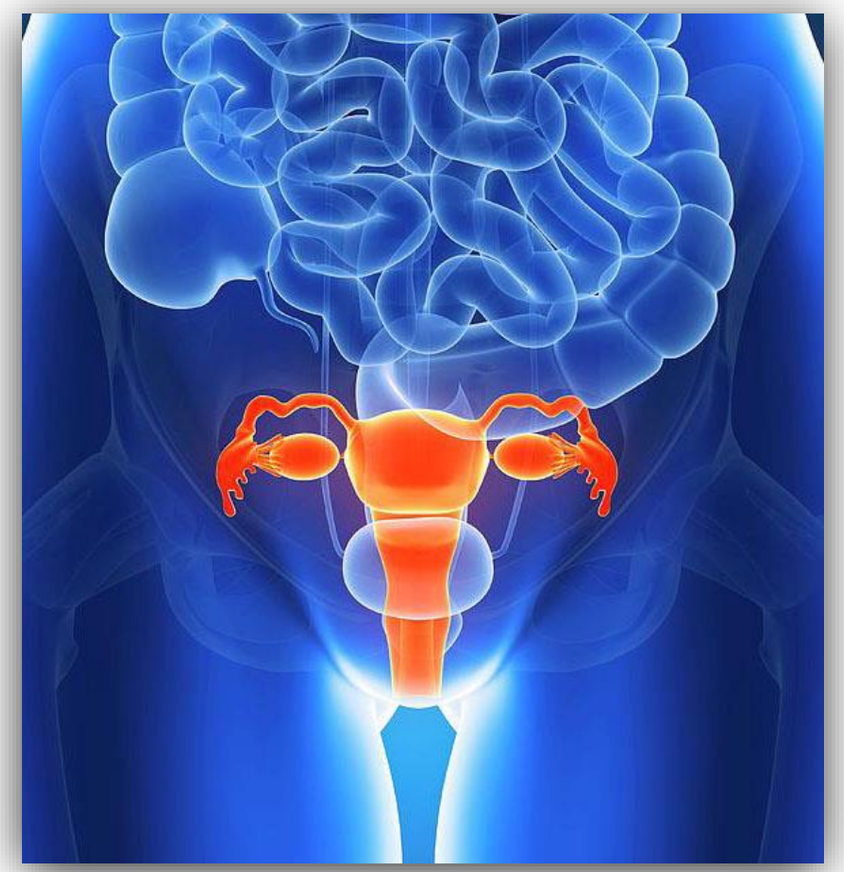
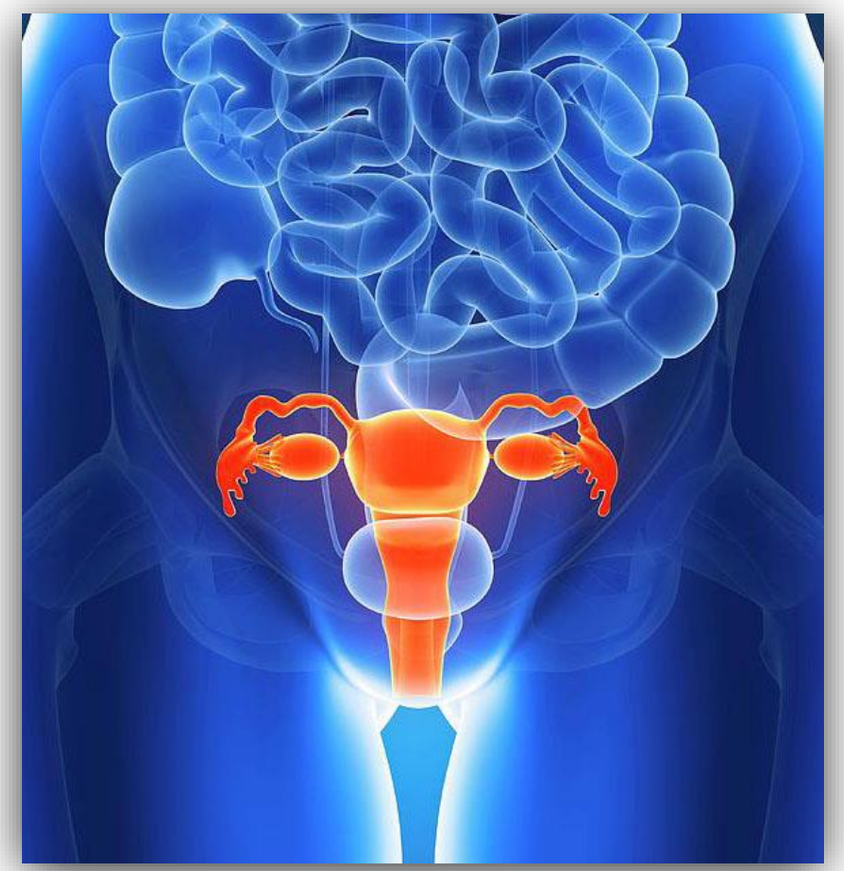
OB GYN SONOGRAPHY REVIEW

Pelvic Pathology



Course Outline

- Vaginal Pathology
- Uterine Pathology
- Endometrial Pathology
- Ovarian Pathology
- Adnexal Pathology



Vaginal Pathology

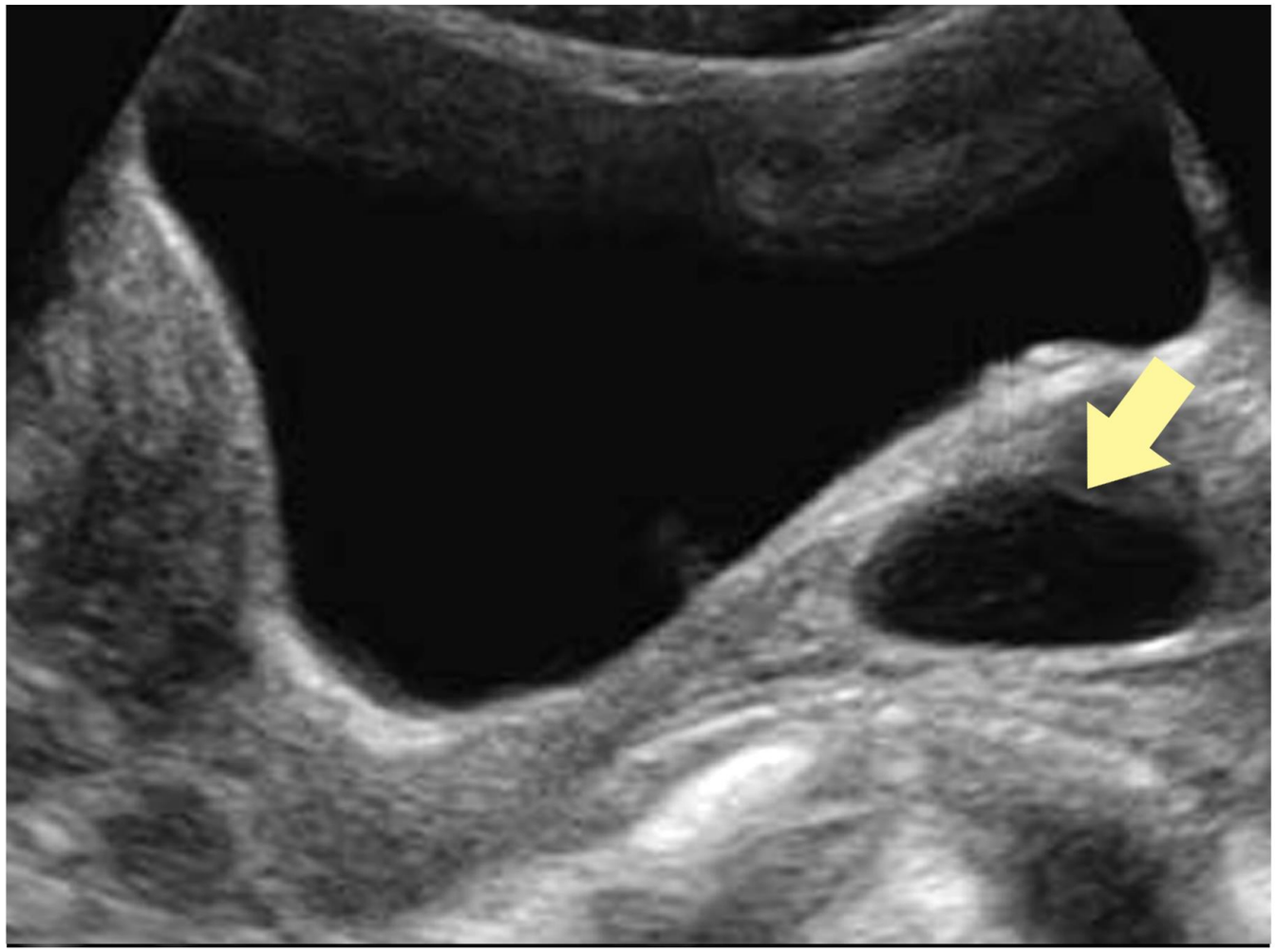
Congenital Vaginal Anomalies

- *Agenesis*: absence of vagina due to incomplete or failed development
- *Atresia*: spectrum of anomalies including imperforation, occlusion, or failed formation of part of the vagina
- *Imperforate hymen*: completely closed hymen resulting from congenital malformation or postnatal inflammatory occlusion
- *Persistent uterovaginal sep*tum: presence of a complete or partial septum within the vaginal cavity

Congenital Vaginal Anomalies

- *Gartner's duct cyst*: mesonephric duct remnant that forms a cyst along the lateral or anterolateral wall of the vagina
  - May be associated with other GU anomalies:
    - Renal agenesis
    - Renal dysplasia
    - Cross-fused ectopia
- *Hydrocolpos:* distended, fluid-filled vaginal cavity without associated distention of uterine cavity. Most common causes:
  - Imperforate hymen
  - Vaginal stenosis

GARTNER'S DUCT CYST

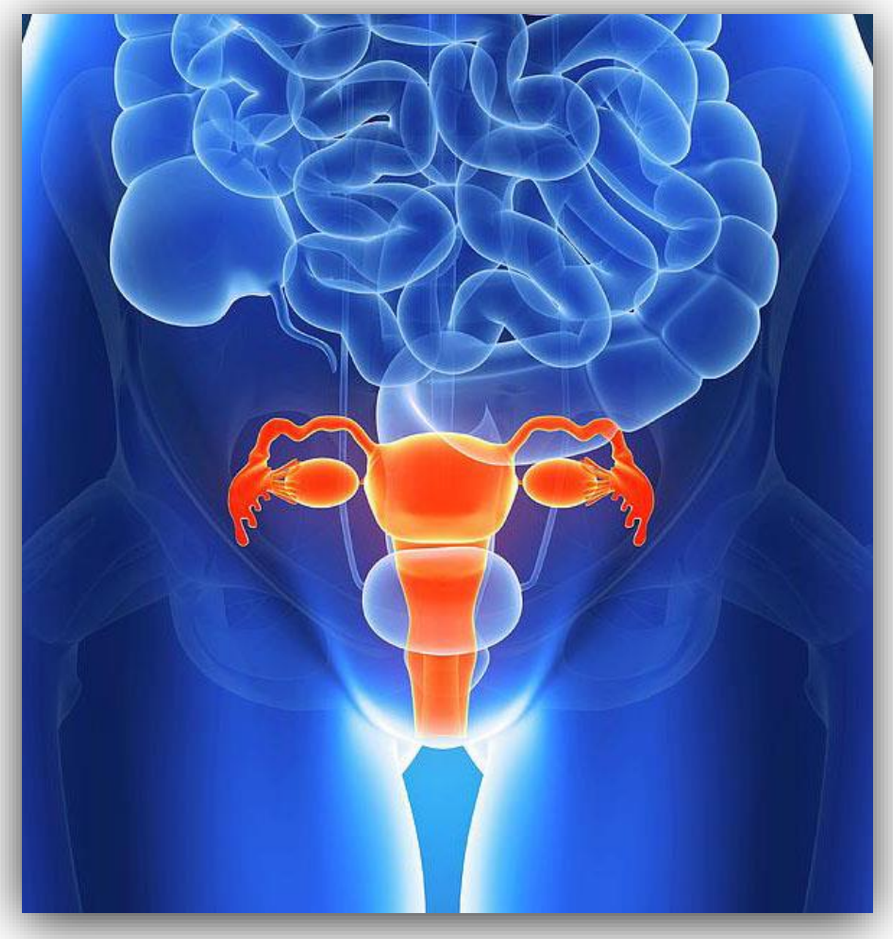


arrow = vaginal cysts

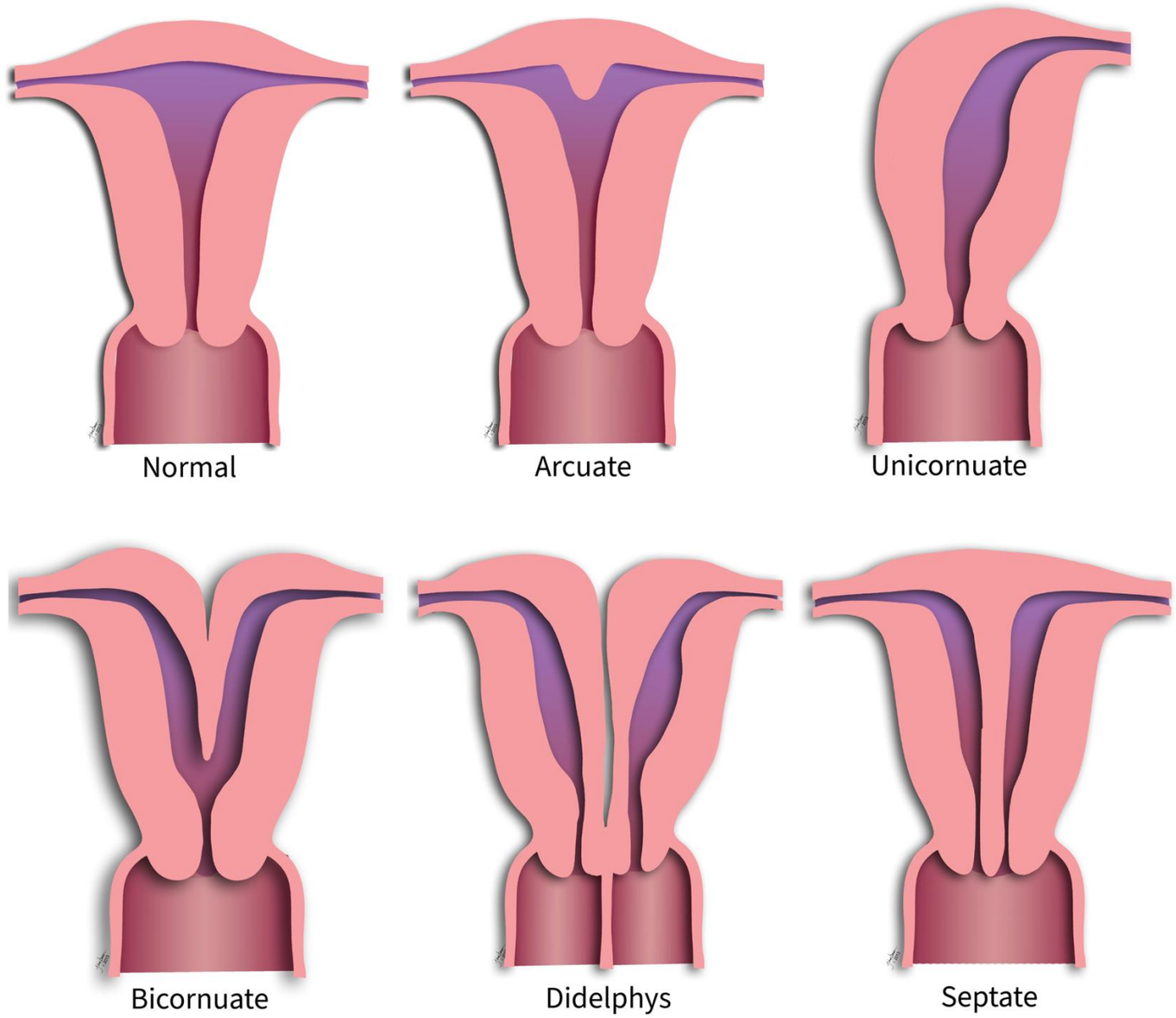
Uterine Pathology

Uterine Pathology

- Congenital anomalies
- Acquired anomalies
  - Asherman syndrome
- Uterine masses
  - Fibroids (leiomyomas, myomas)
  - Uterine leiomyosarcoma
  - Adenomyosis



Congenital Anomalies



Asherman Syndrome

- Obliteration of the endometrial cavity resulting from intrauterine adhesions or *synechiae*
- Caused by excessive or traumatic instrumentation of the uterus
- Significantly interferes with pregnancy
  - ≈ 40% of pregnancies end in spontaneous abortion
- Best diagnosed with direct endometrial imaging methods, i.e., hysteroscopy

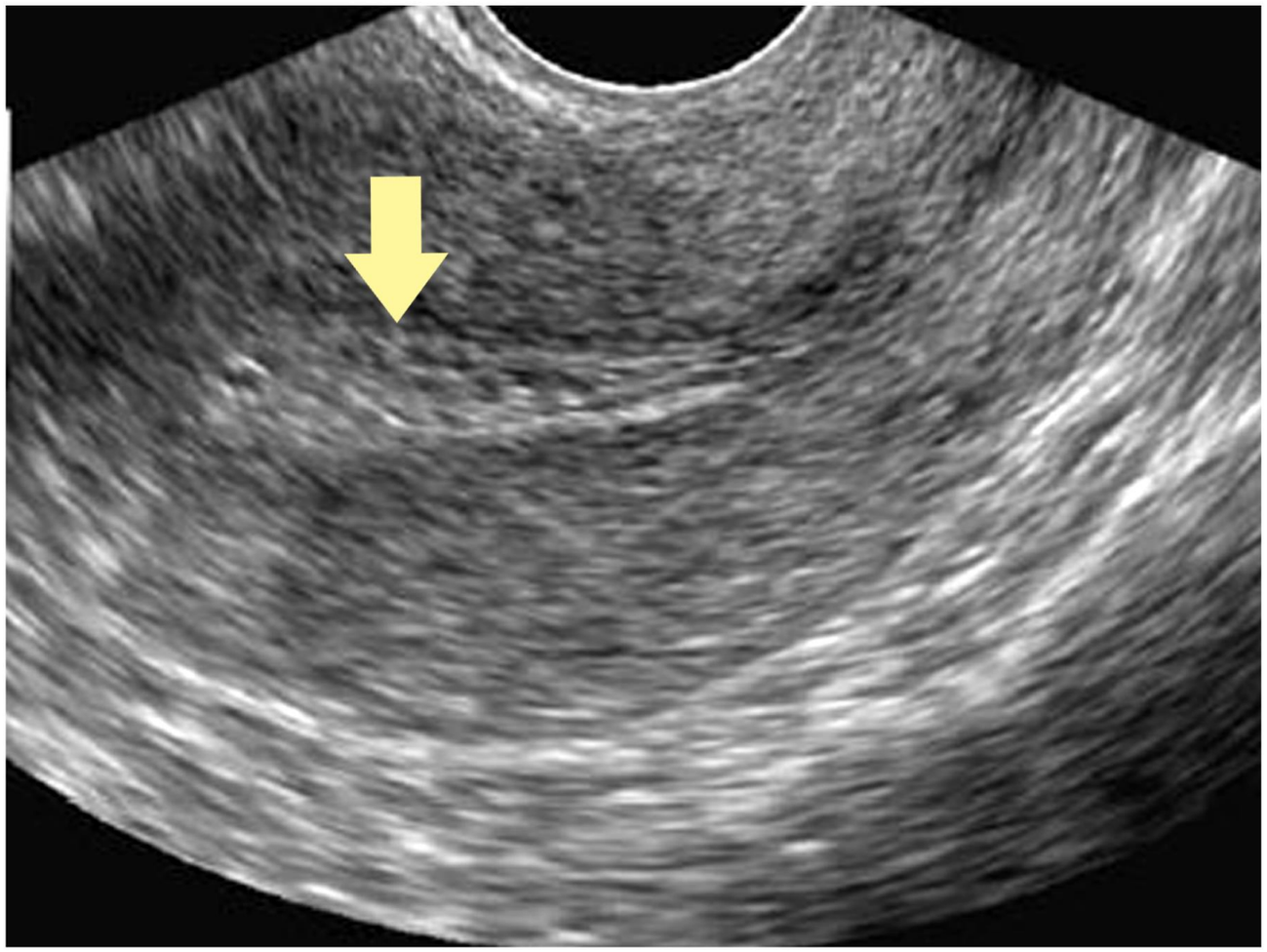
Asherman Syndrome

- Clinical signs and symptoms include:
  - Amenorrhea
  - Pelvic pain
  - Infertility
  - Recurrent spontaneous abortions

Asherman Syndrome

- Sonographic findings include:
  - Thickened heterogeneous endometrium on routine gray scale sonography
  - Intrauterine synechiae on hysterosonography

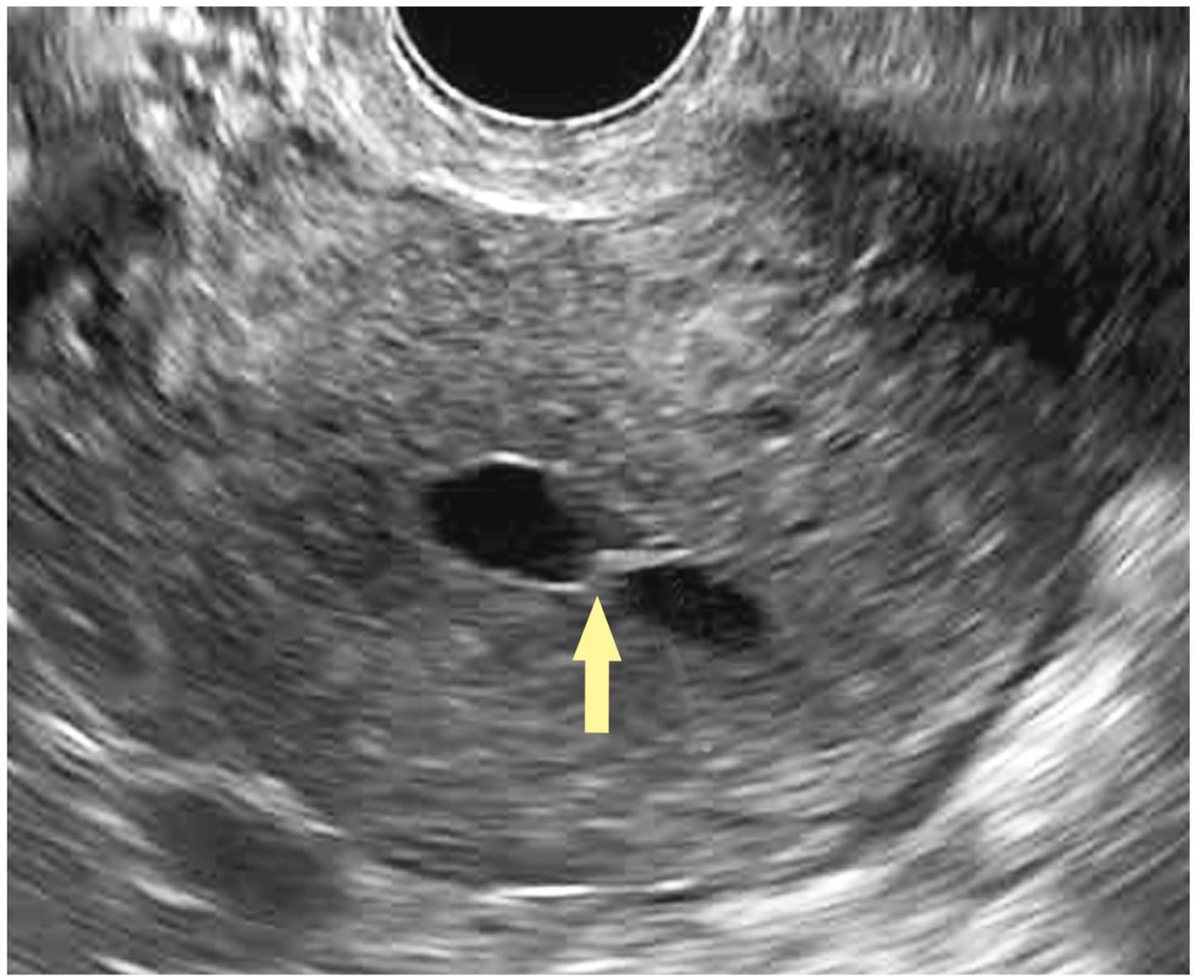
ASHERMAN SYNDROME



arrow = thickened heterogeneous endometrium

Endovaginal ultrasound

ASHERMAN SYNDROME



arrow = intrauterine synechia

Hysterosonogram

Fibroids (Leiomyomas, Myomas)

- Benign tumors arising from uterine muscular tissue
- Occur in ≈ 20% of all symptomatic women in USA
- Prevalence in increased in:
  - African-American women
  - Older women
  - Perimenopausal women
  - Obese women
  - Diabetic women

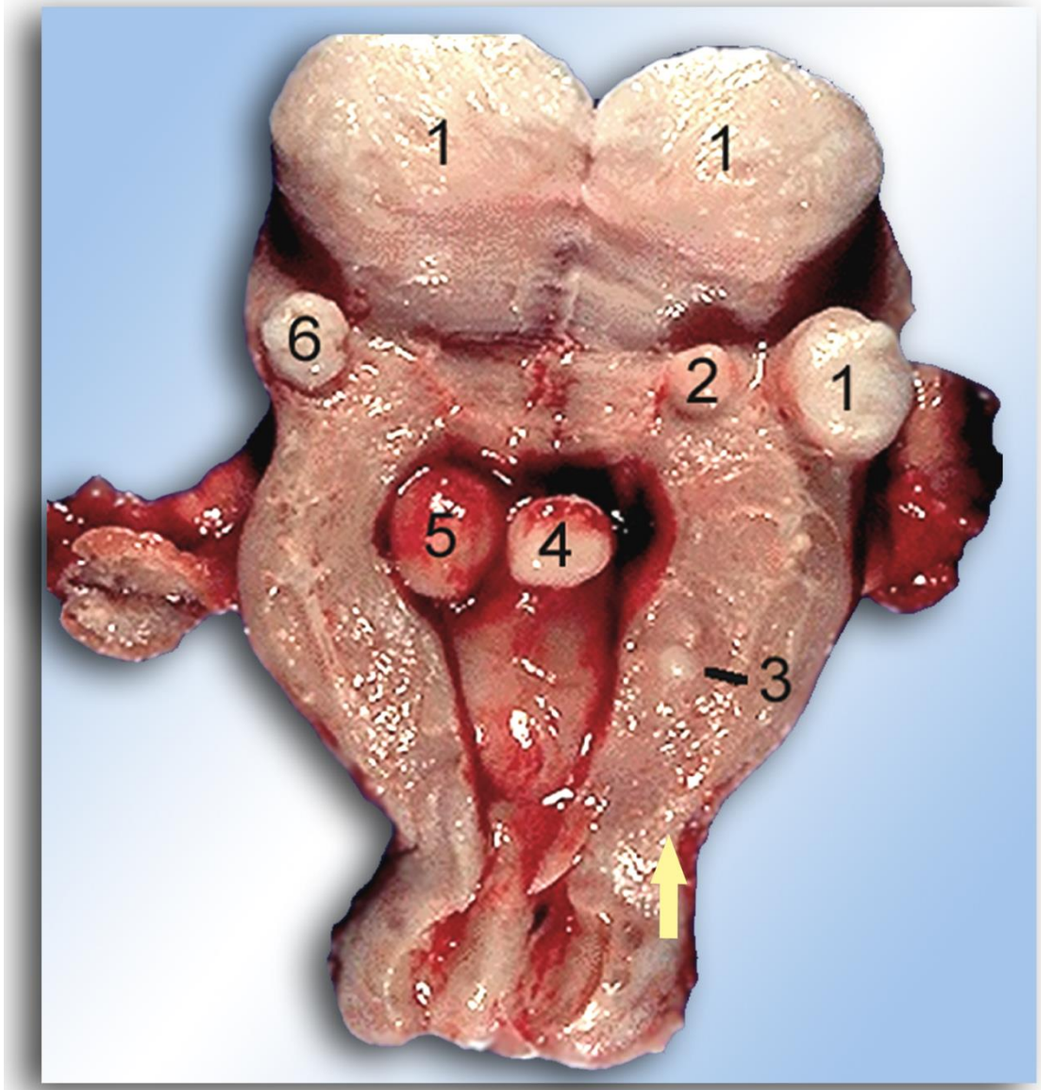
Fibroids (Leiomyomas, Myomas)

- Gross pathological appearance
  - Well-circumscribed, round, or irregularly lobulated
  - Nonencapsulated mass but clearly demarcated from normal uterine tissue
  - Internally characterized by a whorling tissue pattern

Fibroids (Leiomyomas, Myomas)

- Locations:
  - *Pedunculated*: arising from a stalk with internal vascuature
  - *Intramural*: interstitial location within the myometrium
  - *Submucosal*: lying directly beneath the endometrium
  - *Subserosal*: lying beneath the outer surface of the uterus
  - *Interligamentous*: lying within the broad ligament
  - *Cervical*: lying within the cervix
  - *Exophytic*: growing out of and away from uterus

UTERINE FIBROIDS



1 = exophytic
2 = subserous
3 = intramural
4, 5 = submucous
6 = interligamentous

Fibroids (Leiomyomas, Myomas)

- Clinical signs and symptoms include:
  - Abnormal uterine bleeding
  - Pelvic mass on pelvic exam
  - Sensations of pressure in pelvis
  - Frequent urination
  - Pain:
    - Chronic pelvic pain
    - Mid-cycle pelvic pain
    - Dyspareunia (painful intercourse)
    - Pain associated with torsion or degeneration

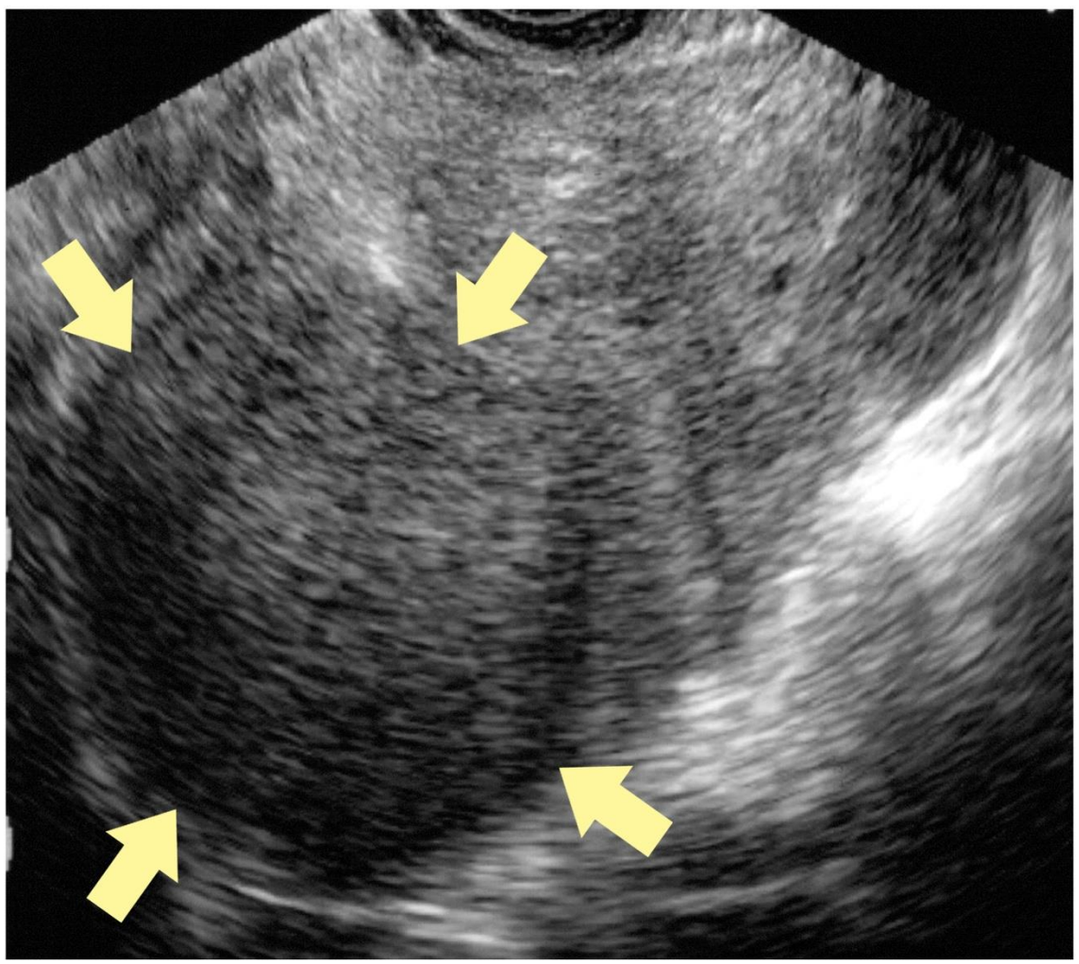
Fibroids (Leiomyomas, Myomas)

- Clinical complications include:
  - Torsion
  - Prolapse
  - Degeneration
    - Cystic
    - Calcific
    - Fatty
- Pregnancy-related-complications
  - Dystocia
  - Placental abruption

Fibroids (Leiomyomas, Myomas)

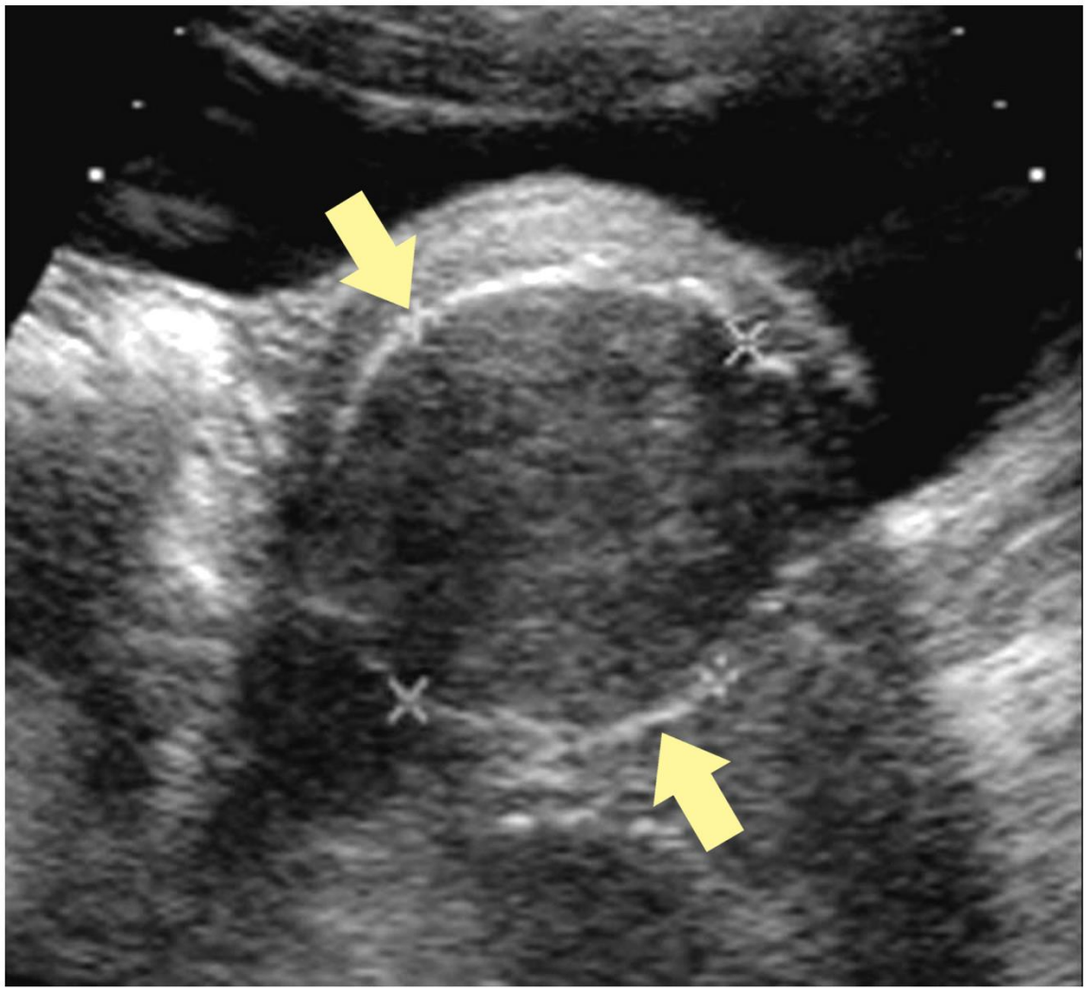
- Sonographic findings include:
  - Specific appearance depends on size, location, number of masses present and type and extent of degeneration
  - Well-circumscribed, hyperattenuating mass in, or arising from, uterus
  - Calcifications within or on the periphery of the mass
  - Distortion of normal uterine contour
  - Changes associated with degeneration

UTERINE FIBROIDS



arrow = well-circumscribed, hyerattenuating mass

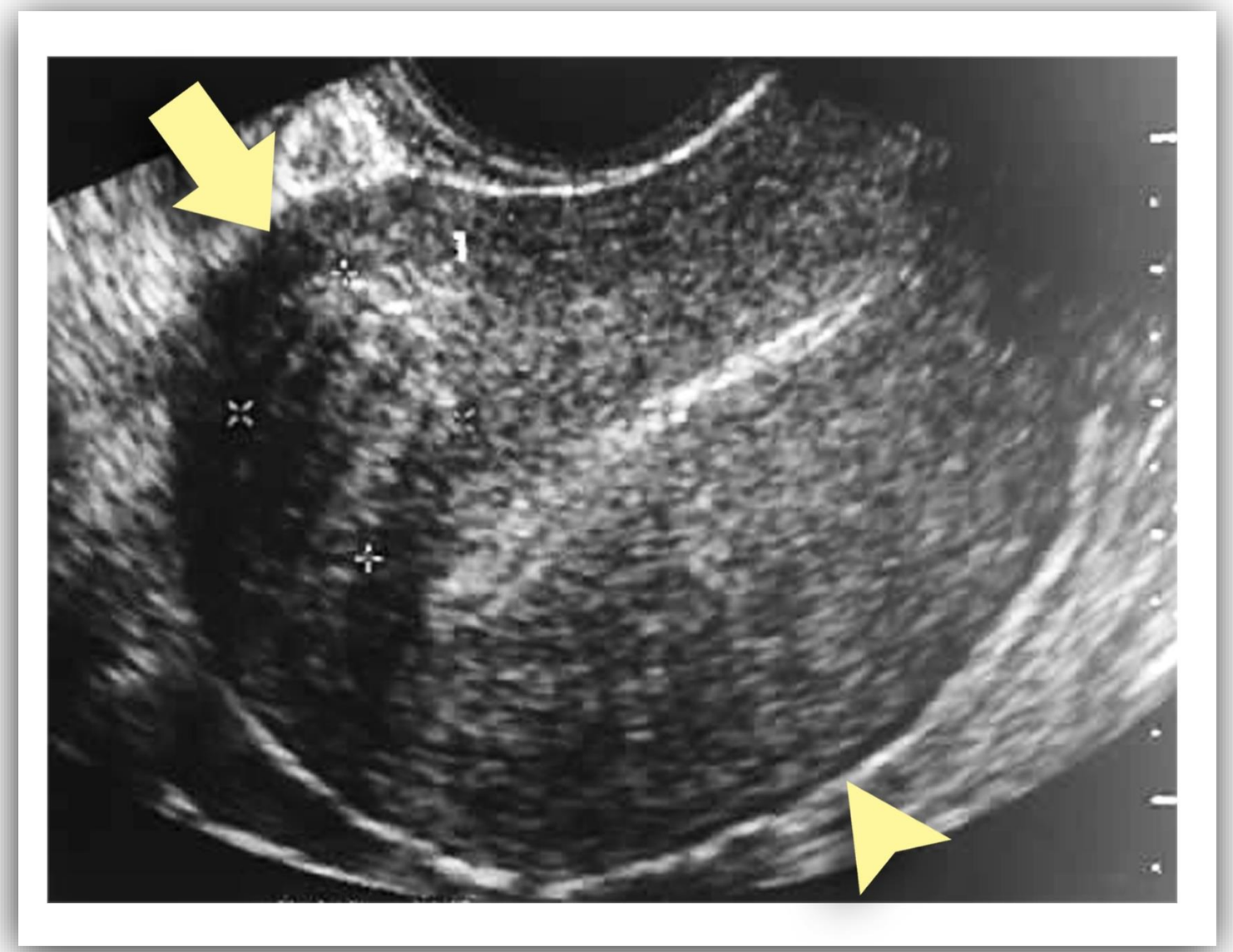
UTERINE FIBROIDS



arrows = calcific degeneration

Calcifications on periphery of mass

UTERINE FIBROIDS

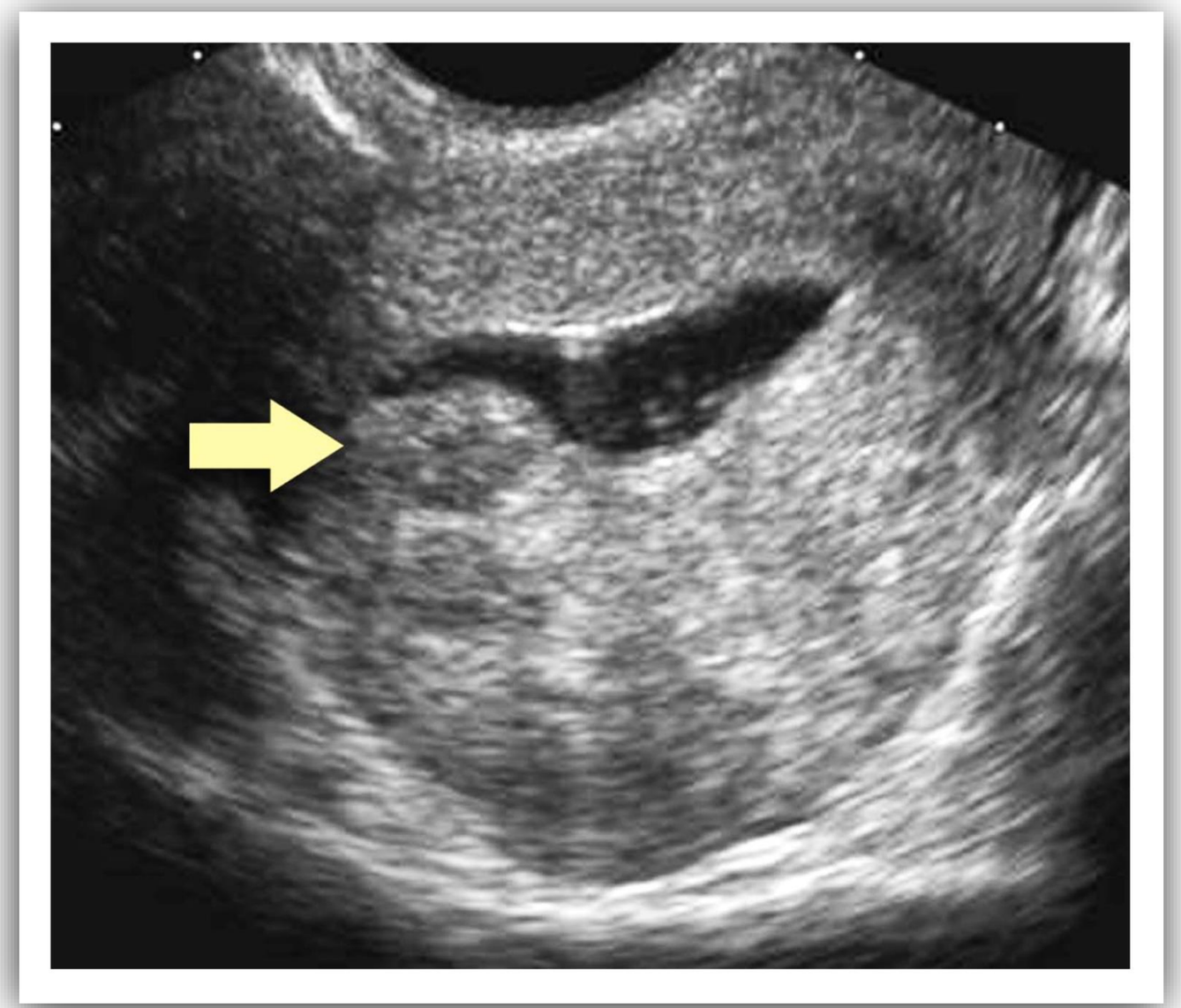


Alteration of uterine contour

UTERINE FIBROIDS

Subserosal fibroid

UTERINE FIBROIDS

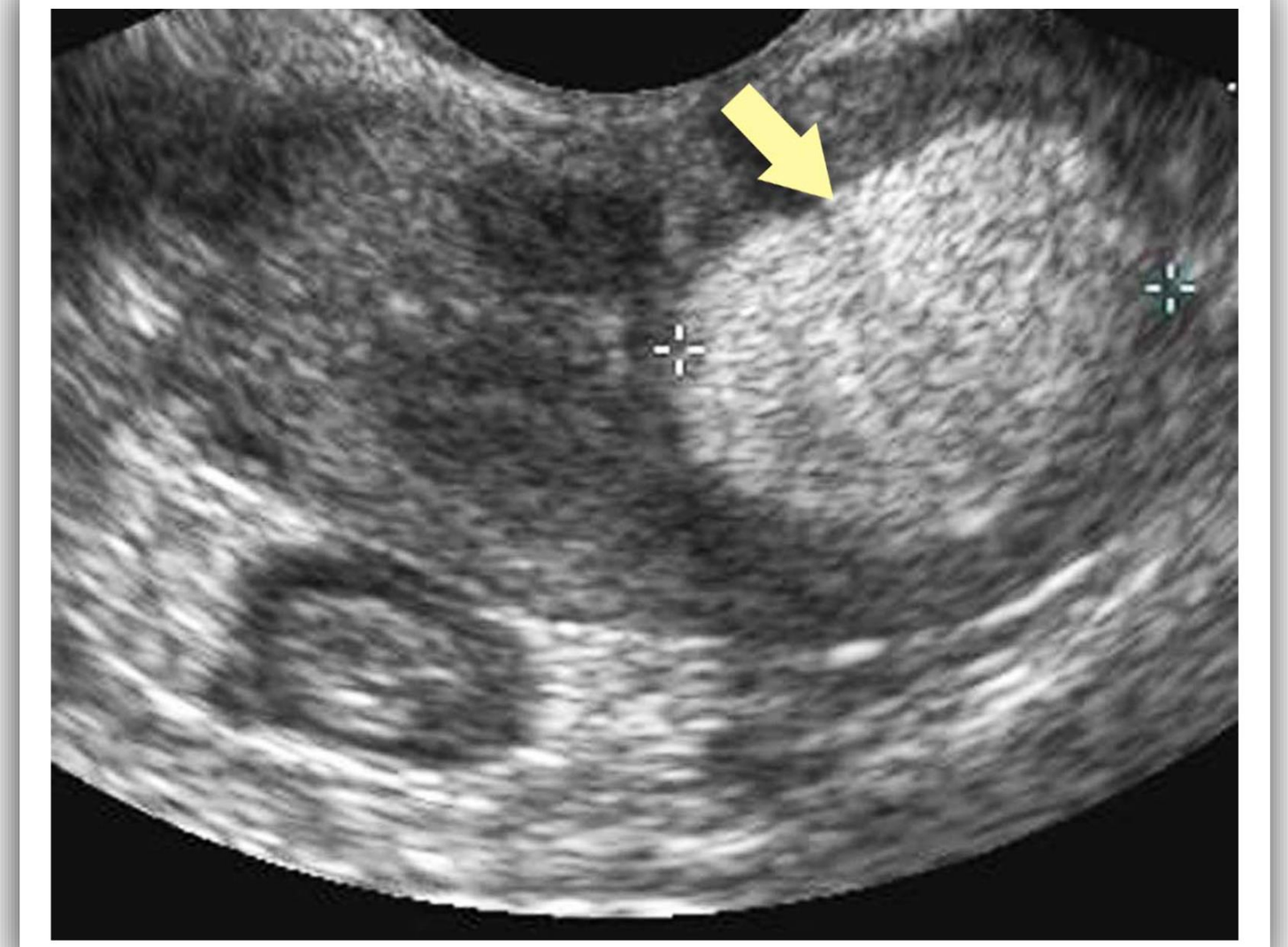


Submucosal fibroid

UTERINE FIBROIDS

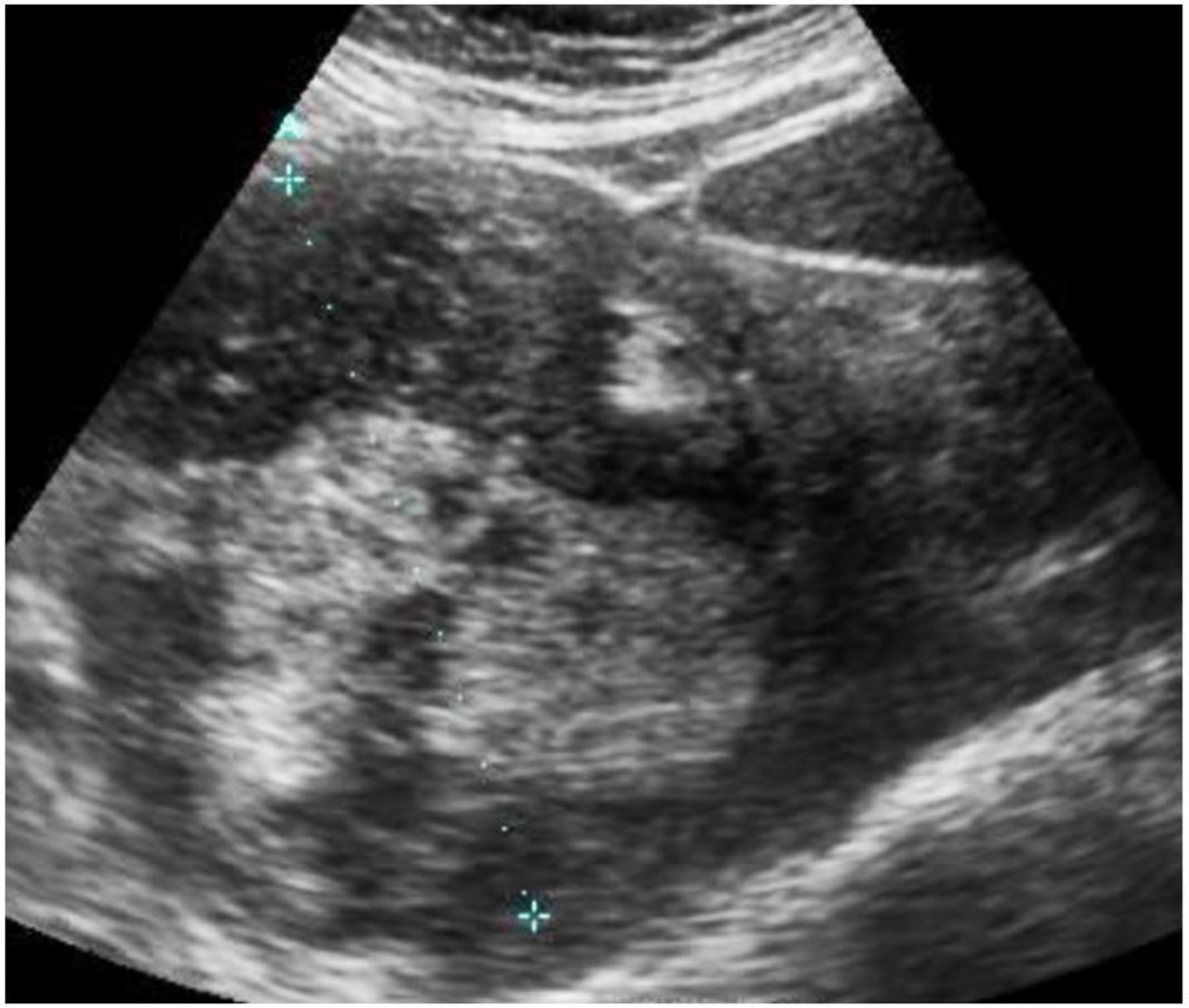
Cystic degeneration

UTERINE FIBROIDS



Fatty degeneration

UTERINE FIBROIDS



Mixed degeneration

Uterine Leiomyosarcoma

- Rare malignant relative of benign fibroids. Arise from smooth muscle cells and can occur anywhere in the uterine body.
- Can spread from myometrium into:
  - Pelvic blood vessels
  - Adjacent pelvic structures
  - Distantly to lungs or liver

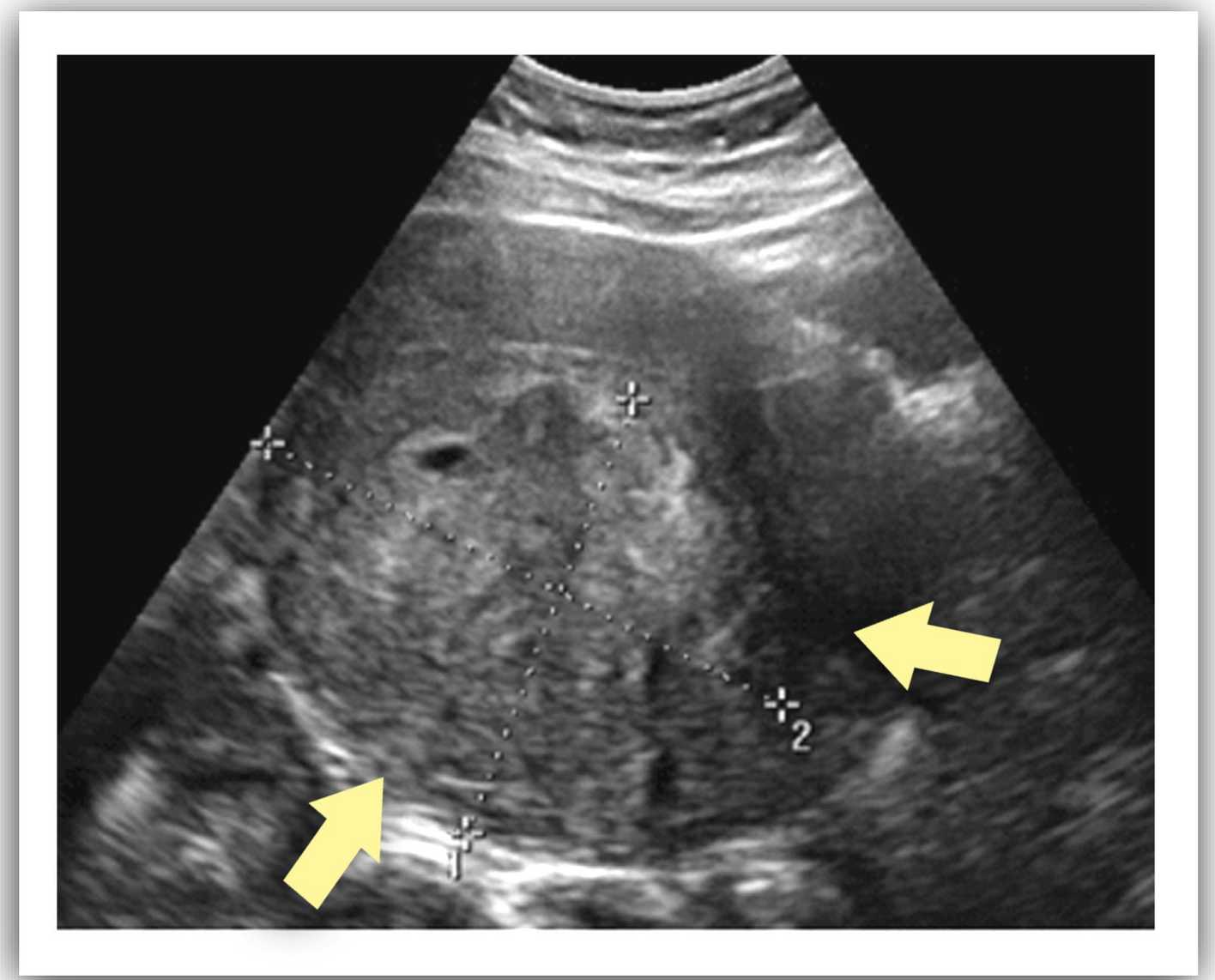
Uterine Leiomyosarcoma

- Clinical presentation:
  - Postmenopausal vaginal bleeding
  - Irregular, intermenstrual bleeding in premenopausal patients
  - Pelvic pain, discomfort
  - Palpable uterine mass

Uterine Leiomyosarcoma

- Sonographic findings include:
  - Large, heterogeneous, hypoechoic uterine mass
  - Indistinguishable from benign fibroid
  - Rapid growth on serial exams
  - High-velocity, low-resistance waveforms in feeding vessels

UTERINE LEIOMYOSARCOMA



Large, heterogeneous mass in uterus

Adenomyosis

- A benign, diffuse disease characterized by infiltration of the endometrial glands and stroma into the myometrium
- Relatively common in women of reproductive years
- Found in 36% of women undergoing hysterectomy
- Risk factors include:
  - Age
  - Gravity
  - Pelvic endometriosis
  - Uterine fibroids

Adenomyosis

- Gross pathology
  - May be focal or diffuse
  - Uterus is enlarged and globular
  - Involvement of both anterior and posterior walls
  - Posterior wall usually greater involvement

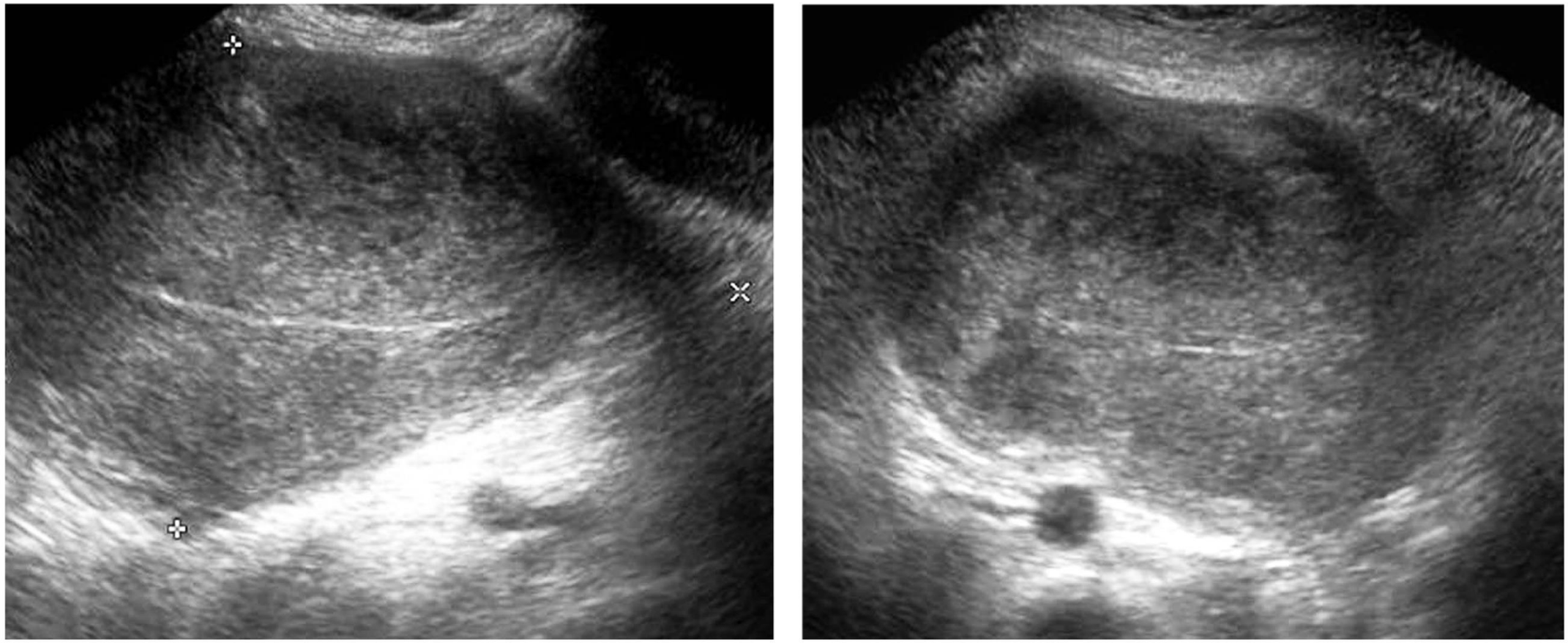
Adenomyosis

- Clinical presentation:
  - Secondary dysmenorrhea
  - Menorrhagia (40-50%)
  - Midline dyspareunia

Adenomyosis

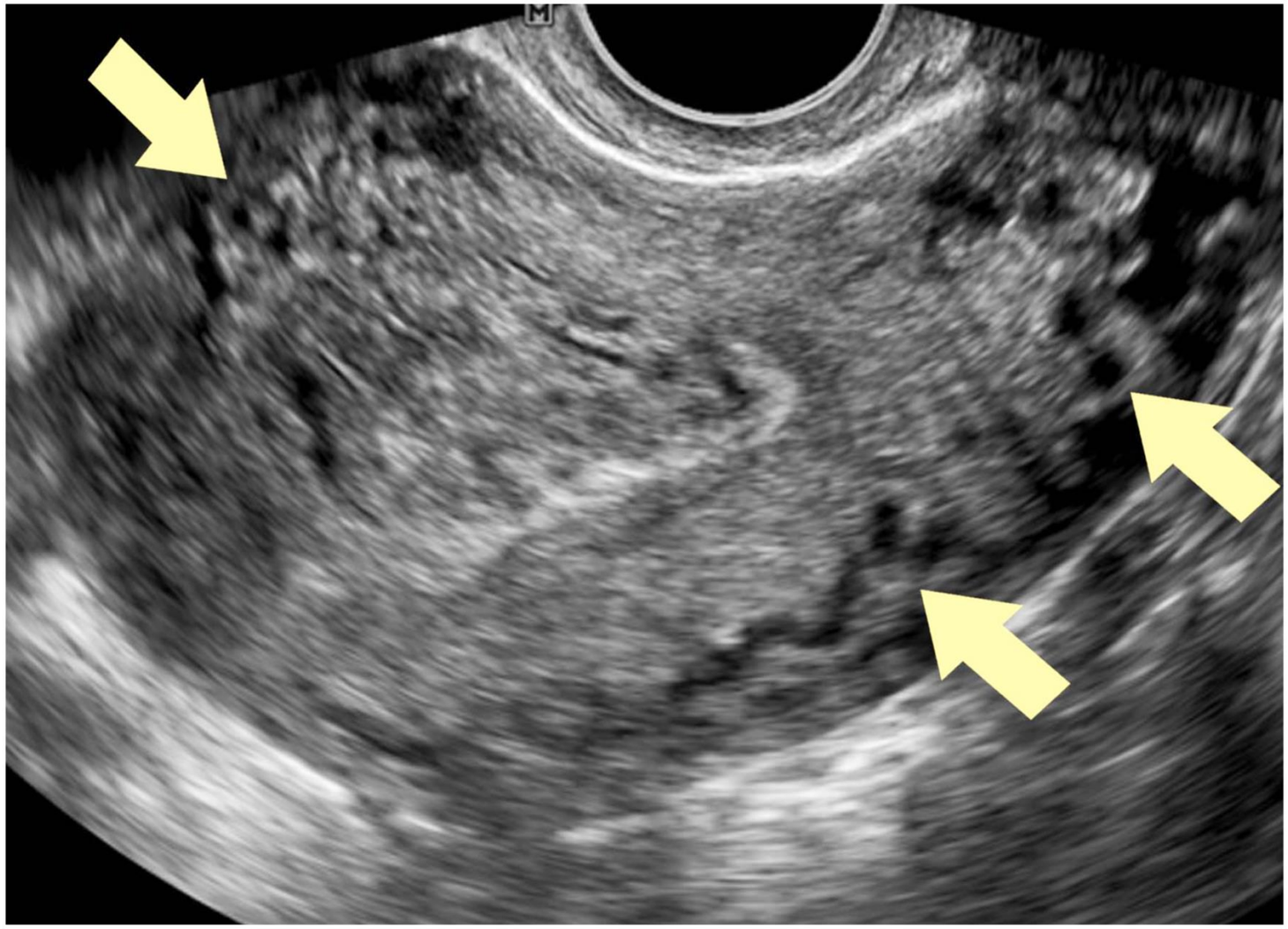
- Sonographic findings include:
  - Symmetrically enlarged uterus with normal contours
  - Focal or diffuse bulkiness, particularly posterior wall
  - Heterogeneous myometrial echo texture
  - Focal cystic areas within the myometrium
  - Indistinct endometrial/myometrial interface

ADENOMYOSIS



Diffuse bulkiness

ADENOMYOSIS

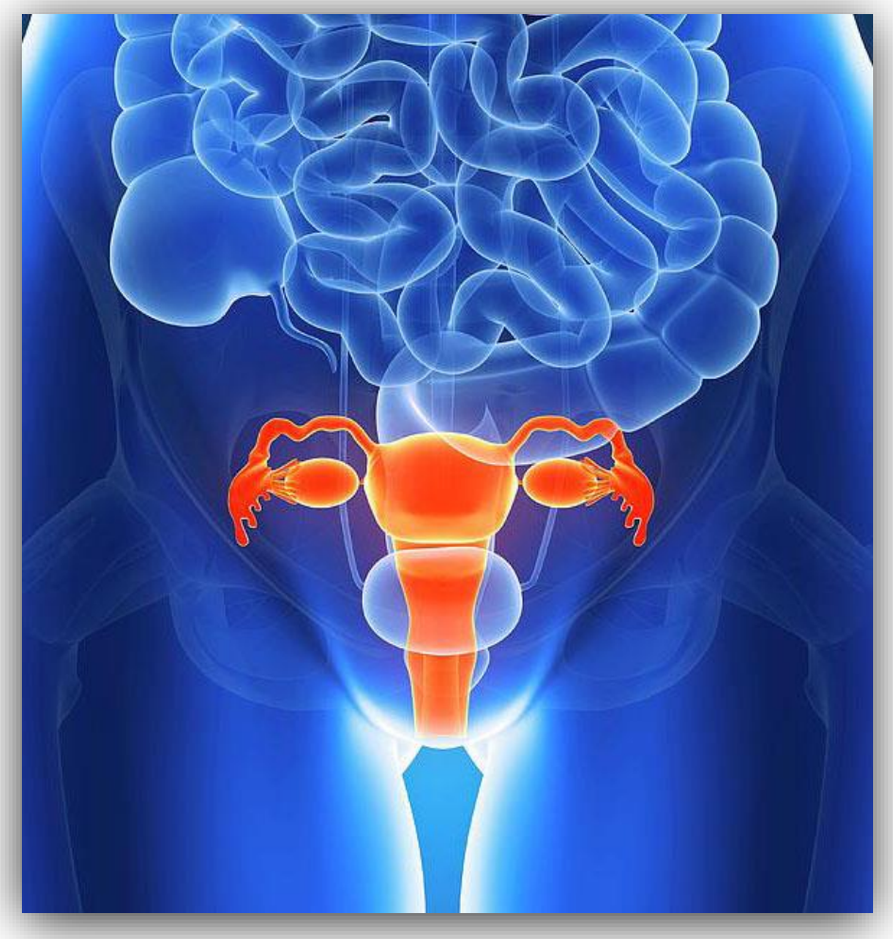


Heterogeneous myometrium

Endometrial Pathology

Endometrial Pathology

- Endometrial hyperplasia
- Dysfunctional uterine bleeding
- Endometritis
- Endometrial carcinoma
- Endometrial polyps



Endometrial Hyperplasia

- A benign condition characterized by excessive proliferation of endometrial glandular tissue; it is a suspected precursor to endometrial carcinoma.
- Some types considered “premalignant”
- Associated with hyperestrogenic states:
  - Tamoxifen administration
  - Estrogen-producing tumors
  - Polycystic ovarian syndrome

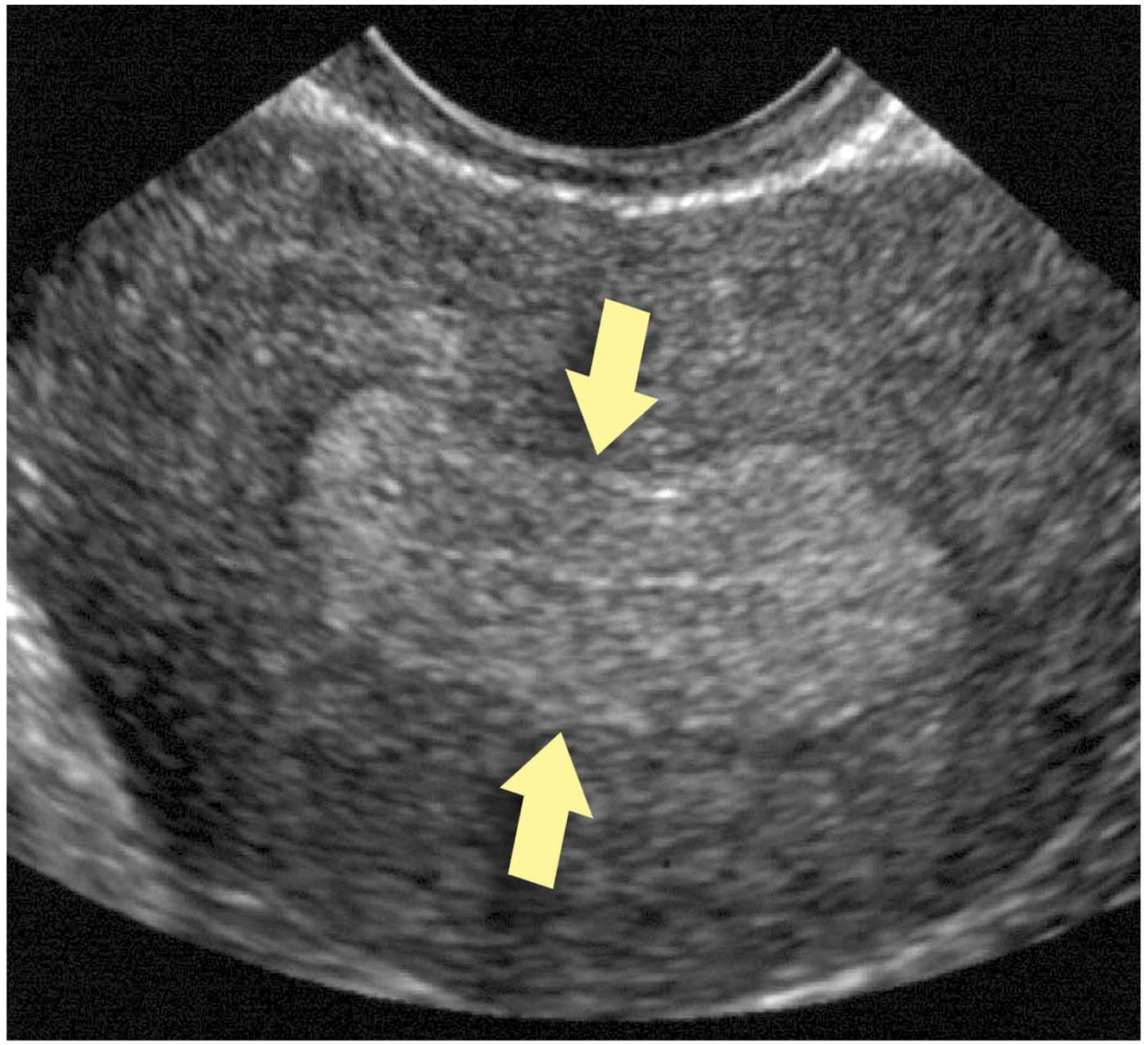
Endometrial Hyperplasia

- Clinical presentation:
  - Vaginal bleeding: intermenstrual, hypermenorrhea, postmenopausal
  - Hyperestrogenism – conditions with possible alteration in estrogen metabolism:
    - Ovarian granulosa cell tumor
    - Polycystic ovarian syndrome
    - Obesity
    - Late menopause

Endometrial Hyperplasia

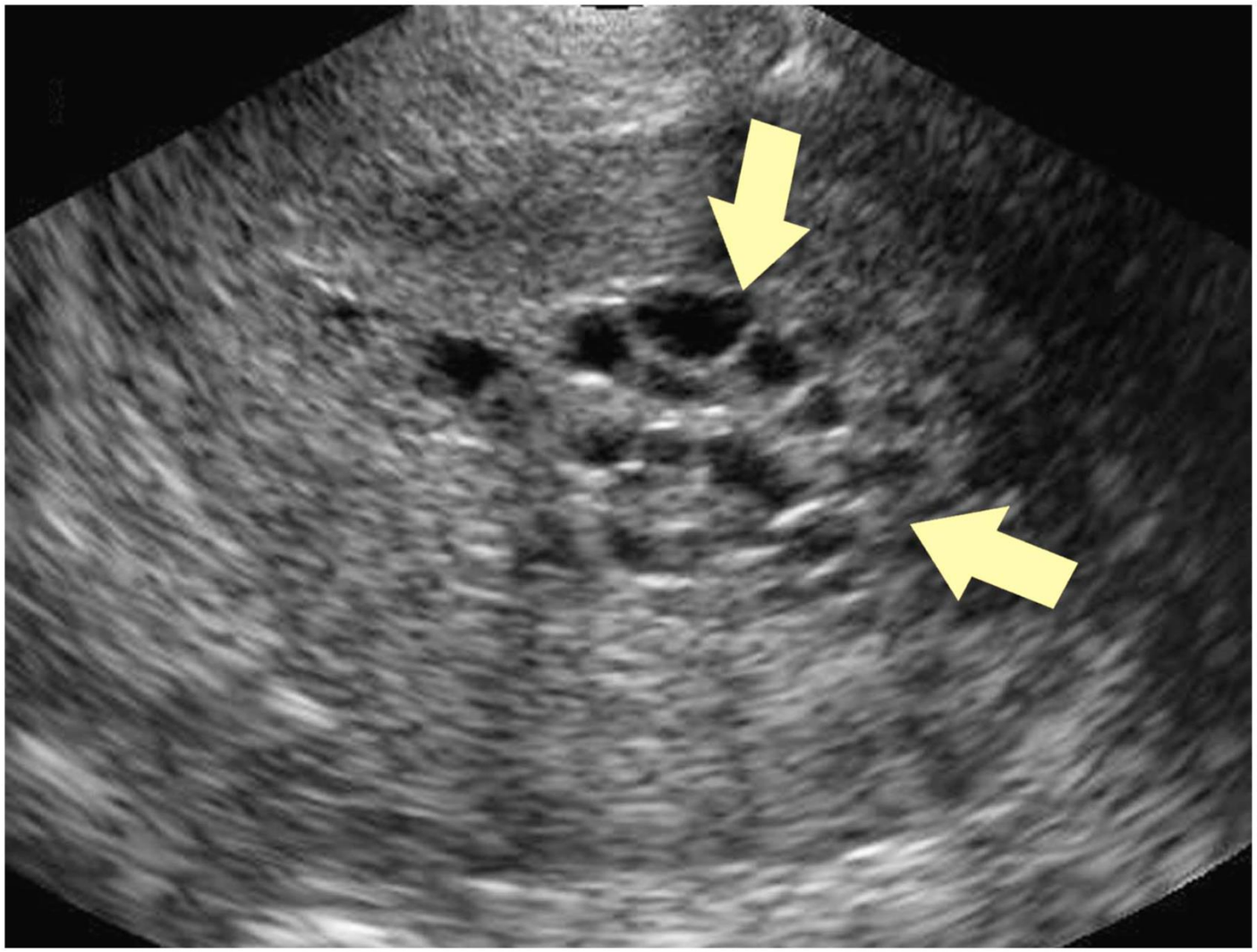
- Sonographic findings:
  - Increased thickness of endometrial stripe > 6mm in postmenopausal women
  - Endometrial stripe > 14mm in premenopausal women
  - Smooth, well-defined borders
  - Homogeneous appearance of the endometrium including cystic changes

ENDOMETRIAL HYPERPLASIA



Increased endometrial thickness

ENDOMETRIAL HYPERPLASIA



Cystic changes

Dysfunctional Uterine Bleeding

- Abnormal vaginal bleeding present without demonstrable structural abnormalities or pathologic causes.
- Usually results from hormonal imbalances:
  - Excess estrogen
  - Deficient progesterone
- Clinical presentation:
  - Vaginal bleeding unexplained by structural or pathological causes

Dysfunctional Uterine Bleeding

- Sonographic findings:
  - No specific sonographic correlates for dysfunctional uterine bleeding
  - Evidence of increased endometrial thickness may be grounds for initiating treatment
- Rules of thumb:
  - Thick, secretory-looking endometrium – inadequate progesterone levels
  - Thin endometrium – may indicate need for combined estrogen and progesterone therapy

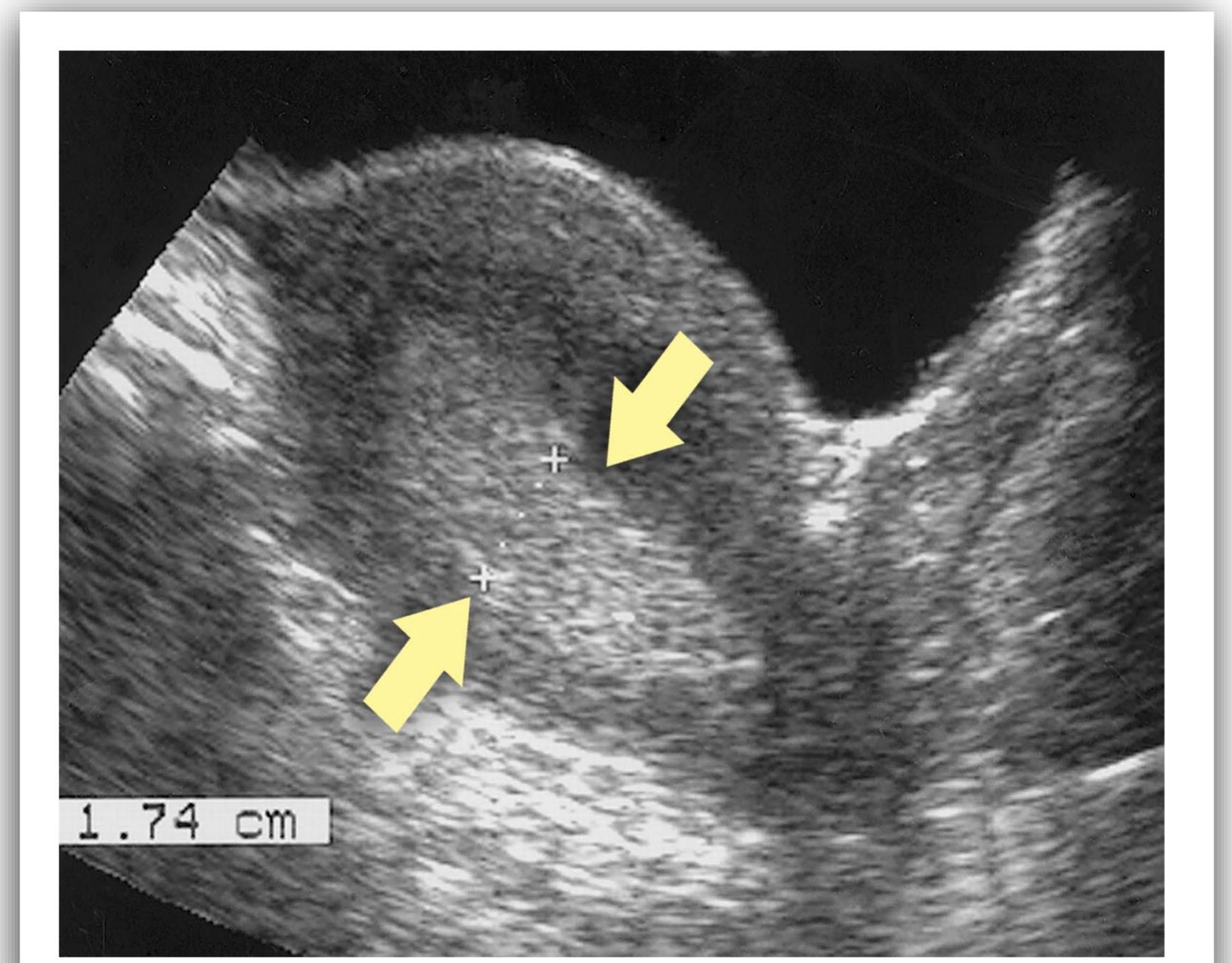
Endometritis

- Any acute or chronic inflammatory reaction of the uterine lining (endometrium). It may spread to the myometrium and, on occasion, the parametrium.
- Etiologies may include:
  - Pregnancy-related
  - Non-pregnancy related
- Clinical presentation:
  - Fever
  - Uterine tenderness
  - Leukocytosis

Endometritis

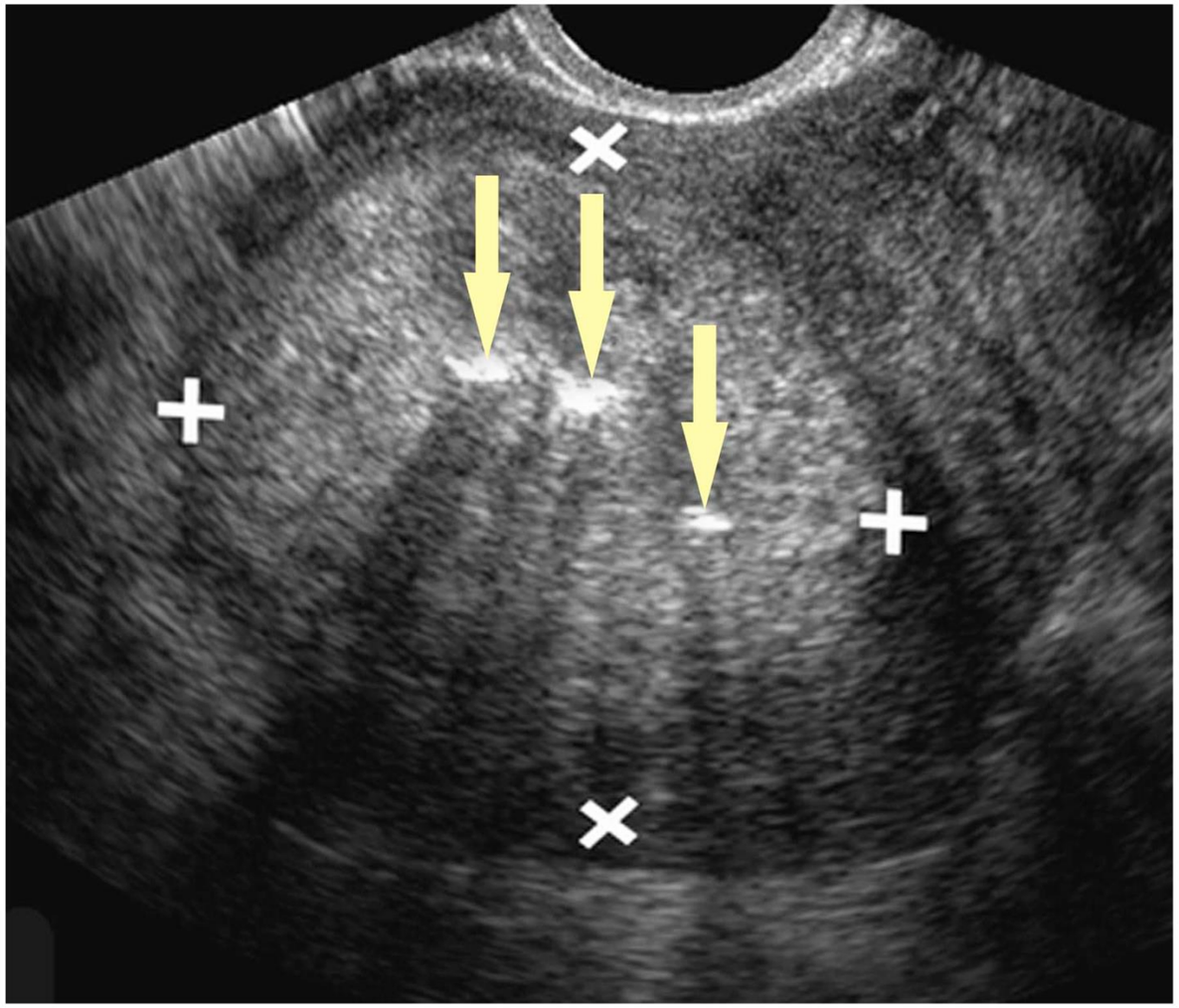
- Sonographic findings
  - May appear normal in early stages
  - Thickened, heterogeneous endometrium
  - Fluid in the endometrial cavity
  - Gas bubbles in endometrial cavity

ENDOMETRITIS



Thickened, heterogeneous endometrium

ENDOMETRITIS



Gas bubbles in endometrial cavity

Endometrial Carcinoma

- Most common gynecologic malignancy
- Usually occurs in women 60 - 70 years
- 75 - 80% occur in postmenopausal women
- ~ 12% in premenopausal women
- Adenonocarcinoma most common histologic type (90%)
- Other histological types:
  - Papillary serous carcinoma
  - Clear cell carcinoma
  - Adenosquamous cell

Endometrial Carcinoma

- Associated risk factors include:
  - Hormone replacement therapy (HRT)
  - Tamoxifen therapy
  - Obesity
  - Early menarche
  - Late menopause
  - Diabetes mellitus
  - Strong familial history of uterine cancer

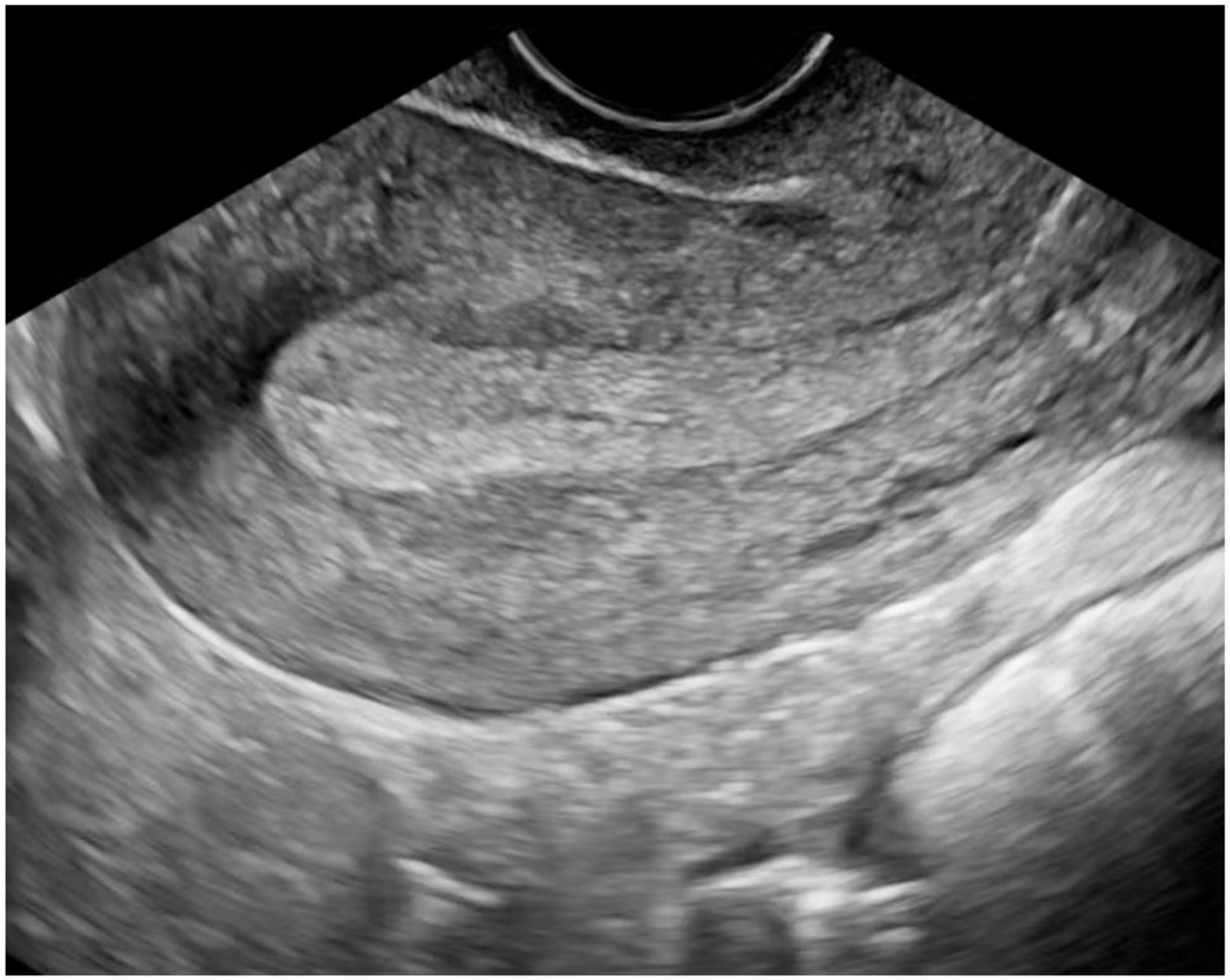
Endometrial Carcinoma

- Malignancy begins in endometrium and grows into uterine cavity
- Myometrial invasion and spread to cervix and adnexa may occur if not treated early
- Clinical presentation:
  - Postmenopausal vaginal bleeding
  - Hypermenorrhea and intermenstrual flow in patients still having periods
  - Pain as the result of uterine distention

Endometrial Carcinoma

- Sonographic findings (early detection):
  - Inhomogeneity and thickening of the endometrial lining (> 5 mm), especially in postmenopausal women (varies with hormonal status)
  - Poorly defined endometrium with irregular contours

ENDOMETRIAL CARCINOMA – EARLY DIAGNOSIS



Thickening of endometrium in postmenopausal woman

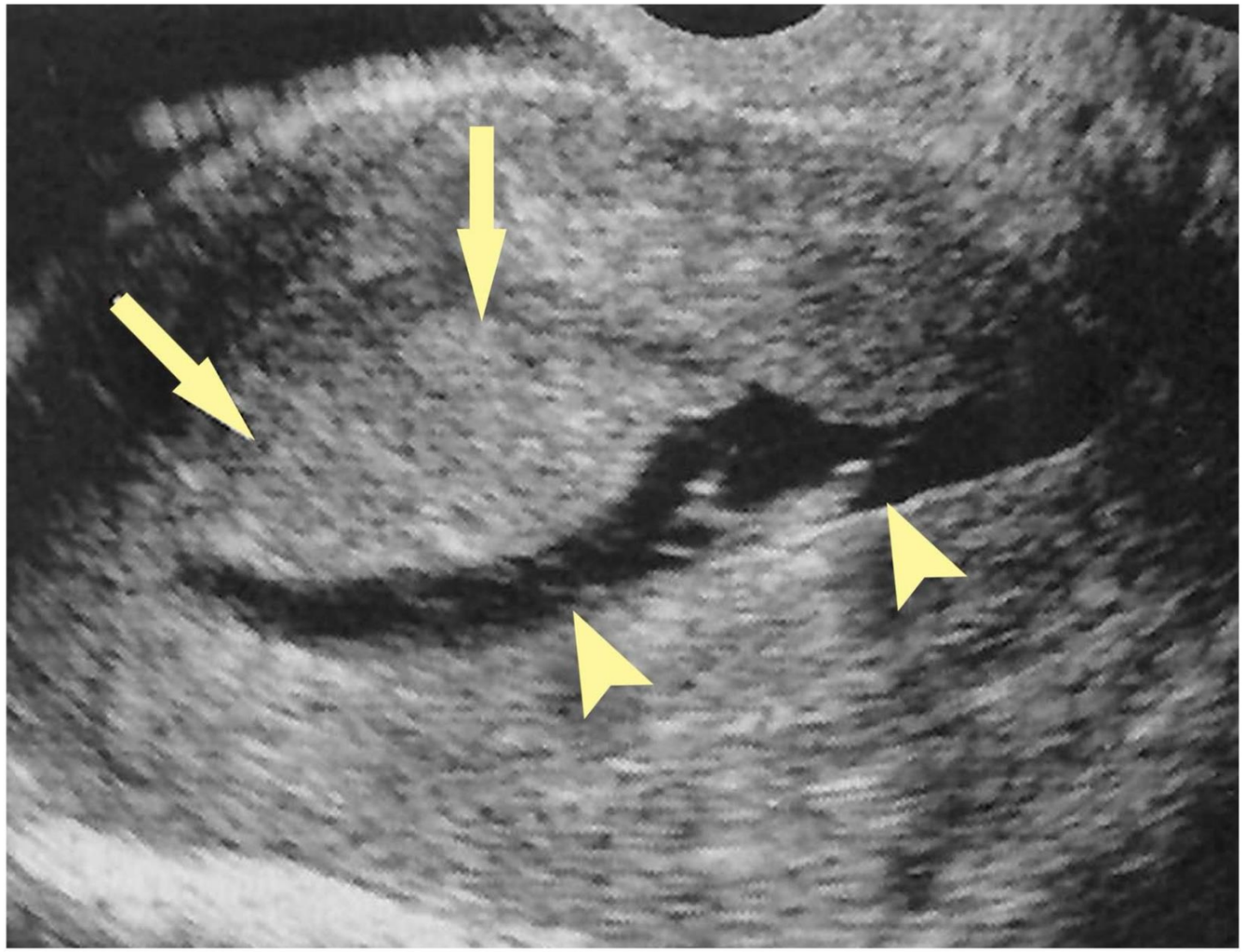
ENDOMETRIAL CARCINOMA – EARLY DIAGNOSIS

Inhomogeneity and thickening of endometrium

Endometrial Carcinoma

- Sonographic findings (late detection):
  - Alteration in size, shape, and sonographic texture of the uterine parenchyma
  - Polypoid mass extending into uterine cavity
  - Increased uterine size
  - Fluid in the endometrial cavity

ENDOMETRIAL CARCINOMA – LATE DIAGNOSIS

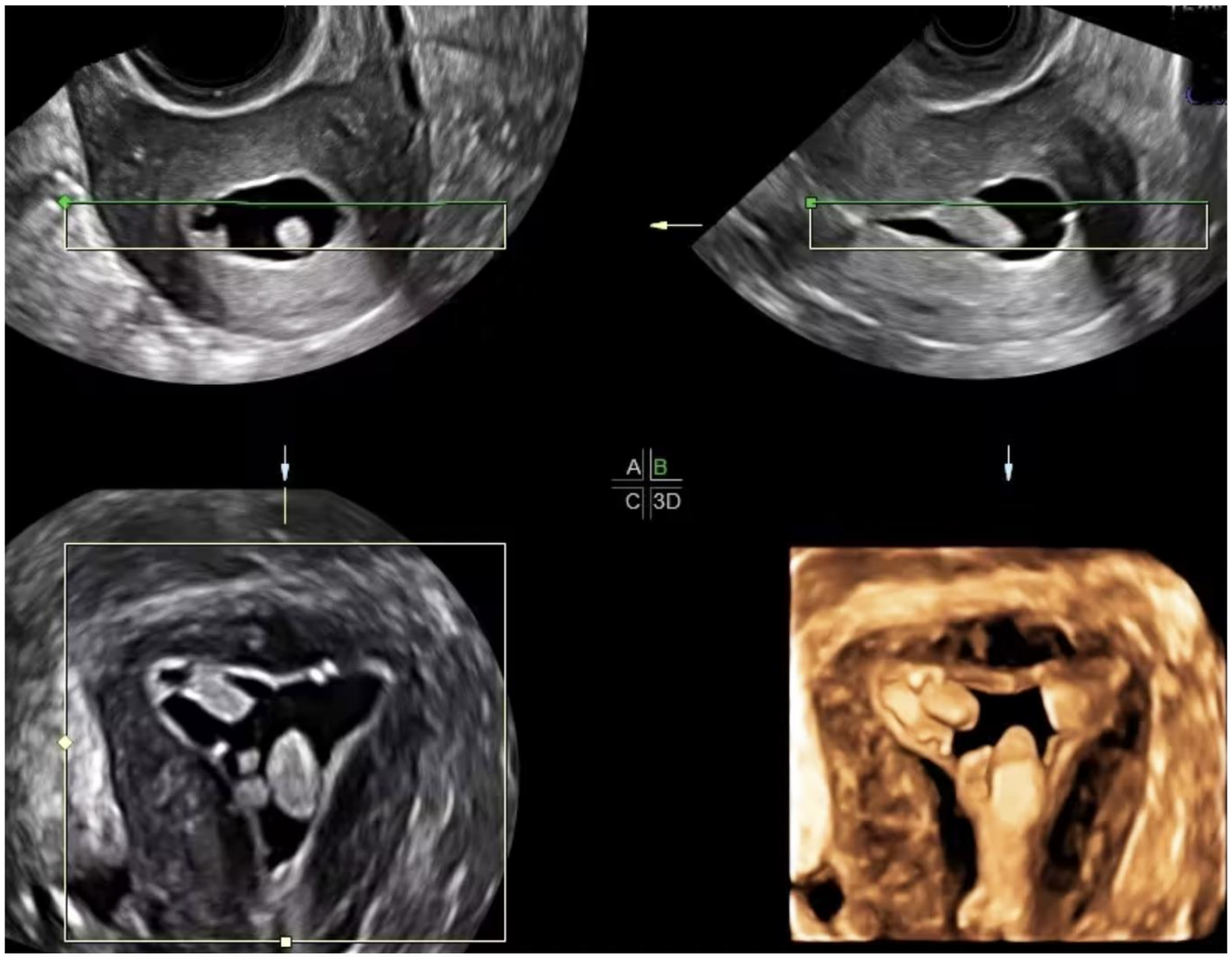


Mass extending into endometrial cavity

ENDOMETRIAL CARCINOMA – LATE DIAGNOSIS

Fluid in endometrial cavity

ENDOMETRIAL CARCINOMA – LATE DIAGNOSIS

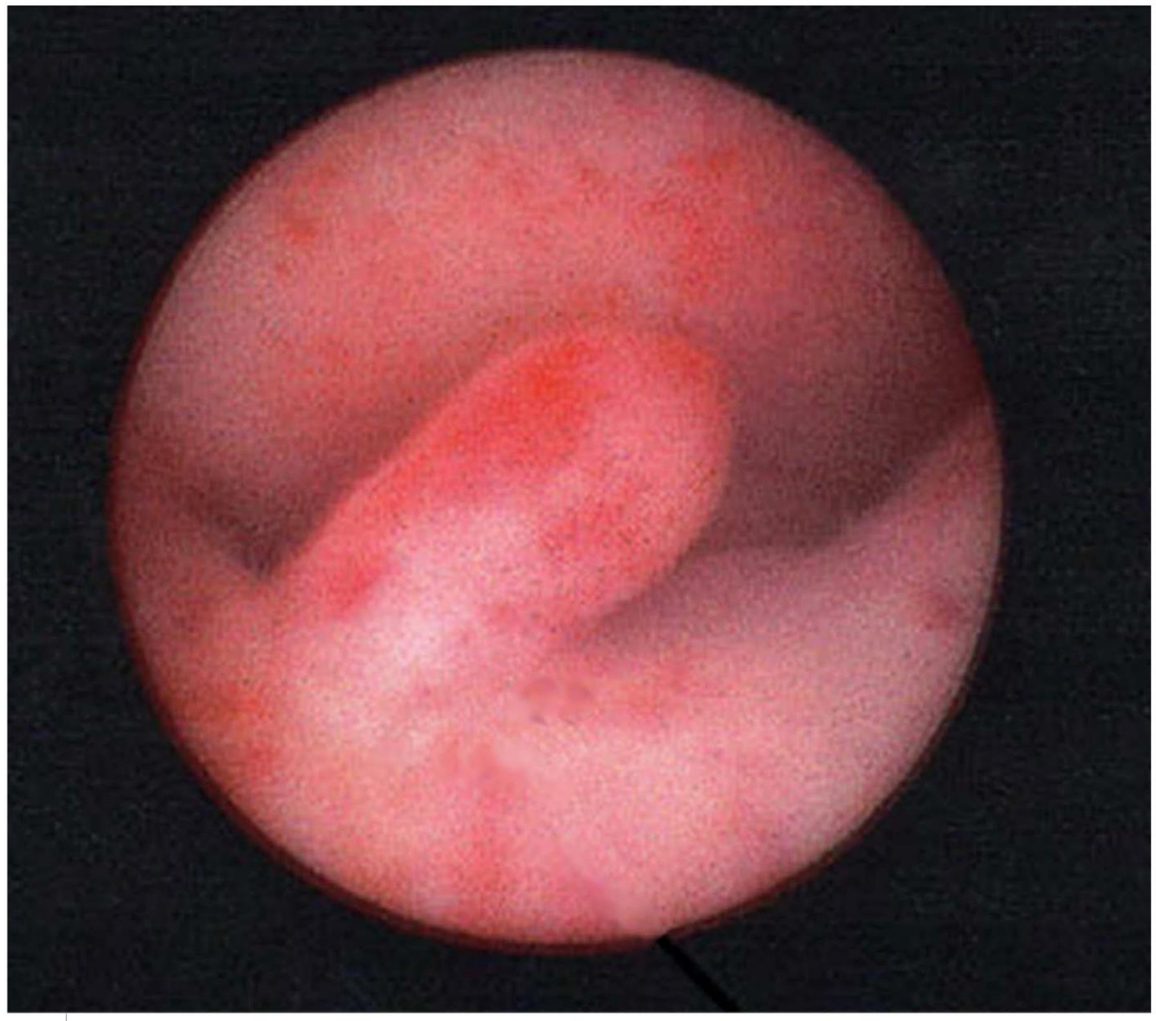


Volumetric tomography

Endometrial Polyps

- Benign sessile or pedunculated projections of endometrial tissue into the uterine cavity
  - Sessile grow from a wide base
  - Pedunculated arise from a vascularized stalk
- May be single or multiple
- Range in size from small 1 mm projections to masses that fill uterine cavity
- Common in women 29 - 59 years
- Greatest incidence after age 50
- May originate in or prolapse into cervix

ENDOMETRIAL POLYPS



Hysteroscopic visualization

Endometrial Polyps

- Clinical signs include:
  - Often asymptomatic
  - Postmenopausal vaginal bleeding
  - Hypermenorrhea and intermenstrual flow in patients still having periods
  - Infertility
  - Usually discovered incidentally during D&C

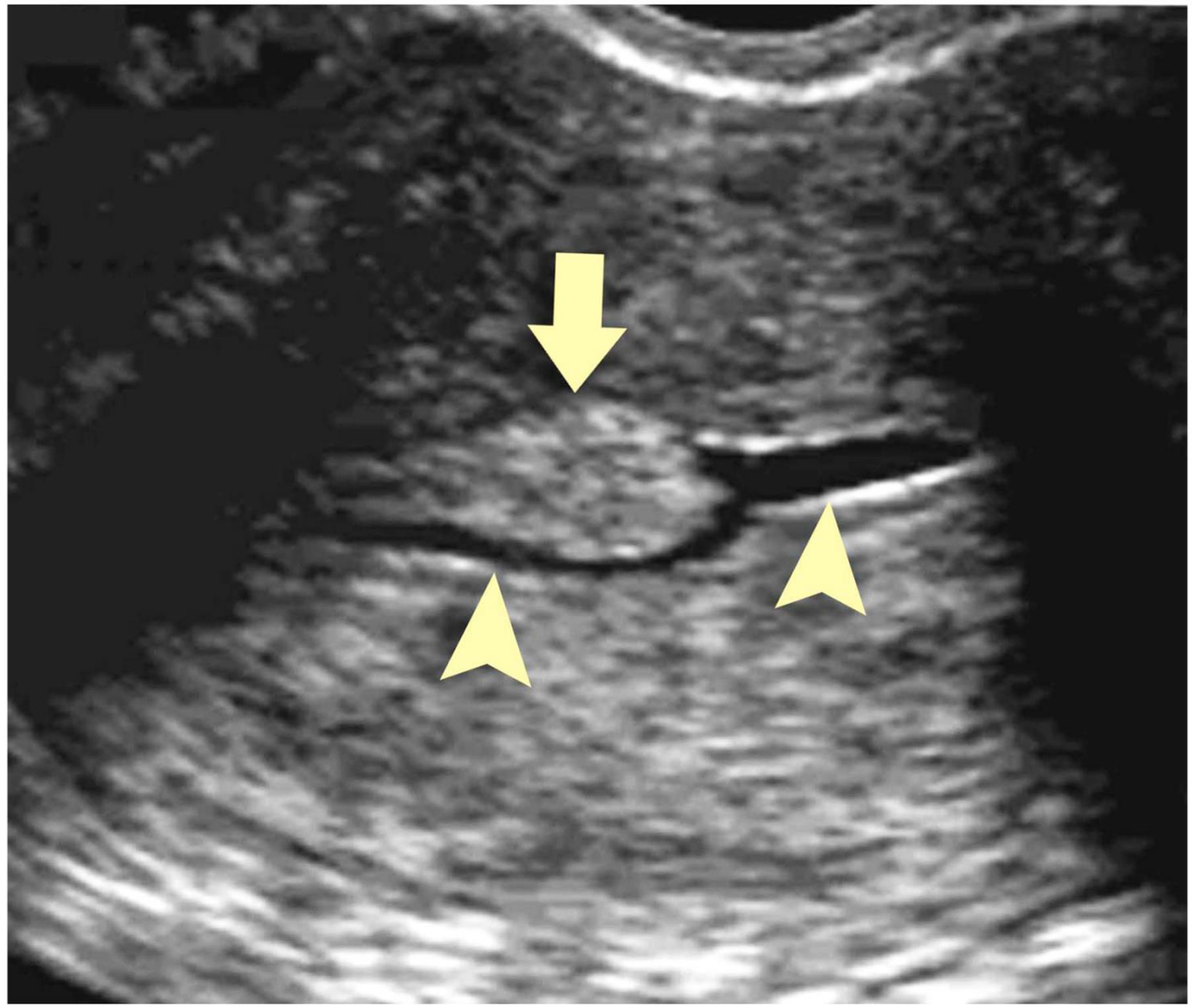
Endometrial Polyps

- Sonographic findings:
  - Non-specific thickened endometrium, either diffuse or localized
  - Discrete mass in the endometrium
    - Smooth intracavitary masses outlined on sonohysterography
    - Vascular pedicle demonstrated with CDI
    - May be indistinguishable from endometrial hyperplasia

ENDOMETRIAL POLYPS

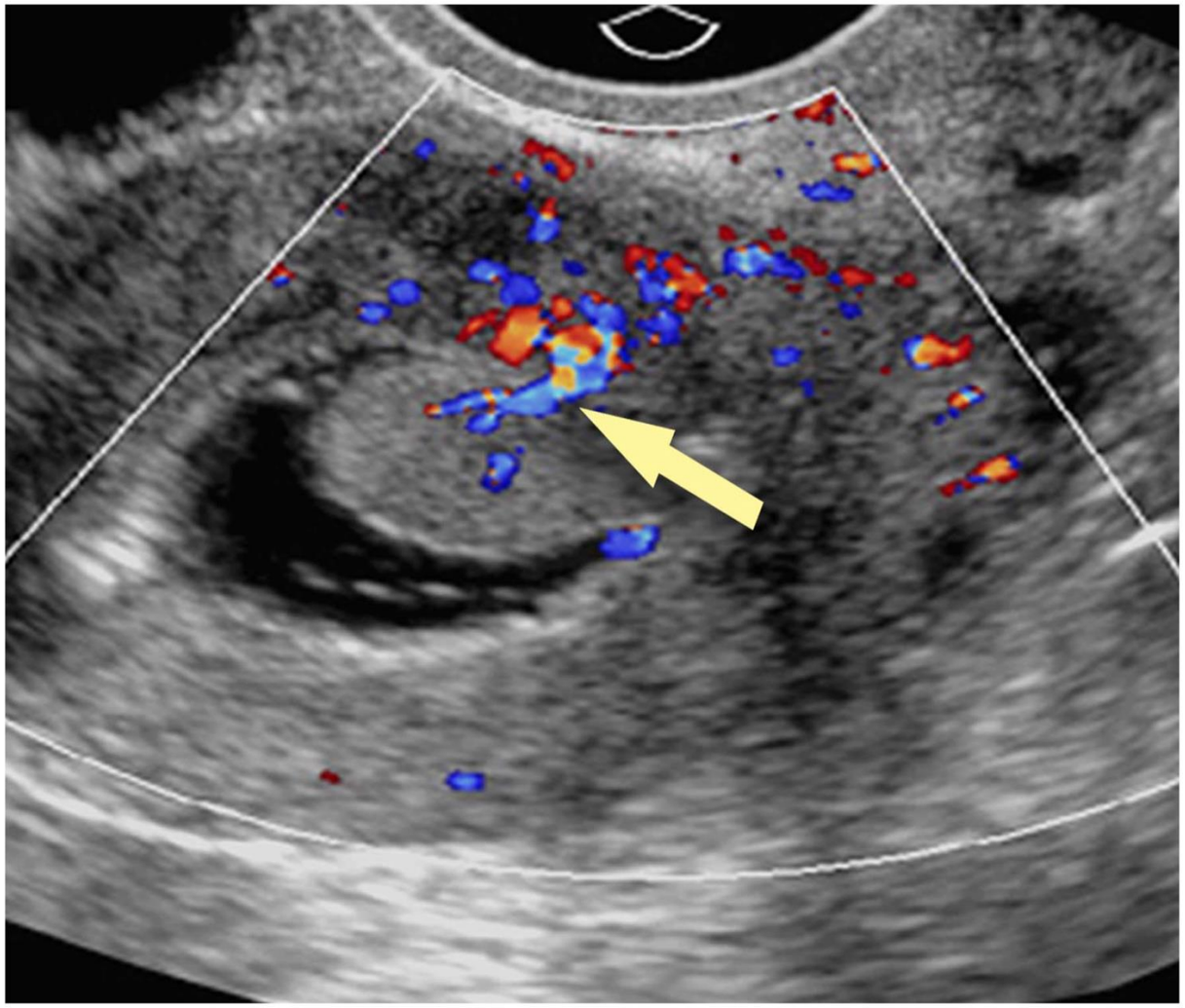
Discrete mass in endometrium

ENDOMETRIAL POLYPS



Smooth mass outline with hysterosonography

ENDOMETRIAL POLYPS



Vascular pedicle

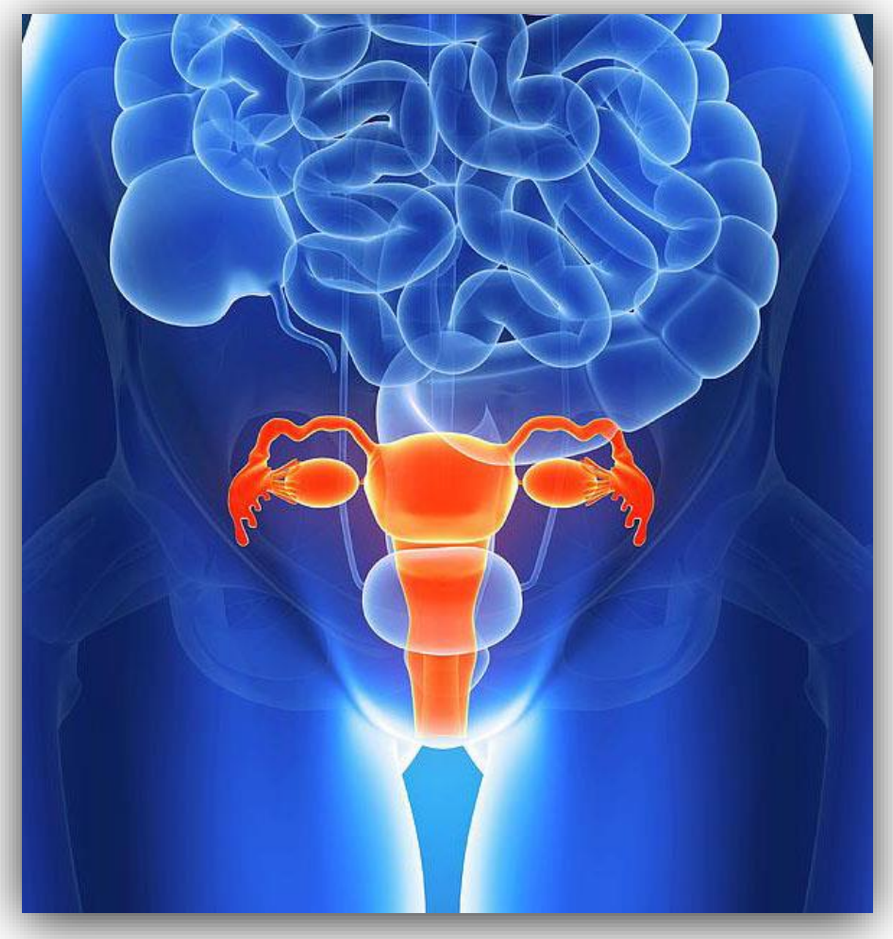
ENDOMETRIAL POLYPS

Volumetric hysterosonographic tomography

Ovarian Pathology

Ovarian Pathology

- Physiological cysts
- Ovarian torsion
- Neoplastic ovarian masses
  - Benign
  - Malignant



Ovarian Cysts

- Most cysts are small and clinically unimportant, however, may represent early benign or malignant neoplasm
- Simple cyst in premenopausaal women are common. Clinical follow-up may be indicated
- Simple cysts < 3 cm considered normal and usually regress spontaneously
  - Persistence > 60 days = non-functional cyst
- Cyst > 3 cm reevaluated with US 6-8 weeks
  - Persistent enlargement or change in appearance indicates further work-up

Physiological Cysts

- Functional cysts resulting from hormonal stimulation of the ovaries and range from 0.5 - 2.5 cm.
- Types include:
  - *Follicular*: dominant follicle which fails to rupture. Most are unilateral and may measure up to 10 cm
  - *Corpus luteum*: dominant follicle which fails to regress measures > 3 cm
  - *Corpus luteum of pregnancy*: cystic enlargement of ruptured follicle associated with pregnancy. Usually regresses by end of 1st trimester

Physiological Cysts

- Types include:
  - *Theca lutein*: cystic enlargement of atretic follicles in response to excessive levels of hCG
  - *Hemorrhagic cysts*
    - May occur spontaneously or when an ovarian cyst torses causing hemorrhage into the lumen
    - Clinically manifest by sudden onset of pelvic pain

Follicular Cysts

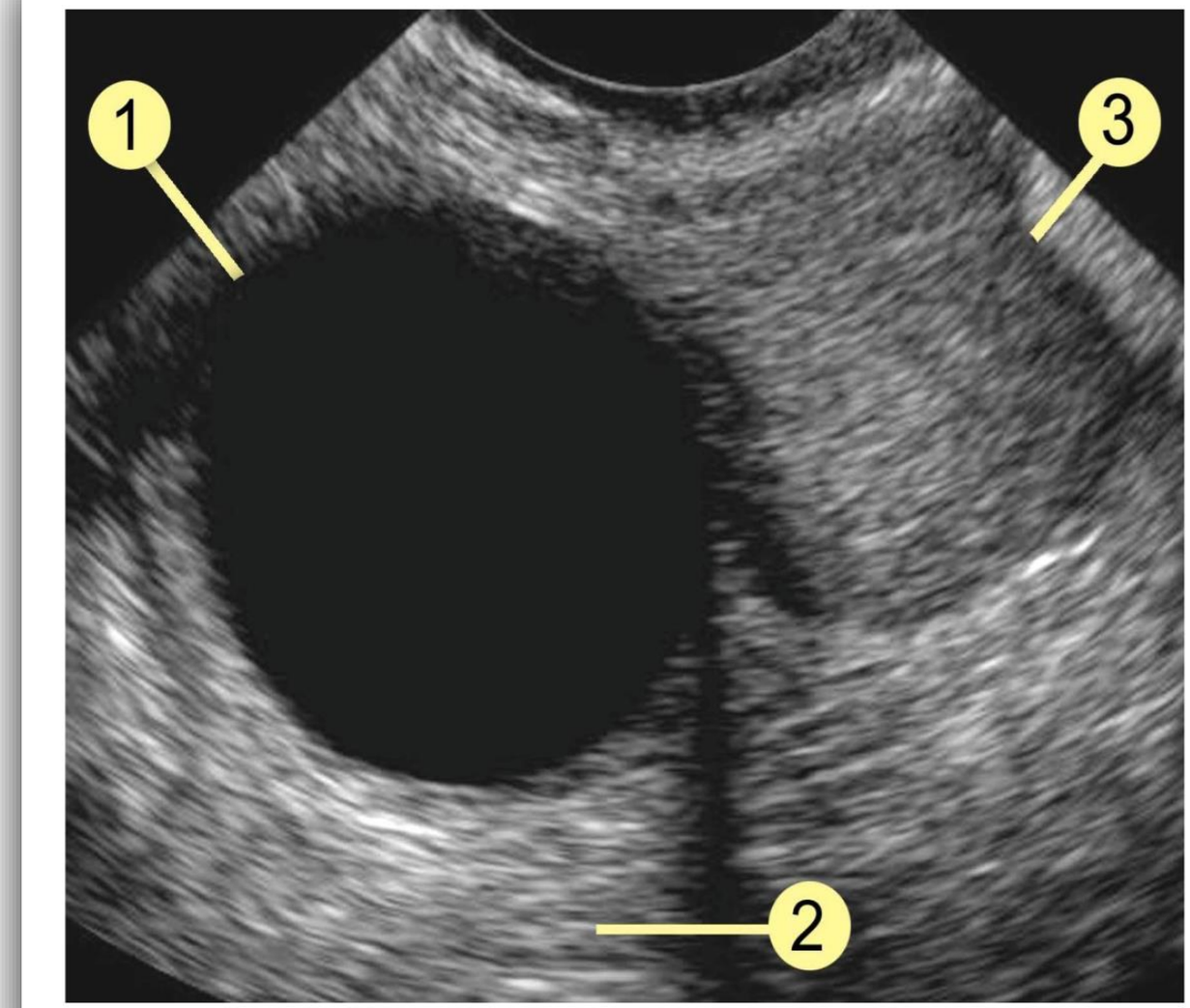
- Dominant follicle which fails to rupture. Most are unilateral and may measure up to 10 cm.
- Clinical presentation:
  - Typically asymptomatic
  - Pelvic pain, dyspareunia and, occasionally vaginal bleeding (may be caused by large cysts)
  - Differential diagnoses include salpingitis and endometriosis

Follicular Cysts

- Sonographic findings:
  - Smoothly marginated mass in the ovarian fossa
  - Unilocular
  - Absent internal echoes (anechoic)
  - Absent nodules or solid components
  - Posterior acoustic enhancement

FOLLICULAR CYSTS

1 = anechoic cystic mass
2 = posterior acoustic enhancement
3 = uterus



Mass in ovarian fossa

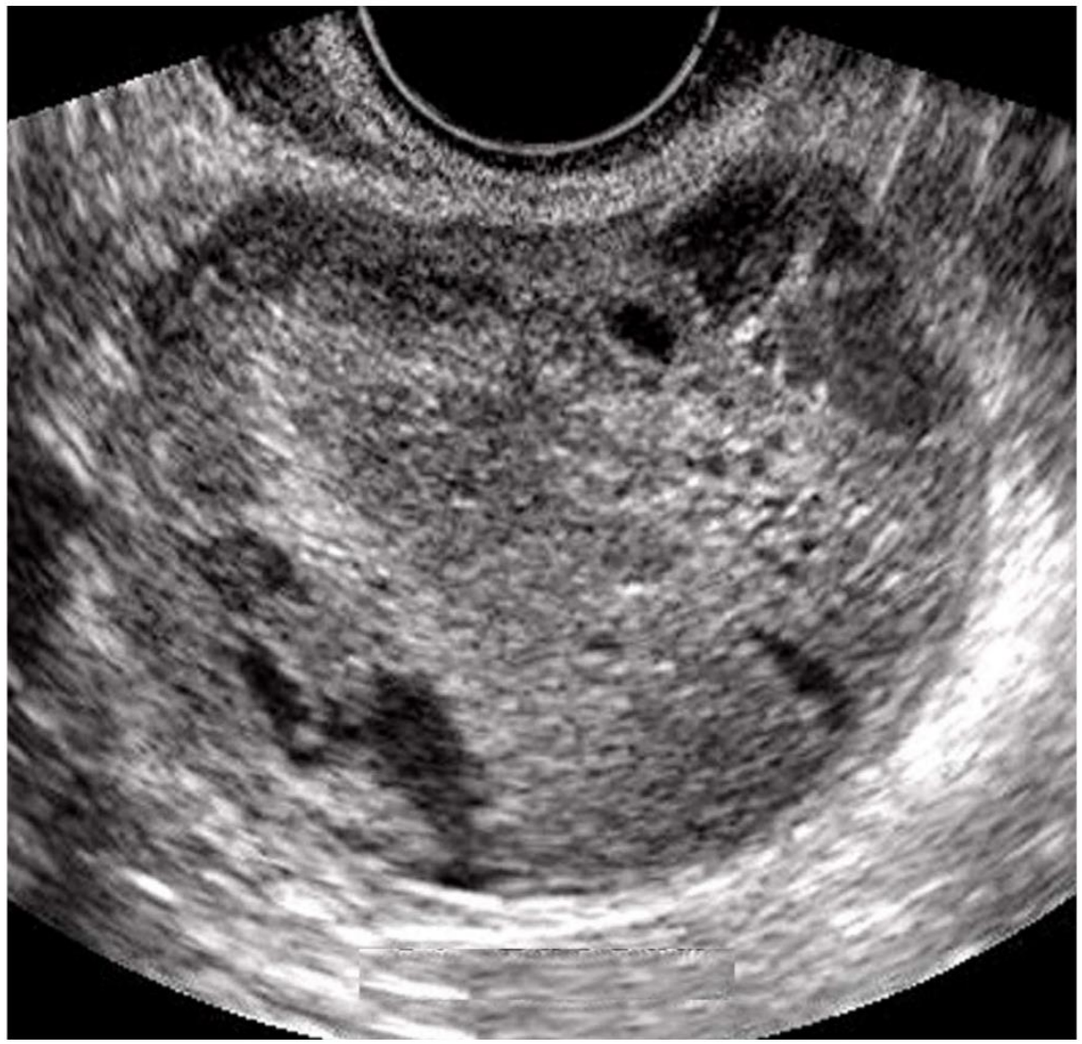
Corpus Luteum Cysts

- Dominant follicle which fails to regress. Measure > 3 cm
- Clinical presentation:
  - Frequently asymptomatic
  - Local pain and tenderness
  - Amenorrhea
  - Delayed menstruation

Corpus Luteum Cysts

- Sonographic findings:
  - Cystic mass in ovarian fossa
  - Either simple or complex cystic appearance
  - Hemorrhage into a corpus luteum cyst
  - Not considered to be corpus luteum cysts until they reach at least 3 cm in diameter

CORPUS LUTEUM CYSTS

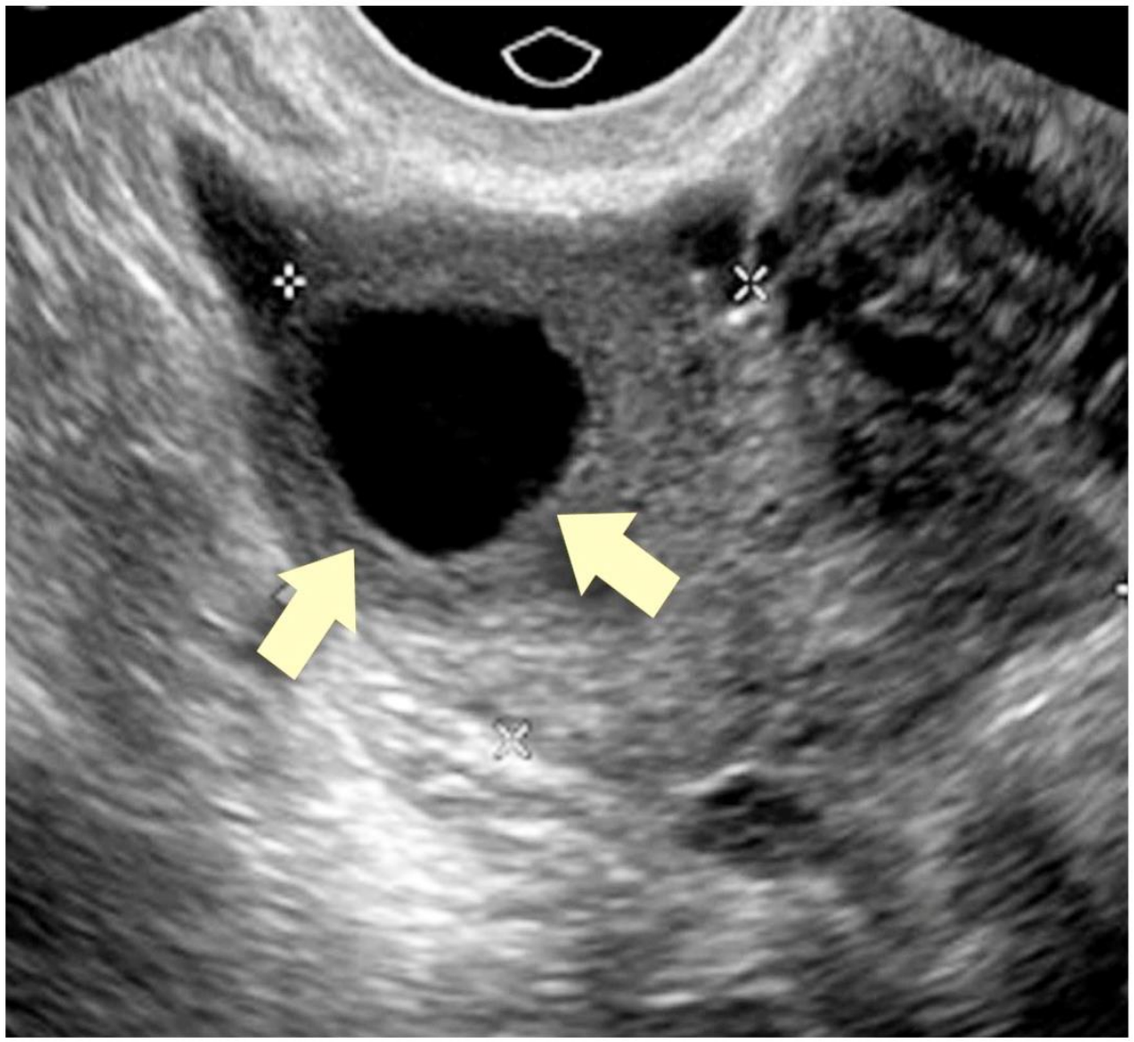


Hemorrhagic corpus luteum cyst

Corpus Luteum of Pregnancy

- Cystic enlargement of ruptured follicle associated with pregnancy. Usually regresses by end of 1st trimester.
- Clinical presentation:
  - Localized pain and tenderness in the ovary
- Sonographic findings (hemorrhagic):
  - Large adnexal mass exhibiting posterior acoustic enhancement
  - Complex internal architecture
  - Thickened, irregular borders

CORPUS LUTEUM OF PREGNANCY



Theca Lutein Cysts

- Cystic enlargement of atretic follicles in response to excessive levels of hCG.
- Associated with:
  - Gestational trophoblastic disease
  - Polycystic ovarian disease (PCO)
  - Hyperstimulated ovarian syndrome (ART)

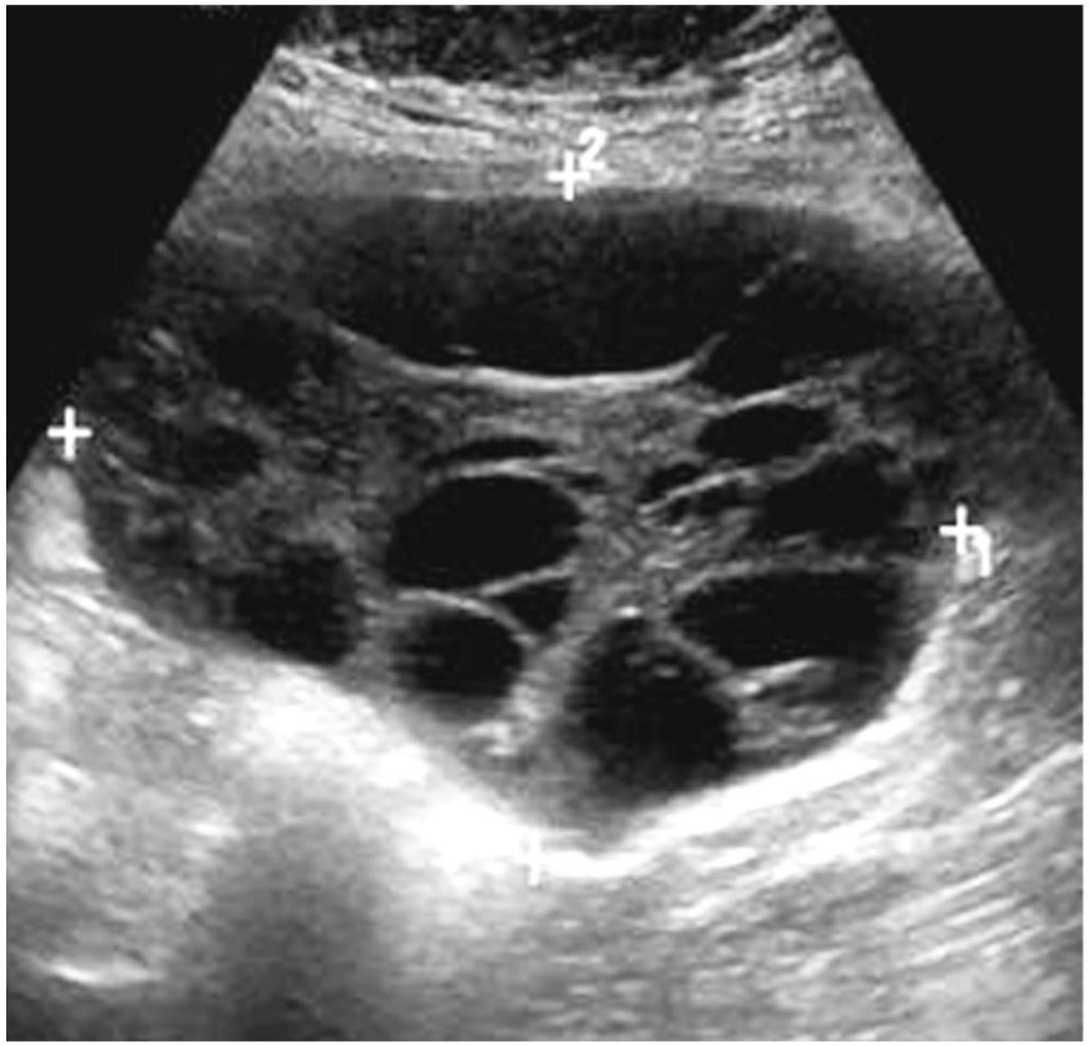
Theca Lutein Cysts

- Clinical presentation:
  - Pelvic fullness
  - Dull aching sensation in pelvis
  - Elevated serum beta-hCG
  - Hyperemesis gravidarum
  - Breast parasthesias

Theca Lutein Cysts

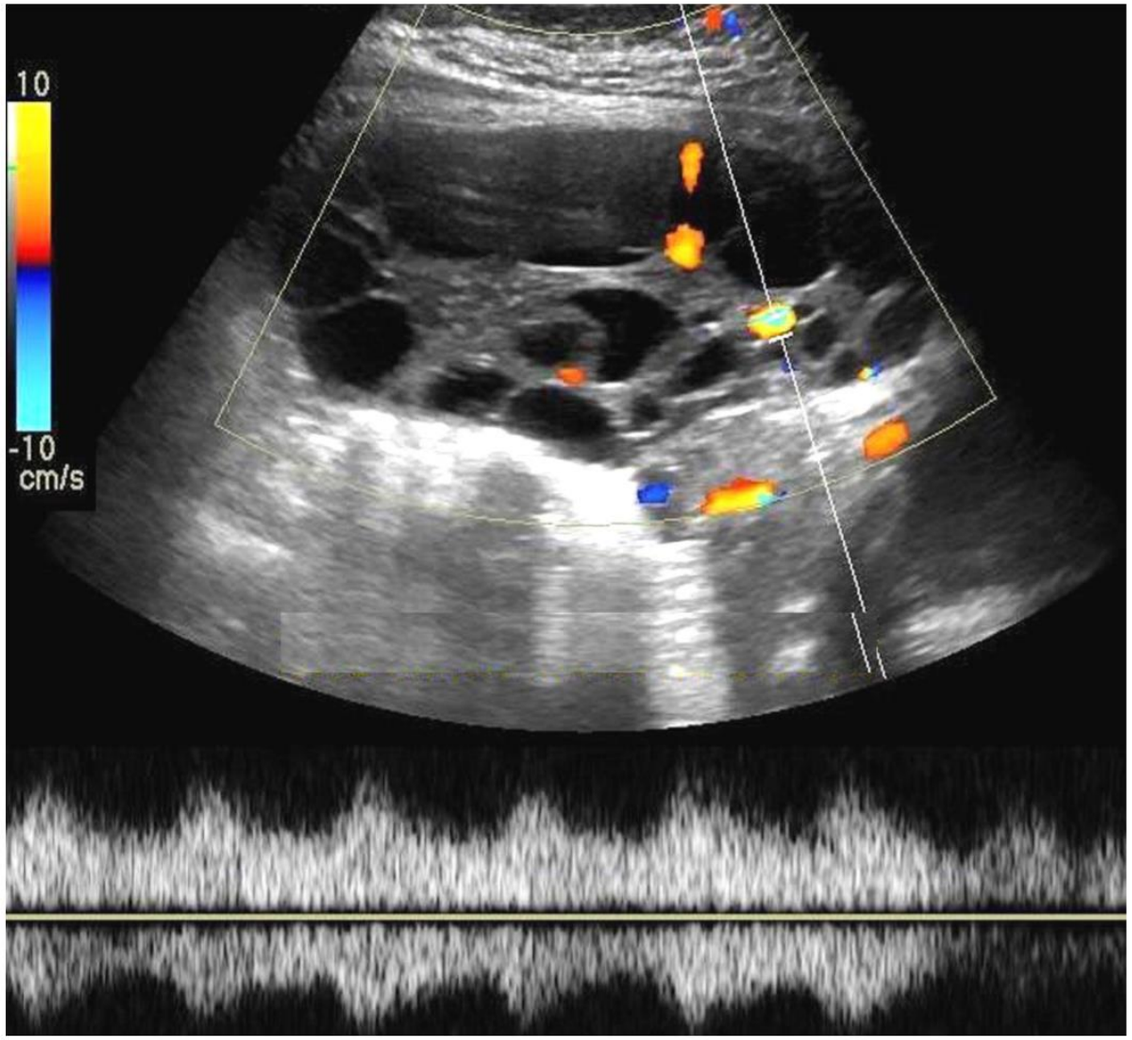
- Sonographic findings:
  - Multiple , bilateral large cysts (2 – 3 cm)
  - Multilocular, septated internal architecture
  - Typical “spoke-wheel” distribution
  - Generous vascular stromata

THECA LUTEIN CYSTS



Spoke-wheel distribution

THECA LUTEIN CYSTS



Generous vascular stromata

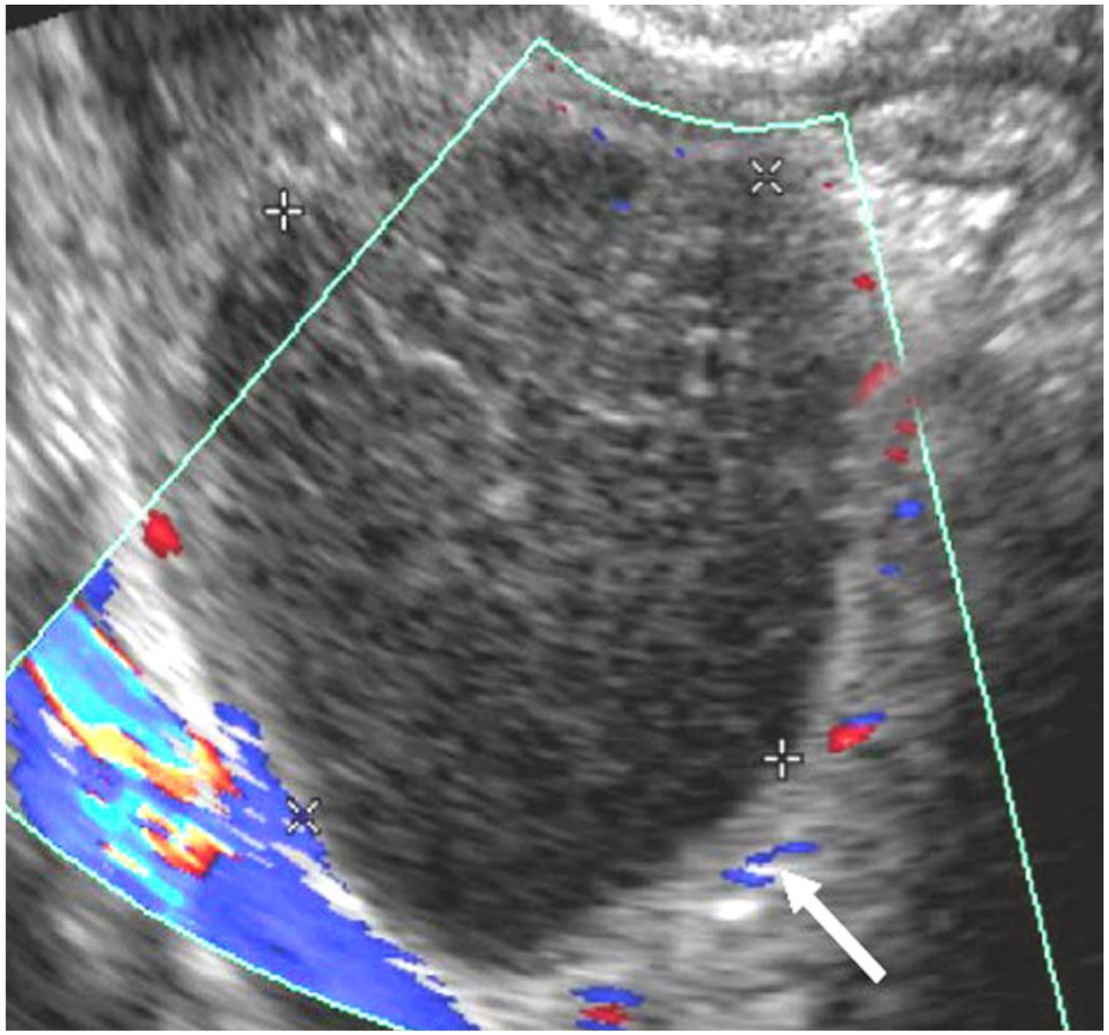
Hemorrhagic Cysts

- Bleeding into lumen of a cyst may occur spontaneously or may be result of torsion.
- Can occur in any type of ovarian cyst
- Confuses sonographic diagnosis
- Clinical presentation:
  - Sudden onset of pelvic pain
  - Palpable adnexal mass

Hemorrhagic Cysts

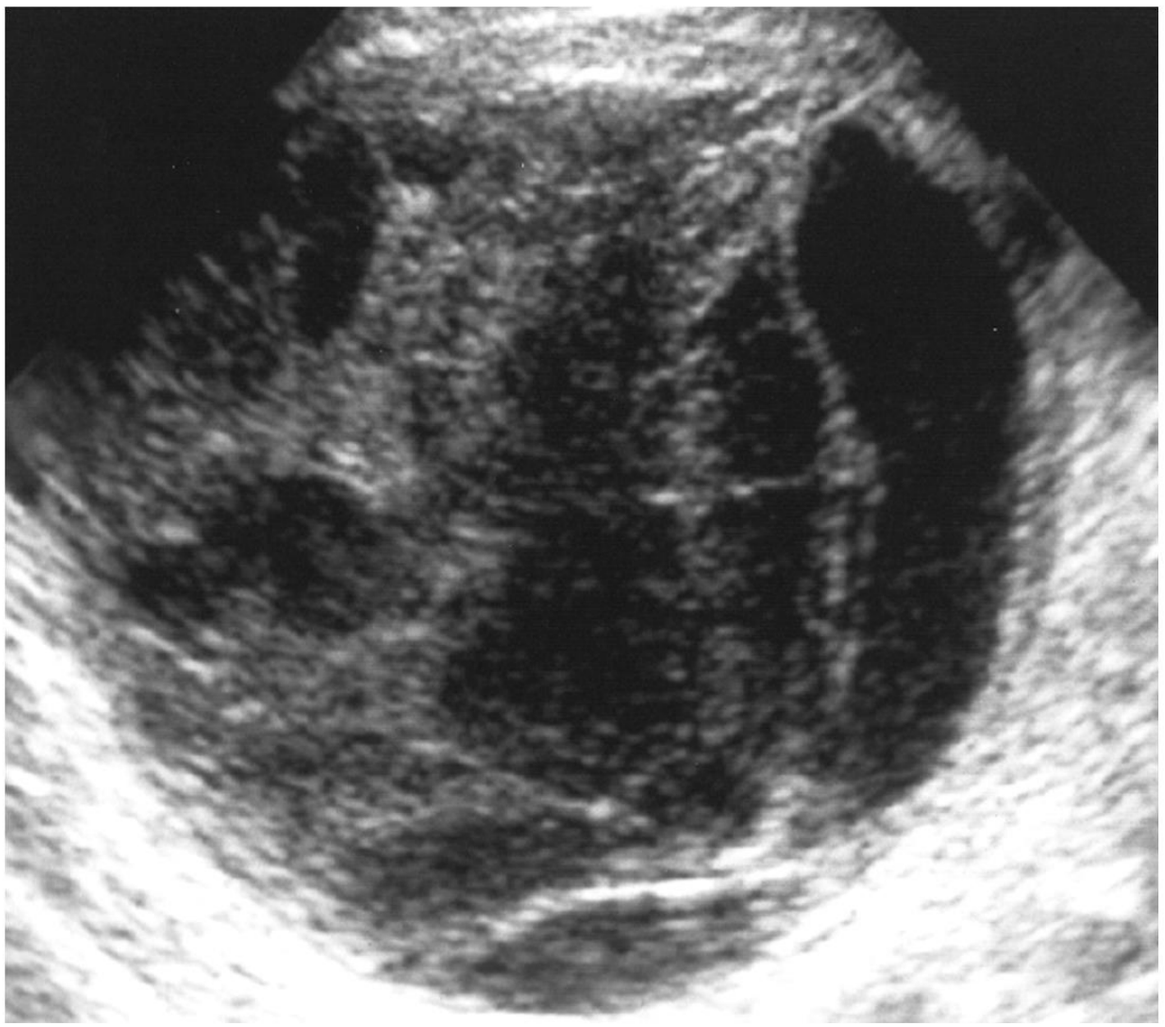
- Sonographic findings (acute cysts):
  - Typical characteristics of a cystic mass: thin-walled, smoothly marginated, posterior acoustic enhancement
  - Diffuse low-level echoes within the lumen that may swirl
- Sonographic findings (chronic cysts):
  - Complex, predominantly cystic mass with thick walls
  - Solid internal architecture representing organized thrombus
  - Absent blood flow within the internal solid components

HEMORRHAGIC CYSTS



Echogenic lumen, absent Doppler signals

HEMORRHAGIC CYSTS



Solid internal architecture

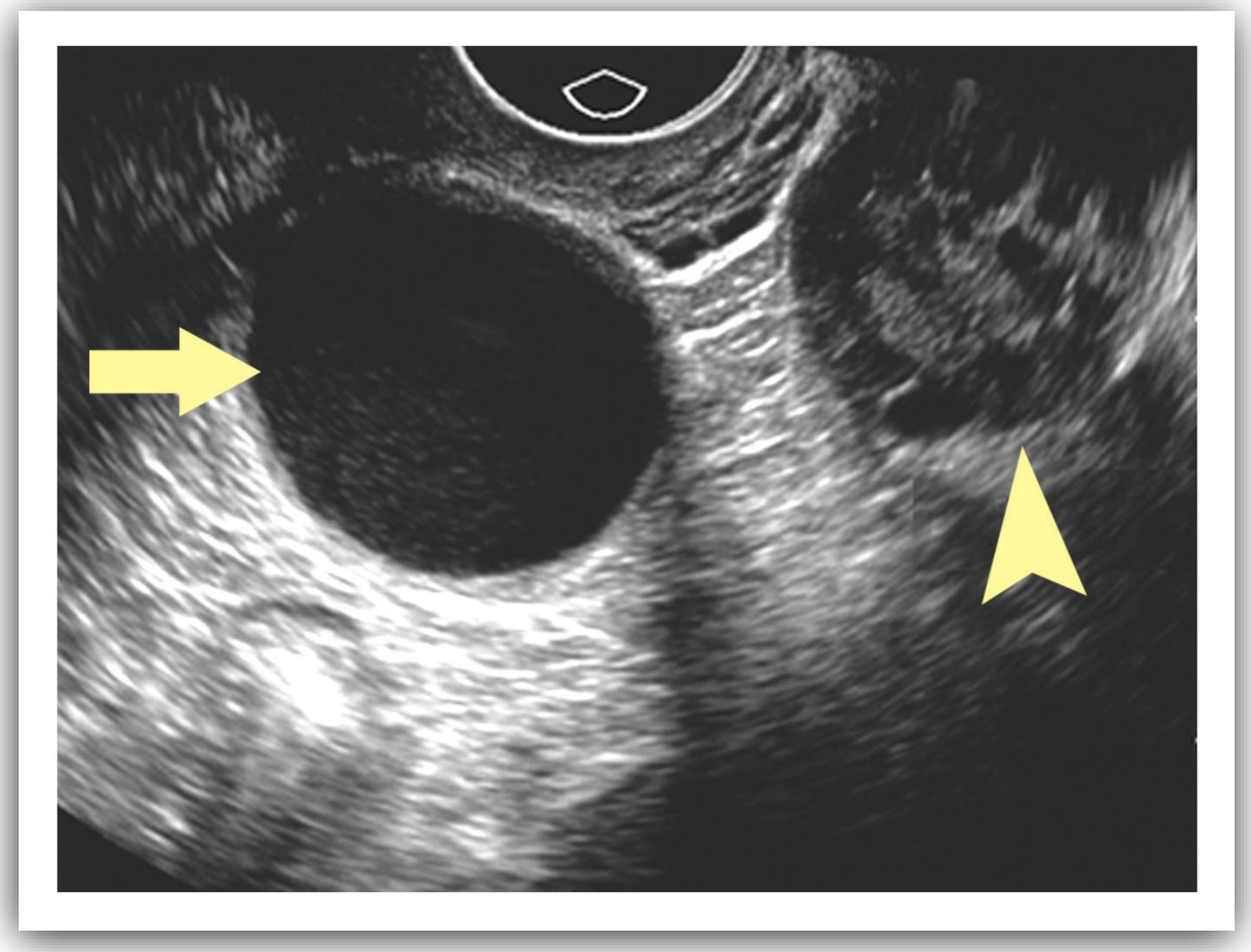
Paraovarian Cysts

- Occur in the broad ligament, not in the ovary
- Account for 10-20% of all adnexal masses
- Most common in 3rd- 4th decade of life
- Clinical presentation:
  - Generally asymptomatic
  - Pelvic pain if cyst is large

Paraovarian Cysts

- Sonographic findings include:
  - Single, unilocular cystic mass in adnexa
  - Located outside ovarian fossa – superior and lateral to uterine fundus
  - Papillary projections present ≈ 30% of cases

PARAOVARIAN CYSTS



Arrow = paraovarian cyst
Arrowhead = adjacent ovary

Polycystic Ovaries

- Term used to describe sonographic appearance of an ovary
- May be caused by hormonal imbalances or unknown etiologies
- May be seen in ~ 20% of women of reproductive age
- May be associate with PCOS but additional clinical and laboratory findings must also be present

Polycystic Ovaries

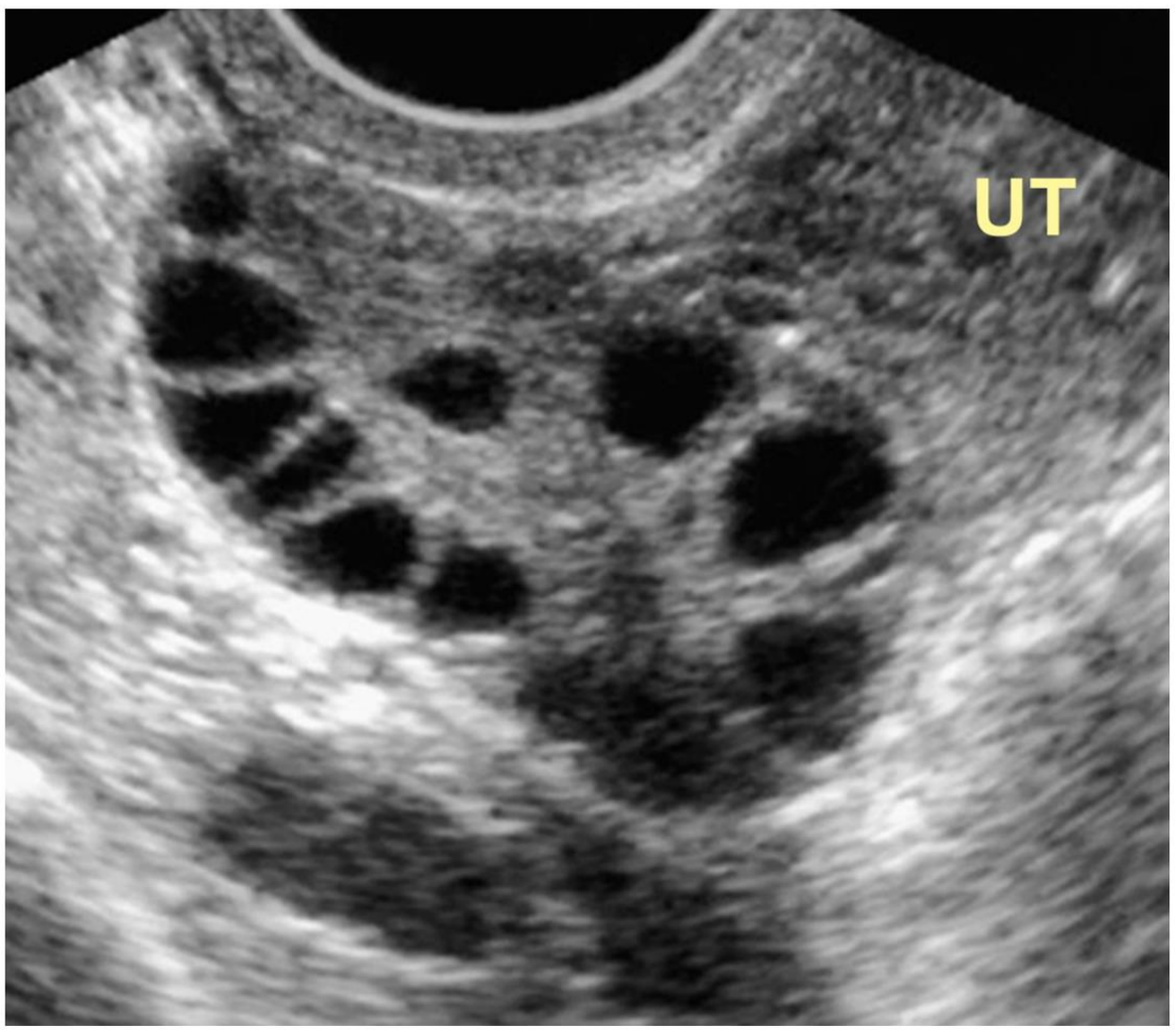
- Clinical signs and symptoms include:
  - Amenorrhea
  - Infertility
  - Hirsutism
  - Obesity

Polycystic Ovaries

- Sonographic findings include:
  - Enlarged, bilateral multicystic ovaries
  - Presence of > 10 follicles
  - Ovarian enlargement (volume > 10cc)
  - May be uni- or bilateral

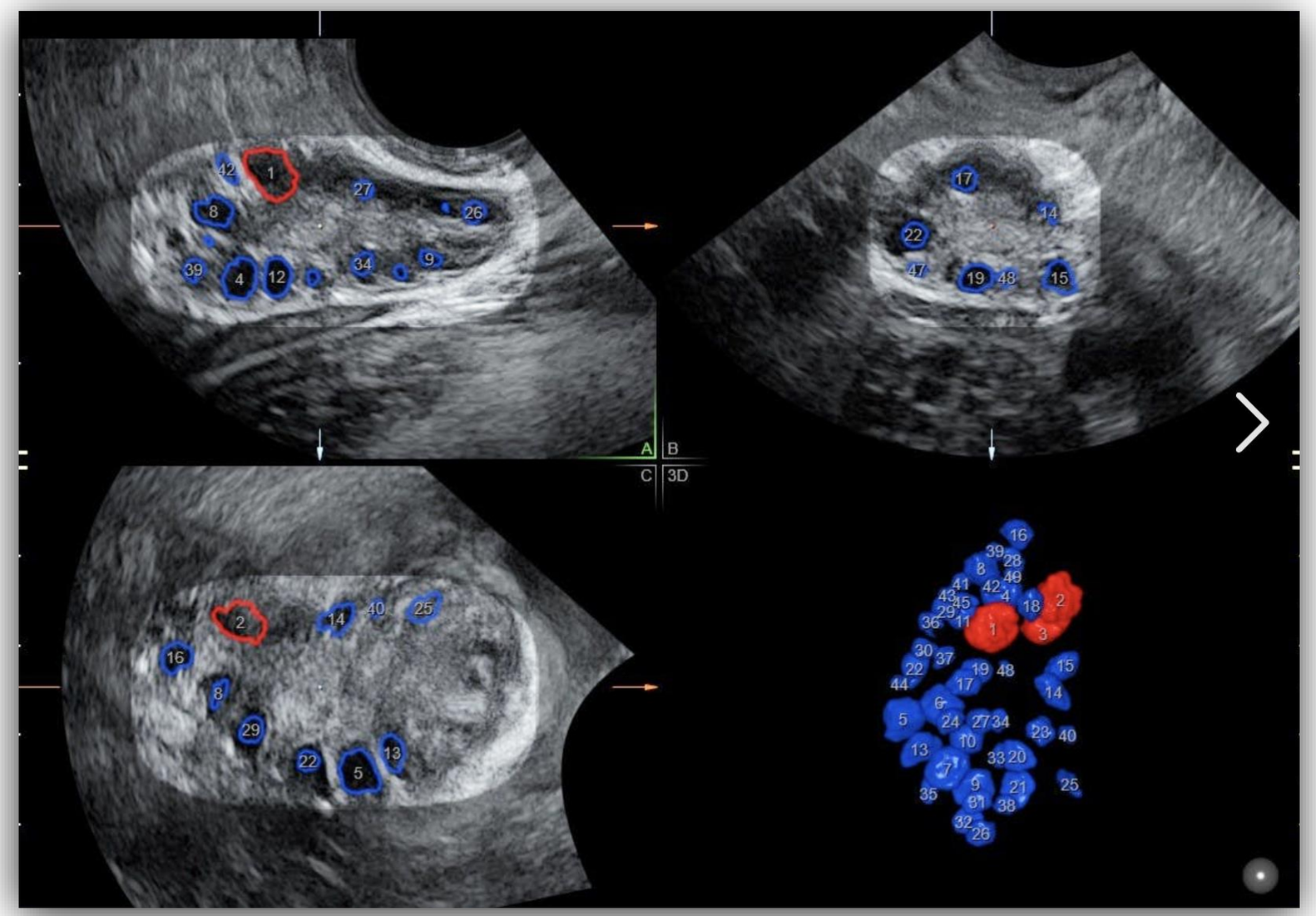
POLYCYSTIC OVARIES

UT = uterus



> 10 follicles

POLYCYSTIC OVARIES



Automated follicle evaluation

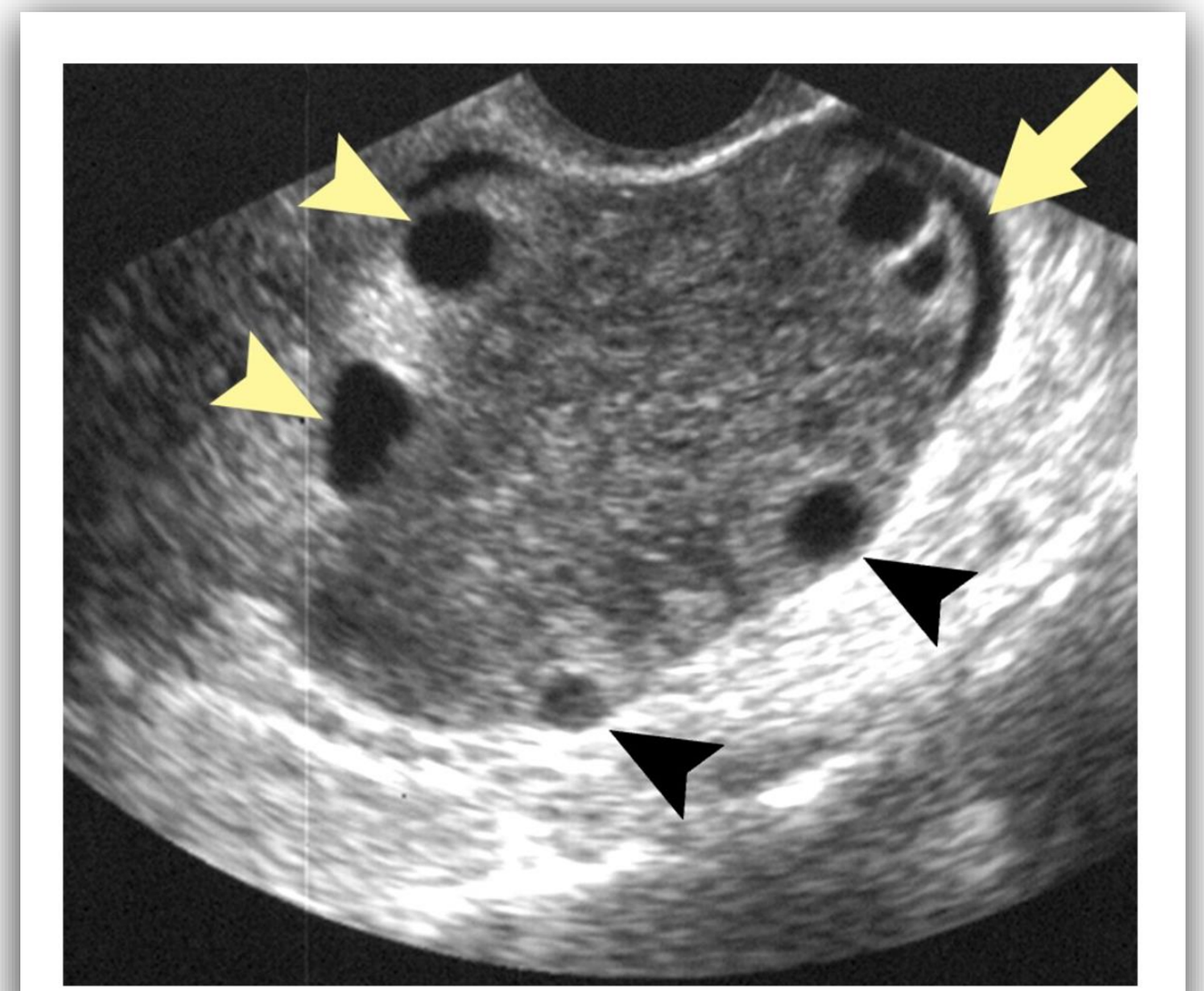
Ovarian Torsion

- Twisting of the ovary and part of the fallopian tube along its pedicle, strangulating arterial, venous, and lymphatic flow.
- More common in young and postmenopausal women
- Etiologies include
  - Hypermobility of ovary
  - Paraovarian cysts
  - Dermoids

Ovarian Torsion

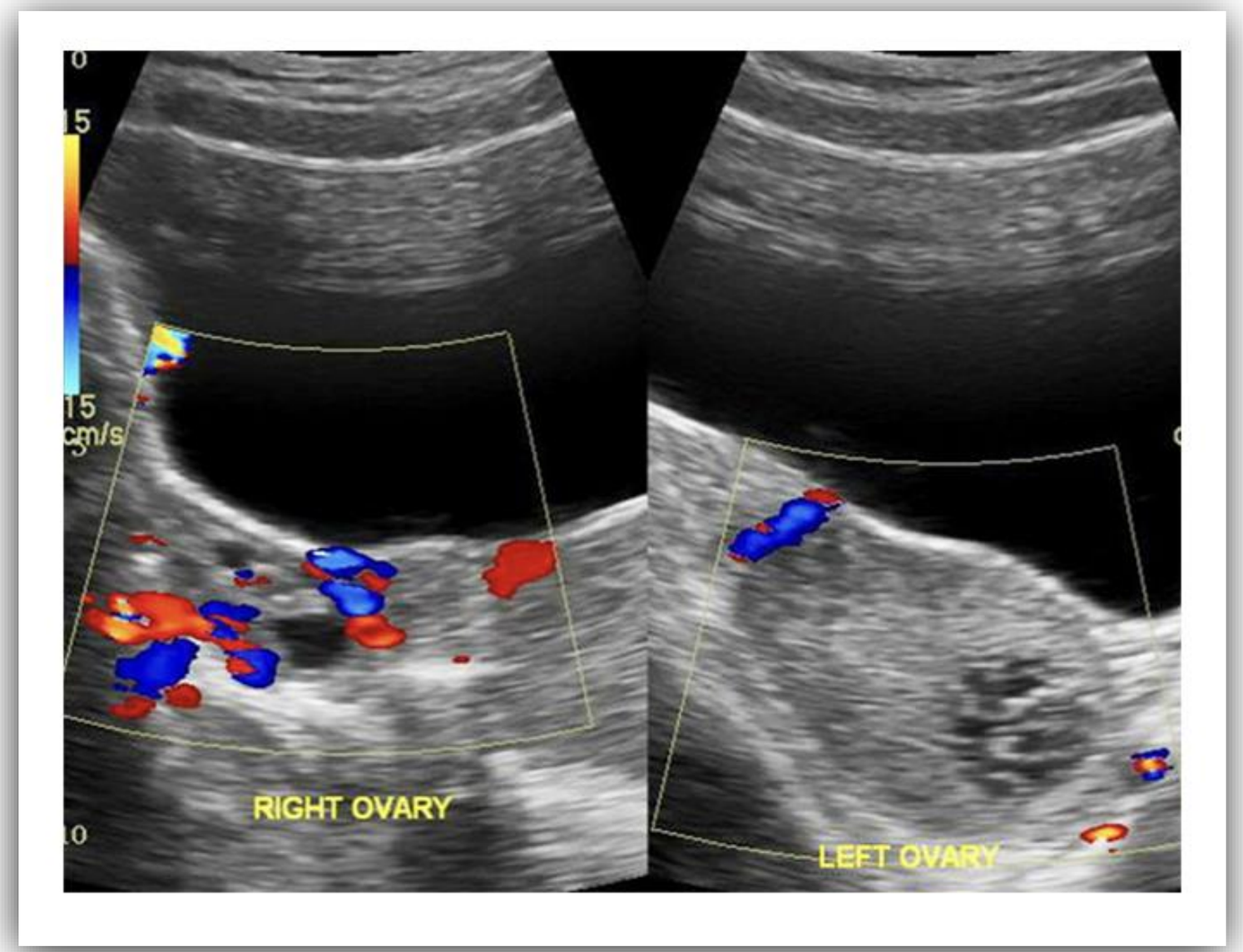
- Clinical presentation includes:
  - Severe lower abdominal pain
  - Nausea and vomiting
  - Leukocytosis
- Sonographic signs include:
  - Enlarged, hypoechoic ovary
  - Free fluid around ovary or in *cul-de-sac*
  - Peripherally displaced follicles
  - Diminished arterial and venous flow in ovarian parenchyma

OVARIAN TORSION



Free fluid around ovary

OVARIAN TORSION



Diminished arterial & venous flow

Neoplastic Ovarian Masses

- Can be categorized histologically or sonographically
- Some masses demonstrate typical sonographic findings, however, specificity is quite low
- Any non-simple mass of ovary is indication for surgical or laparoscopic intervention
- Histologic categories:
  - Malignant
  - Benign

Neoplastic Ovarian Masses

- Sonographic categories:
  - Cystic
  - Solid
  - Complex

Neoplastic Ovarian Masses

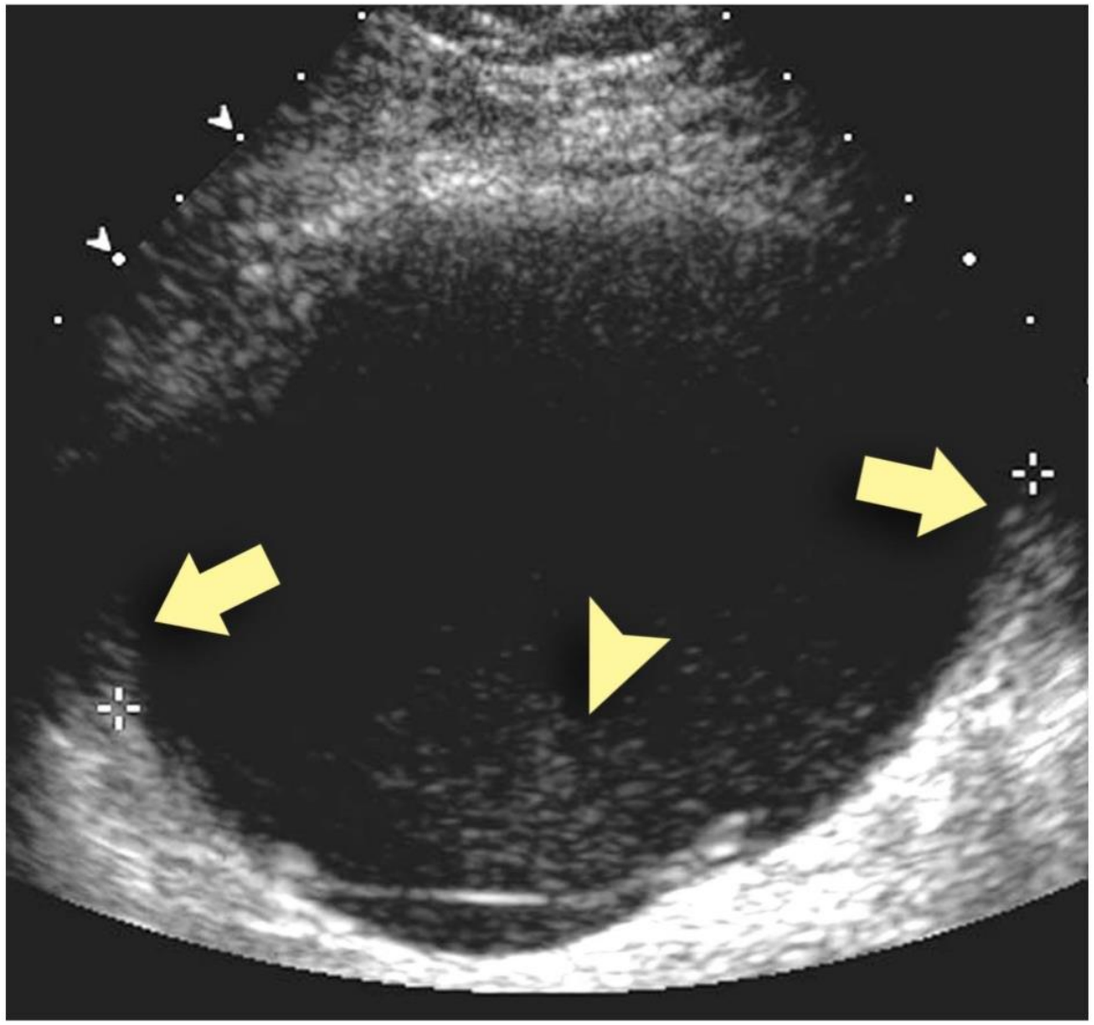
- Clinical presentation includes:
  - Usually non-specific
  - Bloating, abdominal distention, discomfort
  - Malaise
  - Pressure effects of bladder and rectum
  - Constipation
  - Digestive disorders
  - Weight changes
  - Increased abdominal girth
  - Infertility

Scoring Chart		
Feature	**Finding**	**Points**
Inner wall structure	Smooth	1
	Irregularities (≥3 mm)	2
	Papillarities (≥3 mm)	3
Wall thickness	Thin (≤3 mm)	1
	Thick (≥3 mm)	2
Echogenicity	Sonolucent	1
	Low echogenicity	2
	Low echogenicity with echogenic core	3
	Mixed echogenicity	4
	High echogenicity	5

Scoring Chart

- Scoring chart interpretive criteria:
  - Minimum score = 4
  - Maximum score = 15
  - Score < 9 indicates a low risk of malignancy
  - Score > 9 associated with increased risk of malignancy
  - Caveat: mature teratomas and other complex benign masses may score ≥ 9

OVARIAN NEOPLASIA – SCORING CHART



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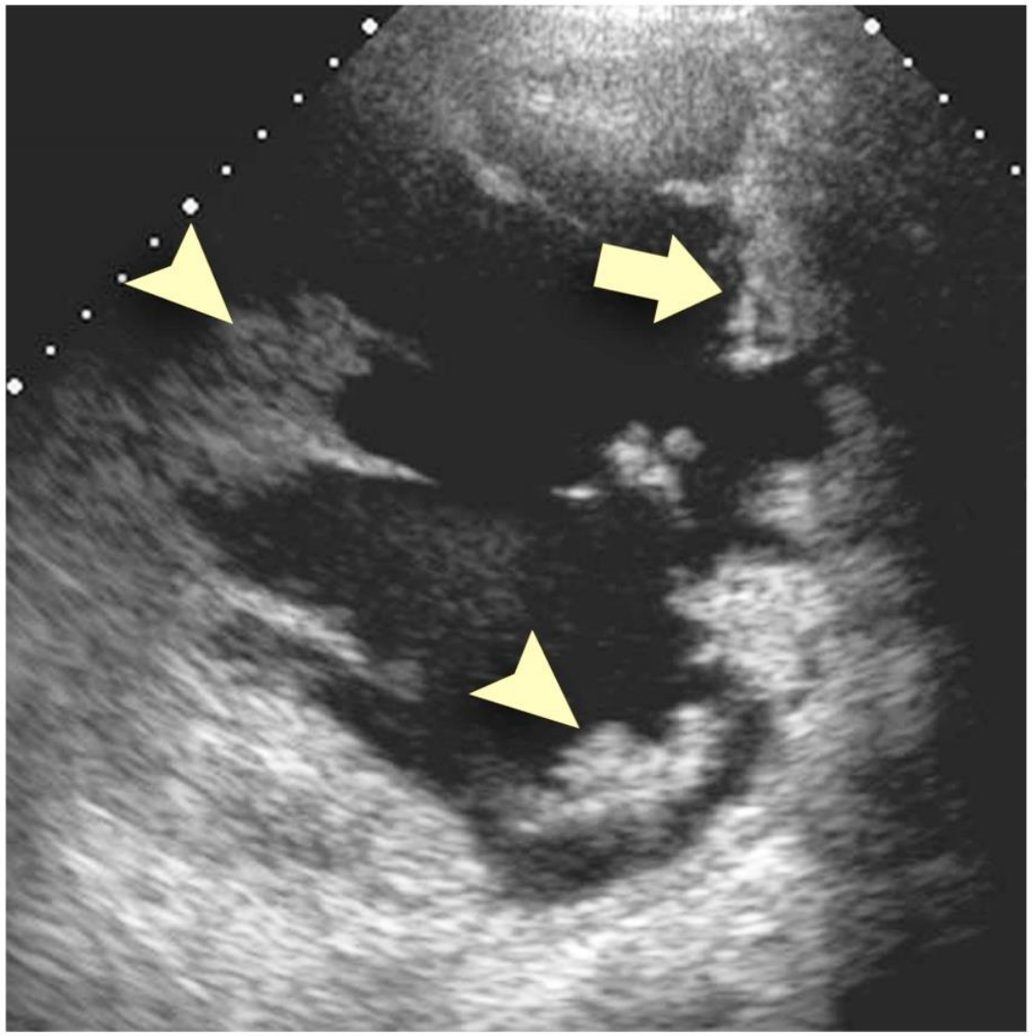
Echogenicity	Sonolucent	1
	Low echogenicity	2
	Low echogenicity with echogenic core	3
	Mixed echogenicity	4
	High echogenicity	5

Score = 3
≤ 9 = low risk
Dx. = benign cystadenoma

OVARIAN NEOPLASIA – SCORING CHART



Scoring Chart		
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Wall thickness	Thin (≤3 mm)	1
	Thick (≥3 mm)	2
Echogenicity	Sonolucent	1
	Low echogenicity	2
	Low echogenicity with echogenic core	3
	Mixed echogenicity	4
	High echogenicity	5

Score = 9
≥ 9 = high risk
Dx = malignant cystadenocarcinoma

Histological Types

- Epithelial neoplasms (65 – 70%)
  - Cystadenoma/cystadenocarcinoma
  - Pseudomyxoma peritonei
  - Transitional cell (Brenner) tumor
- Germ cell neoplasms (15-20%)
  - Teratomas
  - Dysgerminoma
  - Yolk sac tumor
  - Ovarian choriocarcinoma
  - Malignant mixed germ cell tumor

Histological Types

- Sex cord stromal tumors (5-10%)
  - Granulosa cell tumor
  - Fibromas and thecomas
  - Sertoli-Leydig tumors
- Metastatic tumors (5-10%)
  - Krukenberg tumor

Epithelial Tumors

- Arise in the tissue covering the ovary
- Most prevalent type of ovarian tumor
- Both benign (cystadenoma) and malignant (cystadenocarcinoma) types exist
- Mucinous variants: mucinous cystadenoma, mucinous cystadenocarcinoma

Epithelial Tumors

- Other sub types:
  - Undifferentiated adenocarcinoma
  - Endometroid carcinoma
  - Clear cell carcinoma
  - Brenner tumor

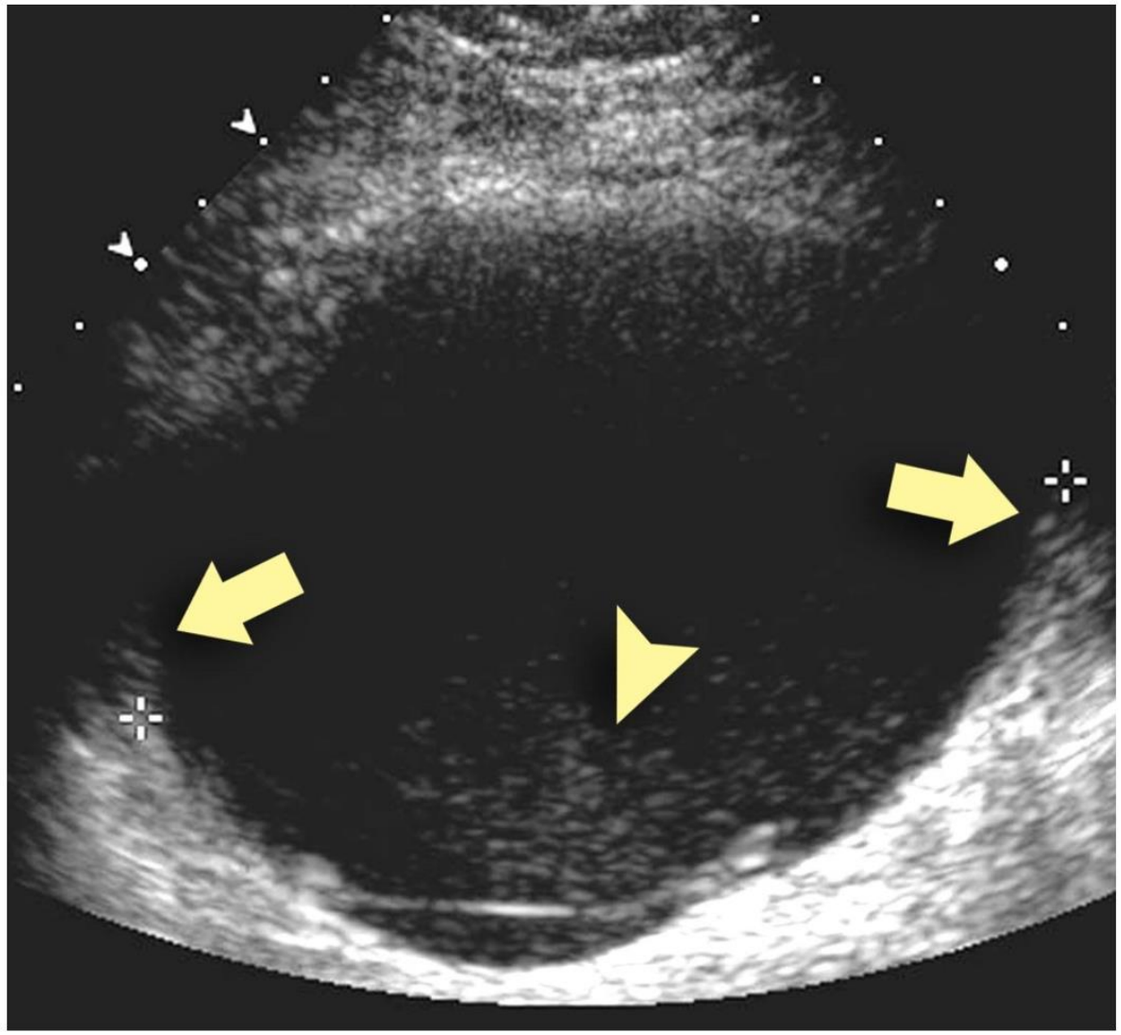
Epithelial Tumors

- Sonographic findings (benign):
  - Smooth borders
  - Unilocular or multilocular cysts
  - Anechoic with low-levels within
  - Internal calcification
  - Absent evidence of internal blood flow with Doppler

Epithelial Tumors

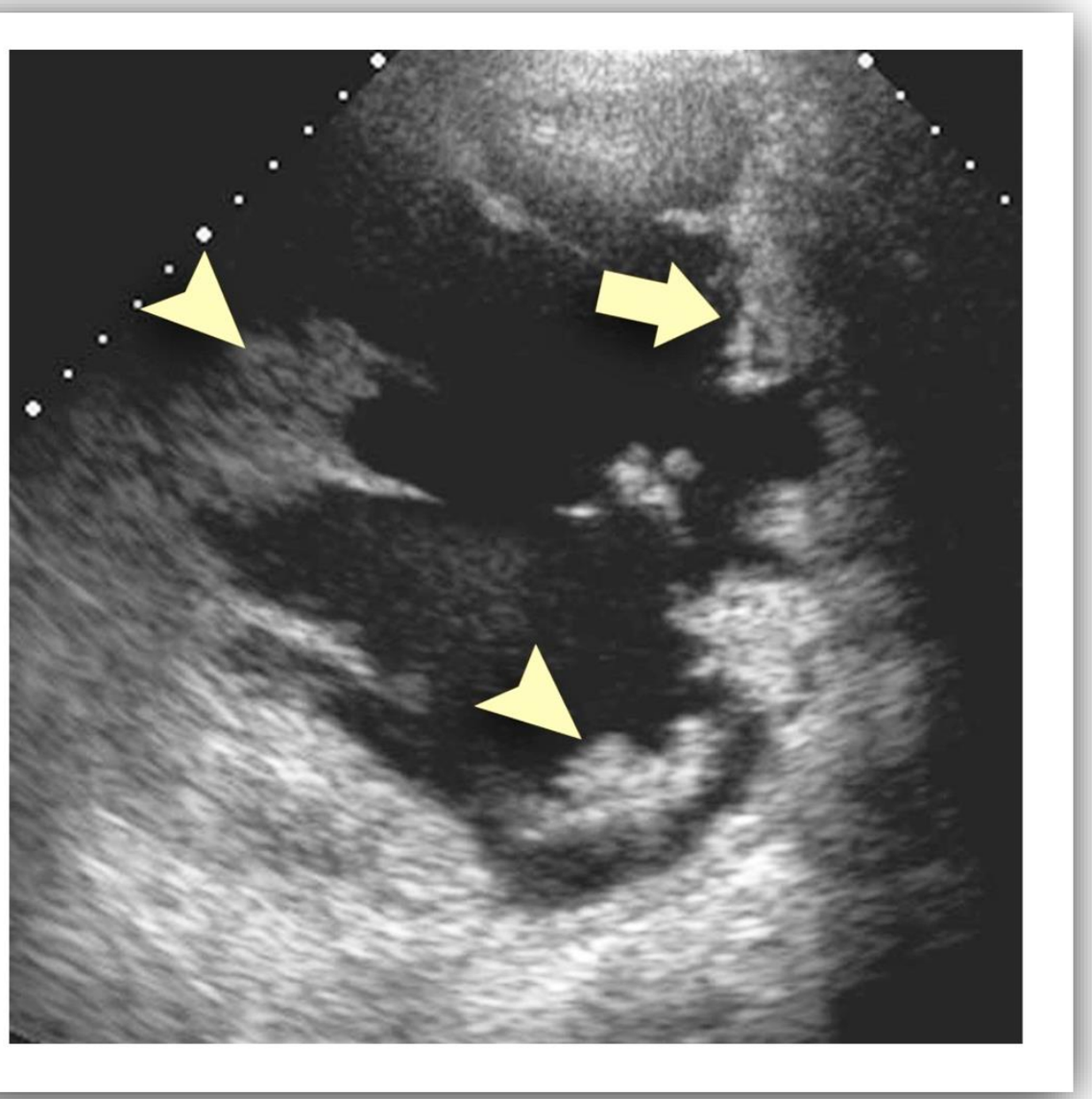
- Sonographic findings (malignant):
  - Irregular borders
  - Solid
  - Mixed solid/cystic
  - Doppler evidence of blood flow to internal components
  - Ascites

EPITHELIAL TUMORS



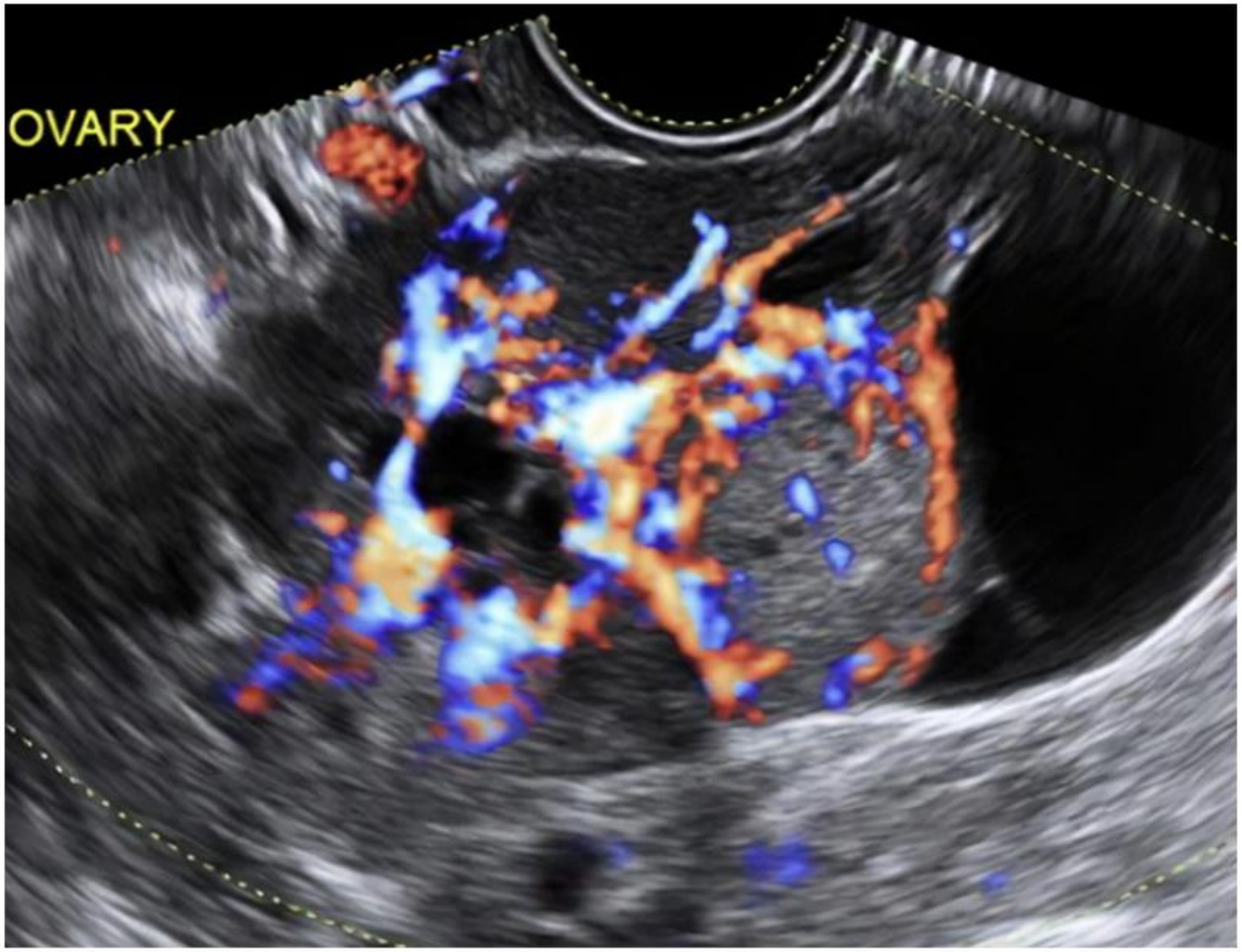
Benign serous cystadenoma

EPITHELIAL TUMORS



Malignant serous cystadenocarcinoma

EPITHELIAL TUMORS



Malignant – blood flow to internal components

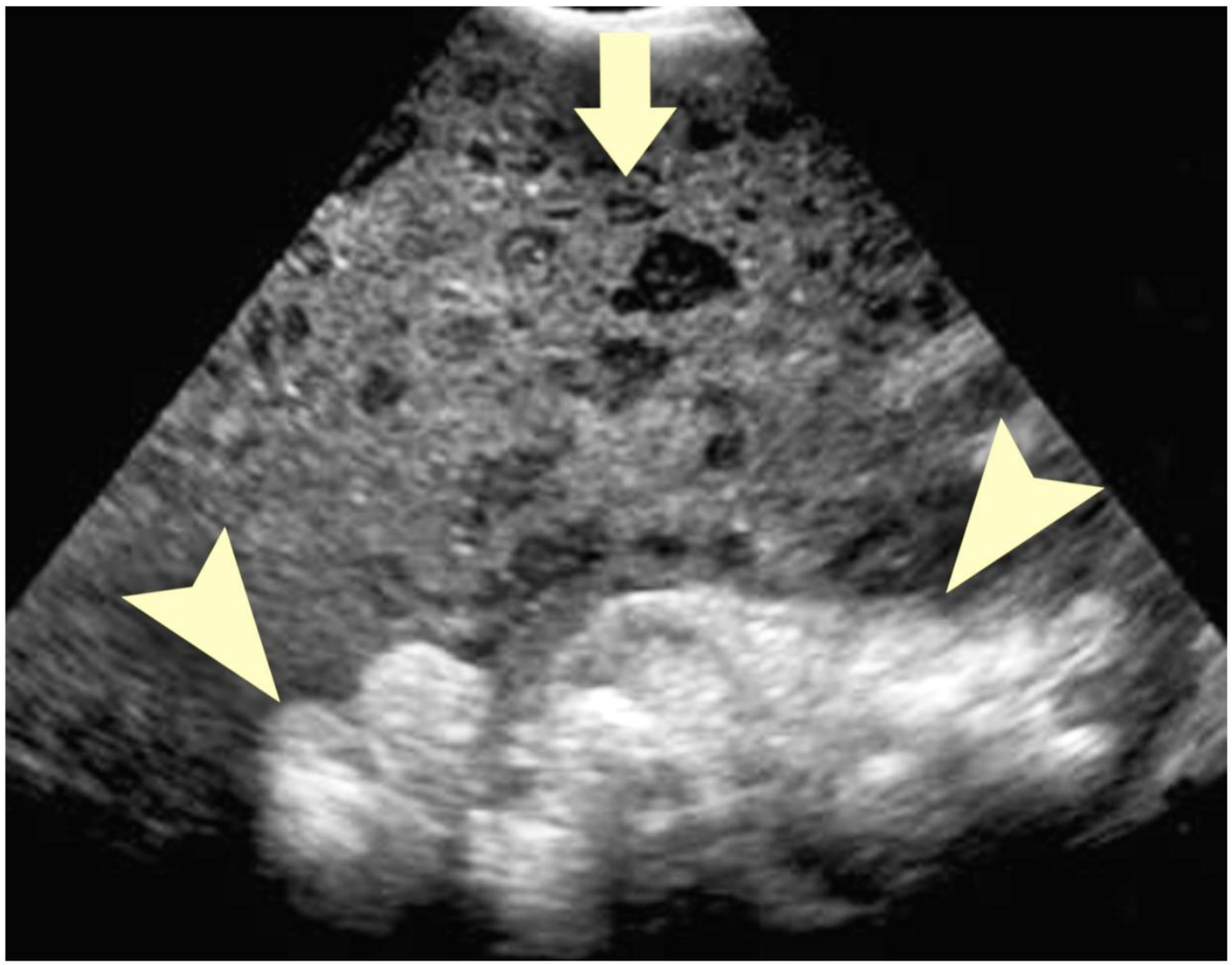
Pseudomyxoma Peritonei

- Large septated mucin-filled cystic masses may rupture
- Peritoneal fluid + ascites = pseudomyxoma peritonei
- Bits of neoplastic tissue can seed peritoneal implants on surface of:
  - Bowel
  - Liver
  - Spleen
  - Omentum
  - Peritoneal walls

Pseudomyxoma Peritonei

- Sonographic findings:
  - Echogenic peritoneal masses
  - Ascites with echogenic particulate matter
  - Displaced small bowel loops

PSEUDOMYXOMA PERITONEI



Arrowheads = displaced small bowel loops
Arrow = echogenic particulate matter

Transitional Cell (Brenner) Tumor

- Uncommon, usually benign, solid epithelial tumor
- Typically occurs in 50 - 60 year old patients
- Frequently bilateral
- Sonographic findings:
  - Solid, hypoechoic ovarian mass
  - May cast an acoustic shadow
  - Calcifications present (50%)

BRENNER TUMOR

Arrow = hyperattenuation with shadowing

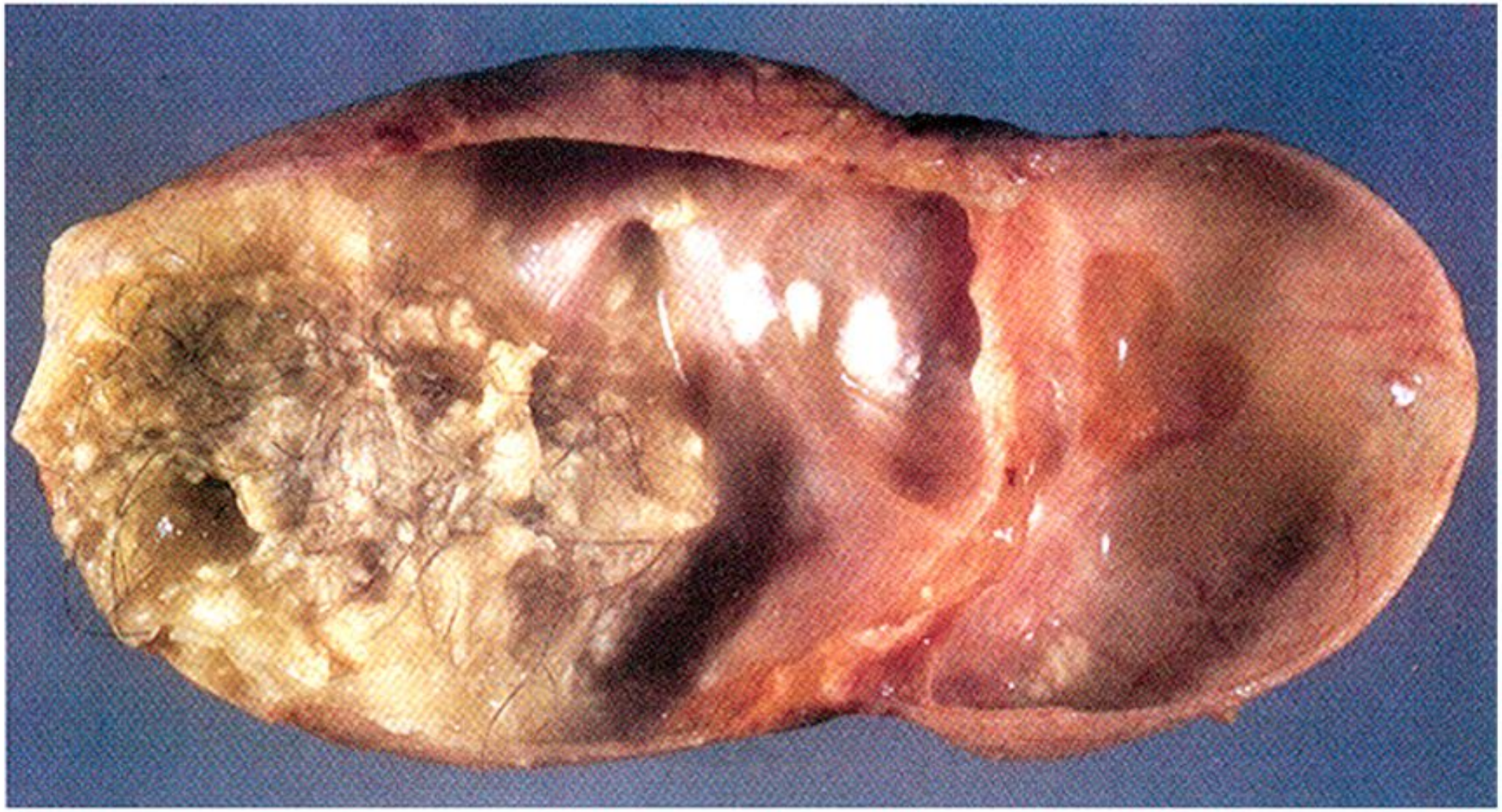
Germ Cell Tumors

- Arise from ectopic embryonic cells migrating from yolk sac
- Account for 15 - 29% of all ovarian tumors
- Most are benign but carry malignant potential
- Histologic types:
  - Teratoma
  - Dysgerminoma
  - Yolk sac tumor
  - Malignant mixed germ cell tumor
  - Ovarian carcinoma

Teratomas

- Complex tumor comprising tissue components from all three germ cell layers
- Name derives from Greek *terato* = monster
- Most common type of germ cell tumor
- Three major subtypes:
  - Mature cystic (generally benign)
  - Immature teratoma (generally malignant)
  - Struma ovarii (rare tumor containing thyroid tissue)

TERATOMAS



Gross pathology

Mature Cystic Teratomas

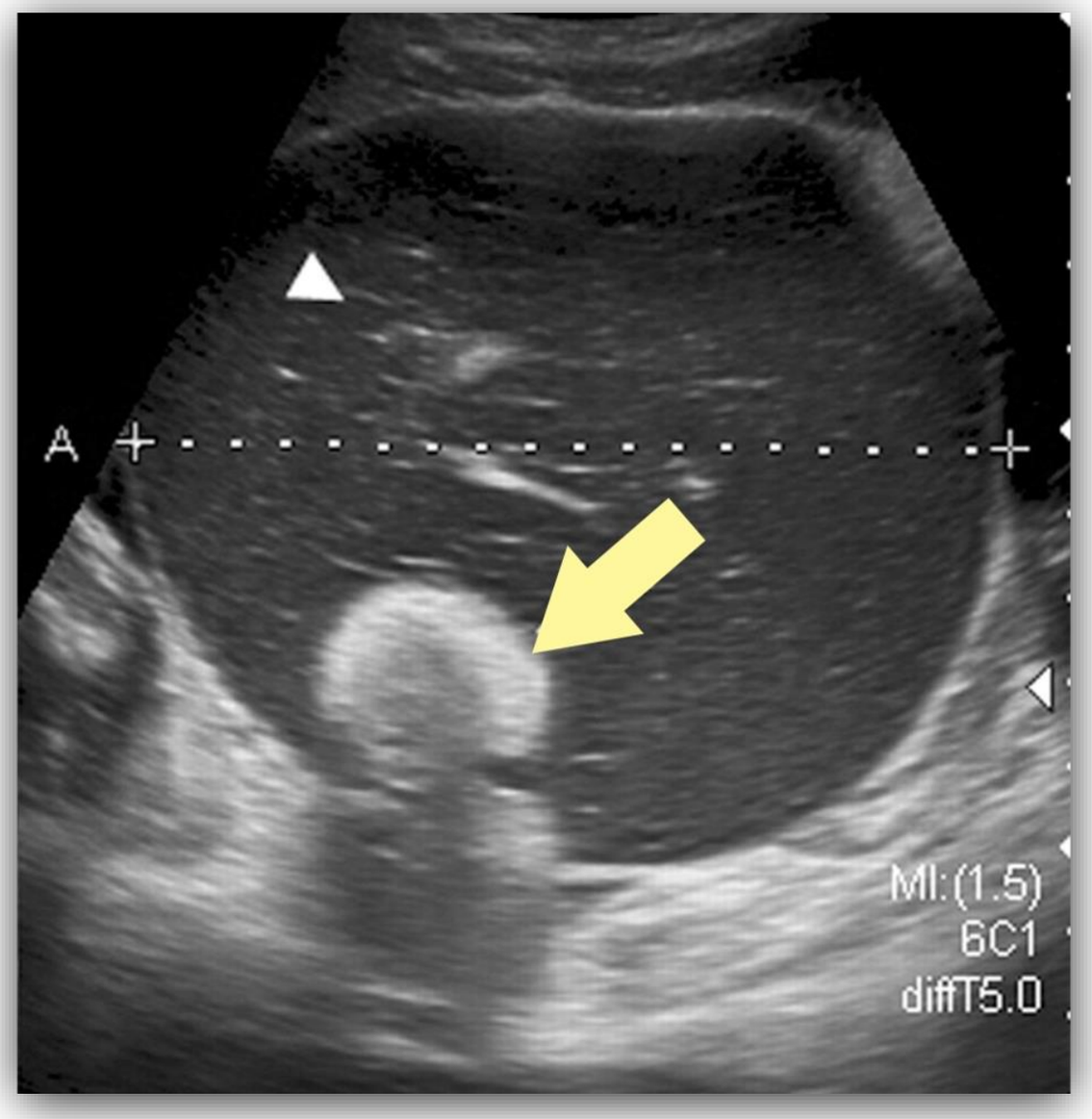
- Most common benign tumor of ovary
- Usually occurs in patients 20 - 30 years
- Frequently referred to as dermoids
- Dermoids – generally benign
- Teratoma – carry a malignant potential

Mature Cystic Teratomas

Sonographic findings:

- Cystic mass with:
  - Dense echogenic tubercle (Rokitansky)
  - Complex internal architecture
  - Calcification
  - Echogenic bands
  - “Tip of the iceberg” sign

MATURE CYSTIC TERATOMAS

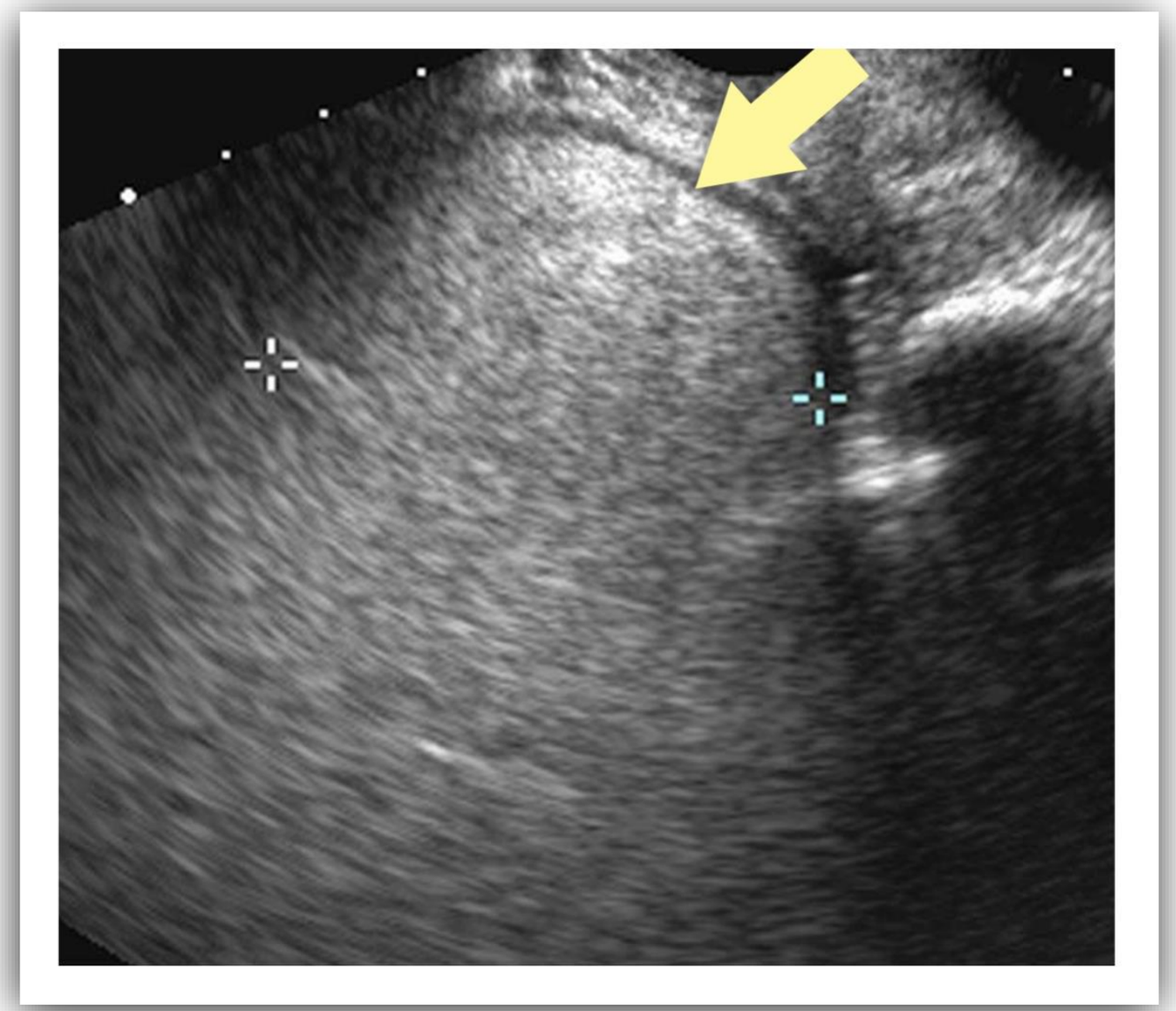


Arrow = Rokitansky nodules

MATURE CYSTIC TERATOMAS

Complex internal architecture

MATURE CYSTIC TERATOMAS



Arrow = “tip of iceberg”

Struma Ovarii

- Mature cystic teratoma composed predominantly thyroid tissue (at least 50%)
- Gross pathology:
  - Large complex cystic mass with solid thyroid tissue, hemorrhage and necrotic debris

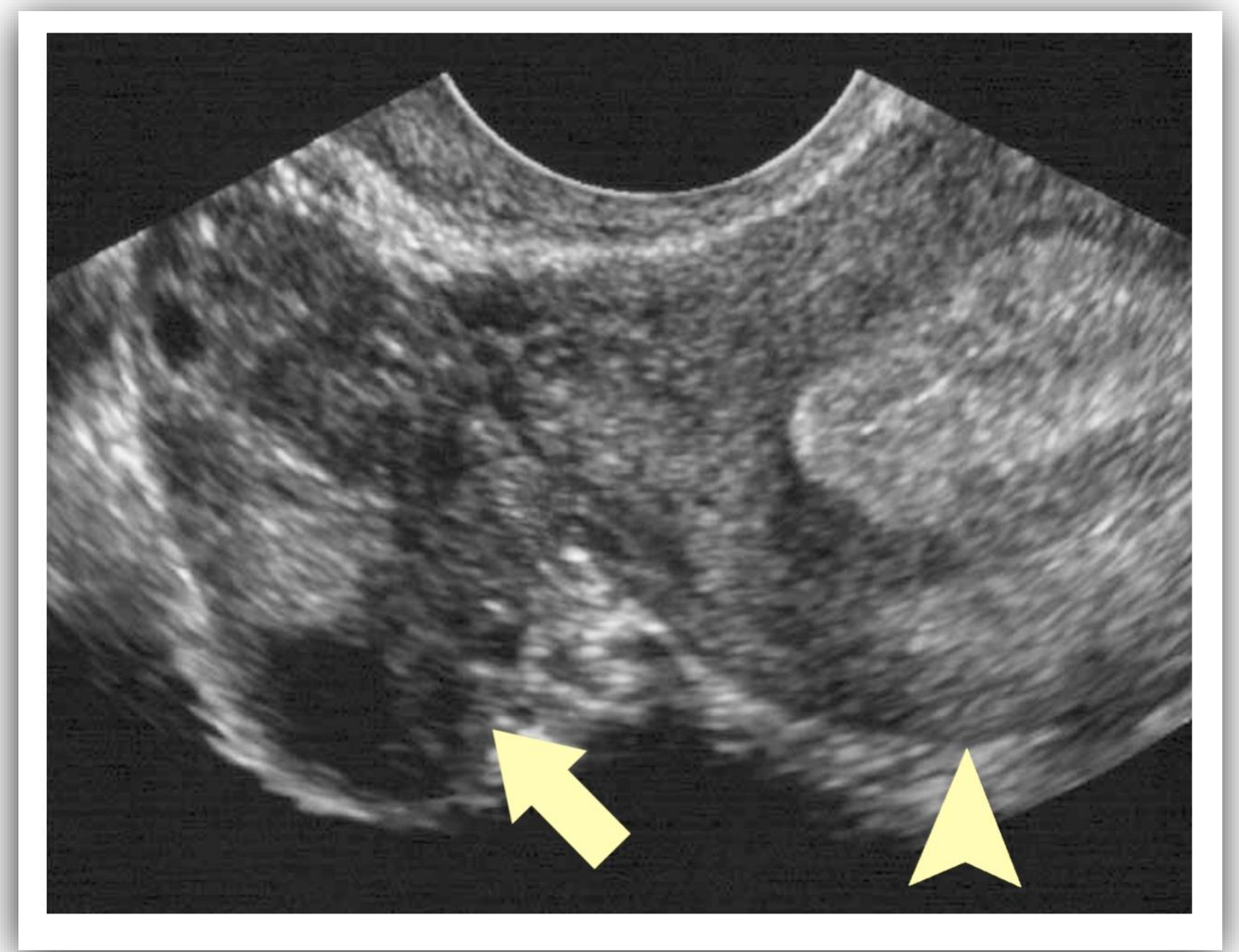
Struma Ovarii

- Sonographic findings:
  - Large multiloculated cystic mass with sold component
  - Complex internal architecture
  - Well vascularized solid component in central portion of mass
  - Ascites (30% of cases)

Immature Cystic Teratomas

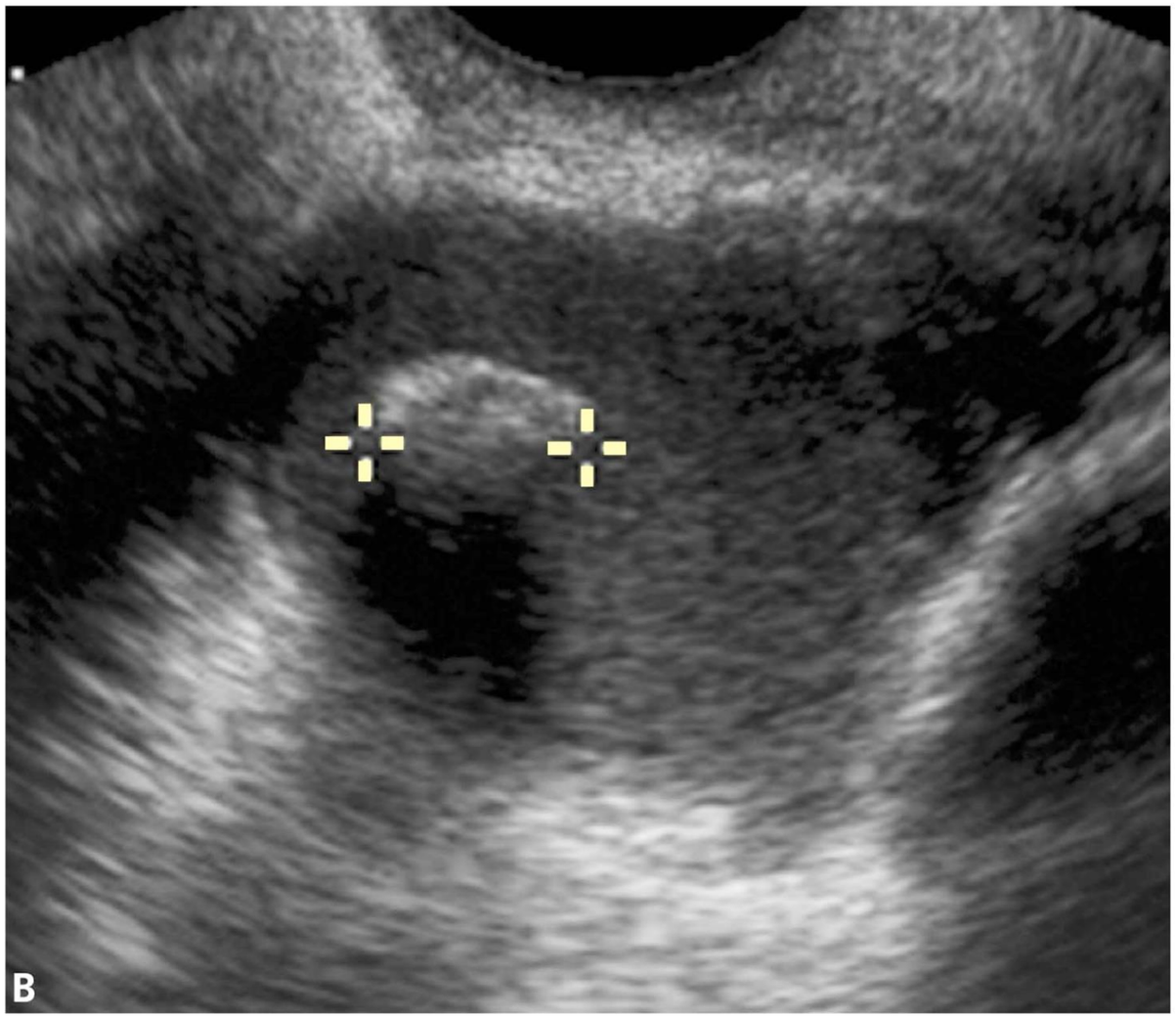
- Presence of more immature tissue
- Higher malignant potential
- Typically larger (up to 25 cm)
- Large encapsulated mass with solid component

IMMATURE CYSTIC TERATOMAS



Arrow = complex mass with cystic component
Arrowhead = uterus

IMMATURE CYSTIC TERATOMAS



Calcification within mass

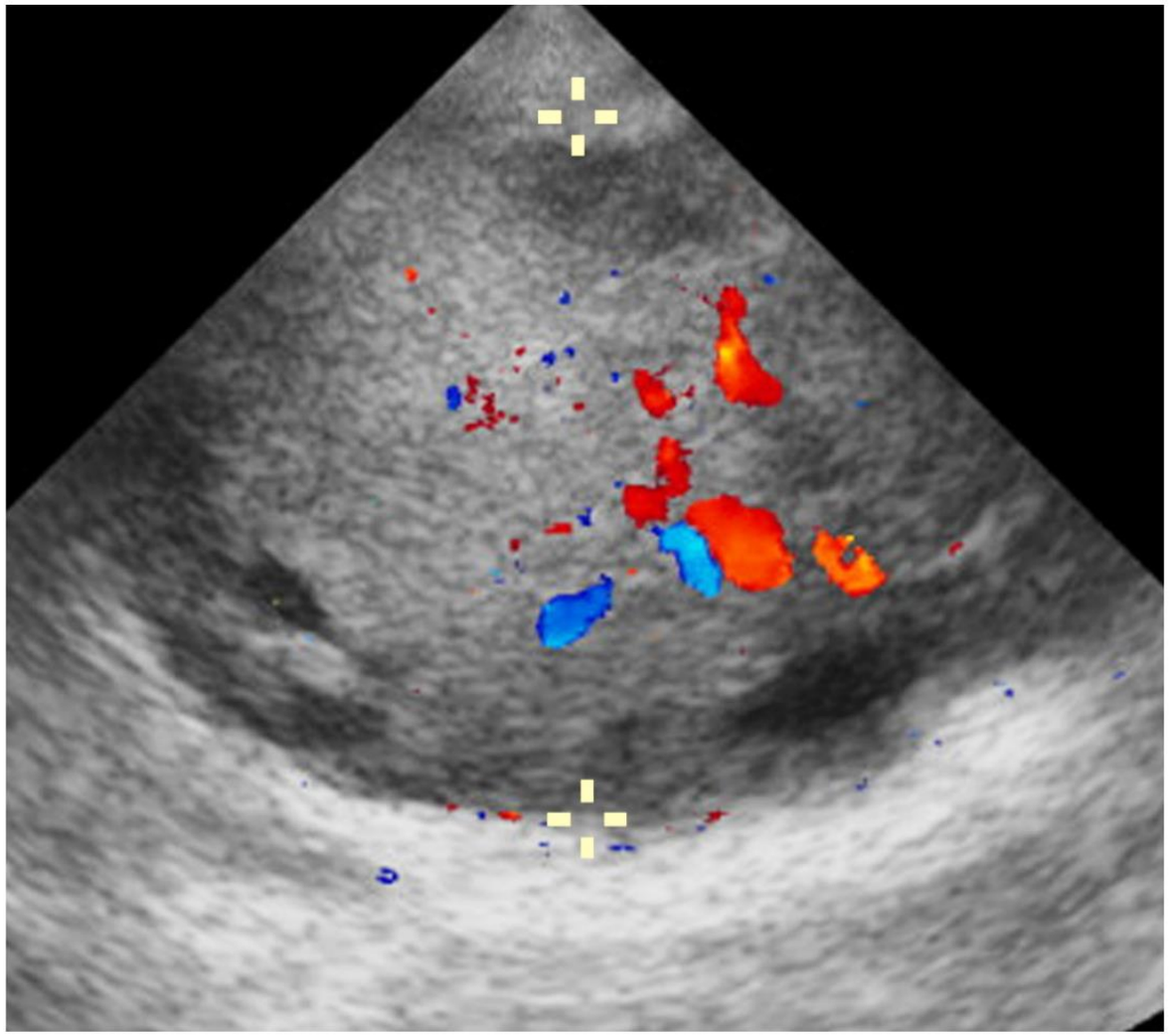
Dysgerminoma

- Arise from primordial germ cells. Considered the ovarian counterpart to testicular seminomas in men
- Occur primarily in women < 30 years
- Always malignant
- Bilateral 15% of cases

Dysgerminoma

- Sonographic findings:
  - Solid ovarian mass with possible focal cystic areas
  - Varying internal architecture
  - Doppler demonstrates flow in solid areas

DYSGERMINOMA



Doppler flow in solid mass

Yolk Sac Tumor

- Arise from a pre-existing dermoid cyst
- Rare
- Occur in the 2nd decade of life
- Well-encapsulated complex mass
- Cystic and solid components
- No specific sonographic signs

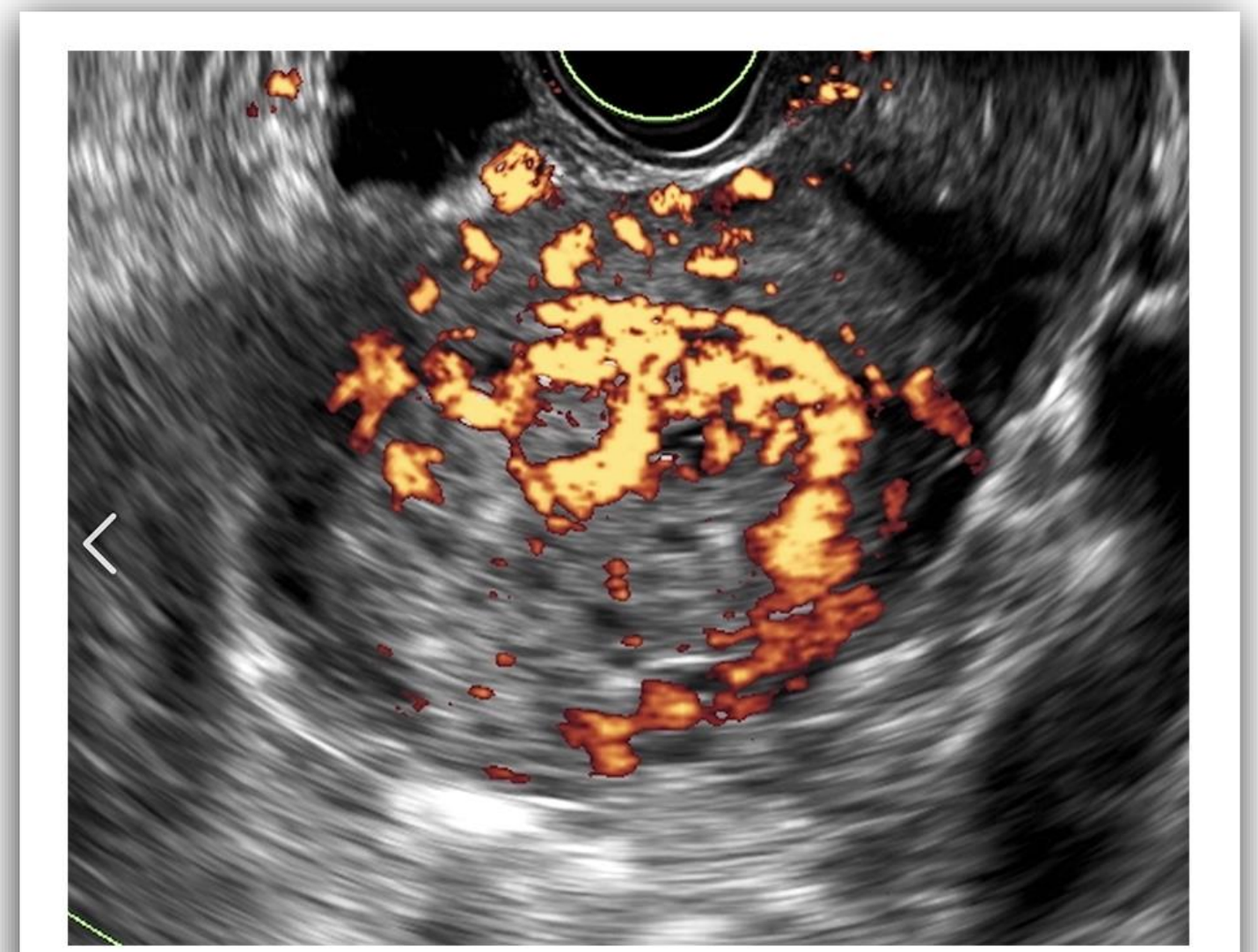
Ovarian Choriocarcinoma

- Malignant tumor. May be primary arising from germ cells or metastatic from uterine primary
- Rare. < 1% of all ovarian cancers
- Have trophoblastic tissue component
- Elevated serum beta hCG levels

Ovarian Choriocarcinoma

- Sonographic findings:
  - Well-defined, solid adnexal mass
  - Highly vascularized on Doppler imaging
  - Cystic, hemorrhagic, and necrotic areas

DYSGERMINOMA



Highly vascularized on Doppler imaging

Sex Cord Stromal Tumors

- Account for 5 - 10% (8%) of all ovarian tumors
- Rare. < 1% of all ovarian cancers
- Categorized by cell type:
  - Granulosa cell: may be solid, cystic, or complex. No specific sonographic findings
  - **Theca cells (thecoma)**
  - **Fibroblasts (fibroma)**
  - **Sertoli-Leydig cells**
  - Stromal cells

Fibromas

- Most common sex cord stromal tumor (70%)
- Occur in older women (> 40 years)
- Ascites present (10%)
- Hard solid mass with smooth surface

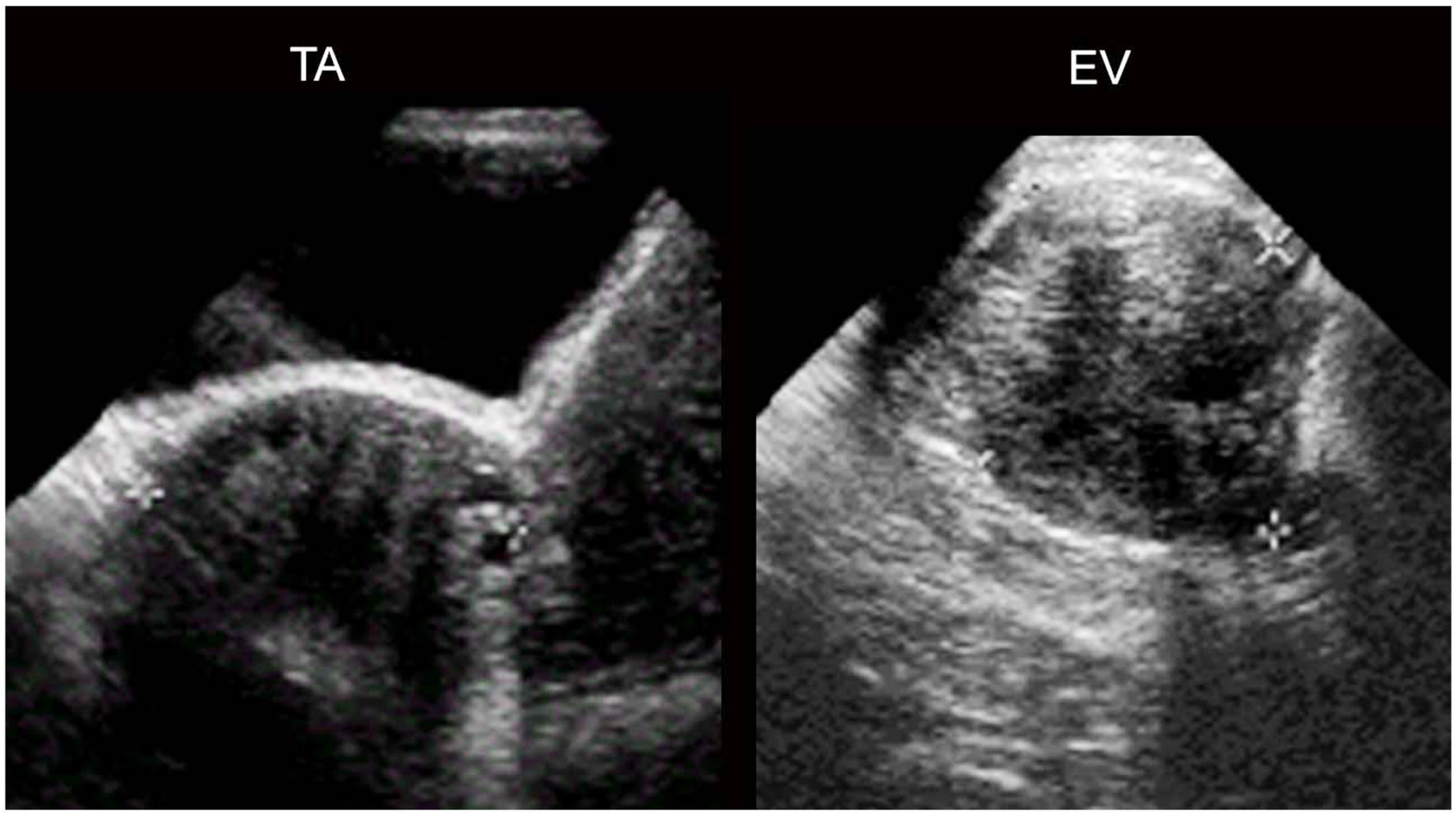
Thecomas

- Solid, benign estrogen producing tumor
- Most common in women < 40 years
- Varying sized masses

Fibromas & Thecomas

- Sonographic findings:
  - Hypoechoic adnexal mass
  - Enhanced acoustic attenuation resulting in posterior acoustic shadowing

FIBROMAS & THECOMAS

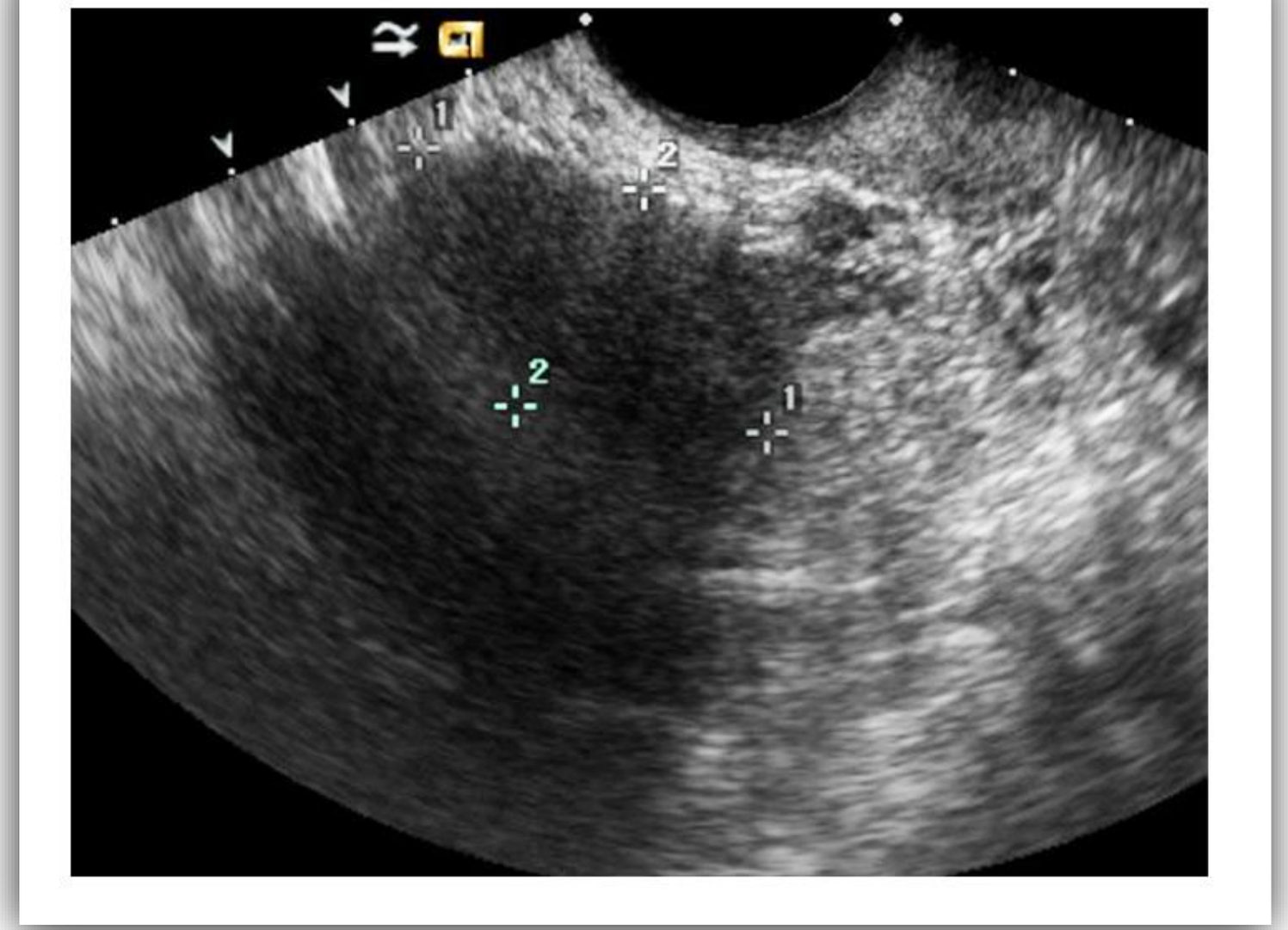


Hypoechoic adnexal mass

FIBROMAS & THECOMAS

Posterior acoustic shadowing

FIBROMAS & THECOMAS



Enhanced attenuation

Sertoli-Leydig Tumors

- Also called androblastomas as they secrete male hormones
- Uncommon, benign tumors account for < 0.5% of all ovarian tumors
- Clinical signs of androgenic exposure:
  - Oligomenorrhea
  - Hirsutism
  - Breast atrophy

Sertoli-Leydig Tumors

- May also present with clinical signs of estrogenic exposure:
  - Irregular menses, menorrhagia
  - Postmenopausal bleeding
- Firm, solid, encapsulated, nodular masses
- No specific sonographic sign

Metastatic Tumors

- Account for ~ 7% of all ovarian tumors
- Most common primaries include:
  - GI tract
  - Breast
  - Thyroid/lymphatic (less common)
- Routes of spread:
  - Direct invasion
  - Lymphatic
  - Hematogeneous
  - Peritoneal

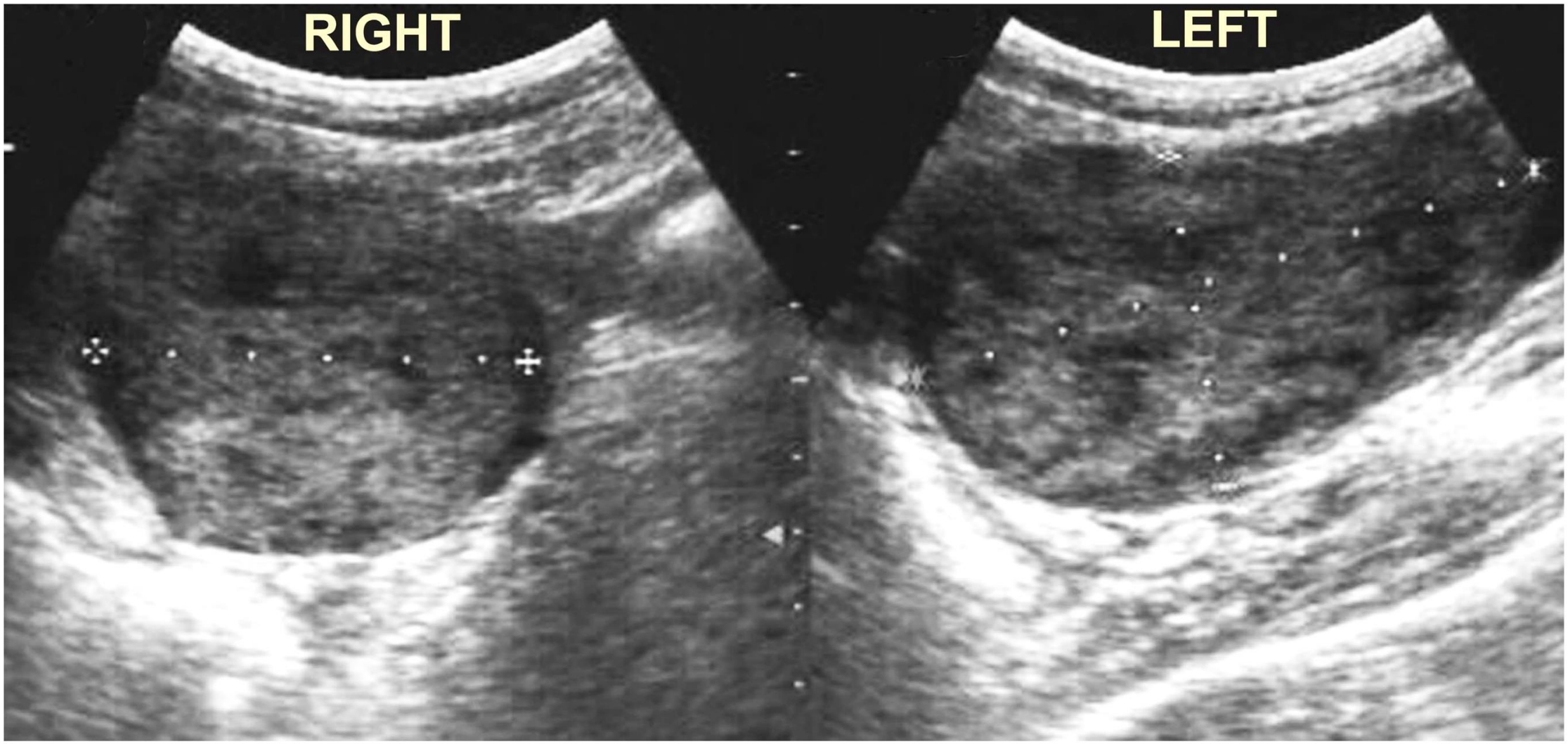
Krukenberg Tumor

- A specific type of metastatic ovarian cancer that may produce endocrinological abnormalities
  - Vaginal bleeding
  - Alterations in menstrual patterns
  - Thyroid/Hirsutism
  - Virilization
- Frequently bilateral
- No specific sonographic signs
  - May demonstrate “moth-eaten” appearance

KRUKENBERG TUMOR

Bilateral complex ovarian masses

KRUKENBERG TUMOR

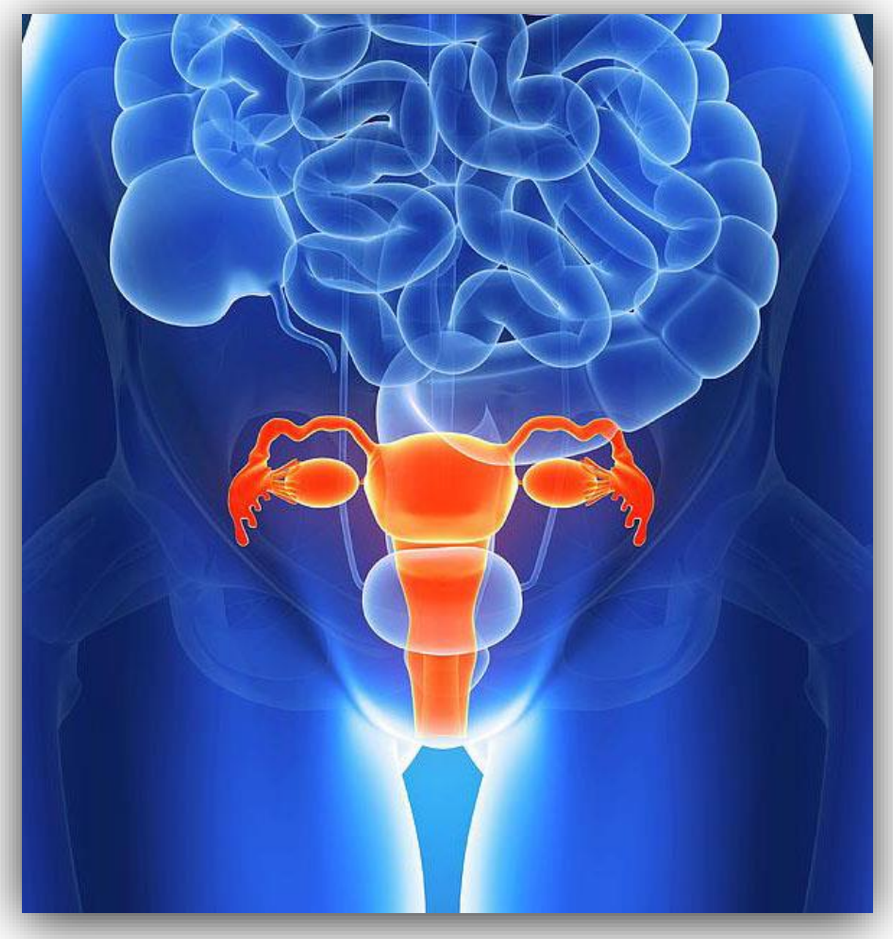


Moth-eaten appearance

Adnexal Pathology

Adnexal Pathology

- Pelvic inflammatory disease
- Endometriosis
- Ovarian vein thrombosis



Pelvic Inflammatory Disease (PID)

- An infectious, inflammatory disease of the internal female reproductive tract that may involve the uterus, fallopian tubes, and adjacent adnexal spaces and structures.
- Predisposes to infertility and ectopic pregnancy
- Infection begins in vagina and cervix and ascends into upper genital tract
- Most common etiology is STD
  - *Chlamydia trachomatis*
  - *Neisseria gonorrhoea*
  - *Haemophilus influenza*
  - *Gardnerella vaginalis*
  - *Peptococcus and bacteroides*

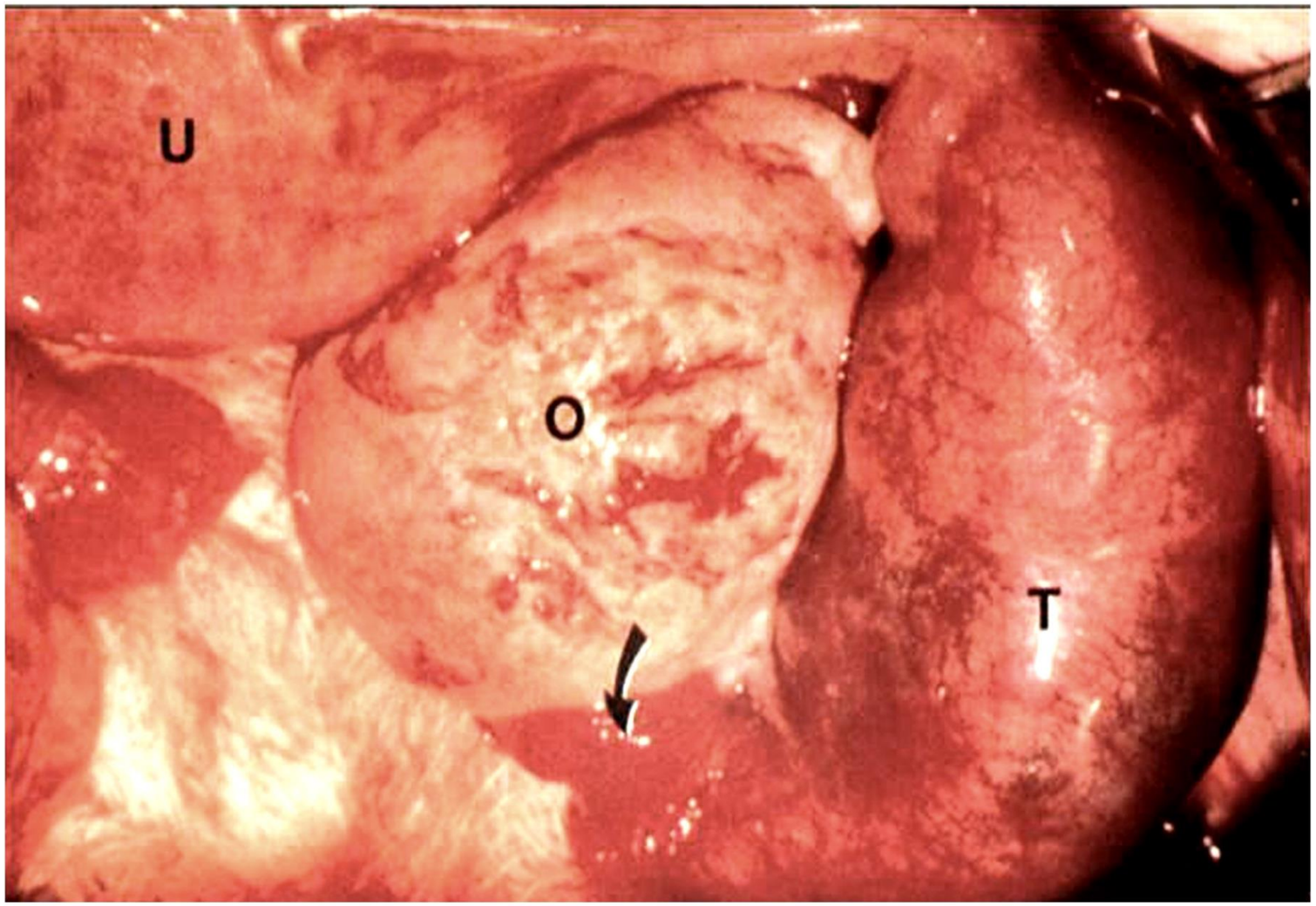
Pelvic Inflammatory Disease (PID)

- Clinical presentation:
  - Fever, leukocytosis
  - Lower abdominal pain
  - Pelvic tenderness, usually bilateral and diffuse
  - Dyspareunia
  - Purulent vaginal discharge
  - Vaginal bleeding

Pelvic Inflammatory Disease (PID)

- Sonographic findings:
  - Ill-defined uterine appearance secondary to inflammation
  - Endometrial cavity thickening (endometritis)
  - Fluid-filled fallopian tube(s) (hydro/pyo-salpinx)
  - Enlarged, ill-defined ovaries (oophoritis)
  - Free fluid in the cul-de-sac and/or peritoneal cavity
  - With tubo-ovarian abscess, complex adnexal masses with thickened walls and cystic components

PELVIC INFLAMMATORY DISEASE

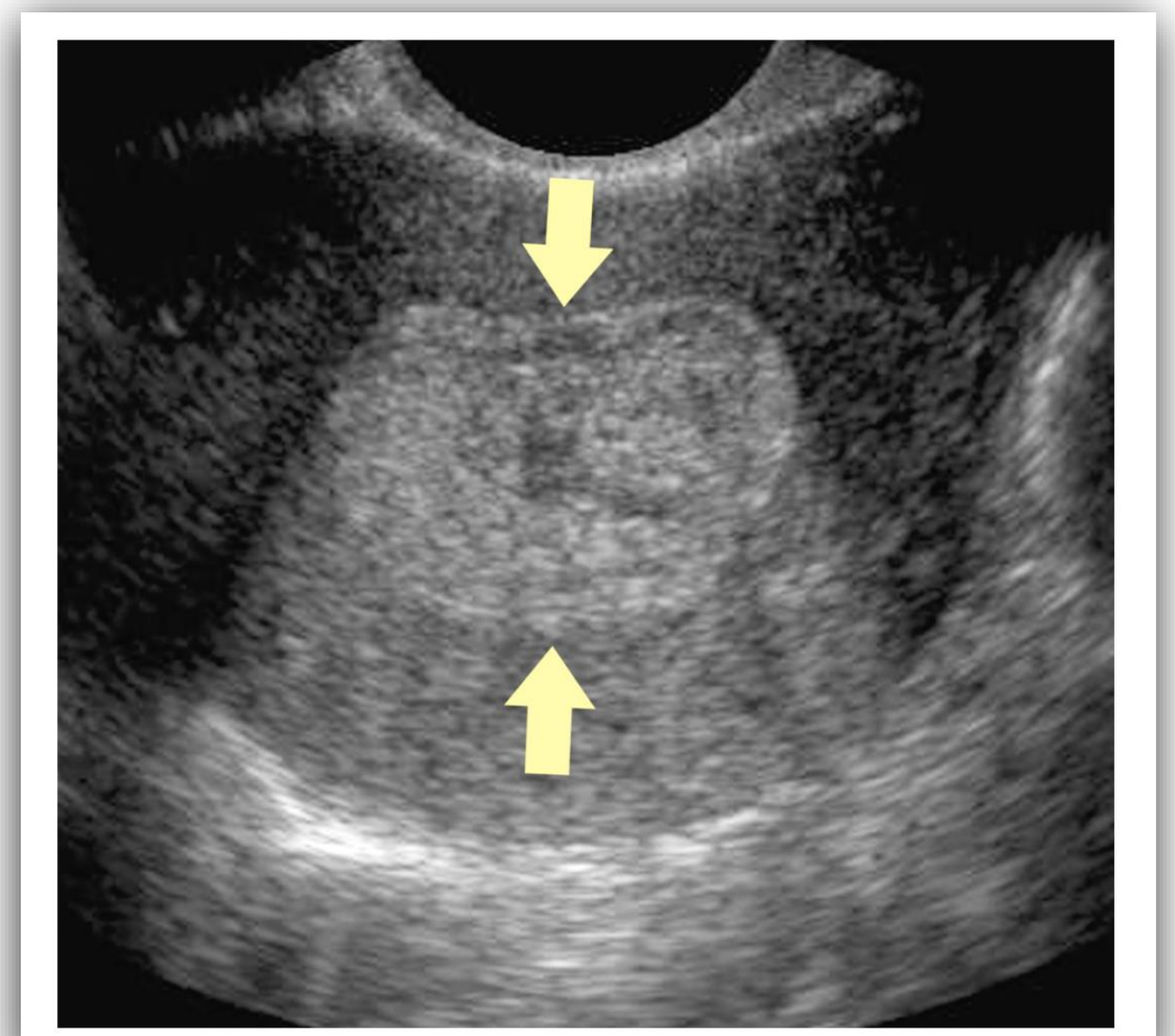


Gross pathology

PELVIC INFLAMMATORY DISEASE

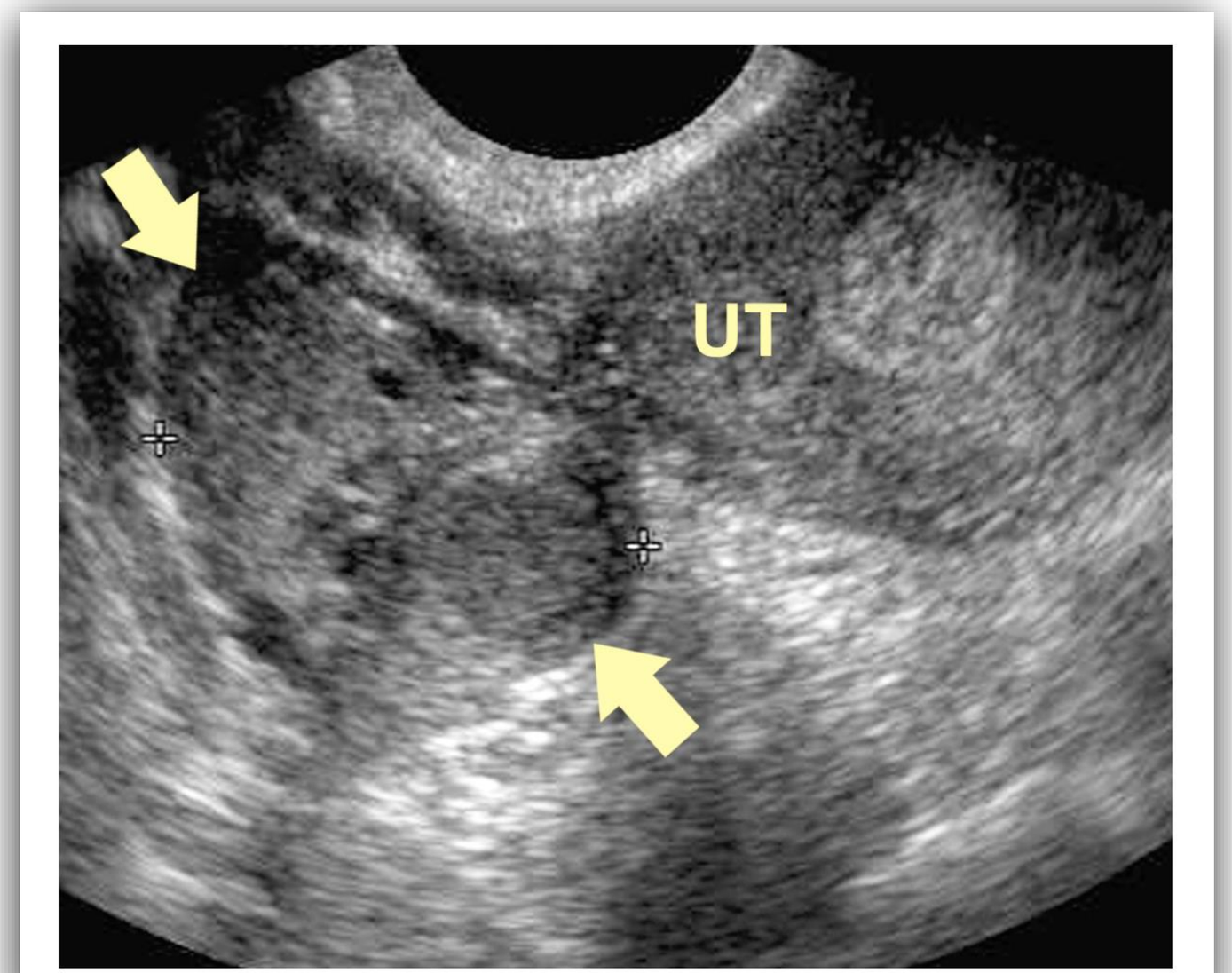
Fluid-filled fallopian tube

PELVIC INFLAMMATORY DISEASE



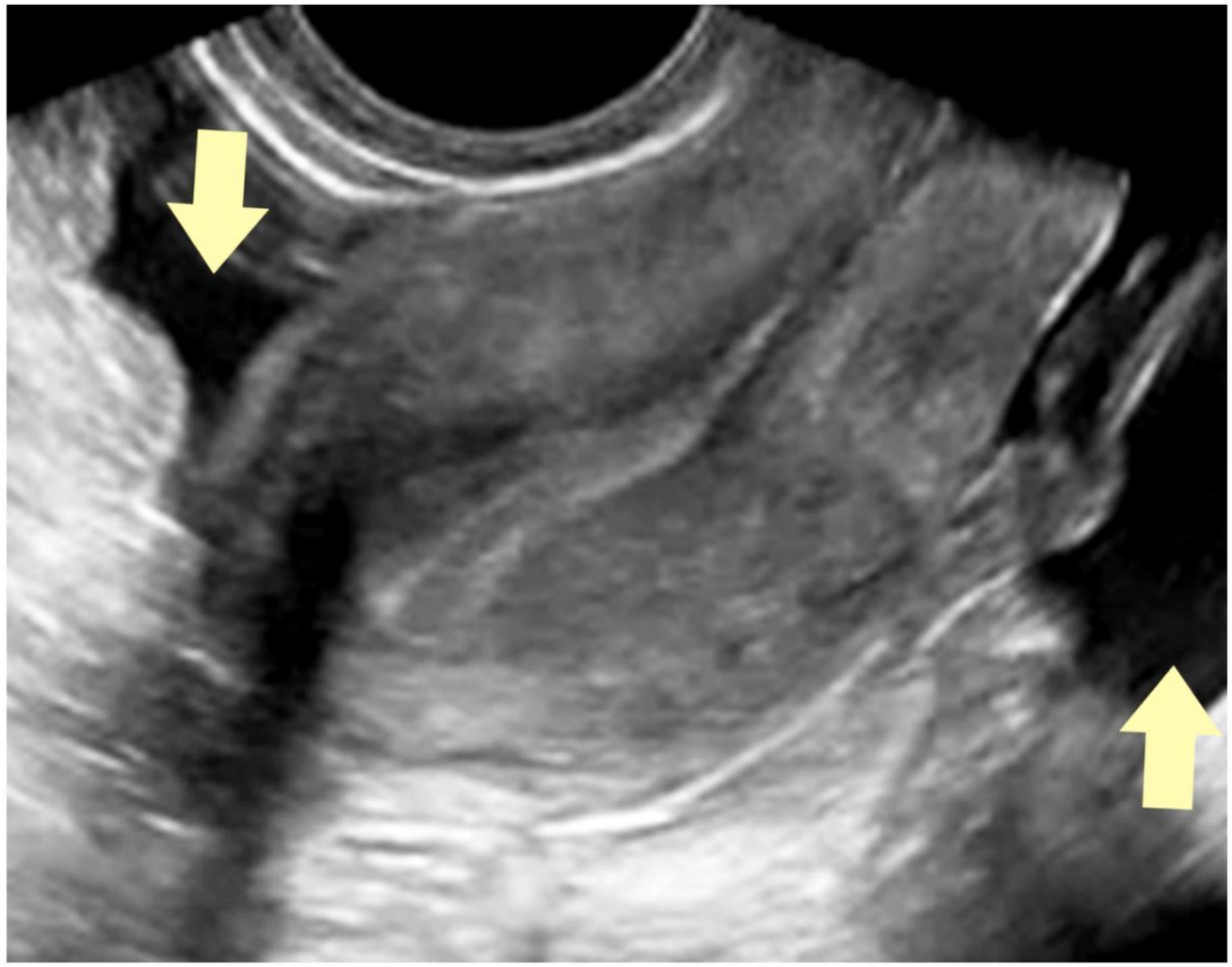
Endometrial cavity thickening - endometritis

PELVIC INFLAMMATORY DISEASE



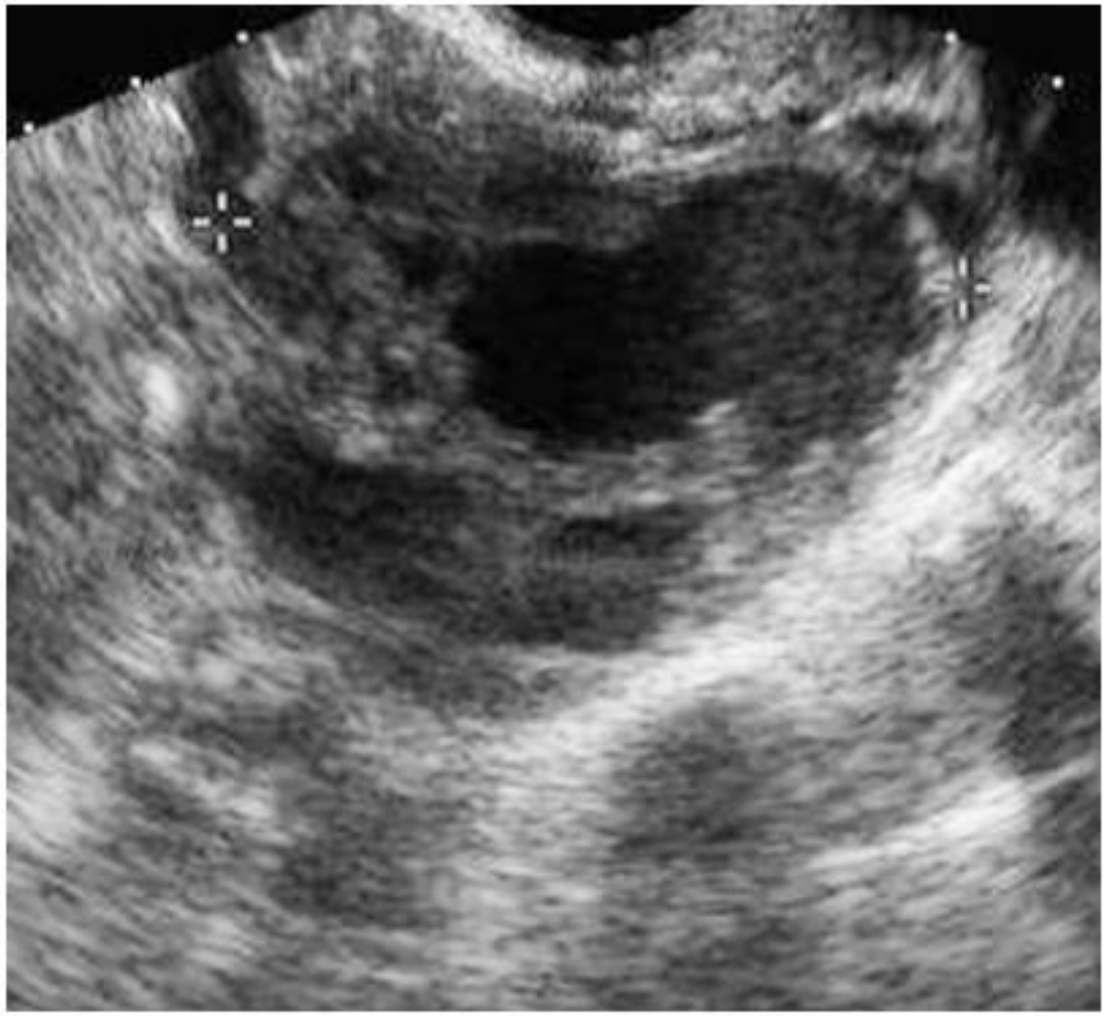
Oophoritis

PELVIC INFLAMMATORY DISEASE



Fluid in both cul-de-sacs

PELVIC INFLAMMATORY DISEASE



Tubo-ovarian abscess

PELVIC INFLAMMATORY DISEASE

Tubo-ovarian abscess

Endometriosis

- Defined as the presence of functional endometrial tissues outside the uterus. Implants may occur anywhere including:
  - Ovary
  - Fallopian tube
  - Broad ligament
  - Posterior cul-de-sac
  - Bowel and bladder

Endometriosis

- Risk factors include:
  - Family history of endometriosis
  - Early menarche
  - Short or long menstrual cycles
  - Heavy bleeding during menses
  - Parity (inverse relationship)
  - Uterine or tubal defects
  - Delayed childbearing

Endometriosis

- Clinical presentation:
  - *Dysmenorrhea*: painful periods
  - *Dyspareunia*: painful intercourse
  - *Dyschezia*: painful defecation
  - *Dysuria*: painful urination

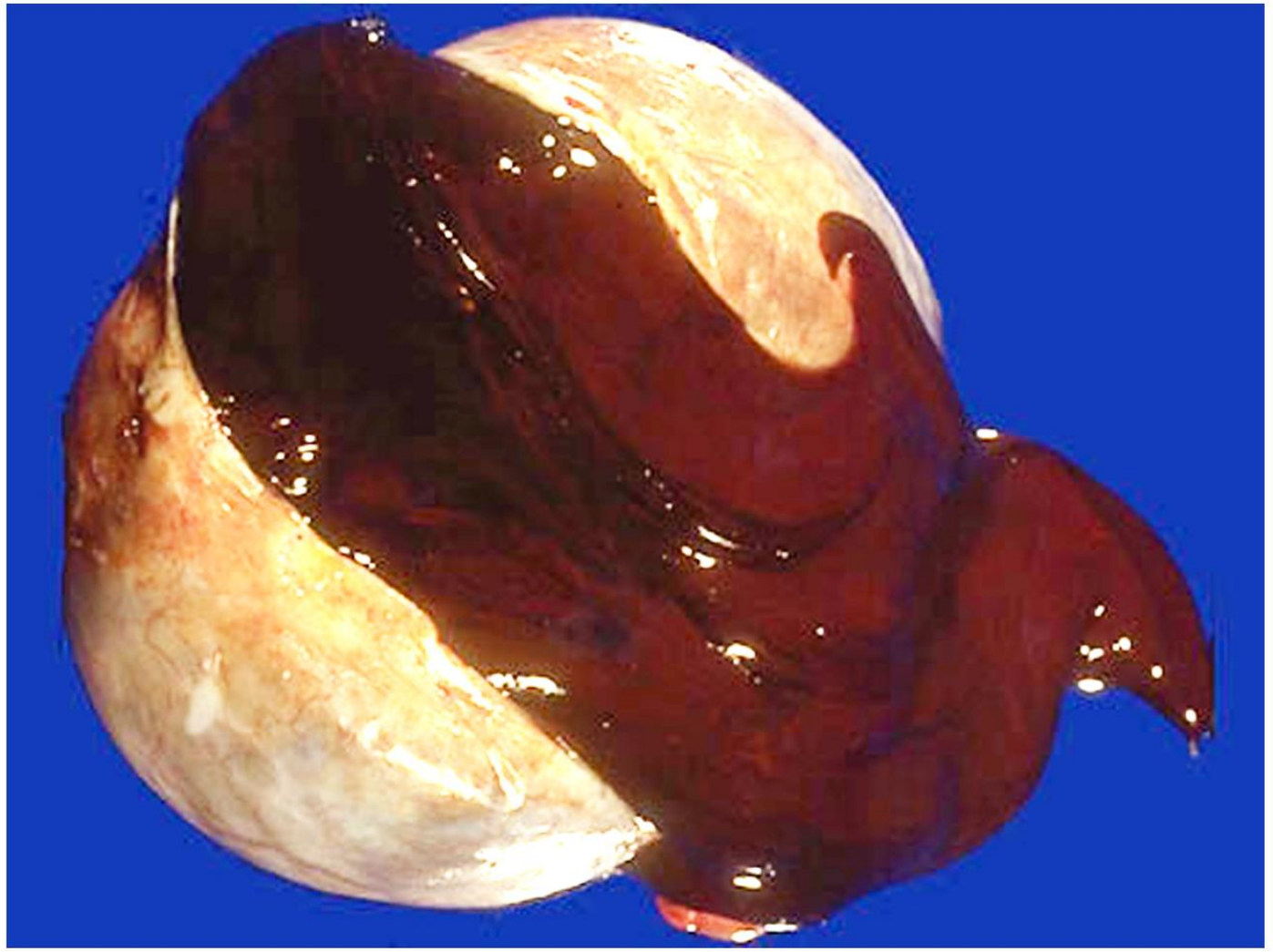
Endometriosis

- Other symptoms include:
  - Infertility
  - Heavy or irregular bleeding
  - Pelvic pain
  - Lower abdominal or back pain
  - Inguinal pain
  - Pain during exercise

Endometriosis

- Diagnosis
  - “Gold standard” – laparoscopic identification of implants
  - Histological confirmation of endometrial glands and stromata in a biopsy specimen
  - Sonography limited to identification of implants that have hemorrhaged
    - “Chocolate cysts”
    - Not useful in identifying implants

ENDOMETRIOSIS

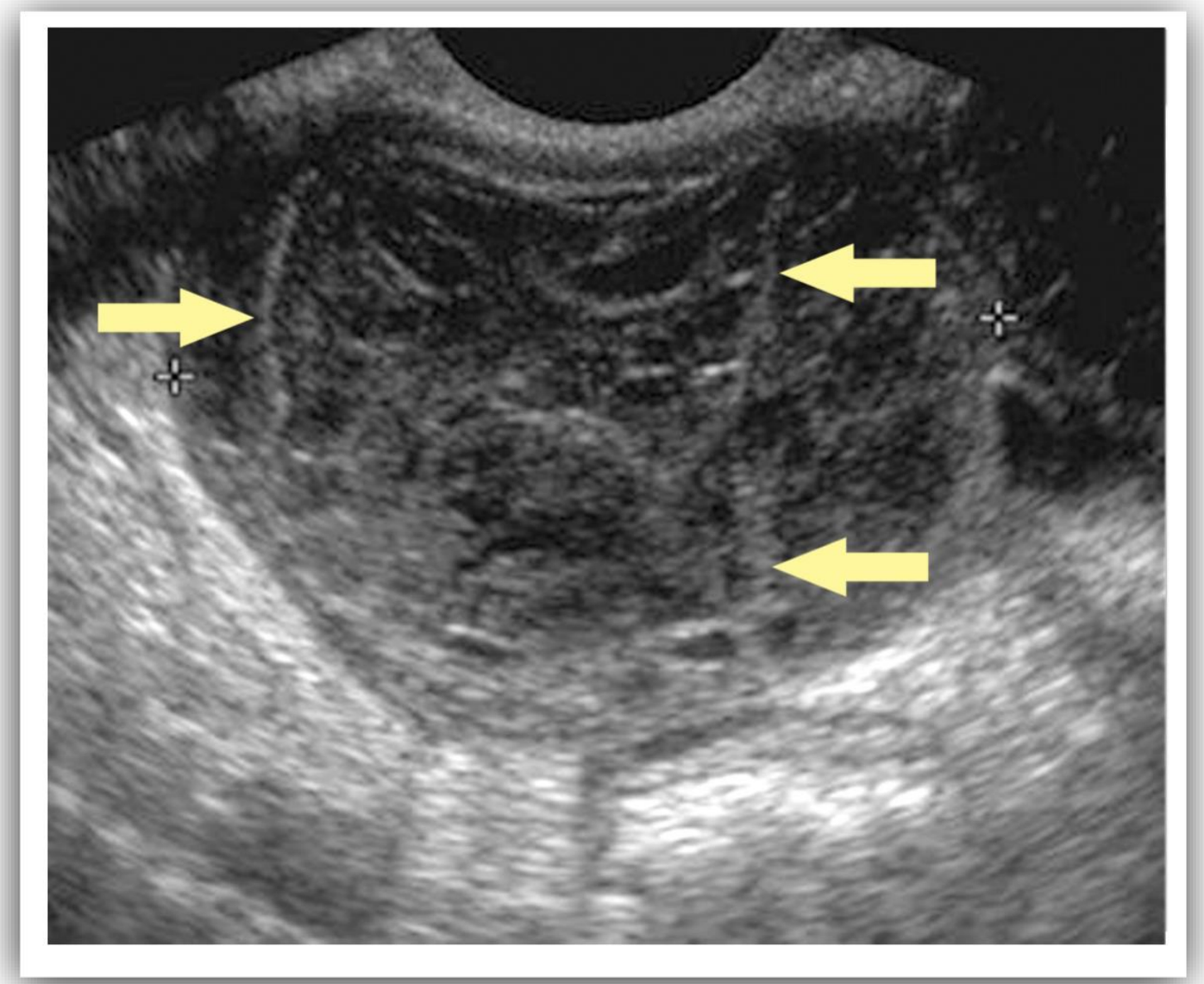


Chocolate cyst – gross pathology

Endometriosis

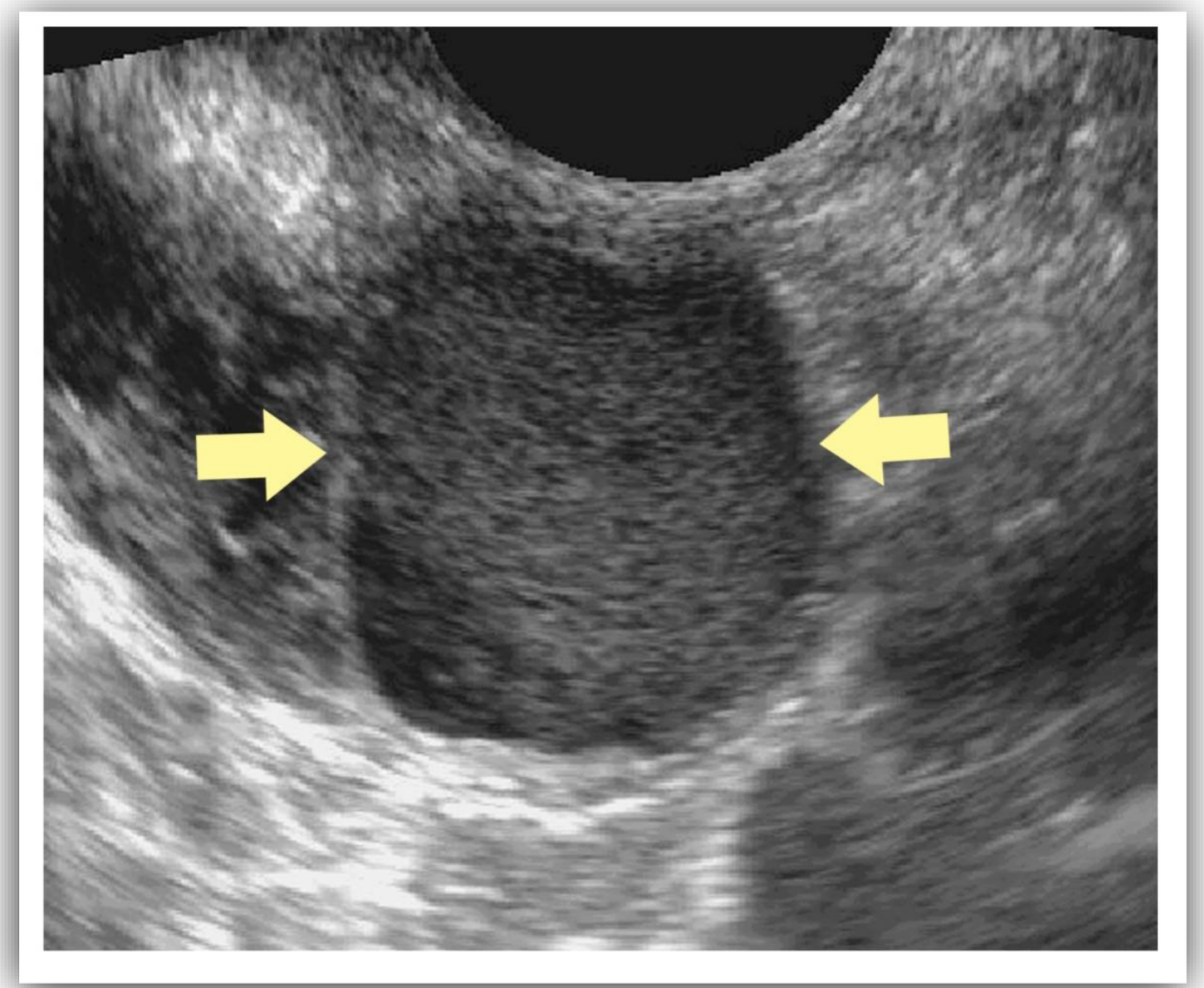
- Sonographic signs include:
  - Well-circumscribed cystic mass with posterior acoustic enhancement.
  - Lumen filled with low-level echoes (chocolate cyst)
  - May be unilocular or multilocular
  - May contain thin or thick septations
  - Mural nodules may be present

ENDOMETRIOSIS



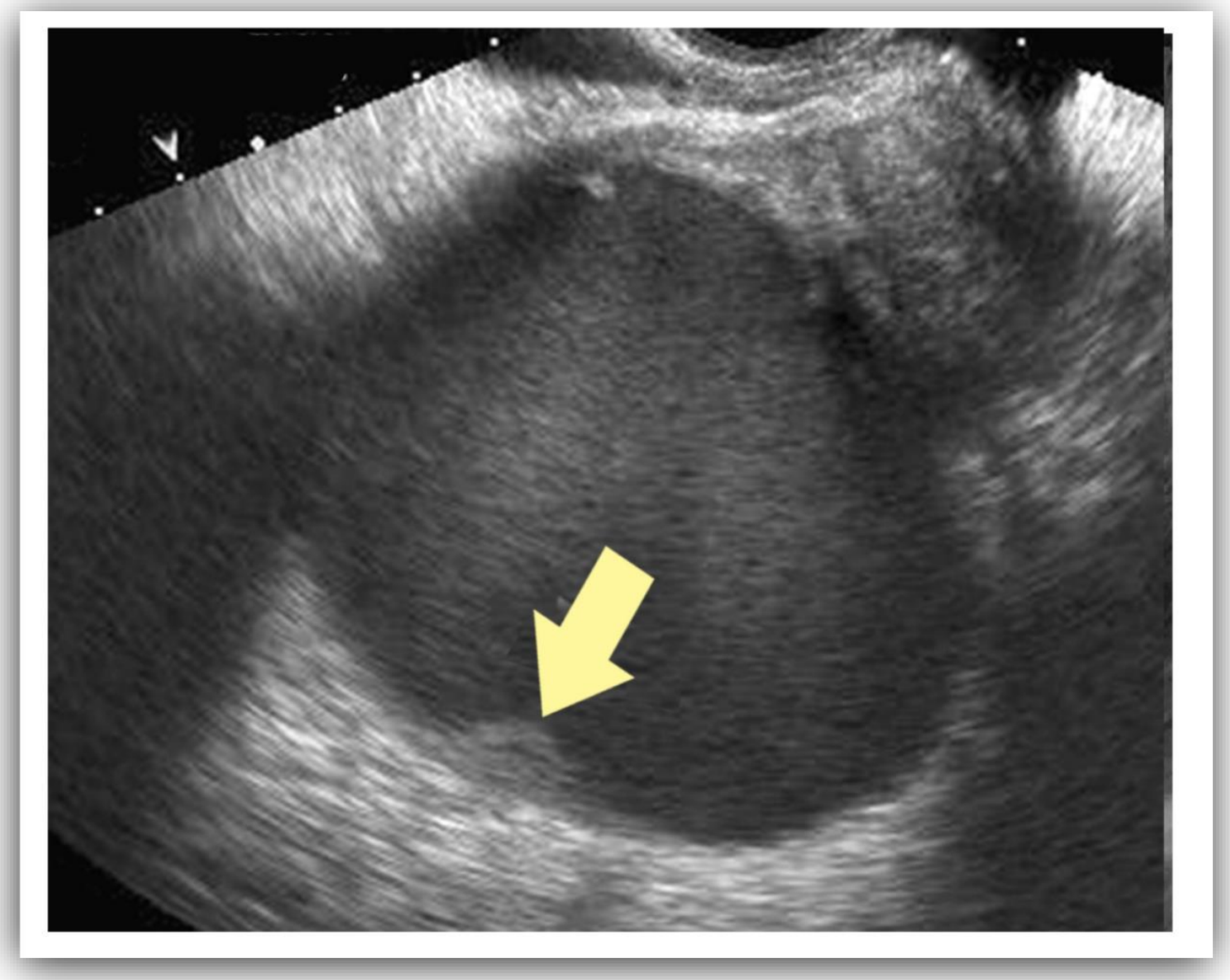
Internal septations

ENDOMETRIOSIS



Chocolate cyst

ENDOMETRIOSIS



Mural nodule

Ovarian Vein Thrombosis

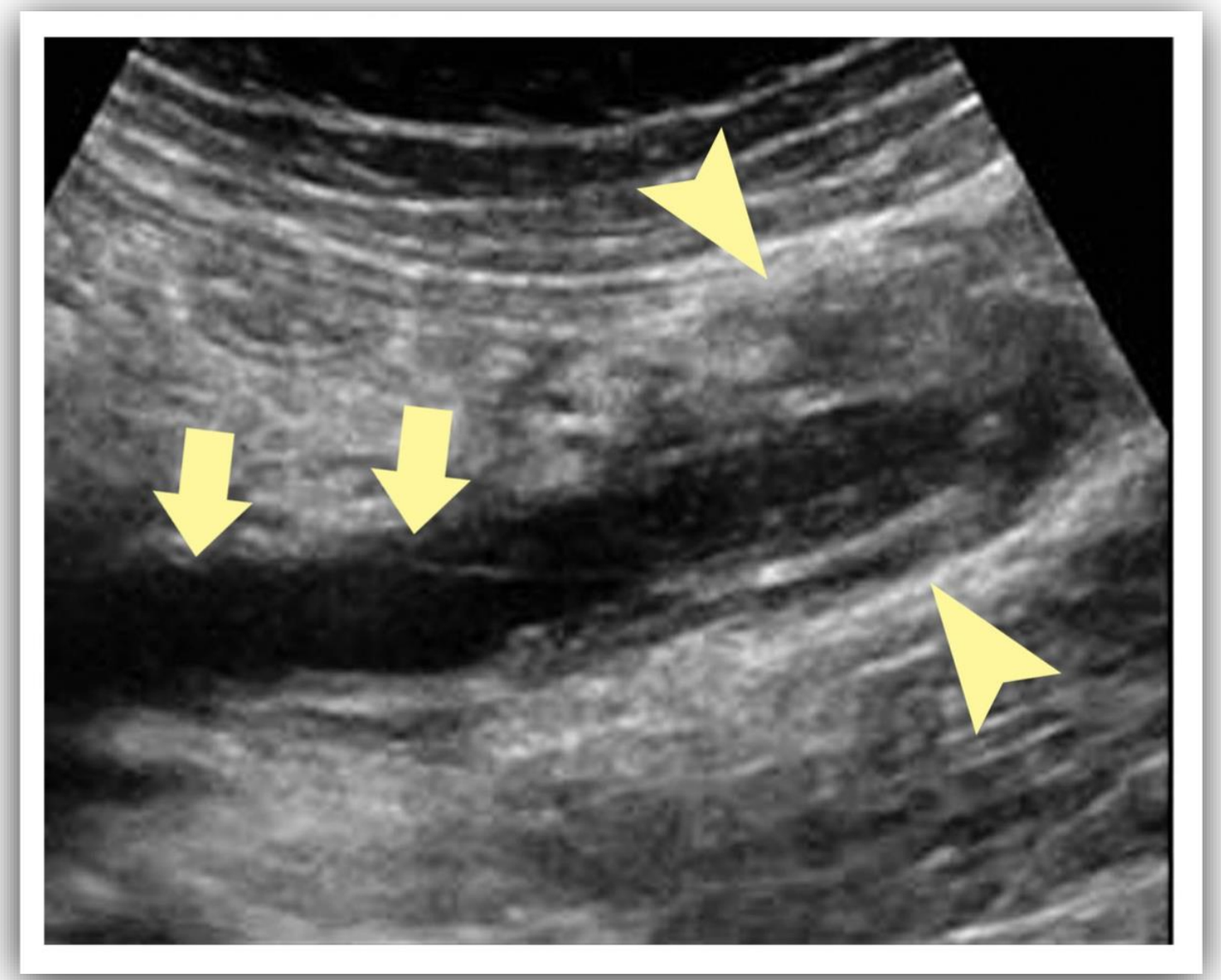
- Typically arises in the presence of Virchow's triad: Venous stasis, hypercoagulability, venous endothelial damage.
- Occurs on right side 80 - 90% of cases
- Clinical presentation:
  - Abdominal pain
  - Fever
  - Pulmonary embolism
  - Sepsis

Ovarian Vein Thrombosis

- Sonographic findings:
  - Tubular, hypoechoic, or anechoic mass in adnexa
  - Tortuous, tubular structure ascending from adnexa to the inferior vena cava
  - Low-mid levels echoes filling venous lumen
  - Absent blood flow with Doppler interrogation

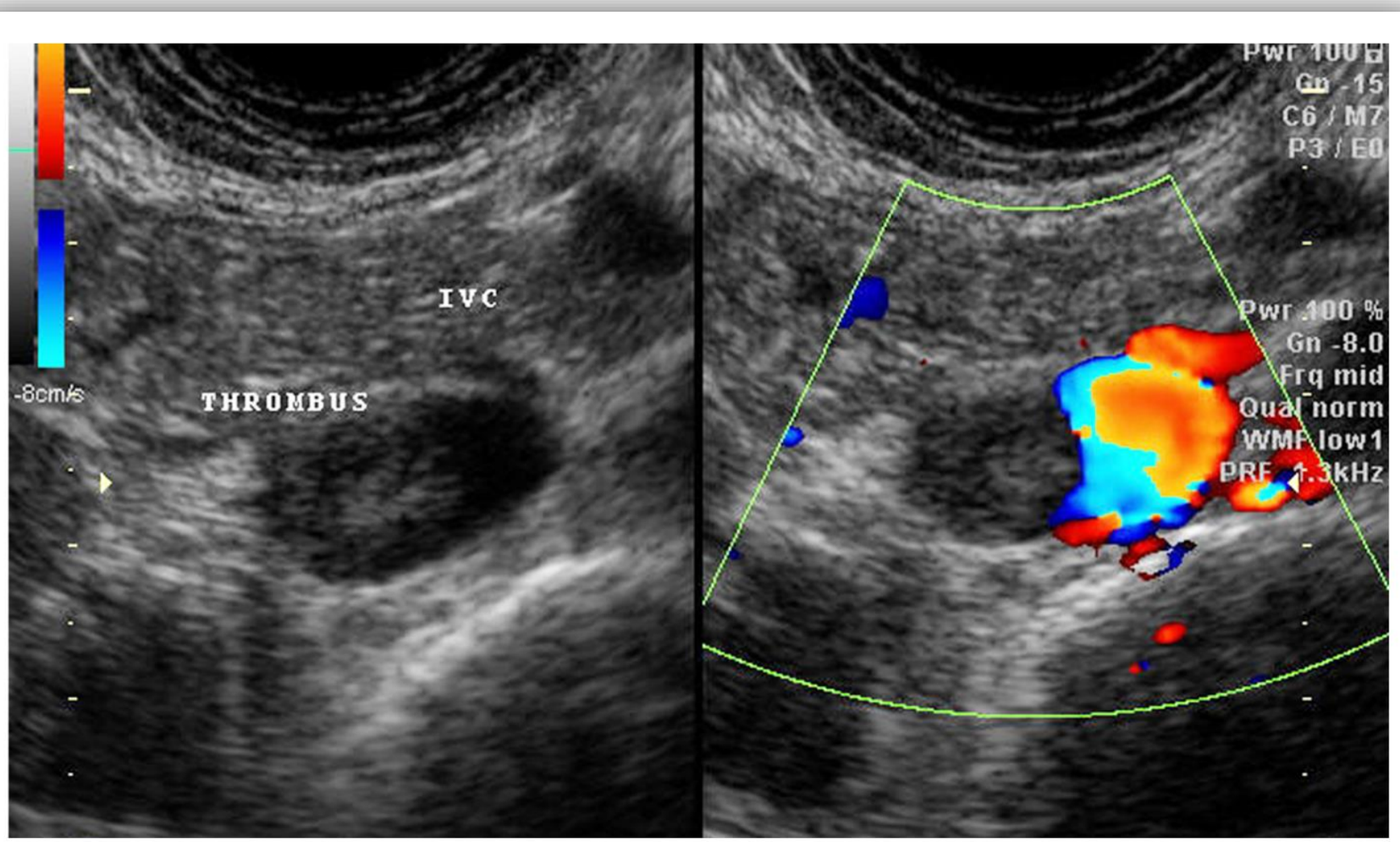
OVARIAN VEIN THROMBOSIS

Arrows = thrombosed vein
Arrowheads = ovary



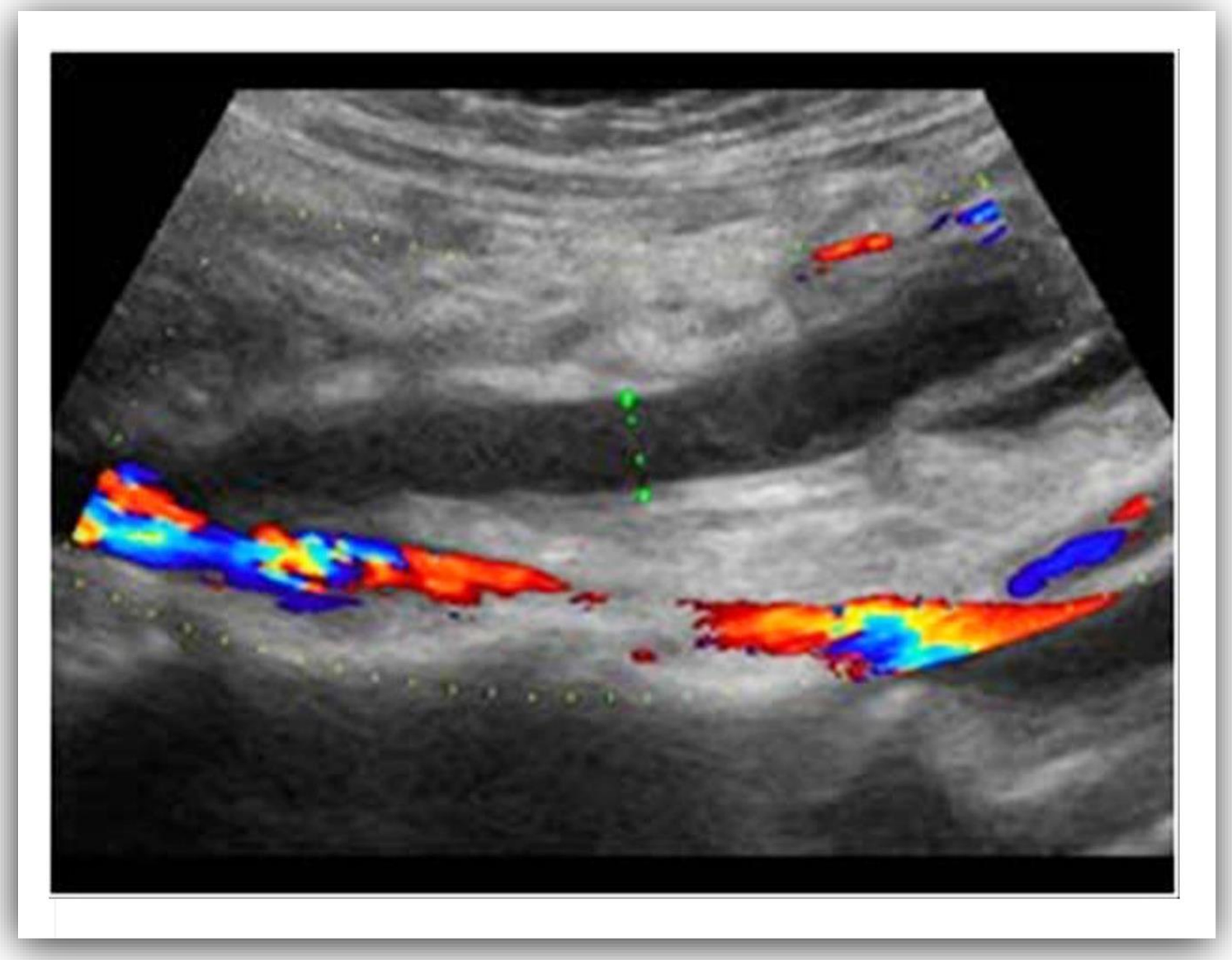
Tubular hypoechoic mass

OVARIAN VEIN THROMBOSIS



Echoes filling venous lumen

OVARIAN VEIN THROMBOSIS



Absent blood flow in vein
(+) flow in adjacent artery

OB GYN SONOGRAPHY REVIEW

Pelvic Pathology