

A Practical Approach to Adnexal Masses



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American Institute for Radiologic Pathology**

**Clinical Associate
Johns Hopkins Community Radiology Division**

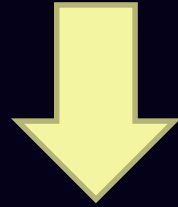
Washington, DC, USA

Nothing to disclose

A Practical Approach to Adnexal Masses

- **Clinical History**
- **Location**
- **Adnexal Lesions**
 - **Diagnosis**
 - **Follow Up**

Adnexal Mass



Clinical History

Clinical History

- **Positive pregnancy test**



Clinical History

- **Positive pregnancy test**
 - **Ectopic Pregnancy**



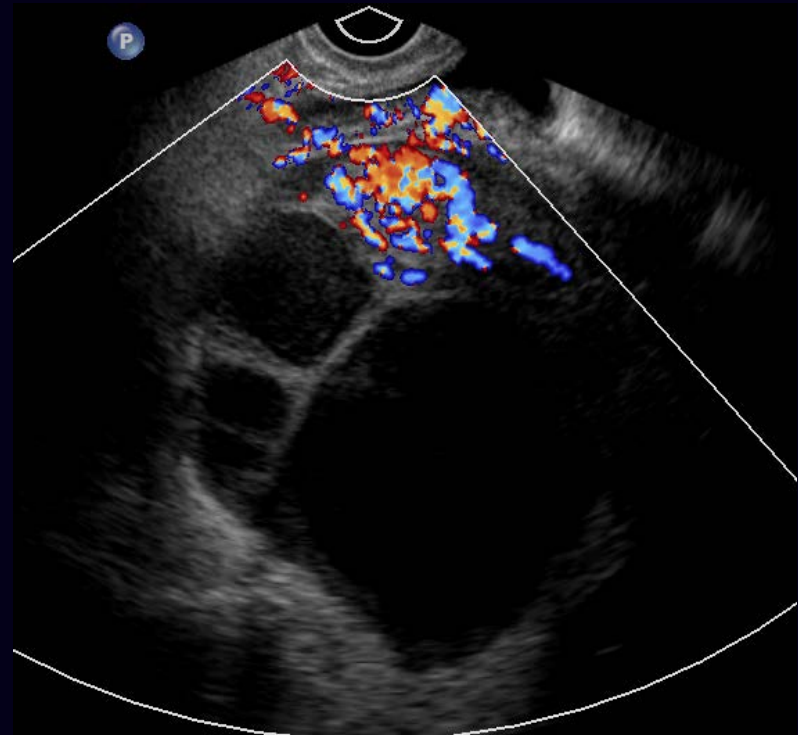
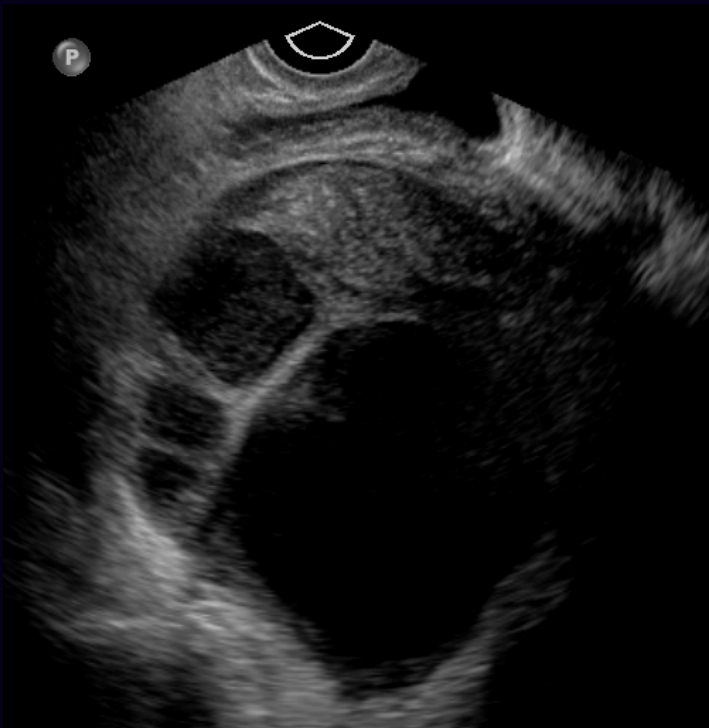
Clinical History

- **Positive pregnancy test**
 - **Ectopic Pregnancy**



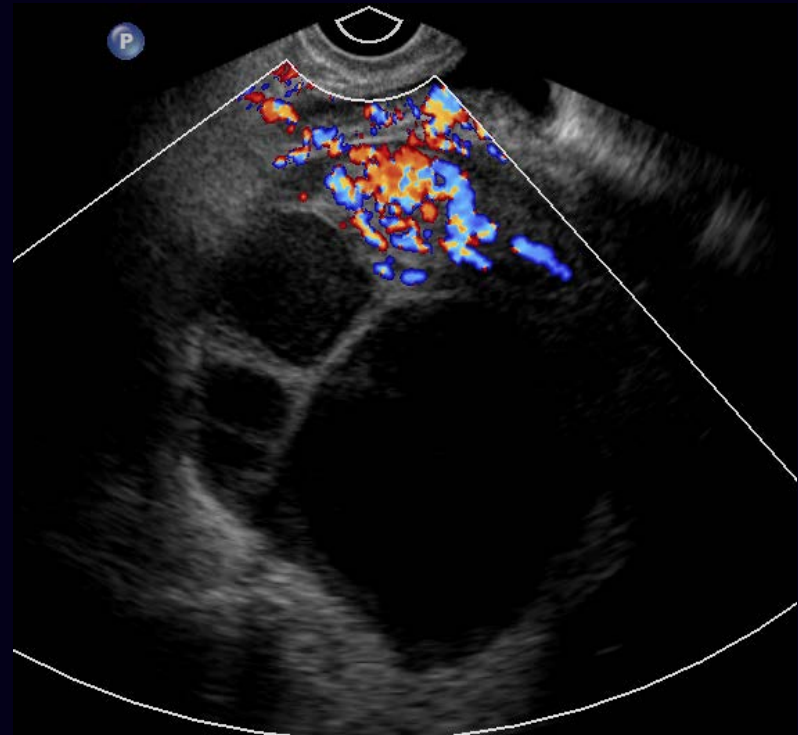
Clinical History

- **Signs and Symptoms of Pelvic Inflammatory Disease**

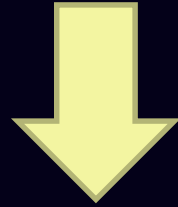


Clinical History

- **Signs and Symptoms of Pelvic Inflammatory Disease**
 - **Tubo-ovarian Abscess**



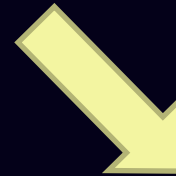
Adnexal Mass



Clinical History



Ovary



Extraovarian

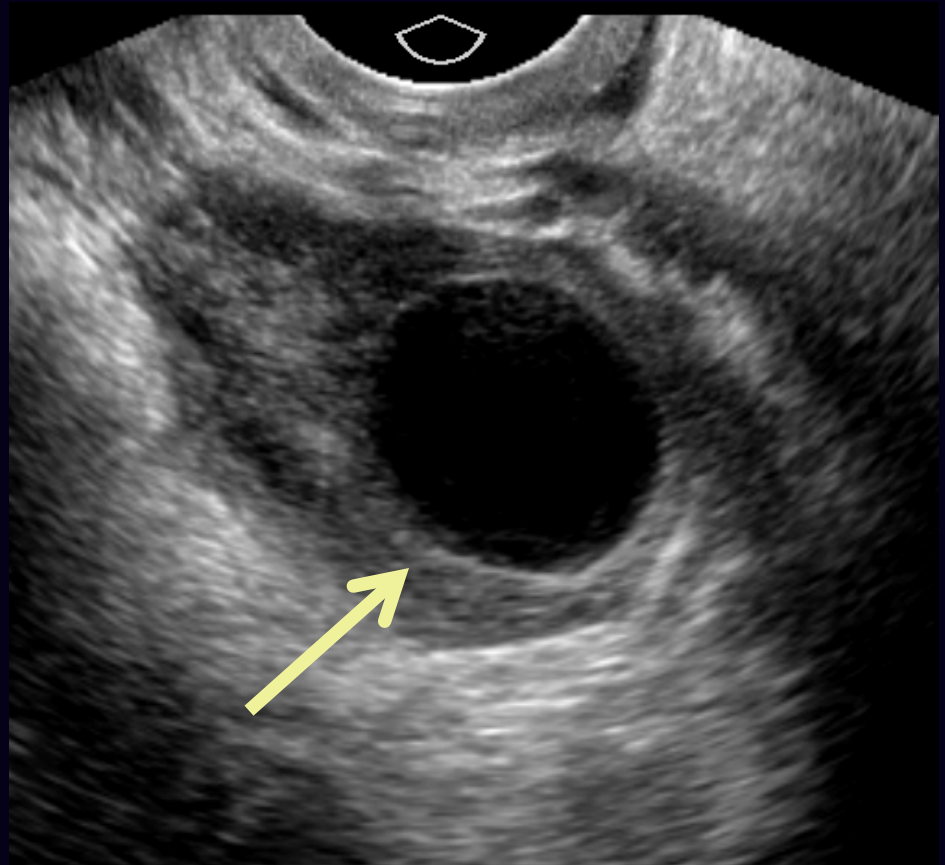
Ovarian Location

- Ovarian tissue extending around lesion



Ovarian Location

- Ovarian tissue extending around lesion



Ovarian Location

- Ovarian tissue extending around lesion
- No separate ipsilateral ovary



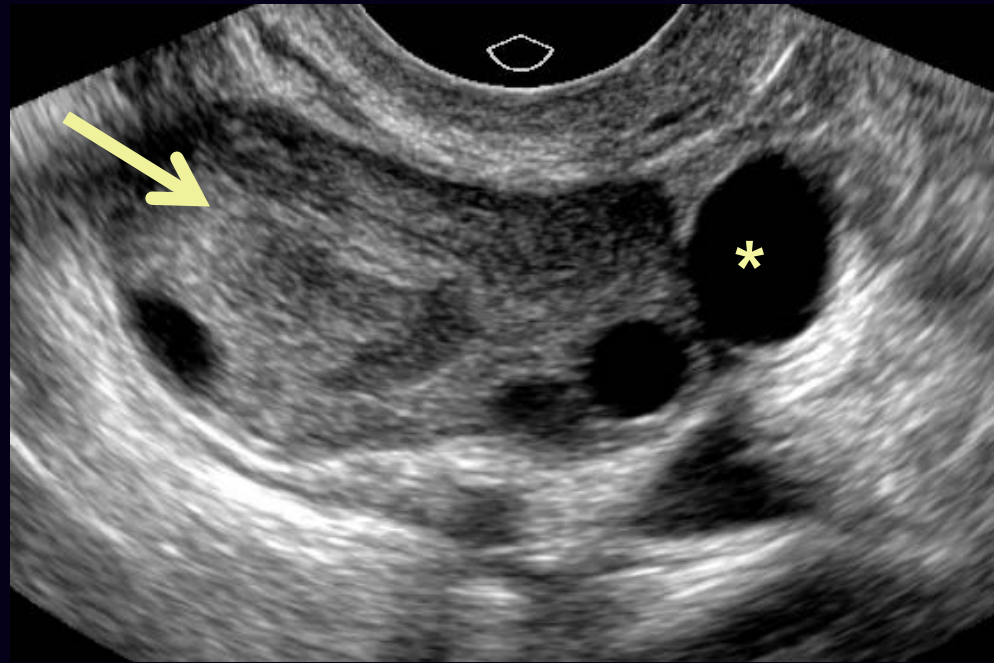
Extraovarian Location

- Ipsilateral ovary separate from lesion



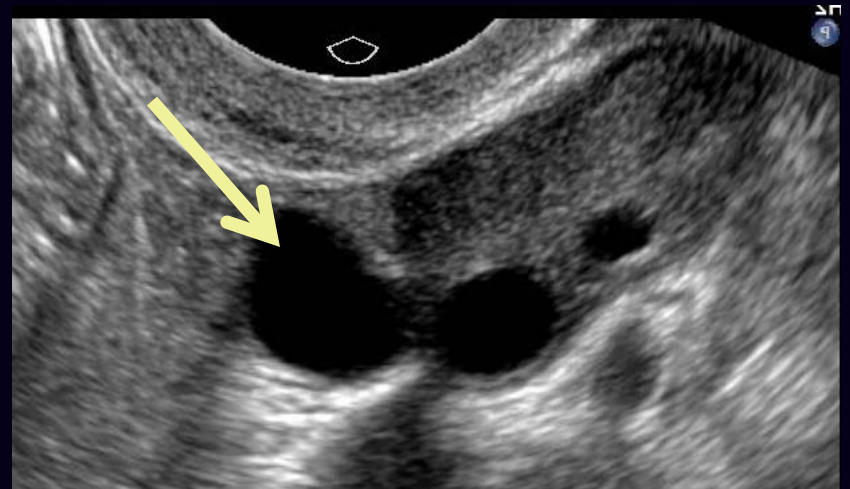
Extraovarian Location

- Ipsilateral ovary separate from lesion



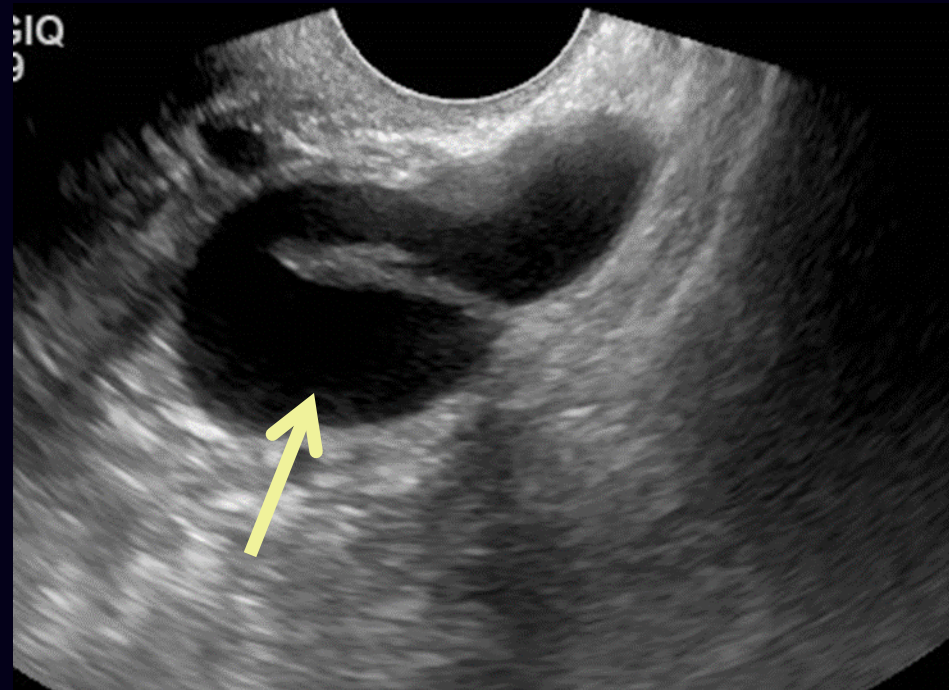
Common Extraovarian Lesions

- **Para-ovarian cyst**
 - Also paratubal cyst



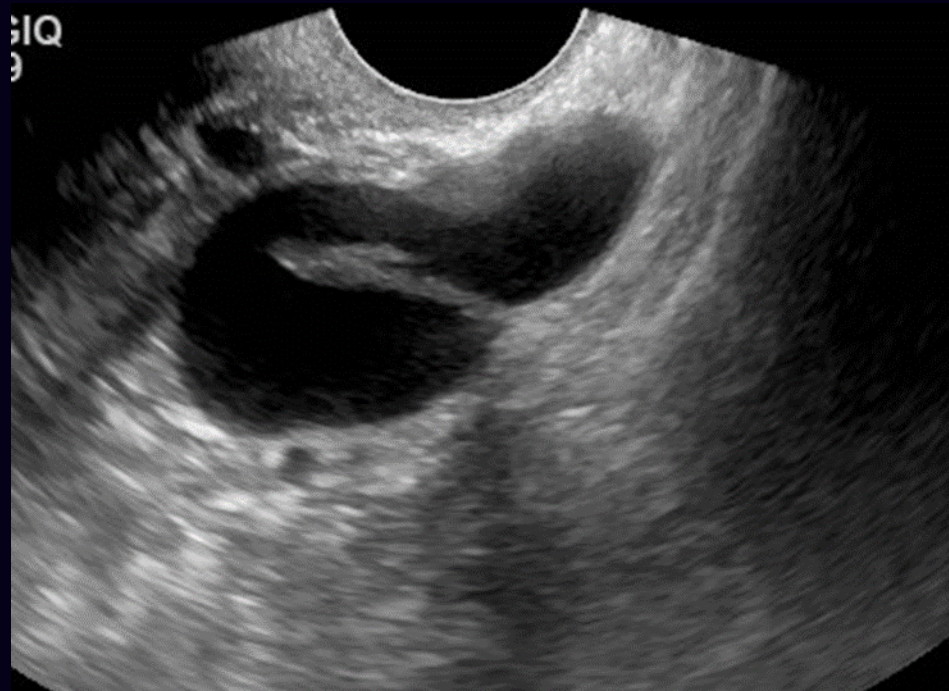
Common Extraovarian Lesions

- Para-ovarian cyst
- Hydrosalpinx
 - Tubular

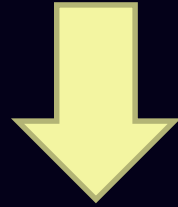


Common Extraovarian Lesions

- **Para-ovarian cyst**
- **Hydrosalpinx**
- **Peritoneal inclusion cyst**
- **Uterine fibroid**



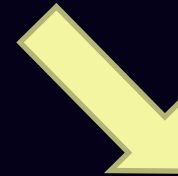
Adnexal Mass



Clinical History



Ovary



Extraovarian



**Simple
Cyst**

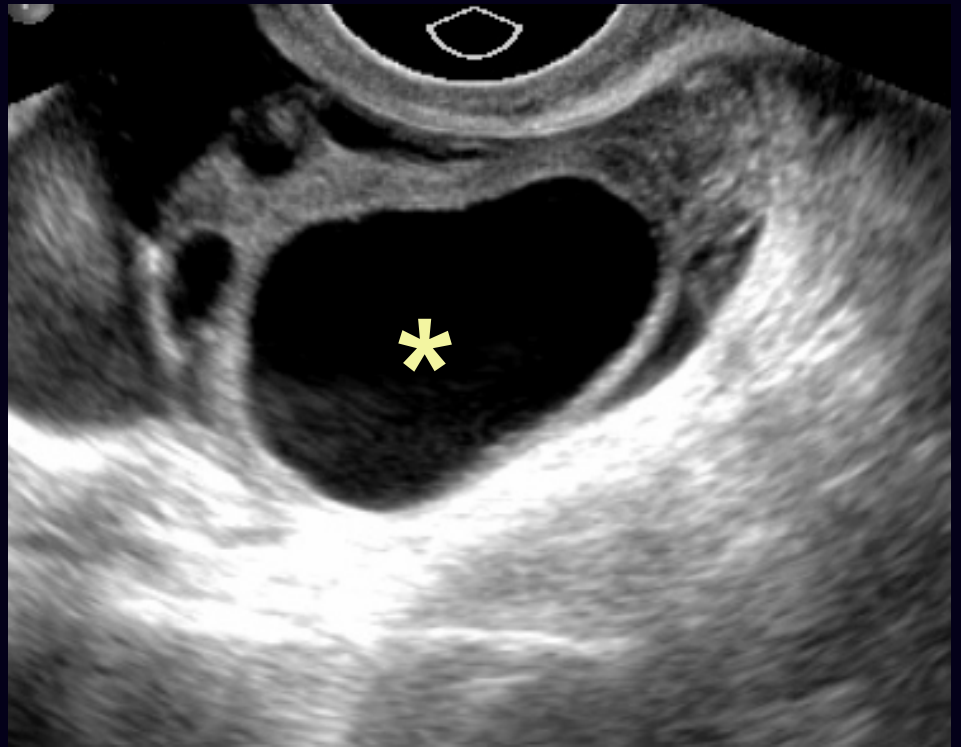
Ultrasound Criteria for a Simple Cyst

- **Anechoic**
- **Imperceptible wall**
- **Increased through transmission**
- **Well defined back wall**
- **No color flow**



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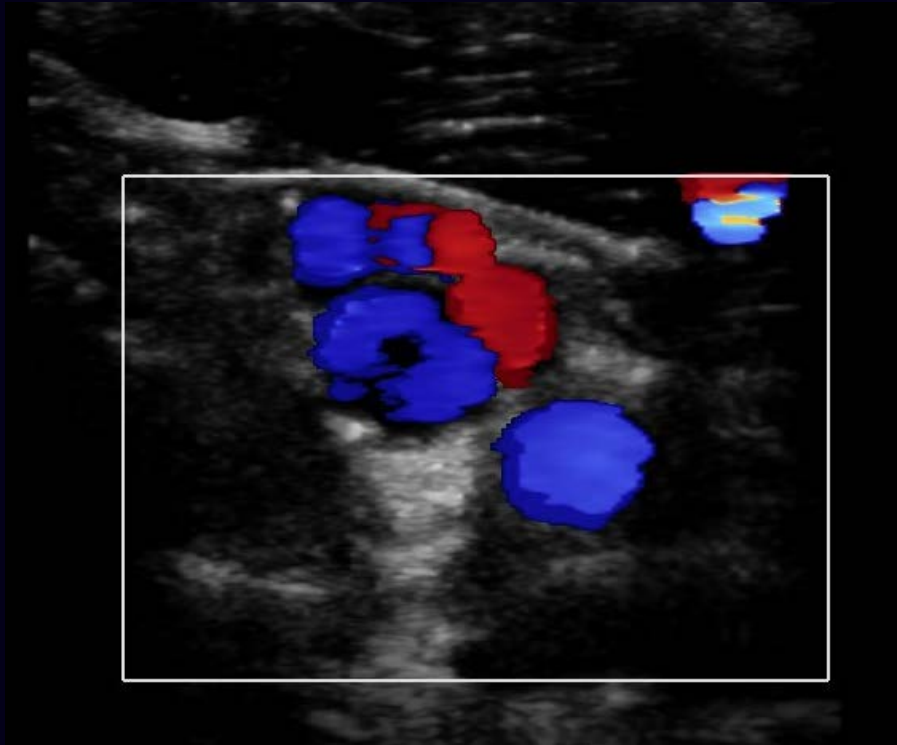


Ultrasound Criteria for a Simple Cyst

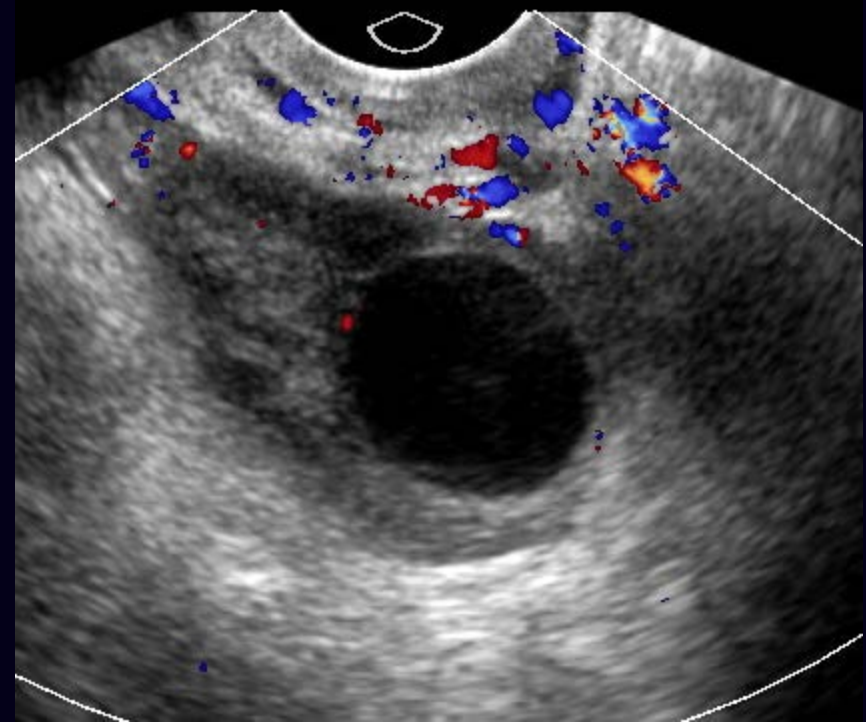
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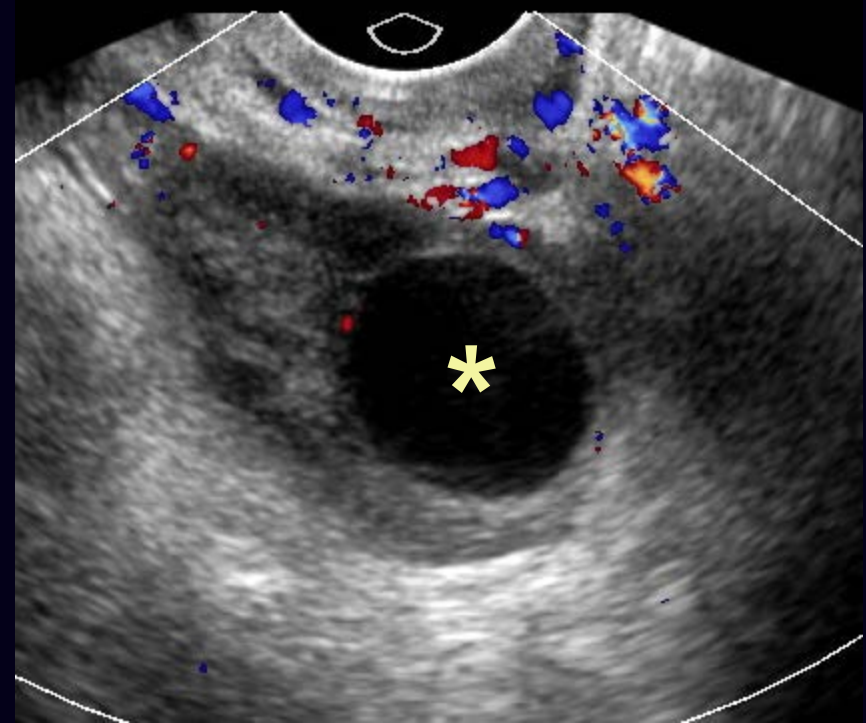
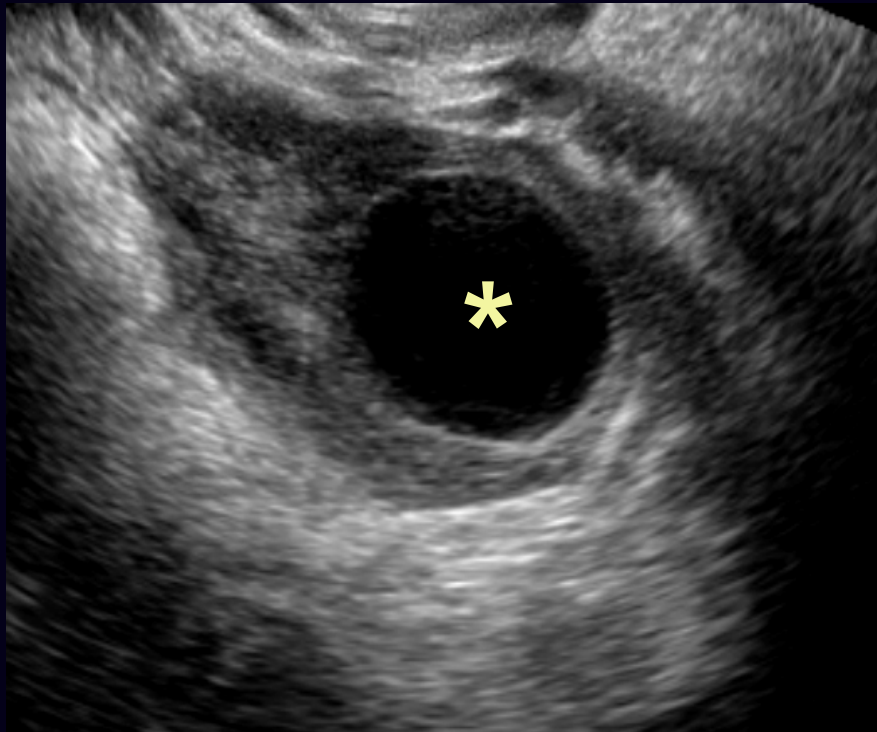
Ultrasound Criteria for a Simple Cyst



Simple Cyst



Simple Cyst



What size matters?

- **Malignancy in a simple cyst by ultrasound criteria**
 - **0.7% Pre-menopausal**
 - **1.6% Post-menopausal**

Ekerhovd E, Wienerroith H, Staudach A, et al. Preoperative assessment of unilocular adnexal cysts by transvaginal ultrasonography: a comparison between ultrasonographic morphologic imaging and histopathologic diagnosis. *Am J Obstet Gynecol.* 2001; 184:48-54.

What size matters?

- **Malignancy in a simple cyst by ultrasound criteria**
 - **0.7% Pre-menopausal**
 - **1.6% Post-menopausal**
 - **All malignancies were over 7.5 cm**

Ekerhovd E, Wienerroith H, Staudach A, et al. Preoperative assessment of unilocular adnexal cysts by transvaginal ultrasonography: a comparison between ultrasonographic morphologic imaging and histopathologic diagnosis. *Am J Obstet Gynecol.* 2001; 184:48-54.

Follow up Pre-menopausal Simple Cyst

- **Less than 5 cm**
 - **No follow up**

Follow up Pre-menopausal Simple Cyst

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- **5 to 7cm**
 - **Could be functional cyst**
 - **Follow up yearly**

Follow up Pre-menopausal Simple Cyst

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 - **Follow up yearly**
- **Over 7 cm**
 - **Further imaging or Surgical consultation**

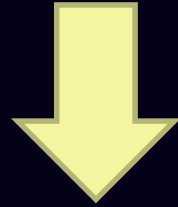
Follow up Post-menopausal Simple Cyst

- **Over 1 cm to 7 cm**
 - **Follow up yearly**

Follow up Post-menopausal Simple Cyst

- **Over 1 cm to 7 cm**
 - **Follow up yearly**
- **Over 7 cm**
 - **Further imaging or Surgical consultation**

Adnexal Mass



Clinical History



Ovary

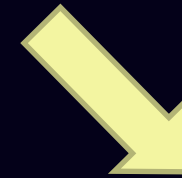
Extraovarian



**Simple
Cyst**

**Benign
Lesions**

Benign Lesions



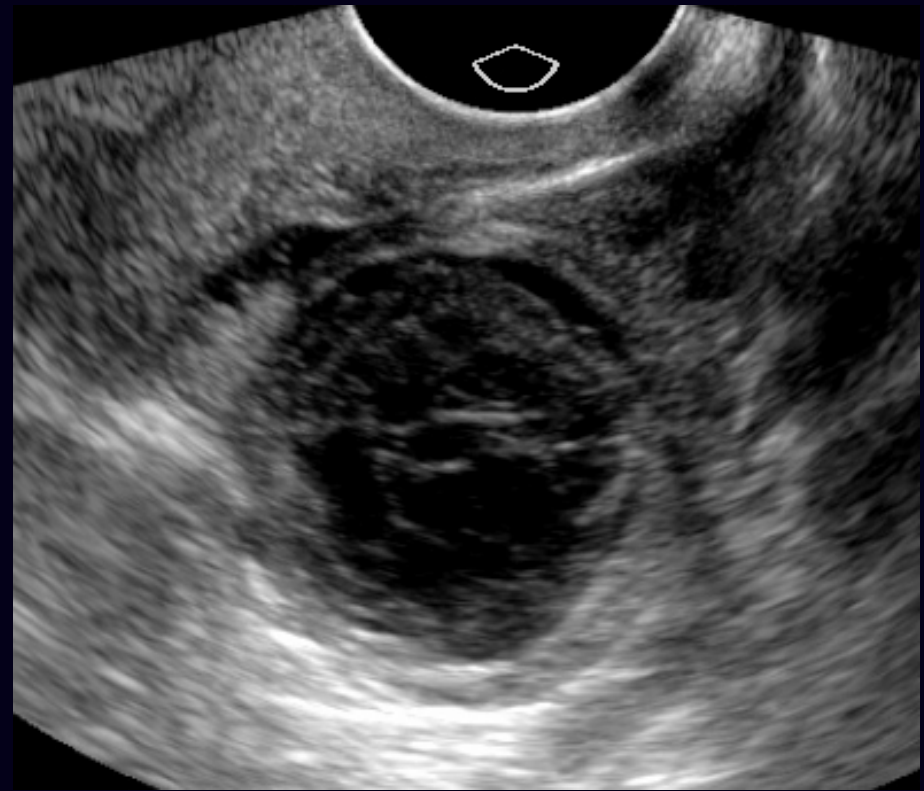
**Hemorrhagic
Cyst**

Endometrioma

**Mature Cystic
Teratoma**

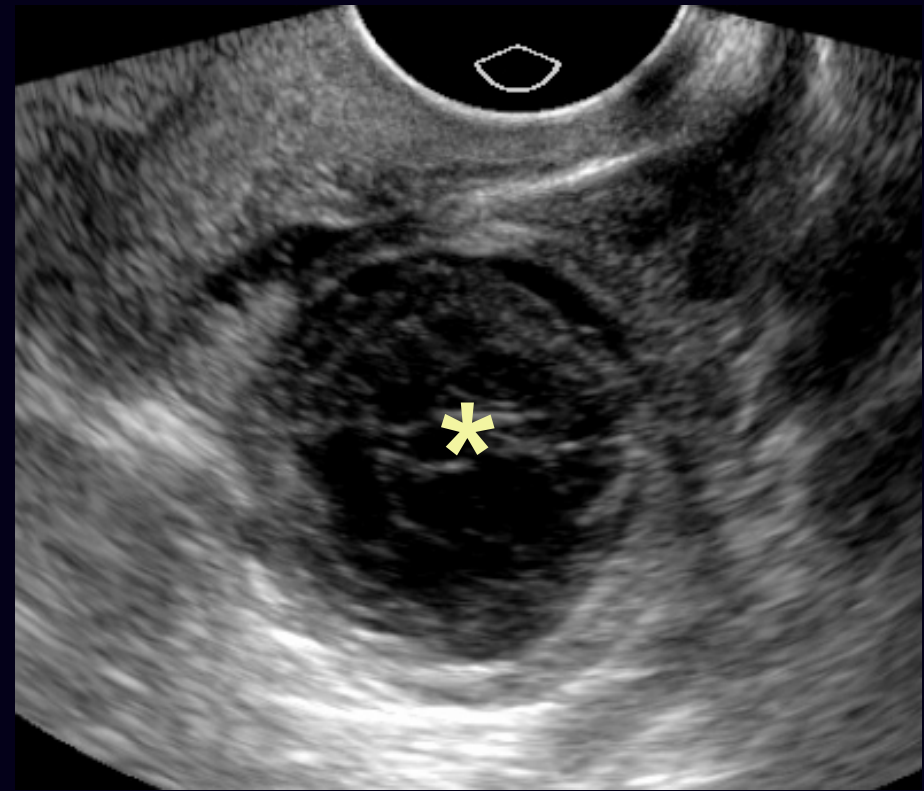
Hemorrhagic Cyst

- **Functional Cysts** that develop internal hemorrhage



Hemorrhagic Cyst

- **Functional Cysts** that develop internal hemorrhage



Ultrasound Appearance of Hemorrhagic Cyst

- **Lace-like internal echoes**
- **Retracting clot**
- **Complicated cyst without internal flow**
- **No color flow**

Hemorrhagic Cyst

- **Lace-like internal echoes**
 - Often do not extend all the way across the cyst
 - Very thin



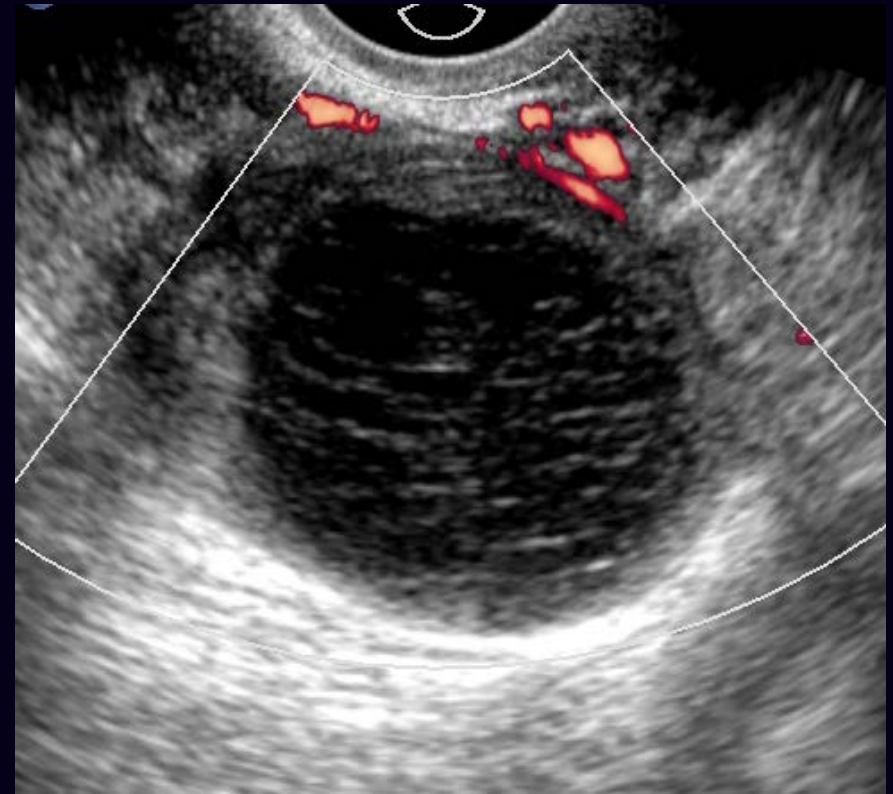
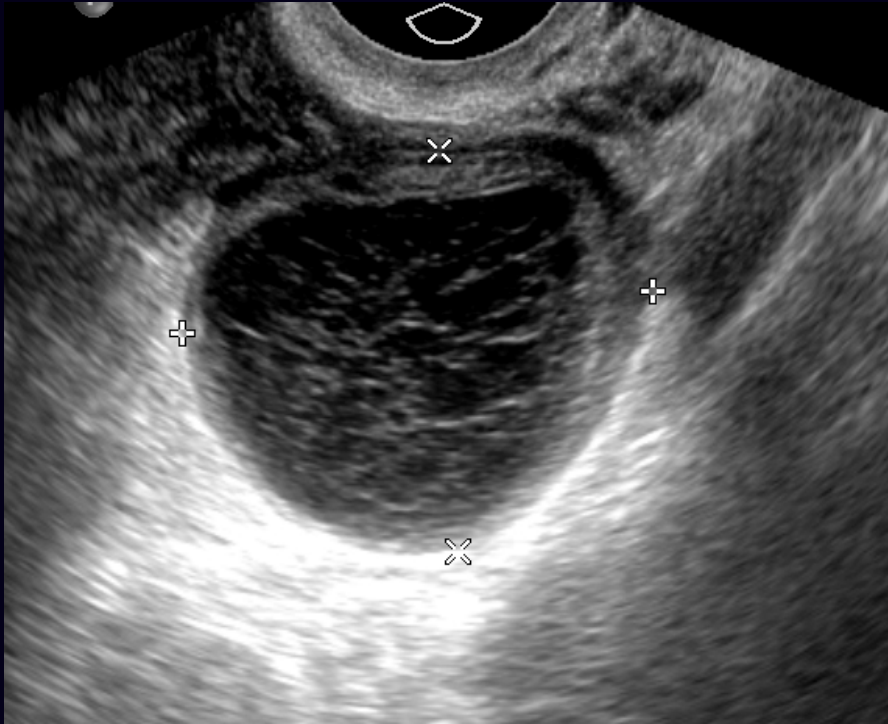
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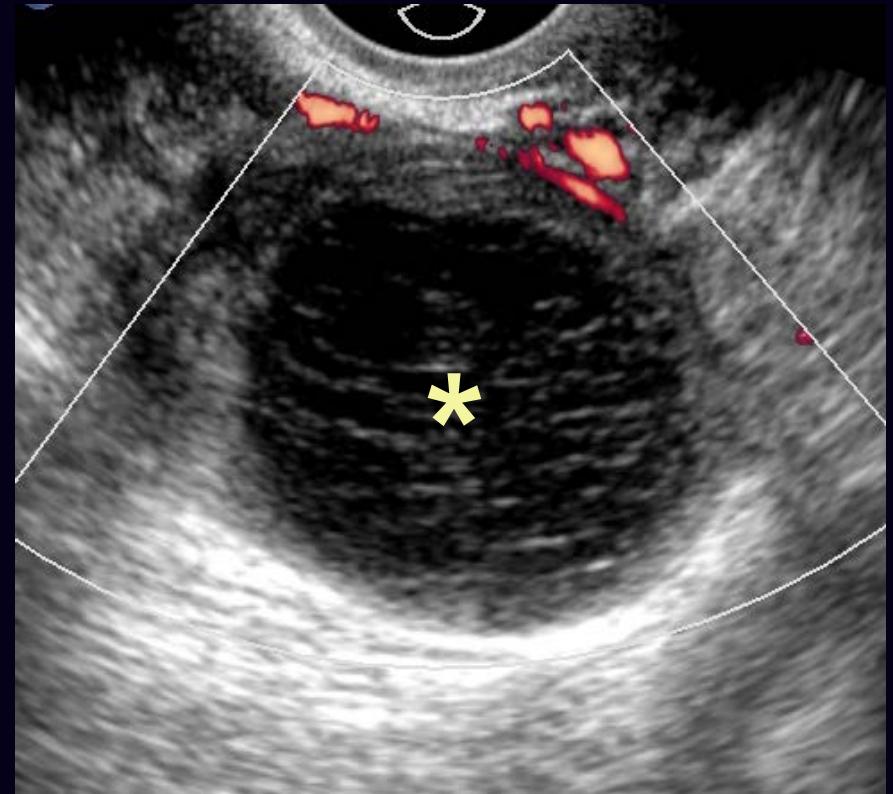
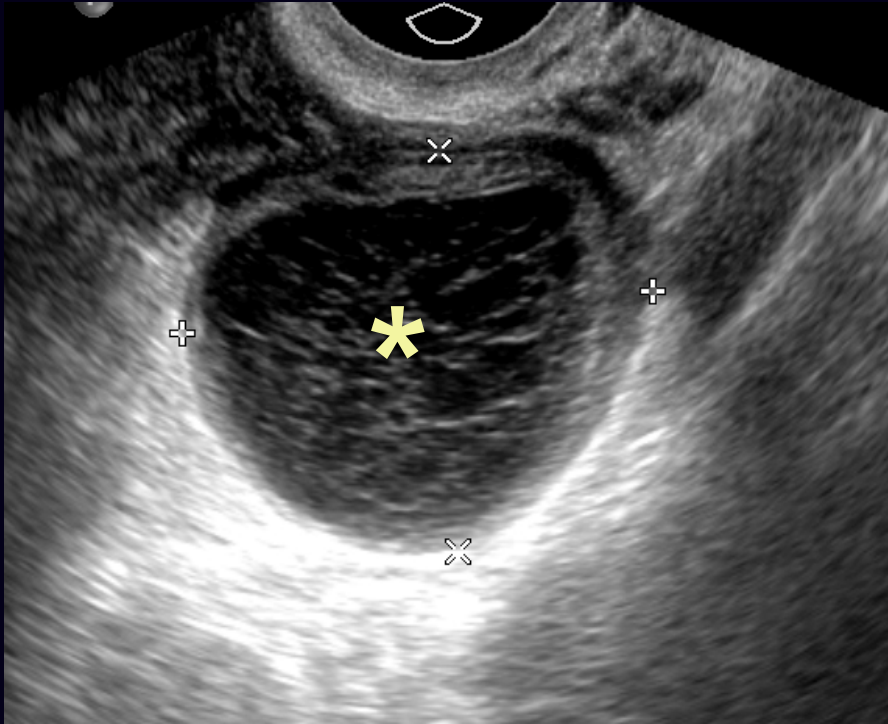
Hemorrhagic Cyst

- Lace-like internal echoes



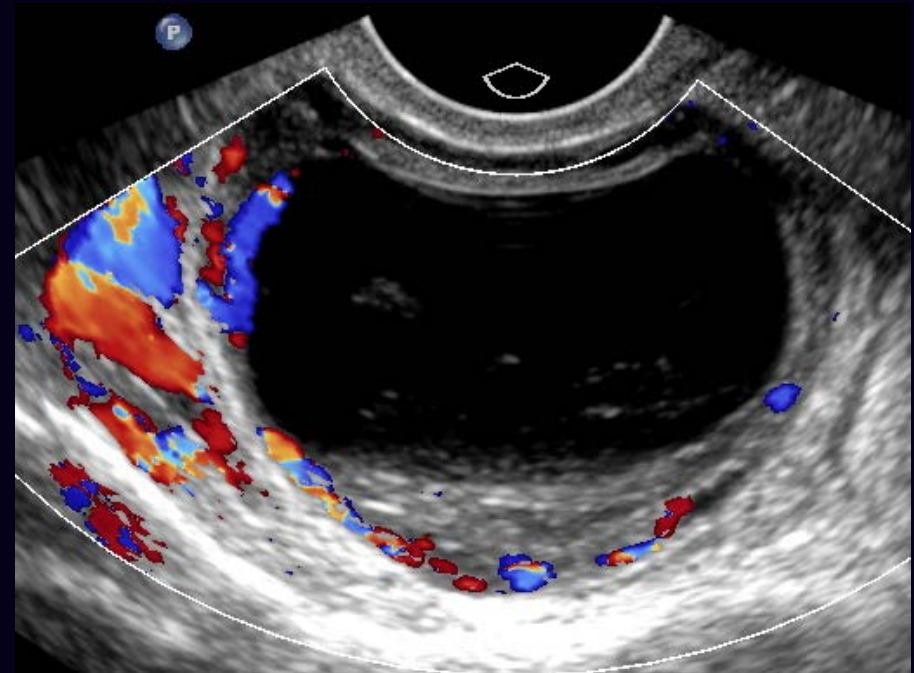
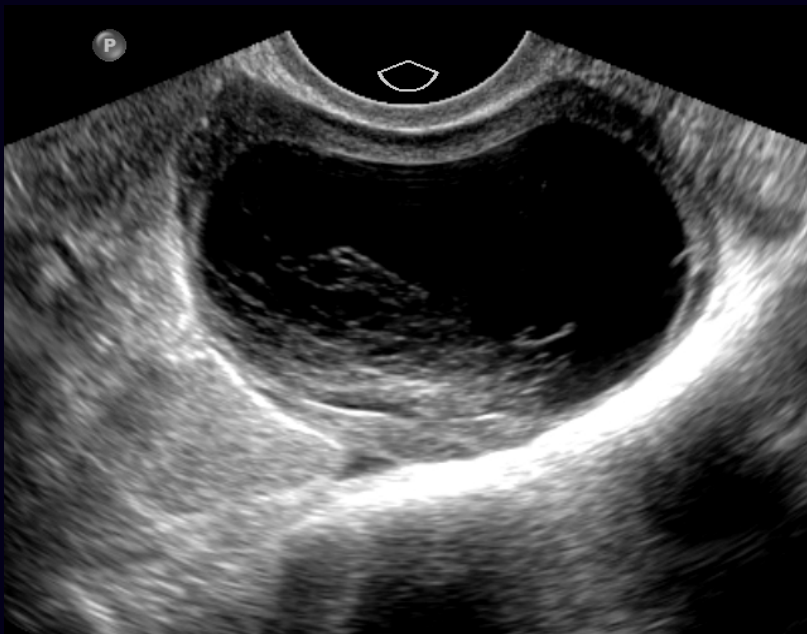
Hemorrhagic Cyst

- Lace-like internal echoes



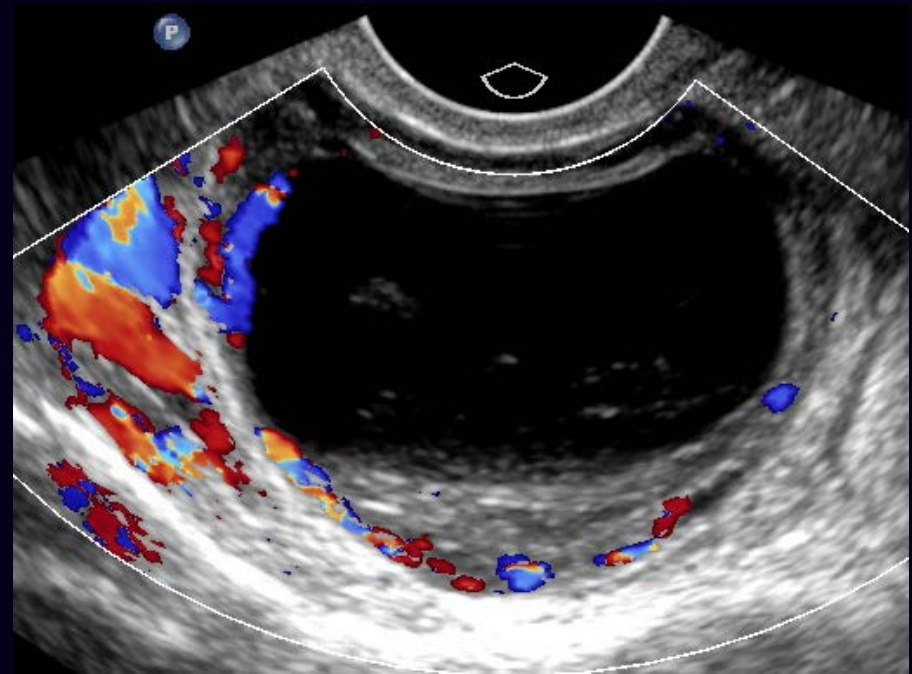
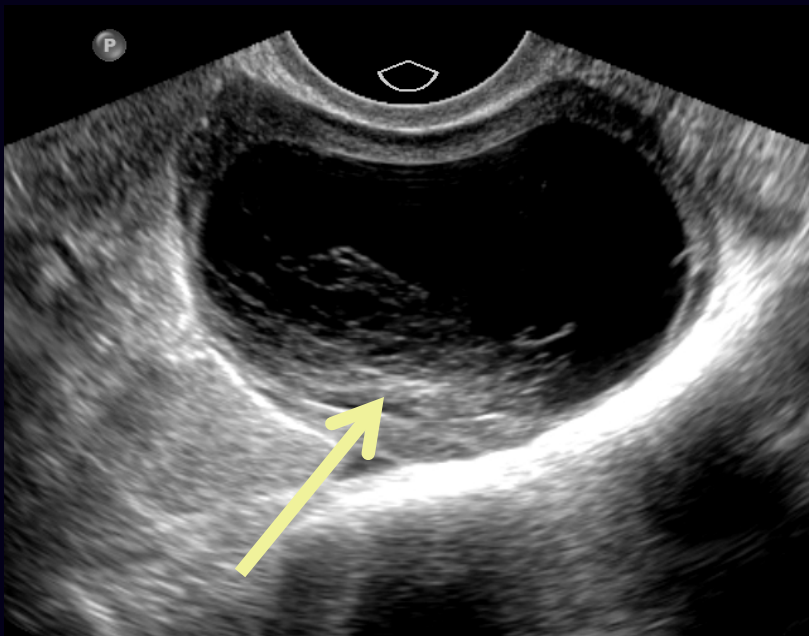
Hemorrhagic Cyst

- Retracting clot
 - Echogenicity with a concave margin



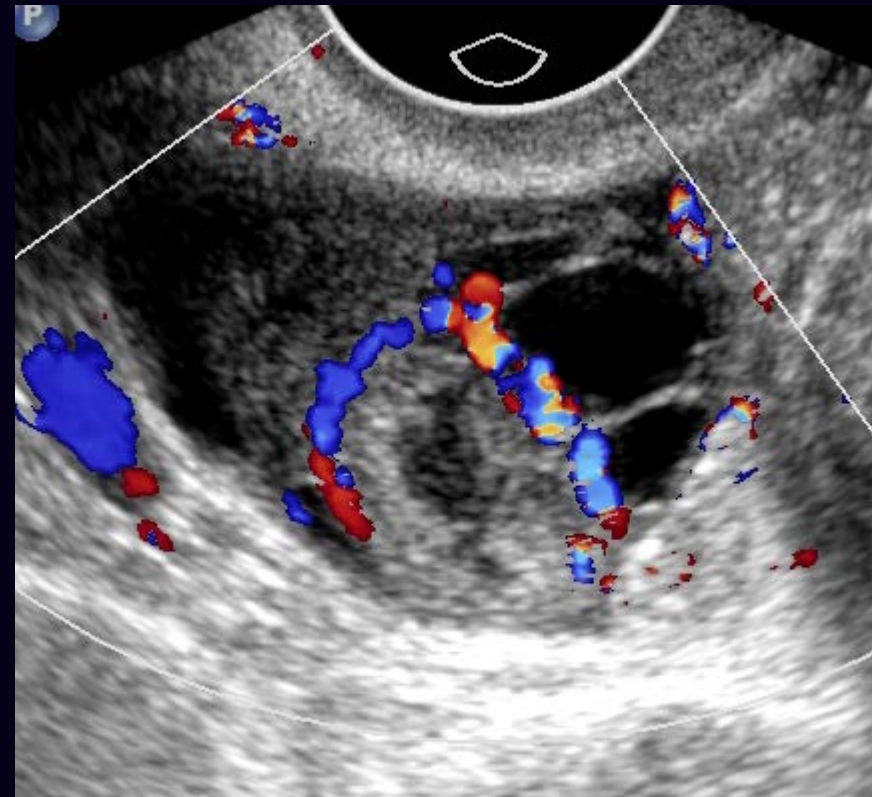
Hemorrhagic Cyst

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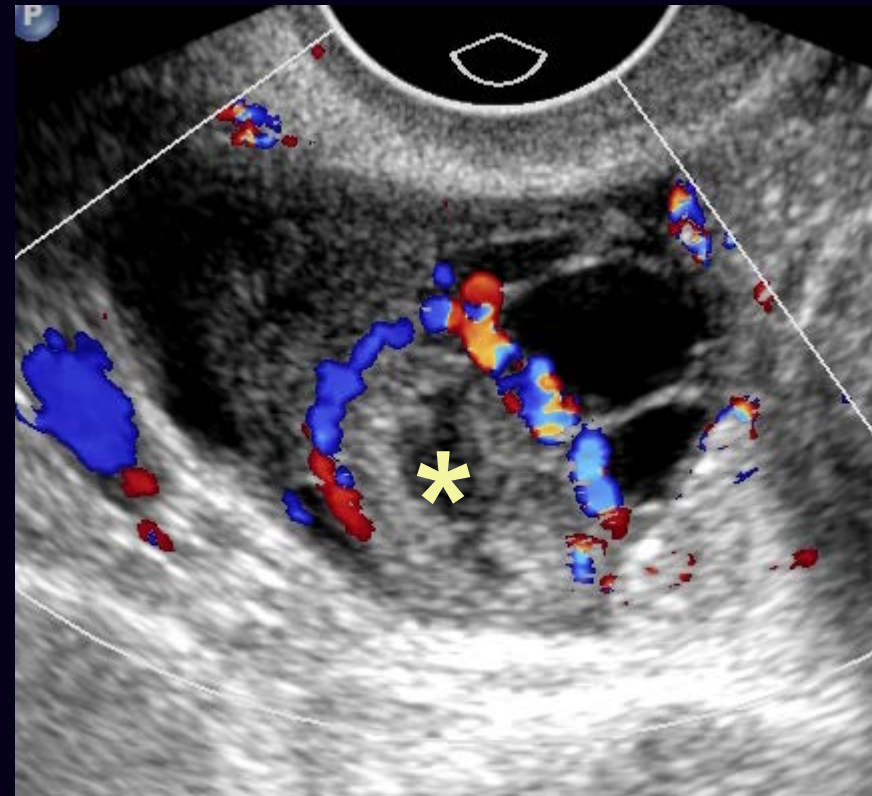
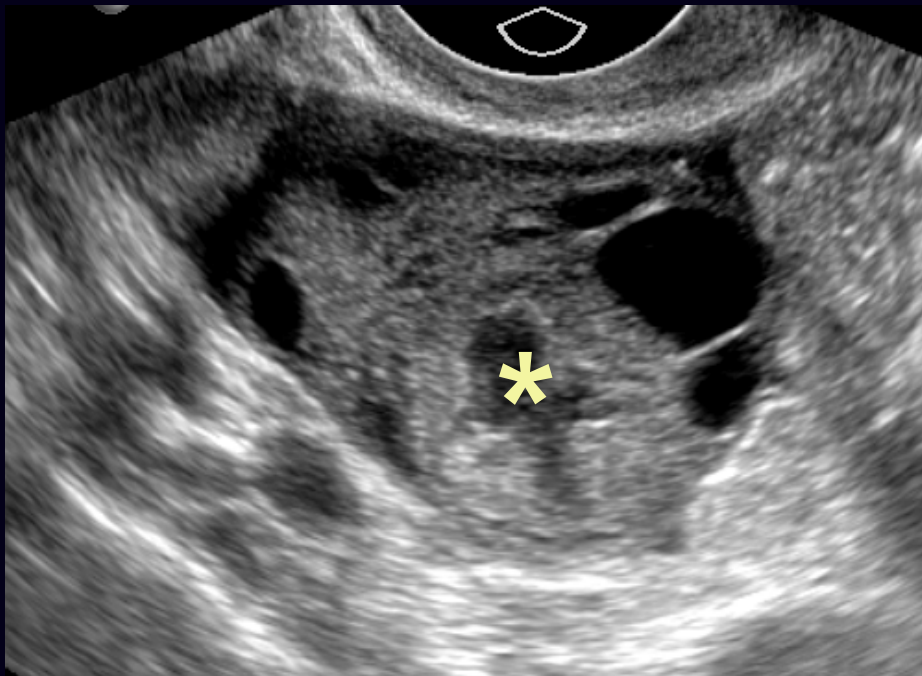
Hemorrhagic Cyst

- **Complicated cyst without internal flow**



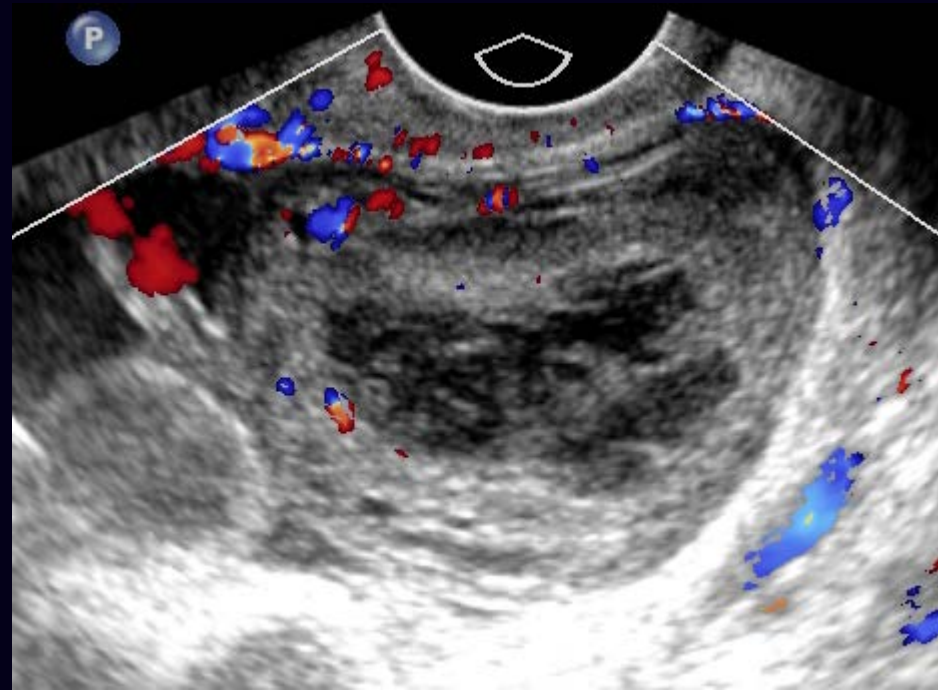
Hemorrhagic Cyst

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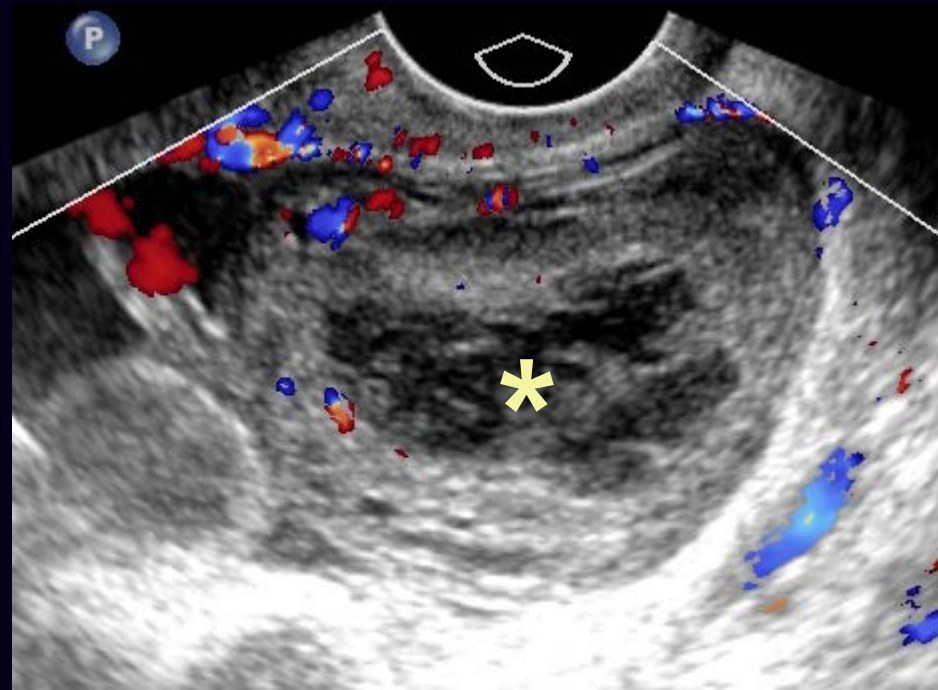
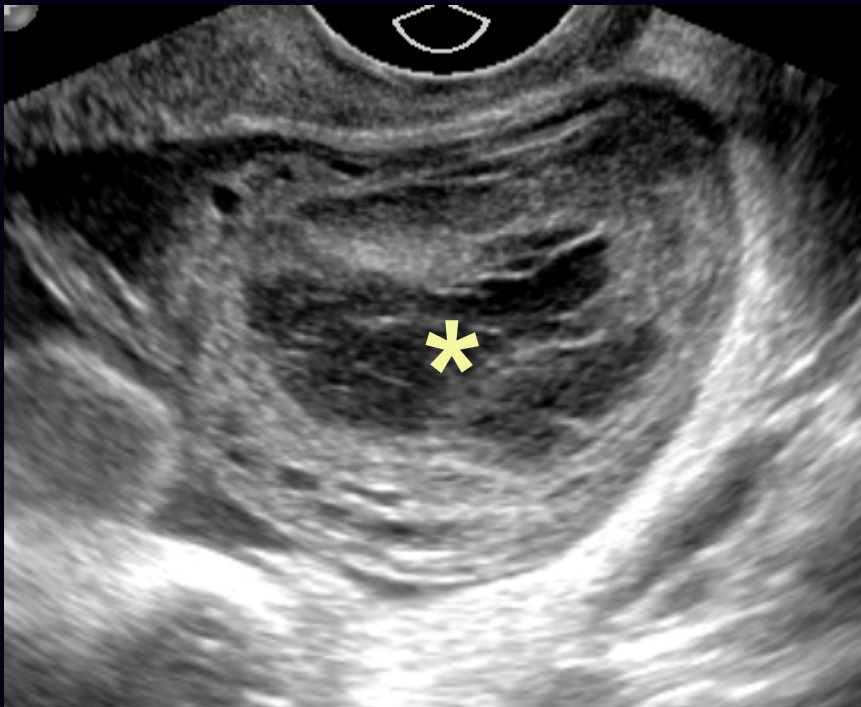
Hemorrhagic Cyst

- **Complicated cyst without internal flow**



Hemorrhagic Cyst

- **Complicated cyst without internal flow**



Hemorrhagic Cyst Follow Up

- **Pre-menopausal**
 - **5 cm or less**
 - **No follow up**

Hemorrhagic Cyst Follow Up

- **Pre-menopausal**
 - **5 cm or less**
 - **No follow up**
 - **Over 5 cm**
 - **Follow up in 6-12 weeks to document resolution**

Hemorrhagic Cyst Follow Up

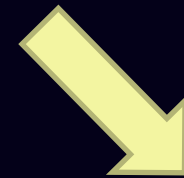
- **Pre-menopausal**
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 - **Over 5 cm**
 - **Follow up in 6-12 weeks to document resolution**
- **Post-menopausal**
 - **Follow up in 6-12 weeks to document resolution**

Hemorrhagic Cyst Follow Up



6 week follow up
Ultrasound

Benign Lesions



**Hemorrhagic
Cyst**

Endometrioma

***Mature Cystic
Teratoma***

Mature Cystic Teratoma

- Also called Dermoid Cyst

Mature Cystic Teratoma

- **Also called Dermoid Cyst**
- **Most common ovarian neoplasm**
 - **Over 98% benign**

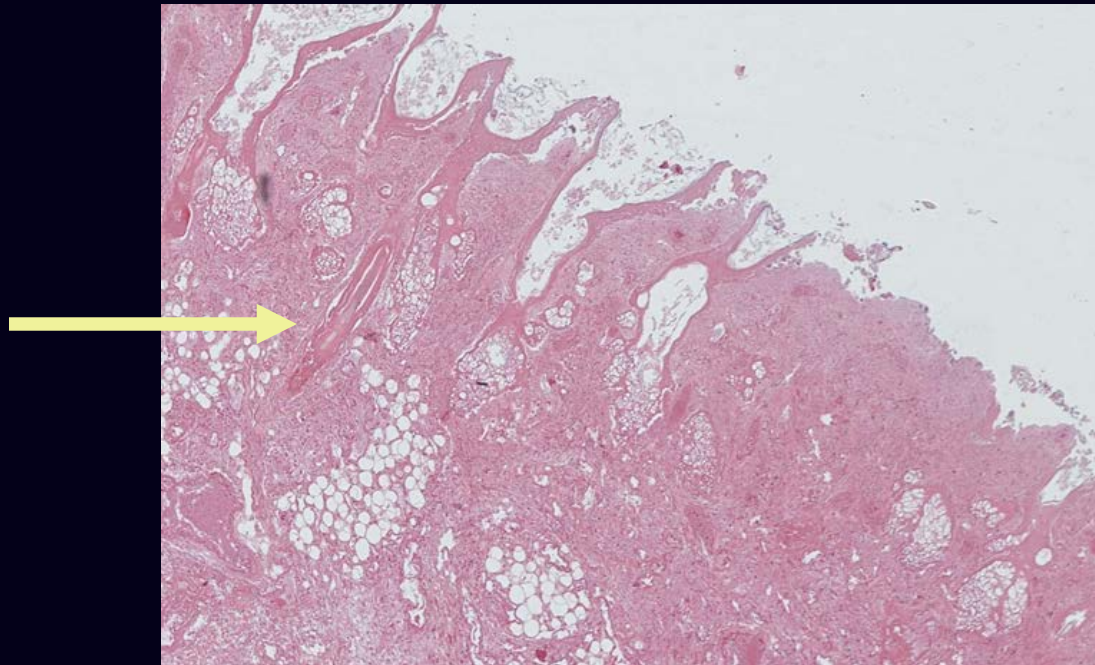
Mature Cystic Teratoma

- **Also called Dermoid Cyst**
- **Most common ovarian neoplasm**
 - **Over 98% benign**
- **Derive from ovarian germ cells**
 - **Contain multiple germ cell layers**

Mature Cystic Teratoma

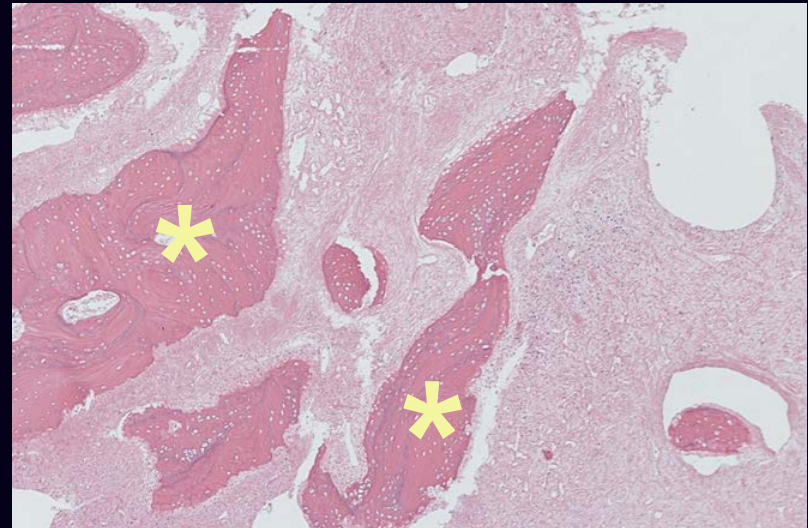
- Derive from ovarian germ cells
 - Contains multiple germ cell layers:
 - Ectoderm 100%
 - Skin, skin appendages, nervous system

Hair
follicle



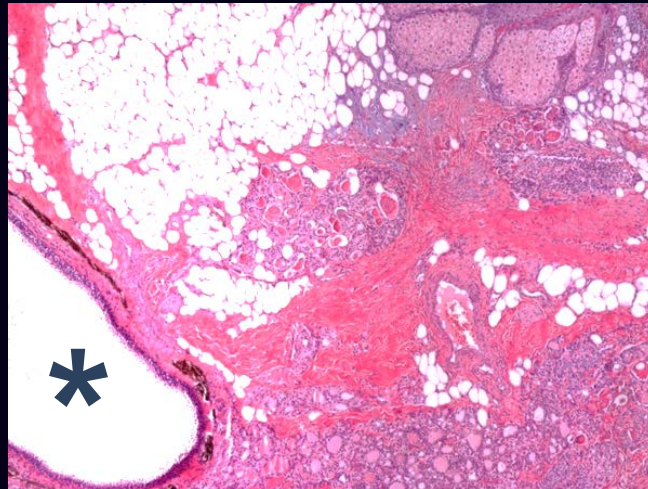
Mature Cystic Teratoma

- Derive from ovarian germ cells
 - Contains multiple germ cell layers:
 - Ectoderm 100%
 - Mesoderm 90%
 - Bones, muscles, connective tissue, blood vessels



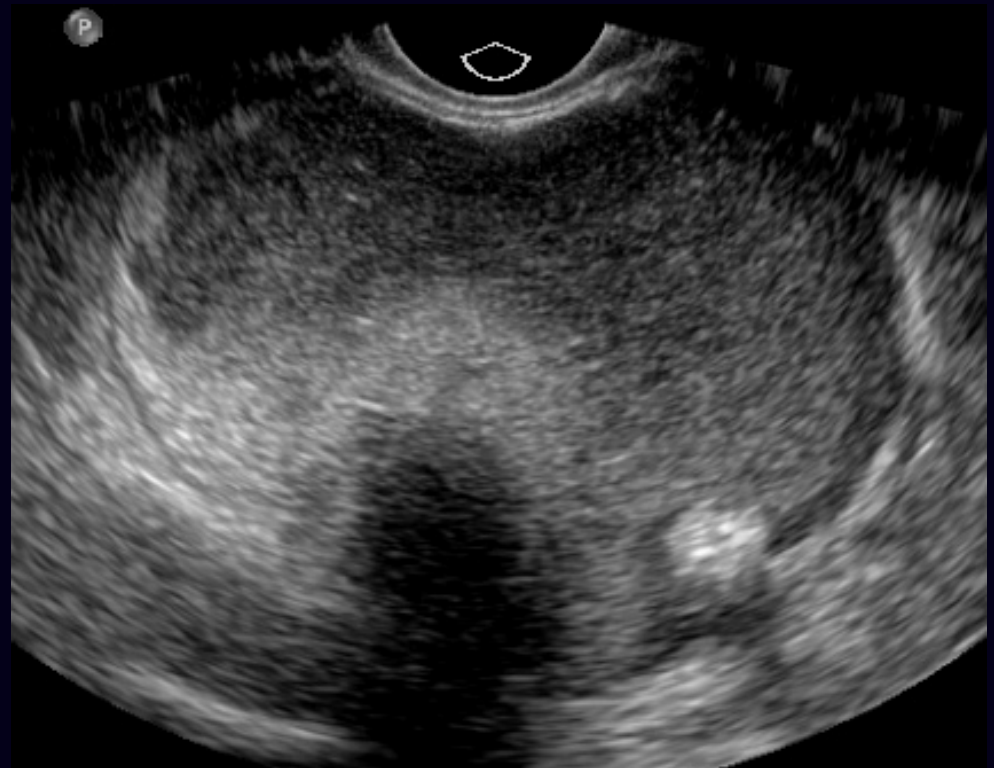
Mature Cystic Teratoma

- Derive from ovarian germ cells
 - Contains multiple germ cell layers:
 - Ectoderm 100%
 - Mesoderm 90%
 - Endoderm 70%
 - Epithelium of respiratory system, urinary system and digestive tract



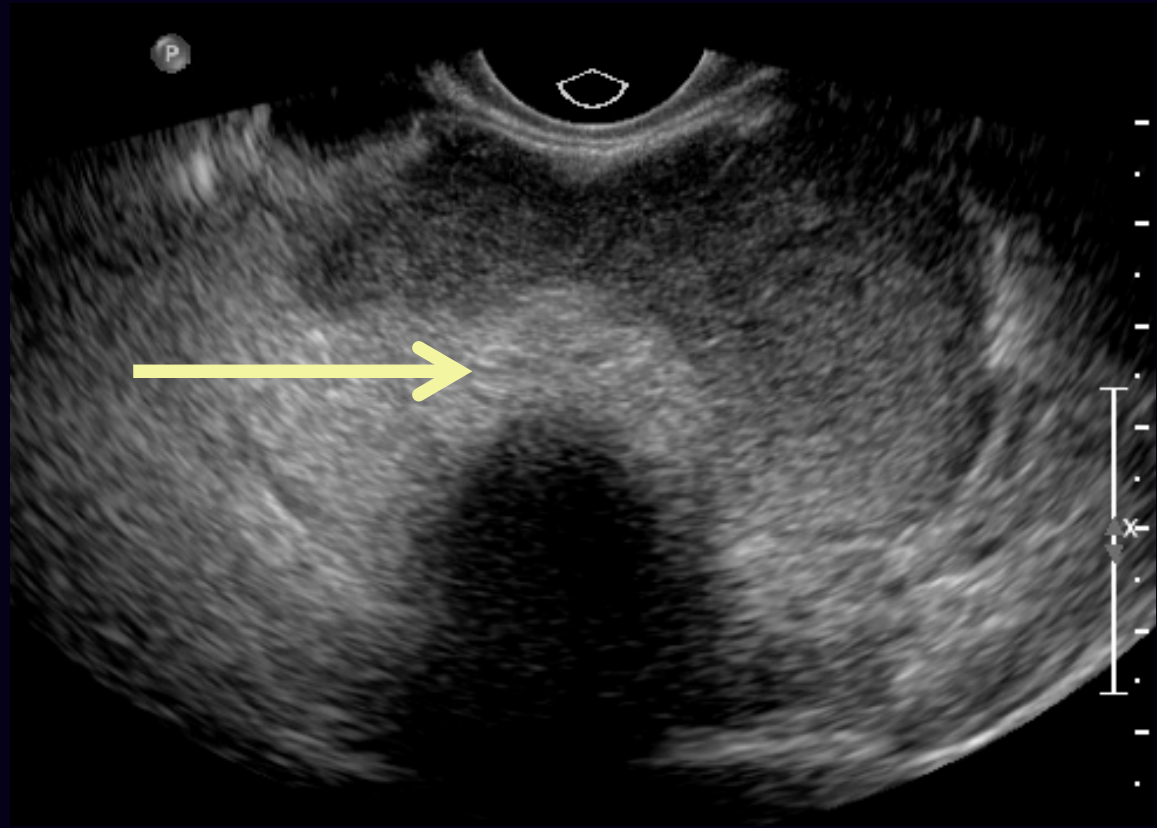
Ultrasound Appearance of Mature Cystic Teratoma

- **Shadowing echogenicity**
- **Focal or diffuse increased echogenicity**
- **Hyperechoic lines and dots**
- **No color flow**



Mature Cystic Teratoma

- **Shadowing echogenicity**
 - **Tip of the iceberg**



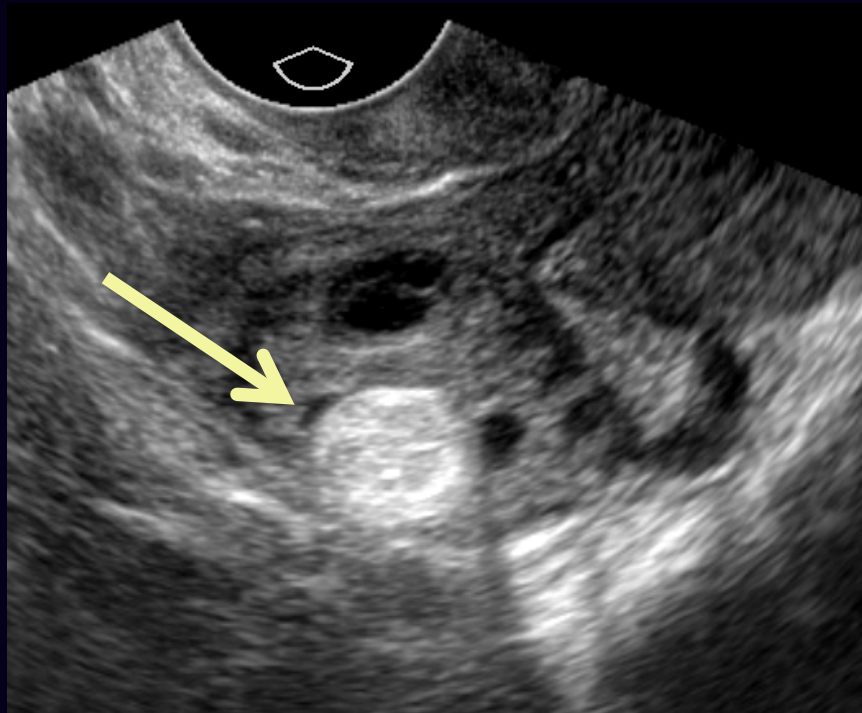
Mature Cystic Teratoma

- Focal or diffuse increased echogenicity
 - Dermoid Plug, Rokitansky Protuberance/Nodule, Echogenic nodule



Mature Cystic Teratoma

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 - Dermoid Plug, Rokitansky Protuberance/Nodule, Echogenic nodule



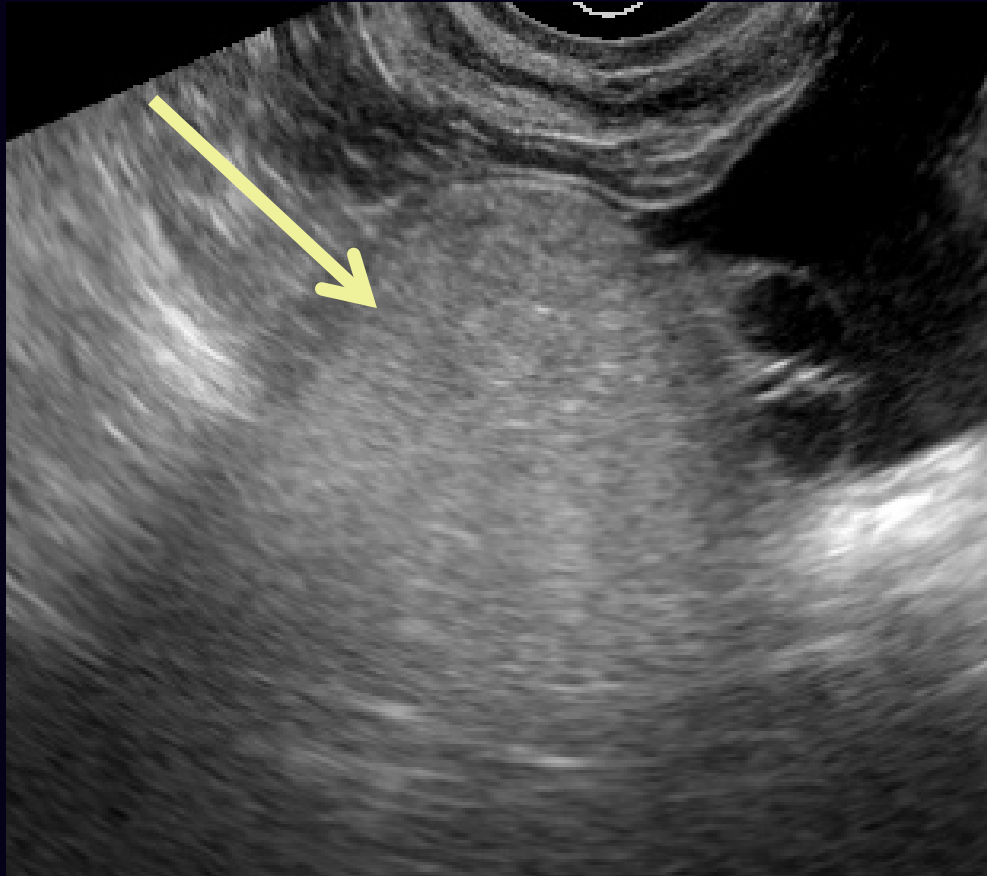
Mature Cystic Teratoma

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Mature Cystic Teratoma

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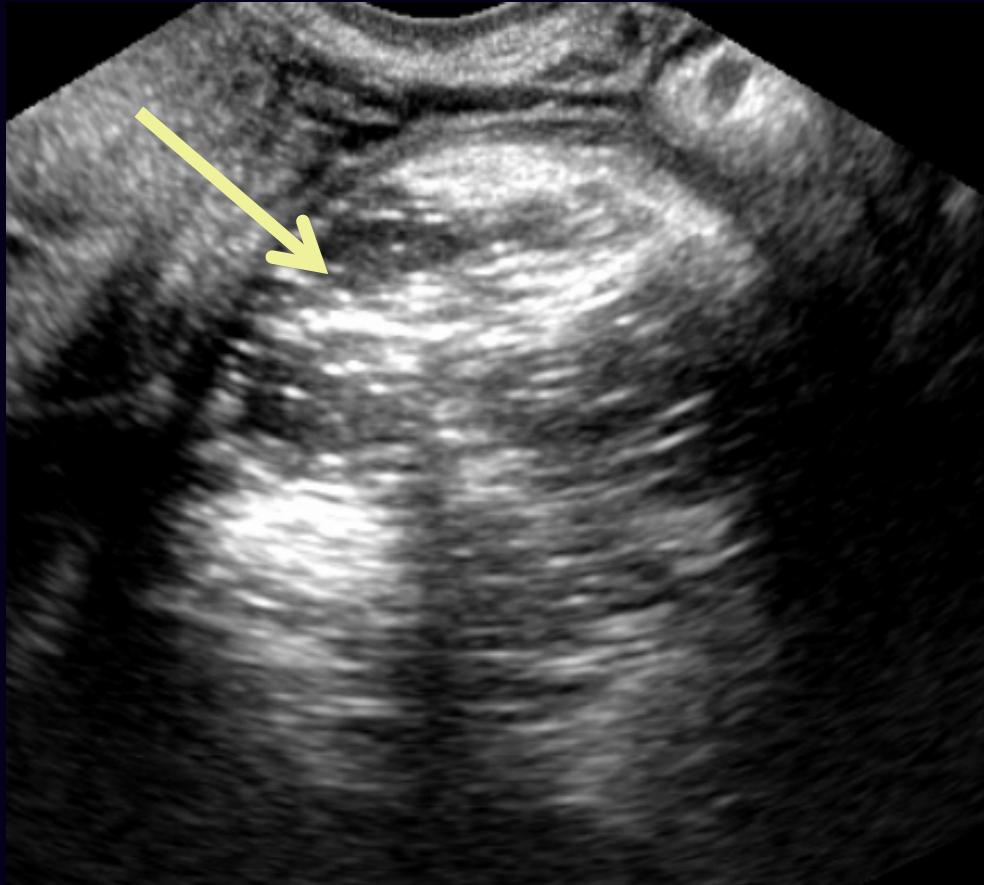
Mature Cystic Teratoma

- Focal or diffuse increased echogenicity



Mature Cystic Teratoma

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Mature Cystic Teratoma

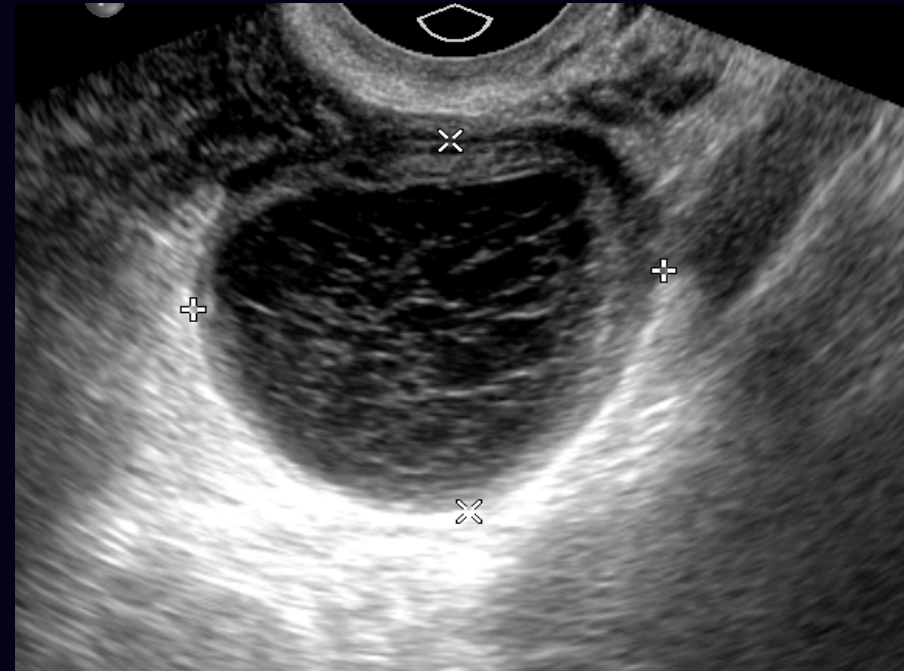
- **Hyperechoic lines and dots**
 - **Dermoid mesh**
 - **Not to be confused with lace like internal echoes**



Mature Cystic Teratoma



Mature cystic teratoma



Hemorrhagic cyst

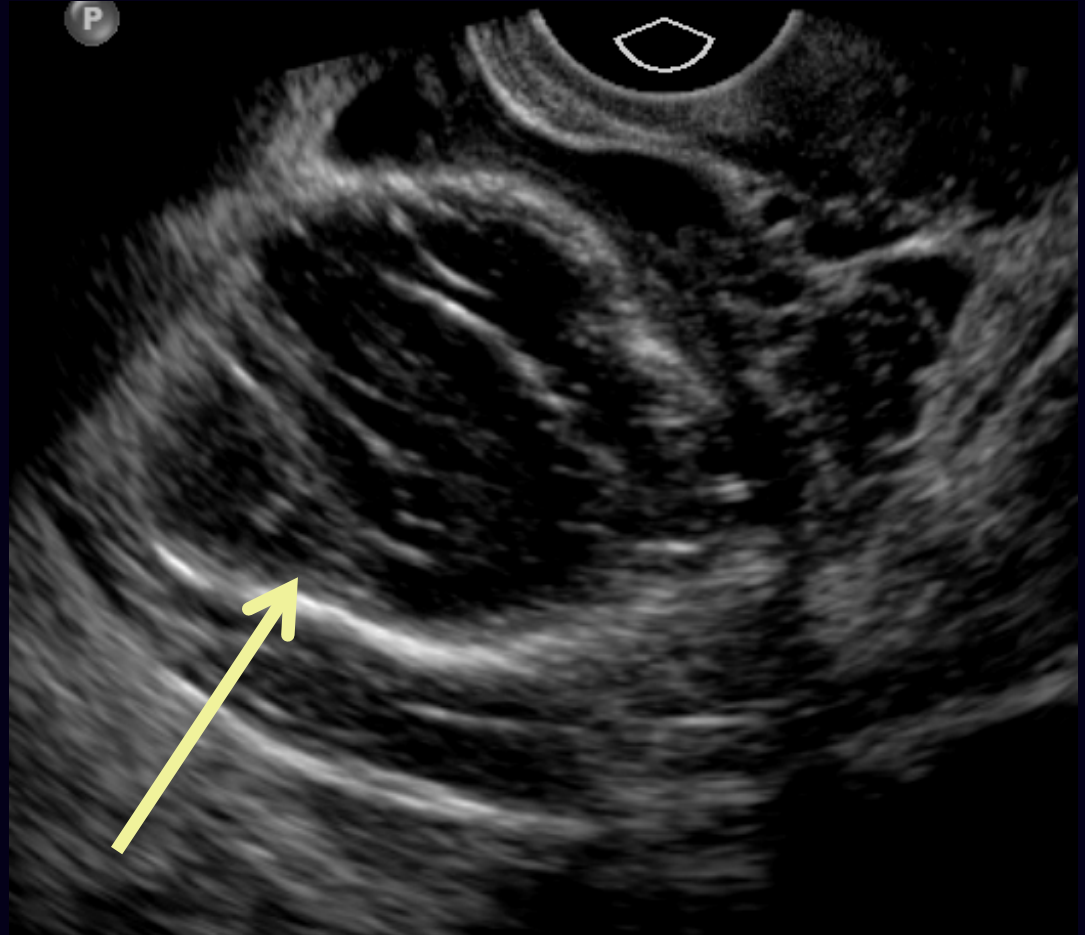
Mature Cystic Teratoma

- Hyperechoic lines and dots



Mature Cystic Teratoma

- Hyperechoic lines and dots



Mature Cystic Teratoma Follow Up

- **Appearance on ultrasound can overlap with endometrioma**
- **Institution/Referring Physician Dependent**
 - **CT or MR**
 - **Fat is diagnostic**
 - **Surgery**

Mature Cystic Teratoma Follow Up



Mature cystic teratoma

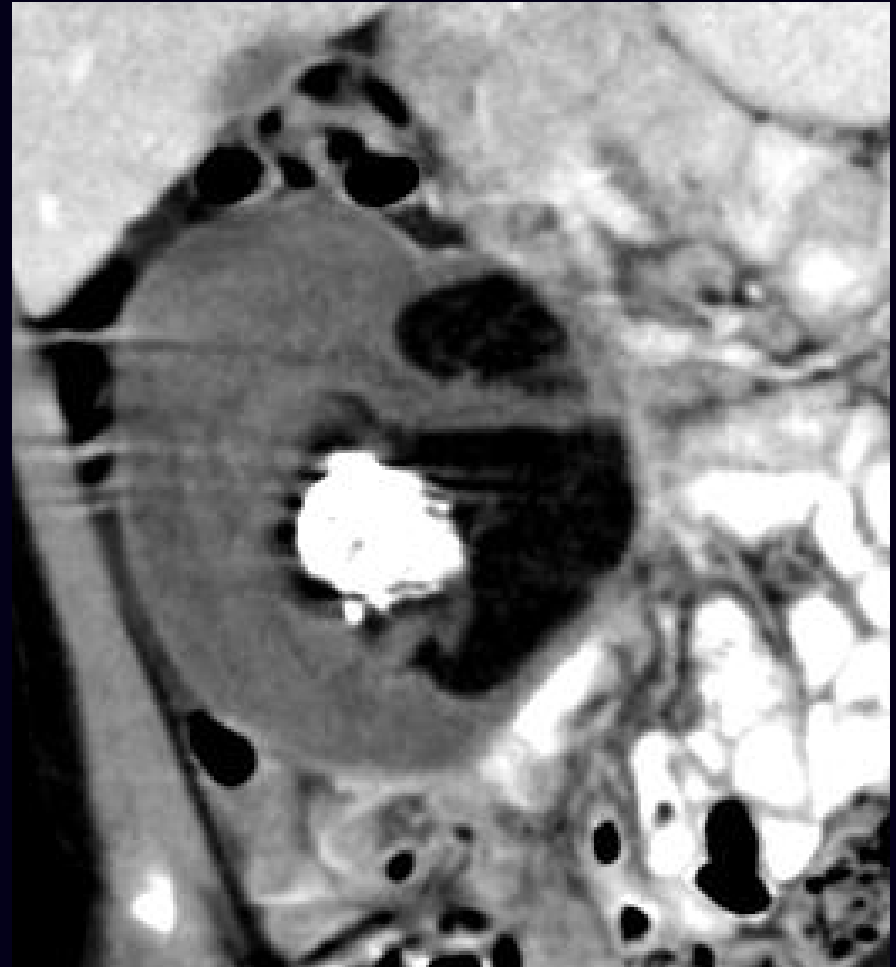


Endometrioma

Mature Cystic Teratoma

CT

- Contains any fat density
 - Approximately -50 to -100 HU



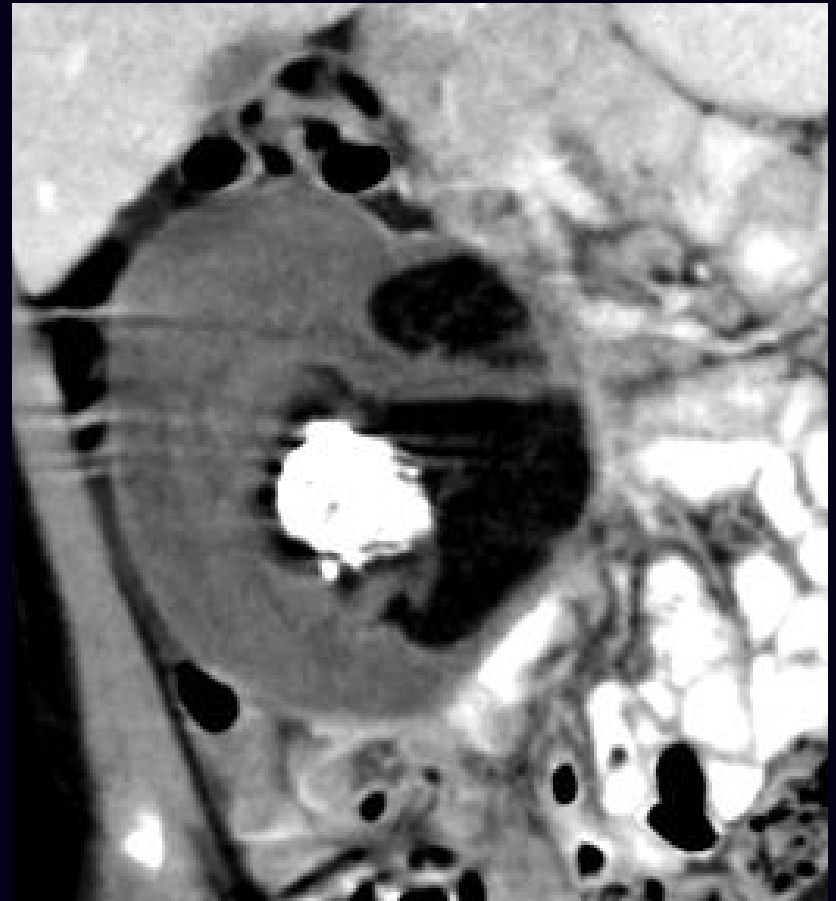
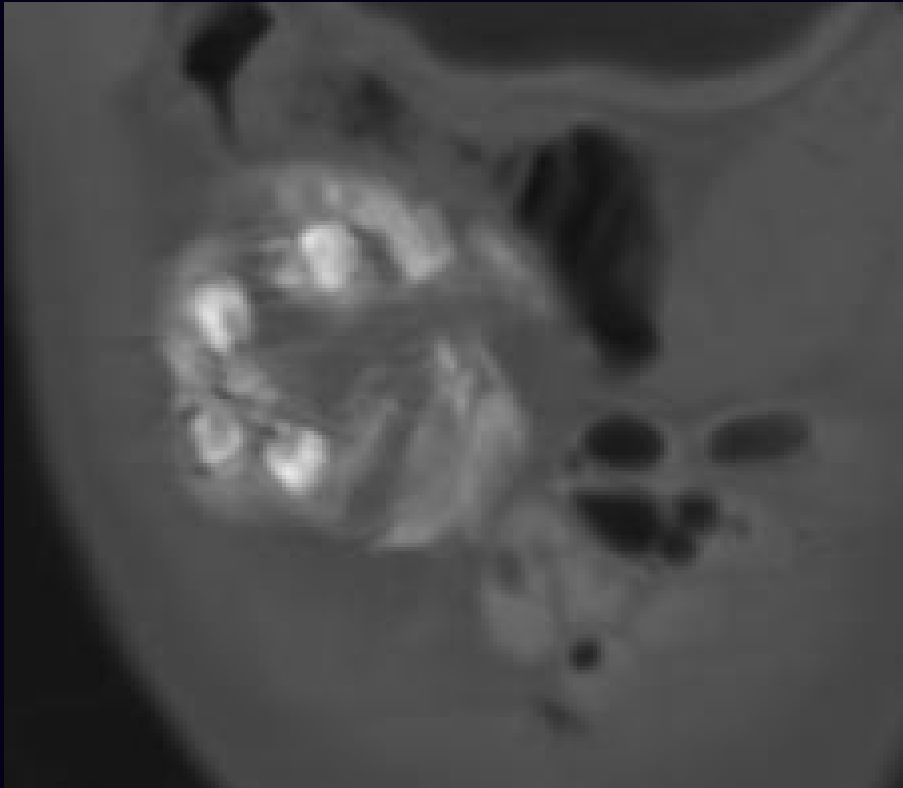
Mature Cystic Teratoma

CT

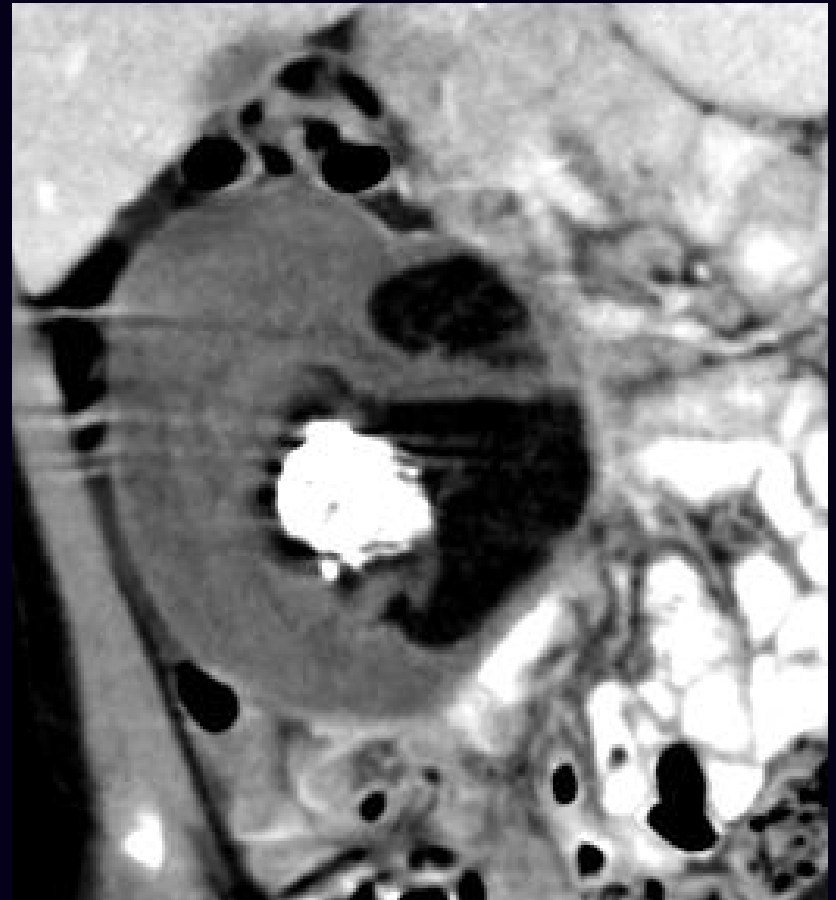
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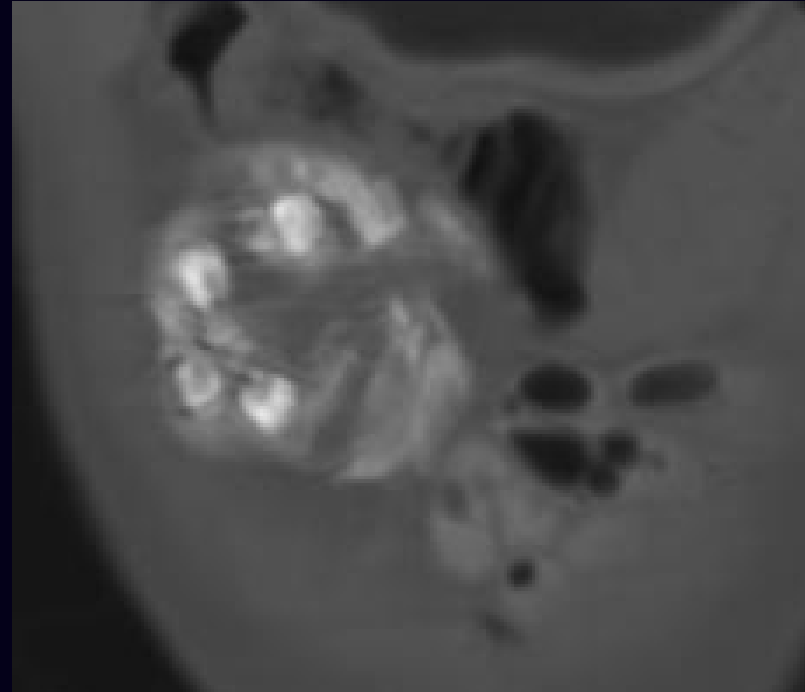
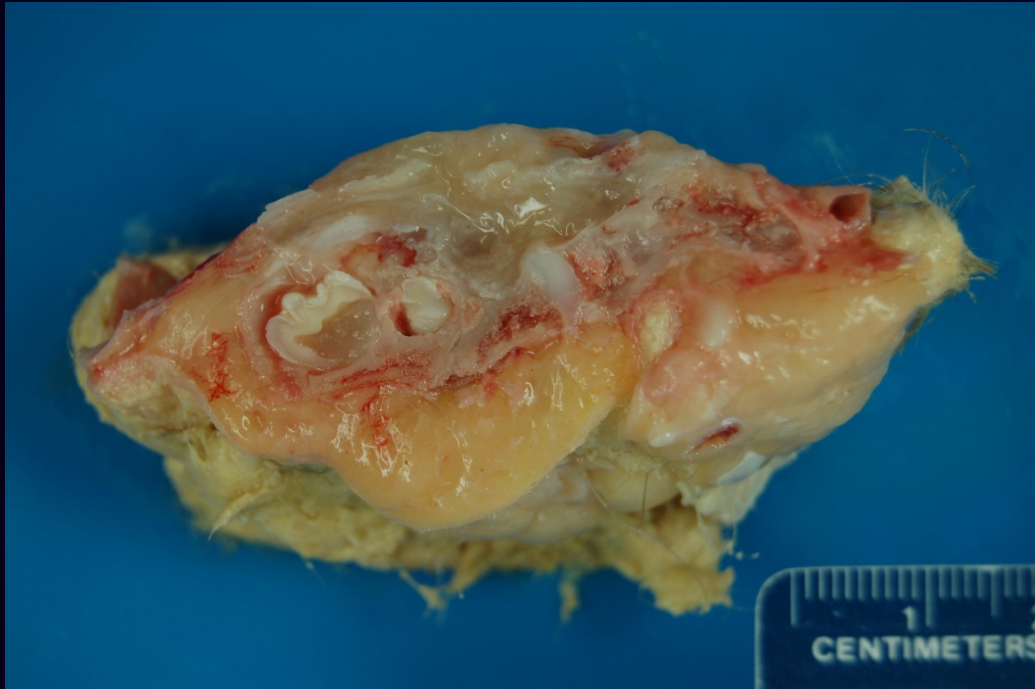
Mature Cystic Teratoma



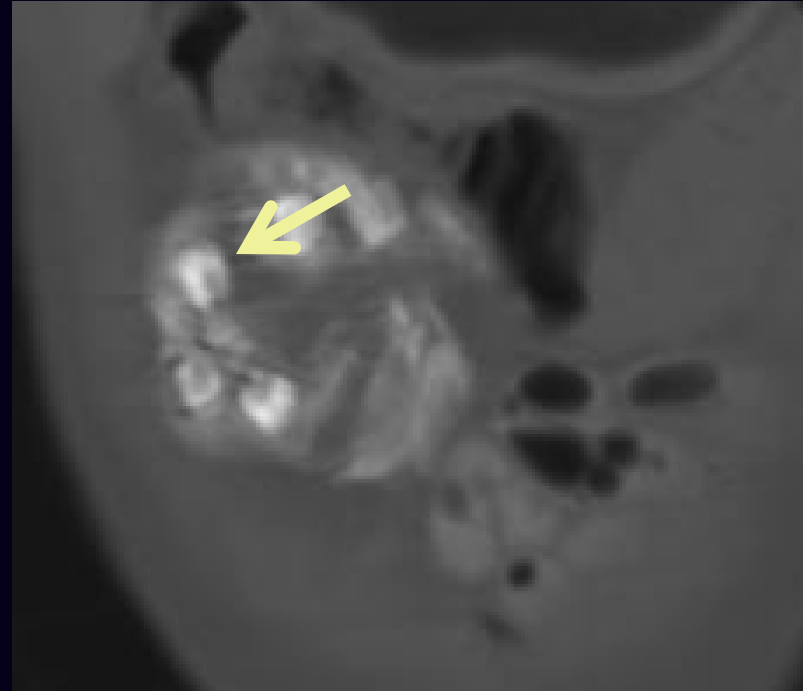
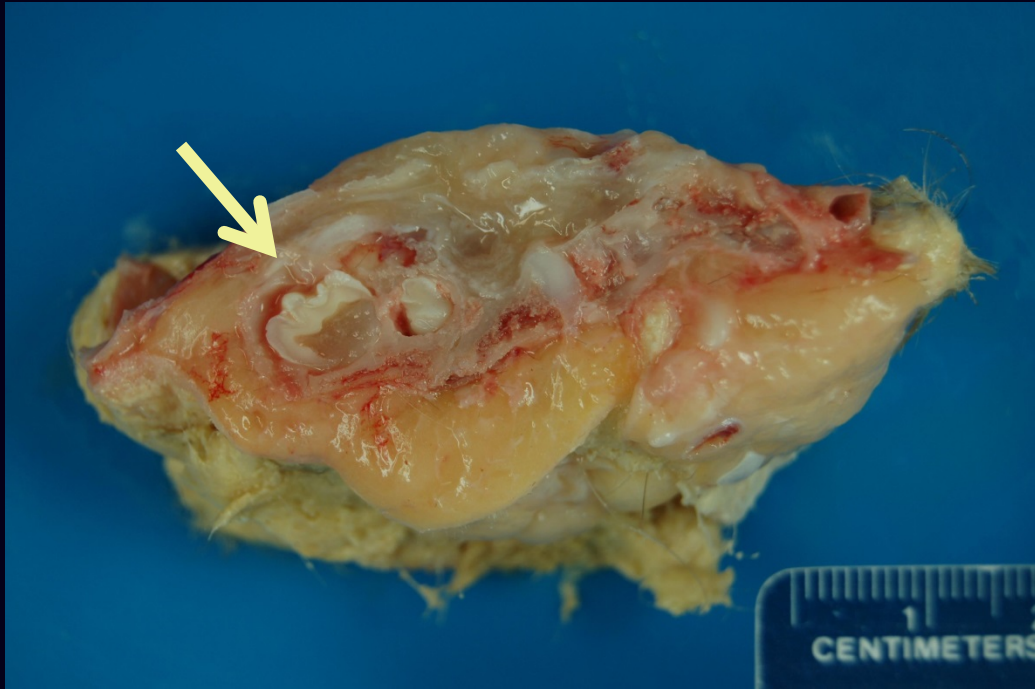
Mature Cystic Teratoma



Mature Cystic Teratoma



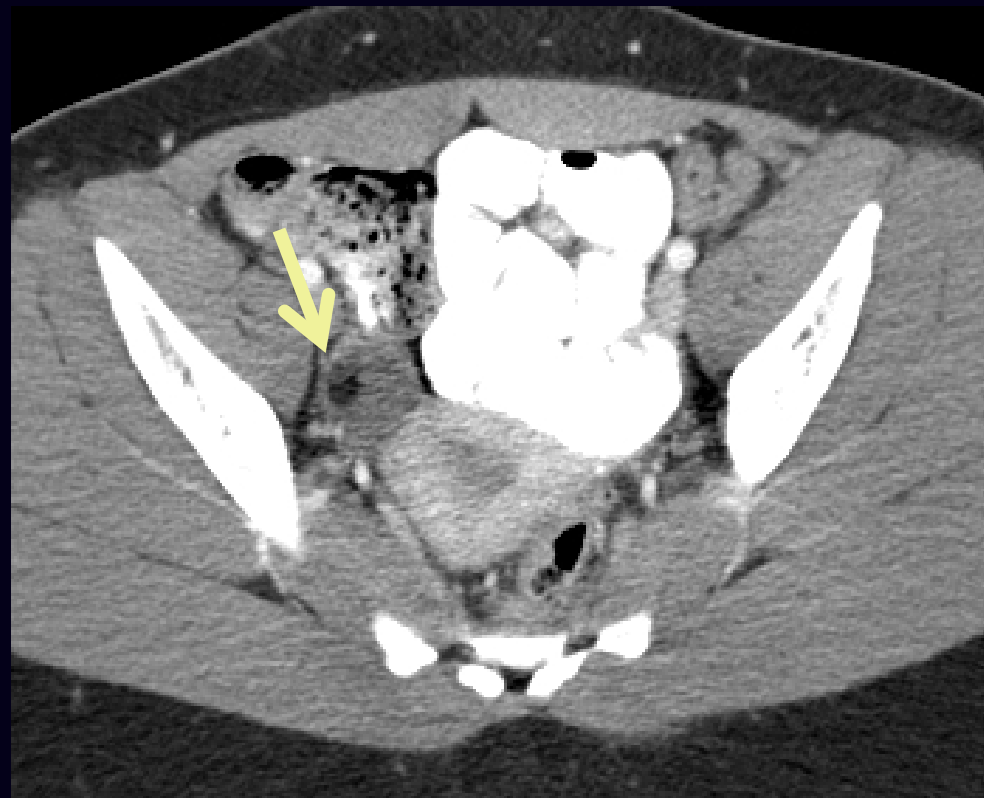
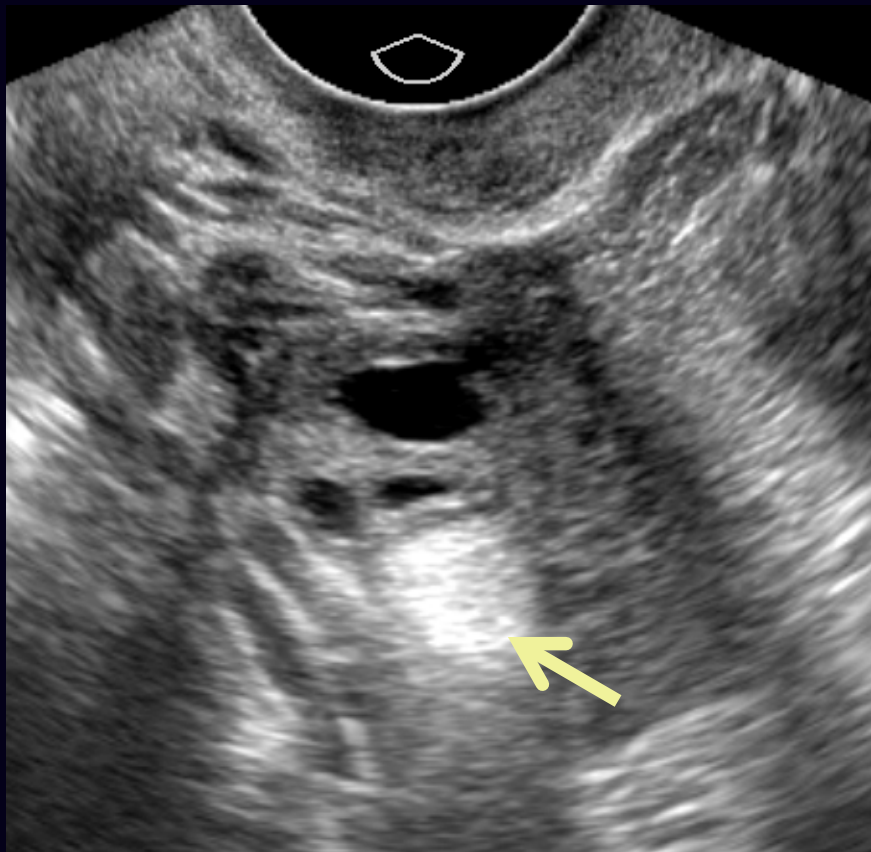
Mature Cystic Teratoma



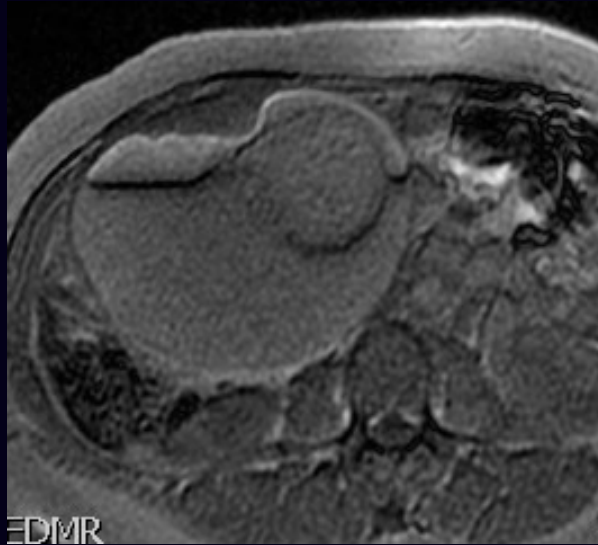
Mature Cystic Teratoma Follow Up



Mature Cystic Teratoma Follow Up



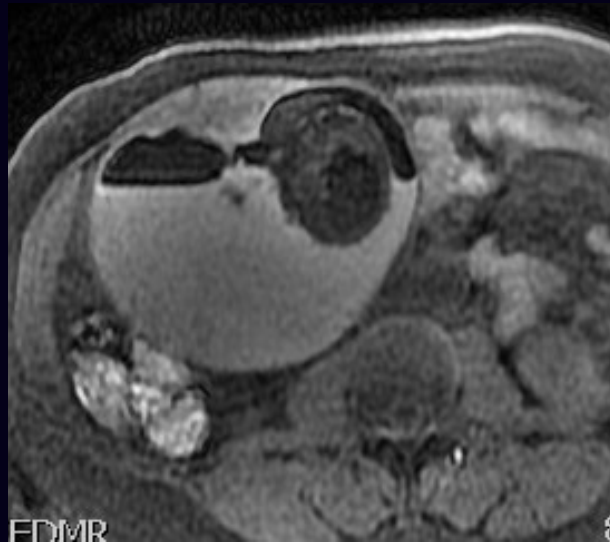
Mature Cystic Teratoma



T1

MR

- Contains any fat density
 - High T1 signal
 - Low T1 fat sat signal
 - High T2 signal



T1
Fat Sat

Mature Cystic Teratoma



T1

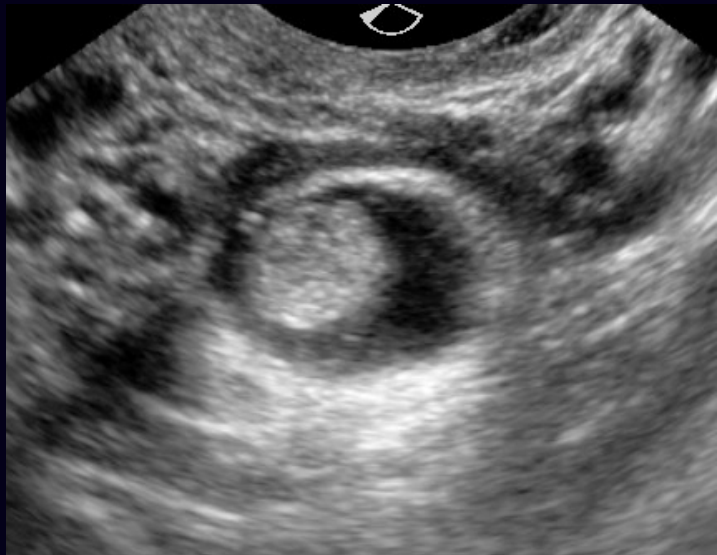
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T1
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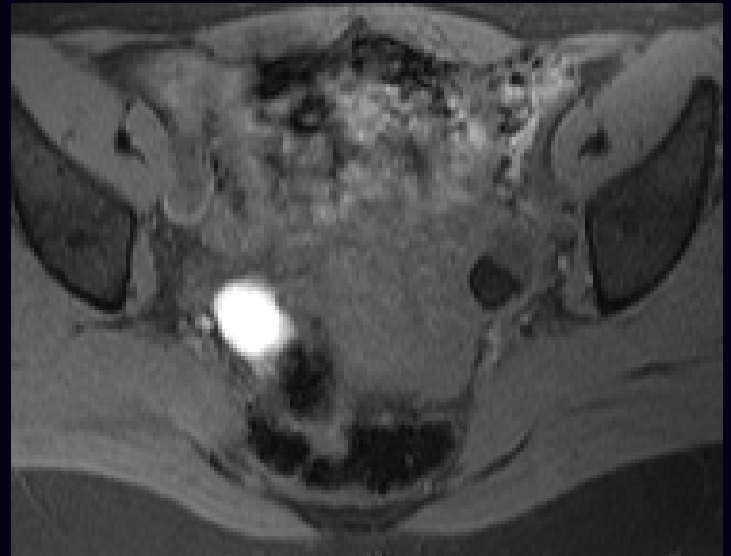
Mature Cystic Teratoma Follow Up



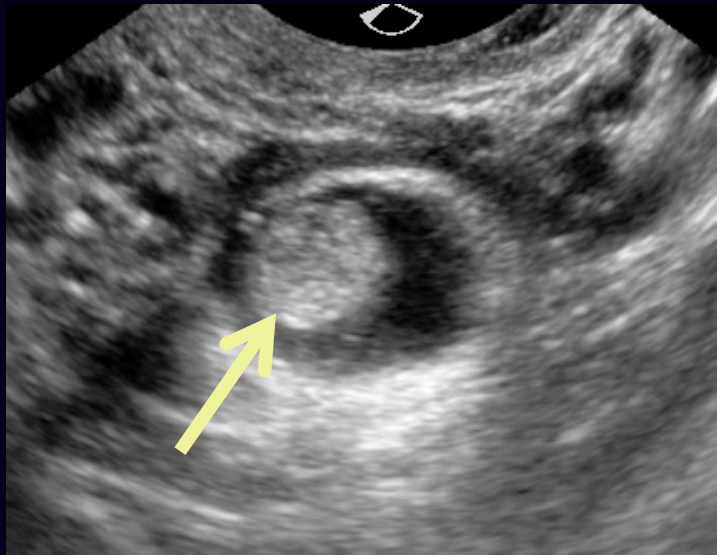
T1



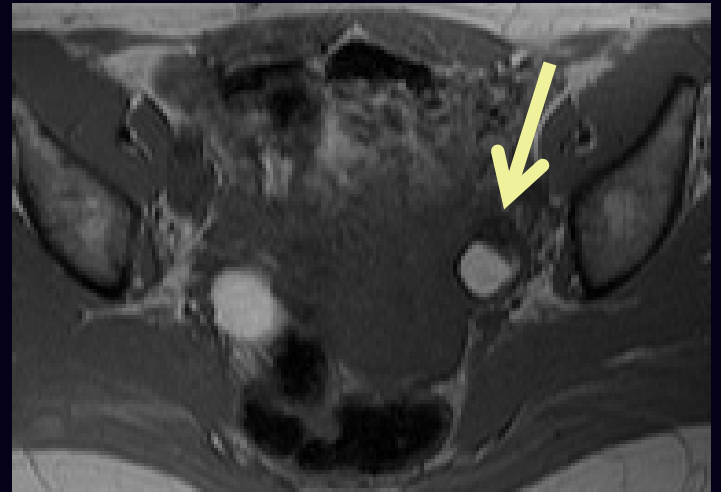
T1
Fat Sat



Mature Cystic Teratoma Follow Up



T1



T1
Fat Sat



Mature Cystic Teratoma

- **Complications**
 - **Torsion**
 - **Most common during pregnancy**

Mature Cystic Teratoma

- **Complications**
 - **Torsion**
 - **Rupture and chemical peritonitis**
 - **Less than 1%**

Mature Cystic Teratoma

- **Complications**
 - **Torsion**
 - **Rupture and chemical peritonitis**
 - **Adhesions**

Mature Cystic Teratoma

- **Complications**
 - **Torsion**
 - **Rupture and chemical peritonitis**
 - **Adhesions**
 - **Infection**

Mature Cystic Teratoma

- **Complications**
 - **Torsion**
 - **Rupture and chemical peritonitis**
 - **Adhesions**
 - **Infection**
 - **Malignant degeneration**

Mature Cystic Teratoma

- Malignant degeneration
 - 2%



Mature Cystic Teratoma

- **Malignant degeneration**
 - **2%**
 - **Differentiated tissues within the mature cystic teratoma give rise to carcinoma or sarcoma**



Mature Cystic Teratoma

- **Malignant degeneration**
 - **2%**
 - **Differentiated tissues within the mature cystic teratoma give rise to carcinoma or sarcoma**
 - **Most common is squamous cell carcinoma arising from squamous lining of cyst**



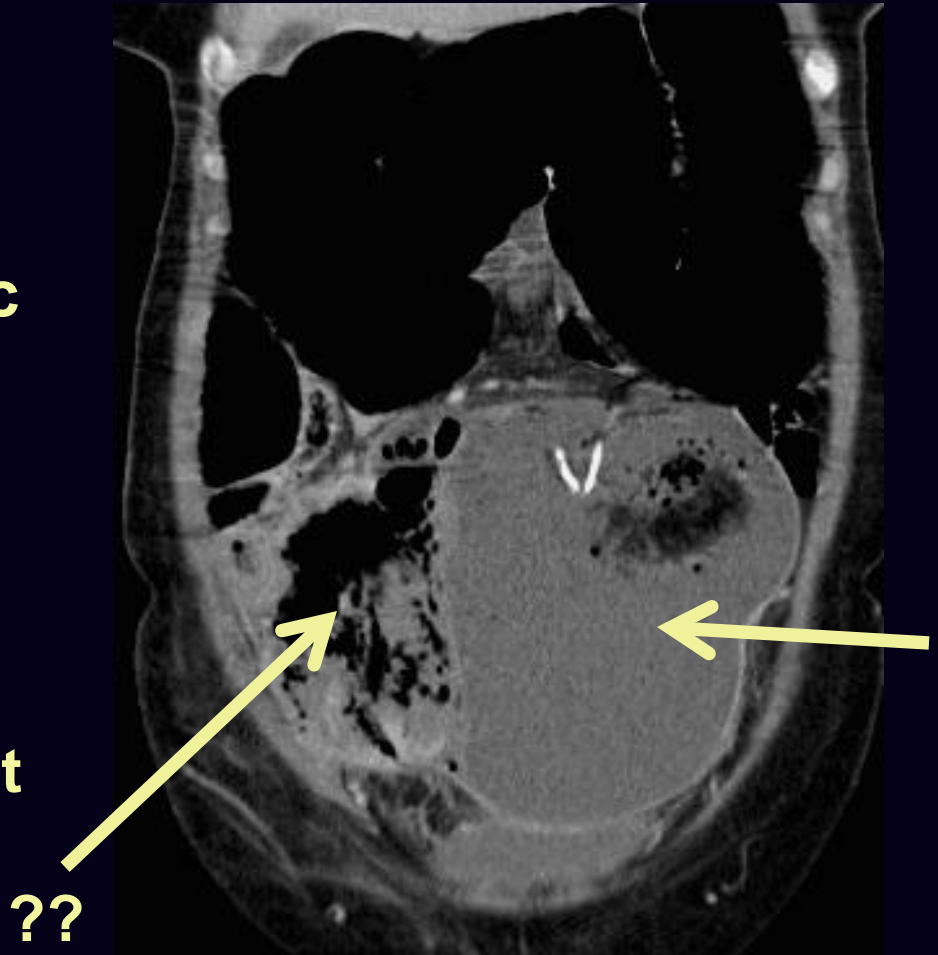
Mature Cystic Teratoma

- **Malignant degeneration**
 - **2%**
 - **Differentiated tissues within the mature cystic teratoma give rise to carcinoma or sarcoma**
 - **Most common is squamous cell carcinoma arising from squamous lining of cyst**
 - **Occurs in 60s or 70s**

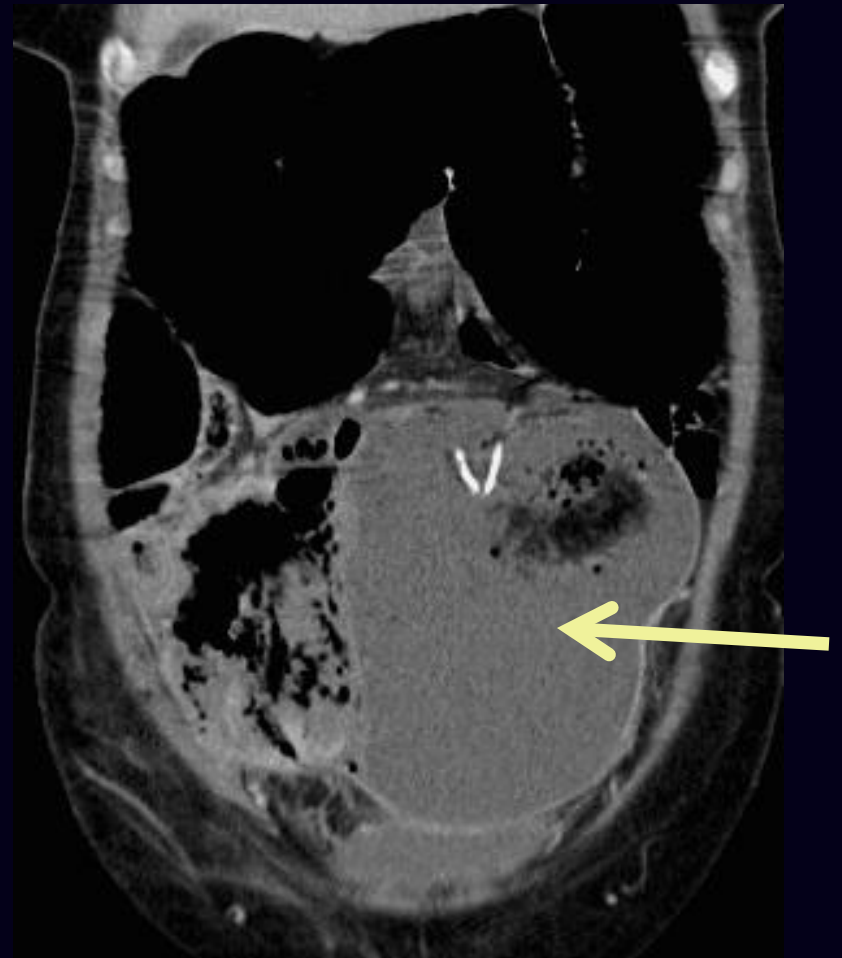


Mature Cystic Teratoma

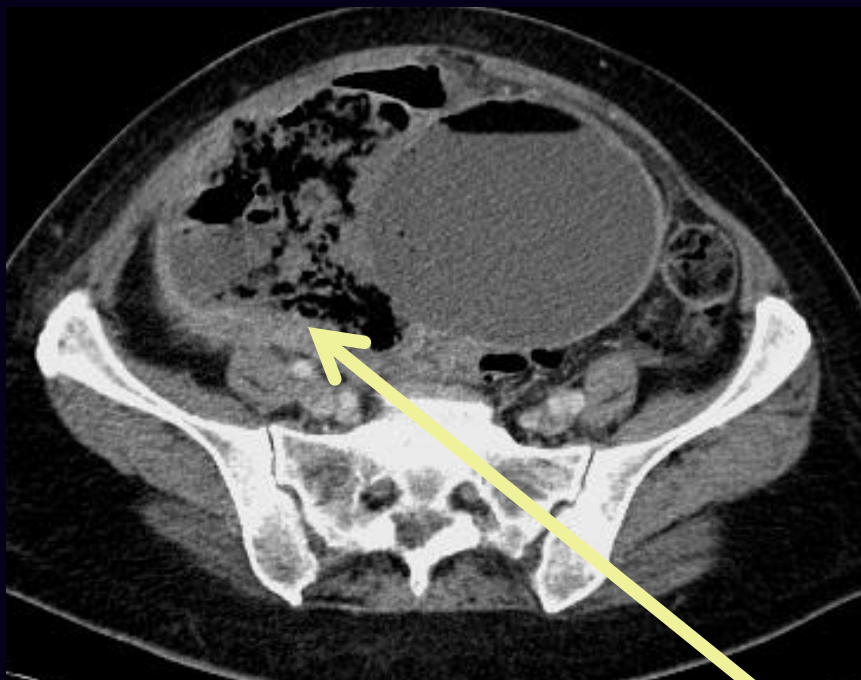
- **Malignant degeneration**
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Mature Cystic Teratoma



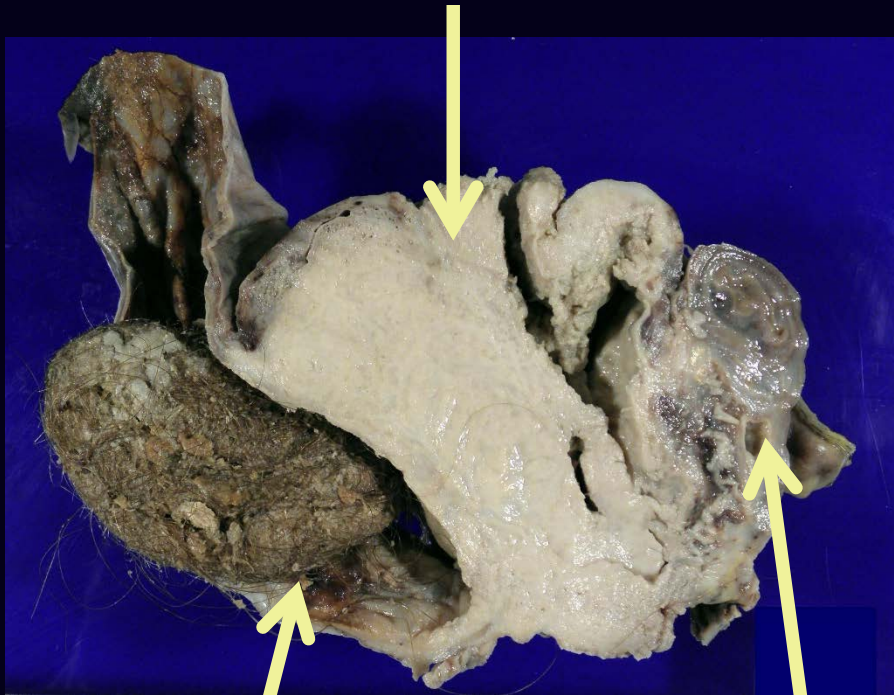
Mature Cystic Teratoma



??

Mature Cystic Teratoma

Squamous Cell Carcinoma

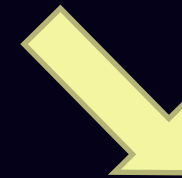


Small Bowel

Mature Cystic Teratoma



Benign Lesions



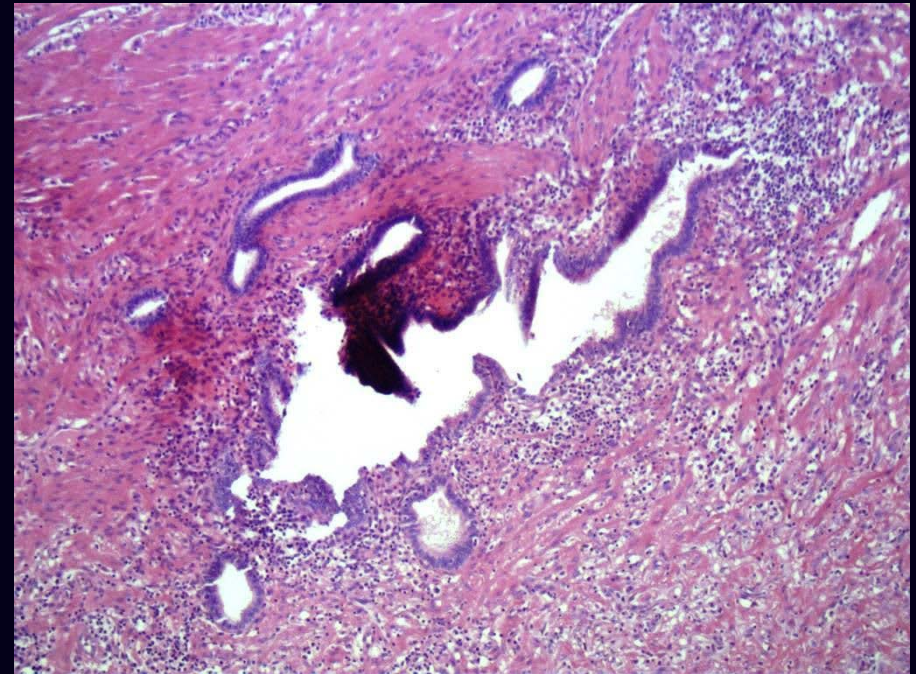
**Hemorrhagic
Cyst**

Endometrioma

**Mature Cystic
Teratoma**

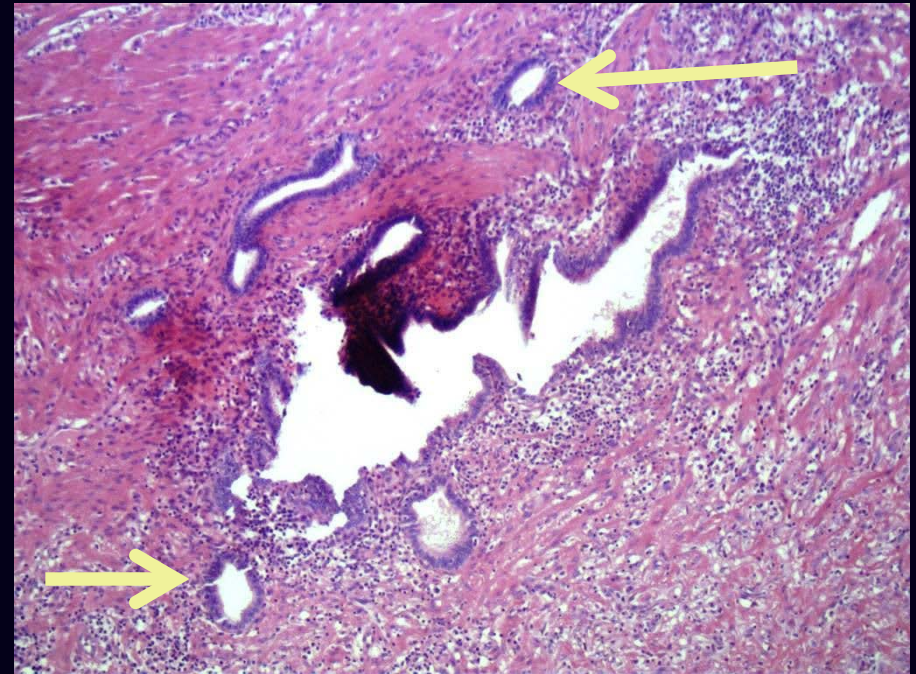
Endometriosis

- Endometrial glands and stroma outside the uterus



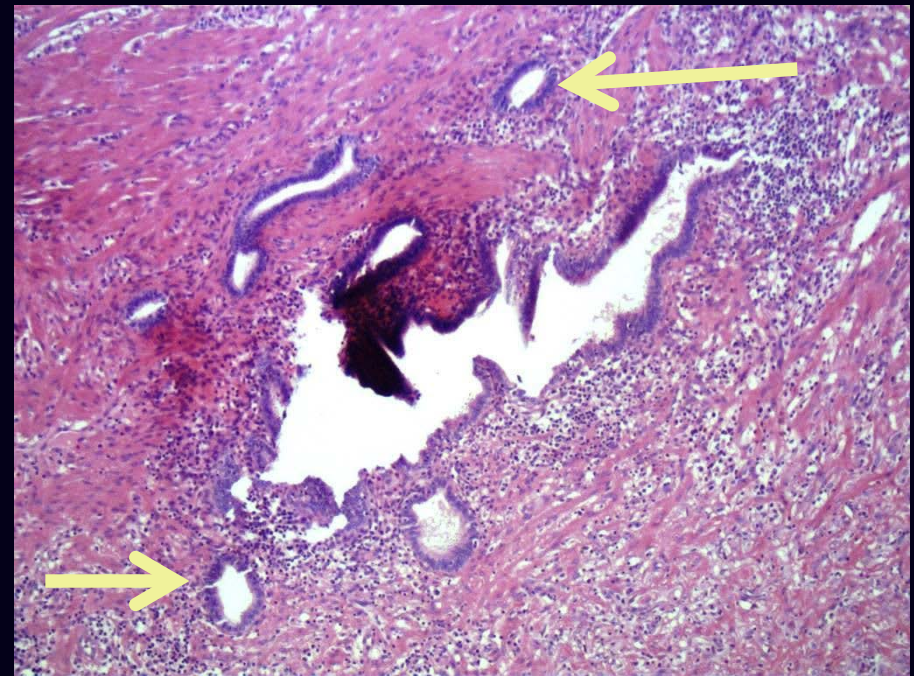
Endometriosis

- Endometrial glands and stroma outside the uterus



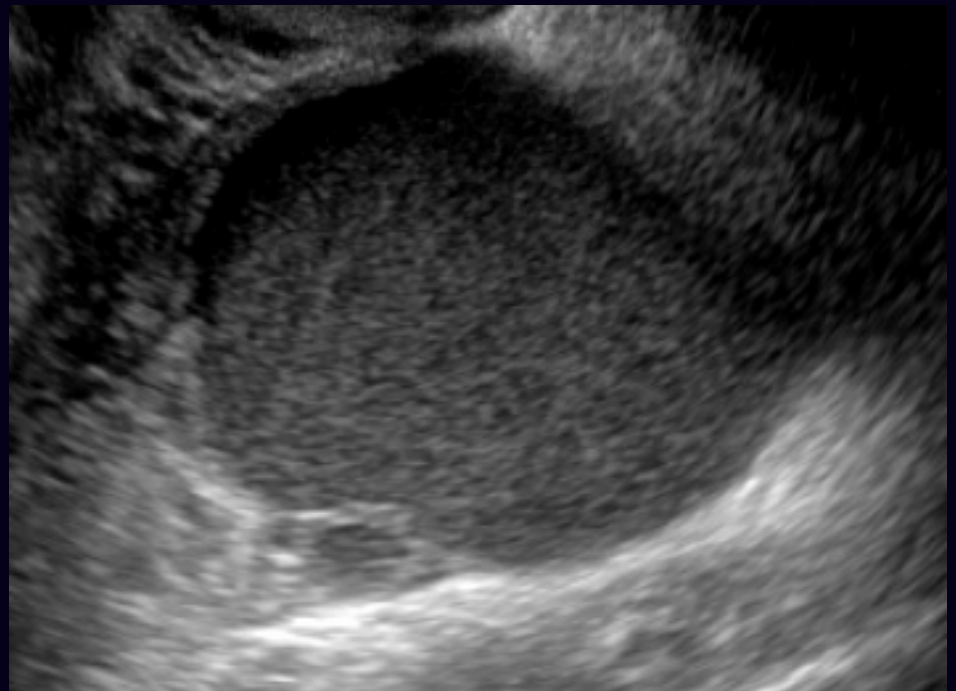
Endometriosis

- Endometrial glands and stroma outside the uterus
- Location
 - Ovaries (80%)
 - Uterosacral ligaments
 - Pouch of Douglas
 - Uterine Serosal Surface
 - Fallopian Tube
 - Rectosigmoid Colon



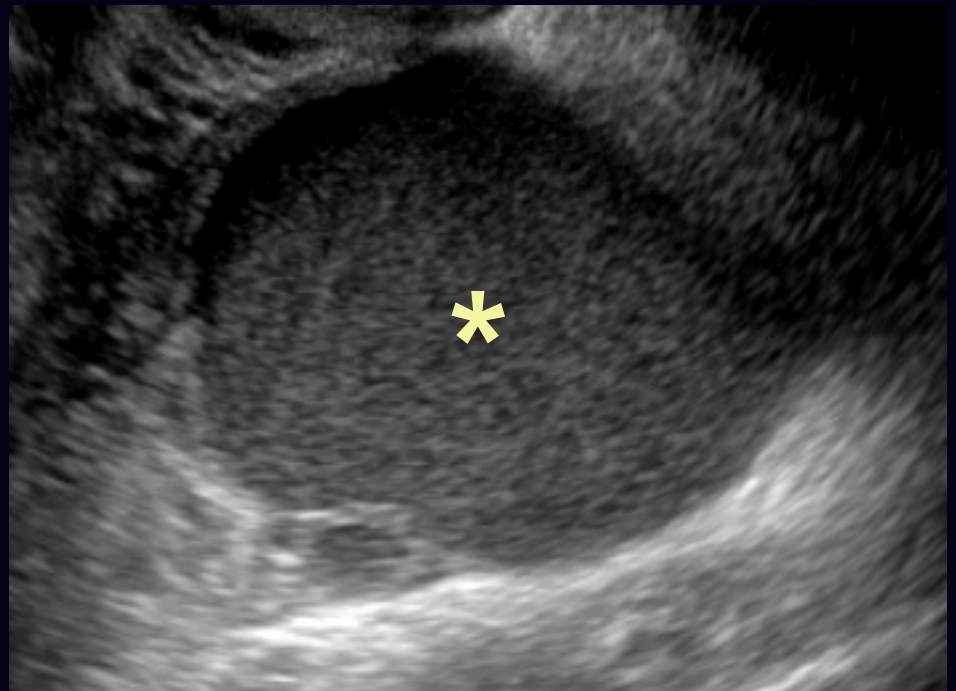
Ultrasound Appearance of Ovarian Endometrioma

- Diffuse, homogeneous low to medium level internal echoes
- Fluid-fluid or fluid/debris levels
- Echogenic wall foci
- No color flow



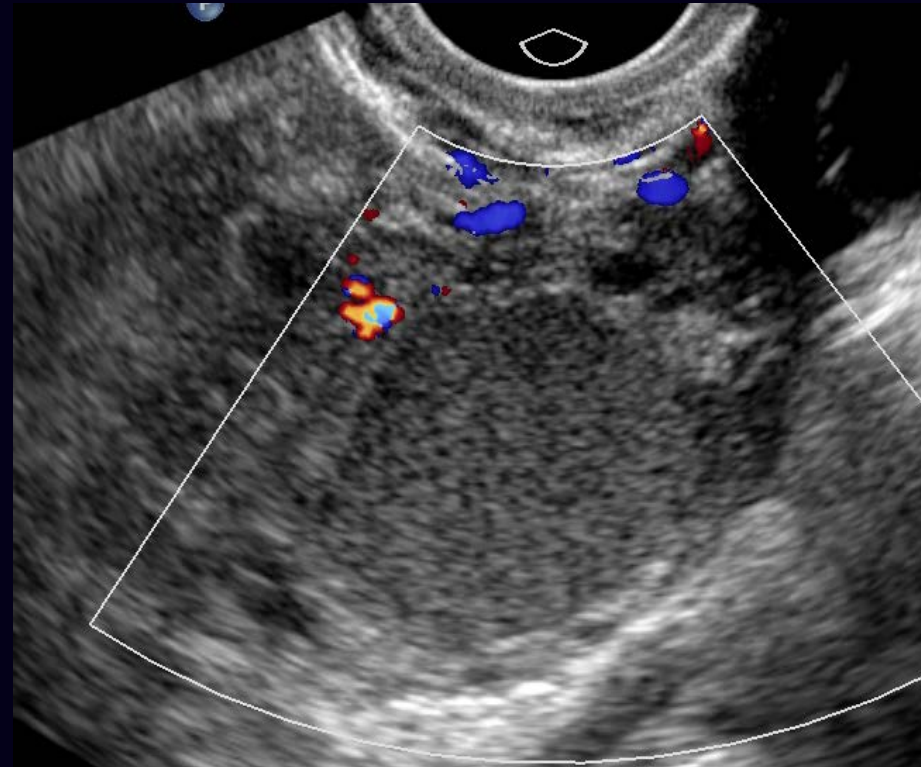
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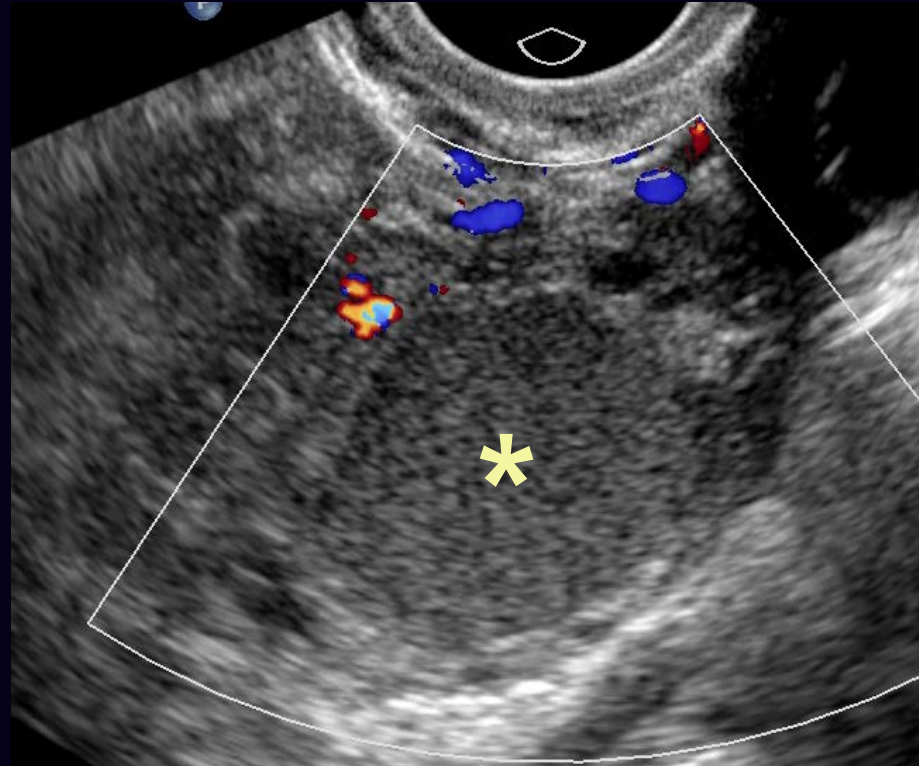
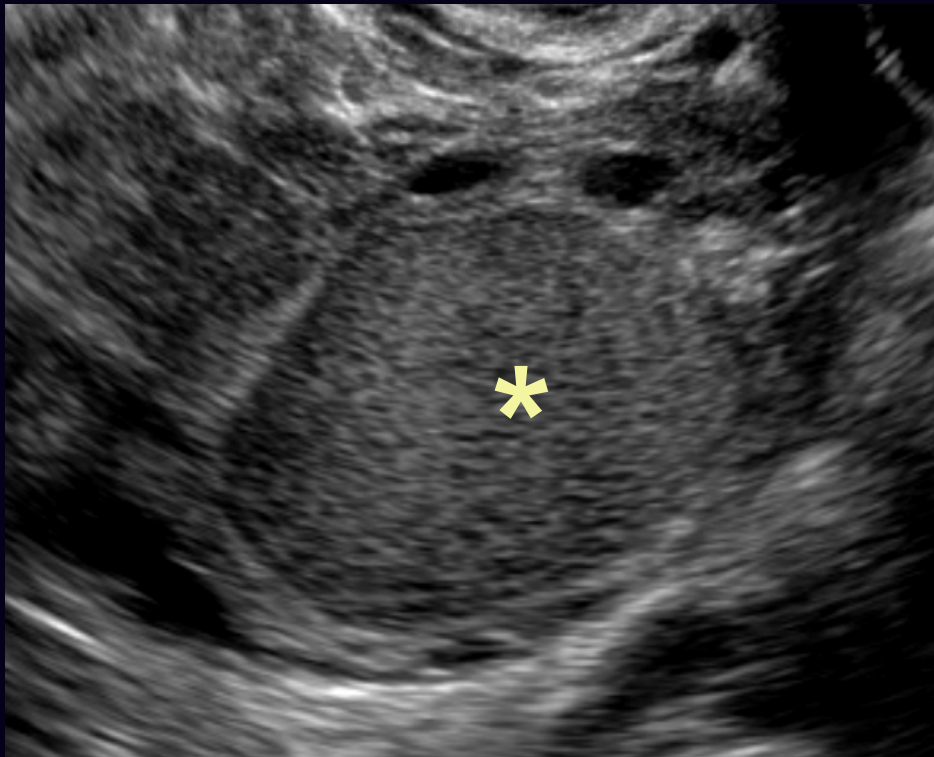
Endometrioma

- Diffuse, homogeneous low to medium level internal echoes



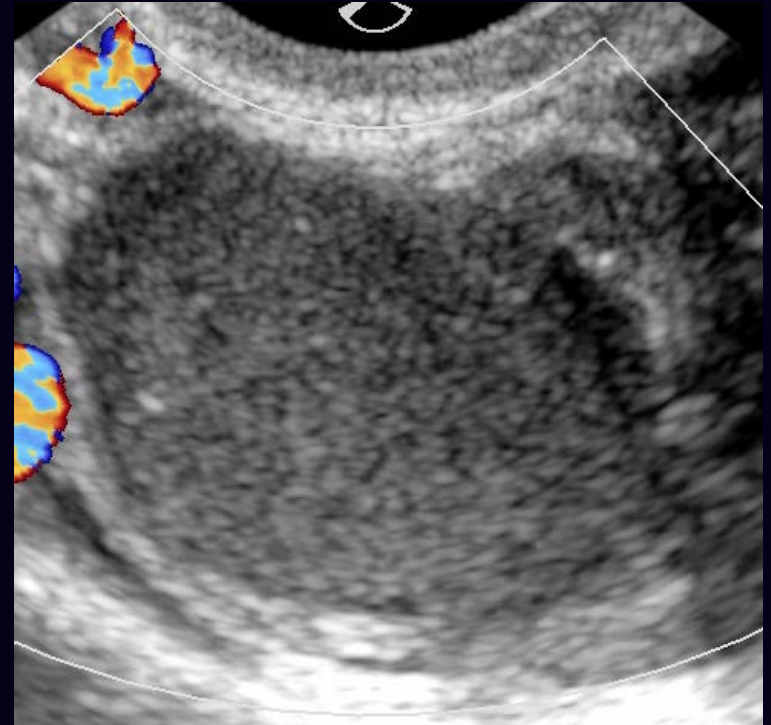
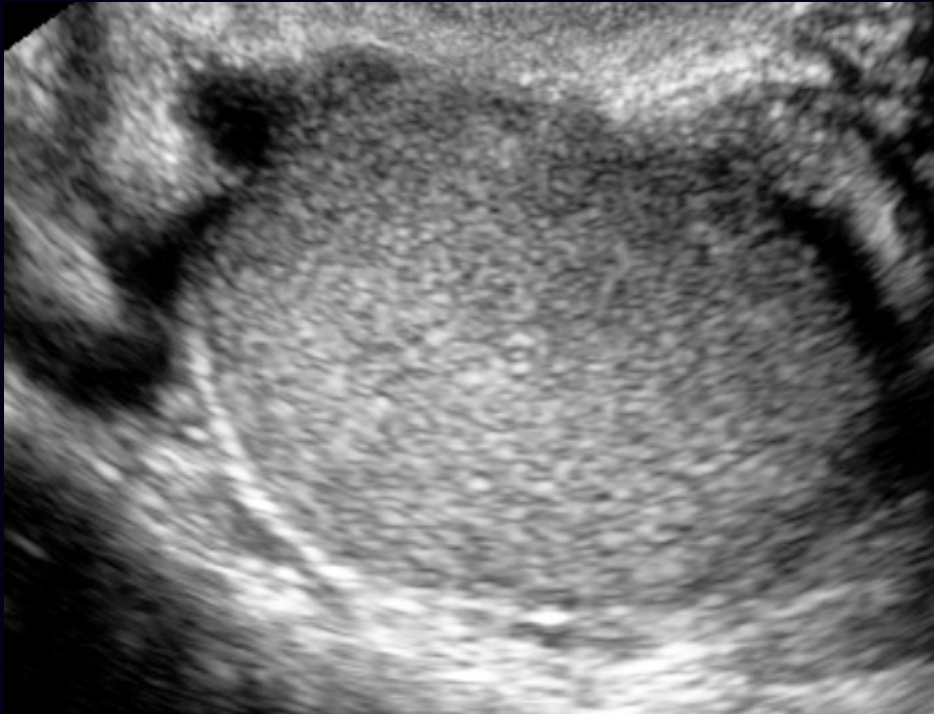
Endometrioma

- Diffuse, homogeneous low to medium level internal echoes



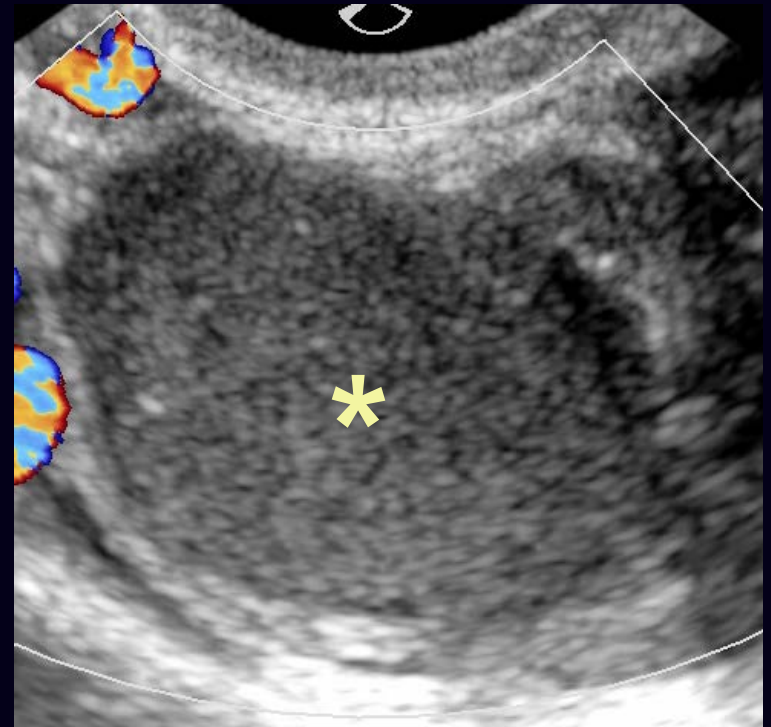
Endometrioma

- Diffuse, homogeneous low to medium level internal echoes



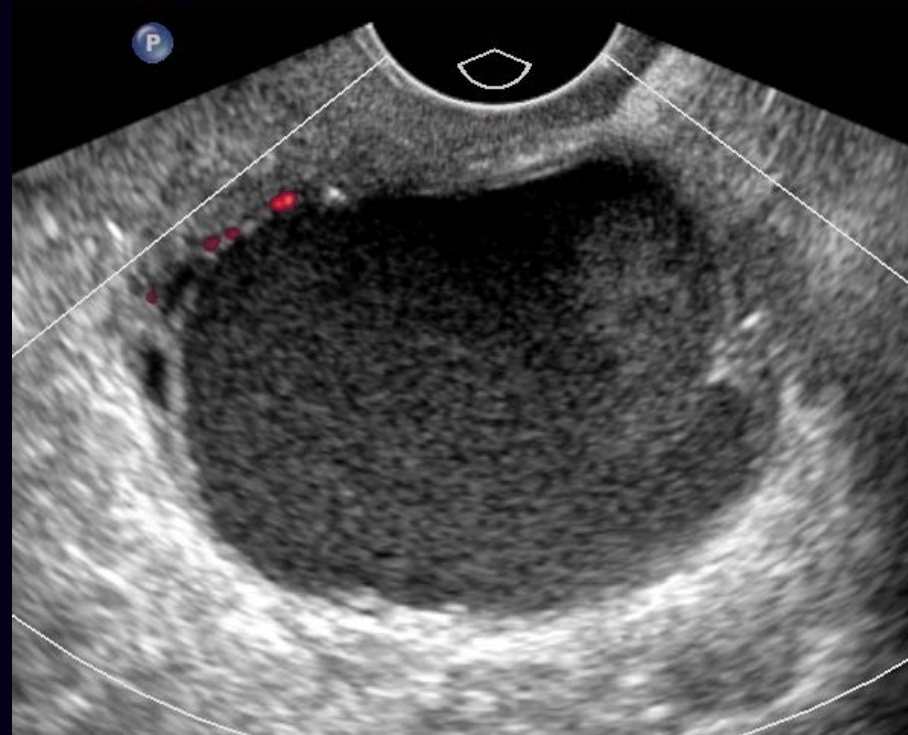
Endometrioma

- Diffuse, homogeneous low to medium level internal echoes



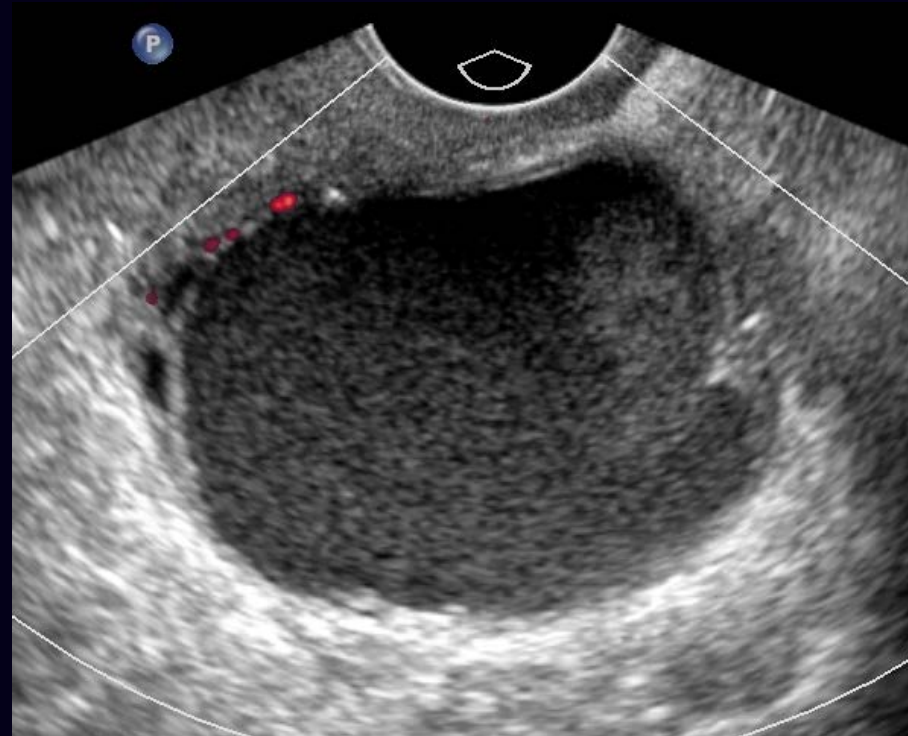
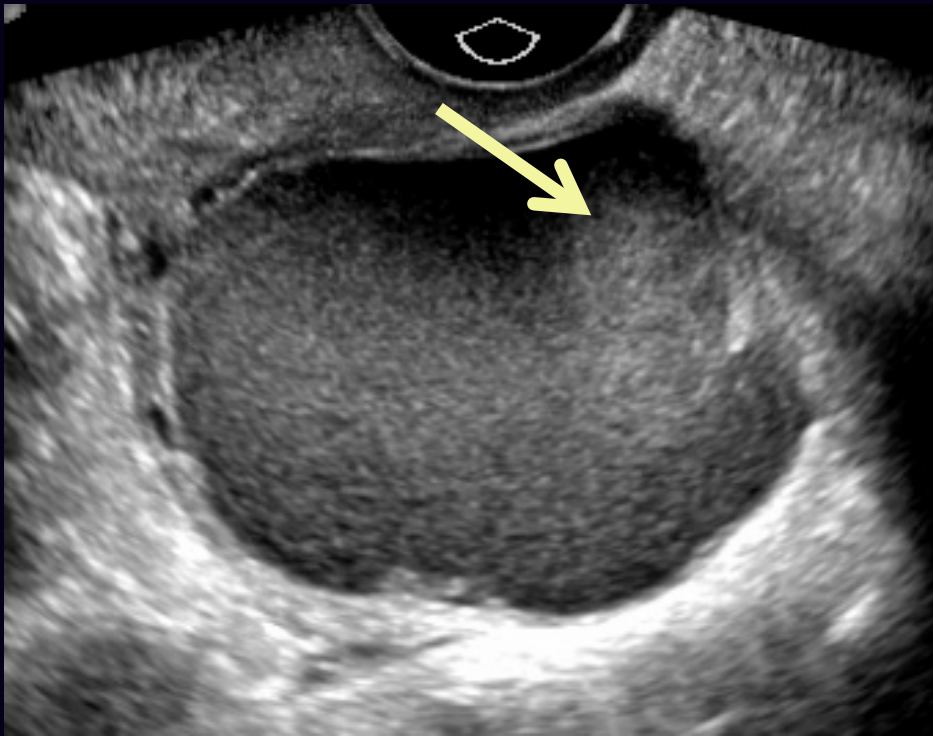
Endometrioma

- Echogenic wall foci



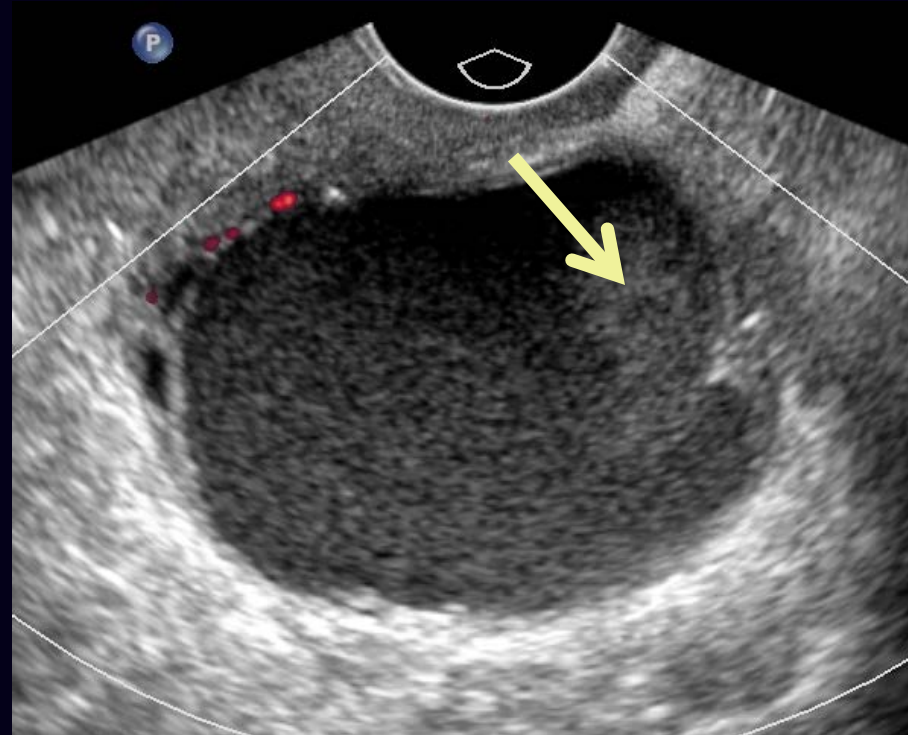
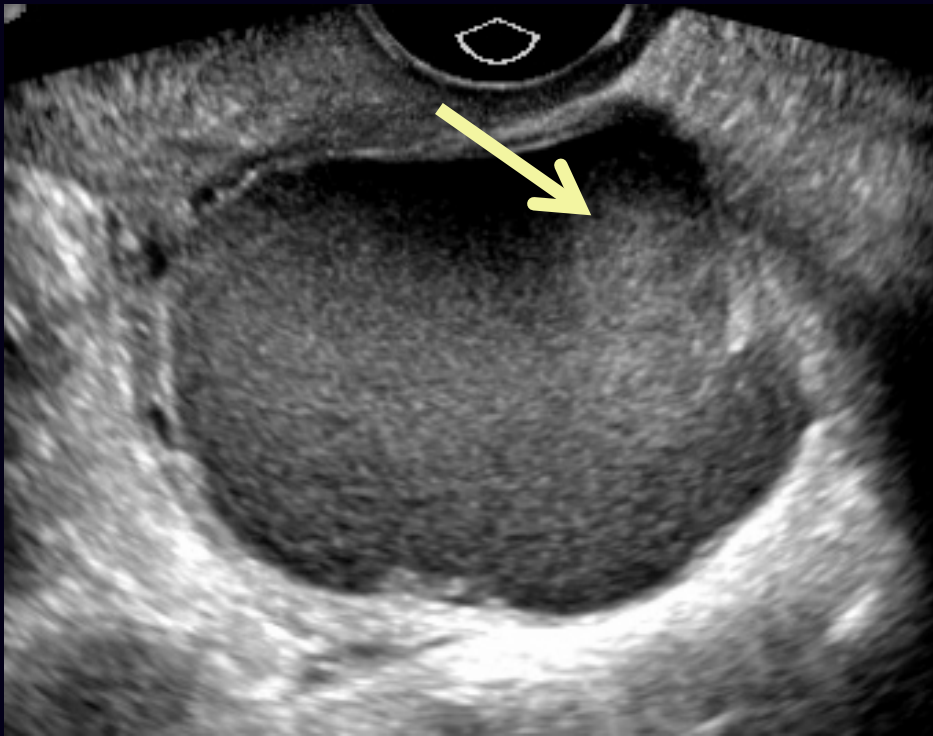
Endometrioma

- Echogenic wall foci



Endometrioma

- Echogenic wall foci



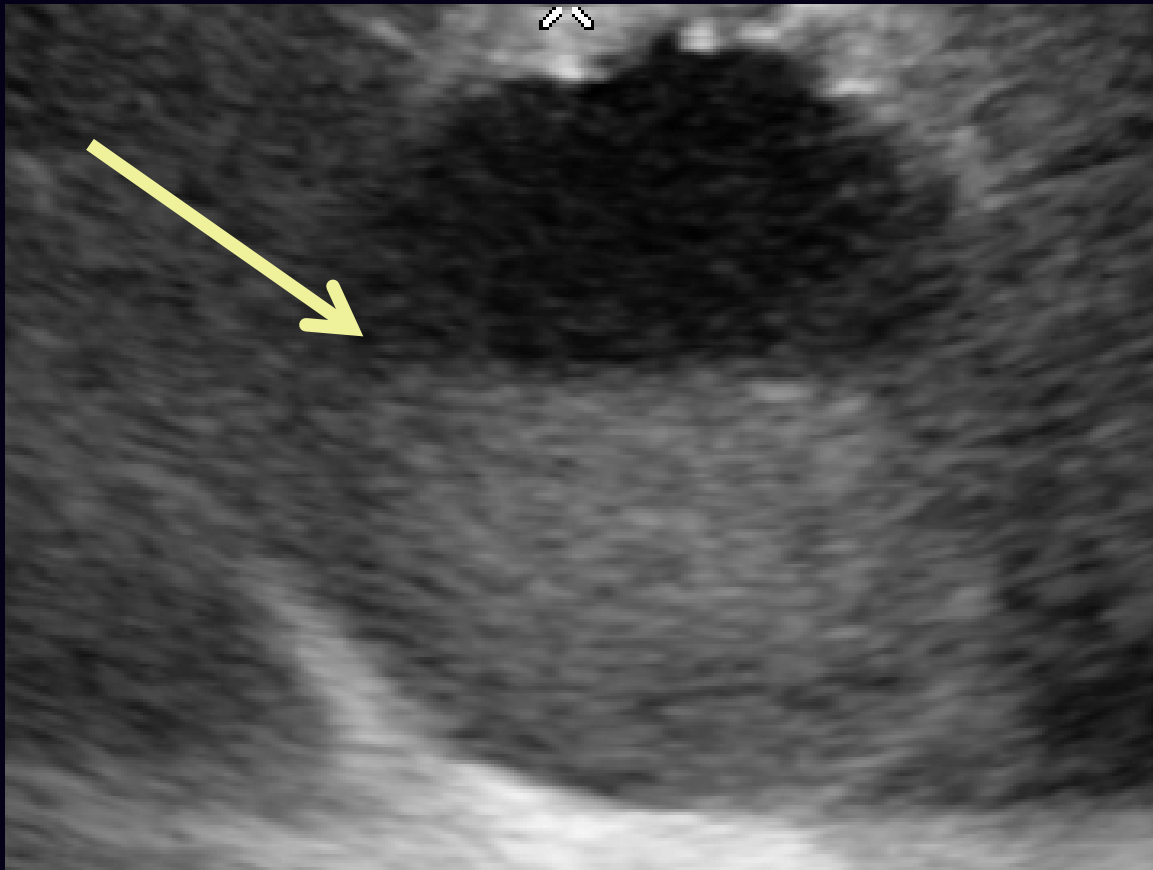
Endometrioma

- Fluid-fluid level



Endometrioma

- Fluid-fluid level



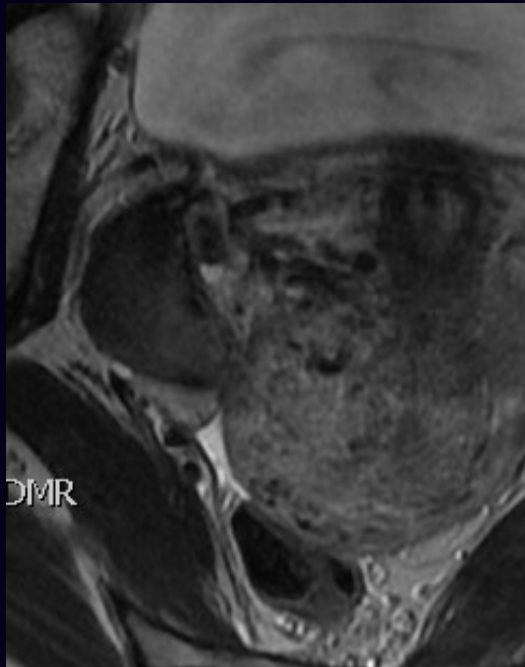
Endometrioma Follow up

- **Appearance on ultrasound can overlap with mature cystic teratoma**
- **Institution/Referring Physician Dependent**
 - **MR**
 - **Surgery**

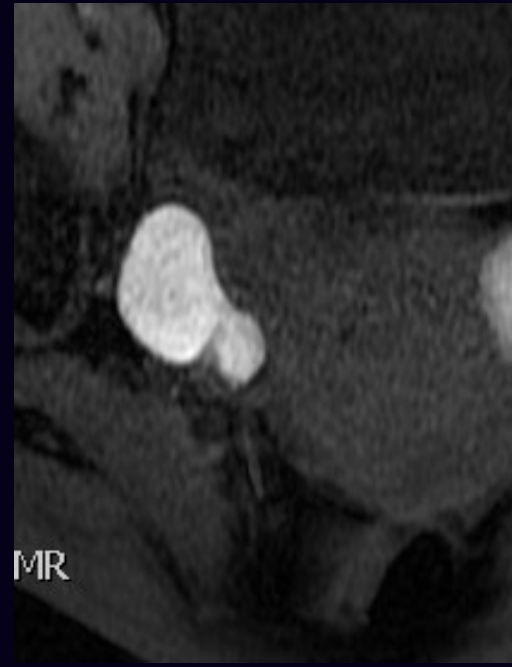
MR Appearance of Ovarian Endometrioma

- T2 shading
- High T1 signal
- “lightblub bright” T1 fat sat signal
- No enhancement

T2



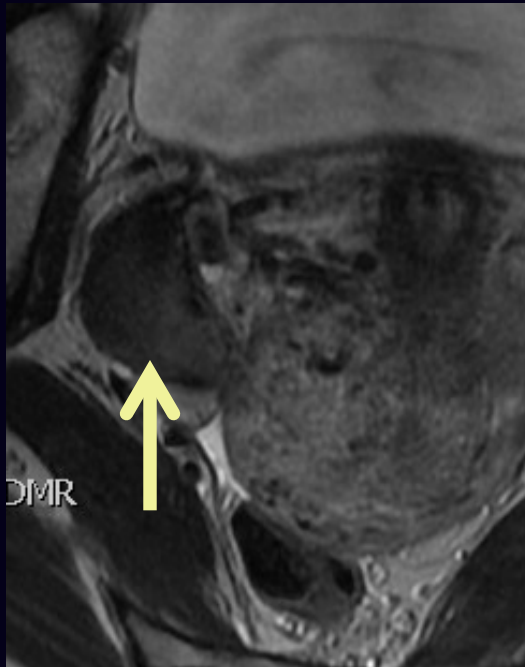
T1
Fat Sat



MR Appearance of Ovarian Endometrioma

- T2 shading
- High T1 signal
- “lightbulb bright” T1 fat sat signal
- No enhancement

T2

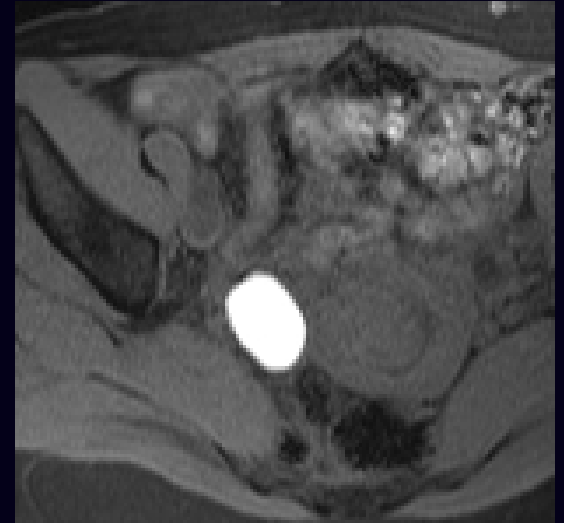


T1
Fat Sat

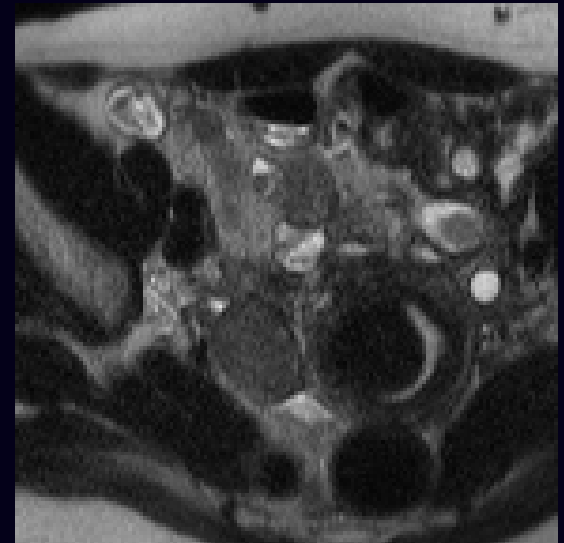
Endometrioma Follow Up



**T1
Fat Sat**



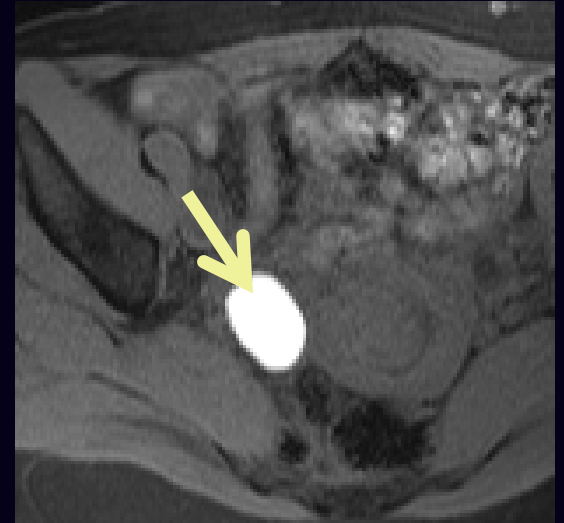
T2



Endometrioma Follow Up



T1
Fat Sat



T2

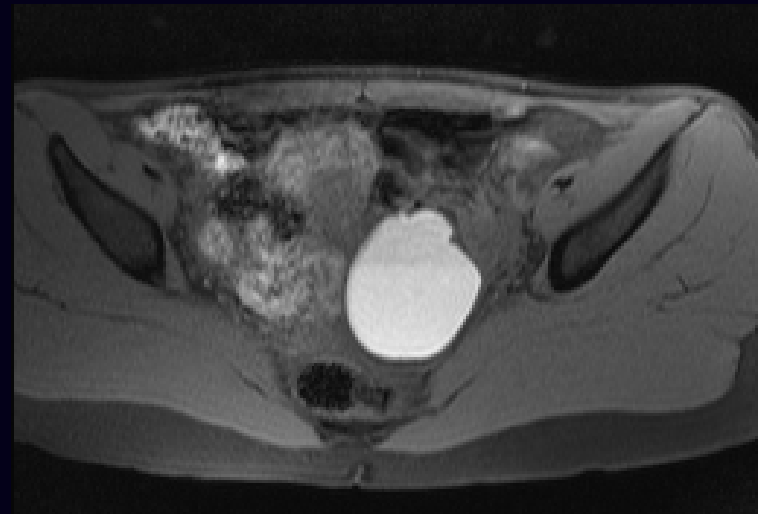
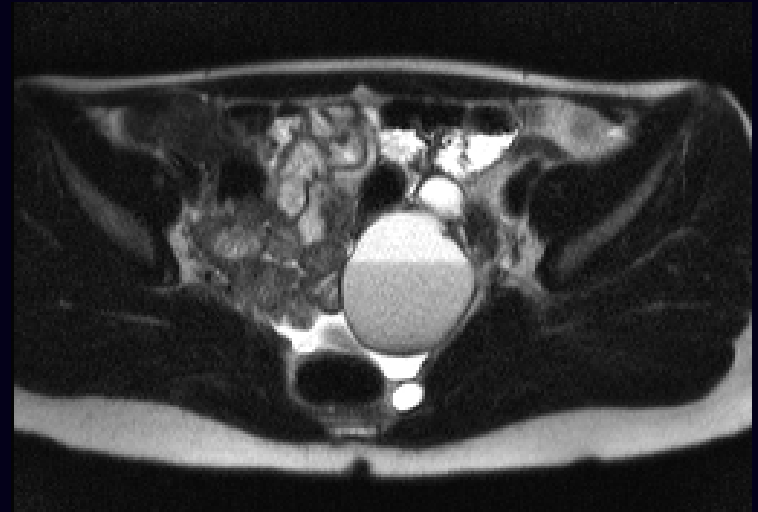


Endometrioma Follow Up



T1
Fat Sat

T2

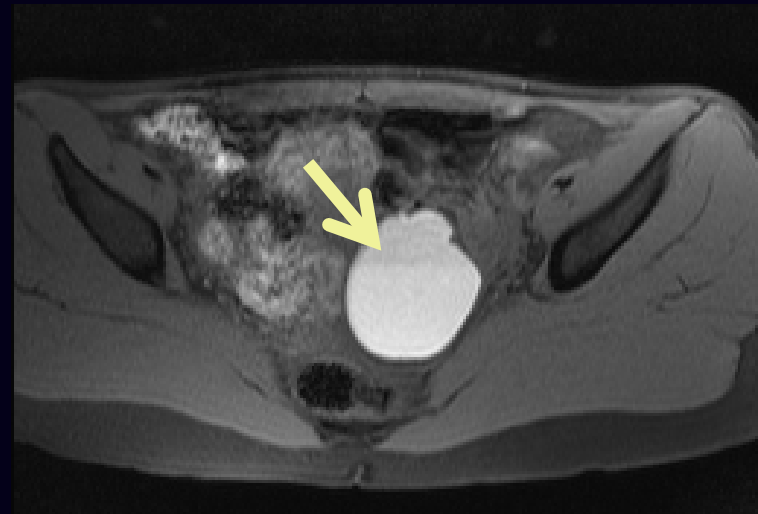
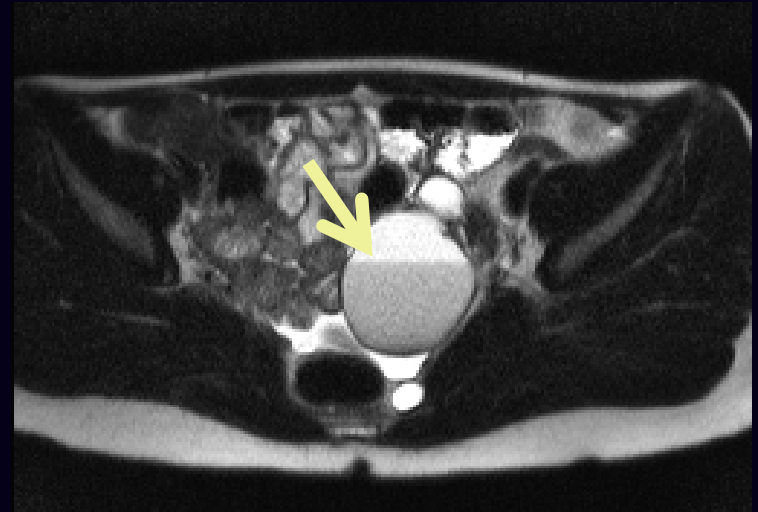


Endometrioma Follow Up

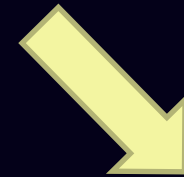


T1
Fat Sat

T2



Benign Lesions

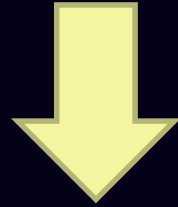


**Hemorrhagic
Cyst**

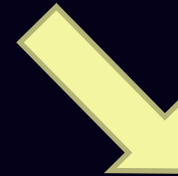
Endometrioma

**Mature Cystic
Teratoma**

Adnexal Mass



Clinical History



Ovary

Extraovarian



**Simple
Cyst**

**Benign
Lesions**

**Possible
Neoplasm**

Possible Neoplasm

- **Lesion does not meet criteria for**
 - **Simple Cyst**
 - **Hemorrhagic Cyst**
 - **Mature cystic teratoma**
 - **Endometrioma**

Possible Neoplasm

- **Lesion does not meet criteria for**
 - **Simple Cyst**
 - **Hemorrhagic Cyst**
 - **Mature cystic teratoma**
 - **Endometrioma**
- **Surgical consultation**

Predicting Benign v Malignant Ovarian Neoplasm

- **Grey scale and Color Doppler Ultrasound together are most predictive**

Kinkel K, Hricak H, Lu Y, et al. US characterization of ovarian masses: a meta-analysis.
Radiology. 2000;217:803-811.

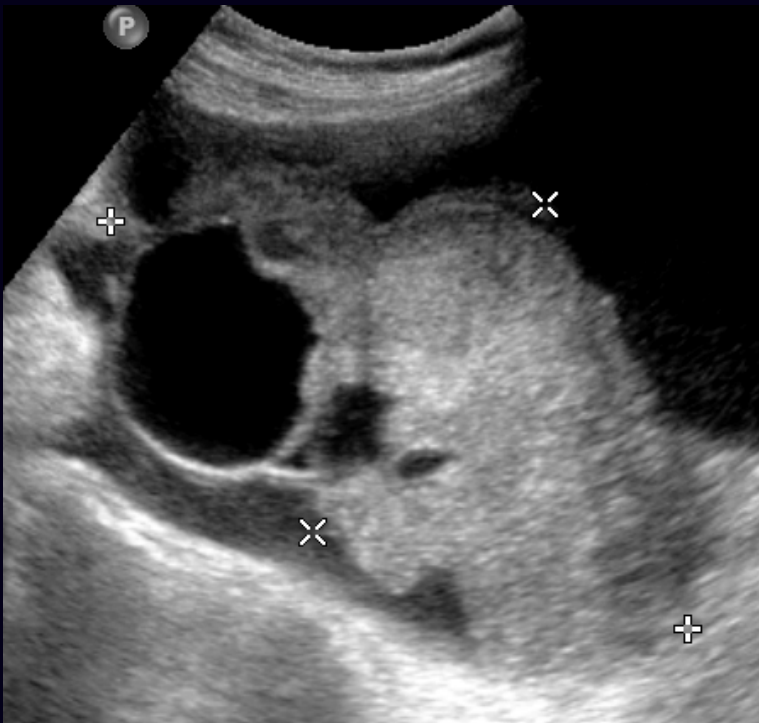
Predicting Benign v Malignant Ovarian Neoplasm

- **Grey scale and Color Doppler Ultrasound together are most predictive**
- **Do not add predictive value**
 - **Resistive Index**
 - **Menopausal Status**



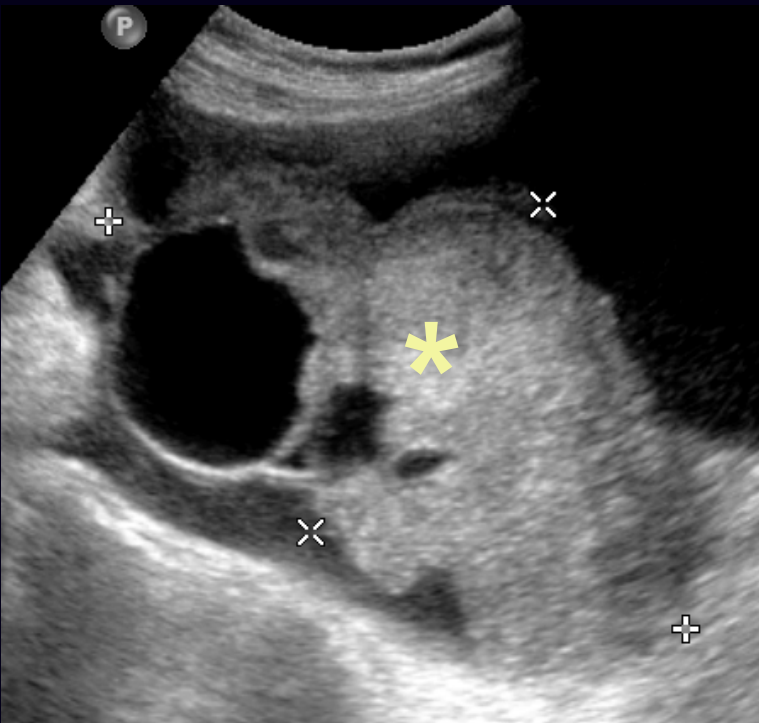
Possible Neoplasm

- **Complex cyst with color flow**



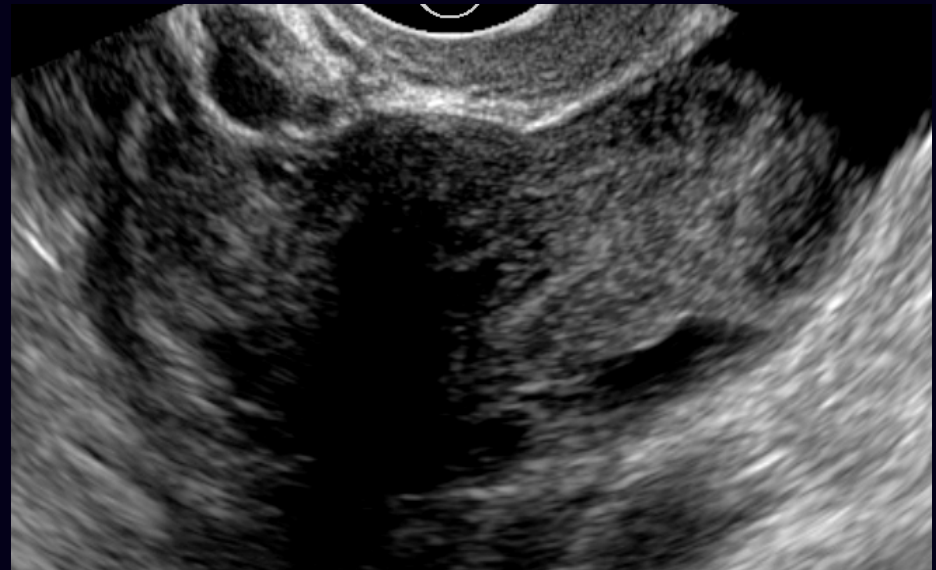
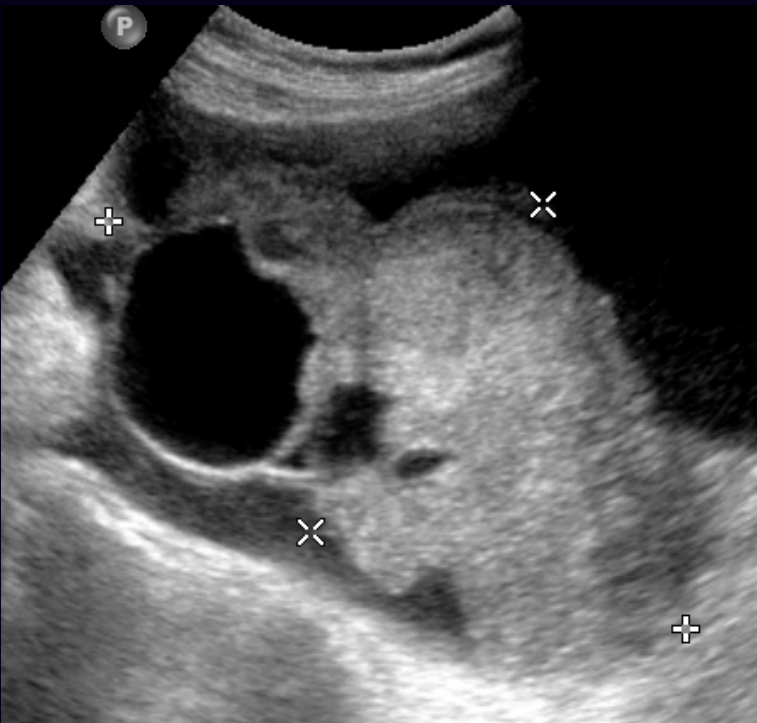
Possible Neoplasm

- **Complex cyst with color flow**



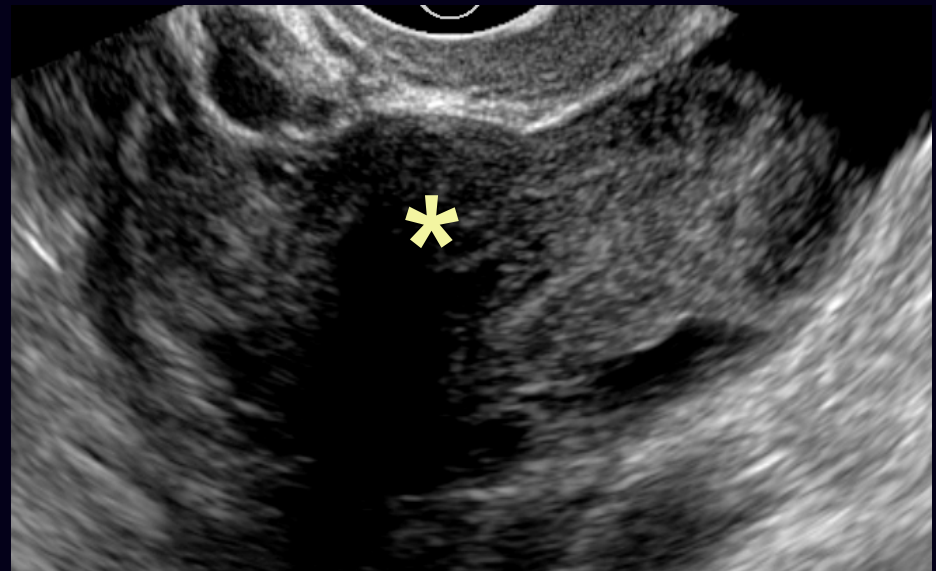
Possible Neoplasm

- **Complex cyst with color flow**
- **Solid Mass**

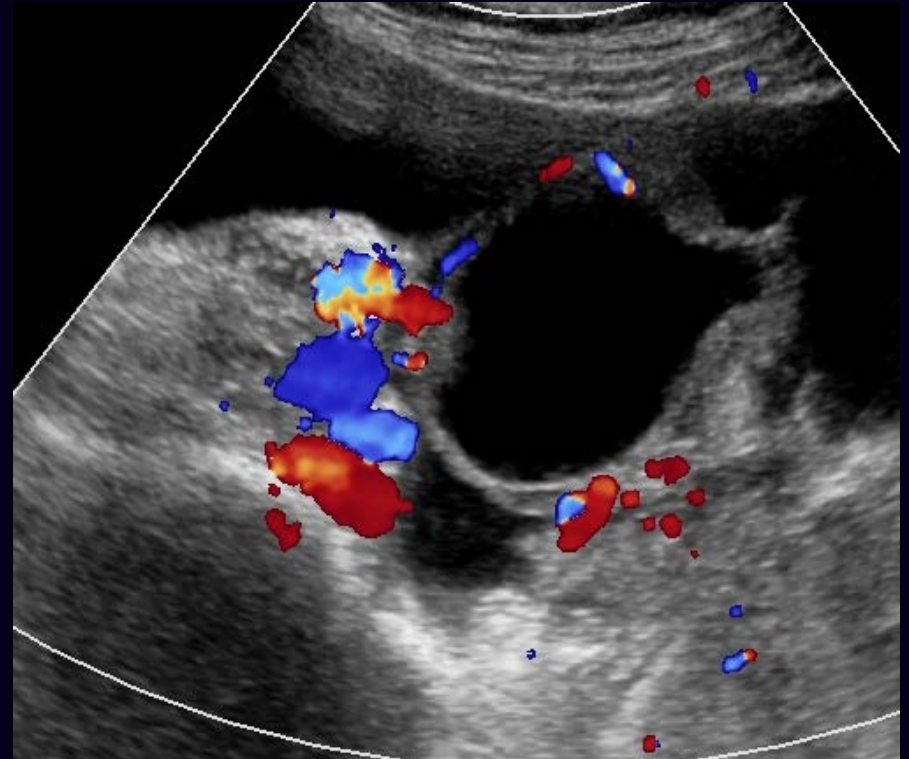


Possible Neoplasm

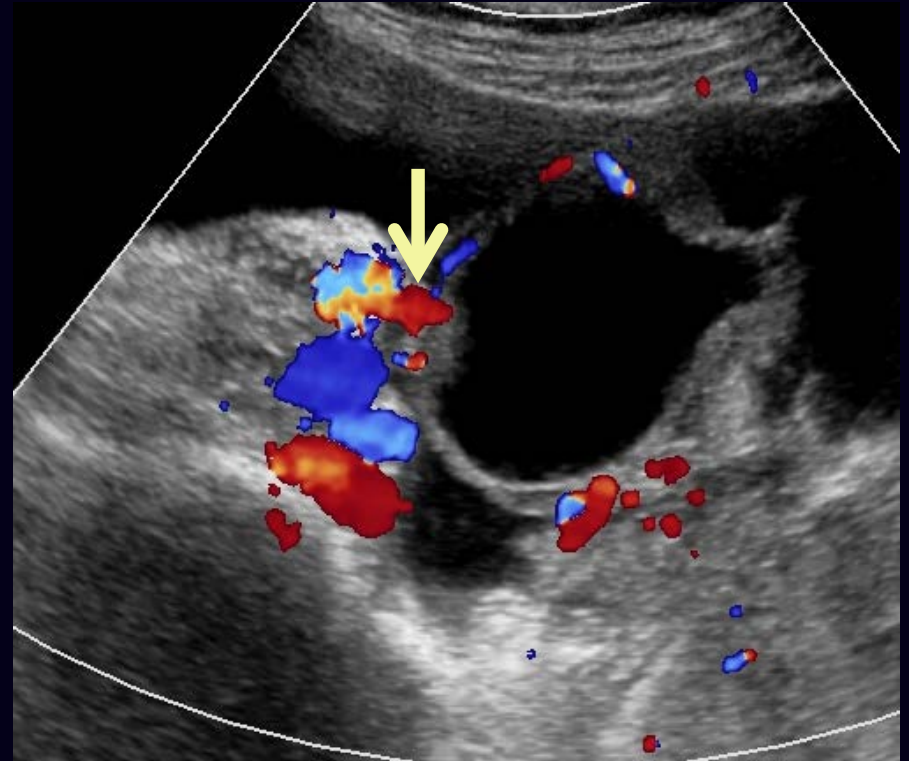
- **Complex cyst with color flow**
- **Solid Mass**



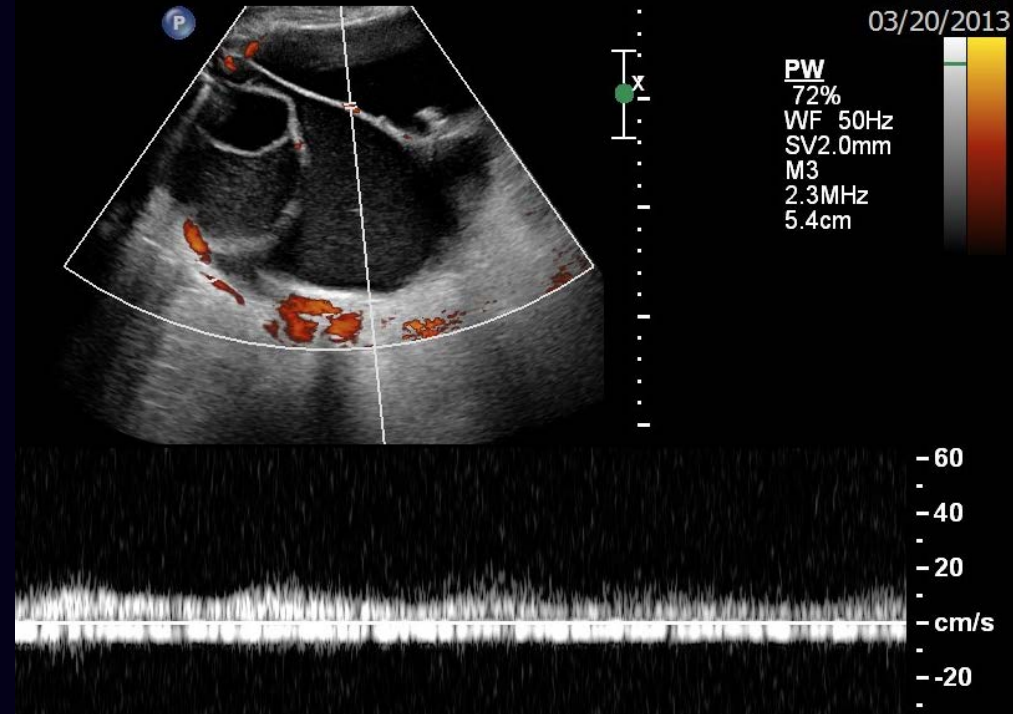
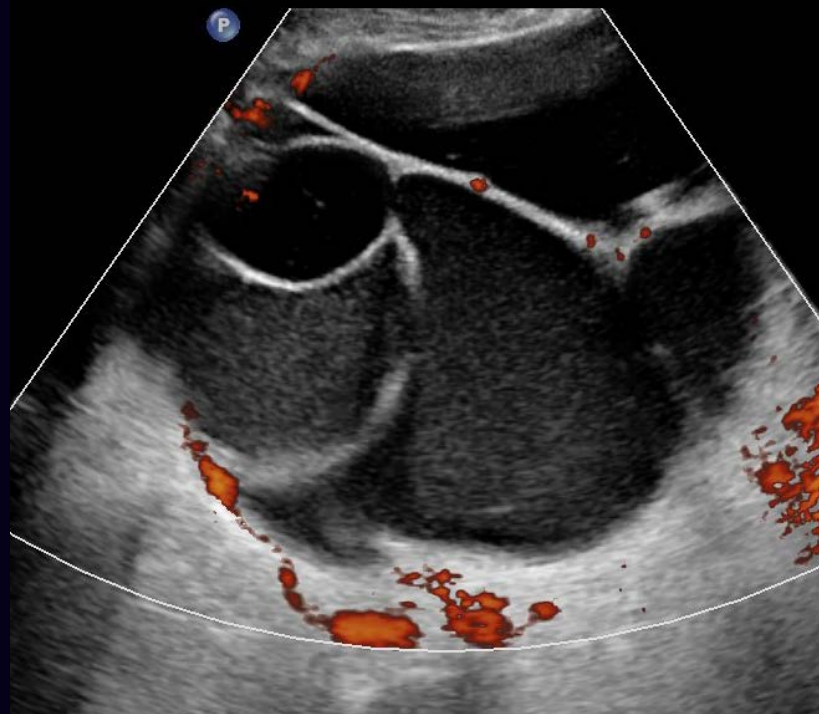
Complex Cyst with Color Flow



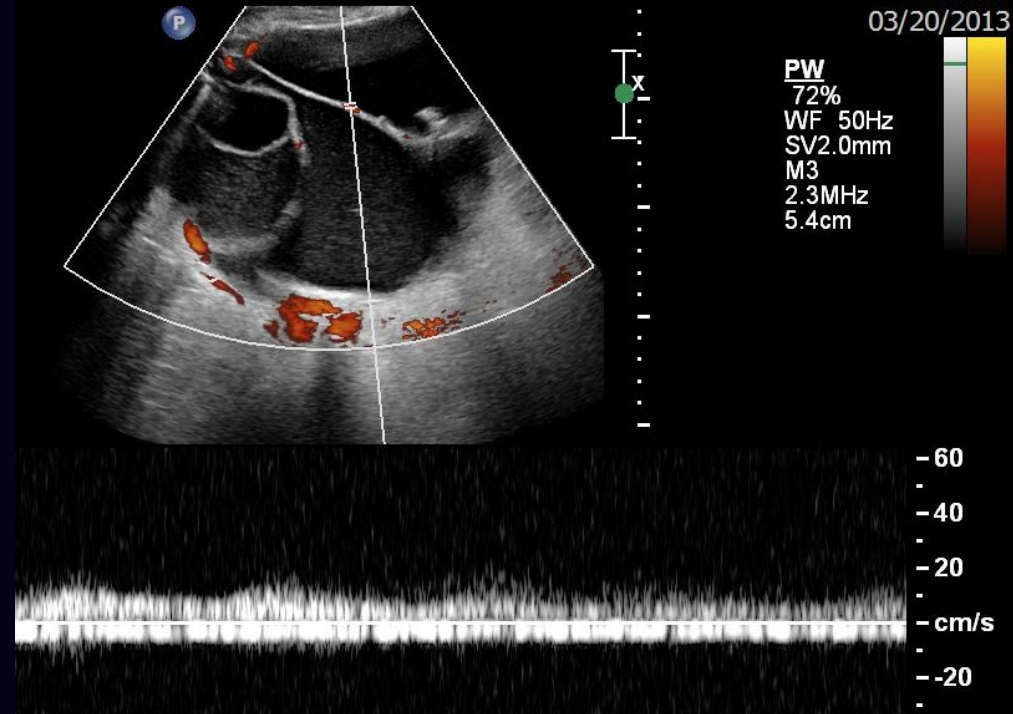
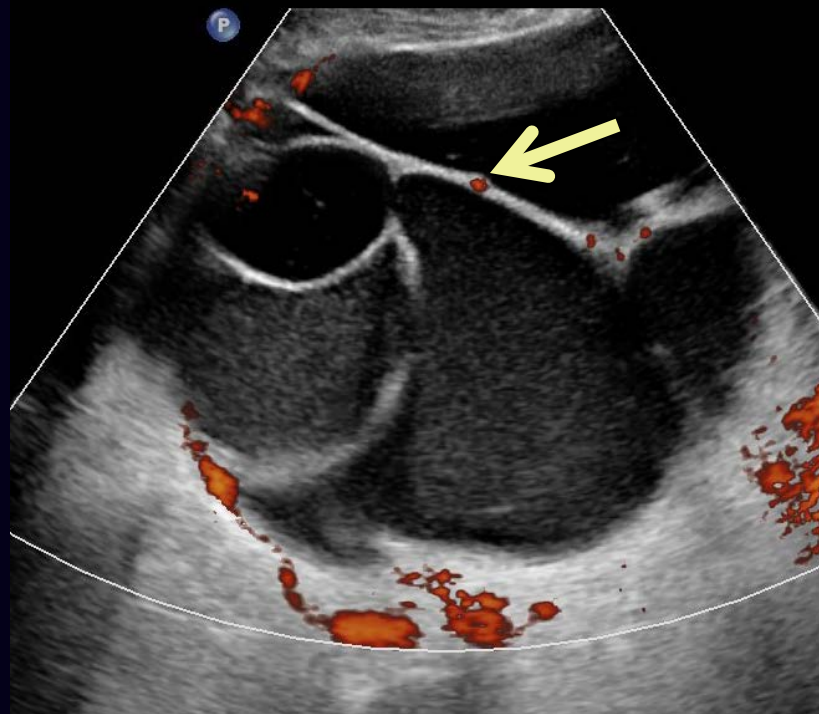
Complex Cyst with Color Flow



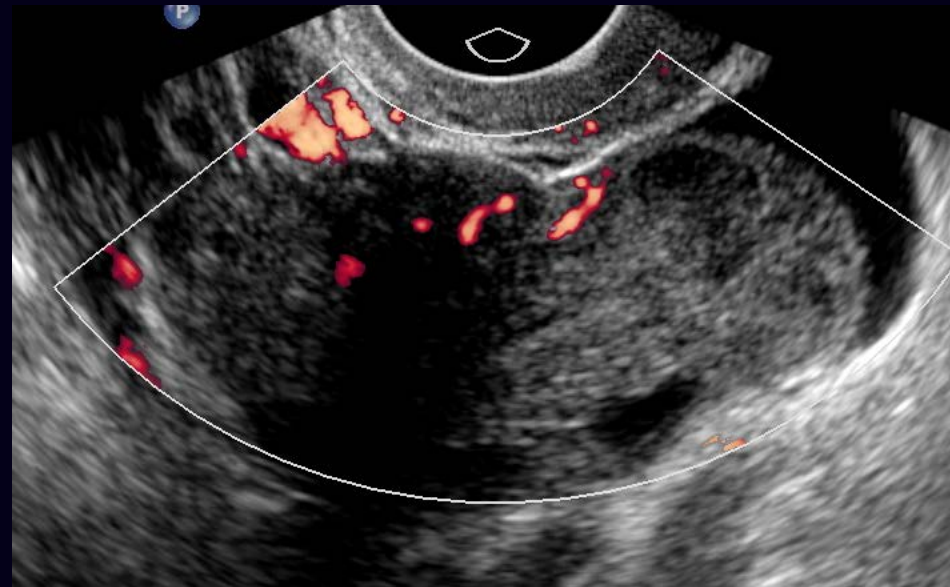
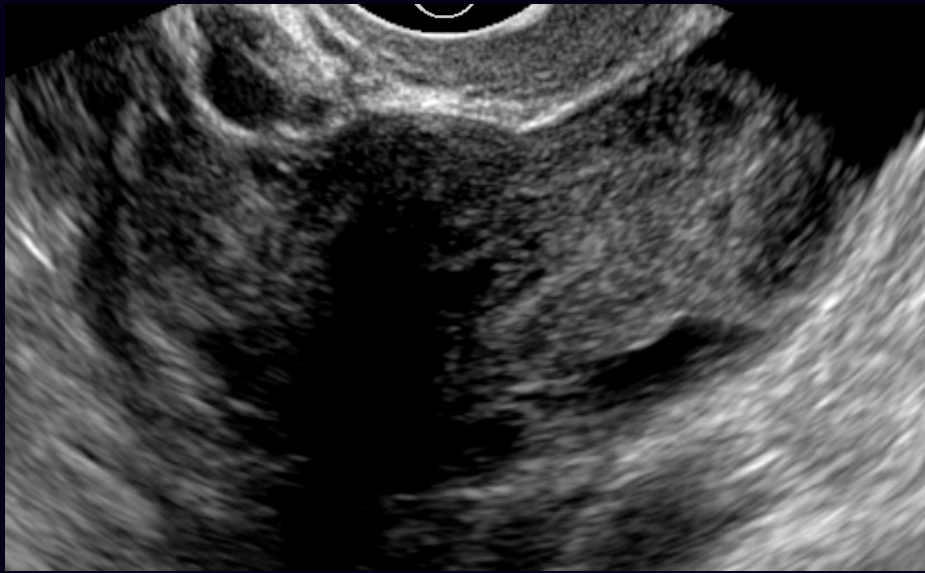
Complex Cyst with Color Flow



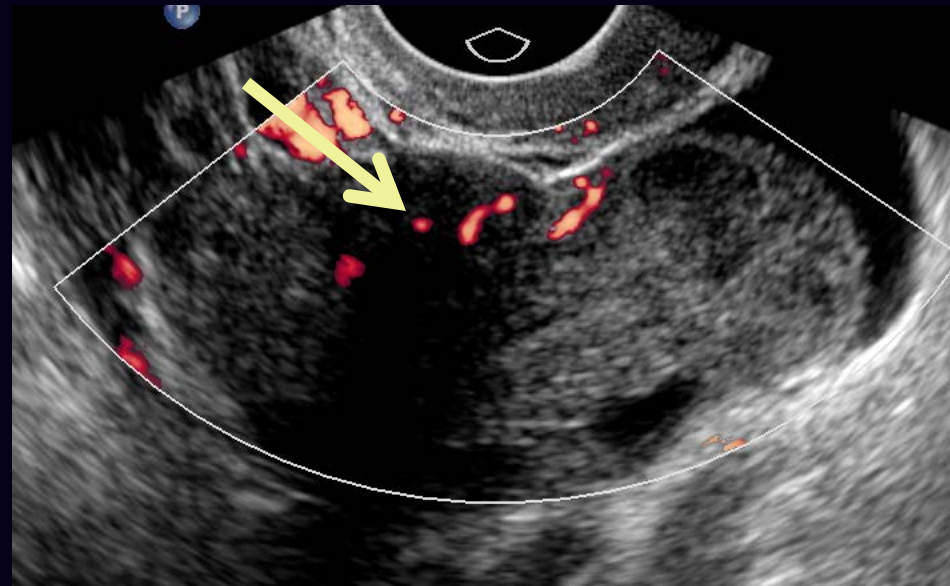
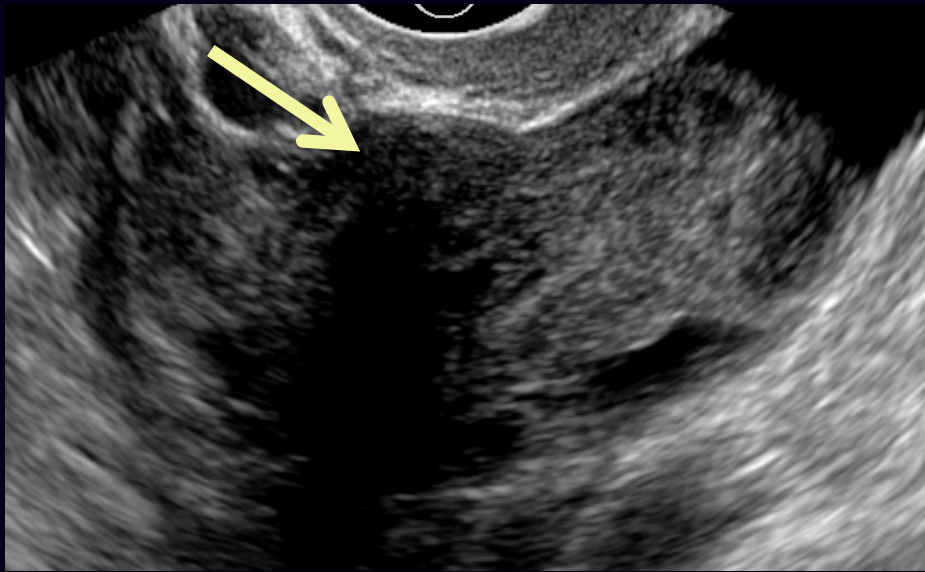
Complex Cyst with Color Flow



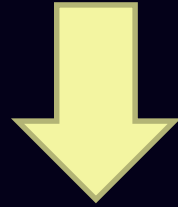
Solid Mass



Solid Mass



Adnexal Mass

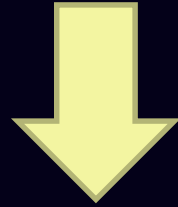


Clinical History

Conclusion-Clinical History

- **Positive Pregnancy Test**
 - **Ectopic Pregnancy**
- **Signs and symptoms of pelvic inflammatory disease**
 - **Tubo-ovarian abscess**

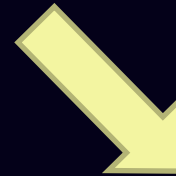
Adnexal Mass



Clinical History



Ovary

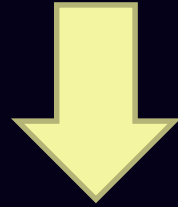


Extraovarian

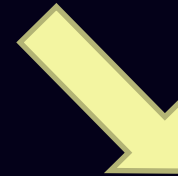
Conclusion-Location

- **Ovarian**
 - **Ovarian tissue surrounding the lesion**
- **Extraovarian**
 - **Separate ipsilateral ovary**

Adnexal Mass



Clinical History



Ovary

Extraovarian



**Simple
Cyst**

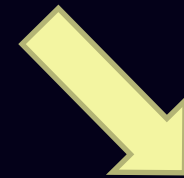
**Benign
Lesions**

**Possible
Neoplasm**

Conclusion – Simple Cyst

- **Pre-Menopausal**
 - **Less than 5 cm**
 - **No follow up**
 - **5-7 cm**
 - **Yearly Follow up**
 - **Over 7 cm**
 - **Further imaging or surgical consultation**
- **Post-Menopausal**
 - **Over 1 cm to 7cm**
 - **Yearly Follow up**
 - **Over 7 cm**
 - **Further imaging or surgical consultation**

Benign Lesions



**Hemorrhagic
Cyst**

Endometrioma

**Mature Cystic
Teratoma**

Conclusion – Benign Lesions

- ***No color flow***
- **Hemorrhagic Cyst**
 - **Pre menopausal**
 - **5 cm or less**
 - **No follow up**
 - **Over 5 cm**
 - **Follow up in 6-12 weeks**
 - **Post menopausal**
 - **Follow up 6-12 weeks**
- **Mature cystic teratoma**
 - **CT or MR**
 - **Surgical consultation**
- **Endometrioma**
 - **MR**
 - **Surgical consultation**

Conclusion – Possible Neoplasm

- **Does not meet criteria for**
 - **Simple cyst**
 - **Hemorrhagic Cyst**
 - **Mature cystic teratoma**
 - **Endometrioma**
- **Complex cyst with color flow**
- **Solid Mass**
- **Surgical consultation**



Thank you!