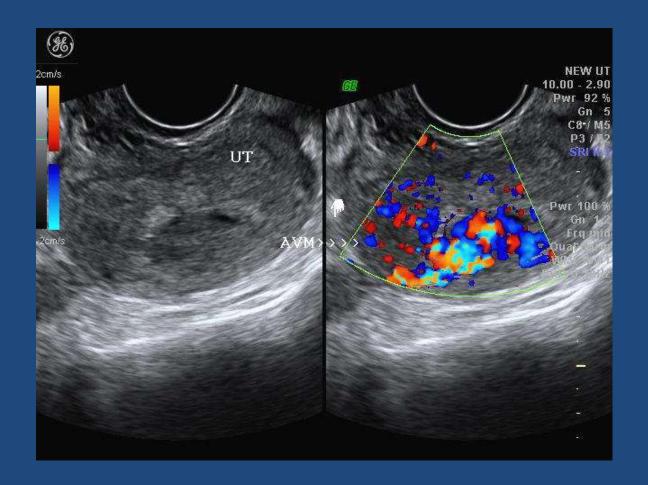


MRI of AdenomyosisFocal thickening of myometrial junction zone

Uterine Arteriovenous Malformations

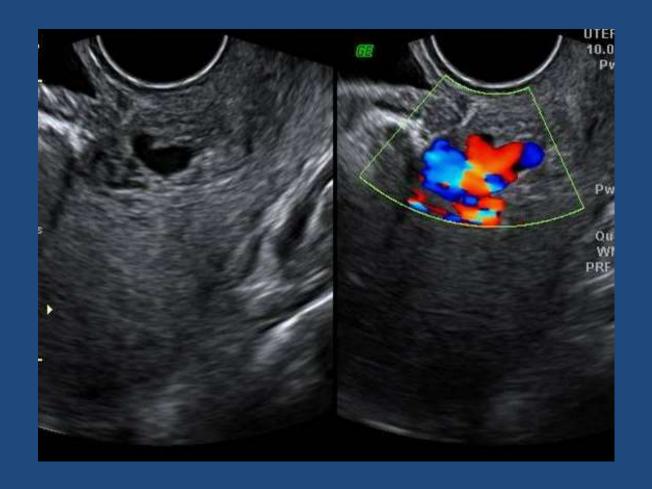
- Consist of a vascular plexus of arteries and veins with no intervening capillaries
- Rare lesions seen in the myometrium and occasionally in the endometrium
- Most are acquired secondary to trauma, surgery or gestational trophoblastic neoplasm

- Greyscale images may be nonspecific or may show multiple serpiginous, anechoic structures
- Color Doppler shows abundant blood flow in the AVM
- Spectral Doppler shows high velocity low-resistence arterial flow with high velocity venous flow





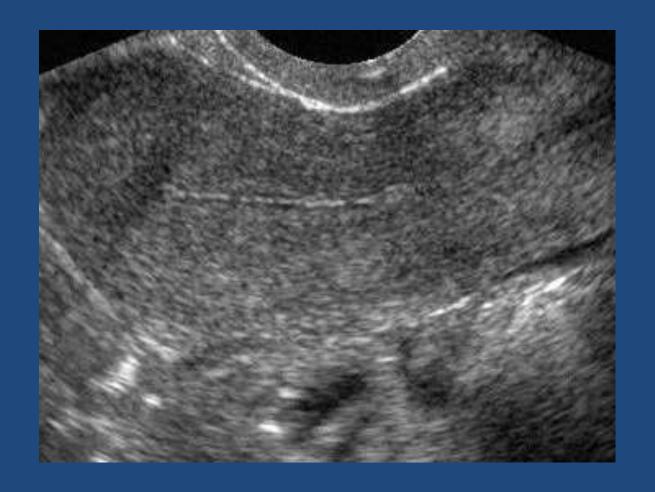
Multiple serpiginous anechoic structures



AVM in Cesarean scar

Endometrial Appearance

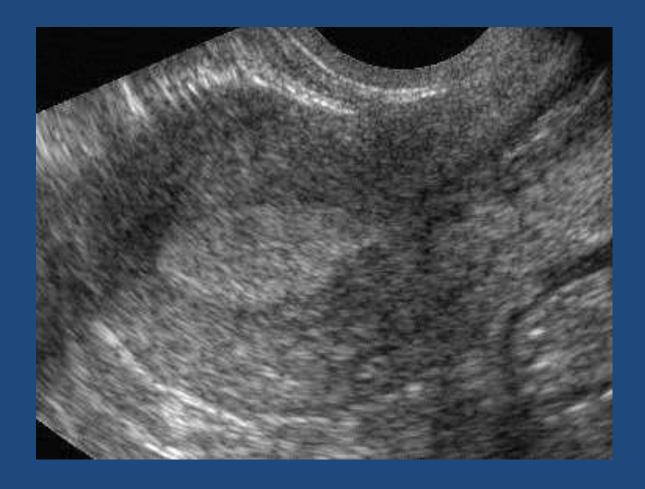
- Normal premenopausal phases
- Early proliferative
- Mid cycle secretory
- Late secretory
- Post menopausal
- Endometrial atrophy
- Endometrial hyperplasia



Early proliferative5-7mm on transvaginal ultrasound

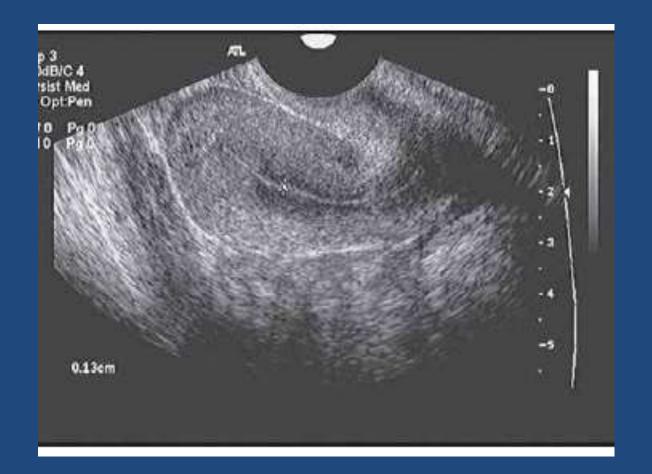


Midcycle secretoryUp to 11 mm on transvaginal ultrasound



Late secretory

7-16mm on transvaginal ultrasound



Post menopausal endometrium

Endometrium should be </=4mm on transvaginal ultrasound

Reasons for post menopausal bleeding

- Endometrial atrophy Endometrial hyperplasia
- Endometrial polyps
- Endometrial carcinoma

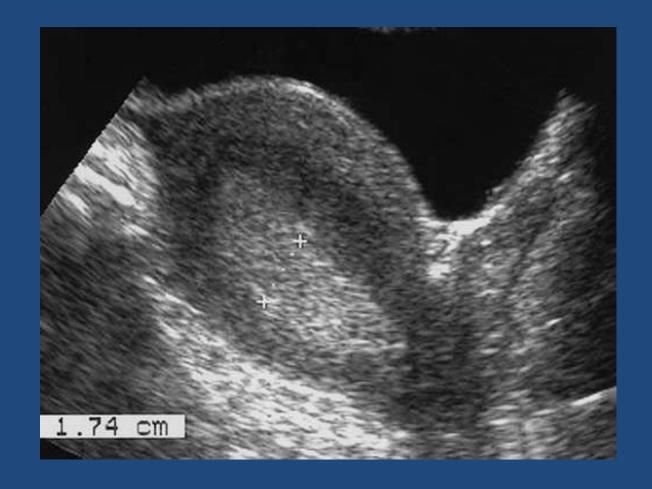


Postmenopausal atrophy

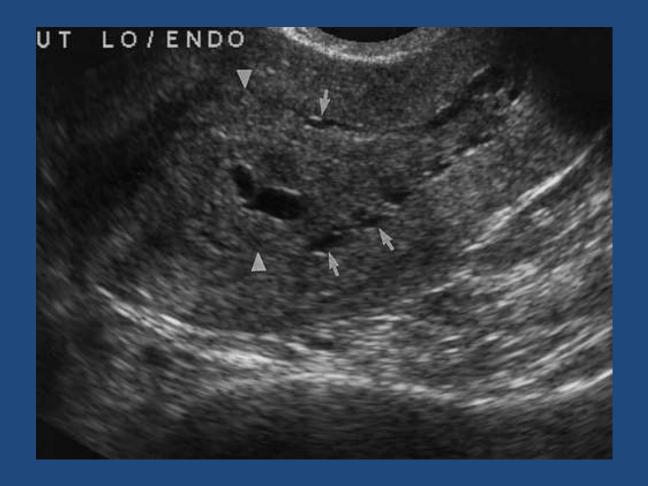
If< than 4mm, postmenopausal bleeding is usually attributed to atrophy May see small amount of fluid or cystic changes

Endometrial Hyperplasia

- Diffuse but may not involve the entire endometrium
- Histologically may +/- cellular atypia
- (25% with atypia progress to cancer)
- -need Bx to determine
- Develops from unopposed estrogen stimulation- hormone replacement, persistent anovulatory cycles, PCO, obesity, estrogen producing ovarian cancers



DiffuseDiffusely thickened and echogenic



Tamoxifen Therapy

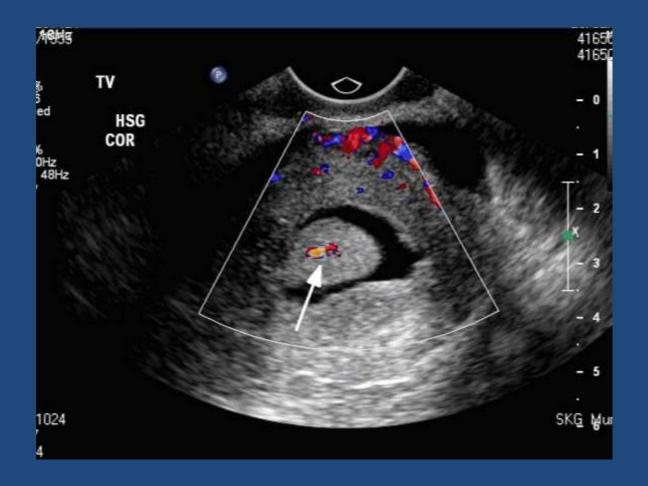
Has estrogenic effect on postmenopausal women-causes endometrial thickening and cystic changes-Increased risk of polyps/Ca

Endometrial Polyps

- Localized overgrowths of endometrial tissue covered by endothelium
- 20% of polyps are multiple
- Malignant degeneration is uncommon
- May be diffuse, focal, pedunculated, stalked or contain cysts
- Best evaluated with sonohysterography



Echogenic polyp



Echogenic polypColor Doppler shows vascular flow



Small single polyp



Multiple polyps



Cystic changes in Endometrial Polyp



Sonohysterography

Helps determine if endometrial lesion is polyp or submucosal fibroid

Endometrial Carcinoma

- Most common gynecologic malignancy occurring in 3% of women
- 75-80% of this cancer occurs in postmenopausal woman
- Accounts for less than 1.5% of cancer deaths in women because > 75% of endometrial cancers are confined to the uterus.

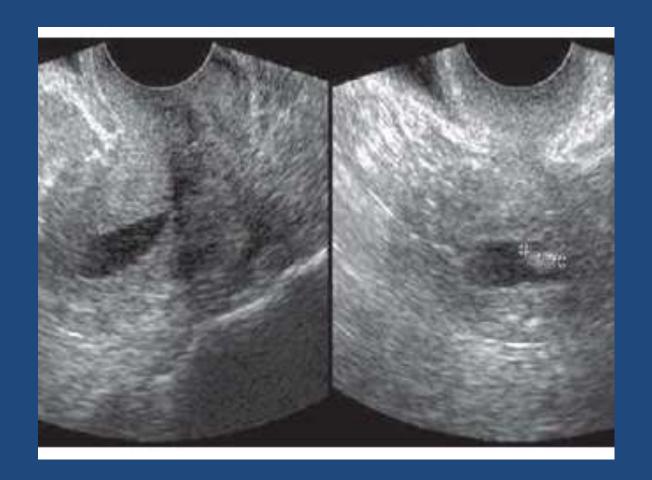
Subtypes of endometrial cancer

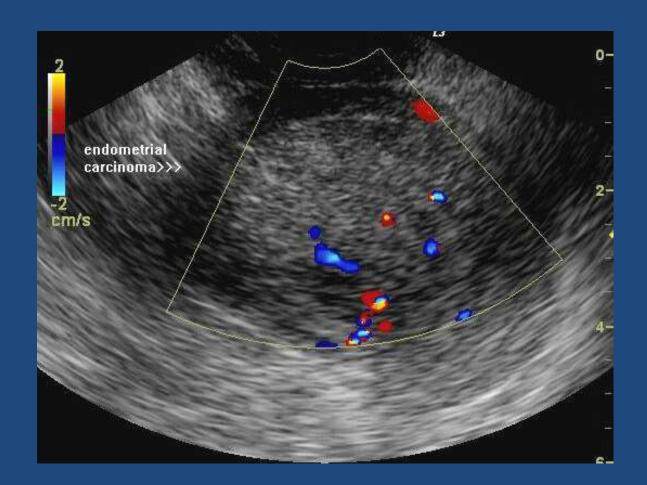
- Type I (80%)
- Well differentiated with slow progression seen in woman 55-65
- PTEN gene mutation in 30-80%
- Arises in setting of hyperplasia/elevated estrogen
- Type II (20%)
- Less differentiated and spreads early
- in woman 65-75
- P53 mutation in up to 50%
- Arises in setting of endometrial atrophy

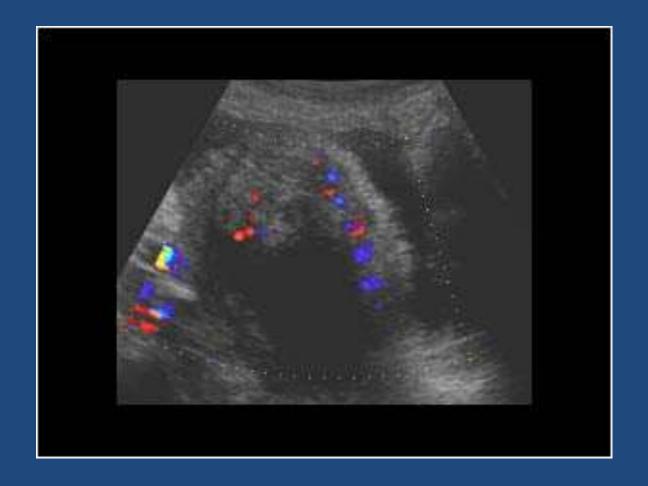
Appearance of endometrial cancer

May resemble hyperplasia/polyps with uniformed thickened echogenic endometrium

More commonly the endometrium is heterogenic with poorly defined borders



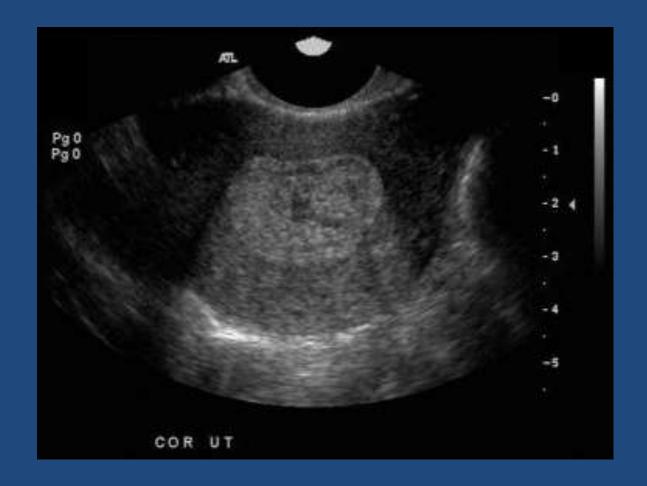




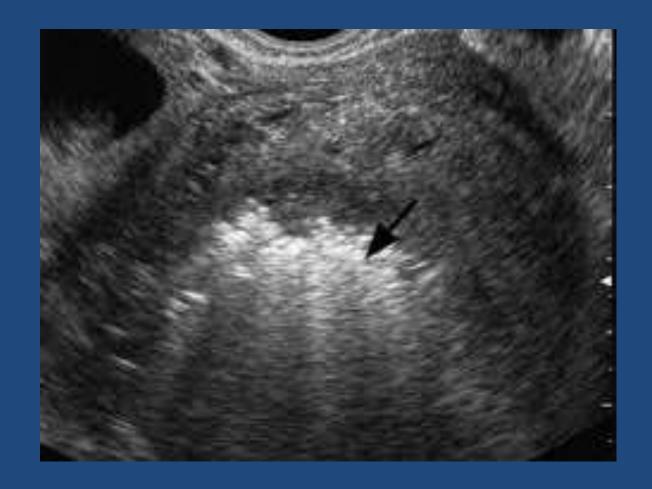
Fluid filled endometrium with an irregular vasculized wall, polypoid lesions and ascitis

Endometritis

- Endometrium may appear thickened, irregular and may or may not contain fluid
- Gas may be seen in the endometrial canal
- May occur postpartum, following surgery or with PID



Thickened heterogenic endometrium Secondary to PID



Poorly defined endometrium with gasFollowing myomectomy for leiomyoma

Endometrial Adhesions

- Endometrium may appear normal on transabdominal and transvaginal US
- Best seen in secretory phase when the endometrium is more hyperechoic
- Sonohysterography demonstrates adhesions as bridging bands of tissue that distort the endometrial cavity



TransvaginalBright hyperechoic scar tissue in the endometrial canal



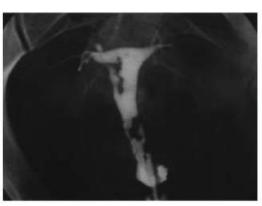
Sonohysterogram

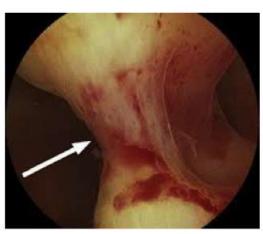
Demonstrates synechiae also known as Asherman's syndrome

INTRAUTERINE ADHESIONS

ADHESION ON HSG

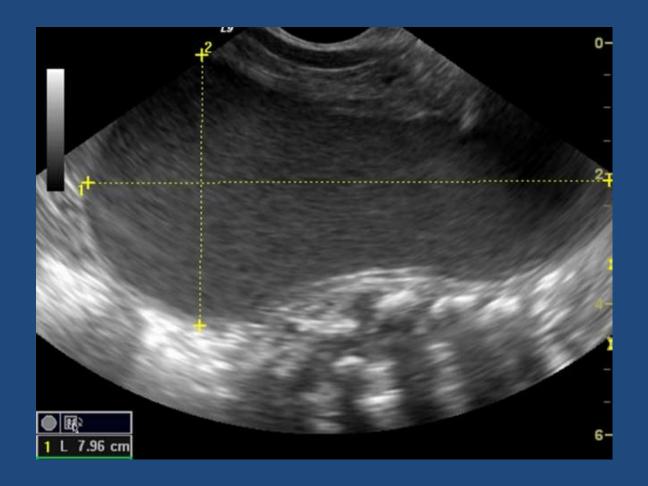
ADHESION AT HYSTEROSCOPY





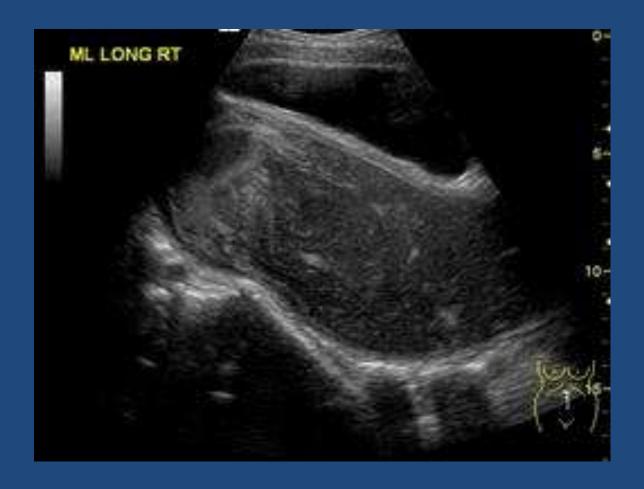
Hydro/Hematometrocolpos

- Accumulation of secretions and/or blood in the uterus and/or vagina with the location depending on the amount of obstruction.
- When congenital due to imperforate hymen, vaginal septum, atresia, rudimentory uterine horn
- When acquired due to endometrial or cervical tumors or postradiation fibrosis



Hydrometacolpos

Secondary to imperforate hymen



HematometrocolposSecondary to cervical tumor

Intrauterine Contraceptive Devices

- Appear as echogenic linear structures in the endometrial cavity in the body of the uterus
- Should see acoustic shadowing and two parallel echoes representing the anterior and posterior surfaces of the IUCD



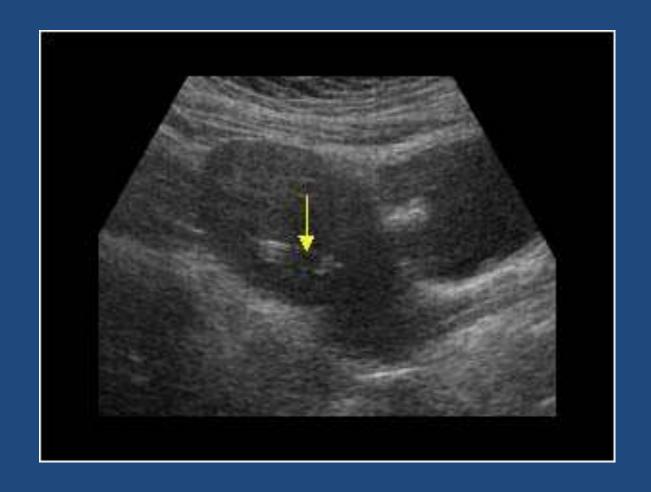
3D US image

IUCD correctly positioned in the fundus and body of the endometrial canal



Malpositioned IUCD

IUCD in endocervical canal



IUCD in the posterior wall of the uterus

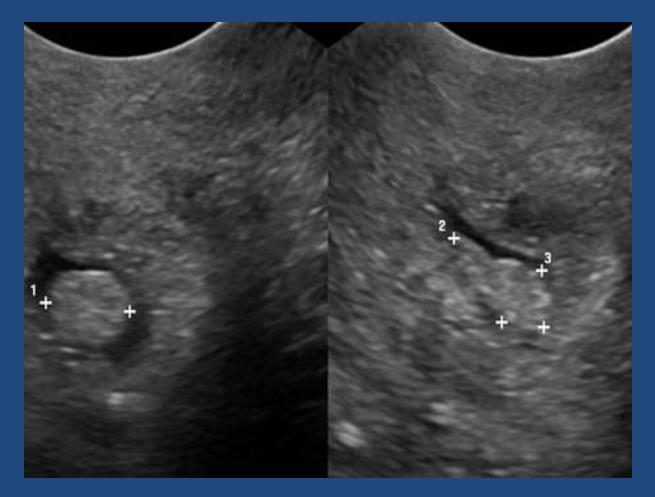
Cervical Lesions

- Nabothian cysts
- Cervical polyps
- Cervical leiomyomas
- Cervical carcinoma



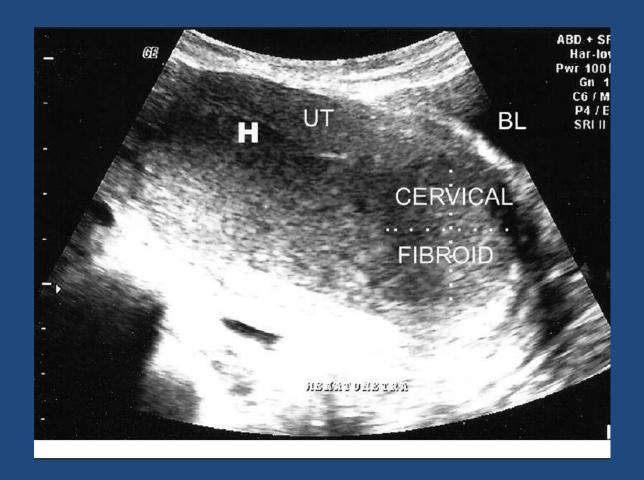
Nabothian cysts

Common finding
Measure few mm to 4 cm
May have internal echoes from hemorrhage or infection



Cervical Polyps

Hyperechoic lesion with vascular flow Frequent cause of vaginal bleeding



Cervical Leiomyoma

Pedunculated fibroids can prolapse into vagina Can be obstructive at childbirth



Cervical Carcinoma

May resemble a cervical Fibroid Usually diagnosed clinically

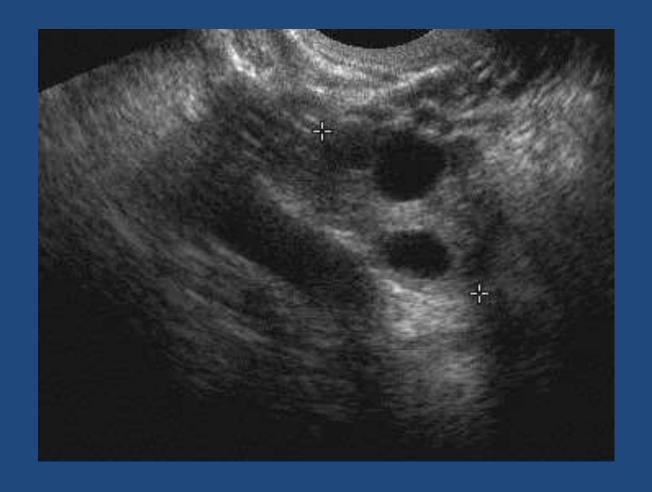
Benign Ovarian Cysts

- Functional Cysts
- Follicular
- Corpus Luteal
- Hemorrhagic Cysts
- Theca-luteal Cysts
- Postmenopausal Cysts
- Endometriomas

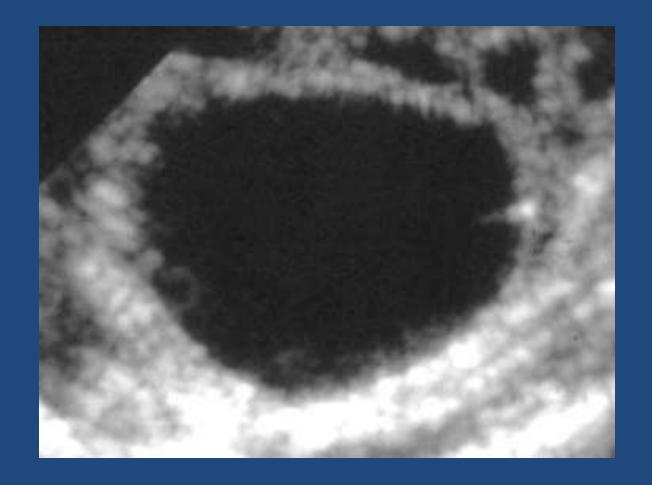


Normal ovarian follicles

-during the proliferative phase

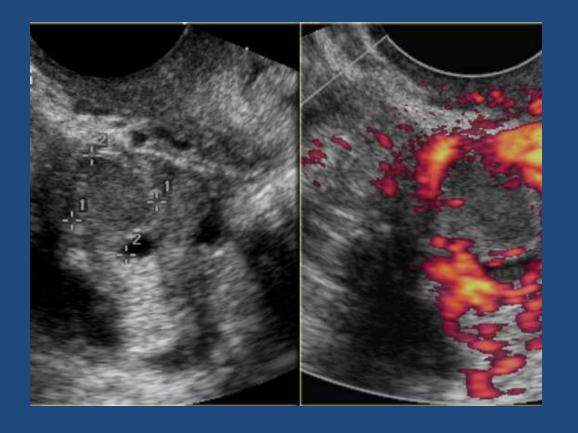


Dominant follicle on Day 10 which can reach 2-2.5 cm at time of ovulation



Follicular cyst

Result of mature follicle failing to ovulate or involute; Cyst must be > than 2.5 cm; usually regress on own

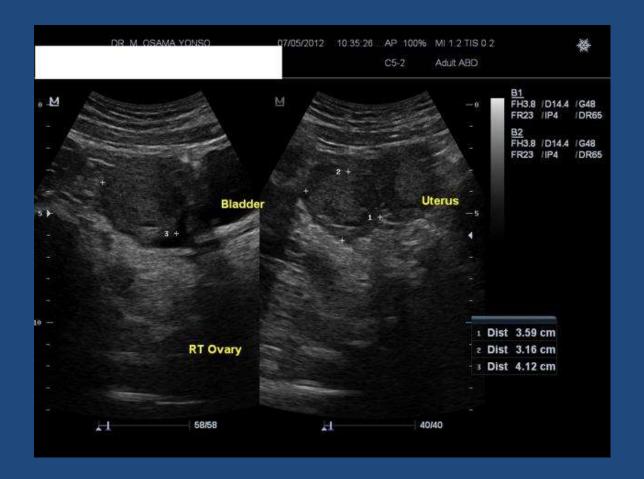


Corpus Luteal Cyst

Result from failure of absorption or from excess bleeding into the corpus luteum Have thicker walls with crenulated appearance

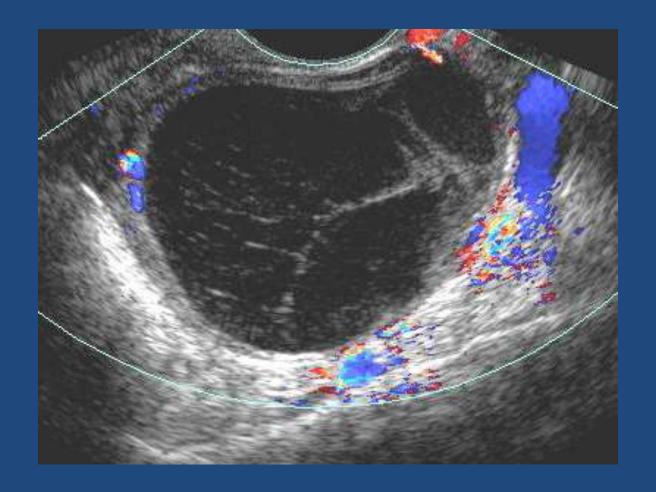
Hemorrhagic cysts

- Internal hemorrhage from granulose cells lining functional or corpus luteal cysts
- Appearance depends on age and amount of hemorrhage ranging from hyperechoic with posterior acoustic enhancement to reticular pattern with internal echoes to fluid-fluid line
- No flow seen within cyst on Doppler



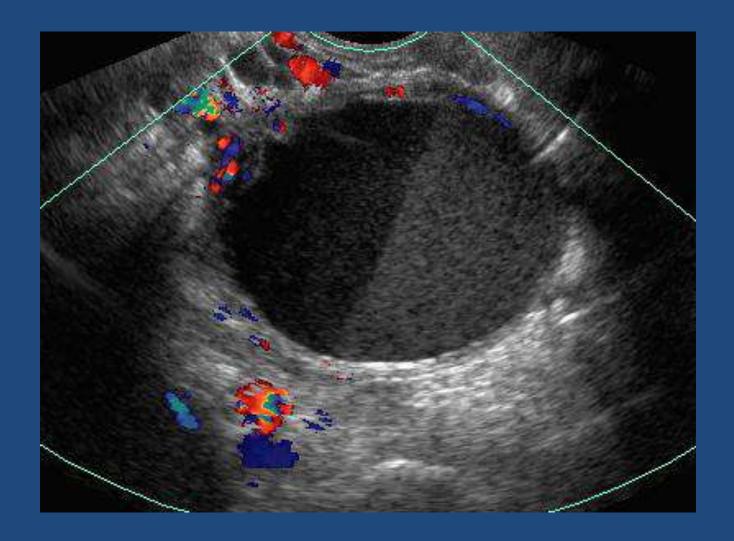
Acute hemorrhagic cyst

Echogenic free fluid in pelvis indicates a leaking or ruptured cyst –woman with these cysts complain of pelvic pain



Hemorrhagic CystsSeptations with internal echoes and no flow





Theca-luteal cysts

- Largest of functional cysts
- Associated with high levels of HCG
- Seen in gestational trophoblastic disease and ovarian hyperstimulation syndrome with infertility drug therapy
- These cysts are bilateral, multilocular and very large

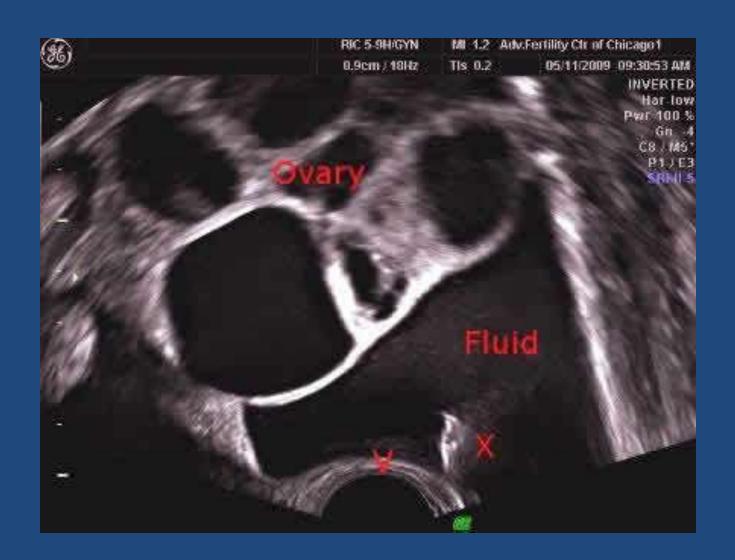


Theca-luteal cysts

Cysts may hemorrhage, rupture or undergo torsion

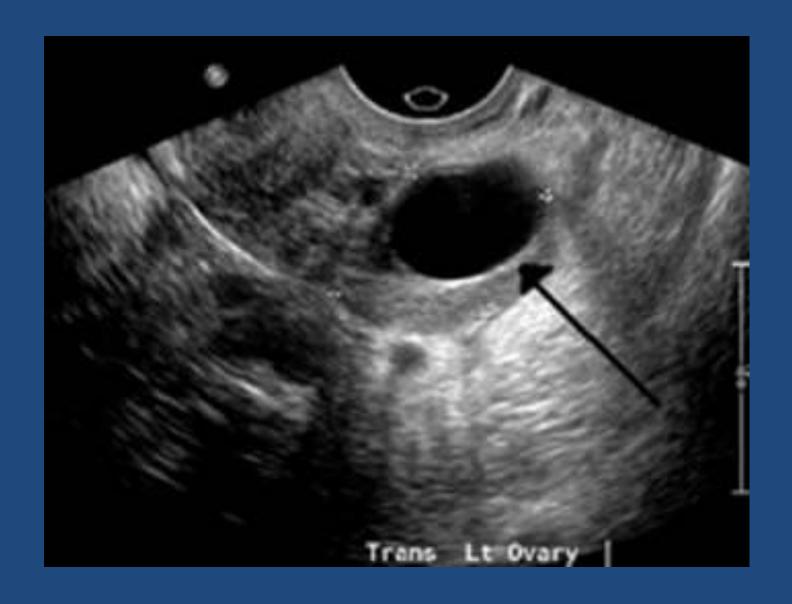
Ovarian Hyperstimulation Syndrome

- Complication of ovulation induction
- Mild form associated with lower abdominal pain, up to 5 cm ovaries, mild ascitis nausea
- Severe form associated with severe abdominal pain and distention, 10cm or larger ovaries with multiple cysts, ascitis, pleural effusions, low BP,oliguria and electrolyte imbalance



Postmenopausal Cysts

- Unilocular <7cm in diameter and without septations or solid components can be followed by US
- <3cm simple cysts seen in 15% of postmenopausal woman
- May disappear or change in size



Ovarian Remnant Cysts

- Small simple to larger complex cysts can infrequently arise from a small amount of residual ovarian tissue following a bilateral oophrectomy
- Usually the remnant of ovarian tissue is secondary to a surgery complicated by adhesions, endometriosis, PID or tumor

Followup of Ovarian cysts in Premenopausal Women

- Simple Cysts
- 1.<3cm=Normal finding
- 2. 3-5 cm=Certainly benign, No F/U
- 3. 5-7cm=Likely benign; yearly F/U
- 4. >7cm=further evaluation with MRI or surgery
- Hemorrhagic Cysts
- 1.<5cm=Describe; No F/u
- 2. >5cm=F/U in 6-12 weeks

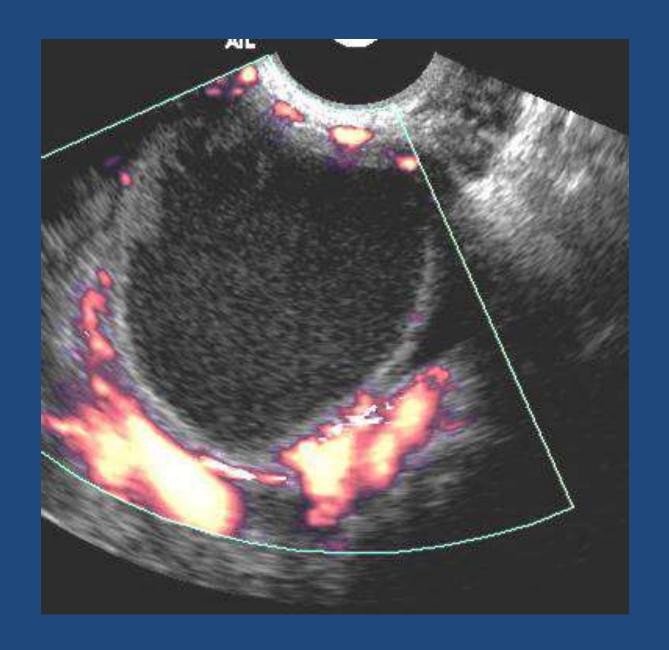
Followup of Ovarian Cysts in Post menopausal Women

- Simple Cysts
- 1.<1cm=inconsequential;No F/U
- 2. 1-7cm=Yearly F/U
- 3. >7cm=Further evaluate with MRI or surgery
- Hemorrhagic Cysts
- Perimenopausal=F/U US in 6-12 wks
- Postmenopausal=Abnormal; Surgery

Endometriomas

- Localized form of endometriosis
- Well defined uni/multilocular cystic mass with diffuse low level internal echoes usually found in the ovary; often bilateral
- May have marginal echogenic nodules or fluid-fluid level
- Show little change over time with no pain or chronic menstraul pain
- Endometriomas > 9 cm show <1% malignant transformation
- Cause decrease ovarian function and fertility



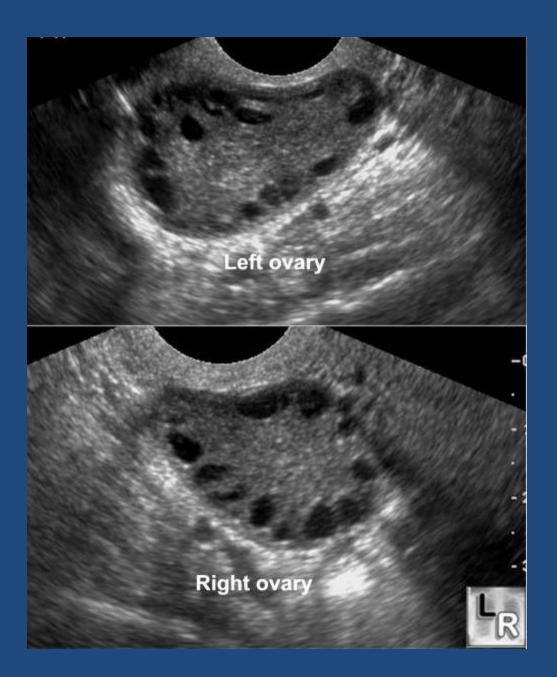


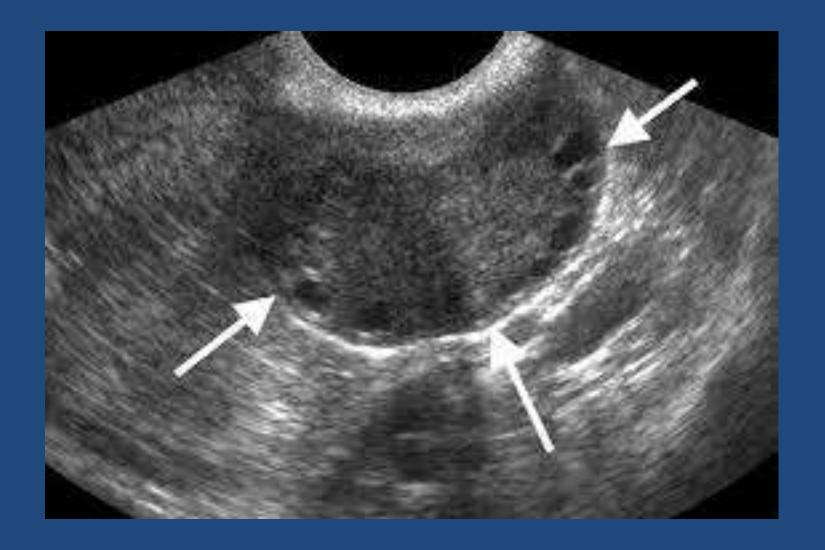
Polycystic Ovarian Disease

- PCOD is an endocrine disorder which causes elevated LH and depressed FSH levels which results in hypersecretion of androgens and chronic anovulation.
- Common cause of infertility and early pregnancy loss
- Increased risk for Type 2 DM, CAD, CVA, HTN and Hyperlipidemia
- Spectrum ranges from thin menstruating woman to obese, hirsute amenorrhic females(Stein-Leventhal syndrome)

PCOD Appearance

- Threshold ovarian volume > 10cm
- There are 12 or more follicles measuring 2-9mm in diameter
- Need to have only one ovary meet either of the criteria to establish the presence of polycystic ovaries
- Increased echogenicity of ovarian stroma





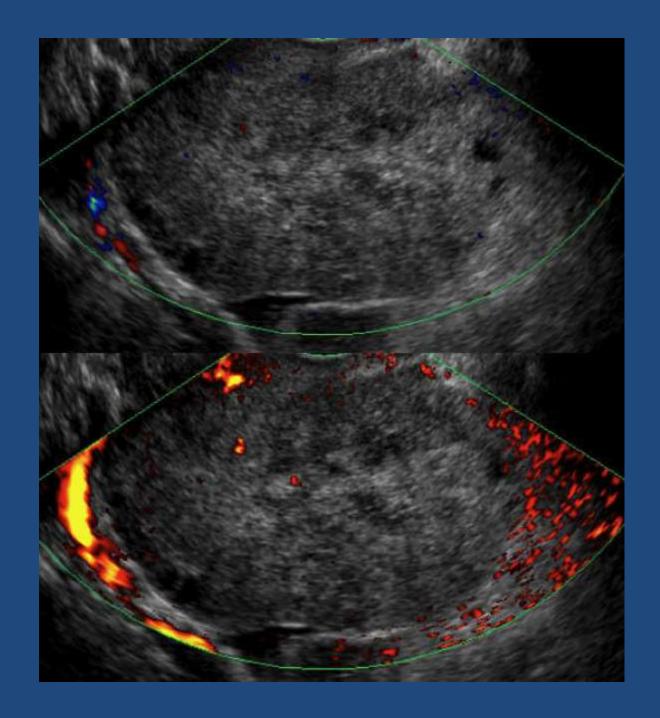
Ovarian Torsion

- Partial or complete rotation of the ovarian pedicle on its axis which compromises the lymphatic and venous drainage causing edema leading to loss of arterial perfusion and infarction
- May occur in normal ovaries or with an ovarian mass

More common in childhood/reproductive years with increased risk during pregnancy

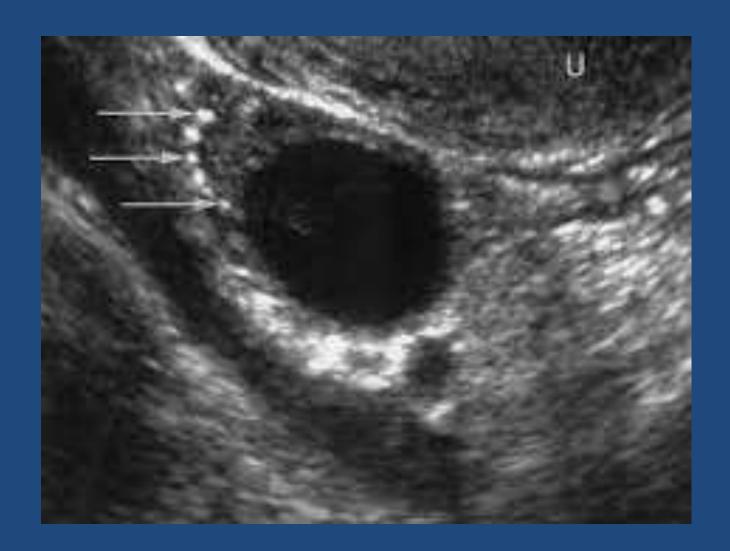
Ultrasound Findings

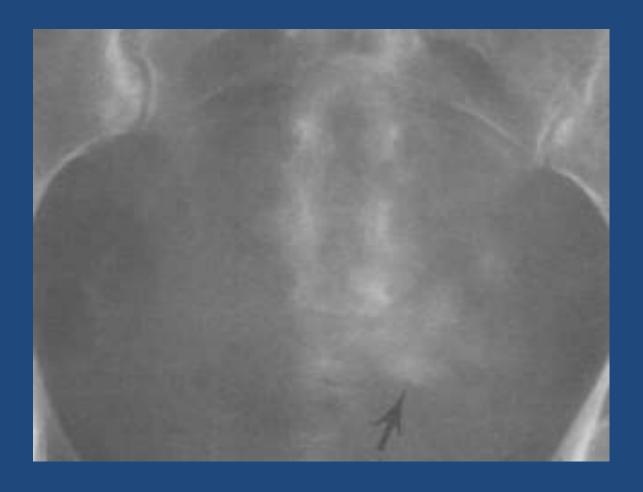
- Enlarged ovary with multiple cortical follicles
- Sparse or lack of flow in the ovary on Color Doppler
- Free fluid often present



Nonshadowing Echogenic Ovarian Foci (EOF)

- EOF in otherwise normal ovaries are caused by a specular reflection from walls of tiny unresolved benign cysts
- · Can be peripheral, central or diffuse
- Average size = 1.8 mm
- Benign and require no further imaging followup





Psammomatous Calcification

Ovarian Neoplasms

Surface epithelial-stromal 65-75%

• Germ cell 15-20%

• Sex cord-stromal 5-10%

• Metastatic 5-10%

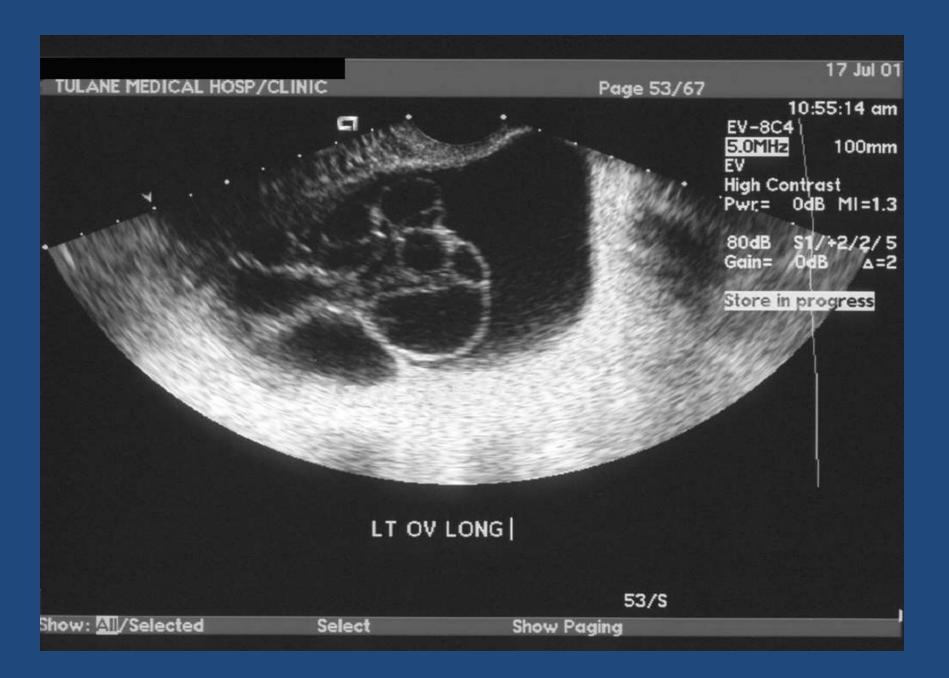
Surface epithelial-stromal Tumors

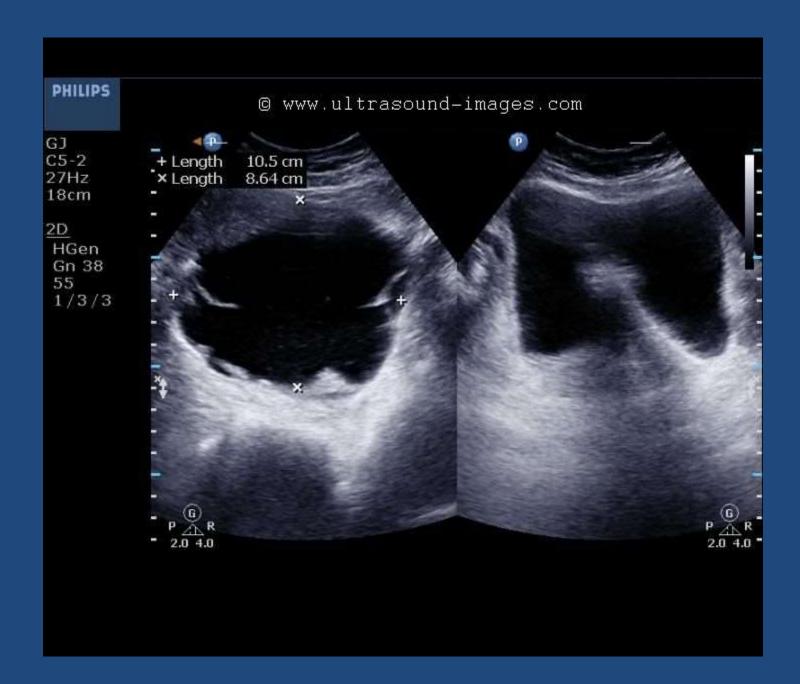
- Account for 65-75% of ovarian malignancies
- Five categories
- 1. Serous cystadenoma/carcinoma
- 2. Mucinous cystadenoma/carcinoma
- 3. Endometrioid carcinoma
- 4. Clear cell carcinoma
- 5. Transitional cell carcinoma

Serous Cystadenomas

- Account for 20-25% of all benign ovarian neoplasms
- Peak incidence in woman age 30-50
- 20% bilateral
- Large thin walled unilocular cystic mass
- May contain septations or mural nodules

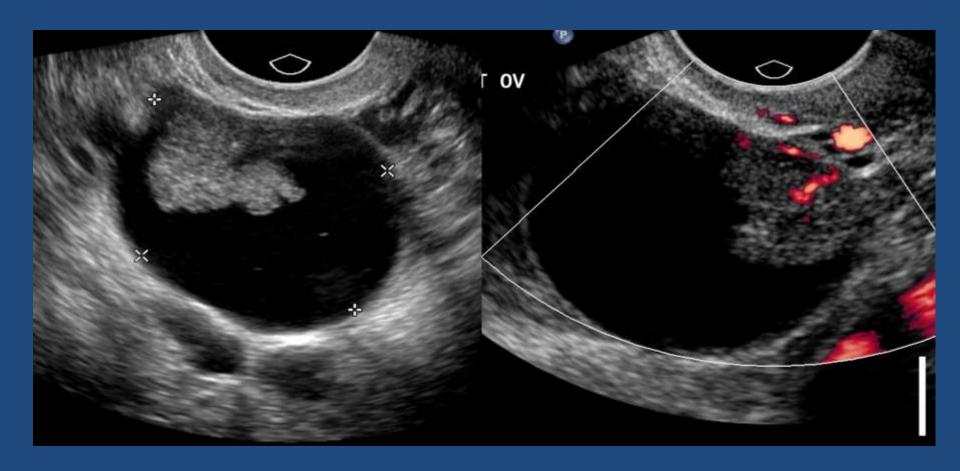


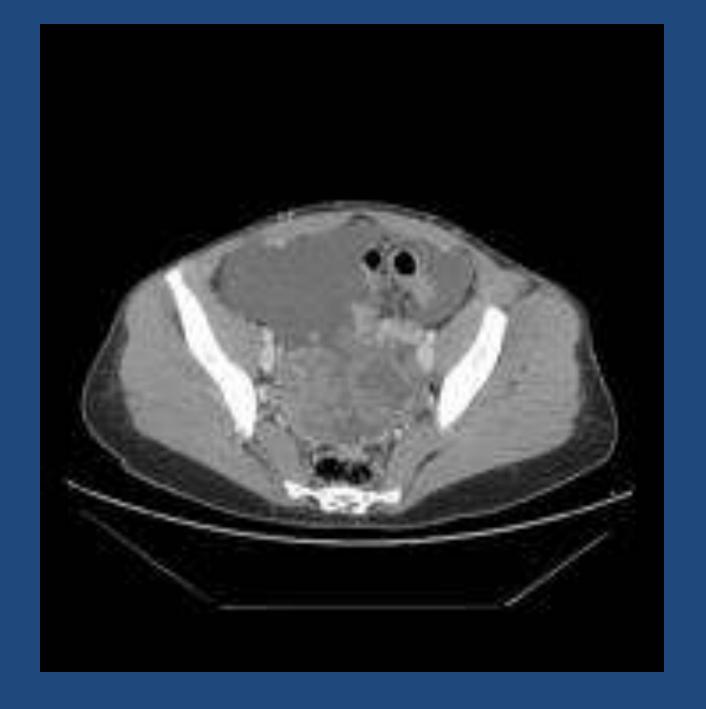




Serous Cystadenocarcinomas

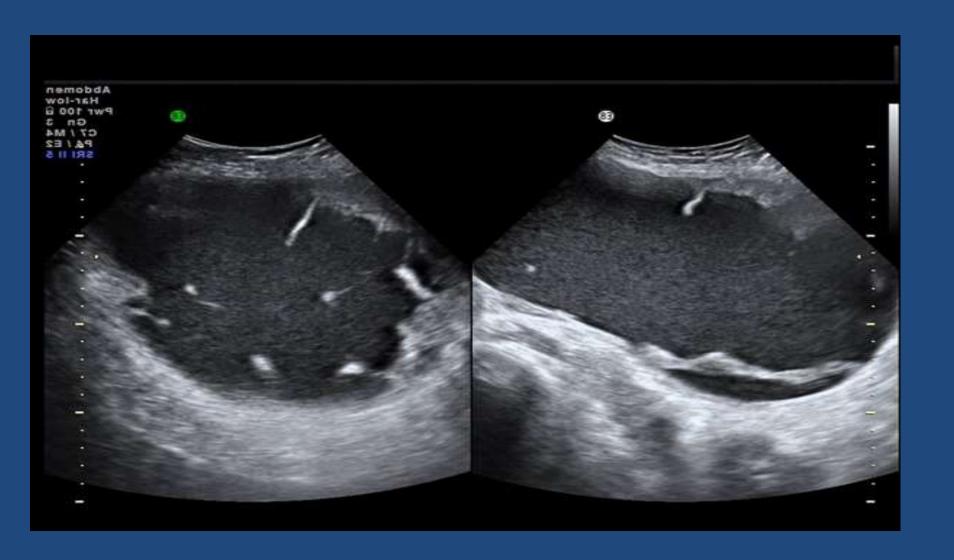
- Account for 40-50% of all malignant ovarian neoplasms
- Most often seen in peri /post menopausal women
- 50% are bilateral
- Very large multilocular cystic mass with multiple papillary projections arising from the walls and septae
- May contain echogenic solid material





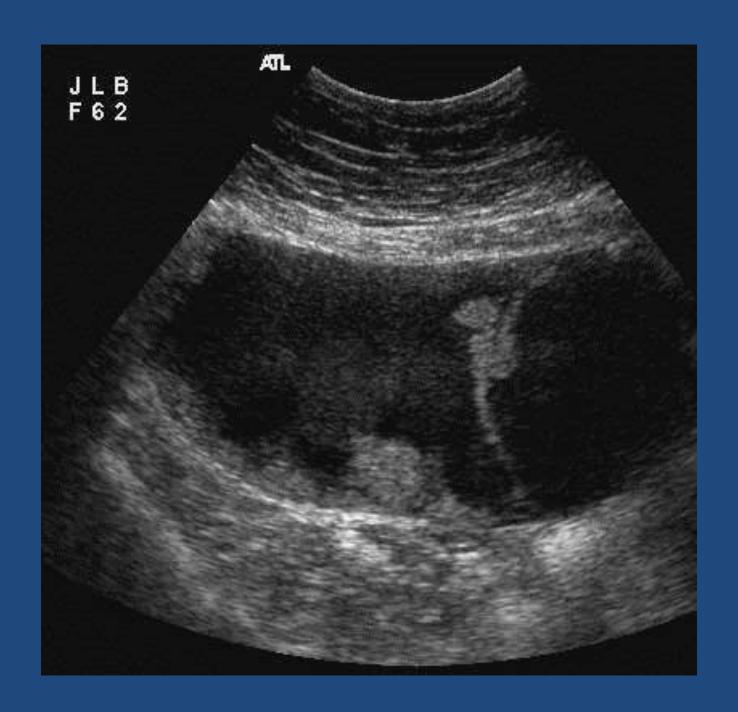
Mucinous cystadenomas

- Account for 20-25% of all benign ovarian neoplasms
- Peak incidence in women 20-50
- 5% are bilateral
- 15-30cm cystic masses with multiple thin septae and low level echoes caused by mucoid material



Mucinous cystadenocarcinomas

- Account for 5-10% of primary ovarian neoplasms
- Most often seen in woman 40-70
- 15-20% are bilateral
- Appearance is similar to mucinous cystadenoma but with septal nodularity
- Can see pseudomyxoma peritonei secondary to intraperitoneal spread



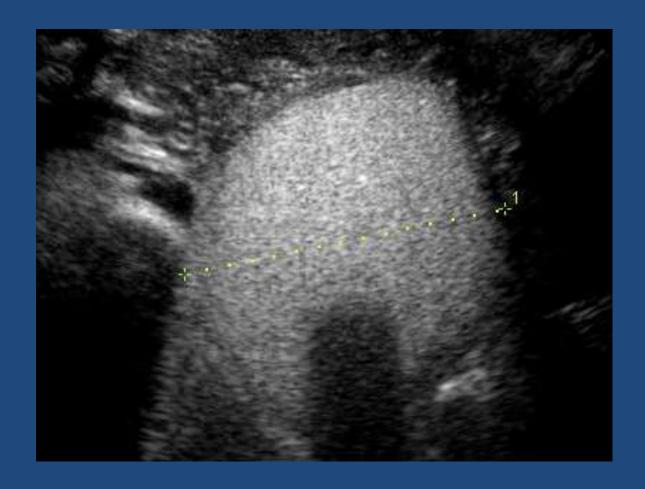
Germ Cell Tumors

- Derived from the primitive cells of the embryonic gonad
- Three categories of germ cell tumors
- 1. Teratoma
- Dermoid
- Immature
- 2. Dysgerminoma
- 3. Yolk sac tumor

Dermoids

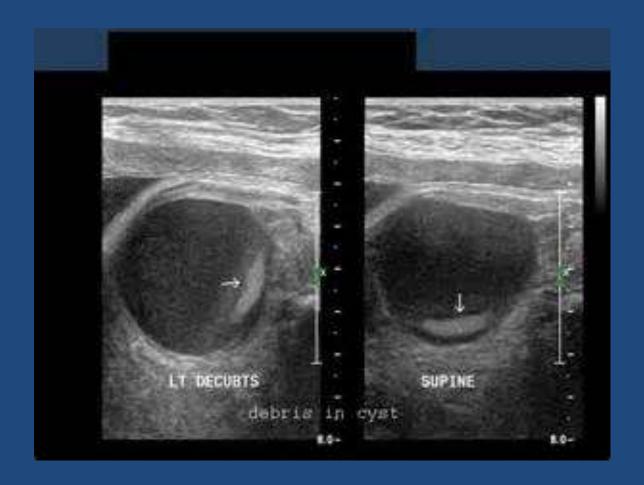
- Account for 95% of germ cell tumors
- AKA a mature cystic teratoma
- Occur in women of child bearing age
- Usually unilocular, few are multilocular and 15% are bilateral
- Compose of ectoderm, mesoderm and endoderm
- Up to 60% contain Ca+
- Presence of fluid fat level is diagnostic





Tip of the Iceberg sign

Echogenic mass of hair and secum which obscures the posterior wall of the lesion



Fat fluid level



Dermoid meshHair fibers in cystic portion

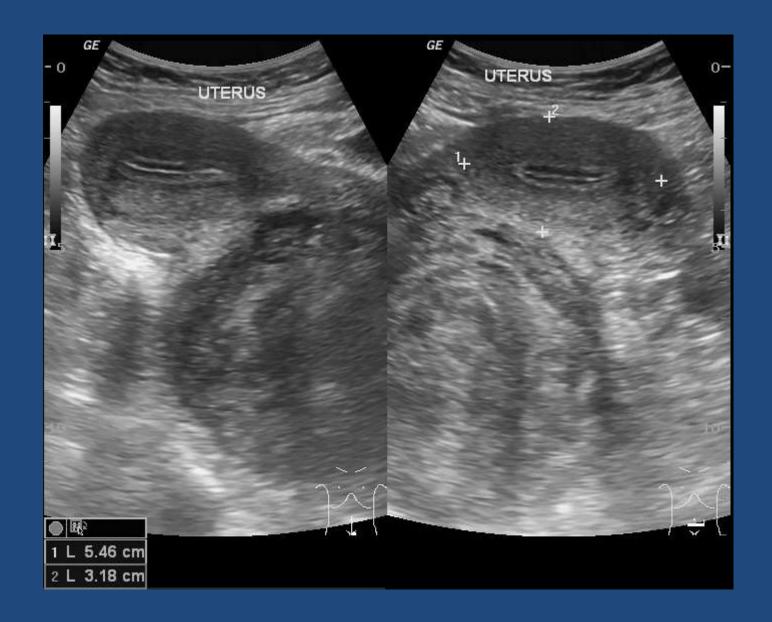


Sex cord-stromal Tumors

- Derived from the sex cords of the embryonic gonad and/or the ovarian stroma
- Three categories
- 1. Granulosa cell tumor
- 2. Sertoli-Leydig cell tumor
- 3. Thecoma and fibroma

Thecoma and Fibroma Tumors

- Arise from the ovarian stroma and contain thecal and fibrous tissue
- On US appear as a hypoechoic mass with marked posterior attenuation of the sound beam



Metastatic Tumors

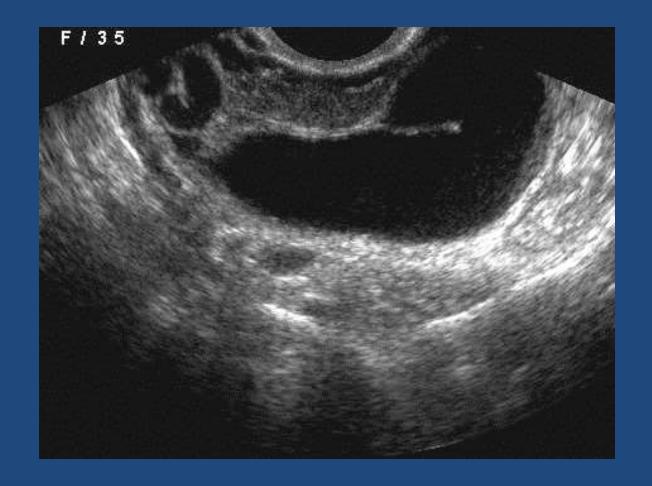
- Three categories
- 1. Genital primary- Uterus
- 2. Extragenital primary
- Stomach
- Colon
- Breast
- 3. Lymphoma



Krukenberg TumorMetastasis from the colon

Extraovarian Lesions

- Hydrosalpinx
- Pyosalpinx/Tubo-ovarian Abcess
- Endometriosis
- Carcinoma
- Peritoneal inclusion cysts
- Para-ovarian cysts



Hydrosalpinx

Distally blocked fallopian tube filled with serous or clear fluid; 2 to infection/endometriosis



Pyosalpinx

Low level internal echoes in dilated fluid filled tube



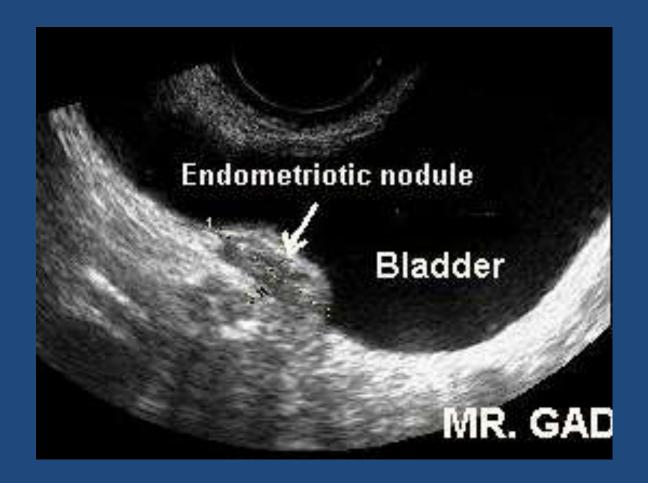
Tubo-ovarian Abcess

Enlarged complex cystic multiloculated mass



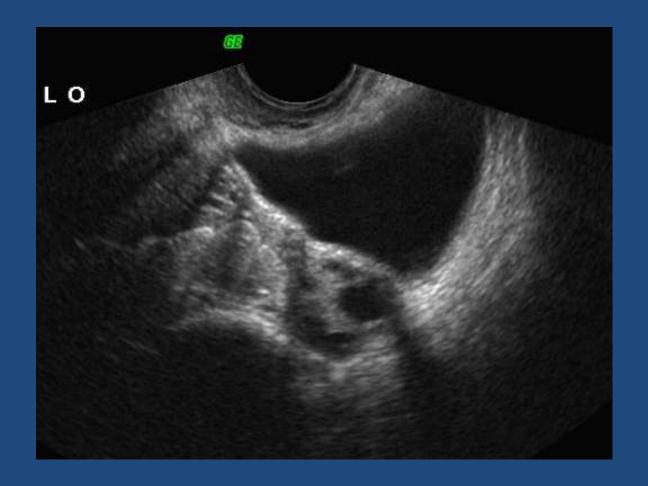
Tubo-ovarian Abcess

May have irregular margins and scattered internal echoes



Endometrial implants

Diffuse endometriosis presents as minute implants on the pelvis organs and their ligaments

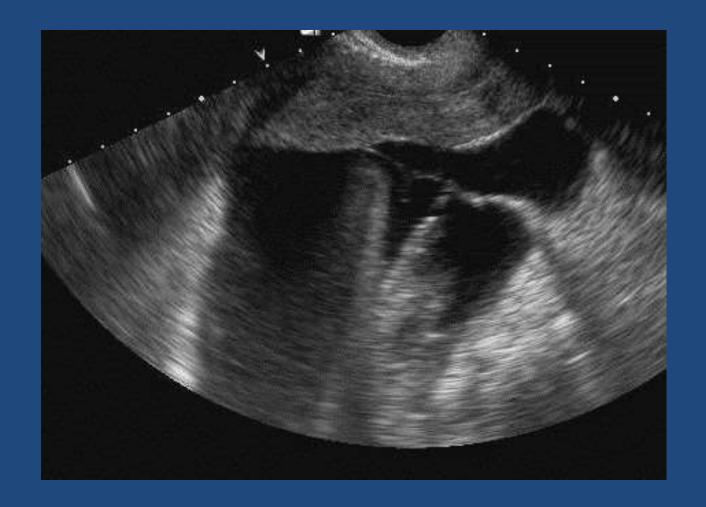


Peritoneal Inclusion Cyst

Occur primarily in premenopausal women with hx of previous surgery, PID, trauma or endometriosis



Peritoneal inclusion cystOvary is entrapped in fluid

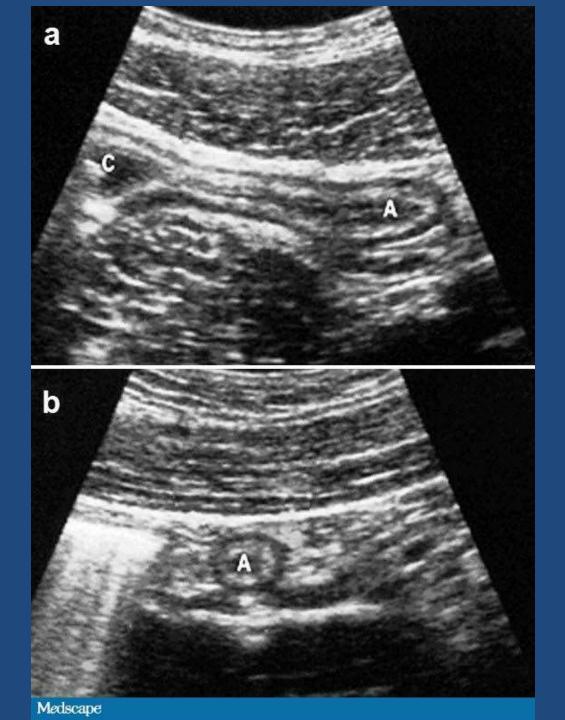


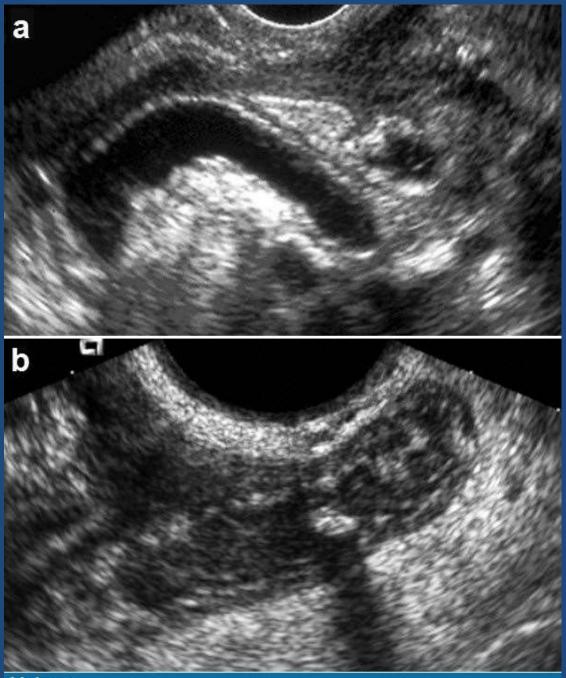
Paraovarian Cysts

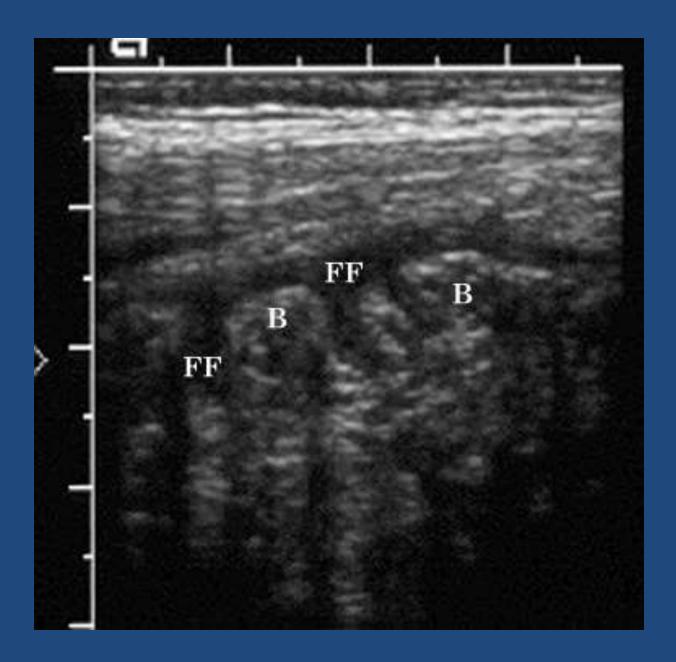
- Cystic dilatation in the vestiges of the Wolffian or Mullerian ducts in the broad ligament
- These cysts are separate from the ovary and fallopian tubes
- Nonfunctional in nature
- Can measure from 1-8 cm in size

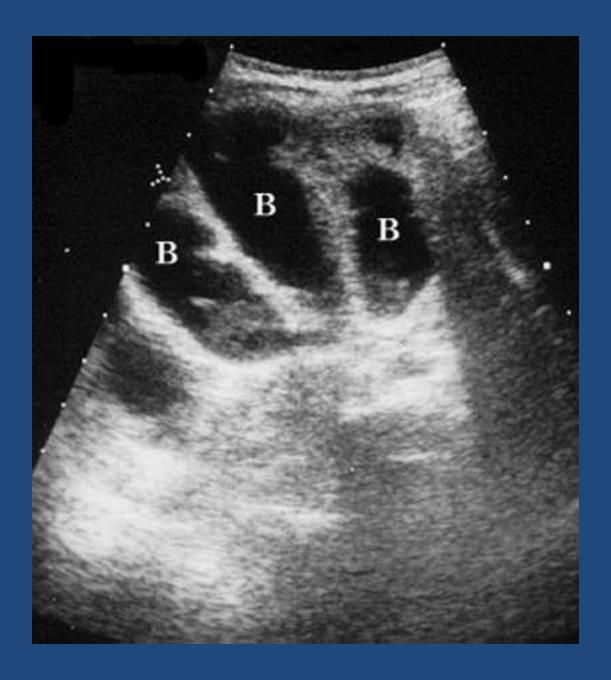
Acute Appendicitis

- Secondary to obstruction of the appendiceal lumen.
- Presents as a blind ending, aperistaltic and noncompressible tubular structure arising from the cecum
- =/> 7mm in diameter
- Advanced cases may perforate and cause an <u>abcess</u>



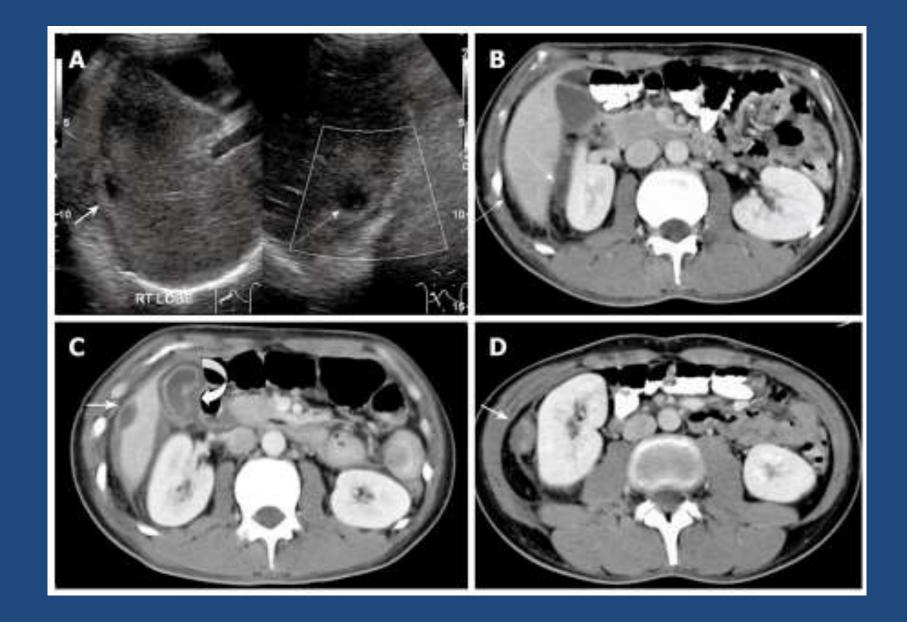






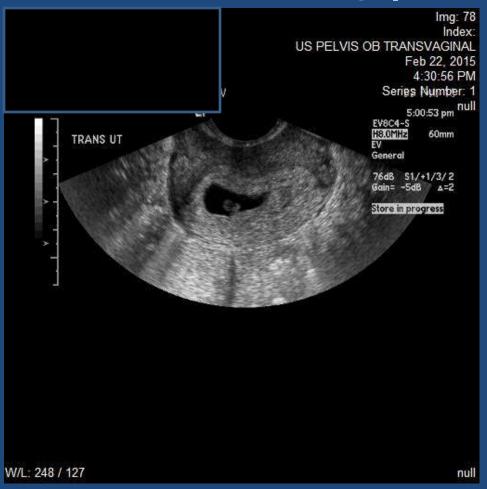


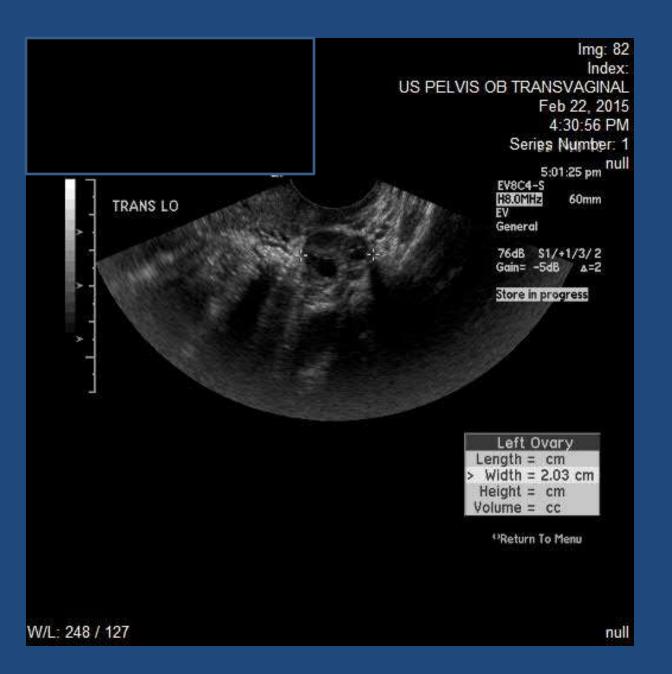


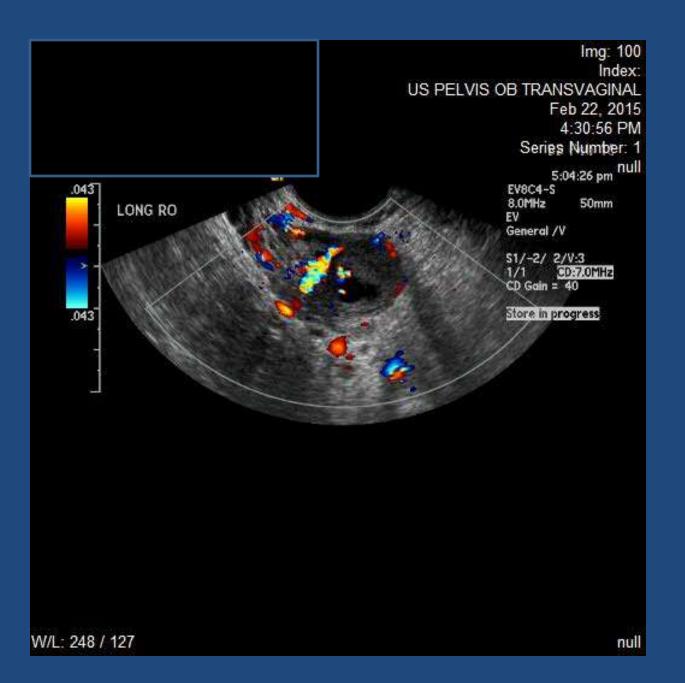


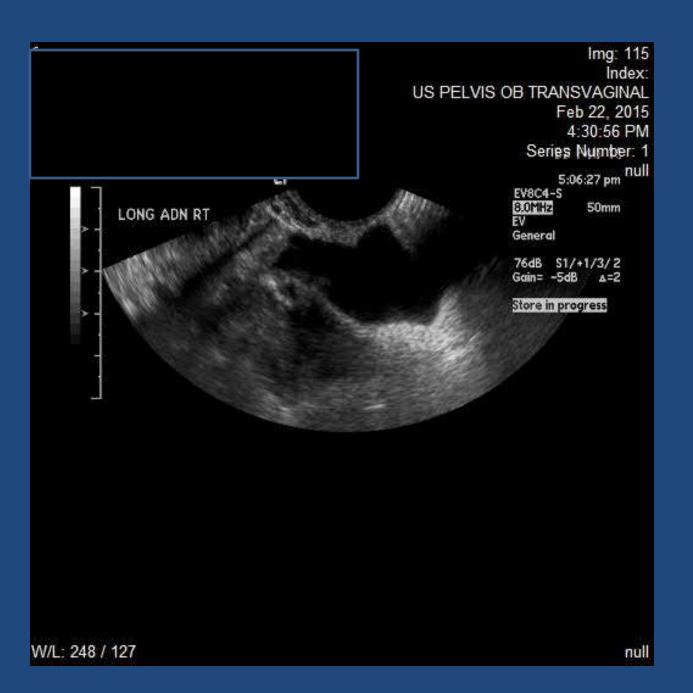
Interesting cases

HX: 28 year old female with pelvic and RLQ pain

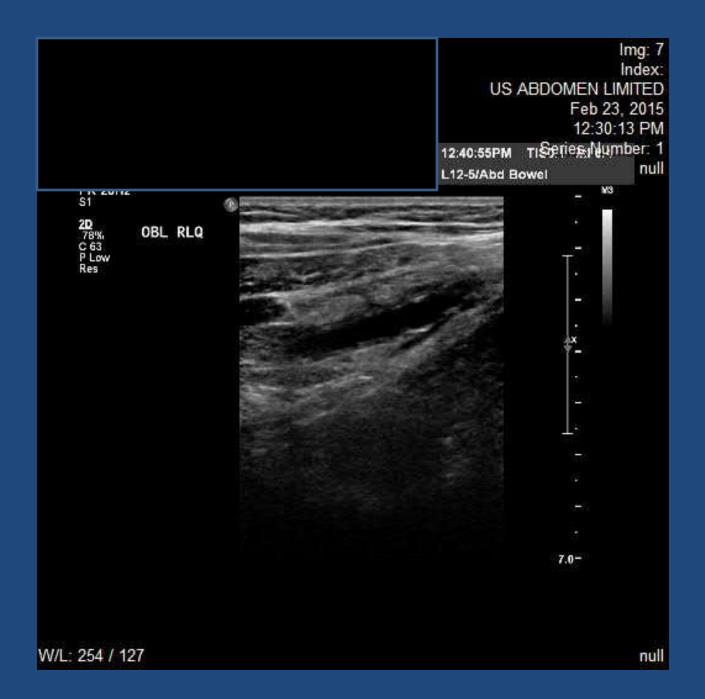






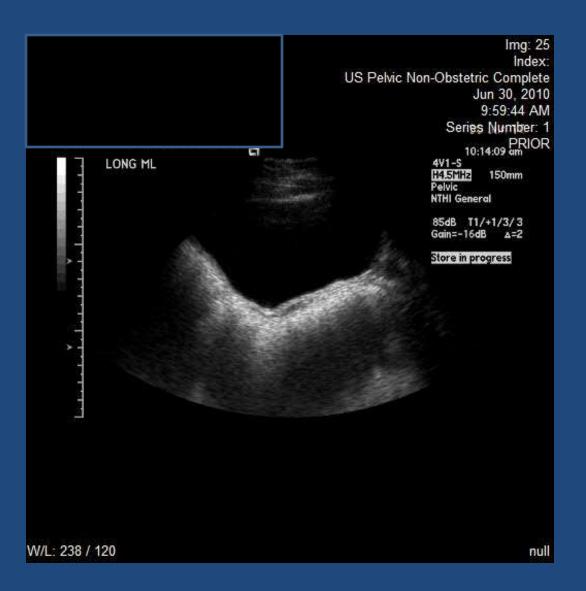






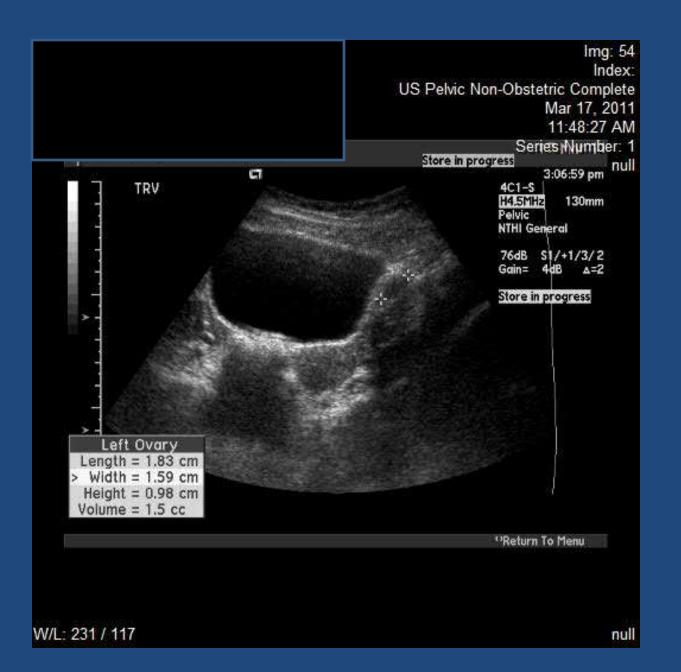
DX: Acute appendicitis and 6 week IUP

HX: 16 yr old amenorhegic female









Dx: Amenorrhegic female successfully tx with hormones

 Hormone imbalance may be at the level of the pituitary/hypothalamus or be related to gonadal end organ failure

Hx: 48 yr old female with excessive uterine bleeding

- Hx of IDDM, LUE DVT tx with Xerelto
- Heavy menstraul bleeding which started 9 days ago
- Hgb=5





W/L: 254 / 127



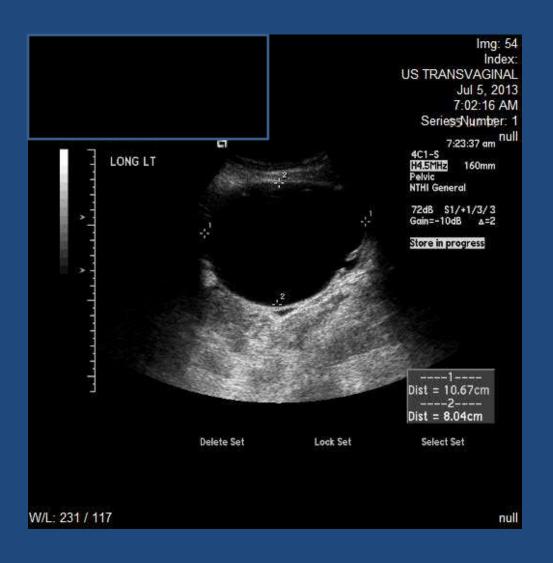
W/L: 254 / 127 null



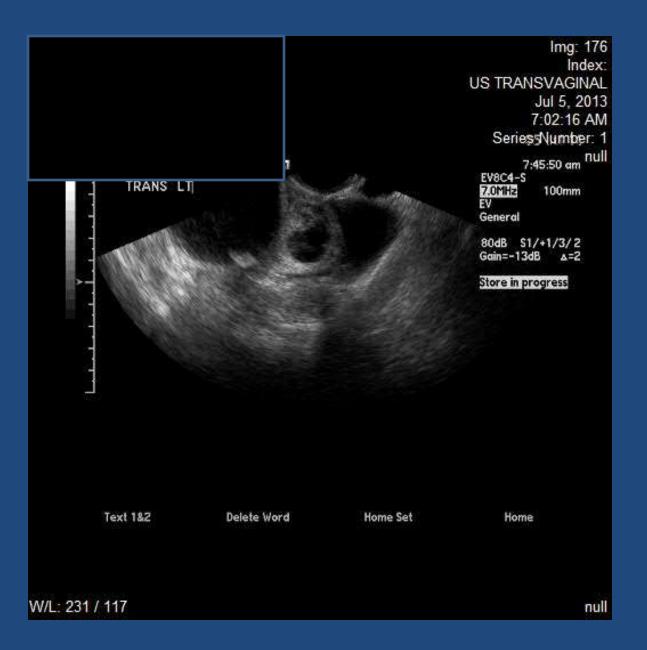
Dx: DUB secondary to med

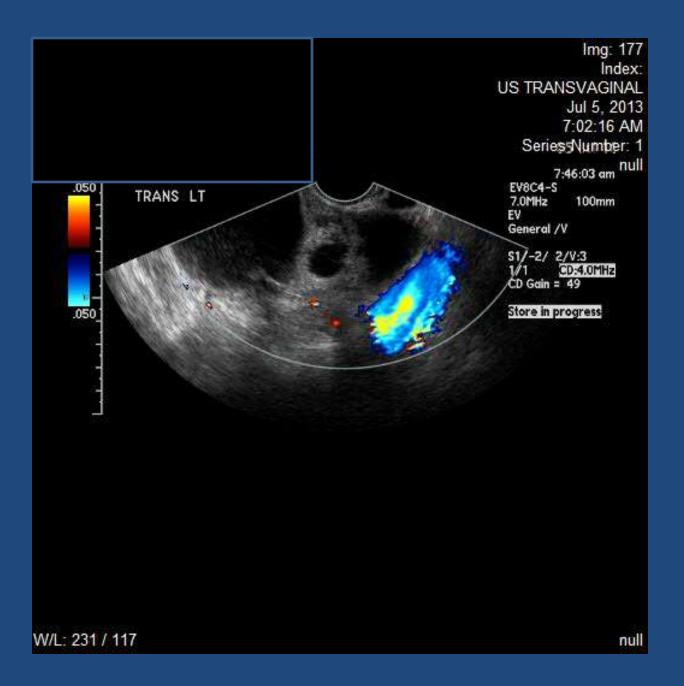
- Pelvic exam revealed no cervical or vaginal mass
- Tx with Provera and blood transfusion

Hx: 29 yr old female with acute onset of LLQ pain



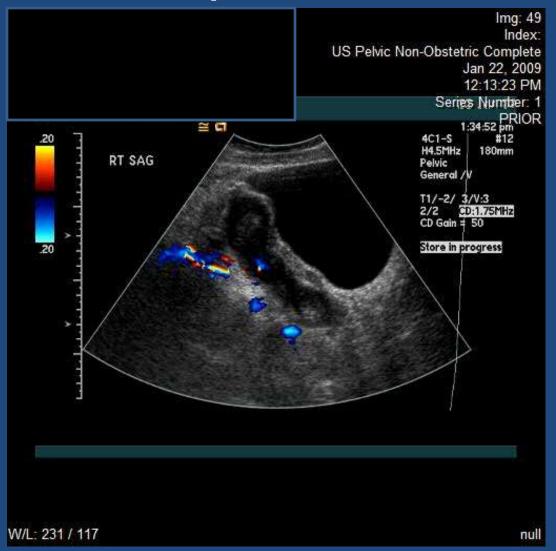


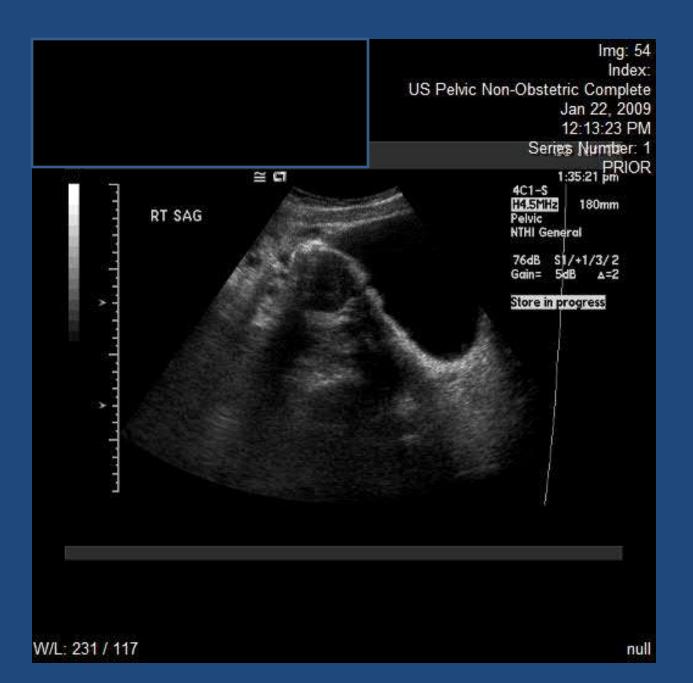


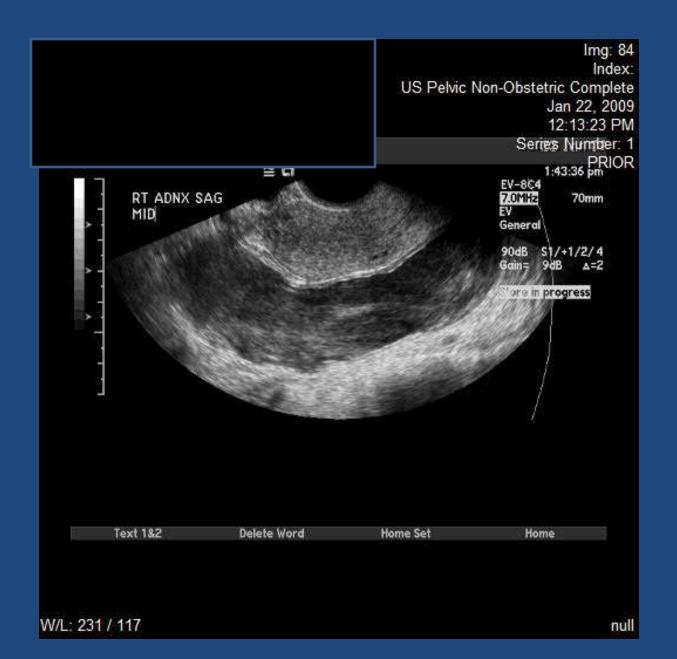


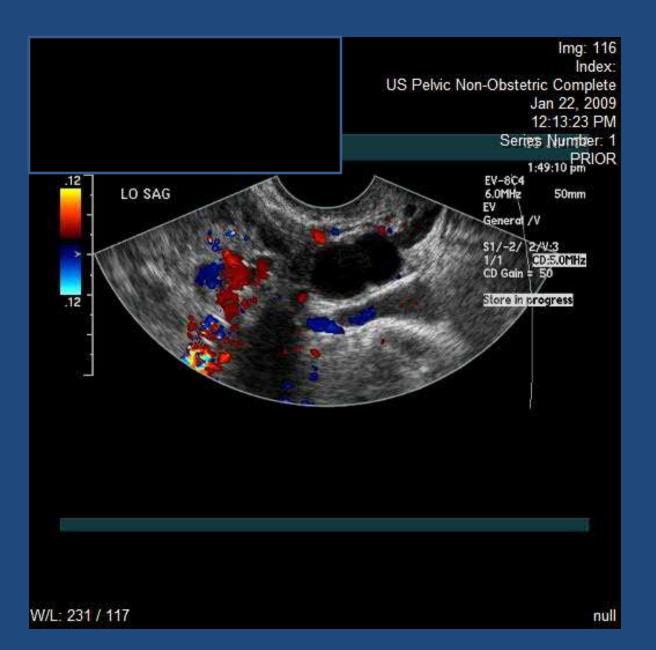
Dx: Torsed mucinous cystadenoma of the left ovary

Hx: 50 yr old female with RLQ pain









Dx: Mucinous adenoma of the appendix/ left ovarian cystadenoma