OB GYN SONOGRAPHY REVIEW

Maternal Complications

Course Outline

- Incompetent cervix
- Maternal diabetes
- Hypertensive disorders of pregnancy
- Maternal TORCH infections
- Uterine rupture
- Coexisting masses
- **Antepartum/postpartum risks**
- The puerperium

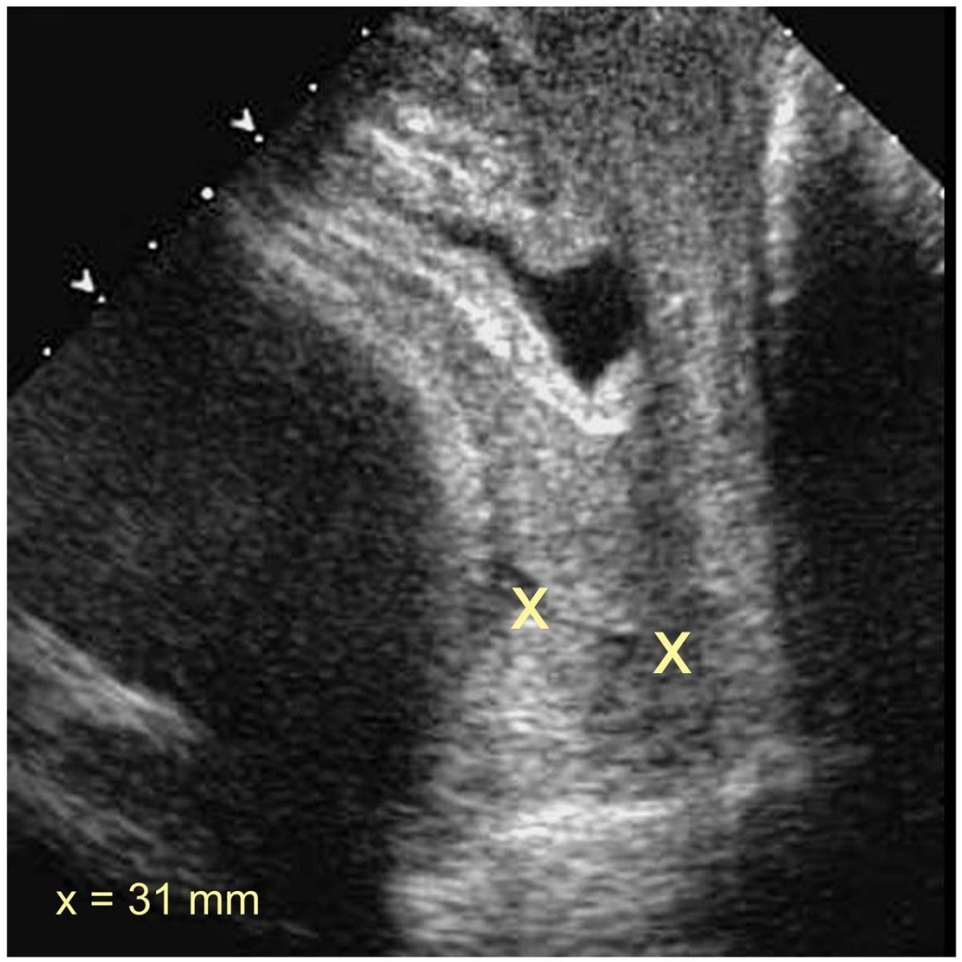
Incompetent Cervix

- Inability of the cervix to prevent expulsion of uterine contents
- Risk factors include:
  - Uterine anatomic abnormalities
  - Exposure to diethylstilbesterol (DES) FDA discontinued 1971
  - Prior cervical surgery or trauma
  - Previous preterm deliveries
  - Multifetal pregnancy

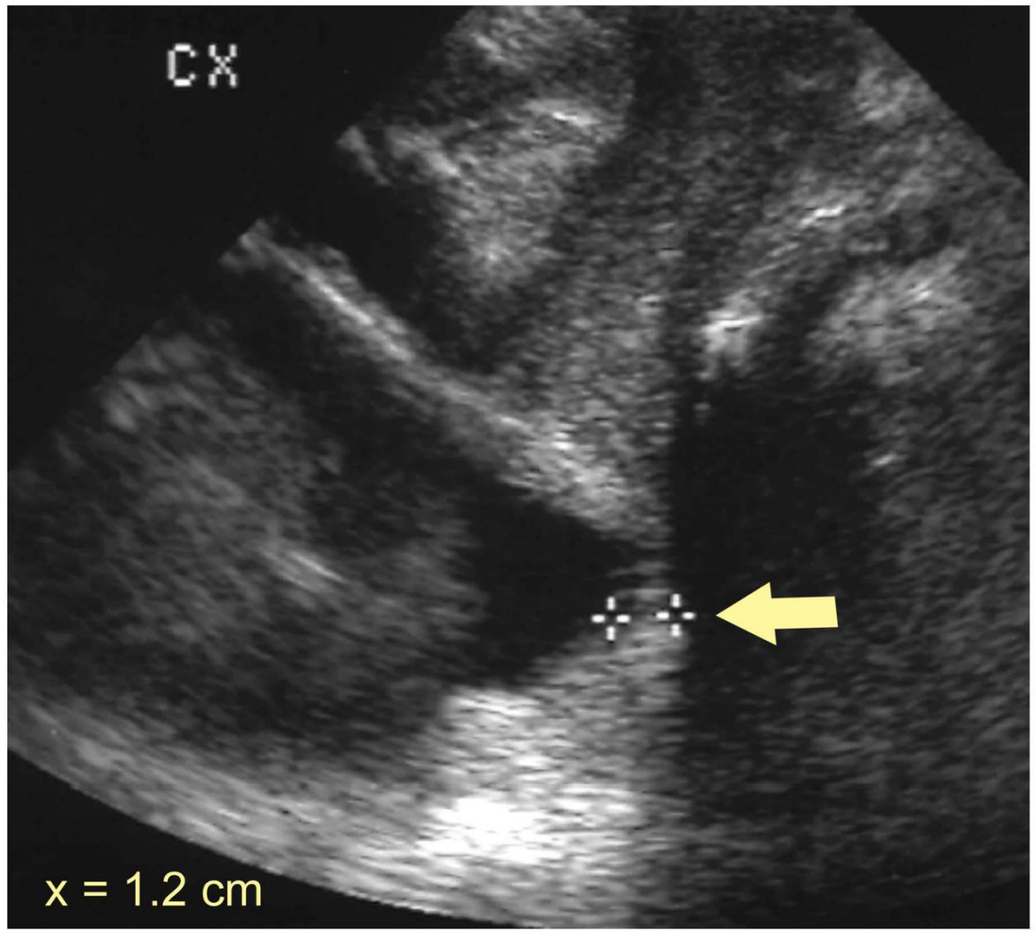
Incompetent Cervix

- Sonographic findings include:
  - Cervical ***length*** < 2.5 cm before 34 weeks
  - Cervical ***width*** > 2cm in 2nd trimester
  - Bulging cervical membranes
  - Bladder over-distention may cause false-negative results

INCOMPETENT CERVIX

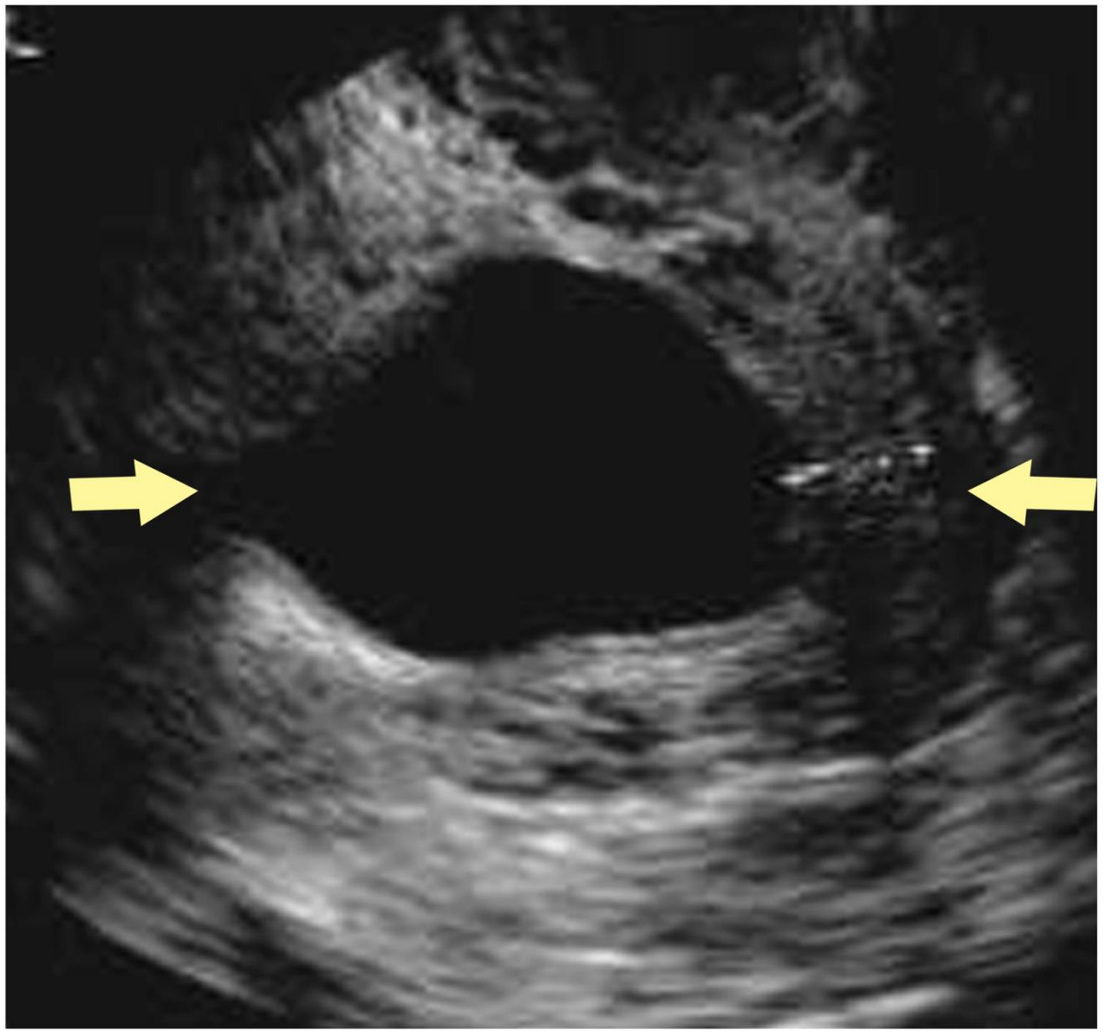


Normal cervical length



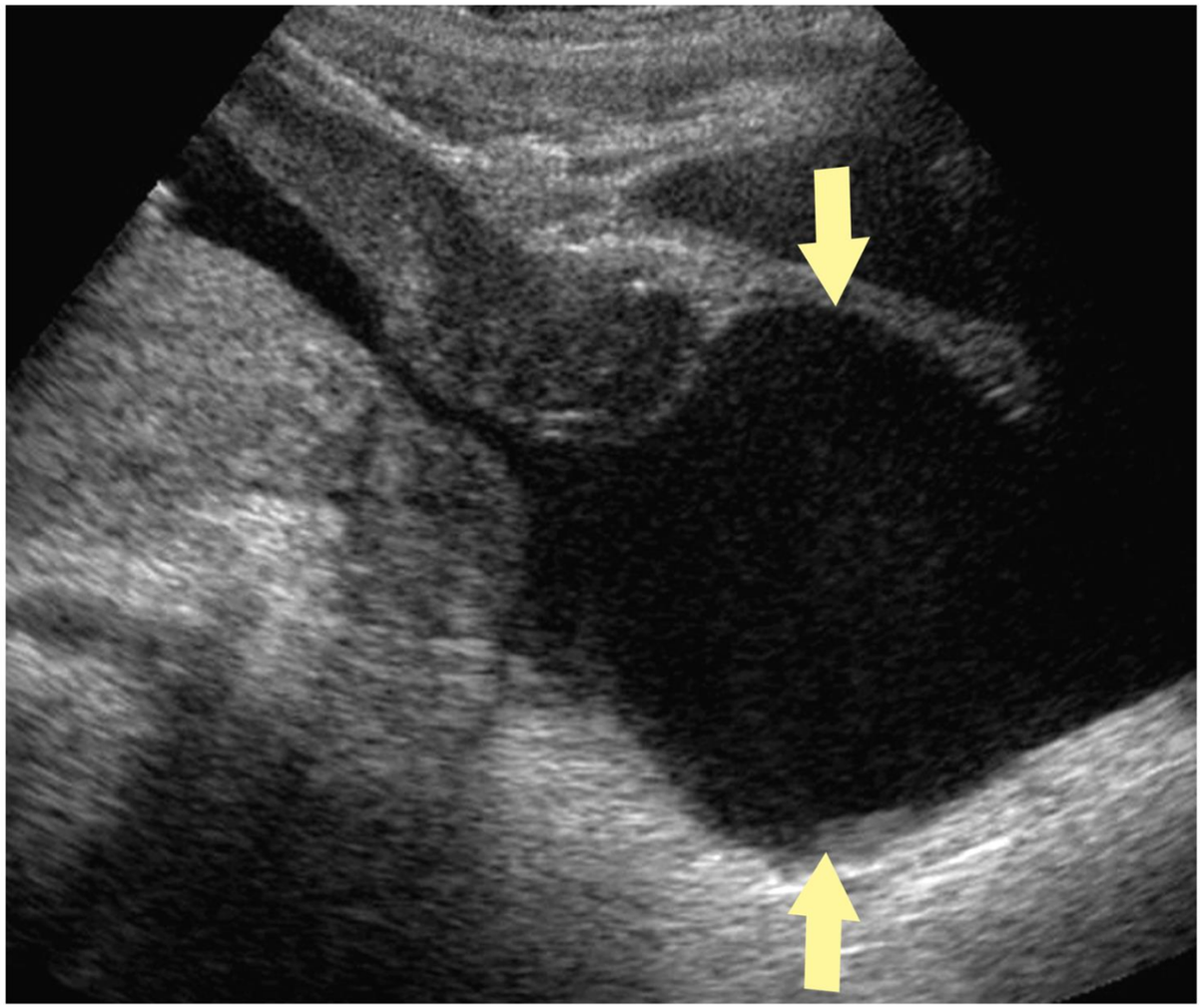
Diminished cervical length

INCOMPETENT CERVIX



Cervical width > 2 cm

INCOMPETENT CERVIX

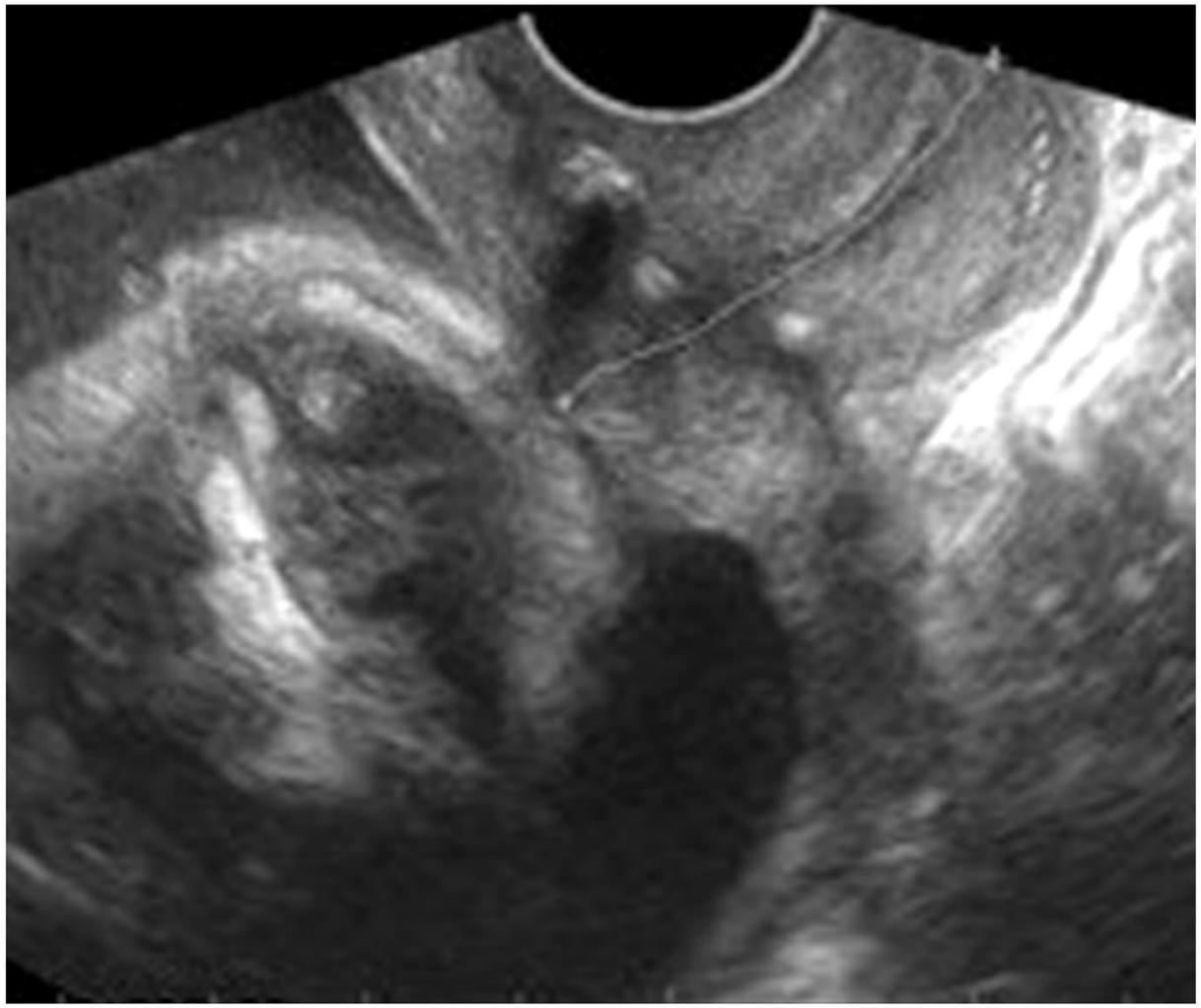


Bulging cervical membranes

Cervical Cerclage

- Surgical treatment of incompetent cervix
- Cervix is sutured, usually in a ring-like configuration to mechanically cinch the cervix
- Sutures removed toward end of pregnancy
- Sonographic findings:
  - Identification of interrupted, curvilinear, brightly echogenic foci in cervix representing sutures

INCOMPETENT CERVIX



Cervical cerclage

Maternal Diabetes

- Diabetes during pregnancy whether preexisting (*diabetes mellitus*) or pregnancy-induced (*gestational diabetes*) poses a significant risk to both mother and fetus

- Episodic maternal glucose surges induce episodic fetal hyperinsulinemia & may result in myriad structural, medical, and growth-related fetal abnormalities

- Maternal complications result from excess fetal growth and increased hemodynamic and metabolic burdens

Diabetes Mellitus (DM)

- Spectrum of disorders of carbohydrate, lipid, and protein metabolism
- May occur spontaneously (90%) or may be secondary to pancreatic, metabolic, or hormonal abnormalities
- Poorly managed pre-existing DM increases risk of fetal congenital abnormalities by 3 – 8 times

Diabetes Mellitus (DM)

- **Type I**
  - Results from insufficient insulin production by pancreas
  - Insulin dependent (IDDM)
  - Juvenile onset
- **Type II**
  - Metabolic disorder resulting from insulin resistance
  - Non-insulin dependent (NIDDM)
  - Adult onset

Gestational Diabetes

- Hormonal and metabolic changes associated with pregnancy can induce elevation of maternal glucose levels
  - Glucose intolerance of pregnancy (GIP) or gestational diabetes
- Typically resolves after delivery
- More commonly associated with fetal growth-related changes
  - Macrosomia
  - IUGR

Fetal Effects

Rule of Thumb

Preexisting DM → anatomic abnormalities

Gestational diabetes → growth related deviations

Fetal Effects

- Anatomic abnormalities include:
  - Caudal regression
  - Neural tube defects
  - Inguinal hernias
  - Club foot (*talipes equinovarus*)
  - Single umbilical artery
  - Renal anomalies
  - Gastrointestinal anomalies
  - Skeletal anomalies
  - Polydactyly

Fetal Effects

- Metabolic abnormalities include:
  - IUGR
  - Macrosomia
  - Hypoglycemia
  - Hypocalcemia

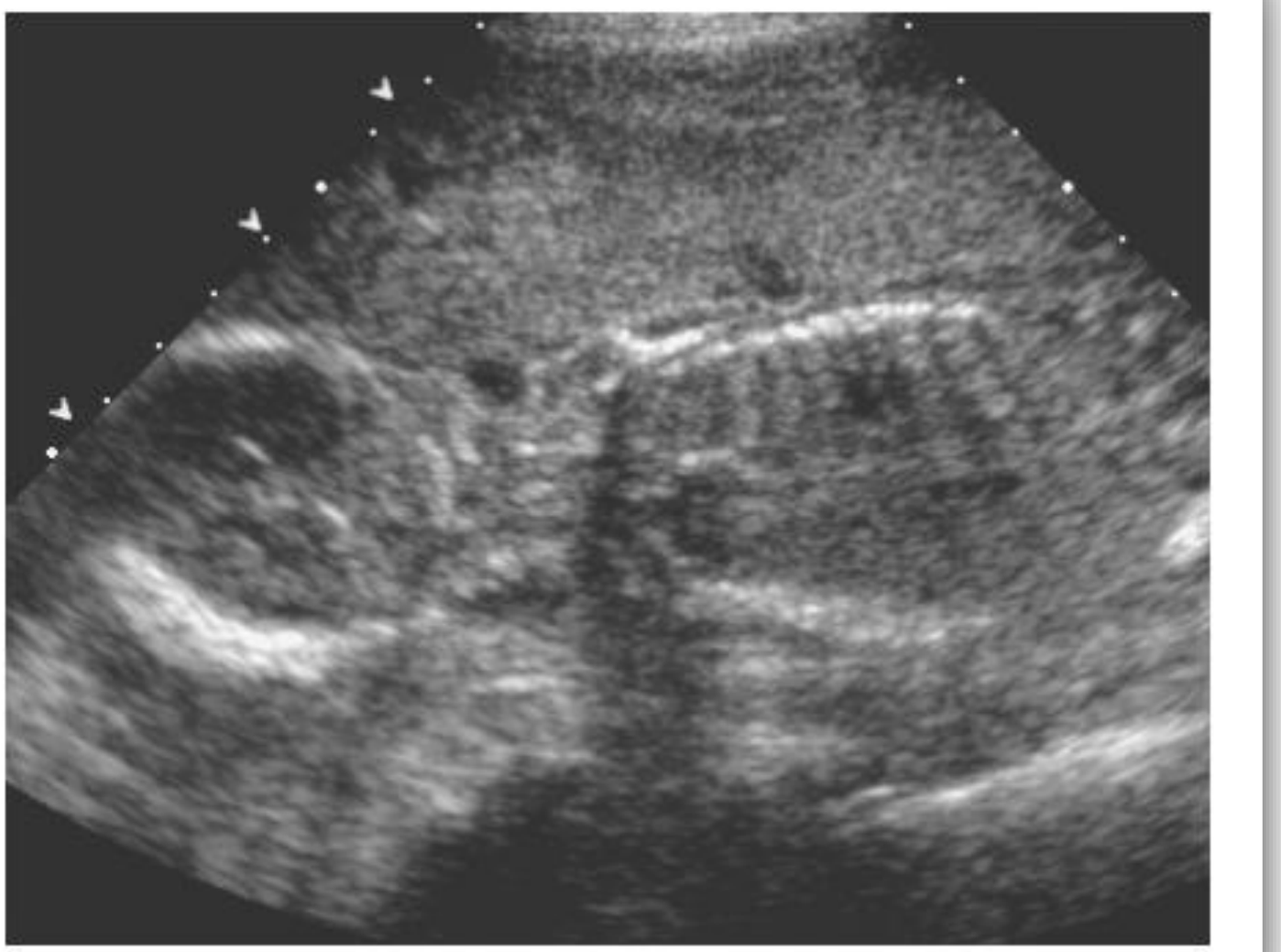
Maternal Effects

- Maternal complications include:
  - Macrosomic delivery problems, birth trauma
  - Pre-eclampsia
  - HELLP syndrome (*hemolysis, elevated LFTs, low platelets*)
  - Renal dysfunction (*diabetic nephropathy*)
  - Hypoglycemia
  - Peripheral vascular disease (*PVD*)

Role of Sonography

- Fetal anatomic abnormalities
  - Identification of specific anatomic abnormalities
  - Single umbilical artery
  - Oligo – or polyhydramnios
- Placental changes:
  - Thickened placenta
  - Premature aging
  - Doppler evidence of placental insufficiency
- Growth-related changes:
  - Macrosomia
  - IUGR

MATERNAL DIABETES



IUGR and oligohydramnios

MATERNAL DIABETES

Thickened placenta

HTN Disorders of Pregnancy

- Most common medical problem encountered in pregnancy (2 -3 % of all gestations)

- Categories of HTN in pregnancy:
  - Preexisting HTN: *chronic elevation of BP before pregnancy*
  - Gestational HTN: *begins after 20 weeks gestations*
  - Pre-eclampsia: (*see below)*

- Replace older term *pregnancy-induced hypertensive disorder (PIHD)*

HTN Definition

Blood Pressure Measurements		
	Systolic (mmHg)	**Diastolic** (mmHg)
Absolute value	140	90
Δ pre-pregnant state	> 30	> 15

Pre-eclampsia

- Underlying organic conditions make control of BP difficult
  - Placental insufficiency
  - Placental thrombosis
  - Trophoblastic invasion of endometrium
- Clinical characteristics:
  - HTN
  - Proteinuria
  - Generalized edema

Eclampsia

- Formerly called *toxemia of pregnancy*
- Uncontrolled pre-eclampsia can evolve into eclampsia
  - HTN
  - Proteinuria
  - Generalized edema
  - **Seizures**
  - **Coma**
  - **Death**

Pre-eclampsia

- Risk factors include:
  - Maternal age ≤ 18 years and ≥ 35 years
  - History of pre-eclampsia
  - Obesity
  - Preexisting diabetes
  - Multiple gestations
  - Gestational trophoblastic disease
  - Hydrops fetalis
  - Triploidy

HTN Disorders of Pregnancy

- Role of Sonography
  - Assess fetal growth (IUGR)
  - Oligohydramnios
  - Decreased placental volume
  - Accelerated placental aging
  - Increased placental resistance
  - Fetal demise

MATERNAL DIABETES

Fetal demise

Maternal TORCH Infections

- Any severe, systemic maternal infection may be transmitted to fetus and cause fetal complications

- **TORCH** is an acronym for the following diseases:
  - **T** oxoplasmosis
  - **O** ther infectious diseases
  - **R** ubella
  - **C** ytomegalovirus (CMV)
  - **H** erpes infections

Maternal TORCH Infections

- Complications include:
  - Spontaneous abortion (1st trimester)
  - Premature labor & delivery
  - IUGR
  - Fetal demise

Toxoplasmosis

- Caused by protozoa *toxoplasma gondii* commonly found in cat feces
- Sonographic findings include:
  - Ventriculomegaly/hydrocephalus
  - Microcephaly
  - Focal intracranial calcifications
  - Increased periventricular echogenicity
  - Periventricular cysts
  - Ascites
  - Hepatosplenomegaly
  - Severe IUGR

TOXOPLASMOSIS

Ventriculomegaly & periventricular cysts

Other - Parvovirus

- Common & highly contagious childhood ailment "*slapped cheek disease*"
- Fetal complications include:
  - Anemia
  - Hydrops fetalis
  - Cardiomyopathy
  - Spontaneous abortion (1st trimester)
  - Fetal demise

Other - Parvovirus

- Sonographic findings include:
  - Signs of fetal hydrops
  - Soft tissue/scalp edema
  - Pleural effusion
  - Ascites
  - Hepatosplenomegaly
  - Cardiomyopathy

PARVOVIRUS

Hydropic scalp edema

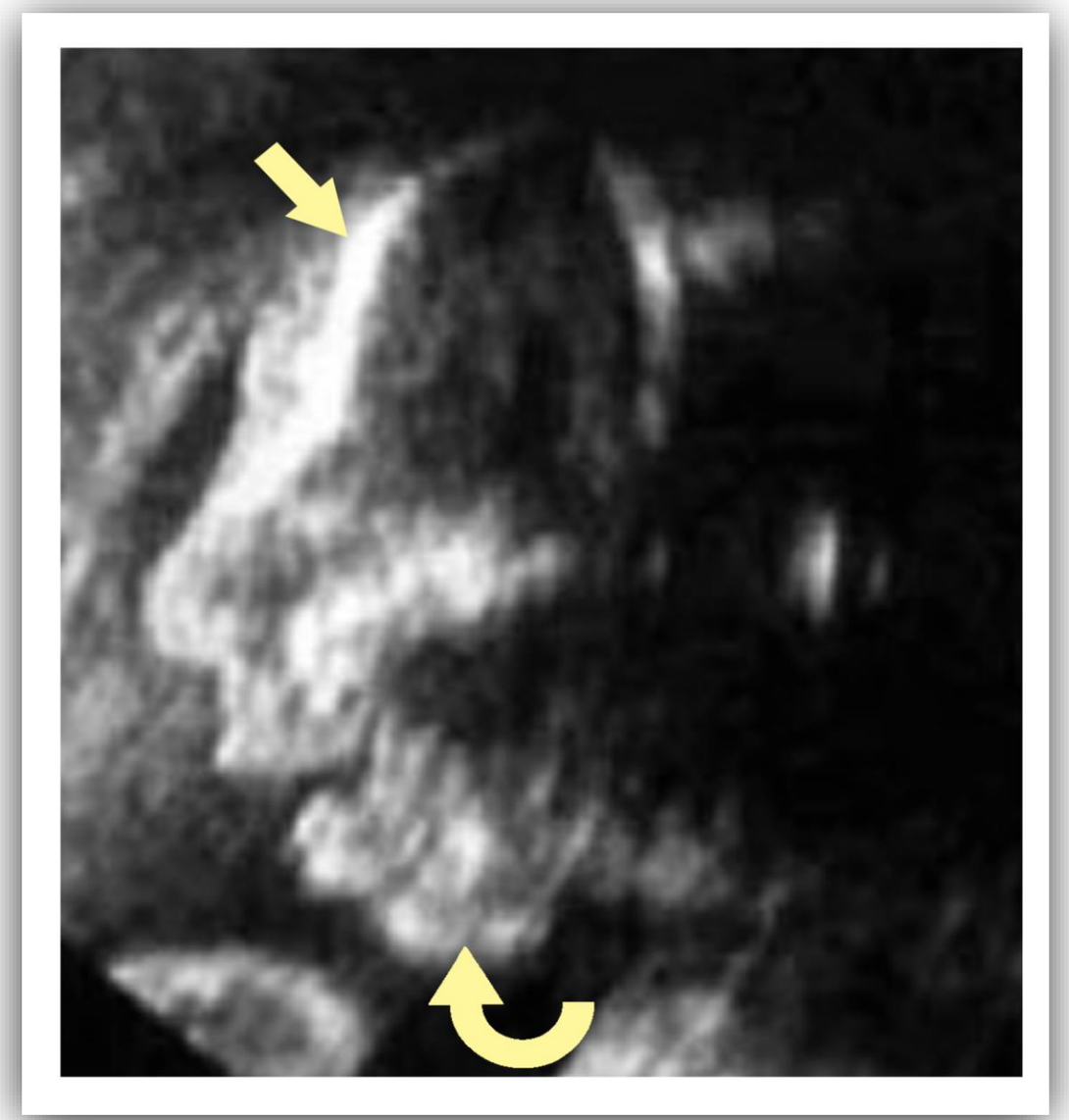
Rubella

- Also known as *German measles, in utero* infection is extremely teratogenic
- Classic triad of fetal complications:
  - Cataracts, retinopathy, microphthalmia
  - Congenital heart disease (esp. patent ductus arteriosus)
  - Deafness

Rubella

- Sonographic signs associated with rubella include:
  - Microcephaly
  - IUGR
  - Hepatomegaly
  - Micrognathia (*small mandible*)

RUBELLA



Microcephaly & micrognathia

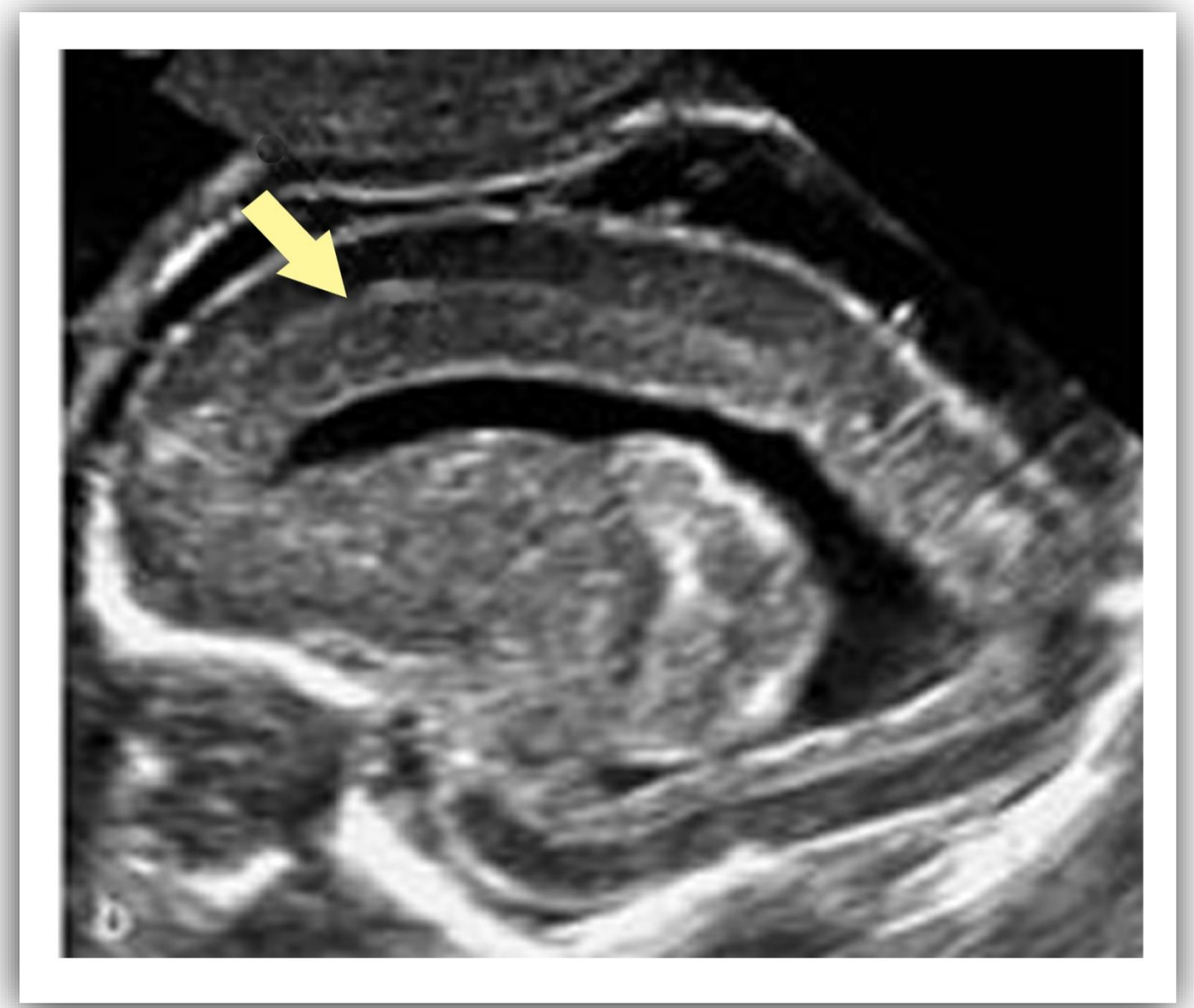
Cytomegalovirus

- Ubiquitous herpes family virus that produces few symptoms in immunocompetent individuals
- *In utero* exposure may result in:
  - Spontaneous abortion (1st trimester)
  - IUGR
  - Abdominal abnormalities (*ascites*, *hepatomegaly*, *splenomegaly*)
  - CNS abnormalities (*microcephaly*)

Cytomegalovirus

- Sonographic signs associated with CMV include:
  - **Increased periventricular echogenicity**
  - **Ventriculomegaly**
  - Ascites
  - Hepatomegaly, splenomegaly
  - Enlarged cisterna magna
  - Lissencephaly (“smooth brain” – absent normal cortical convolutions)
  - Cerebellar cysts

CYTOMEGALOVIRUS



Increased periventricular echogenicity

CYTOMEGALOVIRUS

Ascites & hepatomegaly

Herpes

- Herpes simplex type 2 is rarely transmitted *in utero*
- Transmitted during vaginal delivery may result in neonatal manifestations:
  - Neonatal encephalitis
  - Seizures
  - Psychomotor retardation
  - Spasticity
  - Blindness
  - Learning disabilities
  - Postnatal death

Herpes

- Sonographic signs associated with in utero exposure include:
  - Asymmetric ventriculomegaly
  - Increased cerebral parenchymal echogenicity

Uterine Rupture

- Rare but potentially catastrophic obstetric emergency
- Increased intrauterine pressure may cause dehiscence of previous c-section scar
- Communication between uterine cavity and peritoneal cavities may result in massive hemoperitoneum
- Clinical signs:
  - Acute uterine pain
  - Hemodynamic instability

Uterine Rupture

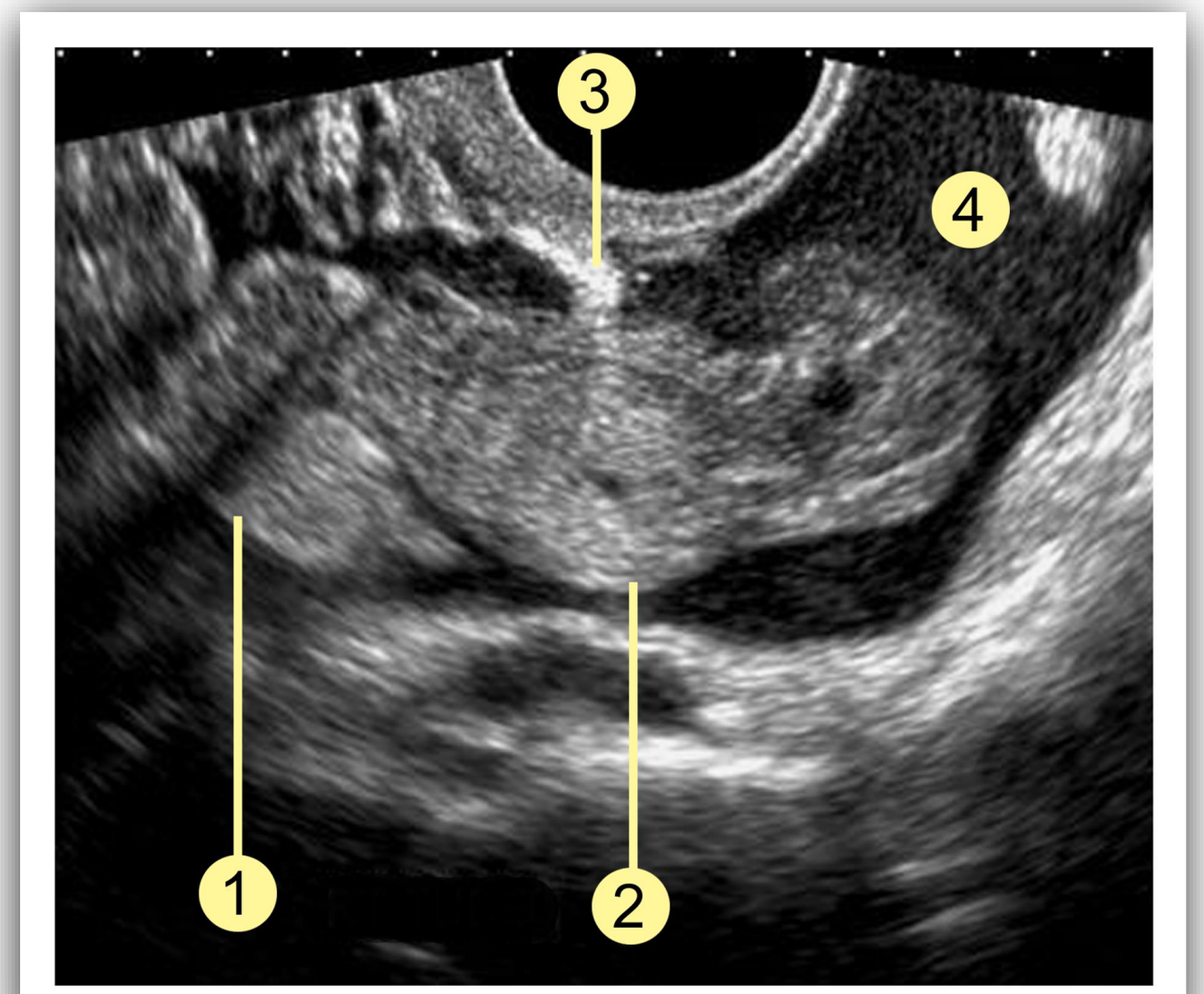
- Maternal complications include:
  - Hemorrhage
  - Shock
  - Postoperative infection
  - Ureteral damage
  - Amniotic fluid embolism
  - Disseminated intravascular coagulopathy (DIC)
  - Maternal and/or fetal death

Uterine Rupture

- Sonographic findings include:
  - Oligohydramnios
  - Large amount of peritoneal fluid (hemoperitoneum)
  - Extrauterine hematoma
  - Identification of a protruding portion of amniotic sac

UTERINE RUPTURE

1 = twin A
2 = twin B
3 = rupture site
4 = hemoperitoneum



Uterine rupture in complicated twin pregnancy

Coexisting Masses

- The presence of a mass sharing the pelvic cavity with a pregnancy

- Complications related to size, location and histopathologic nature of mass and include:
  - Hemodynamic shunting of blood away from gravid uterus
  - Interference with normal vaginal delivers (*dystocia*)
  - Malignant masses present clinical concerns, i.e., timing of oncological treatment and/or termination of pregnancy

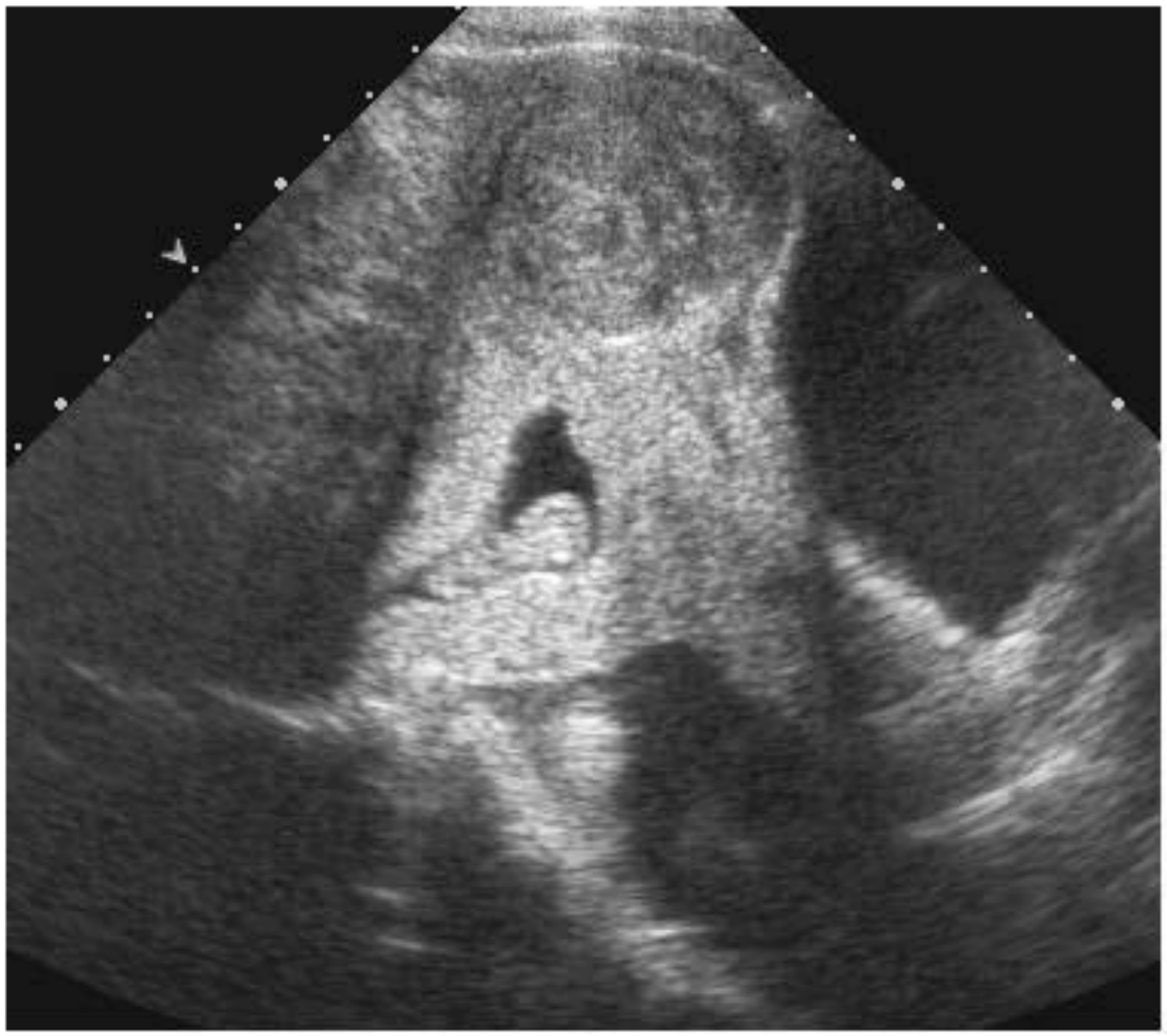
Types of Masses

- The most frequently identified coexisting masses include:
  - Fibroids (*myomata*)
  - Ovarian cysts
  - Malignancies (very uncommon < 0.07%)
  - Solid masses such as:
    - Pelvic kidney
    - Wandering spleen
    - Nongravid horn of a bicornuate uterus
    - Fecal-filled colon

Fibroids

- Common, benign uterine masses
- May increase in size during pregnancy due to hormones of pregnancy
- May cause fetal malpresentation, dystocia
- Sonographic findings include:
  - Hypoechoic mass distorting normal uterine contours
  - Sonolucent center associated with degeneration
  - May be confused with myometrial contraction

COEXISTING MASSES



Anterior uterine wall myoma

Ovarian Cysts

- Two types of cysts are frequent findings in pregnancy
  - Corpus luteum (*regresses by 16 – 18 weeks*)
  - Theca lutein cysts (*GTD and OHSS*)
- Other types include:
  - Benign cystadenomas
  - Benign cystic teratomas

Ovarian Cysts

- Sonographic findings include:
  - Presence of a cystic mass in the adnexa
  - May be simple, septated, or complex
  - Possible distortion of uterine contour

COEXISTING MASSES

Theca lutein cyst

Other Masses

- Possibilities include:
  - Pelvic kidney
  - Wandering spleen
  - Nongravid horn of a bicornuate uterus
  - Fecal-filled colon

COEXISTING MASSES

Nongravid horn of a bicornuate uterus

Antepartum/Postpartum Risks

Antepartum/Postpartum Risks

- Fetal position
- Preterm delivery
- Premature rupture of membranes (PROM)
- The Puerperium

Fetal Position

- Position of the fetus relative to the maternal pelvis
- *Fetal lie:* relationship of long axis of fetus to long axis of mother
  - Longitudinal: long axis of fetus parallel to long axis of mother
  - Transverse: long axis of fetus horizontal to long axis of mother
  - Oblique: long axis of fetus at an angle to long axis of mother

FETAL LIE

Longitudinal lie

Transverse lie

Fetal Position

- *Fetal presentation:* part of fetus expected to be delivered first
  - Cephalic: longitudinal lie with head in maternal pelvis
    - Vertex: parietal bones presenting
    - Face: chin and nose presenting
    - Brow: forehead presenting
  - Shoulder: 4 types based on location of scapula
  - Breech: fetal head in fundus of uterus
    - Complete: thighs flexed, lower extremities flexed
    - Frank: thighs flexed, lower legs extended
    - Footling: hips extended, foot or feet presenting

FETAL PRESENTATION

Cephalic presentation

FETAL PRESENTATION

Complete Breech

Frank Breech

Footling Breech

Preterm Delivery

- Spontaneous delivery before 37 weeks gestation
- Clinical factors associated include:
  - Previous uterine surgery
  - Uterine anomalies
  - Maternal stress
  - Multiple gestations
  - Polyhydramnios
  - Antepartum bleeding (*from previa, abruption*)
  - Systemic infection
  - Idiopathic factors

Preterm Delivery

- Methods used to assess those at risk:
  - Visual/digital cervical examination
  - Monitoring uterine activity measure by tocodynamometer (external monitoring device)
  - Lab tests
  - Sonographic evaluation of cervical length (< 2.5cm suggesting risk for preterm delivery)

Premature Rupture of Membranes (PROM)

- Spontaneous rupture of membranes prior to onset of labor
- Prior to 37 weeks: *preterm premature rupture of membranes* (PPROM)
- Prior to 26 weeks: increased risk of fetal demise and pregnancy loss
- Cause of ≈ 33% of preterm deliveries

Premature Rupture of Membranes (PROM)

- Complications include significant perinatal morbidity including:
  - Fetal respiratory distress syndrome (RDS)
  - Neonatal sepsis
  - Umbilical cord prolapse
  - Placental abruption
  - Fetal death

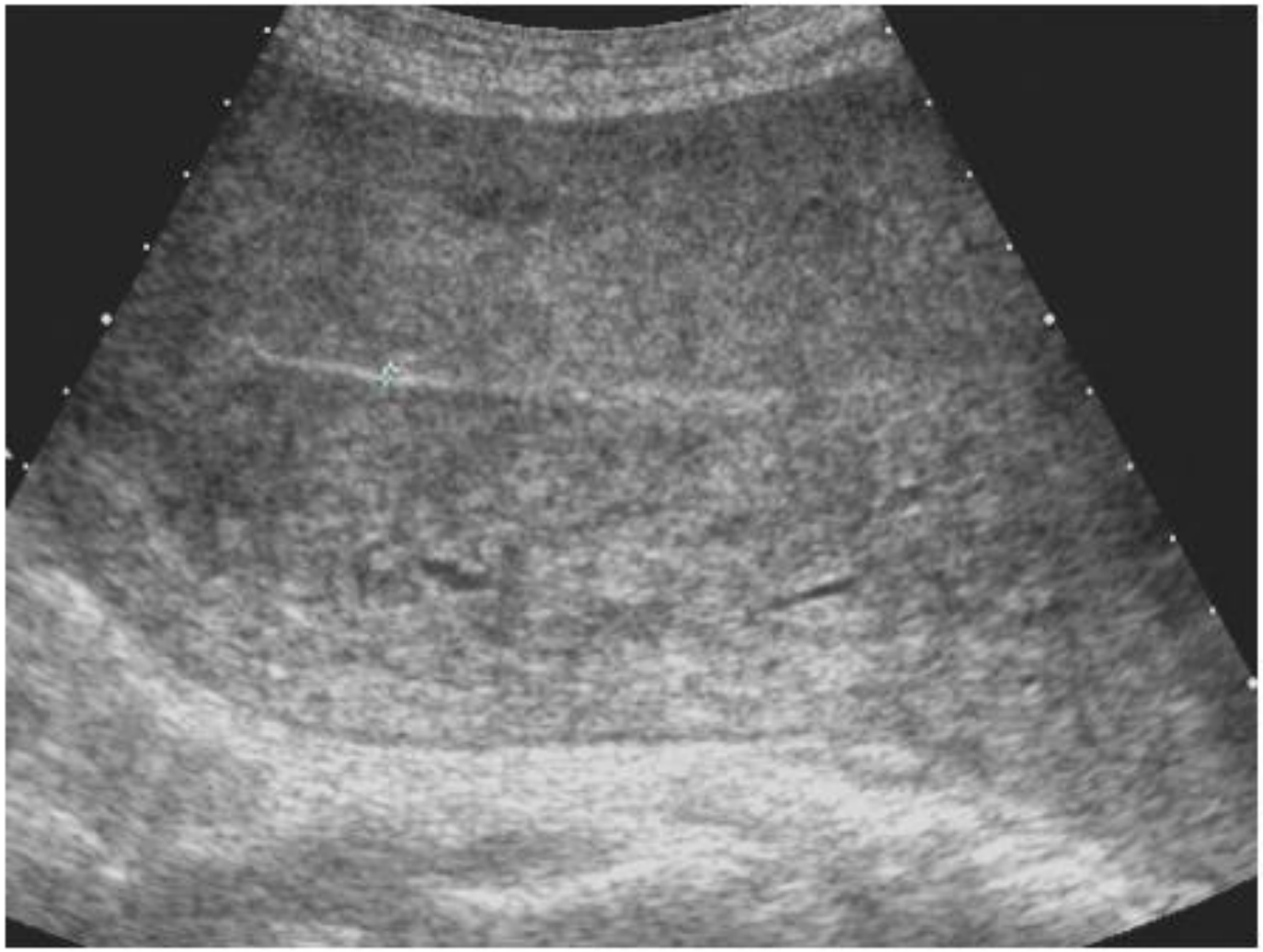
The Puerperium

- Period after delivery that begins with expulsion of placenta and ends when maternal anatomy & physiology return to normal nonpregnant state
- Indications for US include:
  - Retained products of conception (RPOCs)
  - Postpartum hemorrhage
  - Postsurgical hematomas
  - Abscesses
  - Ovarian vein thrombosis

Normal Anatomy

- Uterus appears large and boggy following delivery (*vaginal or c-section*)
- Should return to normal size by 6 weeks postpartum (*involution*)
- Sonographic findings include:
  - Large, hypoechoic uterus with irregular contours
  - Fluid identified in EC representing residual blood
  - Varying shape and position
  - Possible open internal cervical os

POSTPARTUM ANATOMY



Large, hypoechoic uterus

POSTPARTUM ANATOMY

Residual blood in uterine cavity

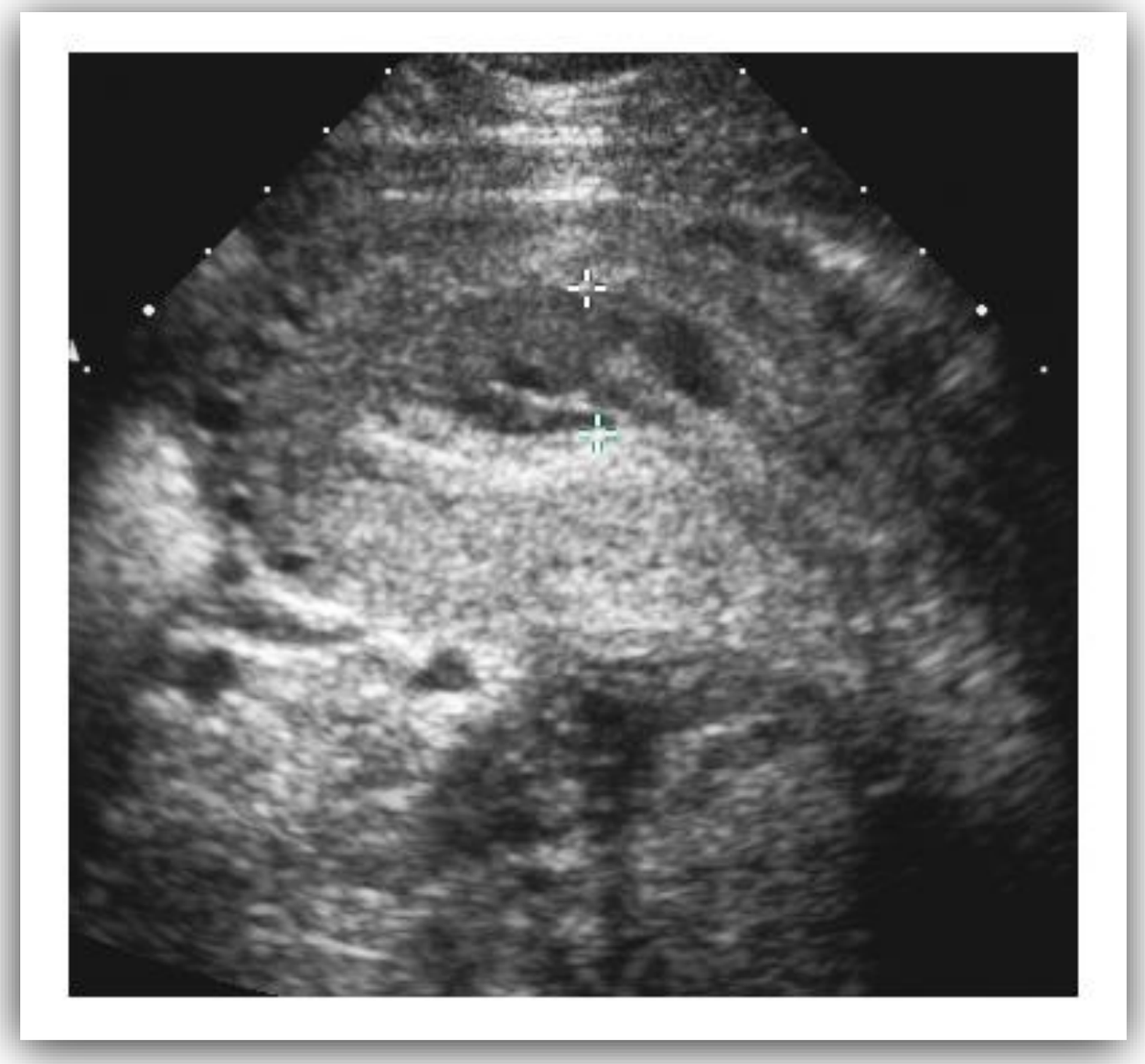
Primary Postpartum Hemorrhage

- Bleeding that occurs in the 1st 24 hours after delivery
- Associated clinical problems include:
  - Coagulopathies
  - Chorioamnionitis
  - Abnormal placental implantation (*previa*, *accreta*)
  - Bilobed placenta
  - Retained placenta

Secondary Postpartum Hemorrhage

- Bleeding that occurs > 24 hours after delivery
- Cause is usually RPOCs
- Sonographic signs include:
  - Fluid-filled uterine cavity in patient with active bleeding
  - Echogenic masses in uterine cavity
  - Doppler evidence of retained placental tissue

POSTPARTUM HEMORRHAGE

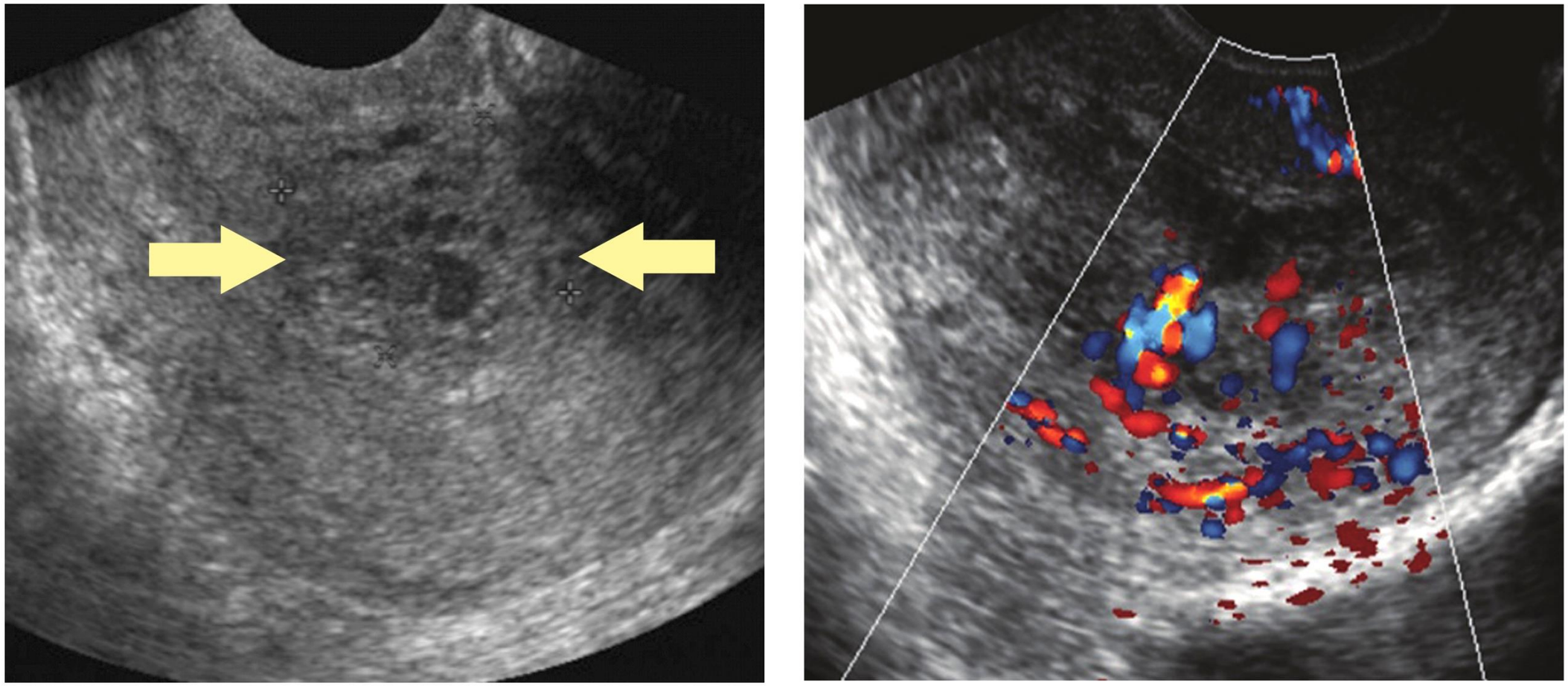


Hematoma in uterine cavity

POSTPARTUM HEMORRHAGE

Echogenic mass in uterine cavity

POSTPARTUM HEMORRHAGE



Postpartum RPOCs

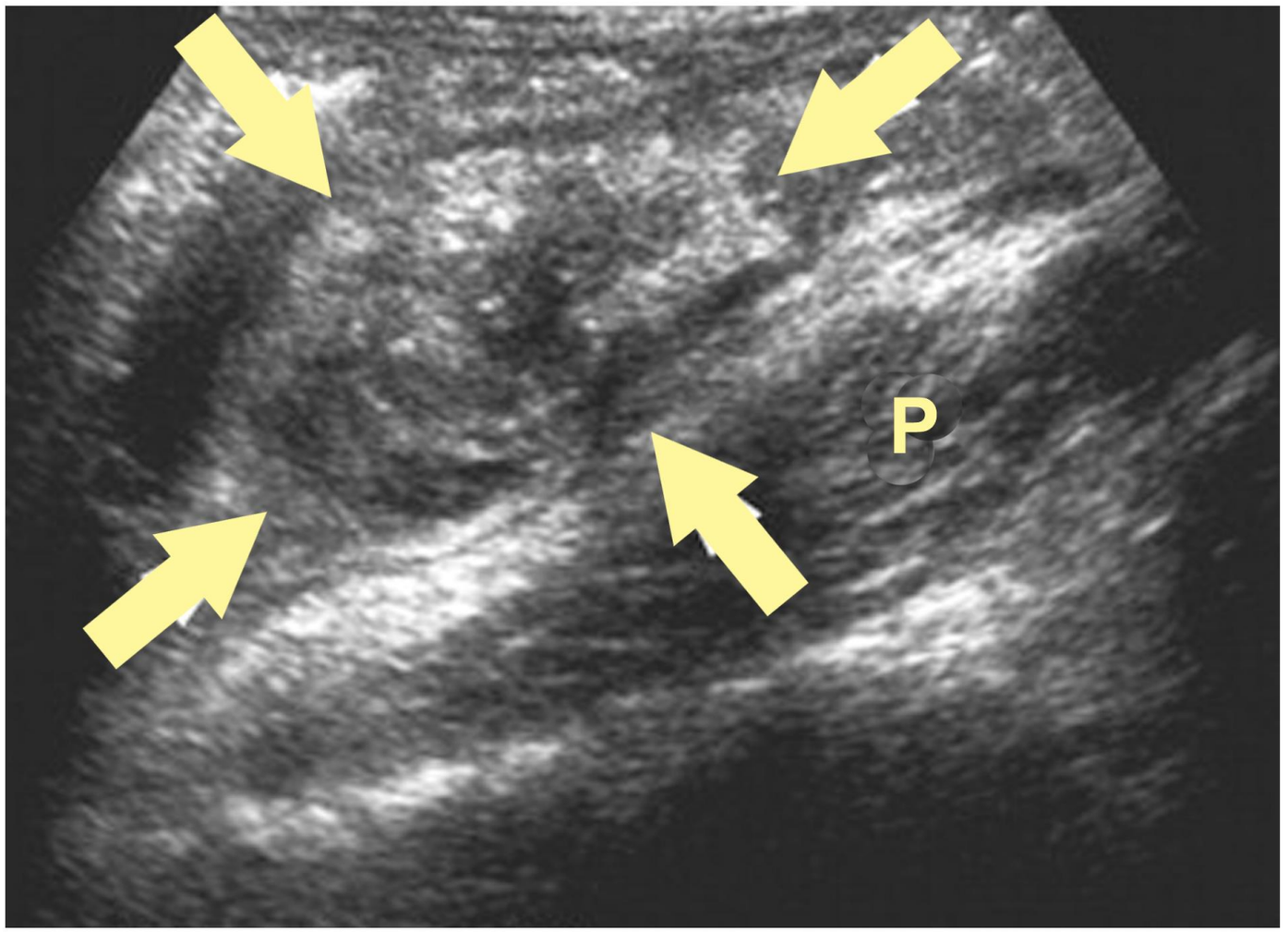
Puerperal Infection

- Infection suspected when patient temp > 100.4º F or 38º
- Clinical signs and symptoms include:
  - Fever
  - Elevated WBCs
  - Uterine tenderness
- Sonography plays little role in diagnosis

Puerperal Abscess

- Persistent puerperal infections may result in localized collection of pus and fluid
- May be located anywhere in pelvic cavity
- More common after c-section delivery
- Sonographic findings include:
  - Complex or anechoic fluid collections anywhere in pelvis
  - Presence of internal debris
  - Acoustic shadowing when gas bubbles present

PUERPERAL ABSCESS



Arrows = abscess
P = psoas muscle

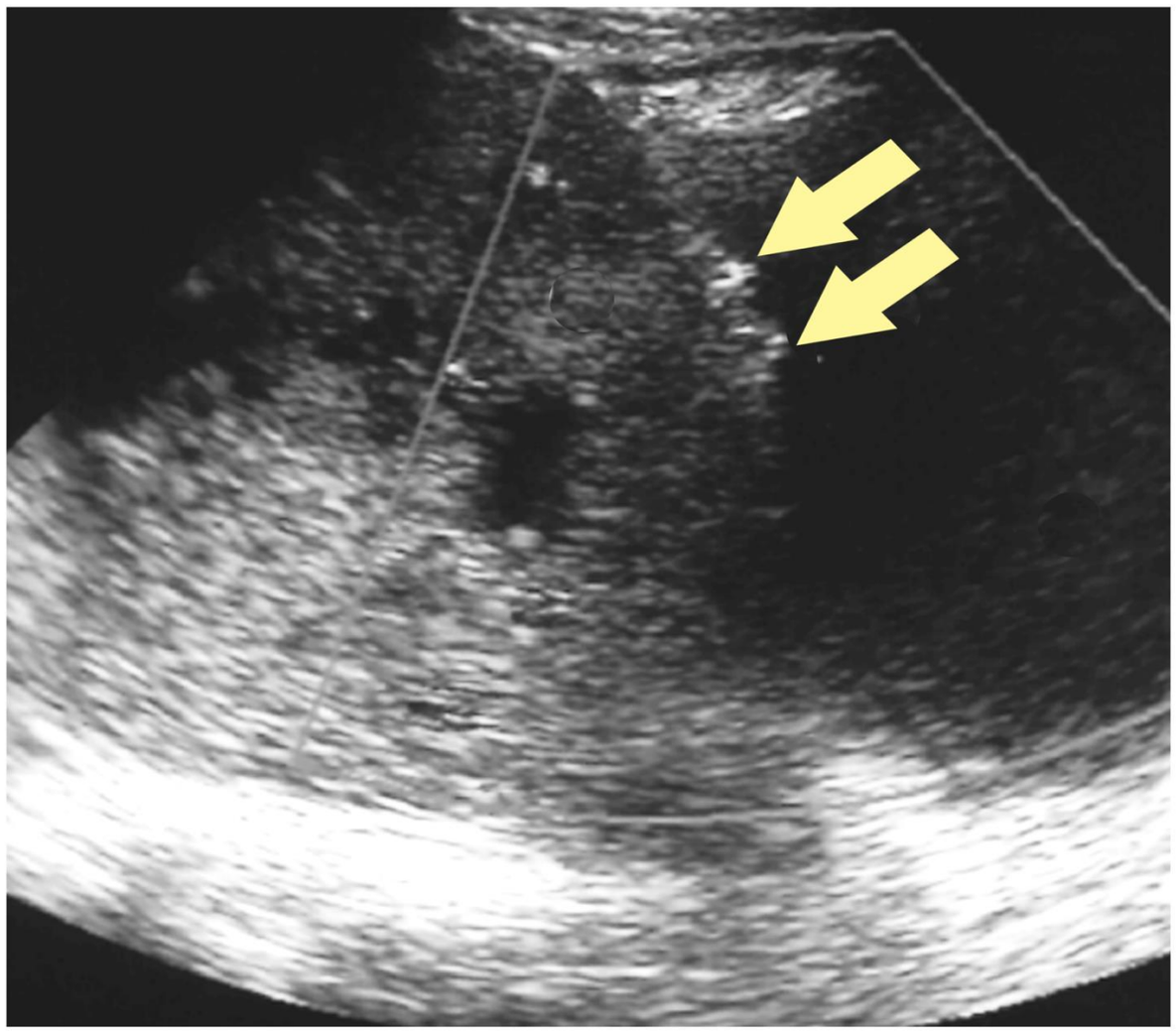
Cesarean Section

- Delivery of fetus, placenta, and membranes through an abdominal wall incision
- Common indications include:
  - Central placenta previa
  - Cephalopelvic disproportion
  - Premature separation of placenta
  - Malpresentation
  - Pre-eclampsia/eclampsia
  - Fetal distress
  - Cord prolapse
  - Maternal genital infection

Cesarean Section

- Sonographic findings associated with c-section include:
  - Presence of highly reflective focal echoes representing sutures
  - Decreased echogenicity in the myometrium surrounding the sutures
  - Anechoic area anterior to uterine incision and the posterior bladder wall

CESAREAN SECTION



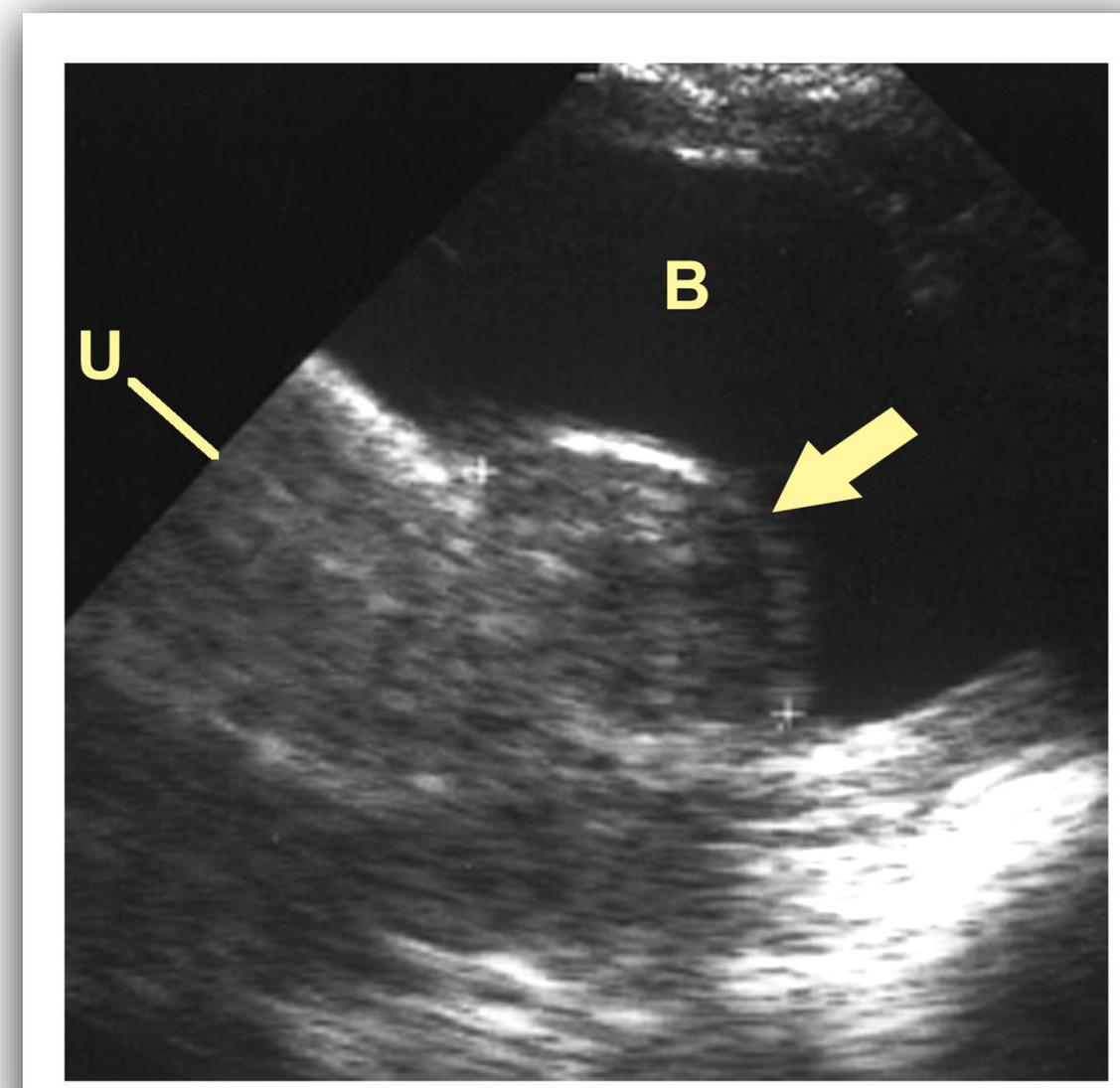
Arrows = sutures

Hematomas

- Typically related to c-section delivery
- Located anterior to uterine incision and posterior bladder wall (*bladder flap*)
- Sonographic findings include:
  - Presence of complex mass between anterior LUS and posterior bladder wall
  - Poorly defined borders
  - Possible presence of internal septations

CESAREAN SECTION

U = uterus
B = bladder
Arrow = hematoma



Bladder flap hematoma

Venous Thrombosis

- Vascular changes associated with pregnancy, labor & delivery predispose a woman to risk of blood clotting
- Three factors contribute (*Virchow's triad*)
  - Hypercoagulability of blood
  - Venous stasis
  - Alterations (damage) in venous endothelium
- Most common locations:
  - Lower extremity (DVT)
  - Ovarian vein

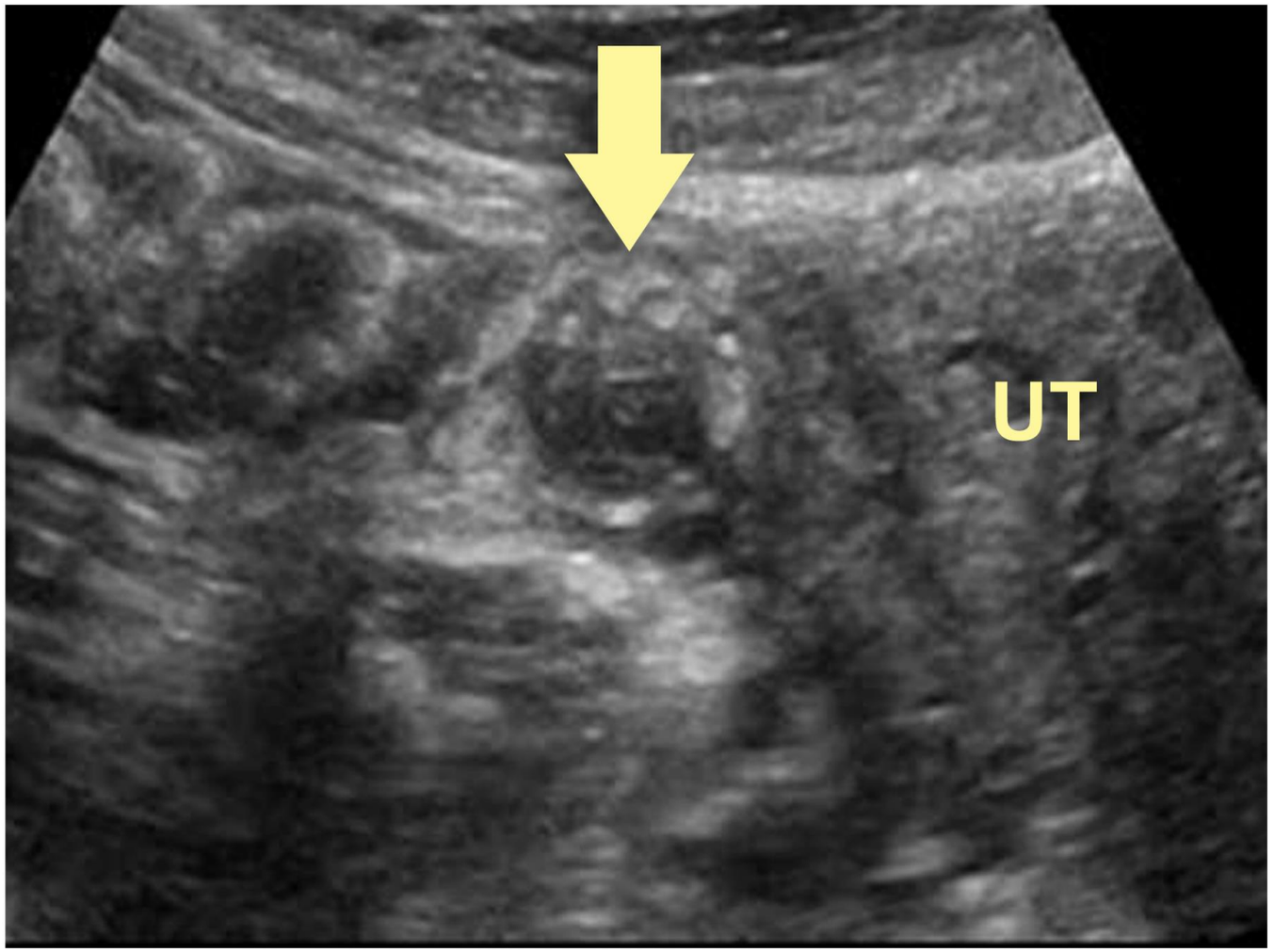
Venous Thrombosis

- Predisposing factors include:
  - Endometritis (*postpartum*)
  - Increased age or parity
  - Obesity
  - Administration of high-dose estrogens
  - Heart disease
  - Anemia

Venous Thrombosis

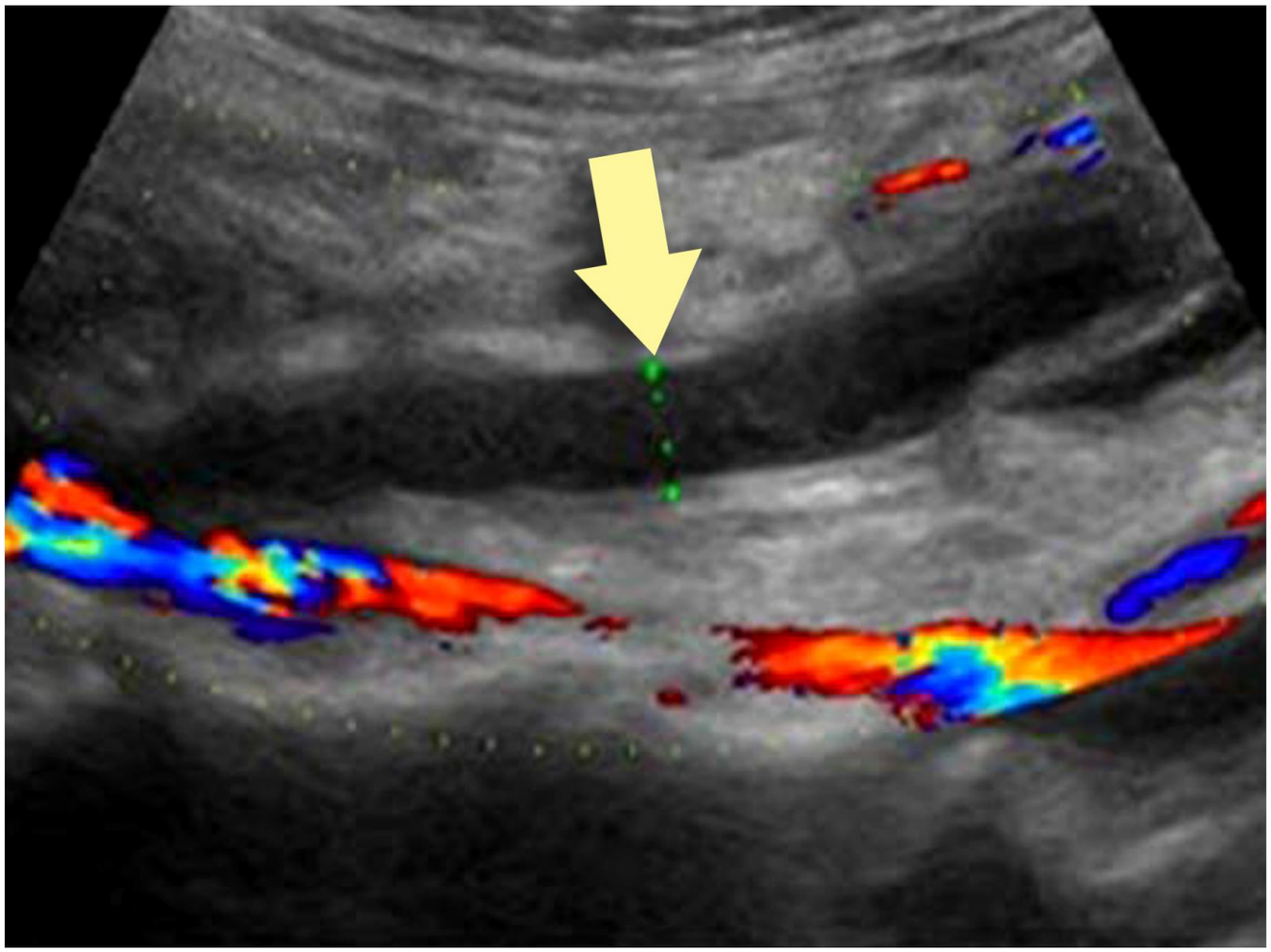
- Sonographic signs in pelvic venous vasculature:
  - Anechoic or hypoechoic oval mass extending superiorly from adnexa
  - Contiguous with ovarian vessel
  - Doppler evaluation that reveals limited or absent blood flow

OVARIAN VENOUS THROMBOSIS



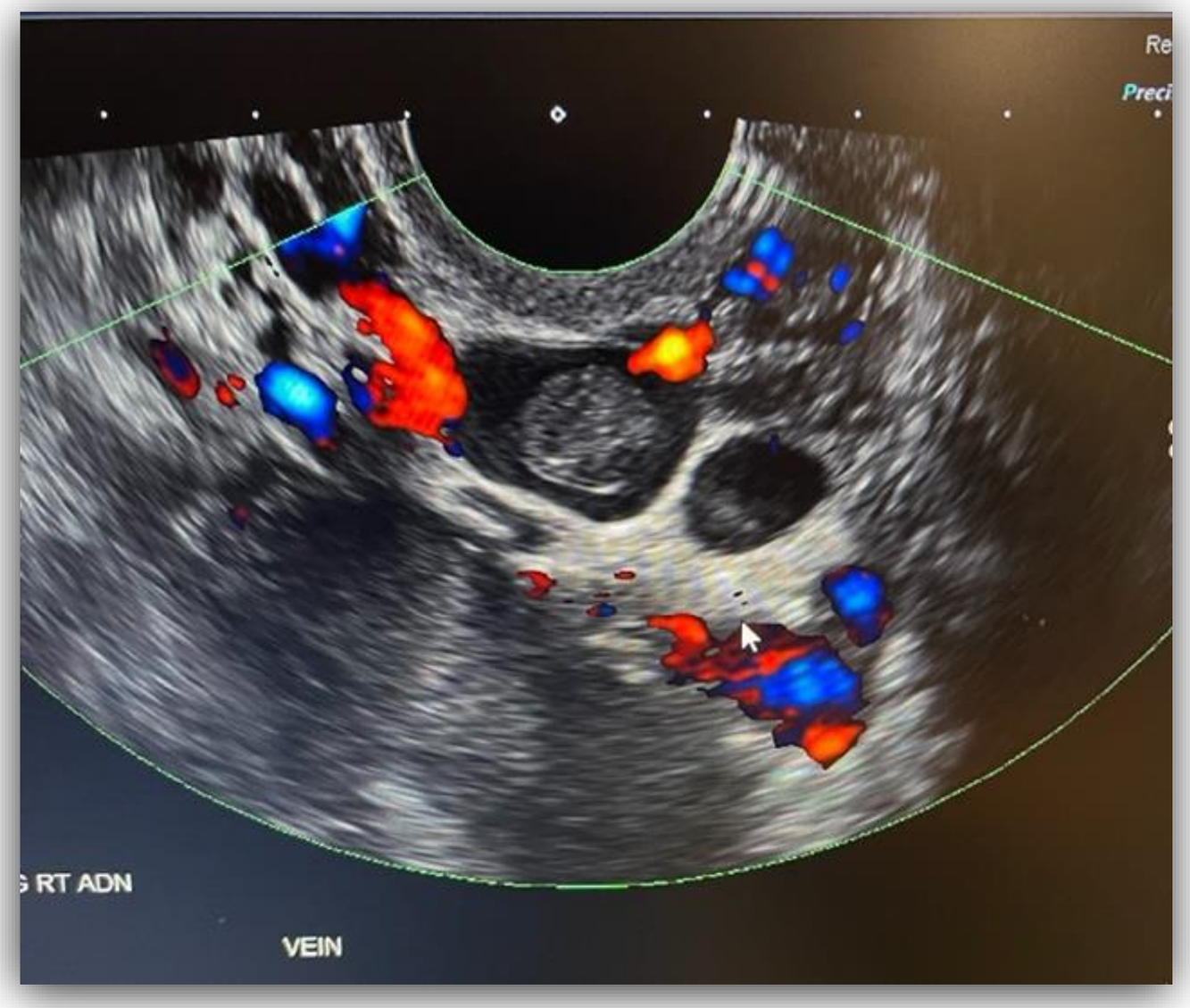
Dilated thrombosed ovarian vein adjacent to the uterus

OVARIAN VENOUS THROMBOSIS



Absent flow in thrombosed ovarian vein
Color flow seen in iliac artery

OVARIAN VENOUS THROMBOSIS



Focal thrombus within lumen of dilated ovarian vein

Image courtesy of Lisa Yee

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