OB GYN SONOGRAPHY REVIEW

Fetal Complications

Course Outline

- Hydrops fetalis
- Intrauterine growth restriction (IUGR)
- Fetal anemia
- Intracranial calcifications
- Fetal demise
- Fetal therapy

Hydrops Fetalis

- An excessive accumulation of fluid in at least 2 locations within a fetus
- Caused by an imbalance in fluid homeostasis in which more fluid is produced by fetus than can be resorbed
- Characterized by:
  - Interstitial edema (*anasarca*)
  - Pleural and/or pericardial effusions
  - Ascites

Hydrops Fetalis - Immune

- Results from immune response from exposure to foreign antigens (*alloantigens*) encountered by the fetal circulatory system. Predominant causes:
  - *Hemolytic disease*: destruction of fetal RBCs by maternal immunoglobulins acting on paternally inherited antigens (*erythroblastosis fetalis*)
  - *Rh isoimmunization*:
    - Rh (-) mother sensitized by prior pregnancy with Rh(+) fetus
    - In a subsequent Rh (+) fetus, maternal antibodies attack fetal antigens
    - Results in destruction of large number of fetal RBCs
- *ABO incompatibility: less severe*

Hydrops Fetalis – Nonimmune

- Results from pathological condition that disrupts normal fluid homeostasis in fetus
- Fetal cardiac anomalies most common cause. Other include:
  - Chromosomal anomalies (*trisomies, Turner syndrome*)
  - Maternal disease (*TORCH infections, diabetes, pre-eclampsia*)
  - Fetal malformations (*obstructive vascular problems, neoplasms, GU abnormalities, skeletal abnormalities, cord/placental problems*)

Hydrops Fetalis

- Sonographic signs include:
  - Polyhydramnios
  - Pericardial effusion
  - Ascites, hepatomegaly
  - Pleural effusions
  - Subcutaneous edema (anasarca > 5 mm)
  - Hydropic facies
  - Cardiomegaly
  - Dilated umbilical vein
  - Abnormally thickened placenta

HYDROPS FETALIS

Pericardial effusion

HYDROPS FETALIS

Pleural effusion

HYDROPS FETALIS

Ascites/hepatomegaly

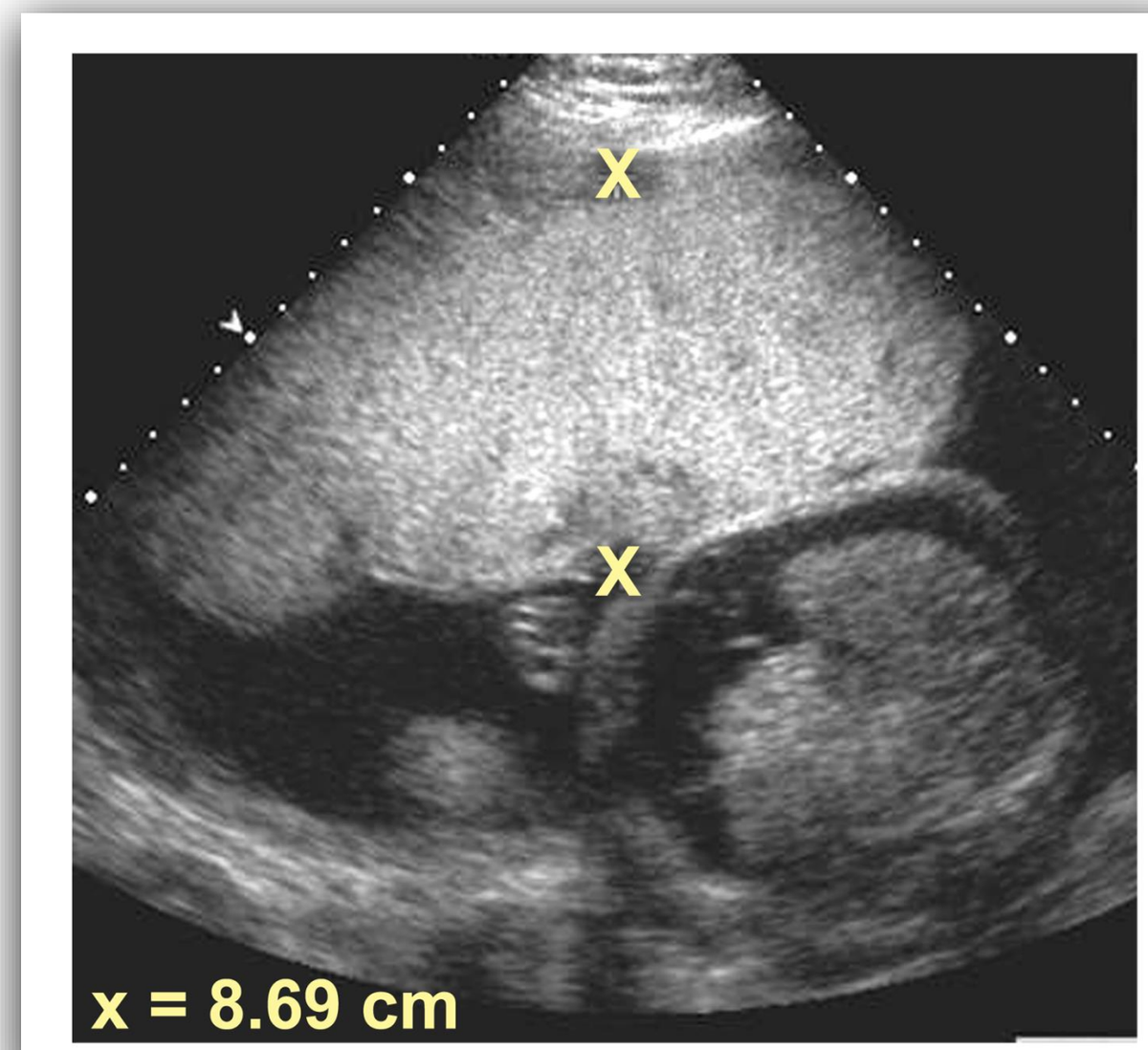
HYDROPS FETALIS

Anasarca

HYDROPS FETALIS

Hydropic facies

HYDROPS FETALIS



Thickened placenta

Intrauterine Growth Restriction (IUGR)

- Generic term allied to large number of physiological conditions that result in neonate weighing below 10th percentile
- Multiple etiologies but most related to conditions of the placenta, uterus, amniotic fluid volume and placental transfer rate
- Reduced uterine plasma volume thought to be major physiological factor

Intrauterine Growth Restriction (IUGR)

- Three major categories of causative mechanisms:
  - Maternal conditions
  - Placental insufficiency
  - Fetal contributing factors
- Two presenting types of IUGR
  - Symmetric IUGR
  - Asymmetric IUGR

Symmetric IUGR

- Accounts for ≈ 25% of cases
- Usually genetic in etiology
- Characterized by all fetal biometric parameters measuring less than expected for dates (below 10th percentile)
- Associated abnormalities:
  - Trisomy 18 (Edwards syndrome)
  - Trisomy 21 (Down syndrome)
  - Neural tube defects
  - Potter sequence

Symmetric IUGR

- Sonographic findings include:
  - All biometric measurements > 2 weeks below expected gestational age
  - Transcerebellar diameter consistent with dates ☑
  - Mature placenta earlier than expected
  - Oligohydramnios
  - Low biophysical profile

INTRAUTERINE GROWTH RESTRICTION

Mature placenta at 33 weeks

Asymmetric IUGR

- Accounts for ≈ 75% of cases
- Usually occurs in the last 8 – 10 weeks of pregnancy
- "*Head sparing*" hemodynamic patterns preferentially shunt blood to brain
- Characterized by asymmetric head and abdominal circumference sizes
  - AC below 10th percentile for date
  - BPD, HC remain appropriate for dates
  - FL remains appropriate for dates

Asymmetric IUGR

- Sonographic findings include:
  - Head circumference to abdominal (HC/AC) ratio > 2 standard deviations
  - AC > 2 weeks behind HC
  - Mature placenta earlier than expects
  - Oligohydramnios

Doppler Evaluation

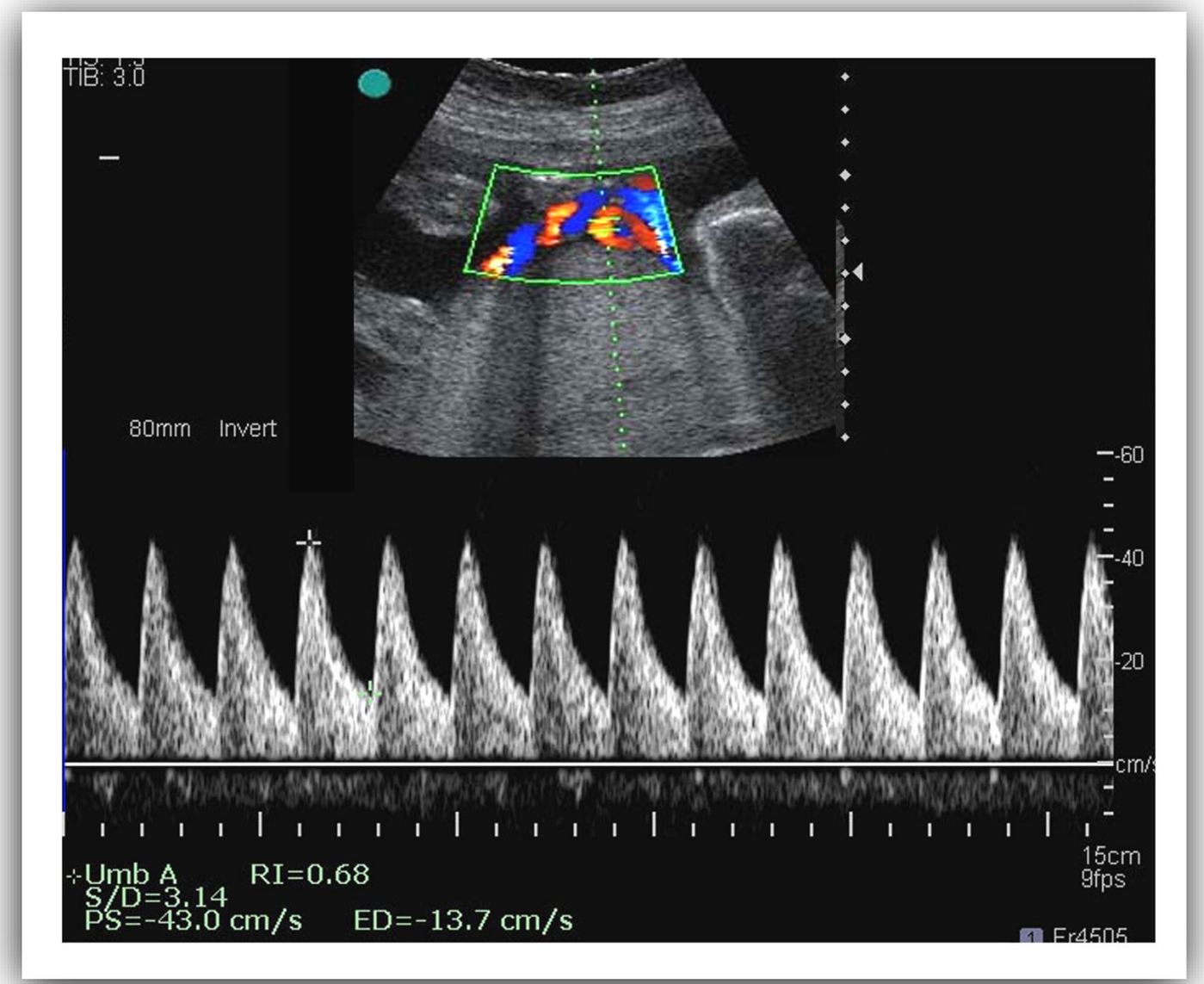
- Many protocols have been developed and investigated over past 30 years
- No one single technique has proven to be diagnostic
- All have low predictive value (20 – 40%)
- When Doppler findings suggest abnormality, additional prenatal monitoring & testing is indicated
- Most widely used Doppler interrogation:
  - Umbilical artery resistance

Umbilical Artery Resistance Doppler

- Indirect measure of blood flow into placenta (RI)
- Progressive decrease in RI during pregnancy is normal
- RI > 0.8 is abnormal
- S/D ratio > 2.6 is abnormal after 30 weeks
- Ratios are higher if measured closer to fetal cord insertion
- **REVERSE DIASTOLIC FLOW IS ALWAYS OMINOUS**

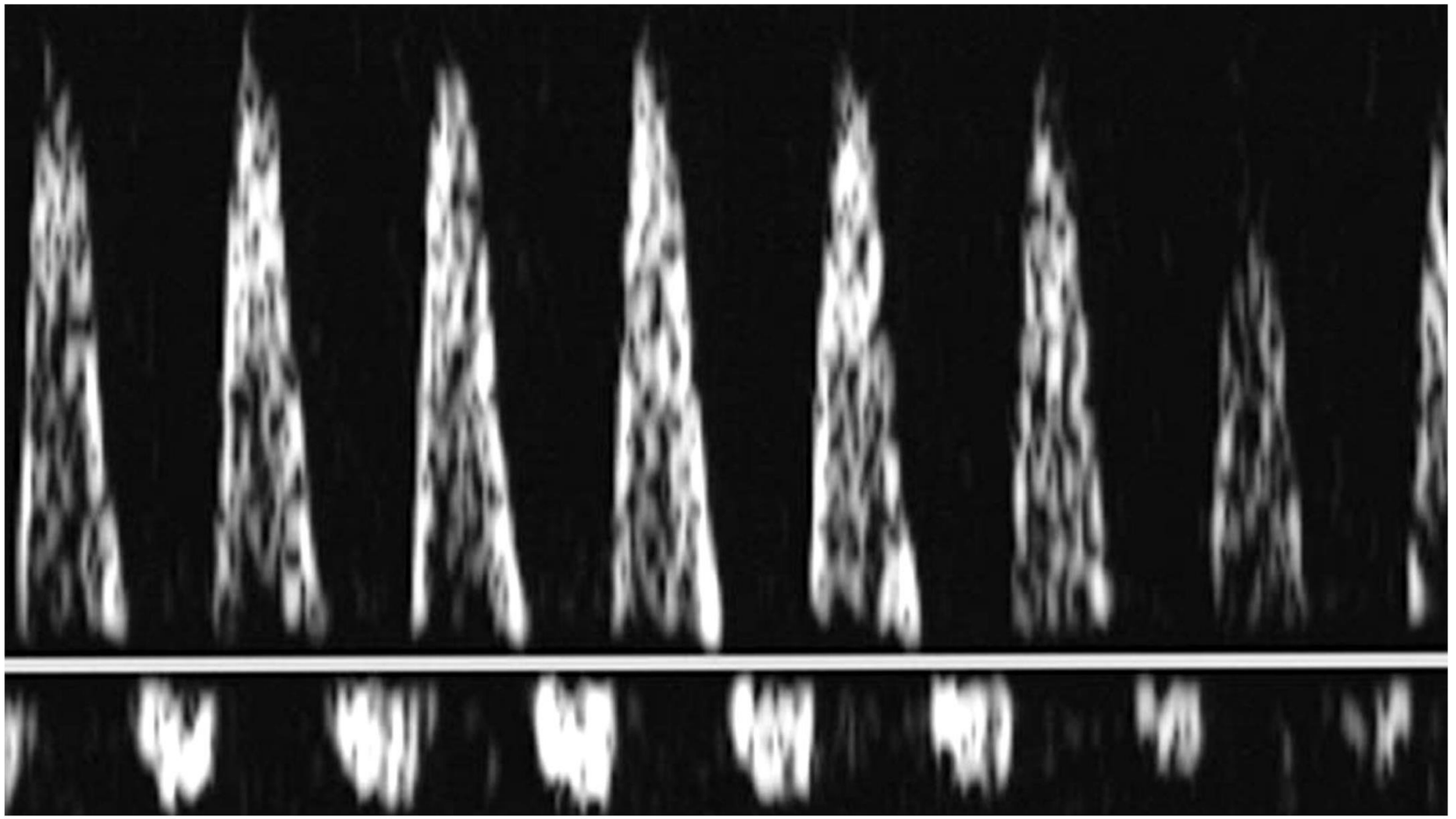
INTRAUTERINE GROWTH RESTRICTION

RI = 0.68



Normal umbilical artery low-resistance spectral waveform

INTRAUTERINE GROWTH RESTRICTION

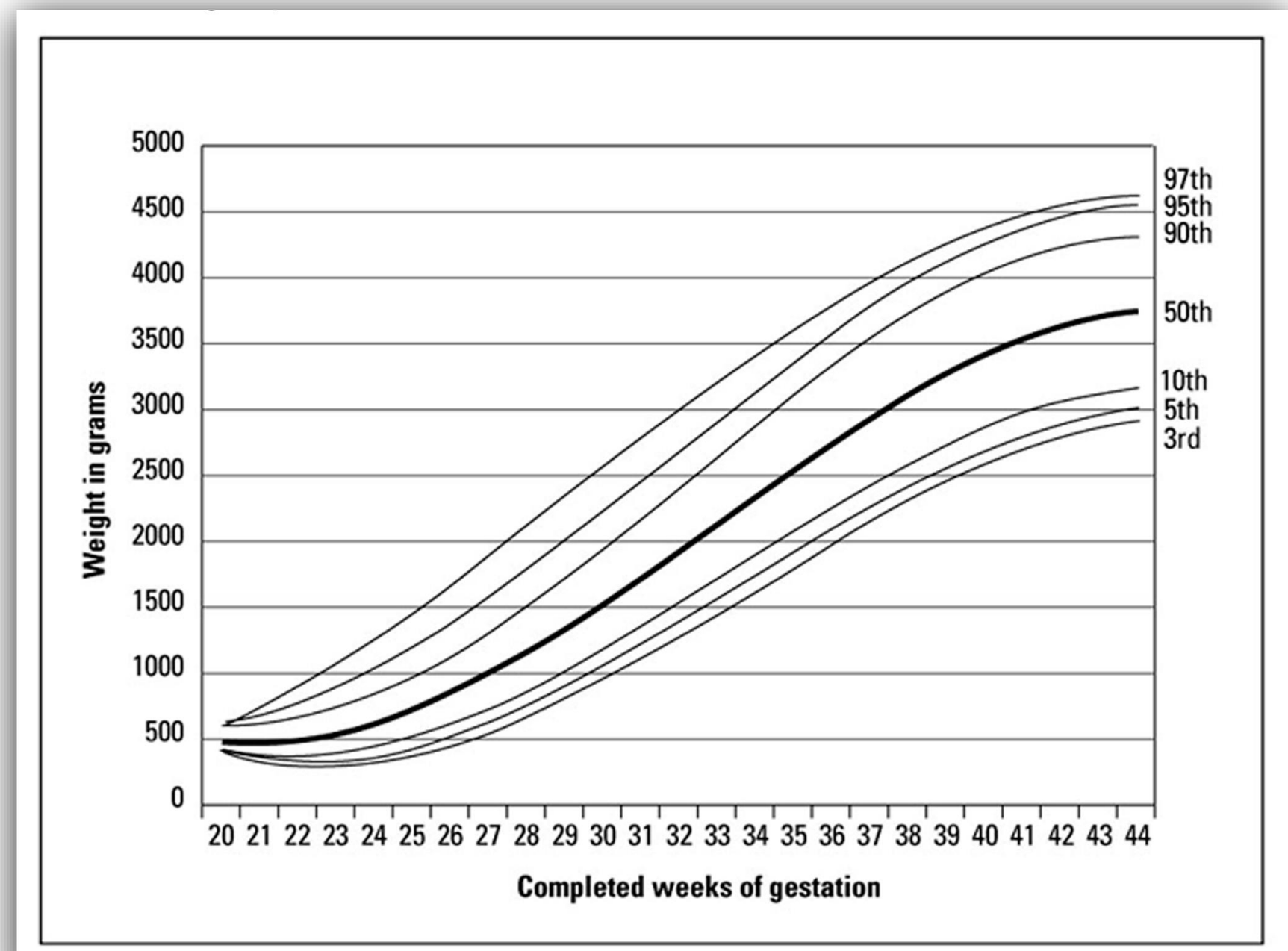


Flow reversal during diastole

Fetal Weight Estimation

- Useful parameter for helping to predict fetal, maternal, and neonatal complications
- Absolute values do NOT correlate well with birth weight
- Serial weight measurements useful in surveillance as term approaches
- Complex algorithms and methods have been developed
- Most using fetal weight percentile charts

INTRAUTERINE GROWTH RESTRICTION



Fetal Weight Estimation

- Sonographic signs associated with abnormal fetal weight:
  - Estimated weight at or below 10th percentile
  - HC/AC ratio above normal range
  - Oligohydramnios
  - Umbilical artery Doppler abnormalities

Fetal Anemia

- Reduction in number of fetal RBCs being carried throughout the fetal circulation
- Reduces oxygen supply to vital organs resulting in increased cardiac output
- Risk factors include:
  - Hemolytic disease (*Rh incompatibility, ABO incompatibility*)
  - Fetal infections
  - Rare hematological syndromes
  - Tumors (*placental chorioangioma, SC teratoma*)

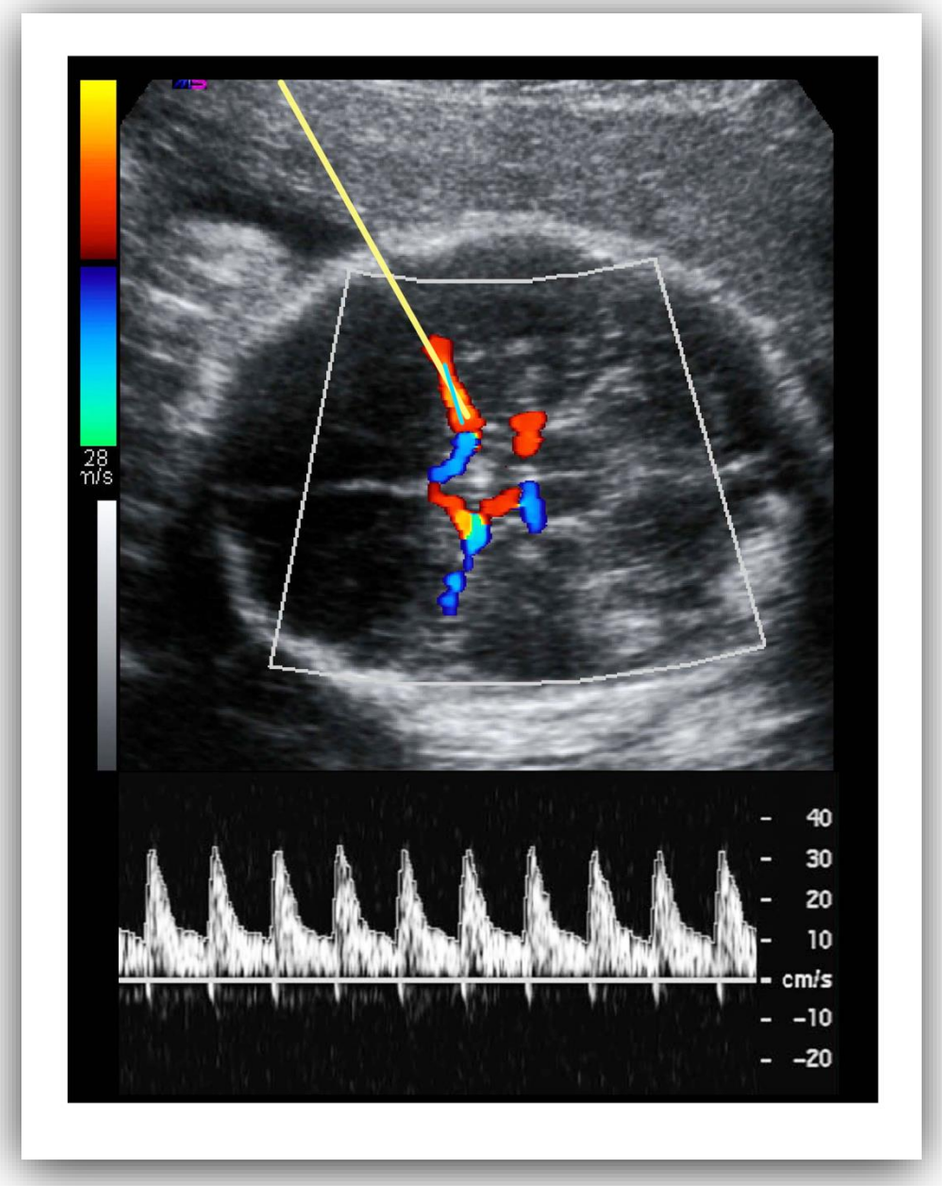
Fetal Anemia

- Sonographic findings include:
  - Hydrops fetalis
  - Hepatosplenomegaly
  - Doppler findings of elevated MCA velocity

MCA Doppler Evaluation

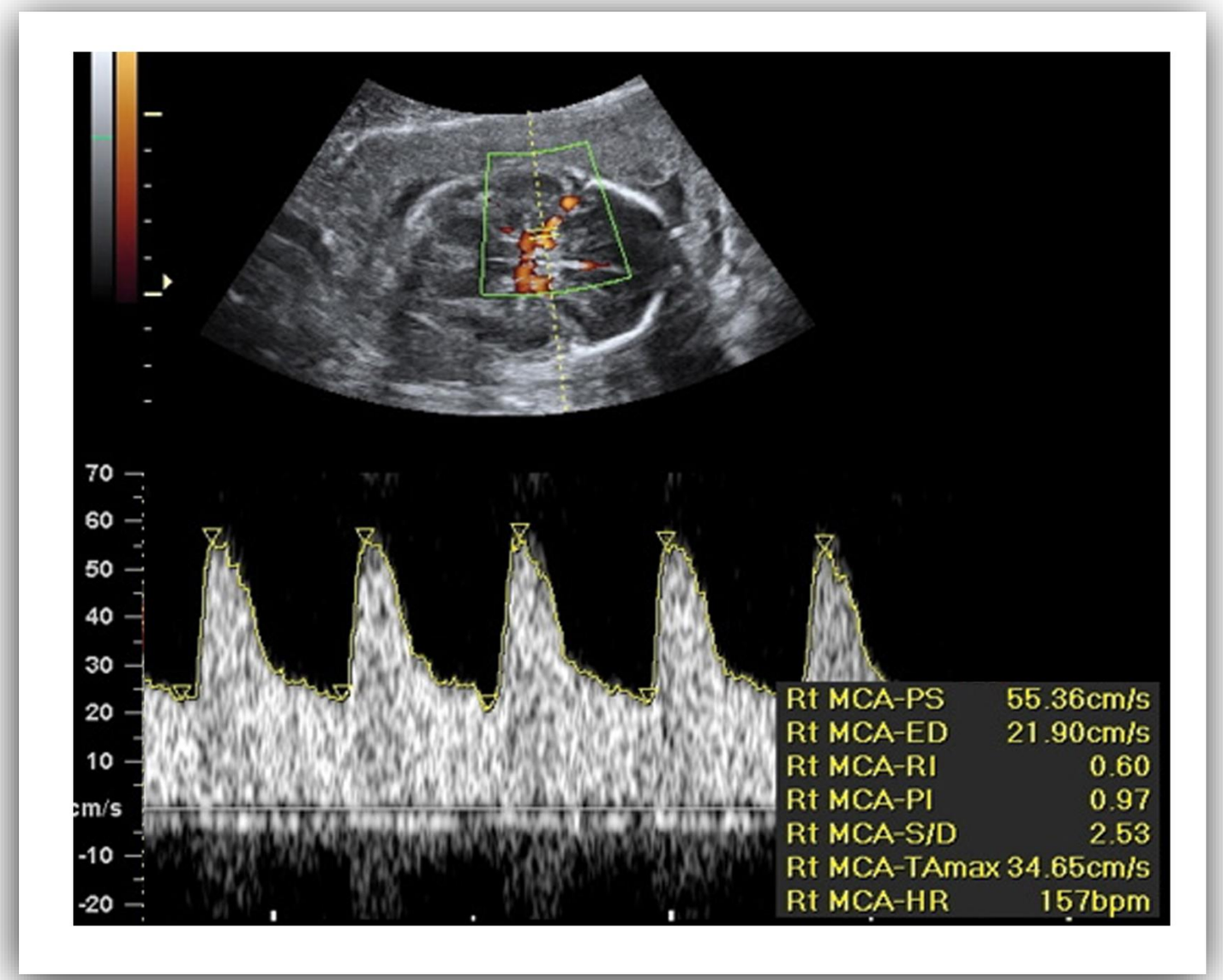
- Indirect method of assessing brain sparing
- Normal flow patterns
  - High resistance with little diastolic flow
- Brain sparing flow patterns
  - Vasodilation ⇨ reduced flow resistance
  - ⇧ diastolic flow

FETAL ANEMIA



MCA – normal flow resistance

FETAL ANEMIA



MCA – abnormal flow resistance

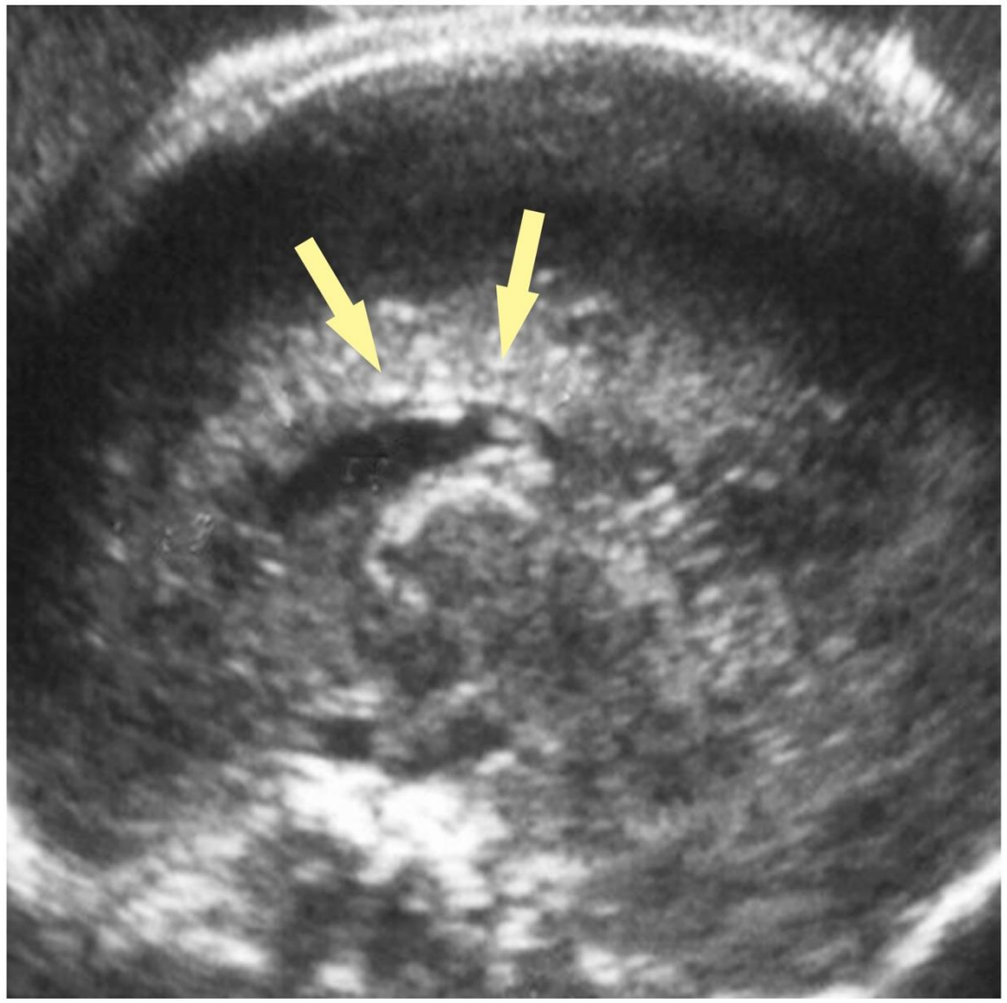
Intracranial Calcifications

- Arise in the fetus as the result of a number of pathological conditions in the mother including:
  - Toxoplasmosis
  - Rubella
  - Cytomegalovirus (CMV)
- In the fetus including:
  - Intracranial tumors (*teratoma*)
  - Neurocutaneous disorders
  - In utero intracranial hemorrhage

Intracranial Calcifications

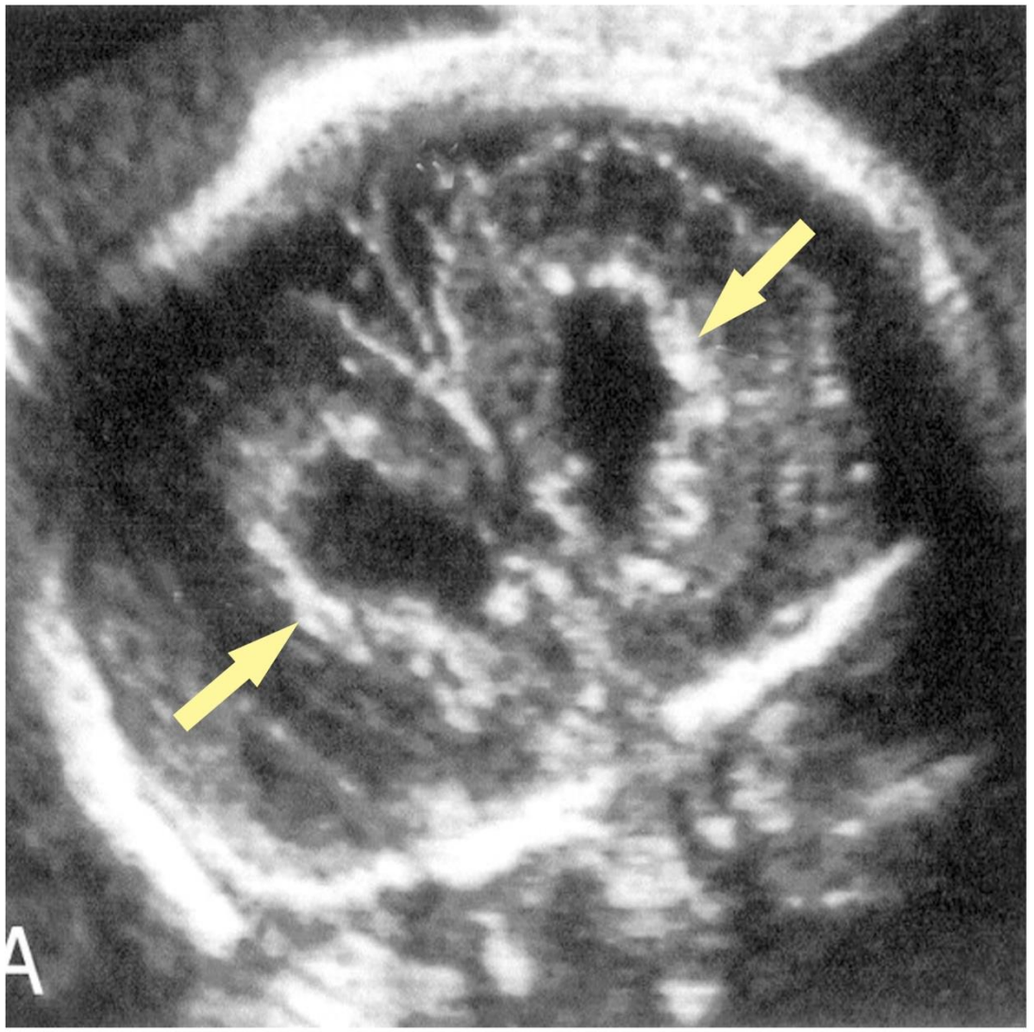
- Sonographic findings include:
  - Punctate echogenic foci found in either groups or in isolation
  - Because of small size, may or may not cast posterior acoustic shadow
  - Periventricular hyperechogenic foci most often associated with CMV infection

INTRACRANIAL CALCIFICATIONS



Non-shadowing periventricular calcifications

INTRACRANIAL CALCIFICATIONS



Periventricular calcifications with CMV infection

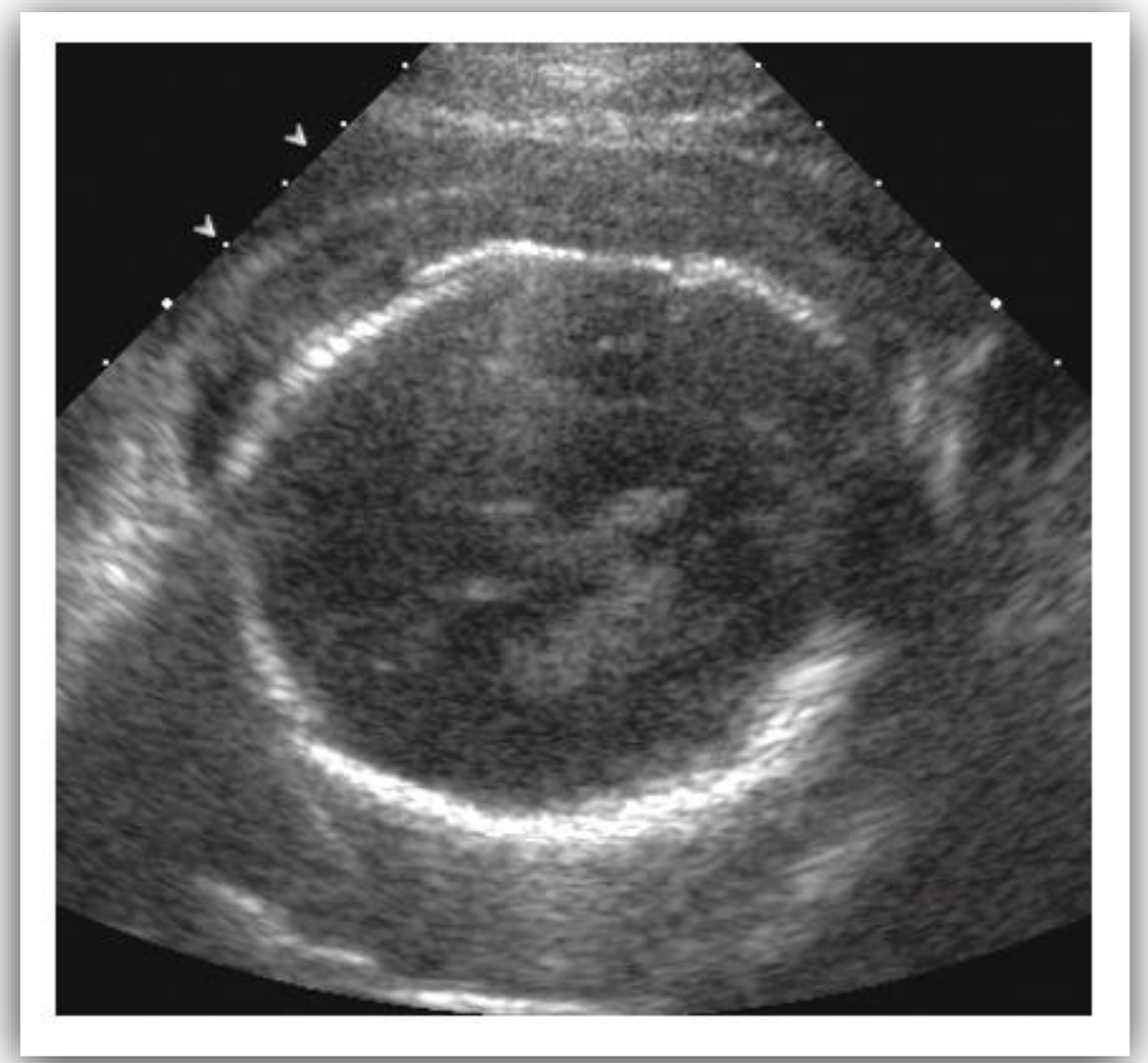
Fetal Demise

- Fetal death any stage of gestation is called *fetal demise*
- Risk factors (many):
  - Maternal
  - Fetal
  - Placental factors

Fetal Demise

- Sonographic findings in 2nd and 3rd trimesters Is dependent upon when the study is performed after the demise and include:
  - Absent cardiac activity
  - Absent fetal motion
  - Overriding skull bones (*Spaulding's sign*)
  - Abnormal angulation of the spine
  - Oligohydramnios
  - Air in pulmonary and/or biliary vasculature

FETAL DEMISE



Spaulding’s sign

FETAL DEMISE

Air in pulmonary and biliary tract

Fetal Therapy

- Several forms of intrauterine fetal therapy have been developed for various fetal conditions
  - Cordocentesis
  - Intravascular fetal transfusion
  - Intraperitoneal fetal transfusion

Cordocentesis

- An invasive method of obtaining a fetal blood sample using US guidance

- Also know as *fetal blood sampling* or *percutaneous umbilical blood sampling* (PUBS)

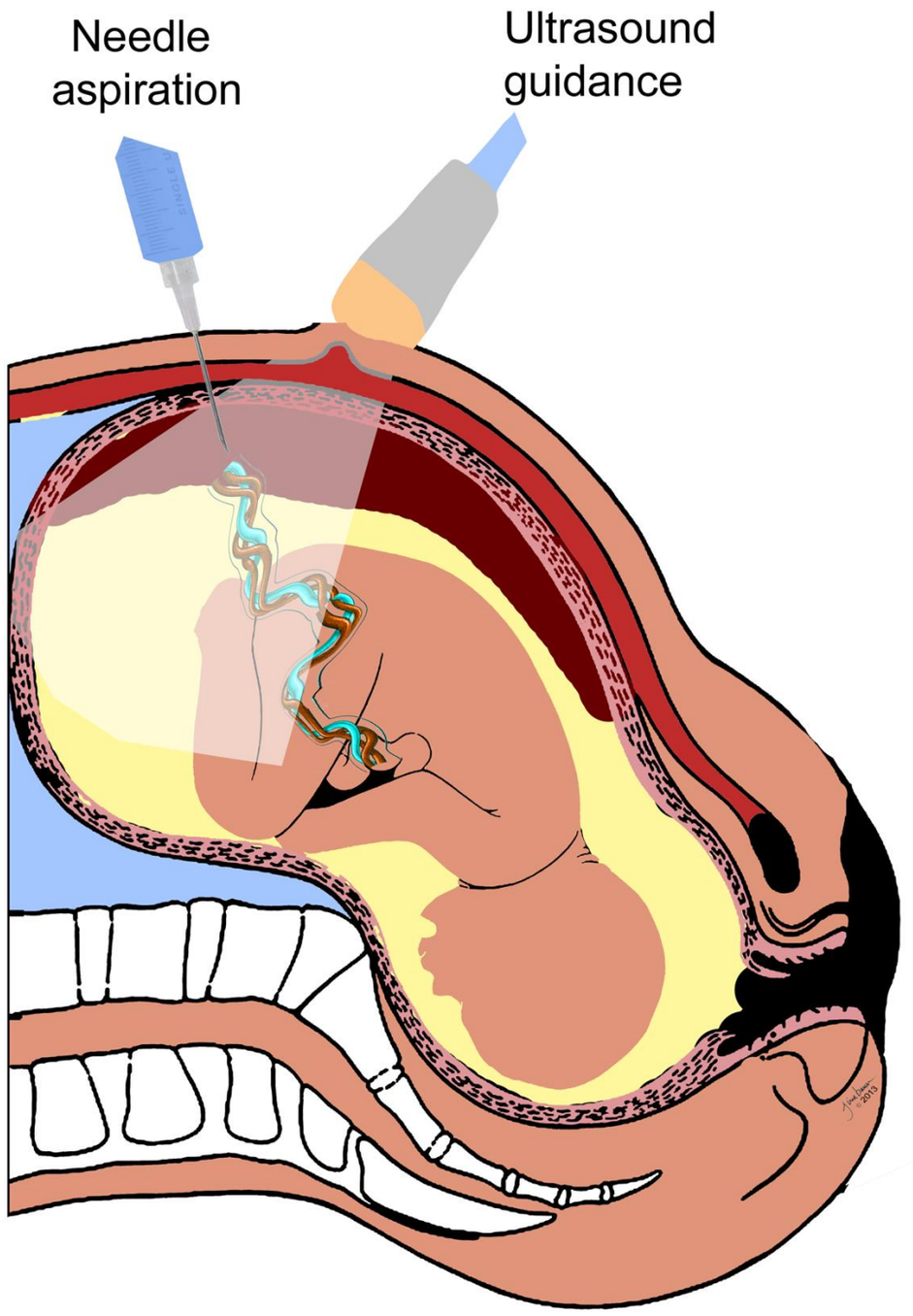
- A fine-gauge needle is inserted transabdominally under direct US guidance

- Directed toward the umbilical vein

Cordocentesis

- Indications include:
  - Assessment of fetal anemia
  - Investigation of genetic diseases
  - Diagnosis of congenital infection
  - Determination of fetal blood type
  - Rh disease
  - Other hematological problems

CORDOCENTESIS



Intravascular Fetal Transfusion

- Treatment of choice in fetuses with hemolytic anemia due to isoimmunization
- Packed RBCs are infused into umbilical vein under US guidance
- US monitoring of needle placement in real-time during infusion

Intraperitoneal Fetal transfusion

- Alternative treatment to *intravascular* method
- Packed RBCs are infused into peritoneal cavity under US guidance
- Less effective and carries more risk of complications than *intravascular* approach

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