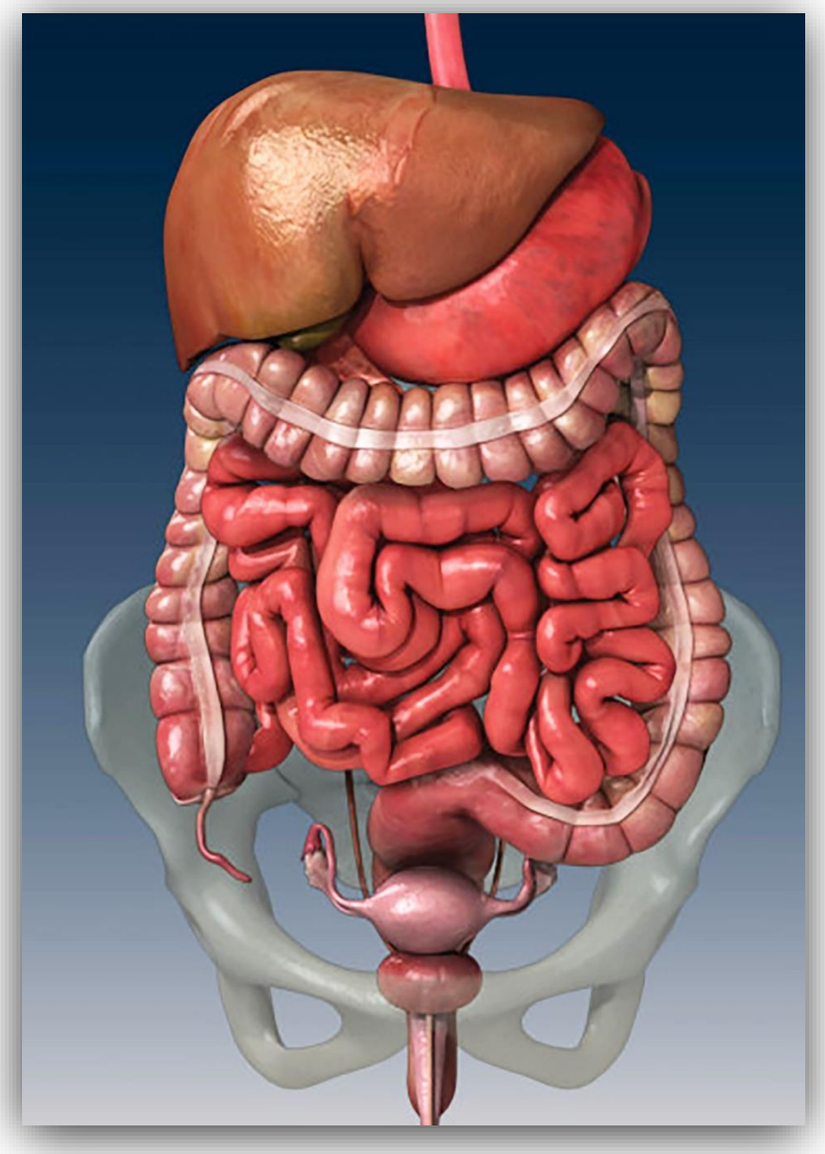
OB GYN SONOGRAPHY REVIEW

Fetal Abdomen and Pelvis

Course Outline

- Embryology
- Normal Sonographic Anatomy
  - Abdomino-pelvic cavity
  - Gastrointestinal tract
  - Vascular anatomy
- Abdominal and Pelvic Abnormalities

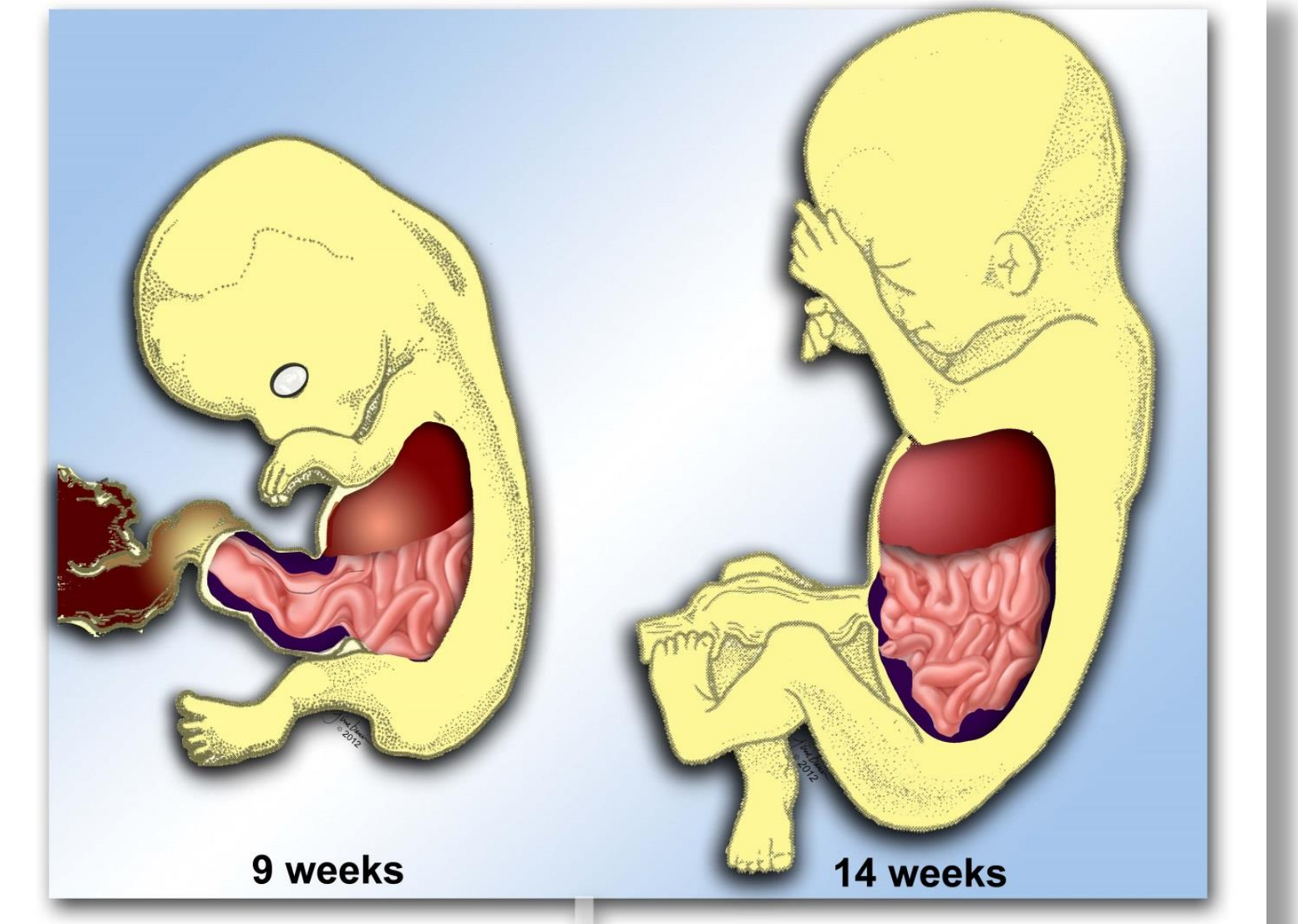


Embryology

Embryological Development

- Most important aspect of GI embryology is development on anterior abdominal wall
- At 8 weeks, the GI tract elongates and its size exceeds available intrabdominal space
- Midgut herniation: early intestinal tract herniates into base of cord
  - Normal sonographic finding in early gestation
- Herniation is reduced by 12th week

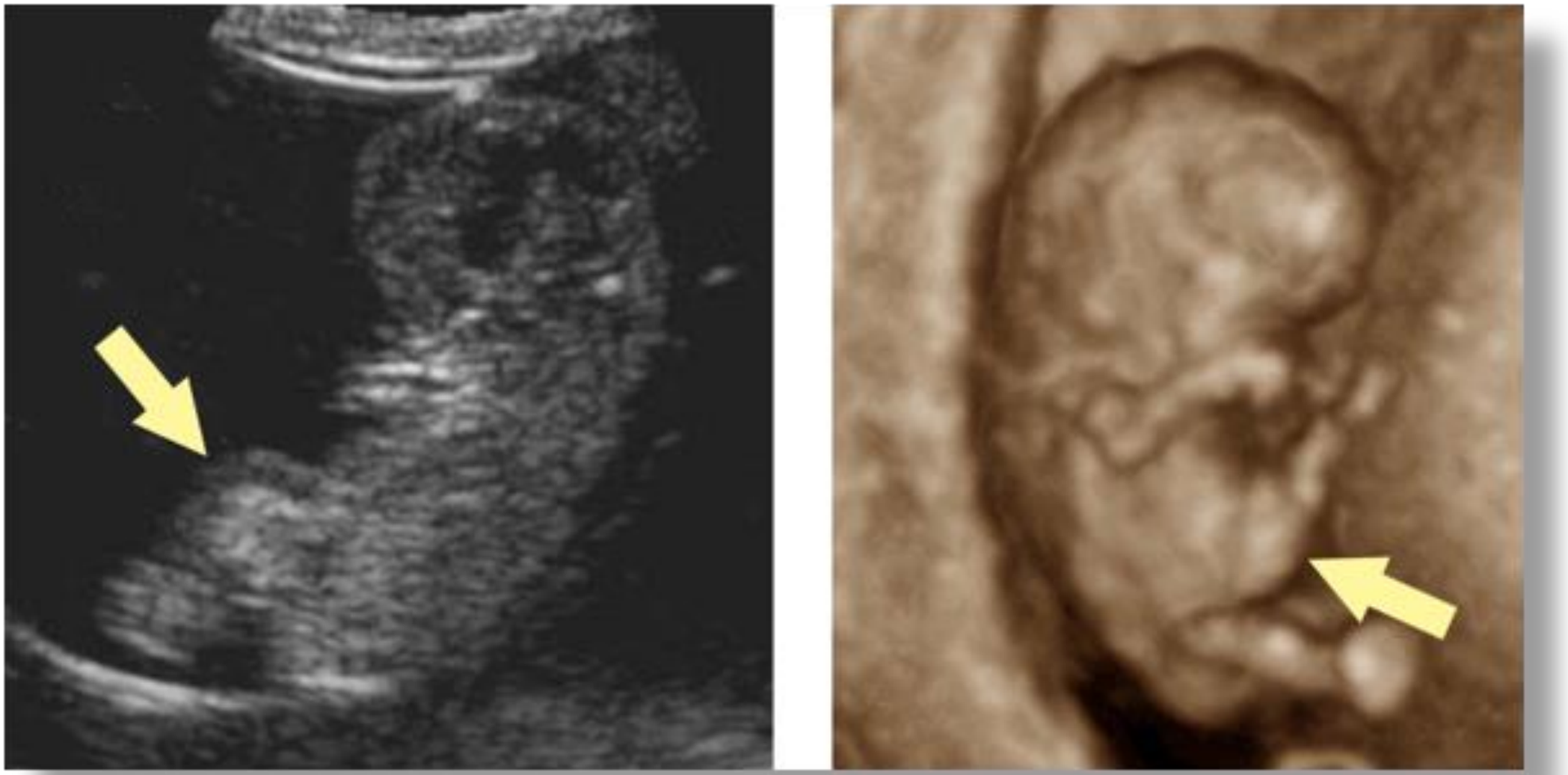
FETAL ABDOMEN AND PELVIS



Normal midgut herniation

Herniation reduced

FETAL ABDOMEN AND PELVIS



Arrow = normal midgut herniation

Normal Sonographic Anatomy

Abdomino-pelvic Cavity

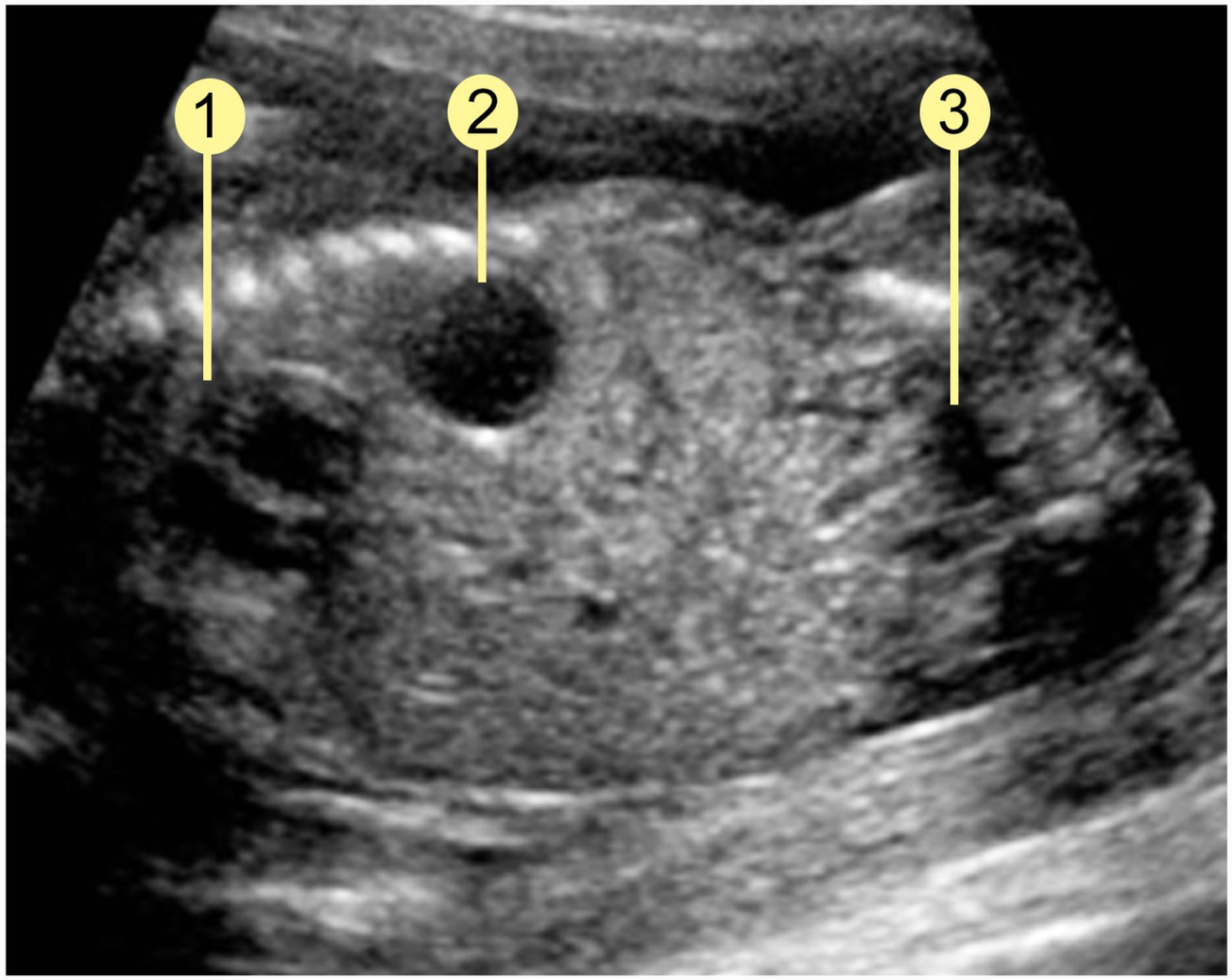
- Heart, stomach, urinary bladder seen in single image
- All organs noted in appropriate location
- Comparative echogenicity noted
    - Lung
    - Liver
    - Bowel
- Stomach, urinary bladder filed with fluid

Gastrointestinal Tract

- Esophagus: rarely seen
- Stomach: ovoid, anechoic/spherical structure in the left upper abdomen
- Intestines:
  - Normally mixed echogenicity/cystic
  - Echogenicity ⇩ skeletal structures ⇧ liver
  - Peristalsis seen by late 2nd trimester

NORMAL SONOGRAPHIC ANATOMY

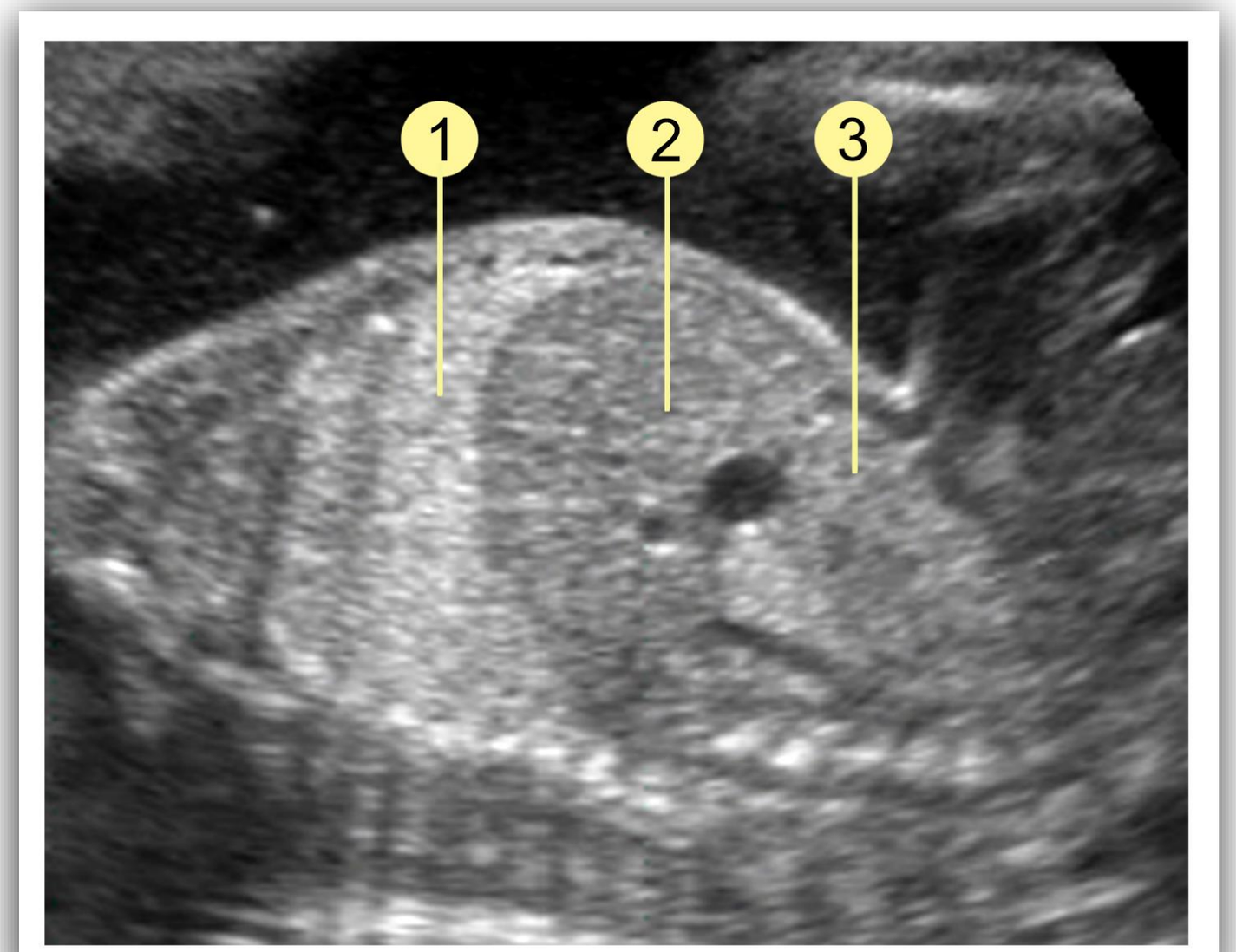
1 = heart
2 = stomach
3 = bladder



Normal location of organs
Stomach & urinary bladder filled with fluid

NORMAL SONOGRAPHIC ANATOMY

1 = lung
2 = liver
3 = bowel

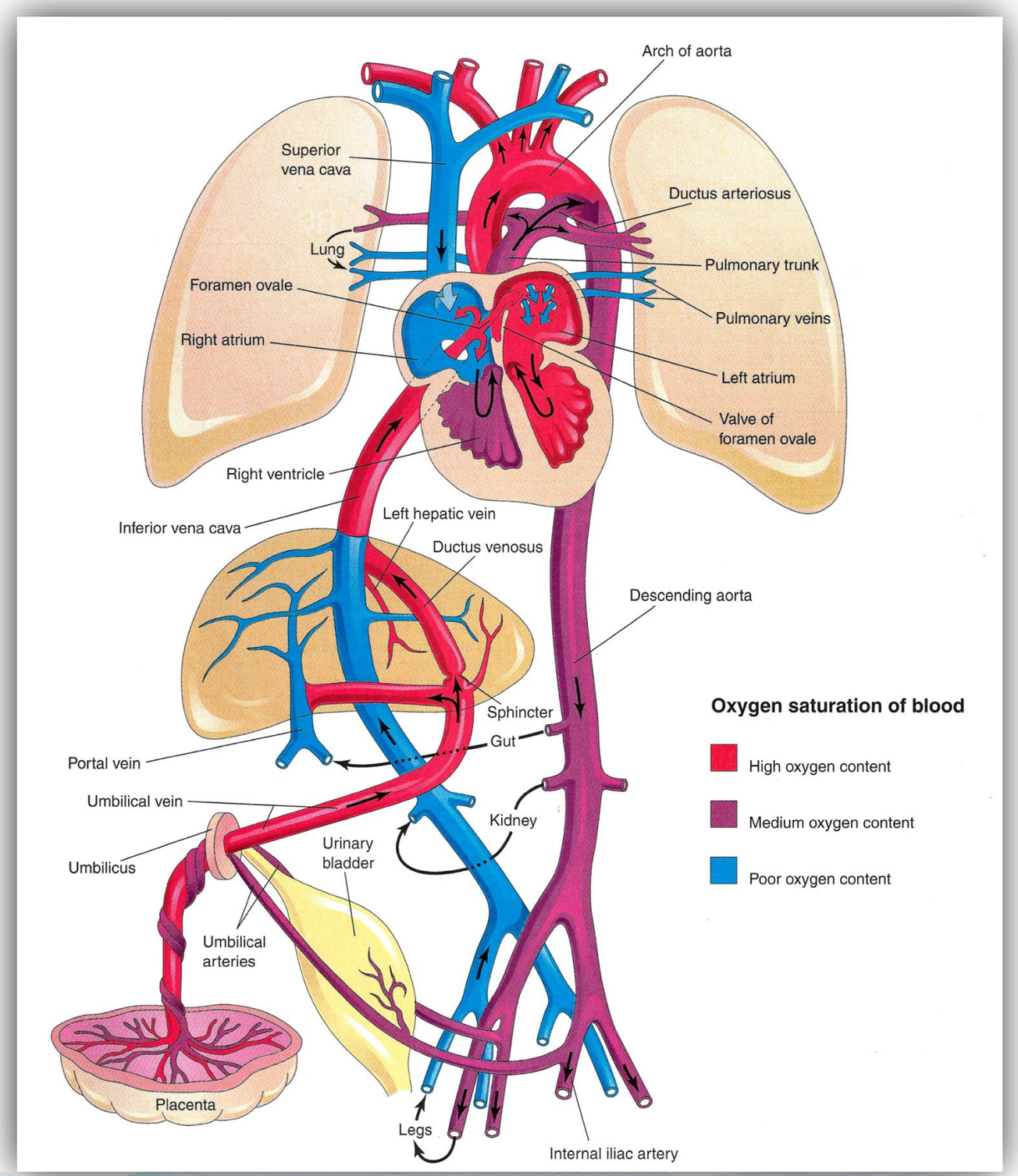


Comparative echogenicity

Vascular Anatomy

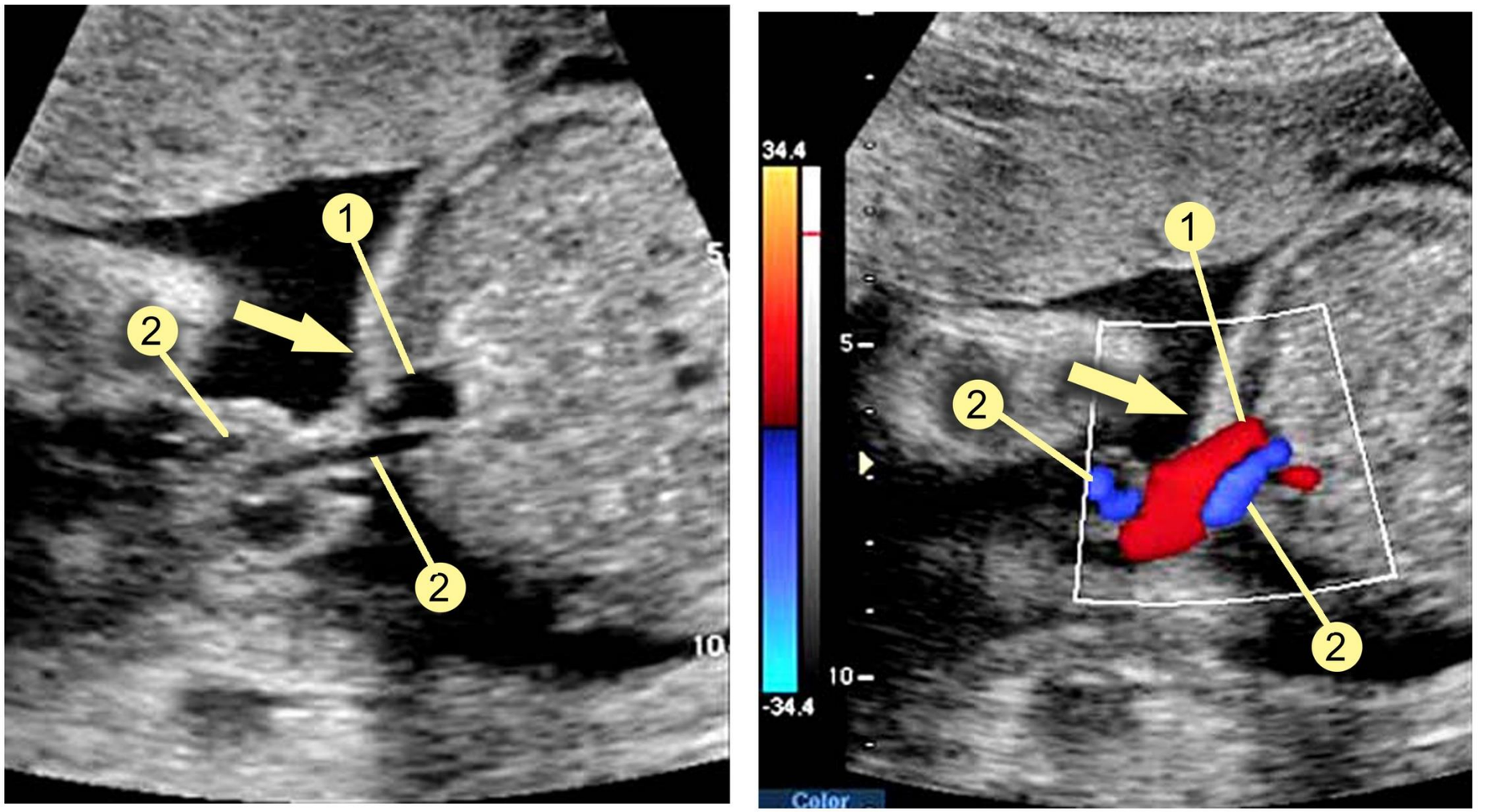
- Umbilical cord insertion noted in appropriate location
- *Umbilical vein* courses into anterior liver separating right and left lobes
- Bifurcates into *right portal vein* and *ductus venosus*
- *Umbilical arteries* course downward from fetal aorta and pass laterally alongside urinary bladder and exit at base of cord

FETOPLACENTAL CIRCULATION



NORMAL SONOGRAPHIC ANATOMY

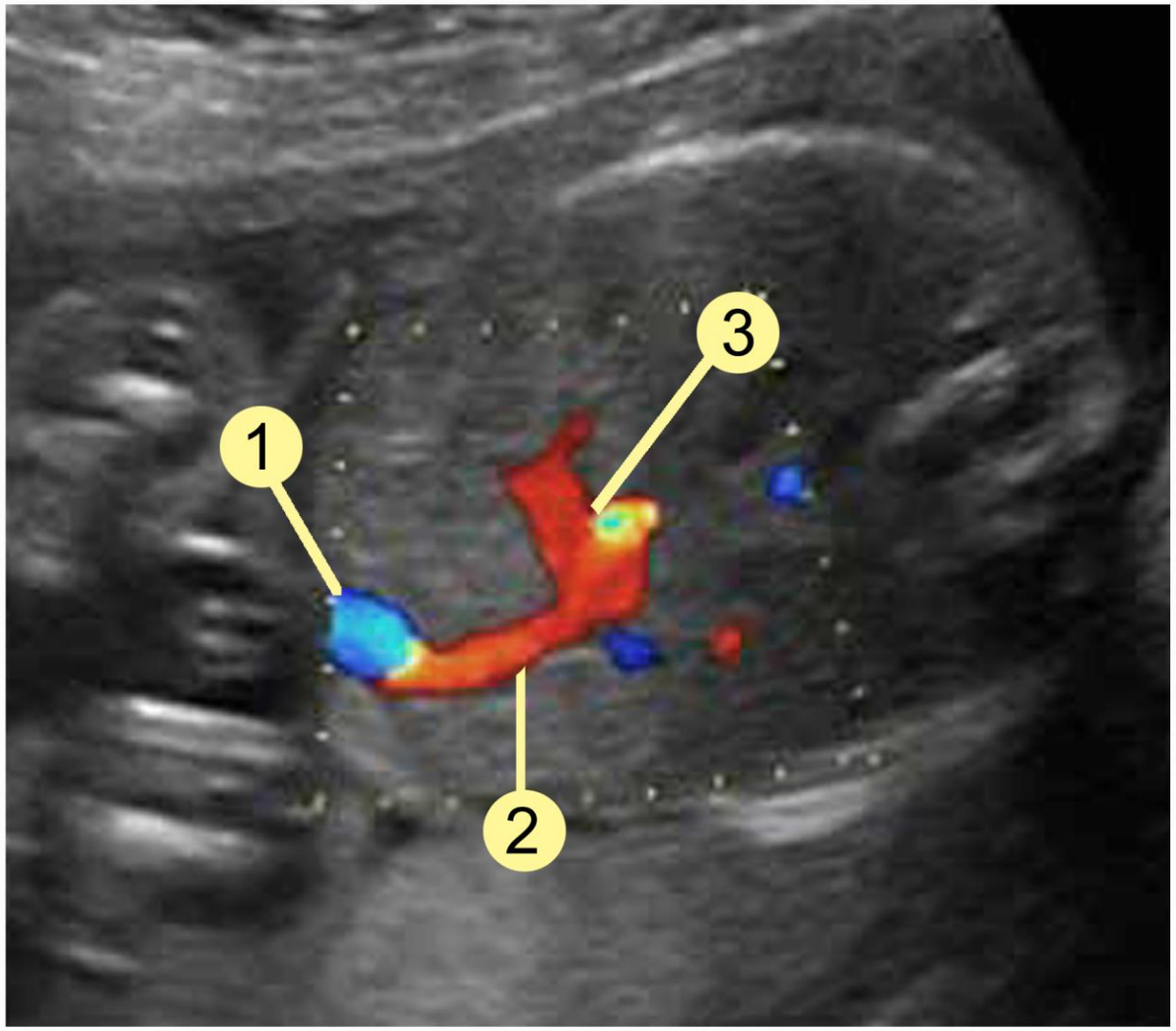
1 = umbilical v.
2 = umbilical a.
Arrow = abd wall



Umbilical cord insertion

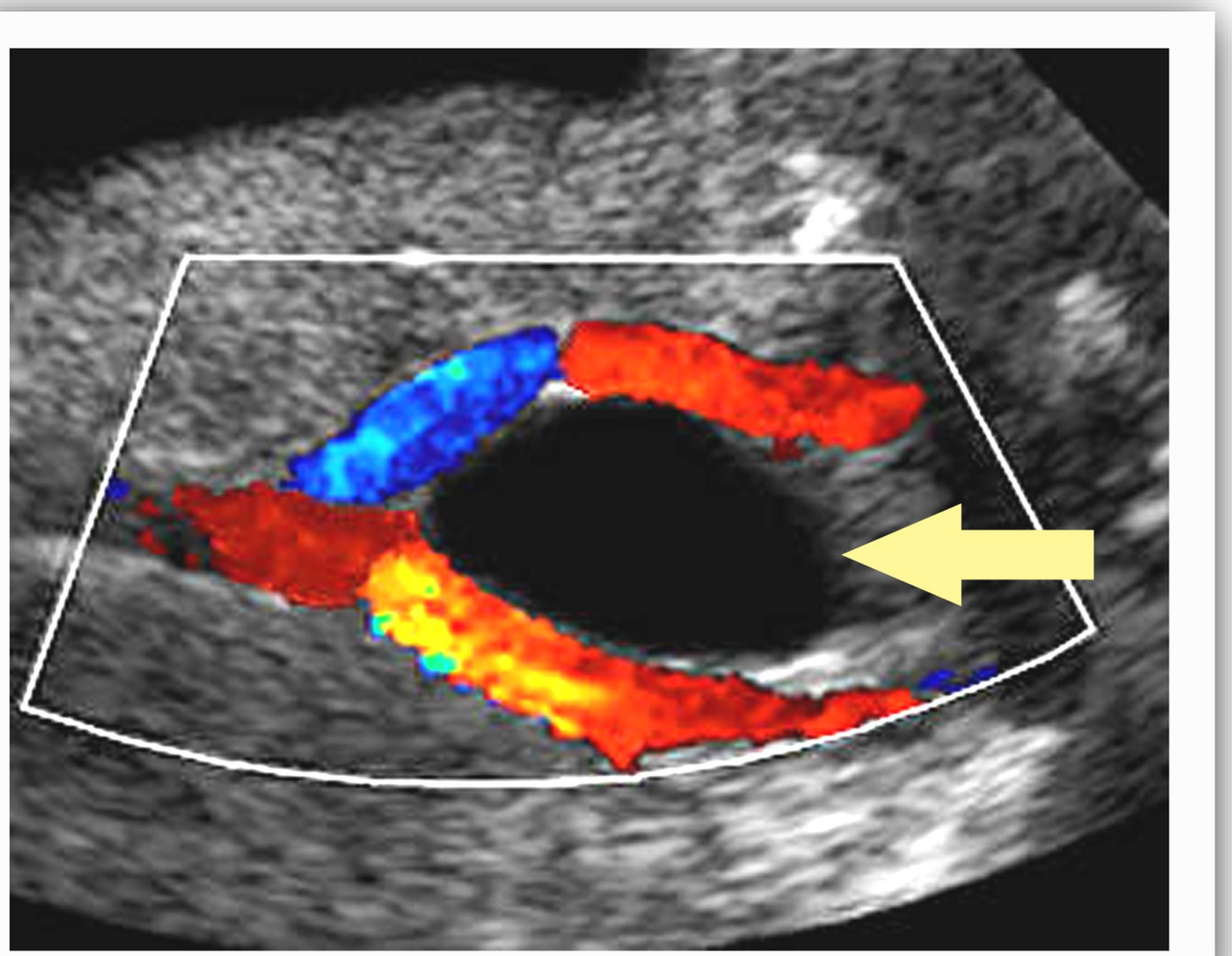
NORMAL SONOGRAPHIC ANATOMY

1 = umbilical v.
2 = portal sinus
3 = portal vein



Umbilical vein

NORMAL SONOGRAPHIC ANATOMY



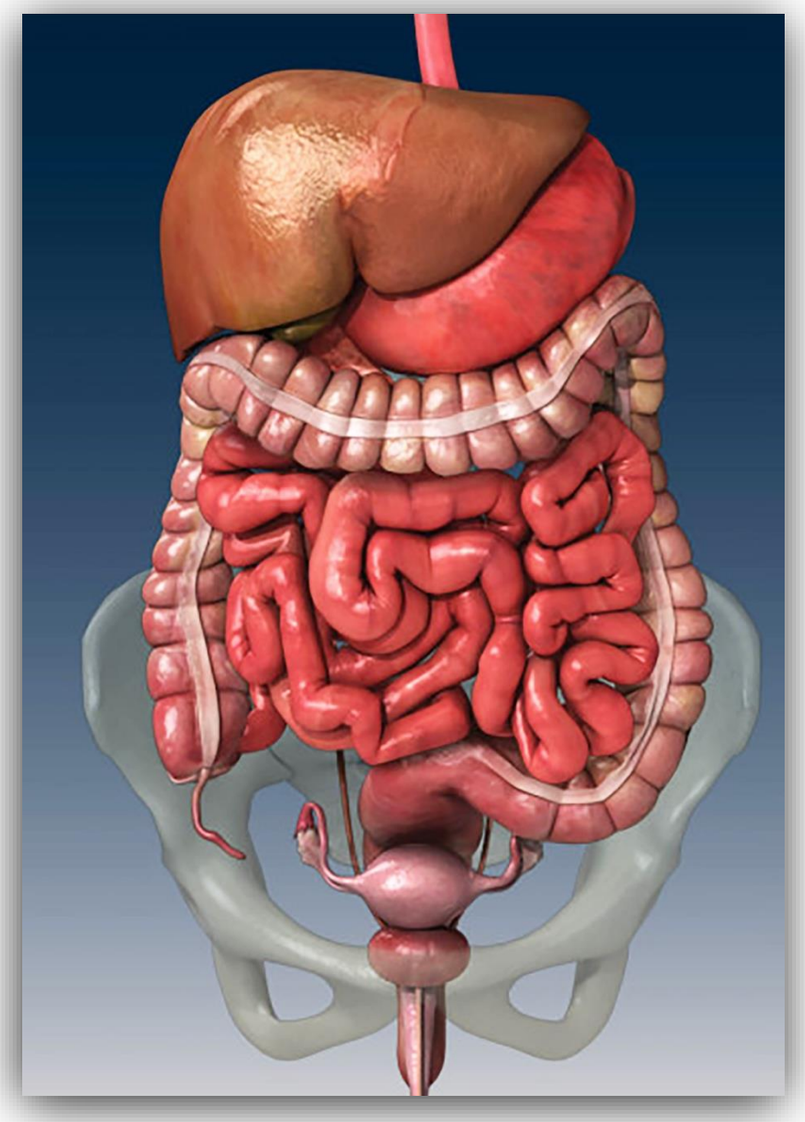
Arrow = urinary bladder

Umbilical arteries

Abdominal and Pelvic Abnormalities

Categories of Abnormalities

- Herniation abnormalities
- Internal abdominal abnormalities
- Hepatobiliary abnormalities
- Pelvic masses



Herniation Abnormalities

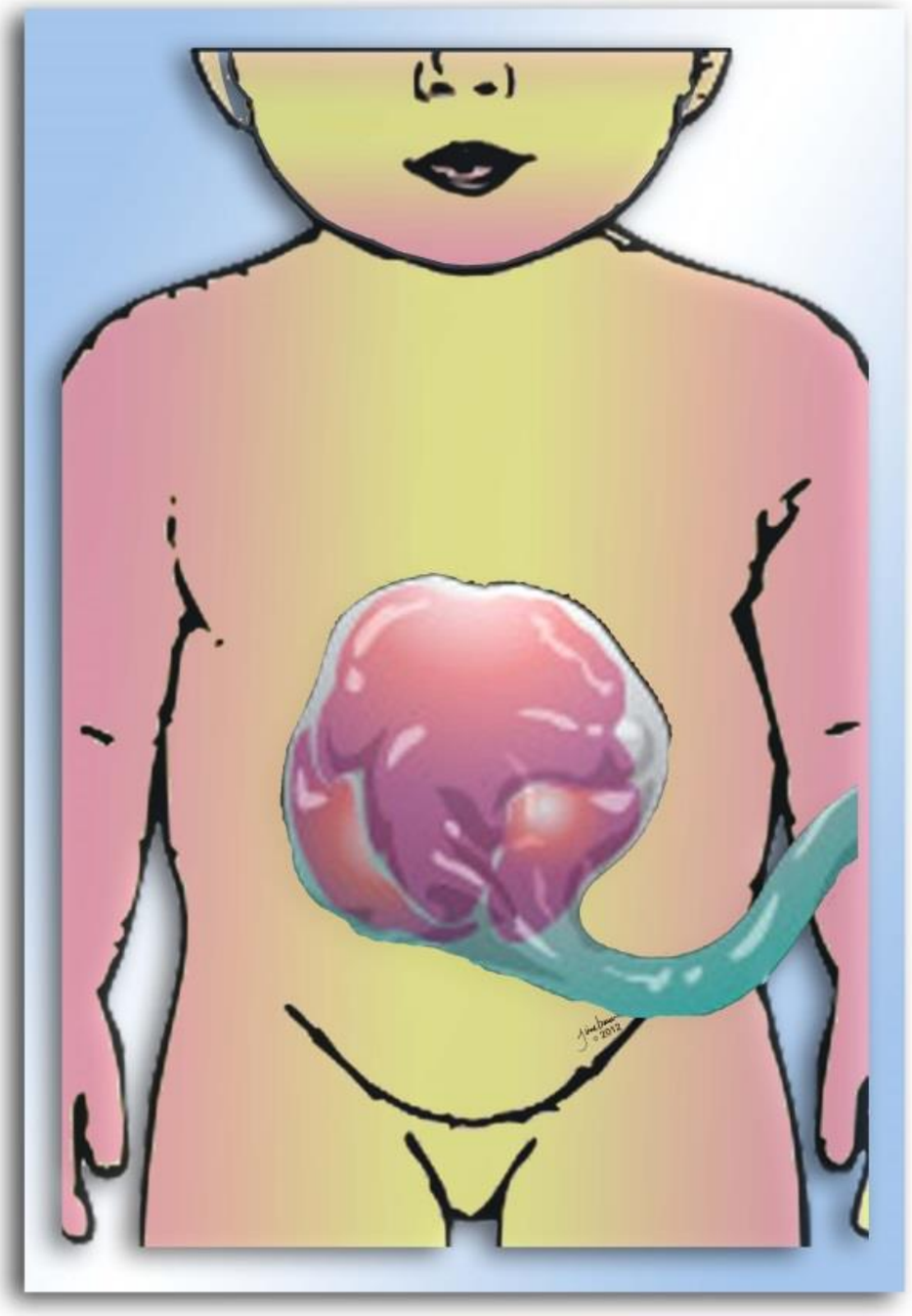
- Abnormalities characterized by exteriorization of abdominal contents include:
  - Omphalocele
  - Gastroschisis
  - Limb-body wall complex
  - Cloacal exstrophy

Omphalocele

- Results from a failure of intestines to return return to abdominal cavity during reduction of midgut herniation
- Contents may include, bowel, mesentery, liver, pancreas, spleen, etc.
- Differentiating characteristics:
  - Midline defect
  - Contiguous with cord insertion
  - Covered by membranous sac

OMPHALOCELE

- At level of cord insertion
- Covered by sac



Omphalocele

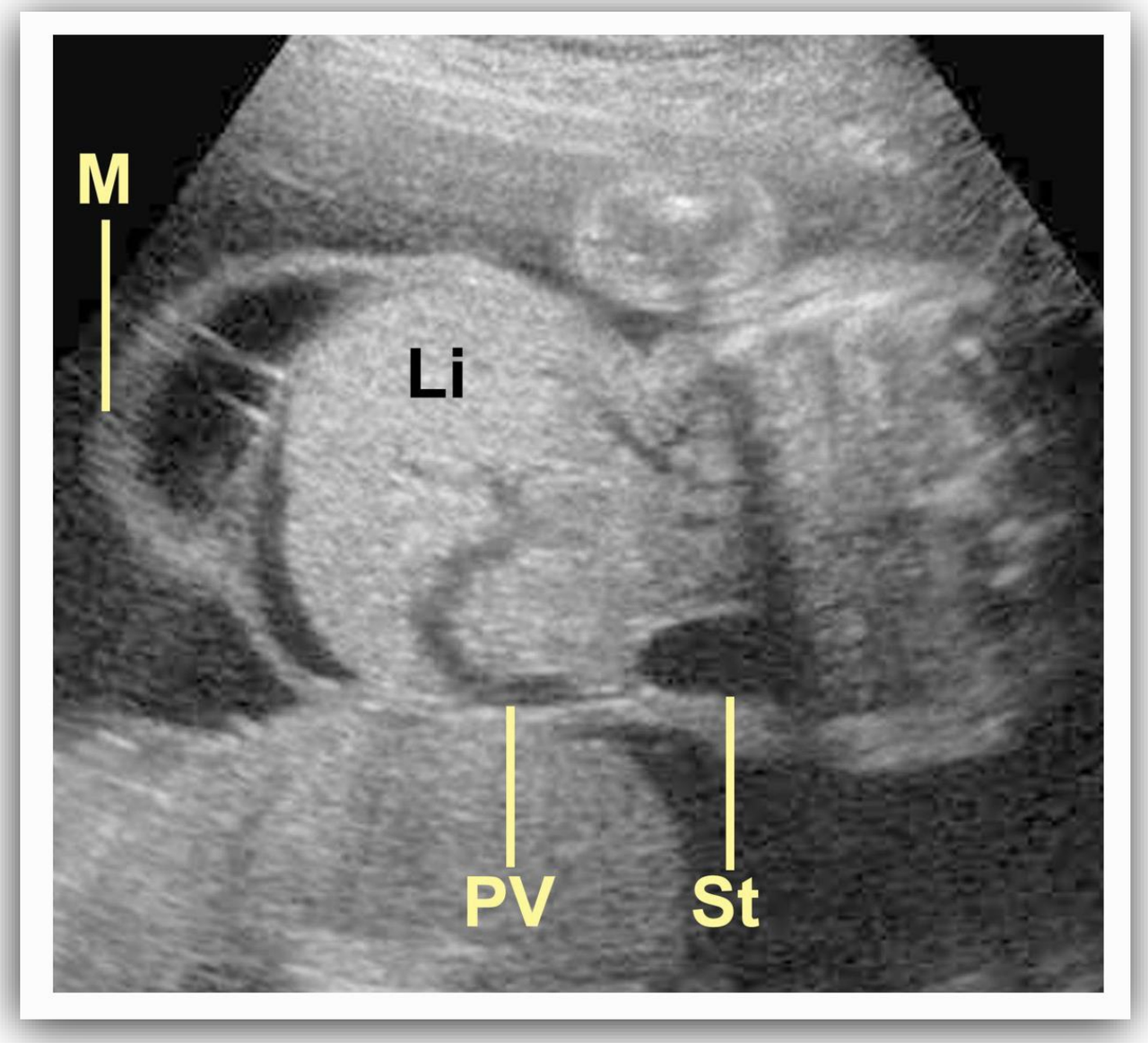
- Associated abnormalities include :
  - Trisomies 13, 18, 21
  - Beckwith – Wiedemann syndrome
  - Pentalogy of Cantrell
  - Turner syndrome
  - Cloacal exstrophy
  - Cardiac anomalies - MANY

Omphalocele

- Sonographic findings include :
  - Complex mass extending from anterior fetal abdomen
  - **At level of cord insertion**
  - **Covered by membranous sac**
  - Small than expected AC measurements
  - Polyhydramnios

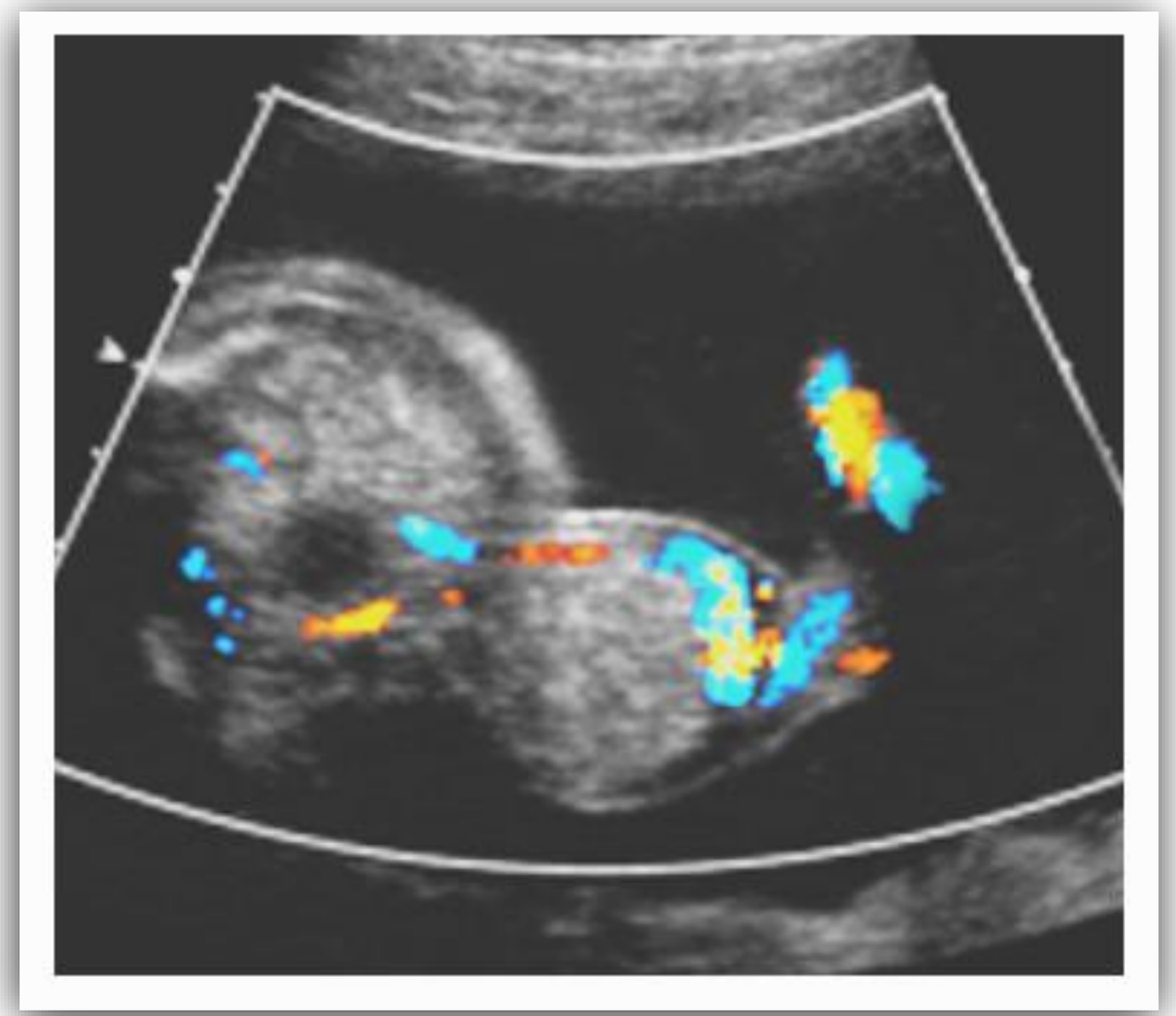
OMPHALOCELE

M = membrane
Li = liver
PV = portal vein
St = stomach



Covered by membrane

OMPHALOCELE



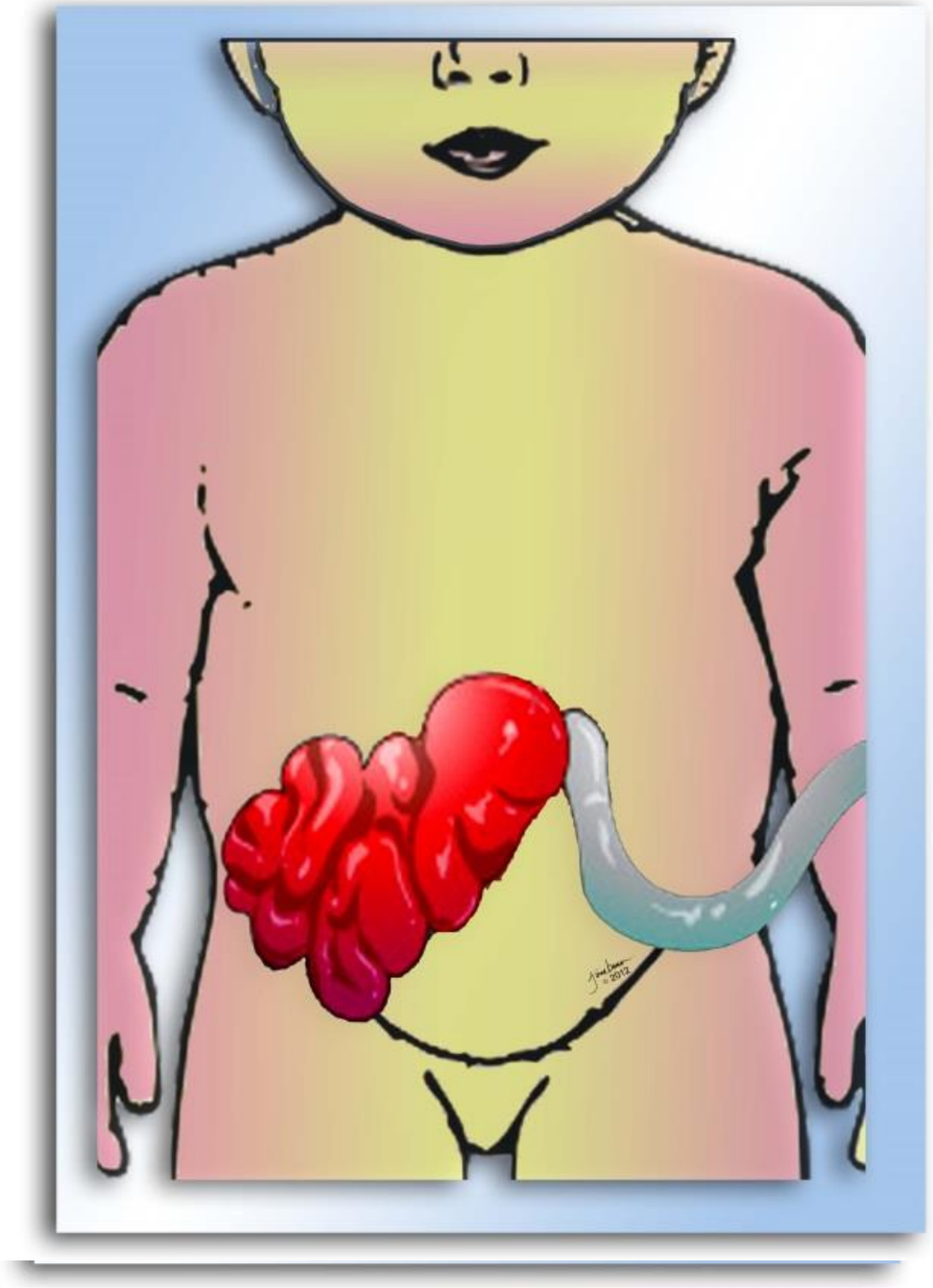
At level of cord insertion

Gastroschisis

- Herniation defect resulting from a failure of anterior abdominal wall development
- Contents may include, bowel, mesentery, liver, pancreas, spleen, etc.
- Differentiating characteristics:
  - Lateral to cord insertion
  - No membranous sac covering

GASTROSCHISIS

- **Lateral to cord insertion**
- **No covering sac**



Gastroschisis

- Associated abnormalities include :
  - Intestinal malrotation
  - Intestinal atresia
  - Intestinal stenosis

Gastroschisis

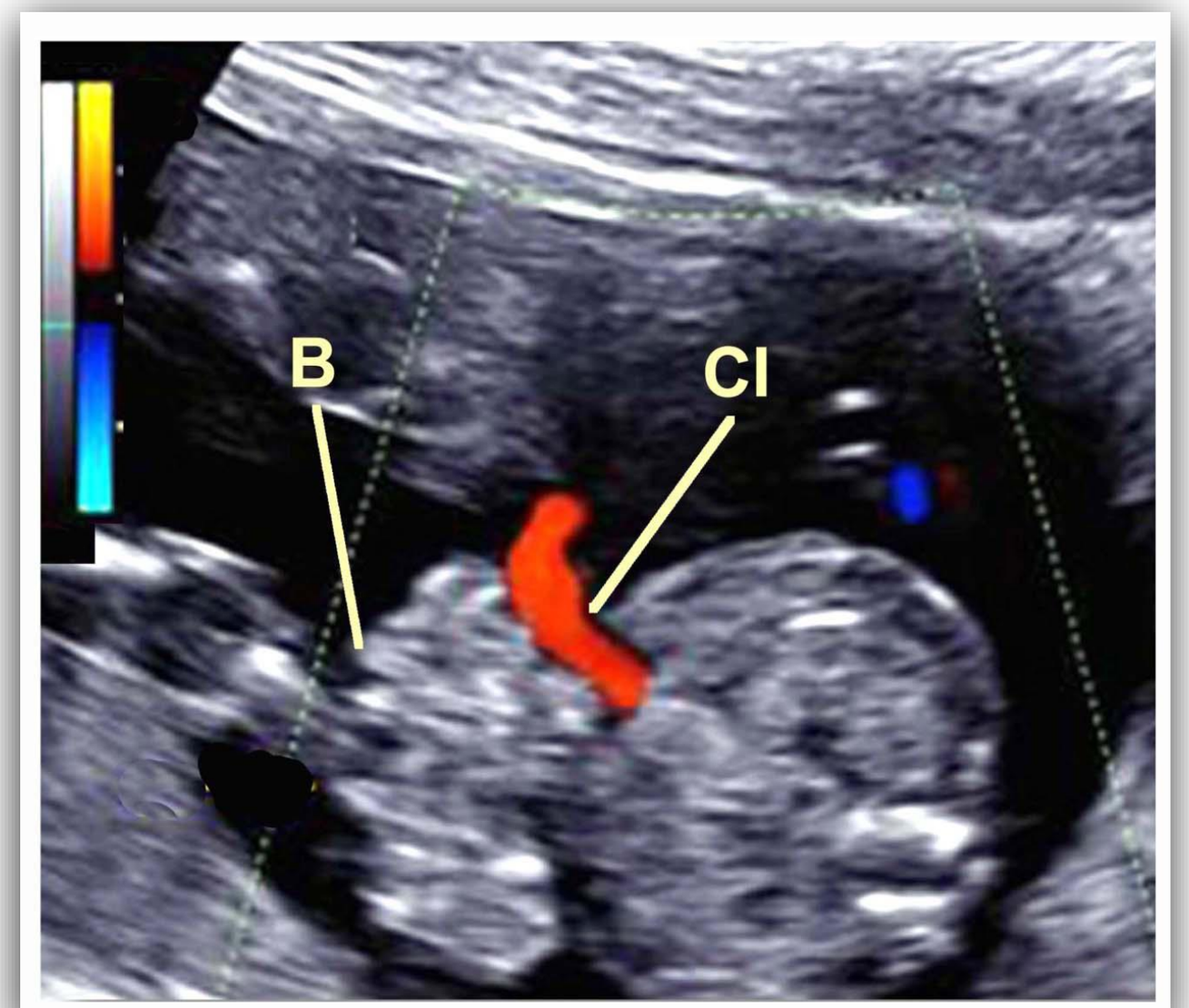
- Sonographic findings include :
  - Complex mass extending from anterior fetal abdomen
  - **Lateral to cord insertion**
  - **Not covered by membranous sac**
  - Small than expected AC measurements
  - Polyhydramnios

GASTROSCHISIS

No membrane

GASTROSCHISIS

B = bowel
CI = cord insertion



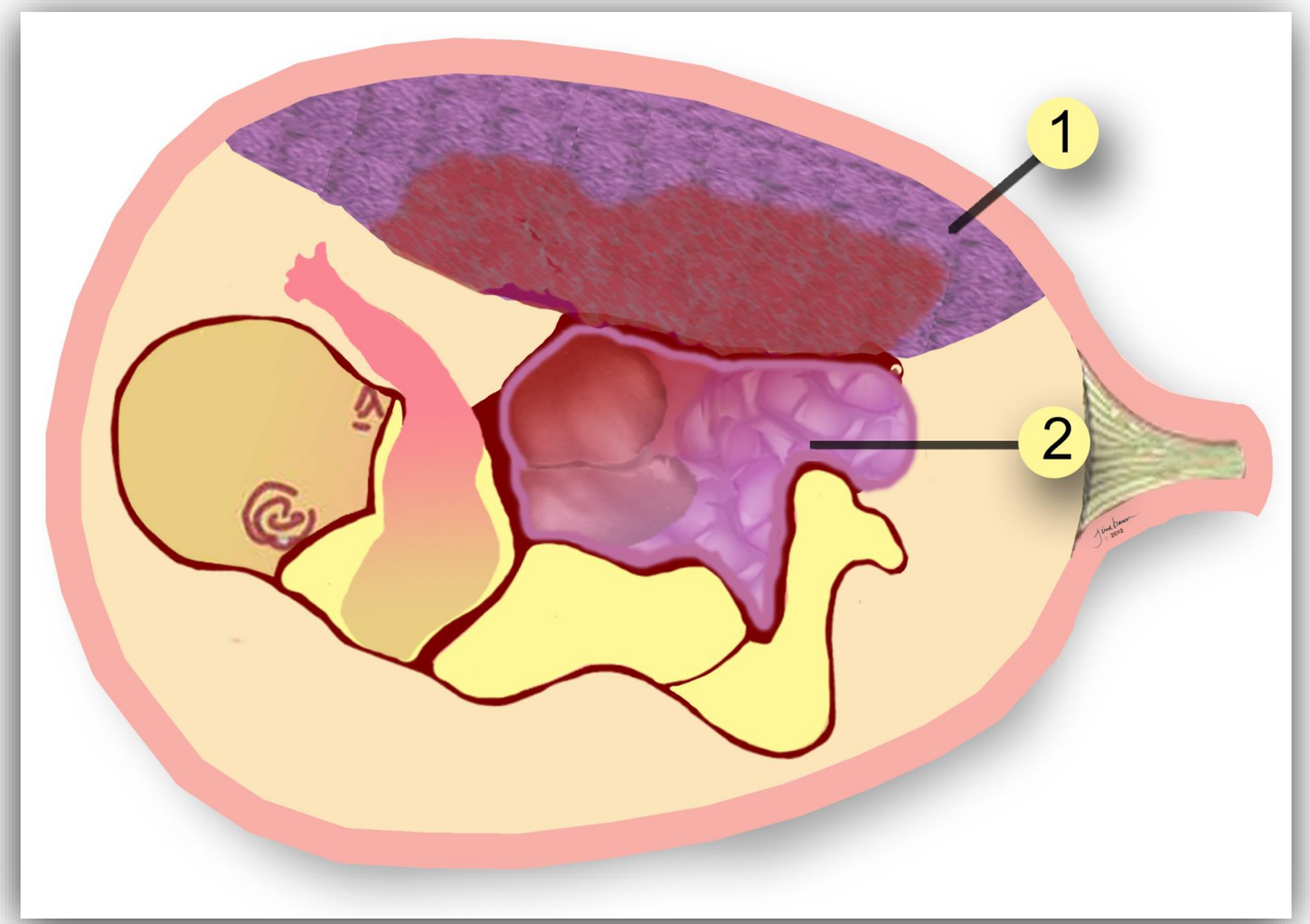
Adjacent to cord insertion

Limb-Body Wall Complex

- Lethal constellation of disruptive anatomic abnormalities involving anterior abdominal wall
- Also called *body stalk anomaly*
- Pathological characteristics:
  - Left-sided abdominoschisis
  - Exteriorization of abdominal contents
  - Attached directly to placental surface

LIMB-BODY WALL COMPLEX

1 = placenta
2 = abdominal contents



Exteriorized abdominal contents tethered to placenta

Limb-Body Wall Complex

- Associated abnormalities include :
  - Neural tube defects
  - Facial clefts
  - Encephalocele
  - Exencephaly
  - Caudal regression syndrome
  - Limb anomalies

Limb-Body Wall Complex

- Sonographic findings include:
  - Dramatic and immediately apparent
  - Deformed fetus tethered to placenta
  - Herniation of liver and abdominal viscera
  - Free fetal movement is absent
  - No free-floating cord identified

LIMB-BODY WALL COMPLEX

Arrow = fetus tethered to placenta

Cloacal Exstrophy

- Results from incomplete closure of inferior part of anterior abdominal wall
- Differentiating characteristics:
  - Lower abdominal wall defect
  - Exteriorization (exstrophy) of the bladder
  - Omphalocele

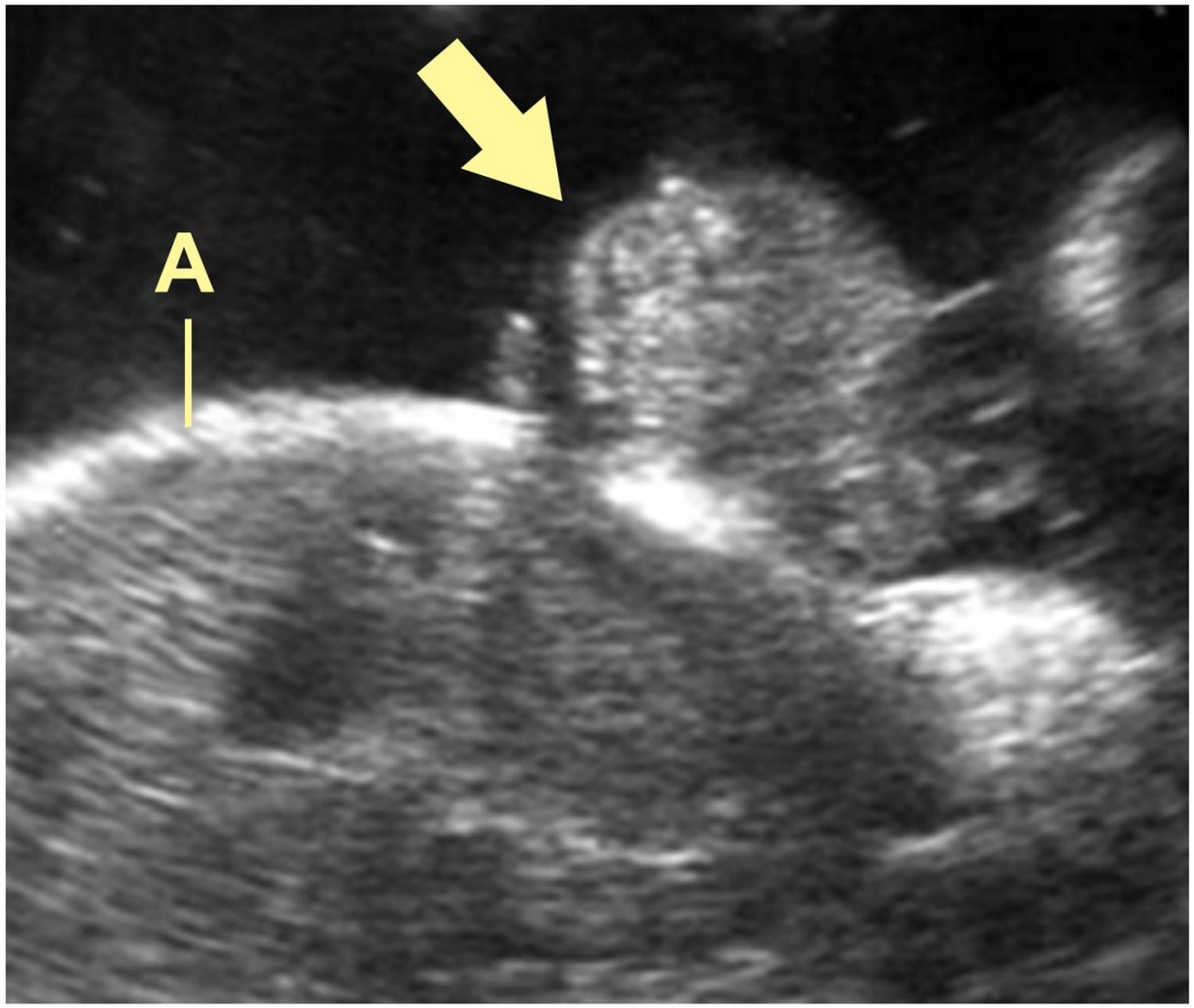
Cloacal Exstrophy

- Associated abnormalities include :
  - Multicystic dysplastic kidneys
  - Hydronephrosis
  - Undescended testes (cryptorchidism)
  - Cleft clitoris
  - Epispadias

Cloacal Exstrophy

- Sonographic findings include:
  - Bladder not identified over 30 minutes of scanning
  - Normal amniotic fluid volume present
  - Soft tissue mass protruding from lower anterior abdominal wall
  - Microphalus in male fetus

CLOACAL EXSTROPHY



Arrow = herniated bladder
A = abdominal wall

Internal Abdominal Abnormalities

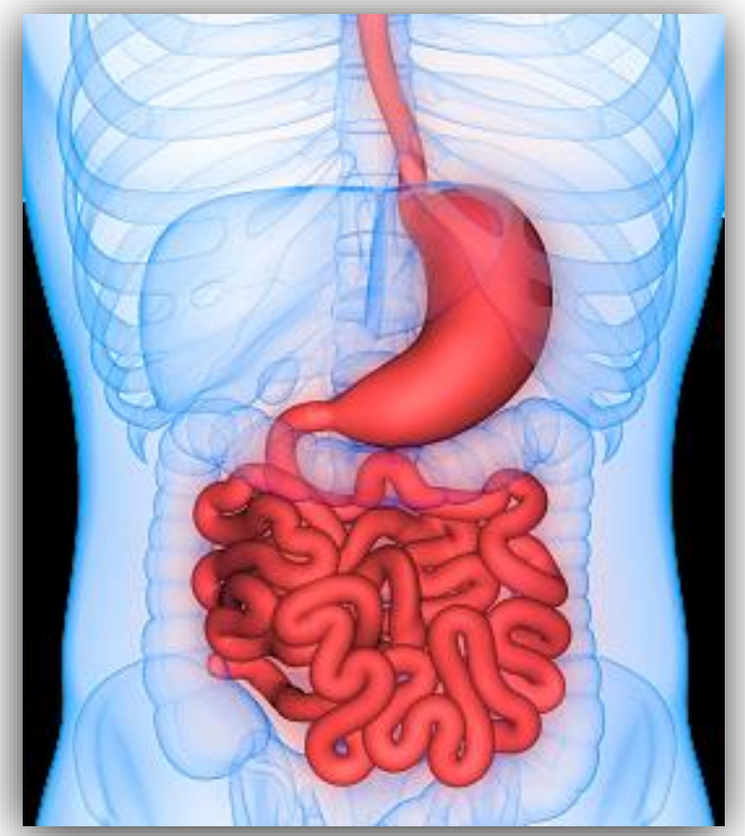
- Abnormalities occurring within the peritoneal cavity are related to the bowel and include:
  - Gastrointestinal atresia
  - Small bowel obstruction
  - Meconium peritonitis

Gastrointestinal Atresia

- Generic term applied to a narrowing of the hollow lumen of the gut
- Passage of amniotic fluid is impeded and fluid accumulates in bowel upstream to obstruction
- Fluid-filled bowel loops and polyhydramnios are characteristic sonographic findings

Esophageal Atresia

- Interruption of the esophageal lumen, typically in the chest
- Associated with T-E fistula 90% of cases



Esophageal Atresia

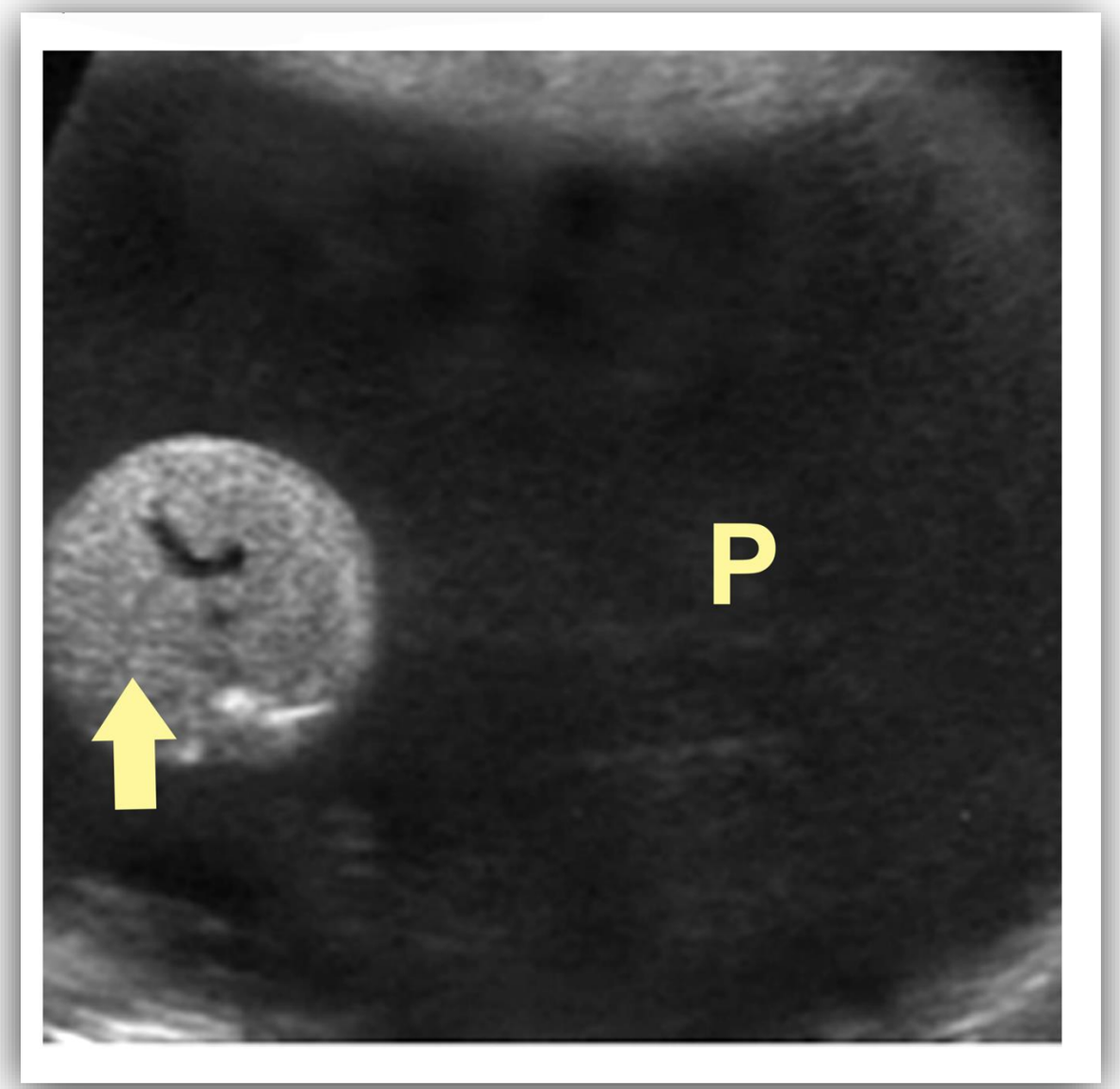
- Associated abnormalities include:
  - VACTERL association
  - CHARGE association
  - Other level of GI atresia
  - Pyloric stenosis
  - Trisomy 18 or 21

V = vertebral anomalies
A = anorectal anomalies
C = cardiac anomalies/cleft lip
TE = tracheoesophageal fistula
R = radial ray/renal anomalies
L = limb anomalies (polydactyly)

Esophageal Atresia

- Sonographic findings include::
  - Failure to demonstrate stomach on serial sonograms
  - Polyhydramnios
  - IUGR (40% of cases)

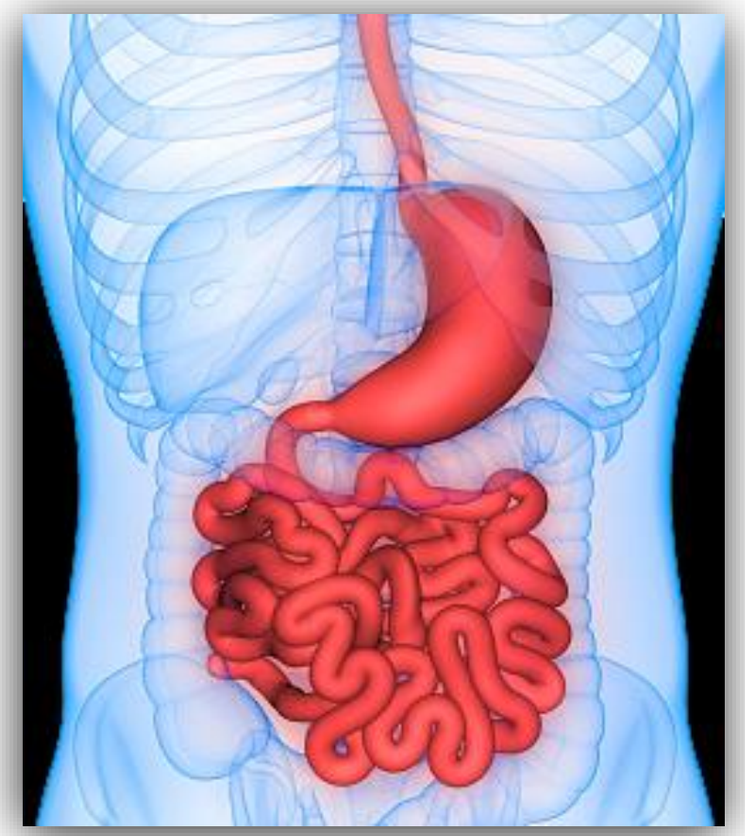
ESOPHAGEAL ATRESIA



Arrow = absent stomach
P = polyhydramnios

Duodenal Atresia

- Interruption of the GI tract in descending and inferior portion of duodenum
- Etiologies include:
  - Failure of canalization in early embryo
  - External compression by choledochal cyst, annular pancreas other abdominal masses



Duodenal Atresia

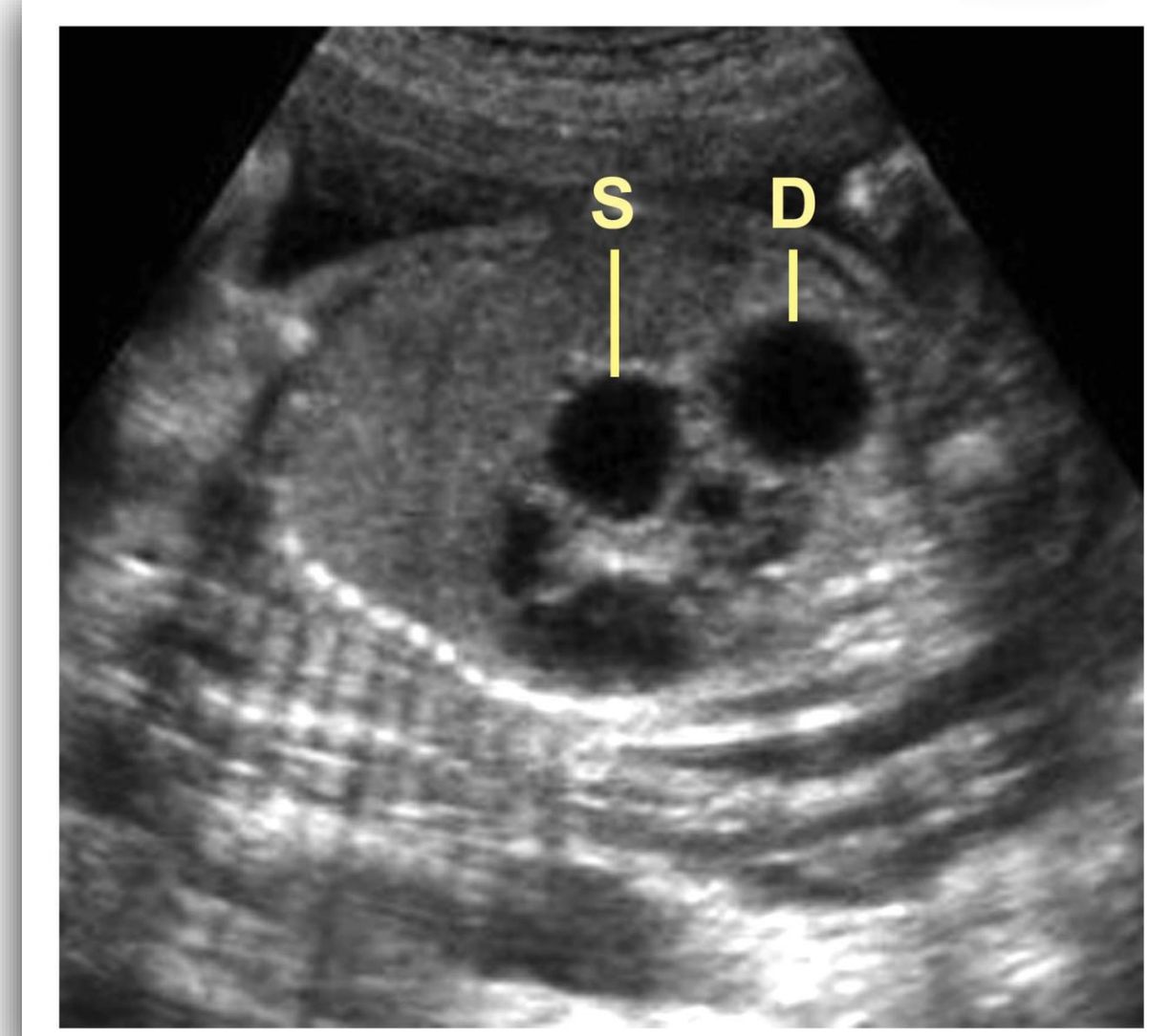
- Associated abnormalities include:
  - Trisomy 21
  - Congenital heart disease
  - VACTERL association
  - CHARGE association
  - Other level of GI atresia
  - Annular pancreas

Duodenal Atresia

- Sonographic findings include::
  - Classic "*double bubble*" sign
  - Identification of focal atretic segment
  - Polyhydramnios

DUODENAL ATRESIA

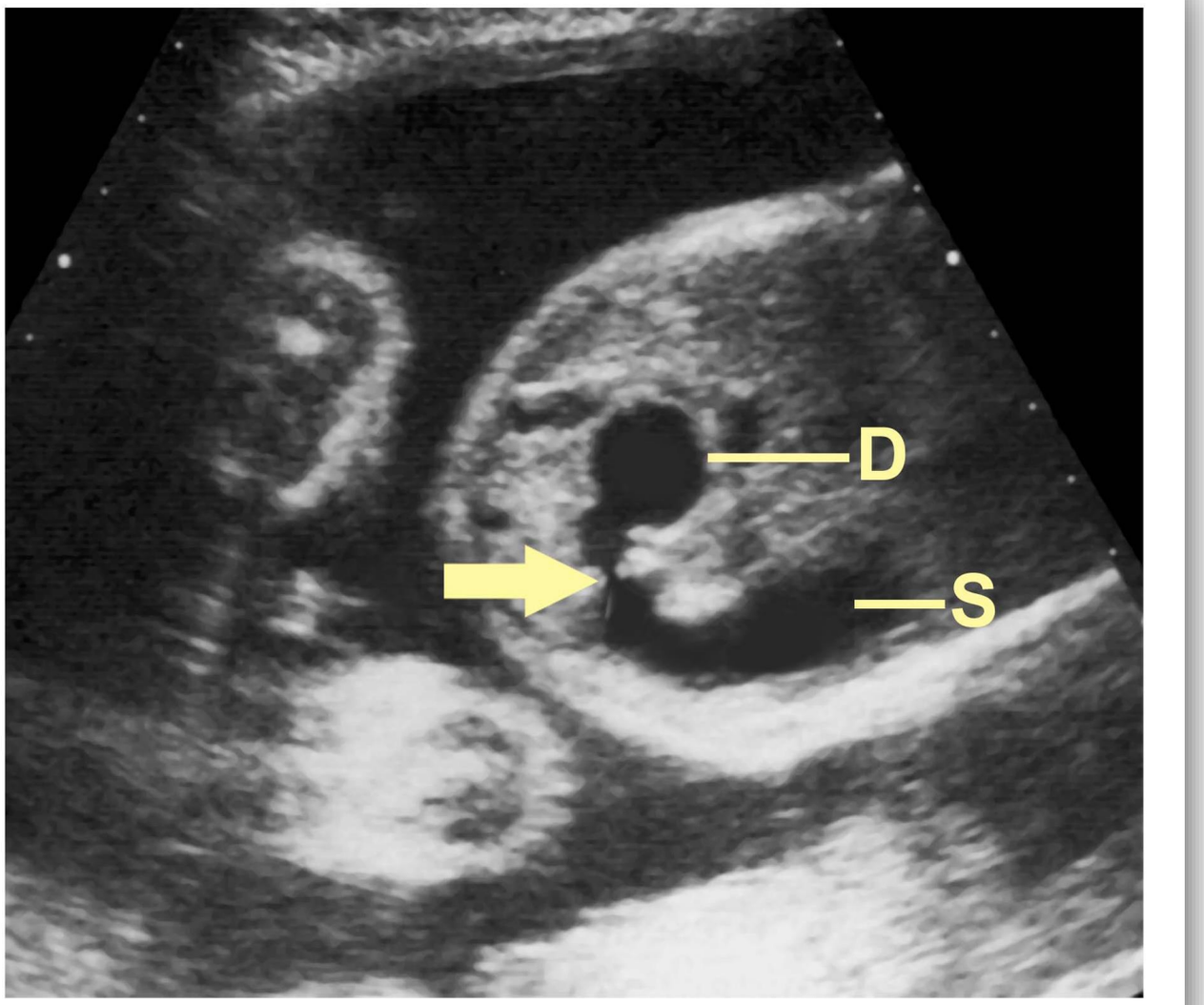
S = stomach
D = duodenum



“Double bubble” sign

DUODENAL ATRESIA

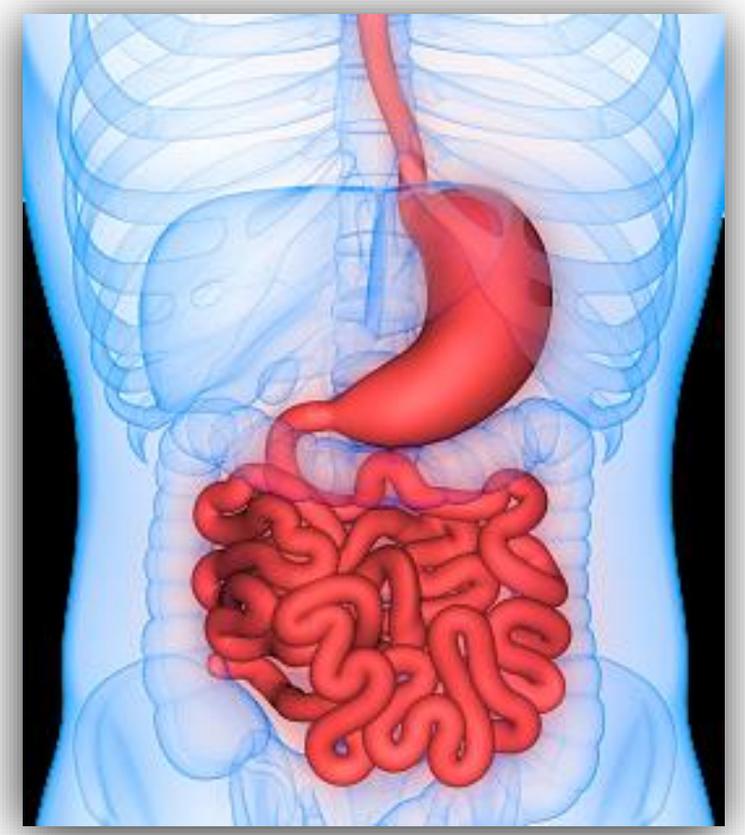
S = stomach
D = duodenum
Arrow = focal atretic segment



Focal atretic segment

Small Bowel Obstruction

- May occur at any level of jejunum or ileum
- Etiologies include:
  - Intestinal atresia
  - Volvulus secondary to malrotation
  - Ischemic vascular insult

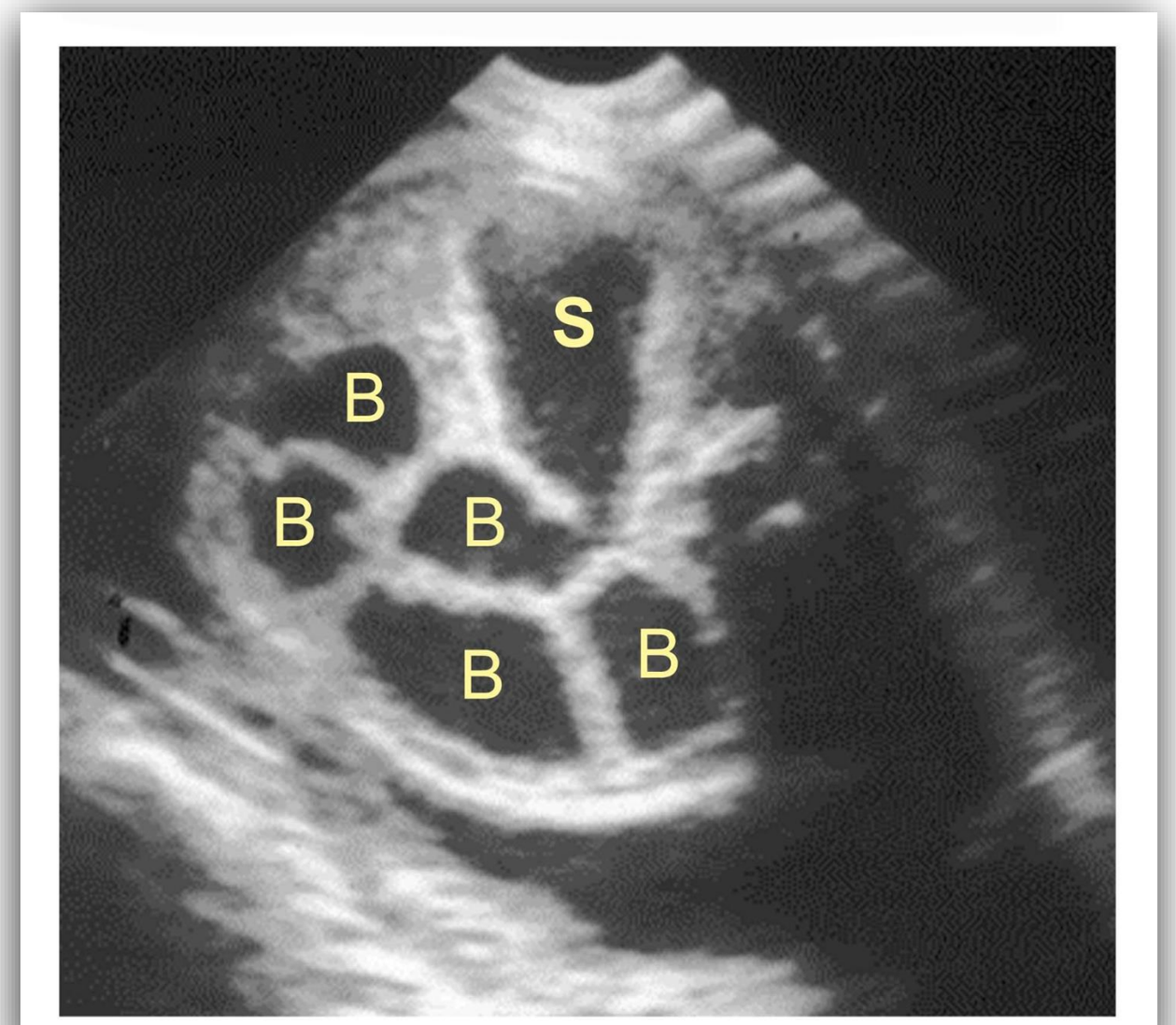


Small Bowel Obstruction

- Sonographic findings include::
  - Multiple dilated, fluid-filled bowel loops
  - Small bowel inner diameter > 7 mm
  - Abdominal distention (AC > expected for dates)

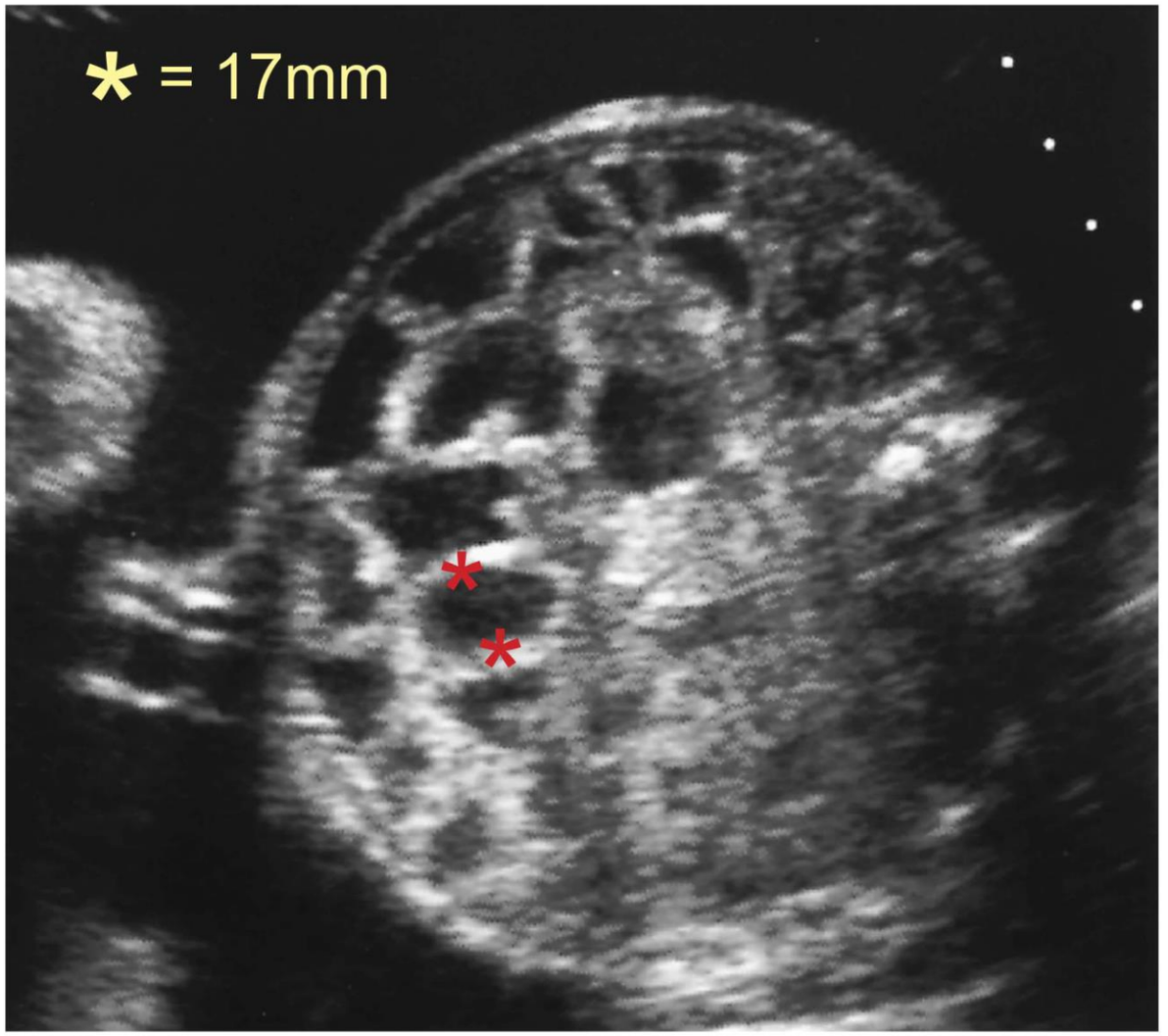
SMALL BOWEL OBSTRUCTION

S = stomach
B = bowel loops



Multiple dilated fluid-fille bowel loops

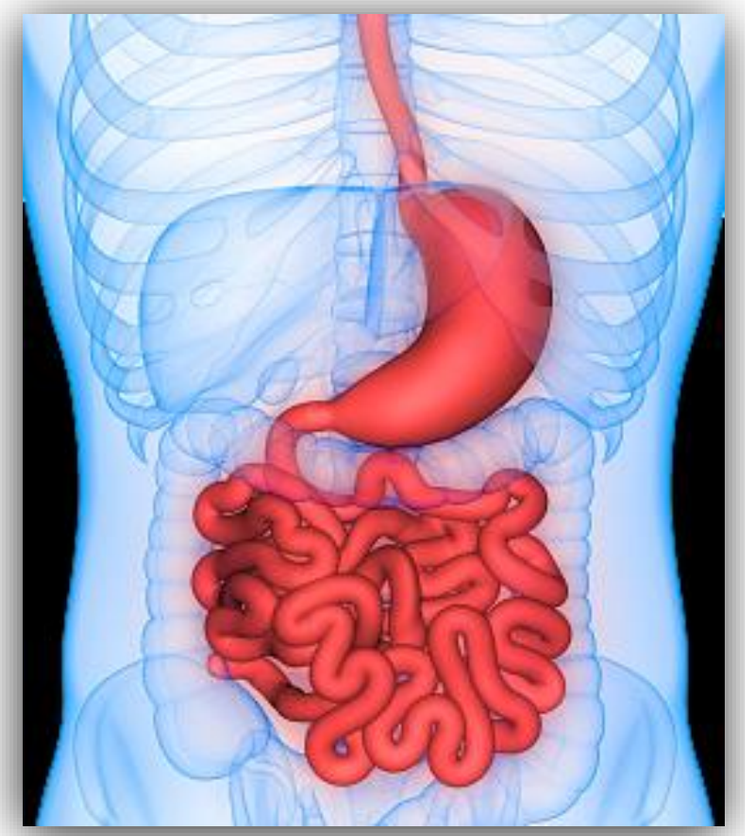
SMALL BOWEL OBSTRUCTION



Inner diameter > 7 mm

Imperforate Anus

- Obliteration of anal opening
- Spectrum of anomaly includes:
  - Membranous separation of anal introitus
  - Anorectal atresia (complete absence of anal mechanism)
- Difficult sonographic diagnosis



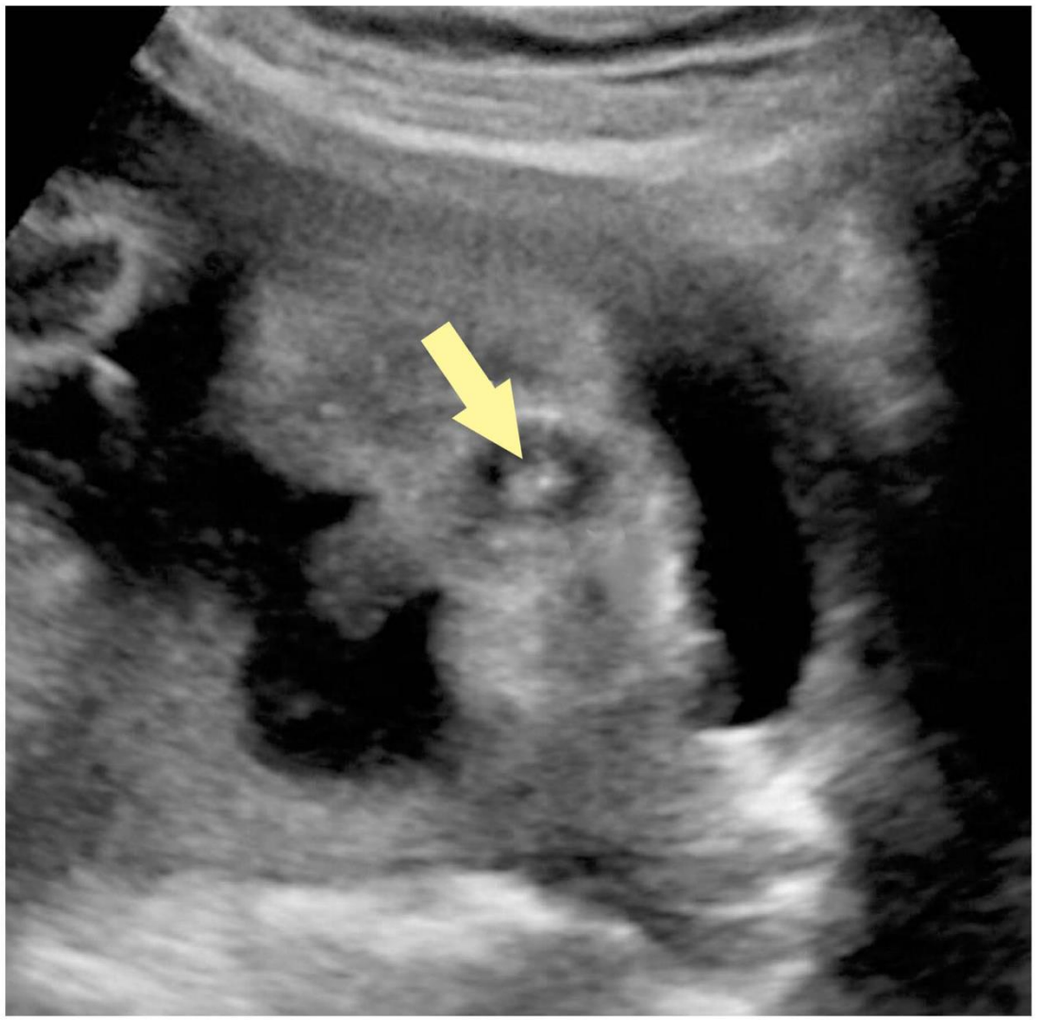
Imperforate Anus

- Associated abnormalities include:
  - Trisomy 21
  - VACTERL association
  - Caudal regression syndrome
  - Esophageal atresia

Imperforate Anus

- Sonographic findings include::
  - Absent perineal ”echogenic spot”
  - Dilated colon
  - Meconium peritonitis

IMPERFORATE ANUS

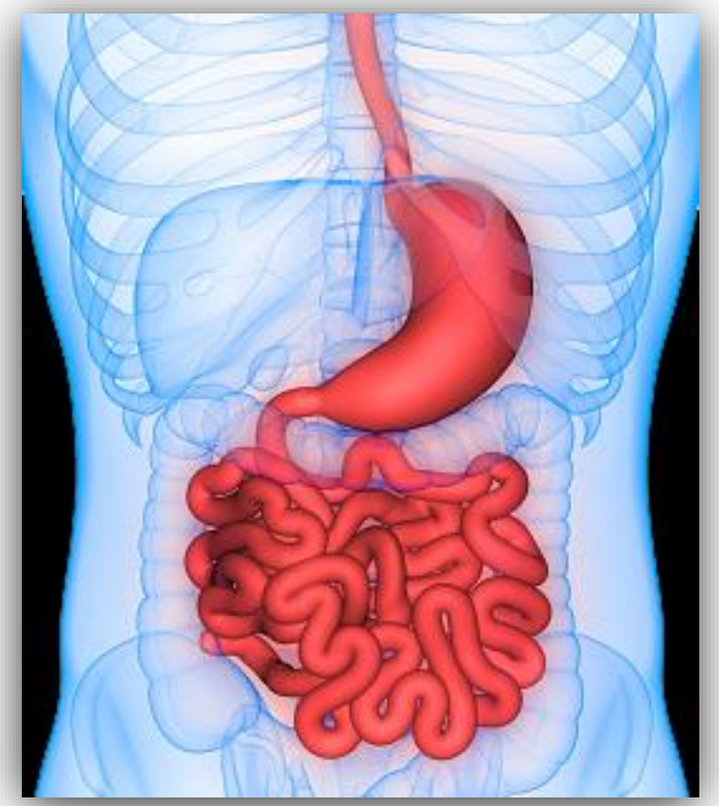


Normal anal ”echogenic spot”

Absent “echogenic spot”

Meconium Peritonitis

- Inflammatory reaction to spillage of fetal meconium into peritoneal cavity
- Increased intra-intestinal pressure can cause bowel perforation
- *Meconium ileus* can cause bowel perforation (cystic fibrosis)



Meconium Peritonitis

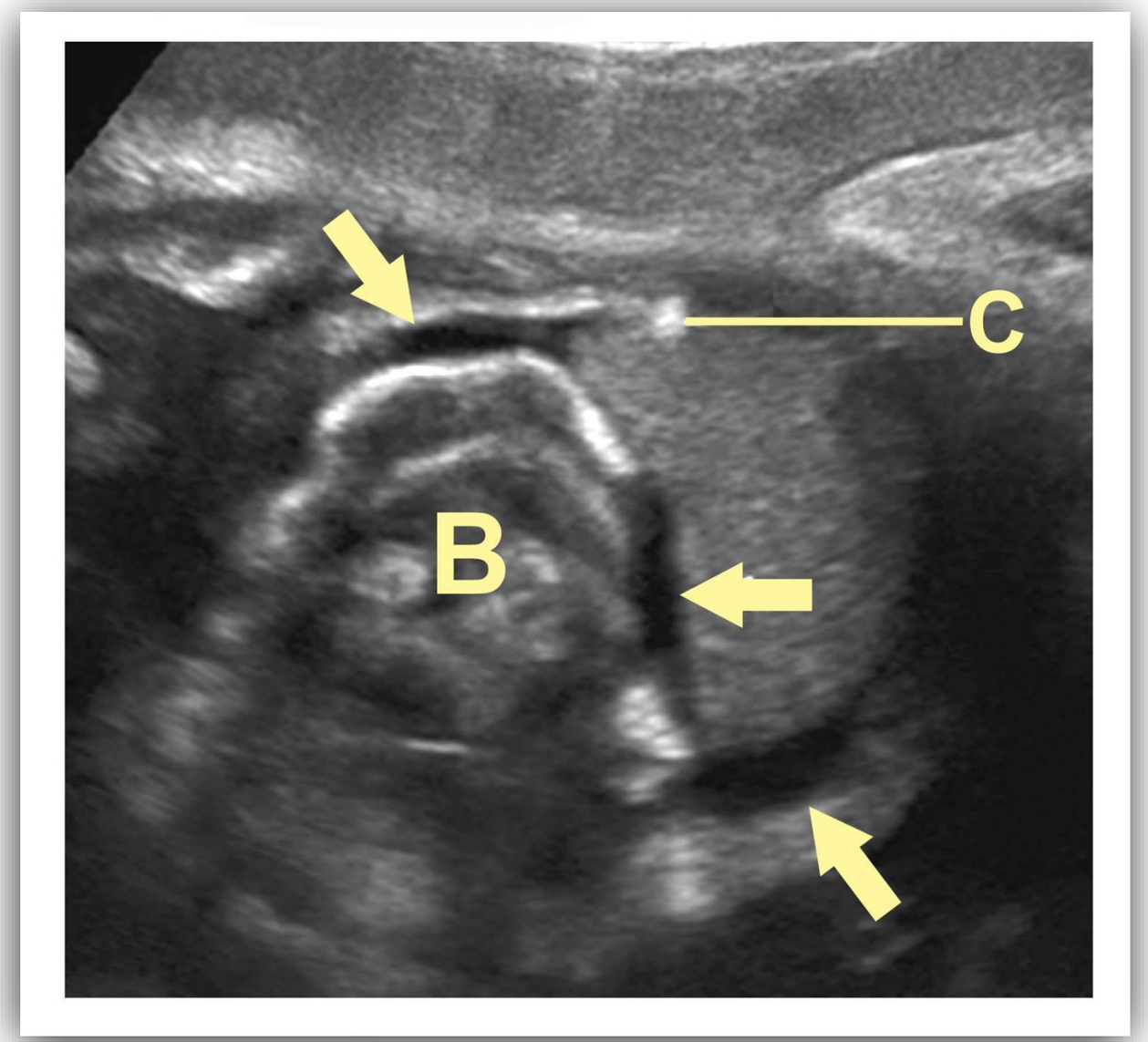
- Associated abnormalities include:
  - Cystic fibrosis
  - Intestinal atresia
  - Polyhydramnios

Meconium Peritonitis

- Sonographic findings include::
  - Echogenic bowel
  - Fetal ascites
  - Intraperitoneal calcifications
  - Meconium pseudocysts
  - Polyhydramnios

MECONIUM PERITONITIS

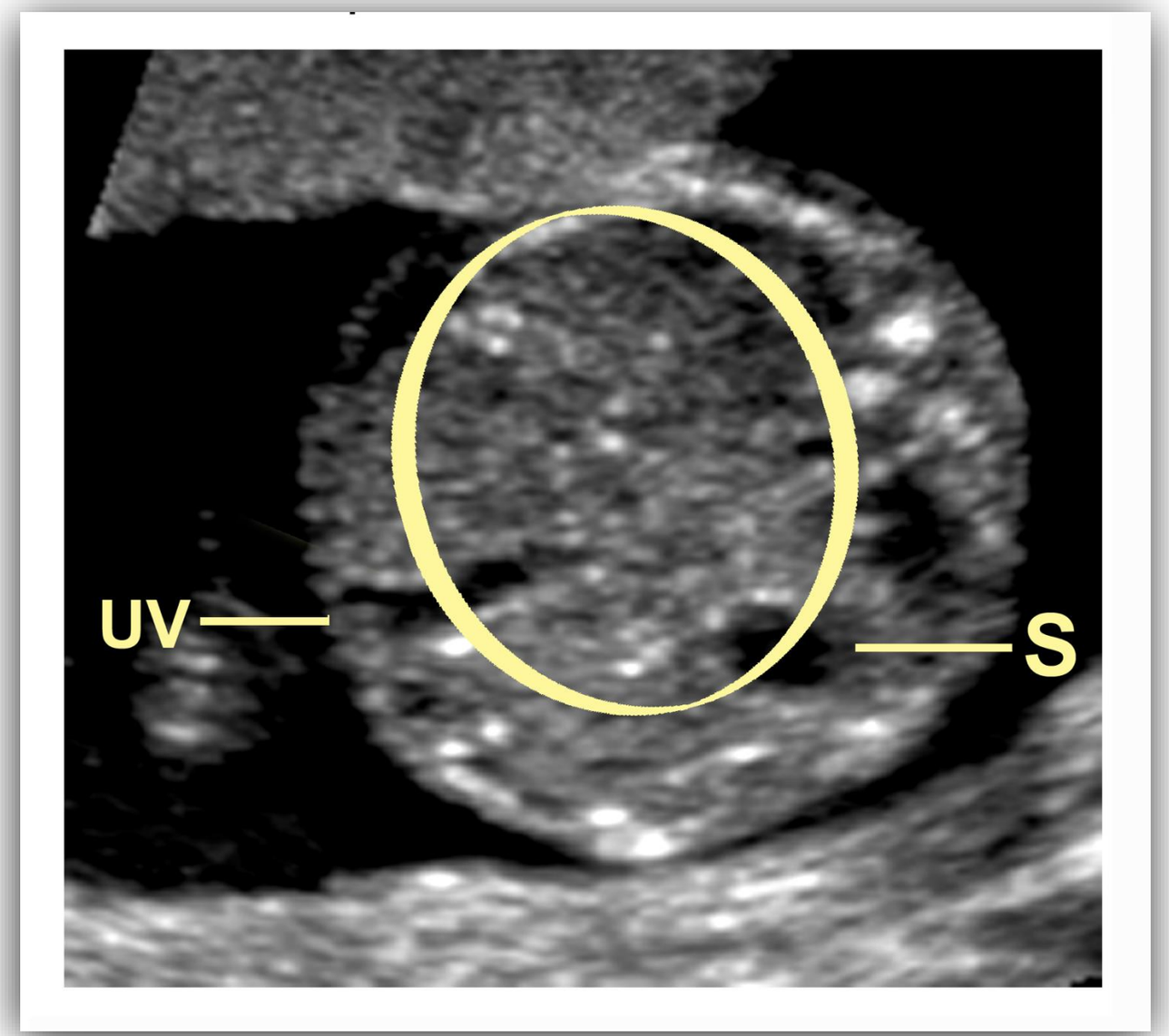
NB = echogenic bowel
C = calcification
Arrows = ascites



Sonographic findings

MECONIUM PERITONITIS

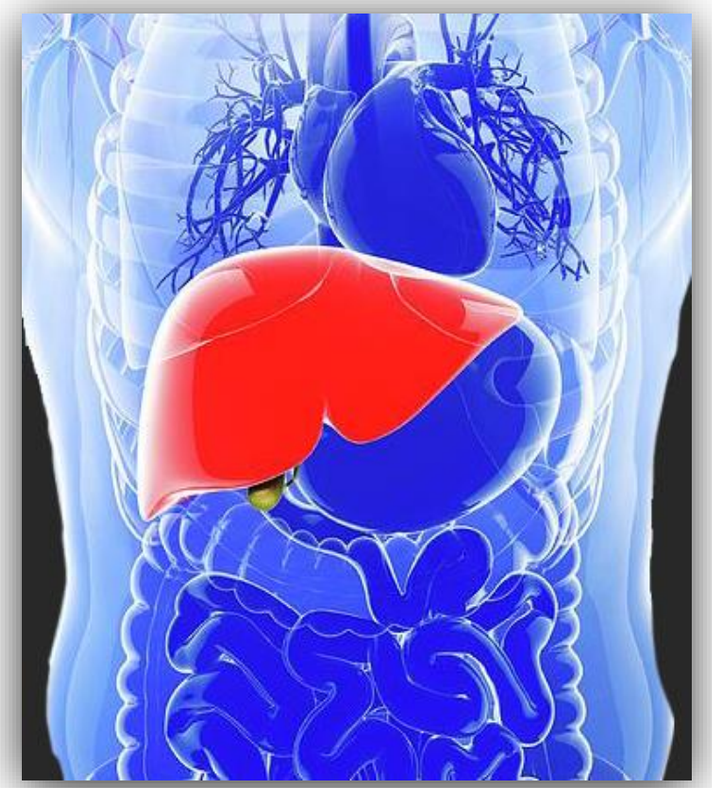
UV = umbilical vein
S = stomach



Intraperitoneal calcifications

Hepatobiliary Abnormalities

- Abnormalities affecting the liver, gallbladder and spleen include:
  - Solid hepatic masses
  - Cystic hepatic masses
  - Hepatic calcification
  - Gallbladder abnormalities
  - Splenic abnormalities



Solid Hepatic Masses

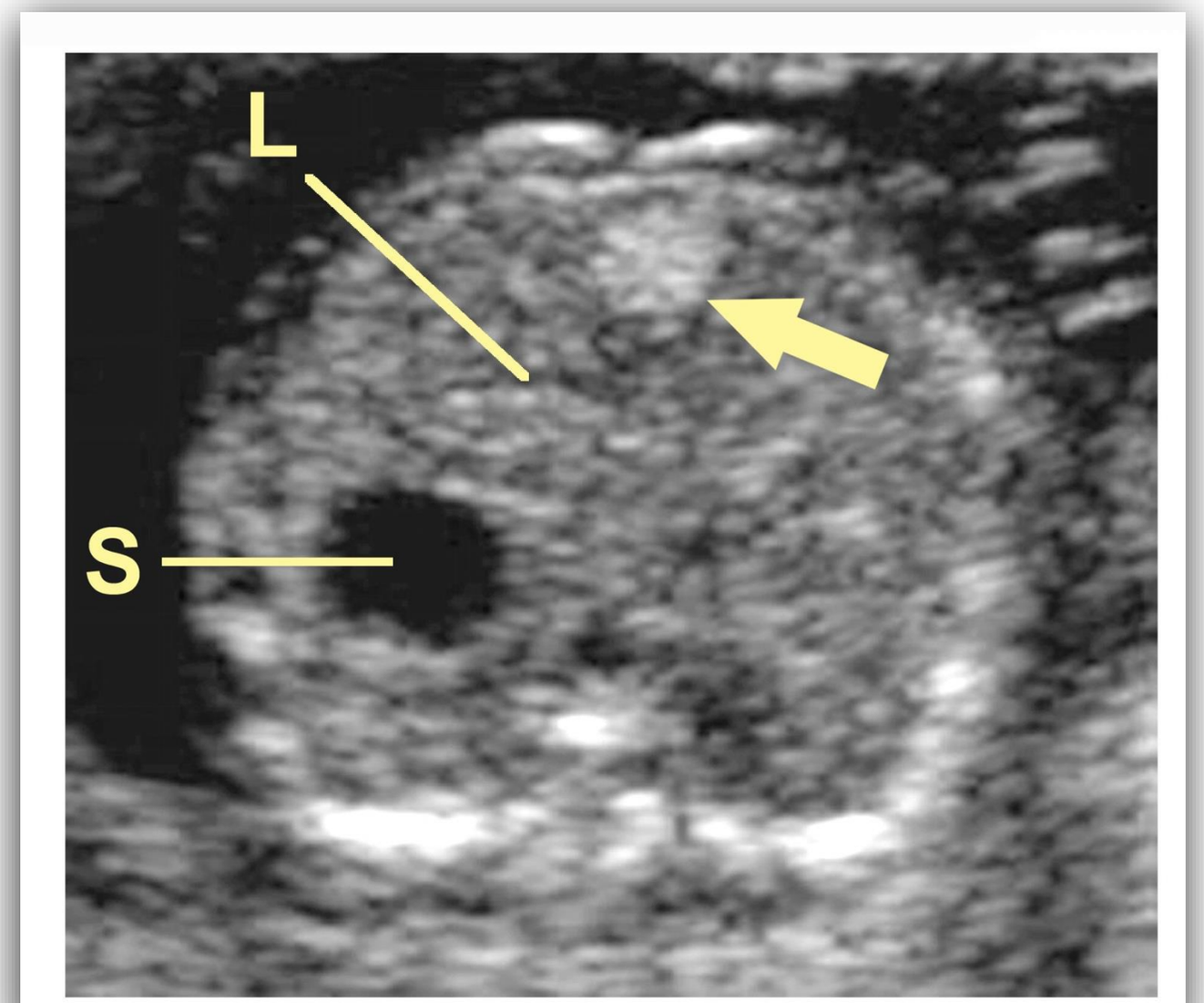
- Always an ominous sonographic finding
- Most common lesions seen in the perinatal period include:
  - Hemangioma (benign vascular tumor)
  - Mesenchymal hamartoma
  - Hepatoblastoma
  - Metastases (from neuroblastoma)

Solid Hepatic Masses

- Sonographic findings include:
  - Focal echogenic or complex mass located in liver
  - Doppler demonstrates arterial blood supply to mass
  - High or low resistive waveforms may be seen

SOLID HEPATIC MASSES

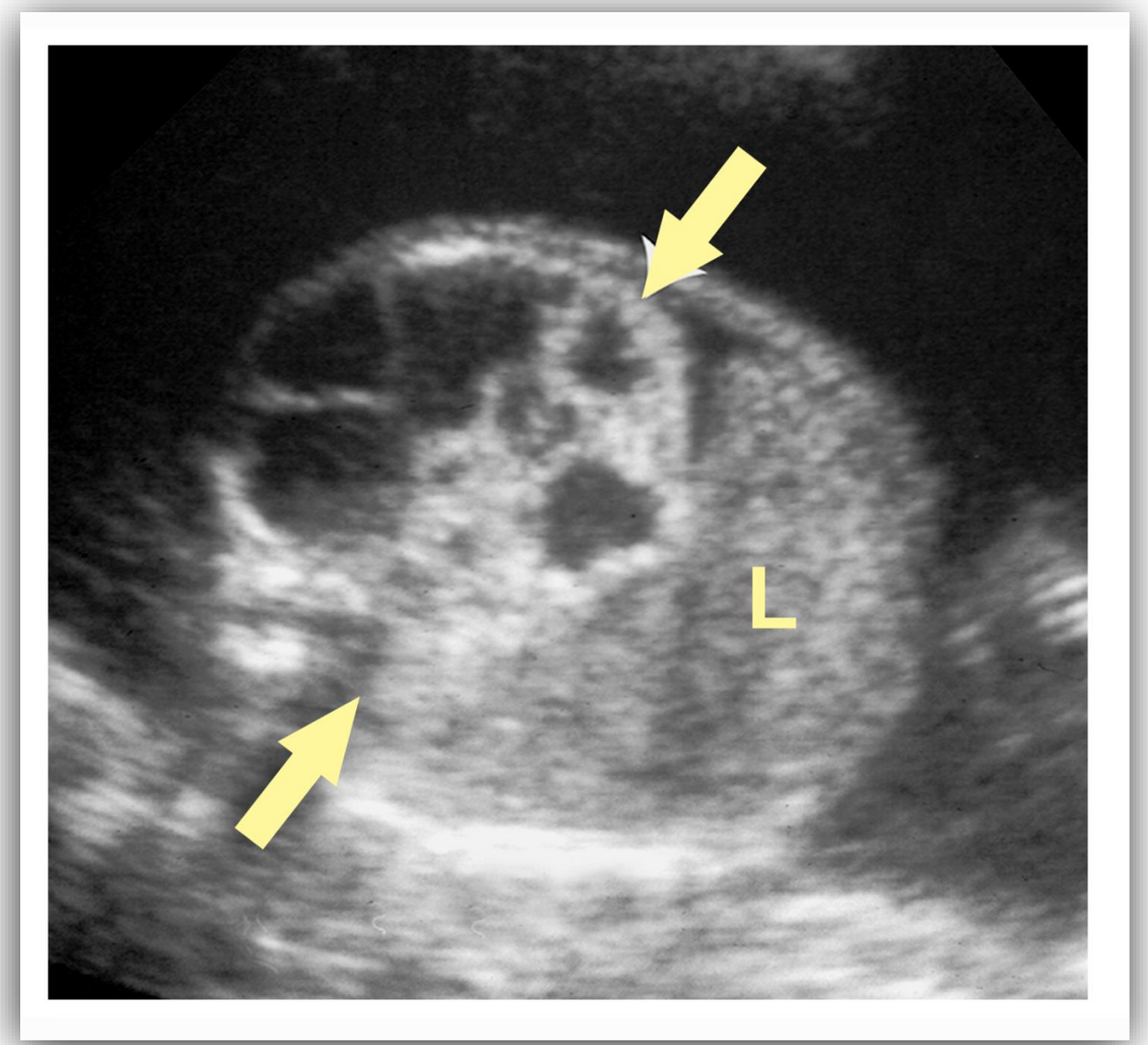
L = liver
S = stomach
Arrow = hemangioma



Hemangioma

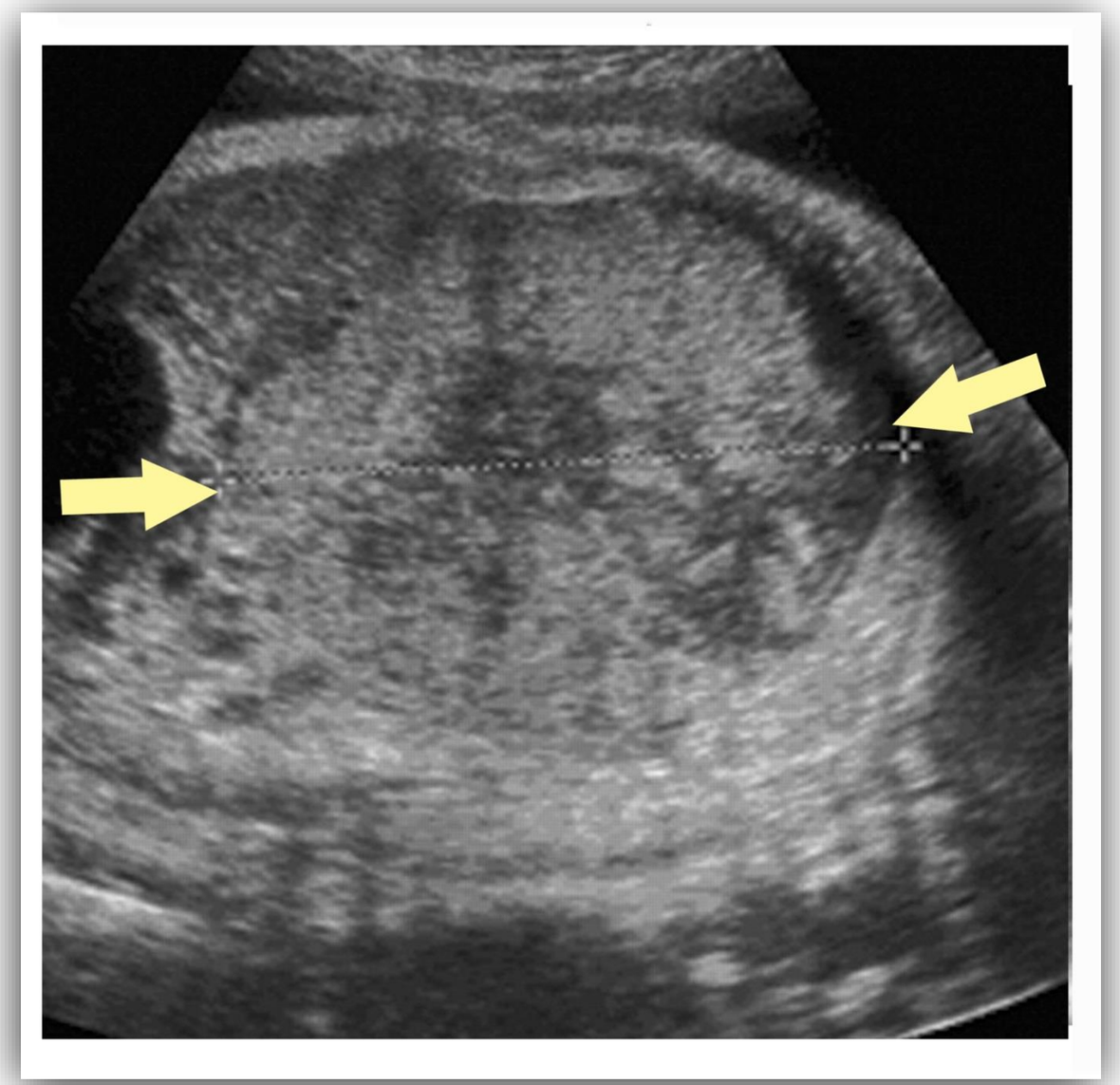
SOLID HEPATIC MASSES

L = liver
Arrows = mass



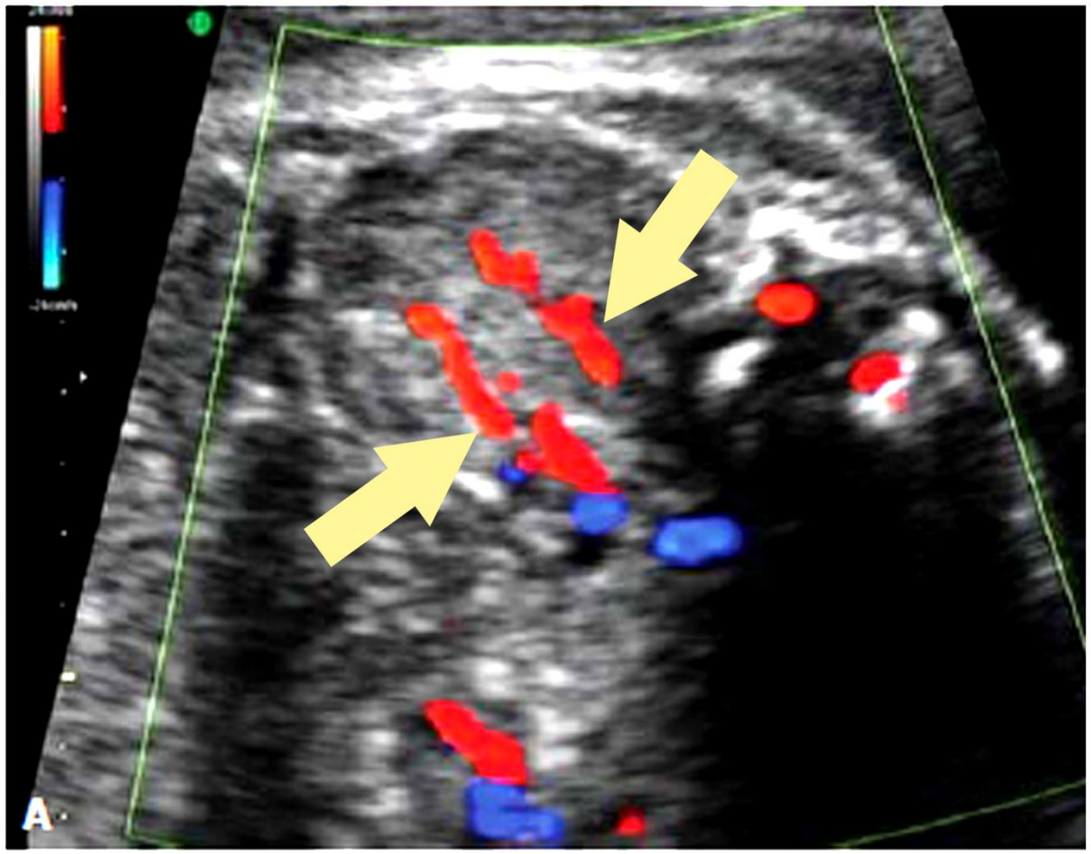
Hamartoma

SOLID HEPATIC MASSES



Hepatoblastoma

SOLID HEPATIC MASSES



Feed vessels

Spectral waveform

Cystic Hepatic Masses

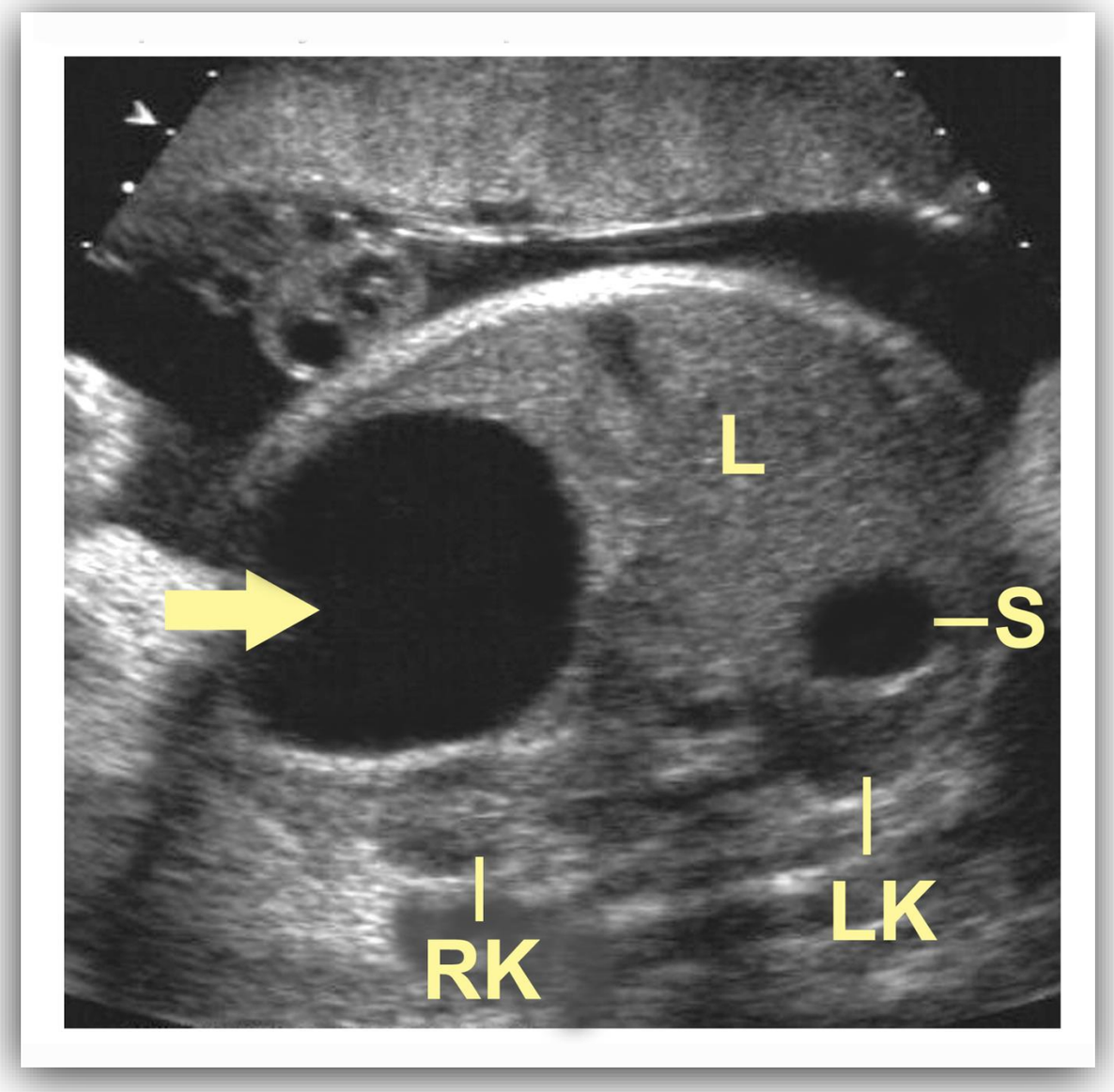
- Uncommon findings usually of little clinical significance
- Most are biliary on origin and include:
  - Hepatic cysts
  - Choledochal cysts

Cystic Hepatic Masses

- Sonographic findings include:
  - Well-circumscribed, anechoic mass in liver
  - Separate from gall bladder
  - Posterior acoustic enhancement

CYSTIC HEPATIC MASSES

L. = liver
S = stomach
LK = left kidney
RK = right kidney
Arrows = mass



Simple hepatic cyst

Hepatic Calcification

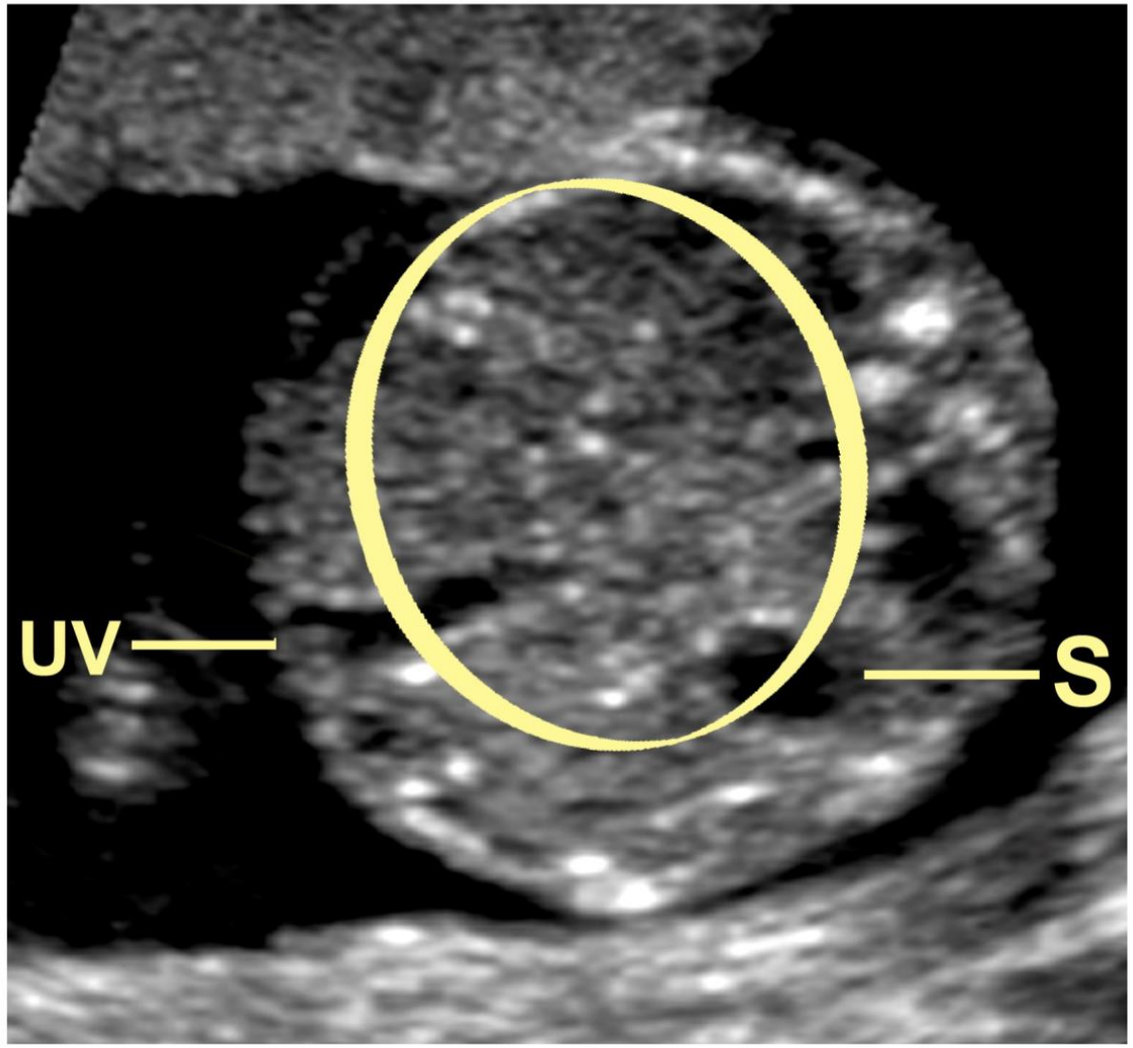
- Common finding (1 : 1750 US exams)
- Site, size, and number are factors in determining significance
- Single with no concomitant abnormalities – f/u only
- Multiple, large, may be associated with:
  - Cytomegalovirus
  - Toxoplasmosis
  - Rubella
  - Syphilis
  - Herpes simplex

Hepatic Calcification

- Sonographic findings:
  - Diffuse: multiple, echogenic foci within liver parenchyma May or may not cast acoustic shadow
  - Focal: focal area of echogenicity that do cast an acoustic shadow
  - Extrahepatic: small, multiple echogenic foci scattered over the peritoneal layer of the liver. May or may not cast acoustic shadow

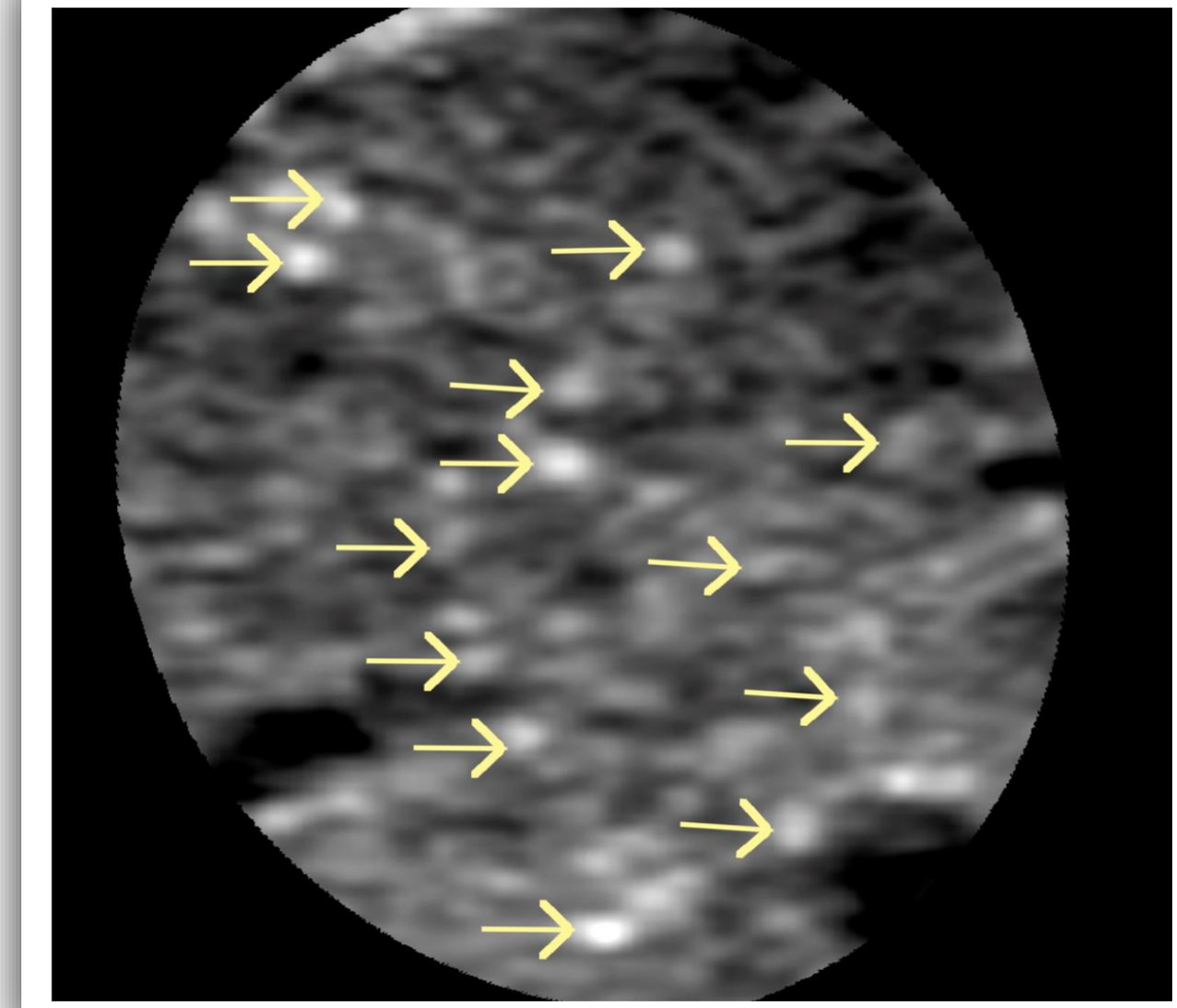
HEPATIC CALCIFICATION

UV = umbilical vein
S = stomach



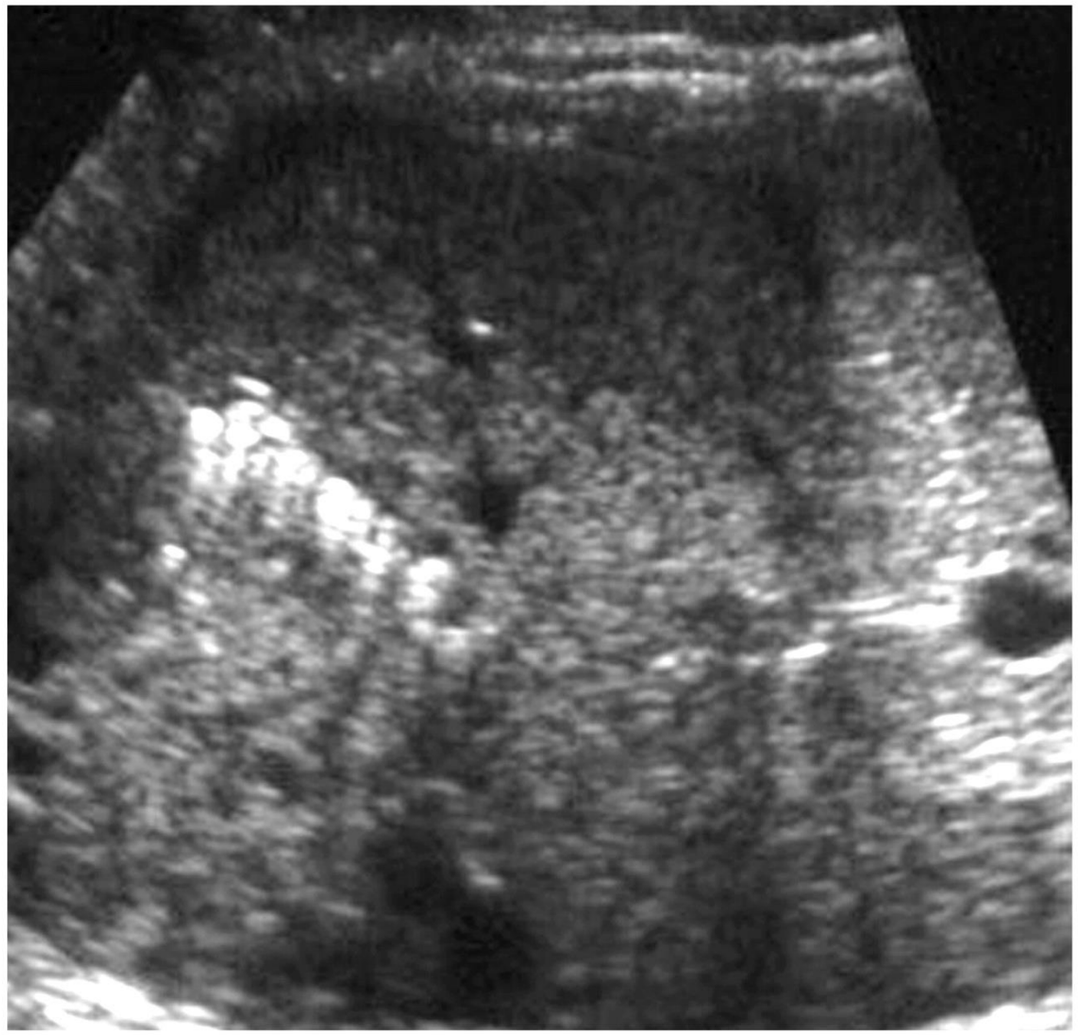
Diffuse calcifications

HEPATIC CALCIFICATION



Diffuse calcifications – close up

HEPATIC CALCIFICATION



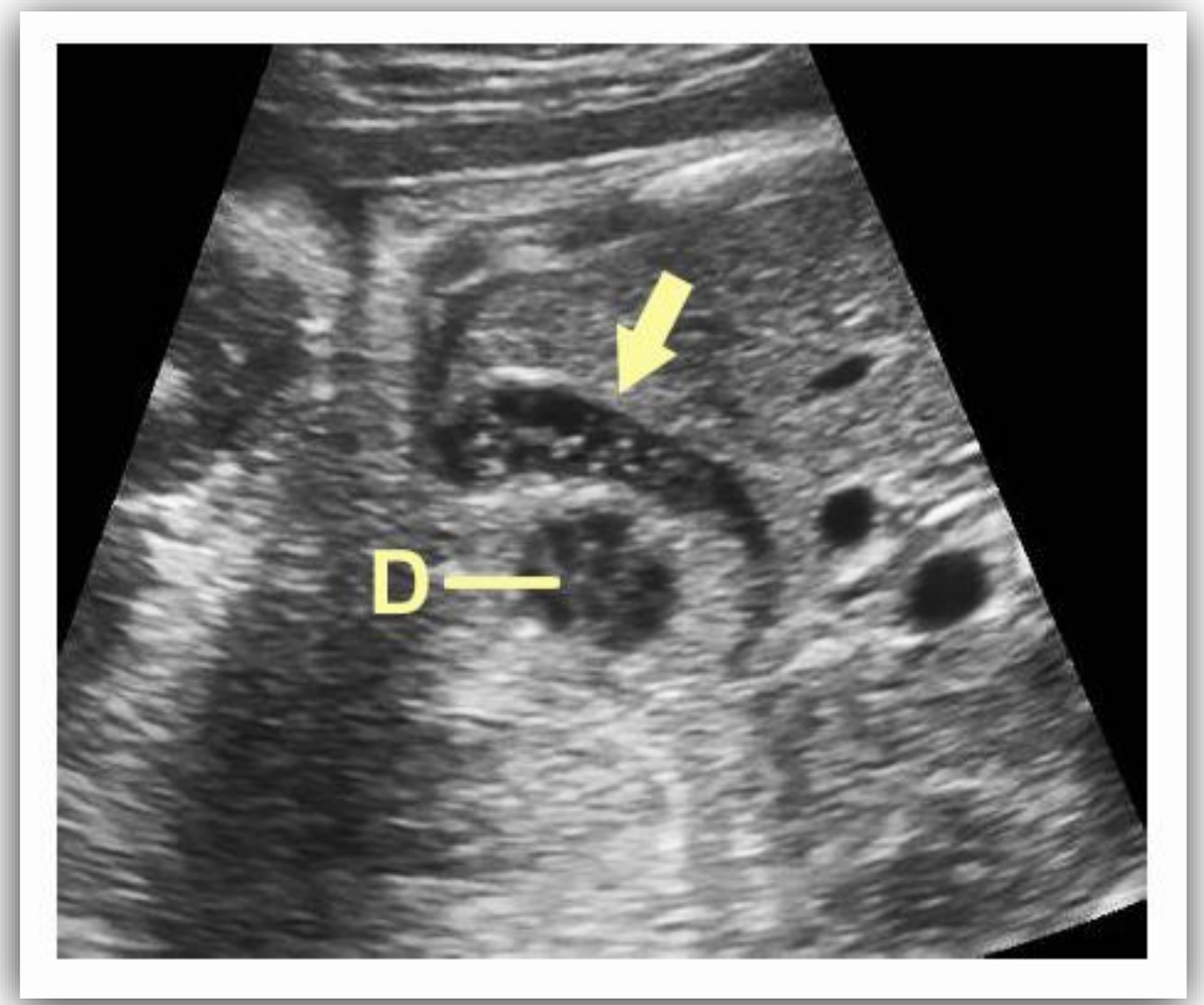
Focal calcifications

Gall Bladder Abnormalities

- Gall bladder visualized 82 – 100% in all 2nd and 3rd trimester fetuses after
- Echogenic foci in gall bladder are common findings
- Inappropriately called *fetal gall stones*
- No studies have demonstrated any pre- or postnatal significance or clinical sequelae
- Does not warrant further follow-up

GALL BLADDER ABNORMALITIES

D = duodenum
Arrow = echogenic foci

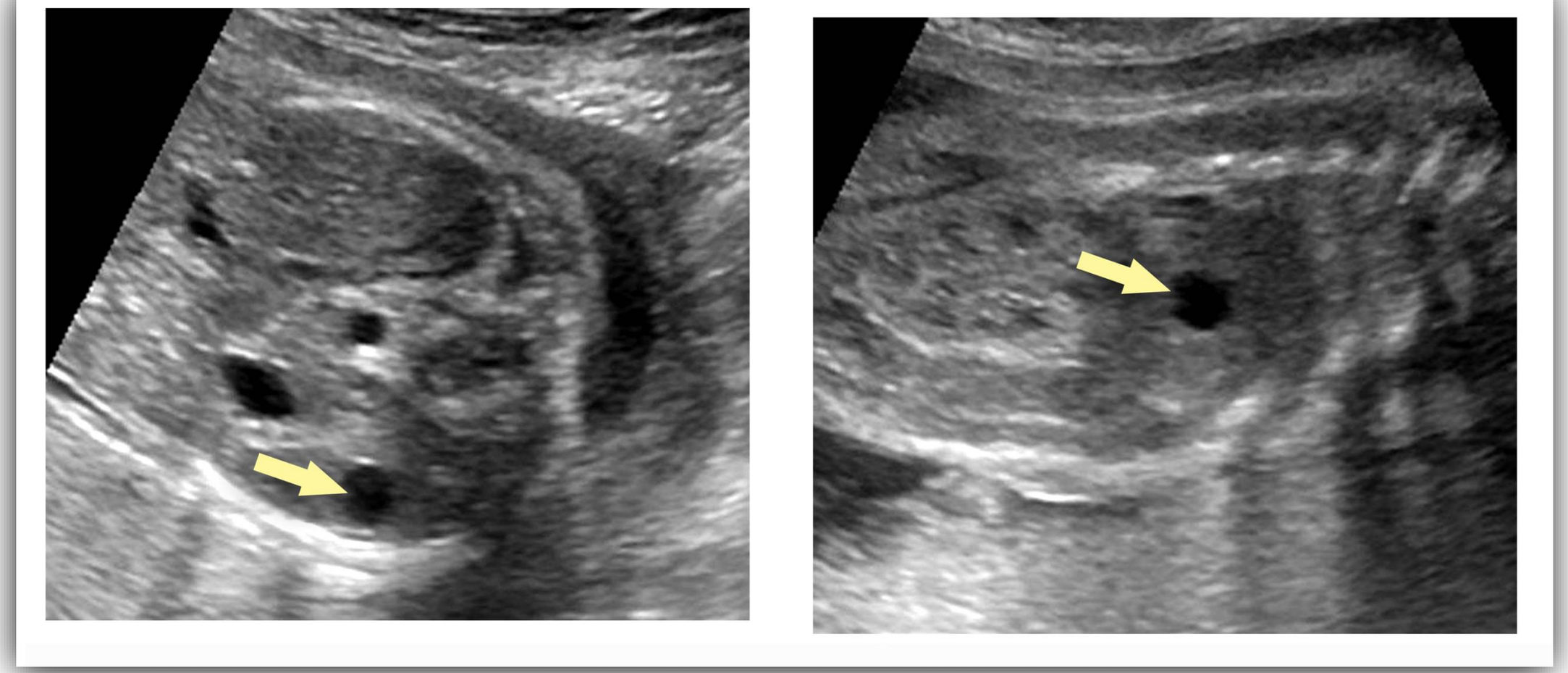


Fetal “gall stones”

Splenic Abnormalities

- Few and rare but include:
  - Splenomegaly
  - Congenital cysts
  - Pseudocysts
  - Solid masses:
    - Dermoids
    - Epidermoids
    - Hemangiomas

SPLENIC ABNORMALITIES



Axial section

Sagittal section

Splenic cyst

Pelvic Masses

- Internal and external pelvic abnormalities include:
  - Ovarian cysts
  - Sacral teratomas

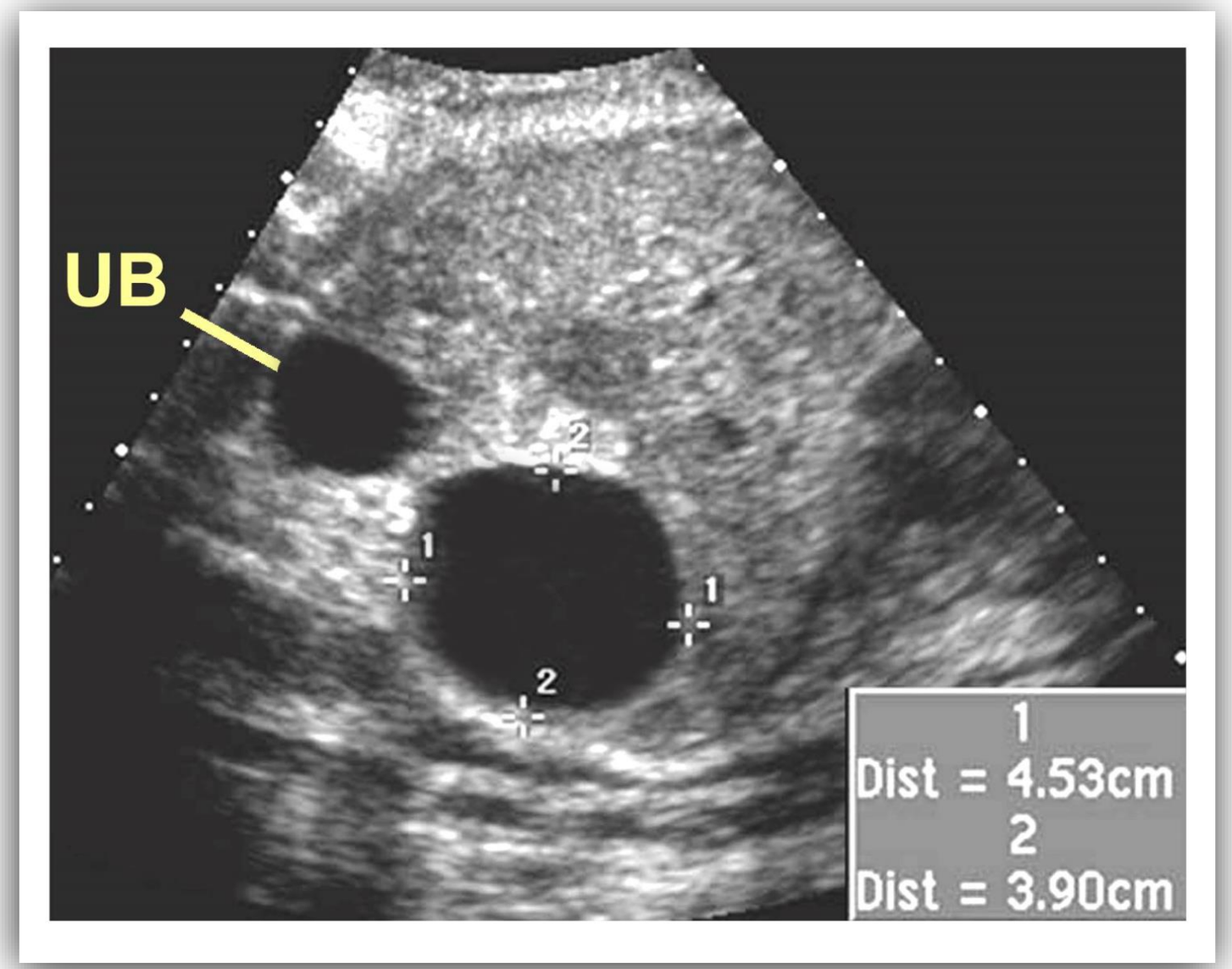
Ovarian Cysts

- Stimulation of fetal ovaries by maternal hormones may cause cysts
- Functional type of cyst
- More common unilaterally than bilaterally
- May be difficult to differentiate from urachal or mesenteric cysts

Ovarian Cysts

- Sonographic findings include:
  - Simple cystic mass found in fetal pelvis
  - Separate from GI tract, kidney, ureter and bladder
  - Female gender identified

OVARIAN CYSTS



UB = urinary bladder

Sacral Teratomas

- Congenital germ cell tumors consisting of tissue derived from all three embryonic tissue layers
- Teratoma = "*monster tumor*"
- May be cystic, solid, or complex
- Categorized by location relative to sacrum
  - Pre-sacral: arising from anterior aspect of sacrum
  - Sacrococcygeal: arising from posterior aspect of sacrum

Sacral Teratomas

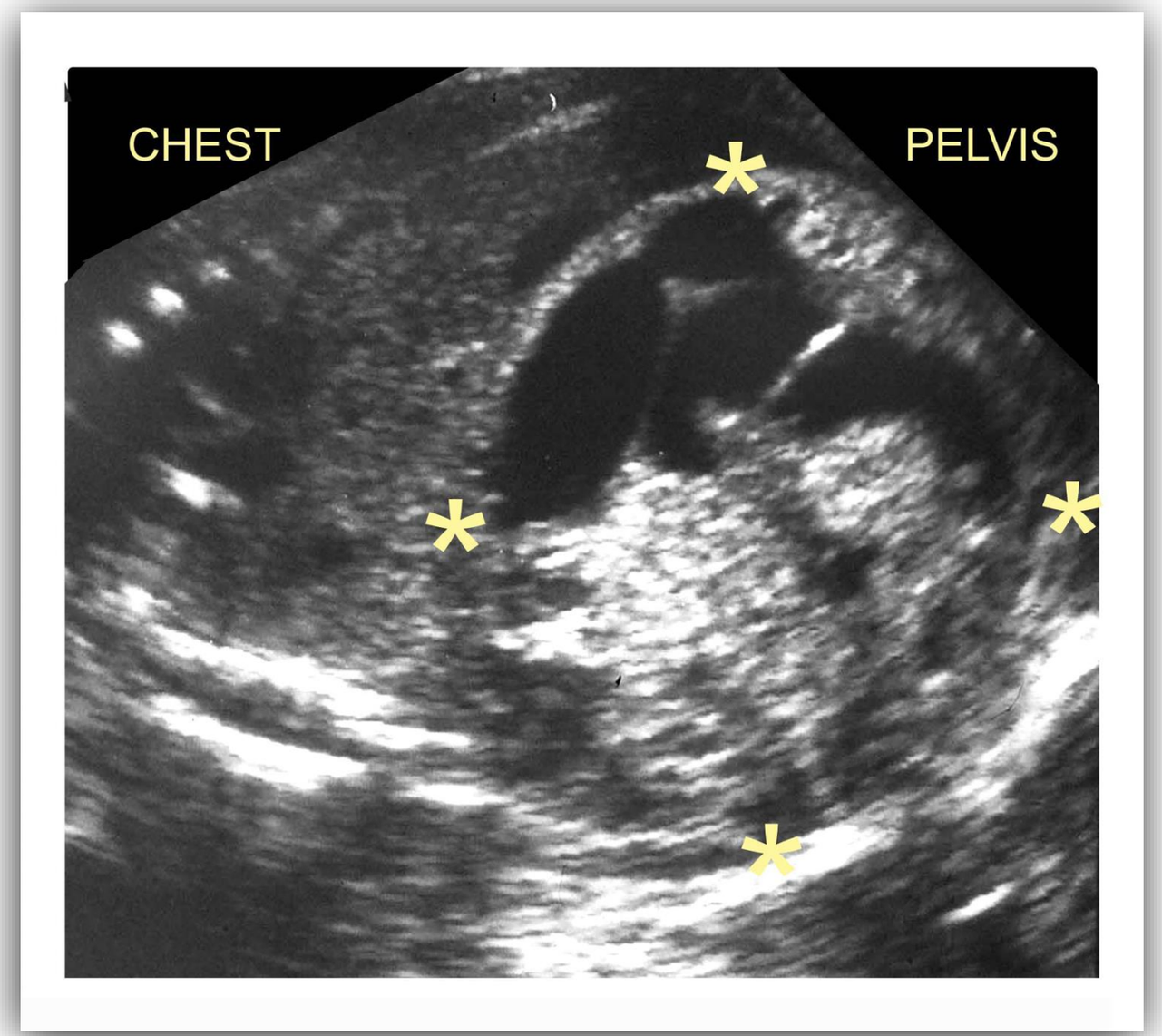
- Associated abnormalities include:
  - Myelomeningocele
  - Vertebral anomalies
  - Hydrops fetalis
  - Ureteral obstruction
  - Gastrointestinal obstruction
  - Tumor rupture
  - Dystocia (difficult delivery)

Sacral Teratomas

- Sonographic findings include:
  - Complex, large mass seen in the fetal pelvis or arising from fetal rump
  - May contain cystic, solid, and calcific components
  - Presacral tumors project into fetal abdomen
  - Sacrococcygeal tumors project exophytically off fetus into amniotic cavity

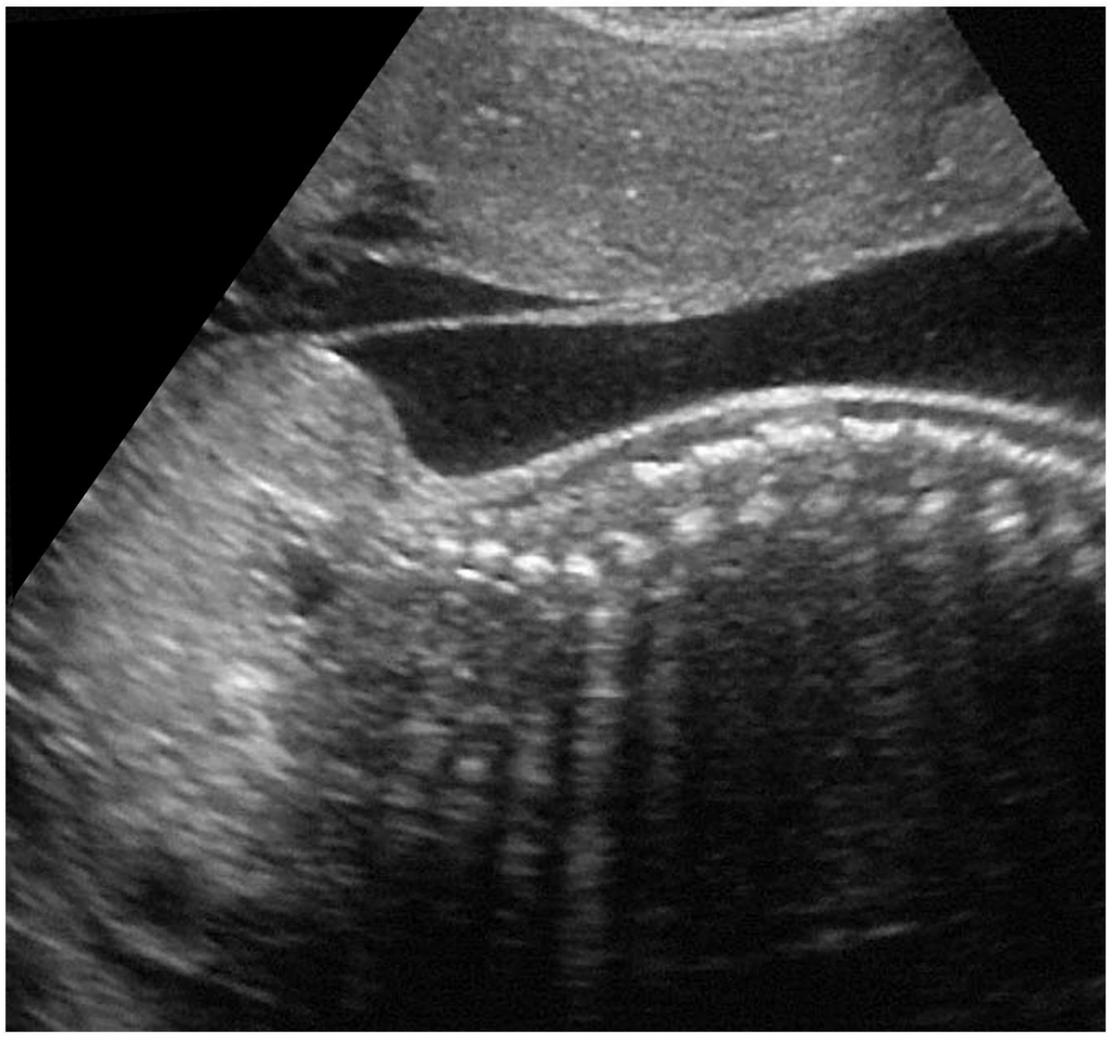
SACRAL TERATOMAS

Coronal section

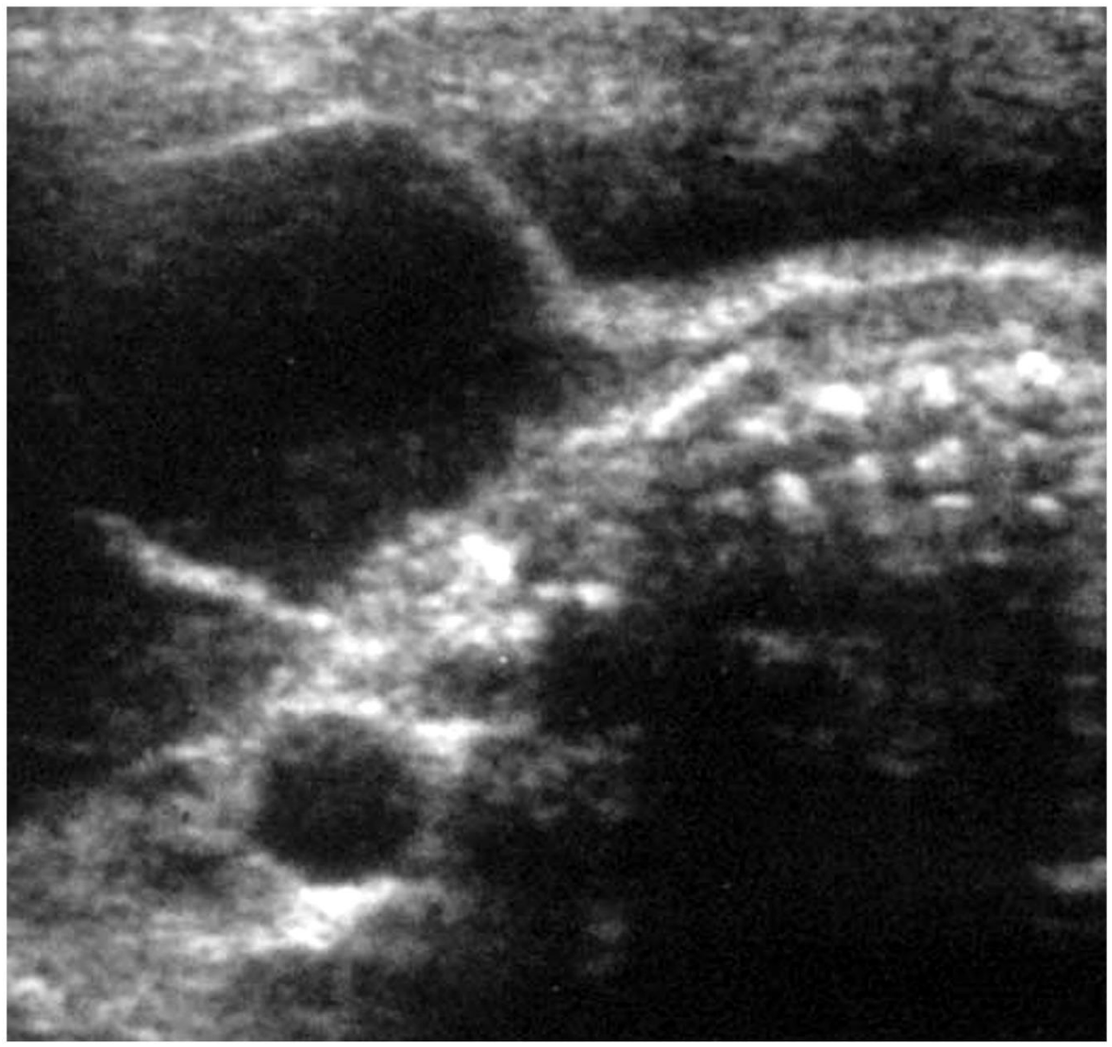


Presacral teratoma

SACRAL TERATOMAS



Sagittal section



Sacrococcygeal teratoma

OB GYN SONOGRAPHY REVIEW

Fetal Abdomen and Pelvis

Jim Baun, BS, RDMS, RVT, FSDMS

KPSAHS

Date