OB GYN SONOGRAPHY REVIEW

Multiple Gestations

Course Outline

- Clinical background
- Monozygotic twins
- Dizygotic twins
- Higher-order multiple gestations
- Sonographic evaluation
- Abnormalities of multiple gestations

Clinical Background

- Increased perinatal morbidity & mortality (M&M) associated with multifetal gestations
- Twin births account for ≈ 10% of all fetal M&M
- M&M 4 – 6 x higher than in singleton pregnancies
- Perinatal death rate ≈ 5 – 10 x higher

Maternal Complications

- Hypertensive disorders
- Anemia
- Premature rupture of membranes (PROM)
- Hyperemesis gravidarum
- Polyhydramnios
- Delivery complications include:
  - Cesarean delivery
  - Placental abruption
  - Postpartum endometriosis

Fetal Complications

- Premature delivery
- Malpresentation
- Cord accidents (prolapse, entanglement)
- Hypoxia of co-twin
- IUGR
- Fetal death
- Developmental anomalies
- Polyhydramnios

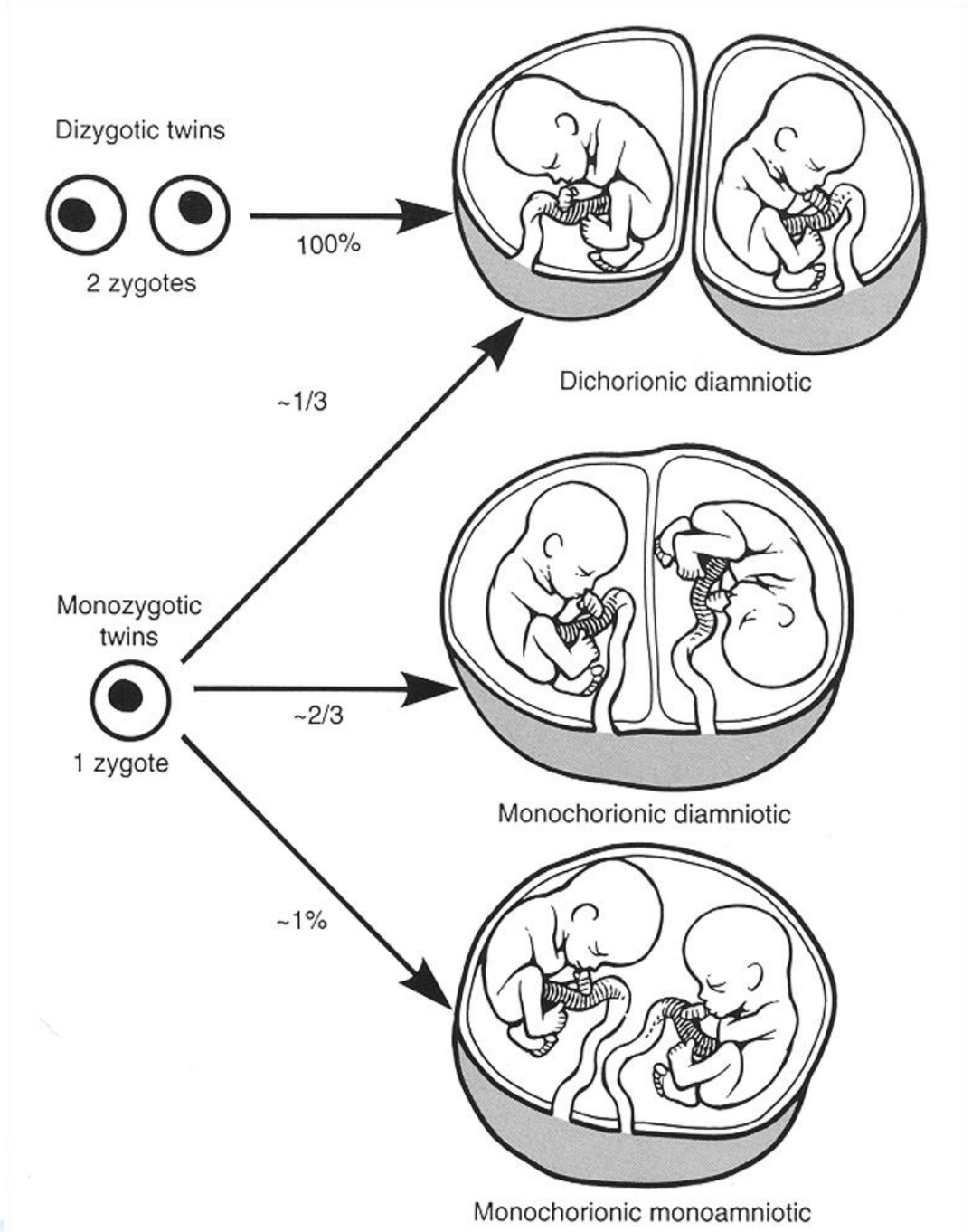
Clinical Findings

- Early and more severe pressure problem in maternal pelvis:
  - Hemorrhoids
  - Constipation
  - Backaches
- Increased fetal activity
- Increased uterine size (larger than expected for dates)
- Maternal shortness of breath and/or difficulty breathing
- Excessive maternal weight gain

Zygosity

- Dizygotic:
  from 2 fertilized ova

- Monozygotic:
  from 1 fertilized ovum



Monozygotic Twins

- Also known as *identical twins* result from fertilization of a single ovum by a single sperm
- A variety of placental and membrane combinations are possible
  - Chorionicity: number of placentae present
  - Amnionicity: number of amniotic sacs present
  - Configuration determined by timing of division of embryonic disc
- Dizygotic twins ALWAYS have two amnions, two chorions, two placentae

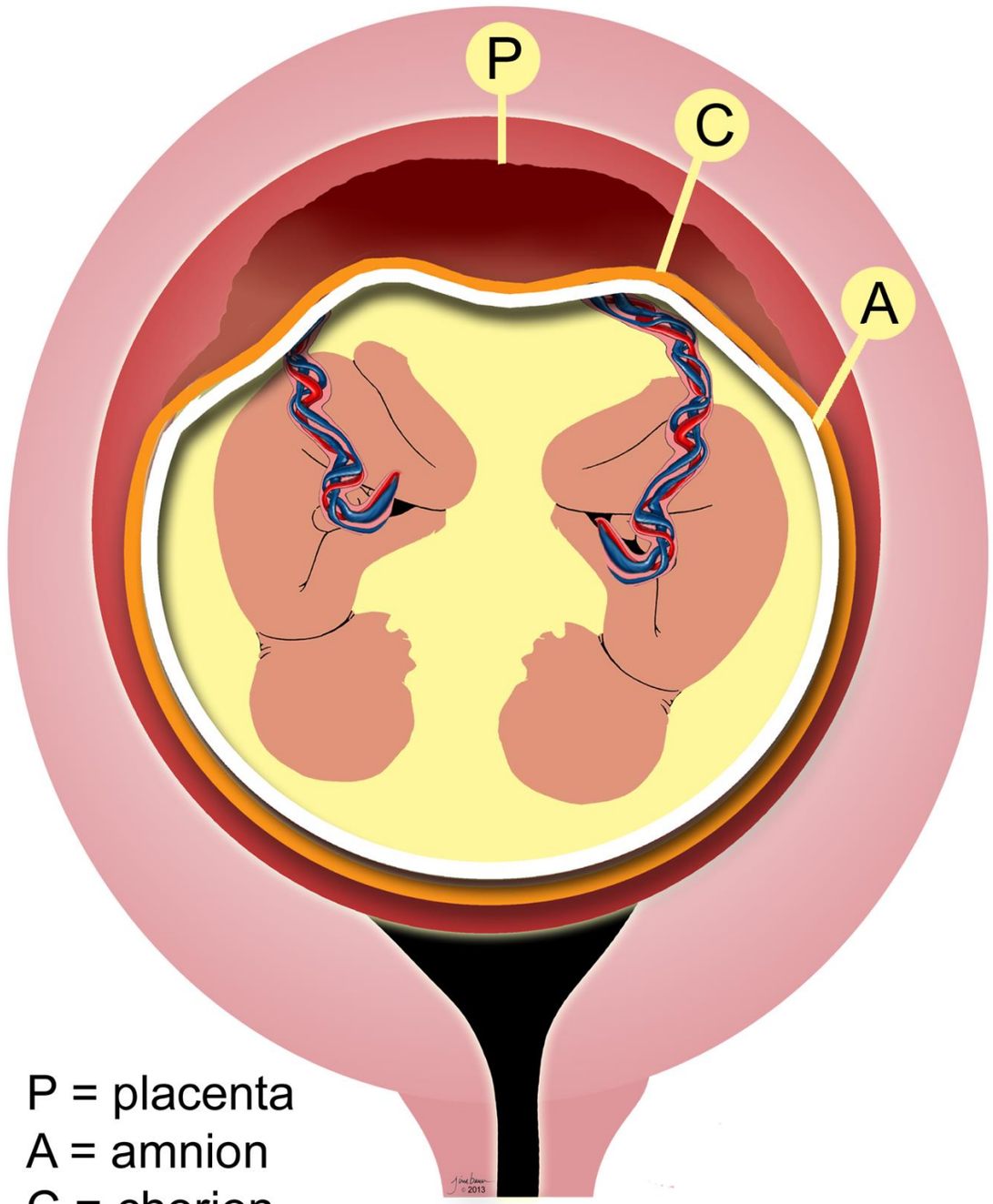
Monozygotic Twins

- Three types:
  - Monochorionic/monoamniotic (MM), single placenta, single sac
  - Monochorionic/diamniotic (MD), single placenta, two sacs
  - Dichorionic/diamniotic (DD), two placentae, two sacs

Monochorionic/Monoamniotic Gestations

- Single placenta, single sac
- Division occurs after differentiation of trophoblast
- 7 – 8 days post conception
- Least common type of twinning (1 – 2 %)
- Most likely to experience complications
  - Twin-to-twin transfusion
  - Twin embolization
  - Cord entanglement/thrombosis
  - Conjoined twinning

MONO/MONO GESTATION

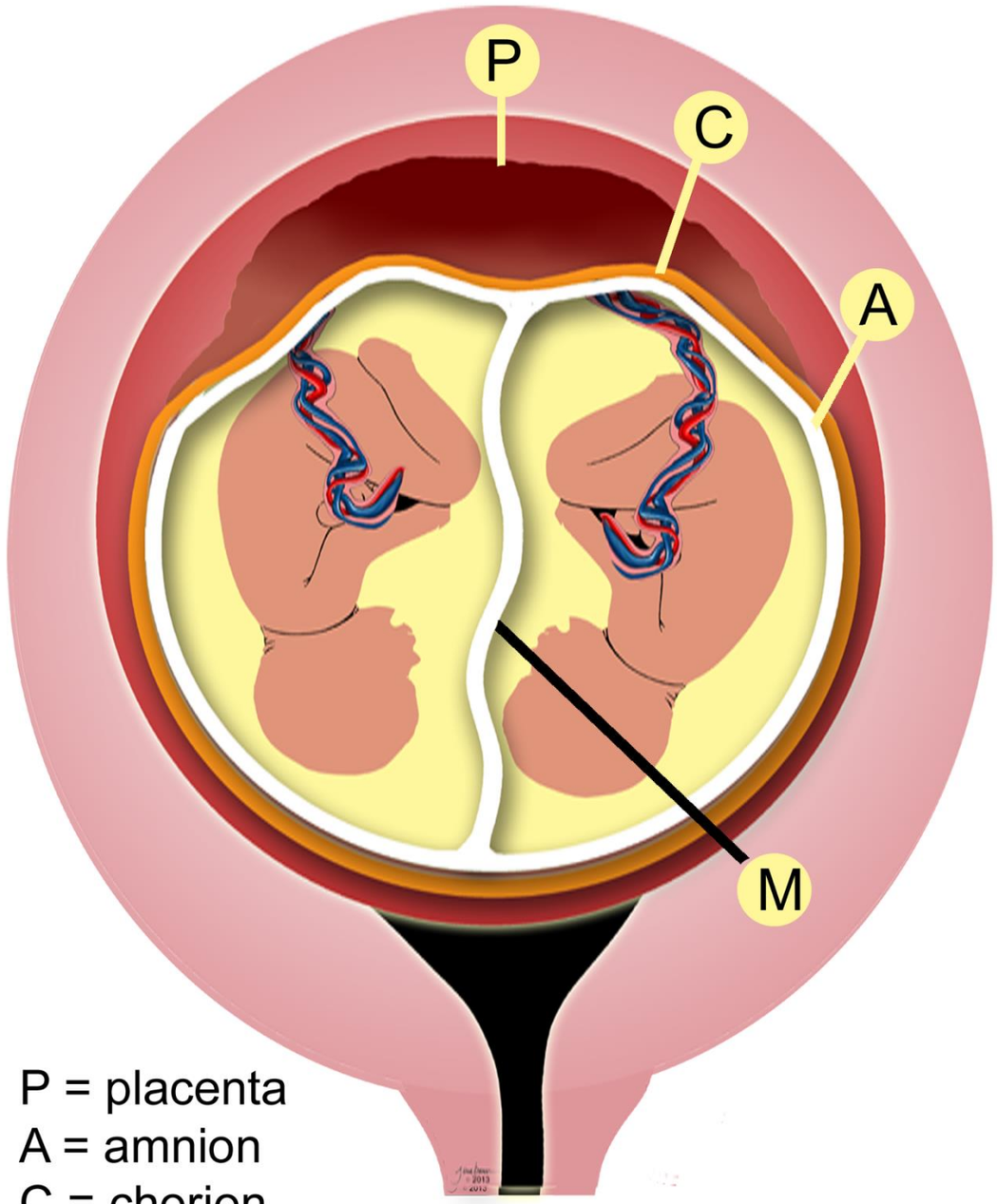


P = placenta
A = amnion
C = chorion

Monochorionic/Diamniotic Gestations

- Single placenta, two amniotic sacs
- Division occurs after differentiation of amnion
- 5 – 10 days post conception
- Most common type of twinning (70 – 75 %)

MONO/DI GESTATION

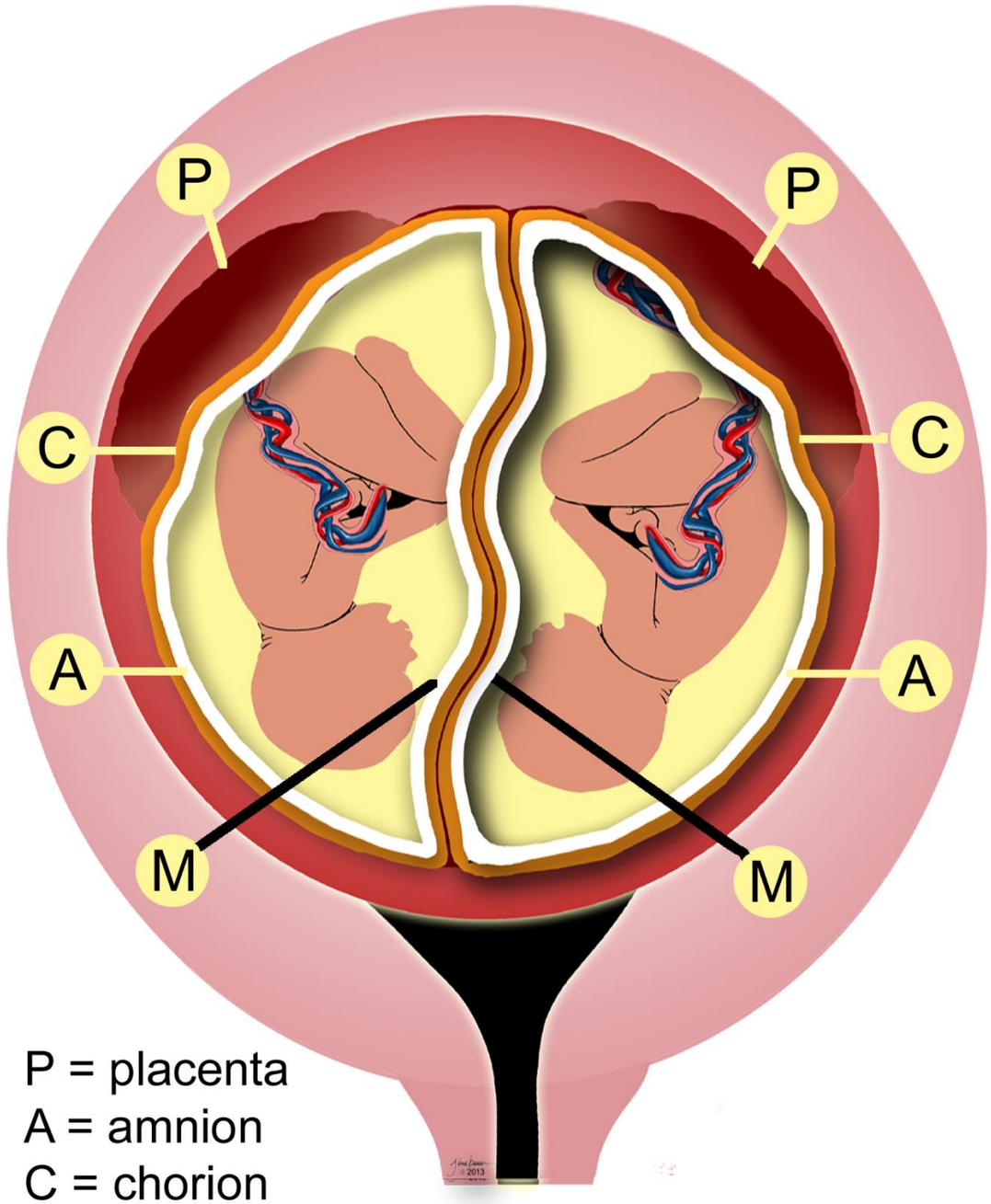


P = placenta
A = amnion
C = chorion
M = separating amniotic membrane

Dichorionic/Diamniotic Gestations

- Two placentae, two amniotic sacs
- Division occurs before implantation
- Each conceptus has its own implantation site
- Account for 20 – 25 % of monozygotic twins

DI/DI GESTATION



P = placenta
A = amnion
C = chorion
M = separating chorionic & amniotic membrane

Dizygotic Twins

- Also known as *fraternal twins* result from fertilization of a two separate ova (zygotes)
- Two separate implantations
- Dizygotic twins ALWAYS have two amnions, two chorions, two placentae
- May appear as single placenta on US if blastocysts implant closely and placentae fuse

Higher-Order Multiple Gestations

- Defined as three or more fetuses associated with a single pregnancy
- More prevalent since advent of assisted reproductive technologies (ART)
- Zygosity varies
  - May be all separate fertilized ova
  - May be monozygotic pairs present

HIGHER ORDER MULTIPLE GESTATIONS

Triplets

HIGHER ORDER MULTIPLE GESTATIONS

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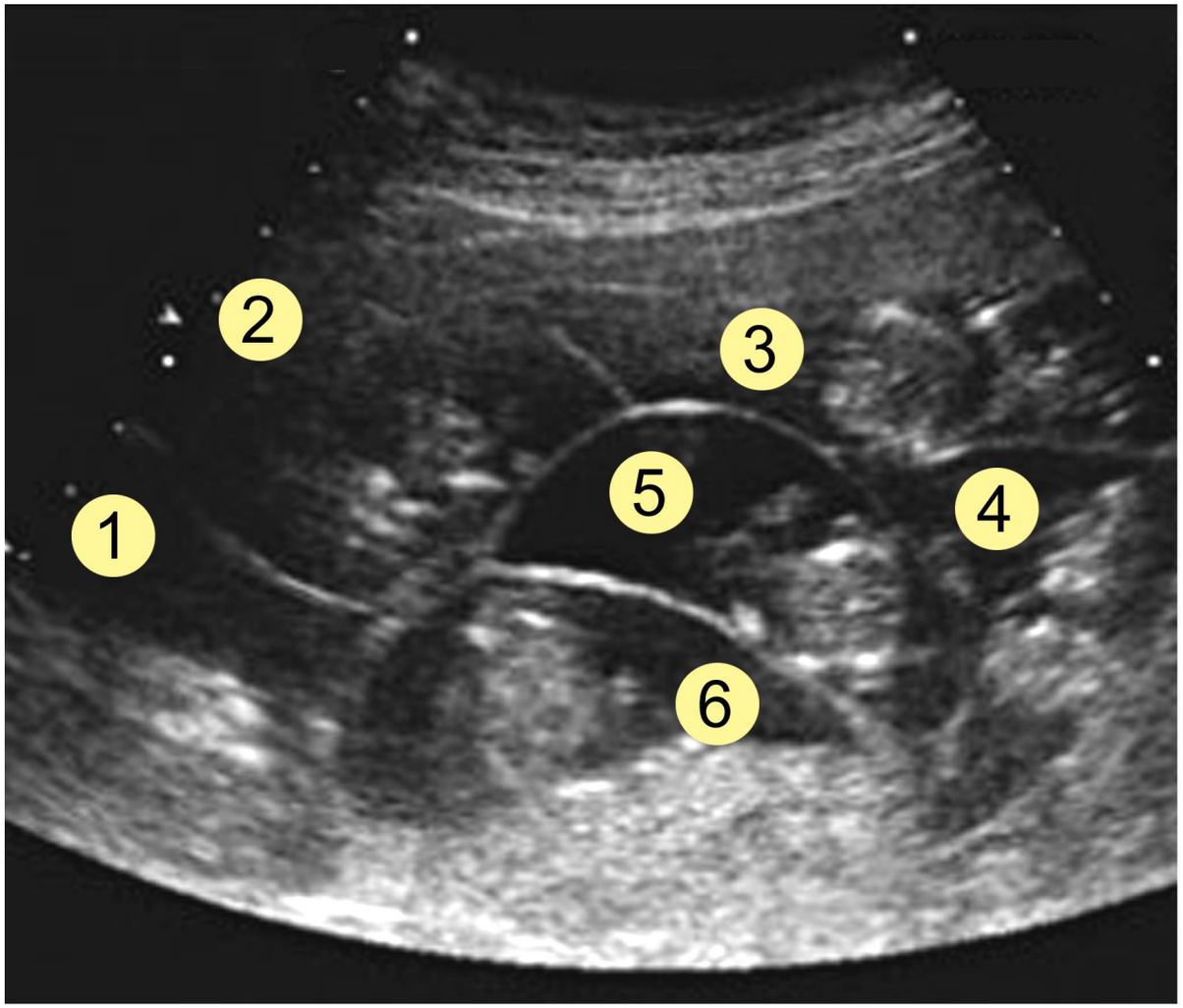
HIGHER ORDER MULTIPLE GESTATIONS



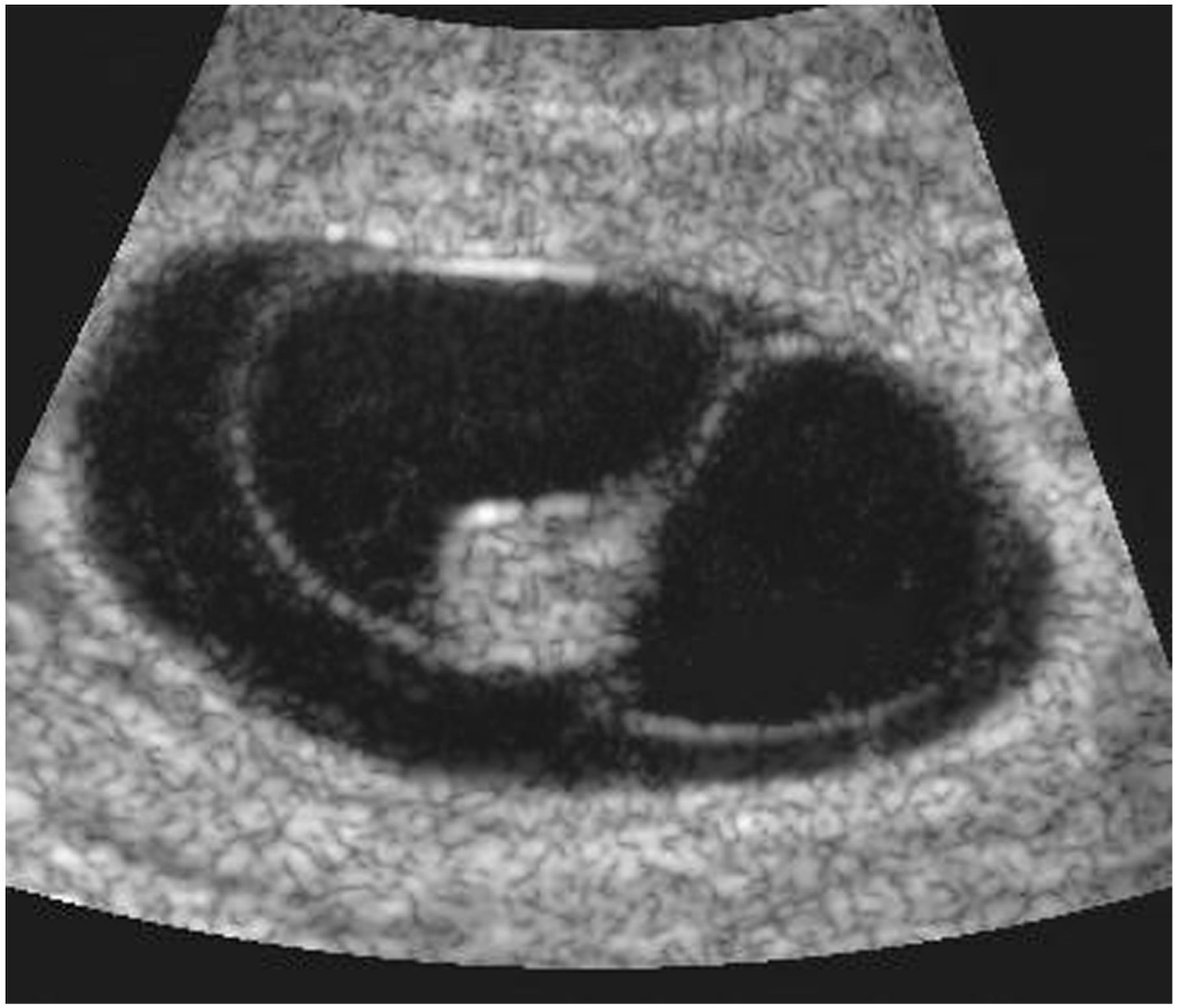
Sextuplets

Sonographic Evaluation

First trimester: best time to assess number of gestational sacs (GS) and chorionicity

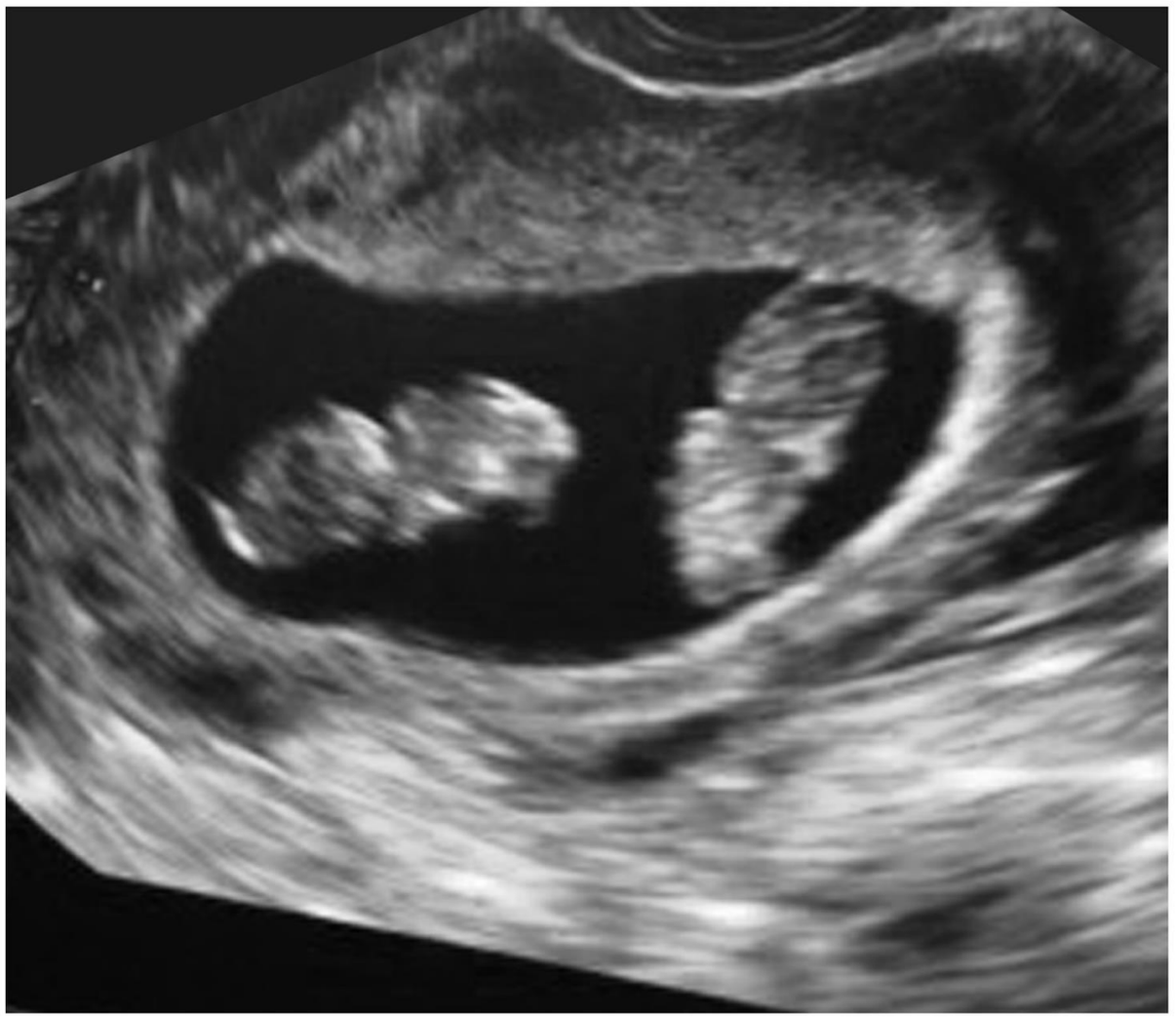
GS #	Embryos #	Amniotic Sacs #	Chorionicity
1	2	2	mono/di
1	2	1	mono/mono
2	2	2	di/di (monozygotic)
2	2	2	di/di (dizygotic)

SONOGRAPHIC EVALUATION – FIRST TRIMESTER



Monozygotic
mono/di

SONOGRAPHIC EVALUATION – FIRST TRIMESTER



Monozygotic
mono/mono

SONOGRAPHIC EVALUATION – FIRST TRIMESTER

Monozygotic or Dizygotic
di/di

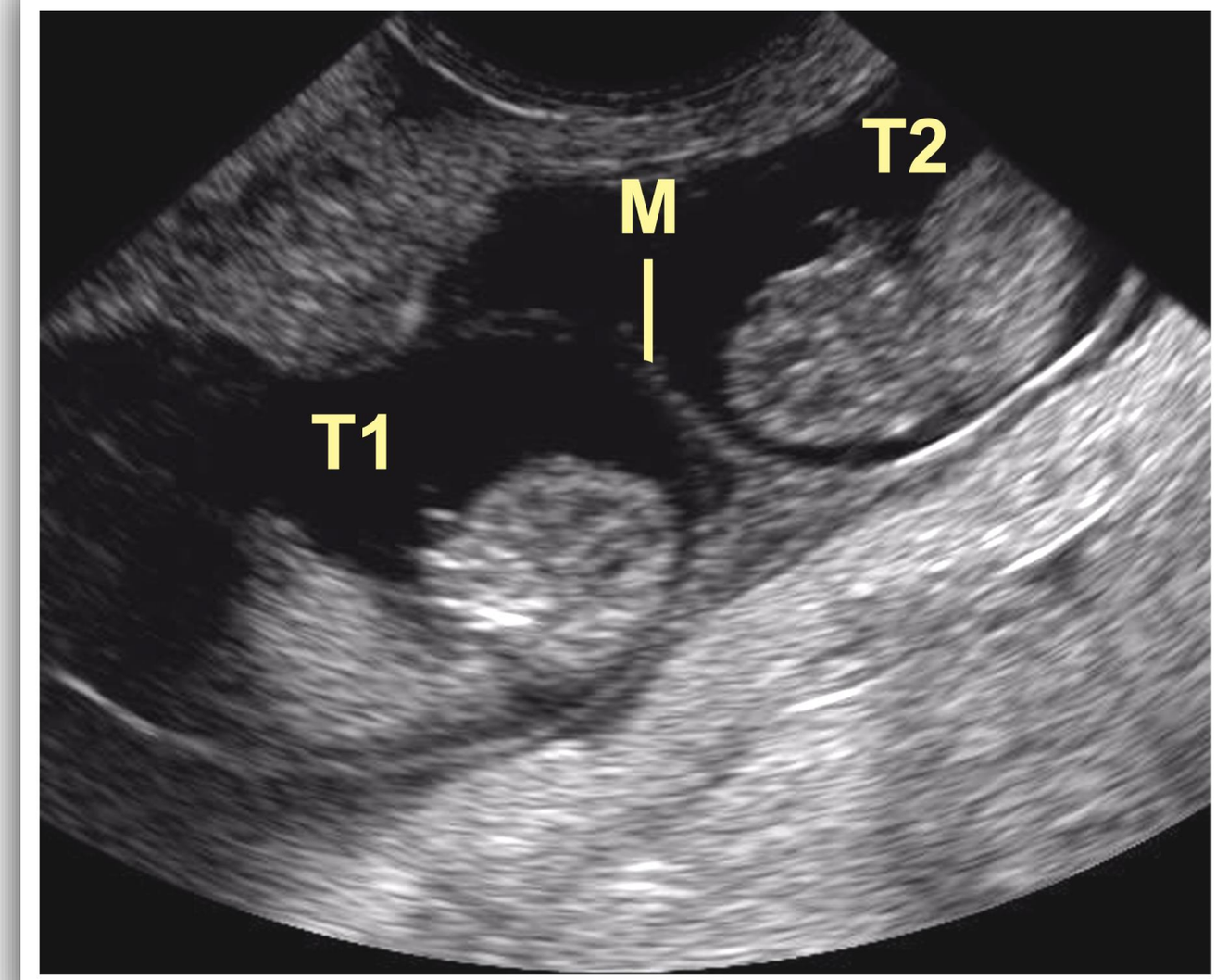
Sonographic Evaluation

- Second & third trimester: determination of chorionicity becomes more difficult
- Most important sonographic finding is identification of membrane separating two gestations
- Absence is a strong indicator of mono/mono
- Raises specter of attendant complications and comorbidities

Sonographic Evaluation

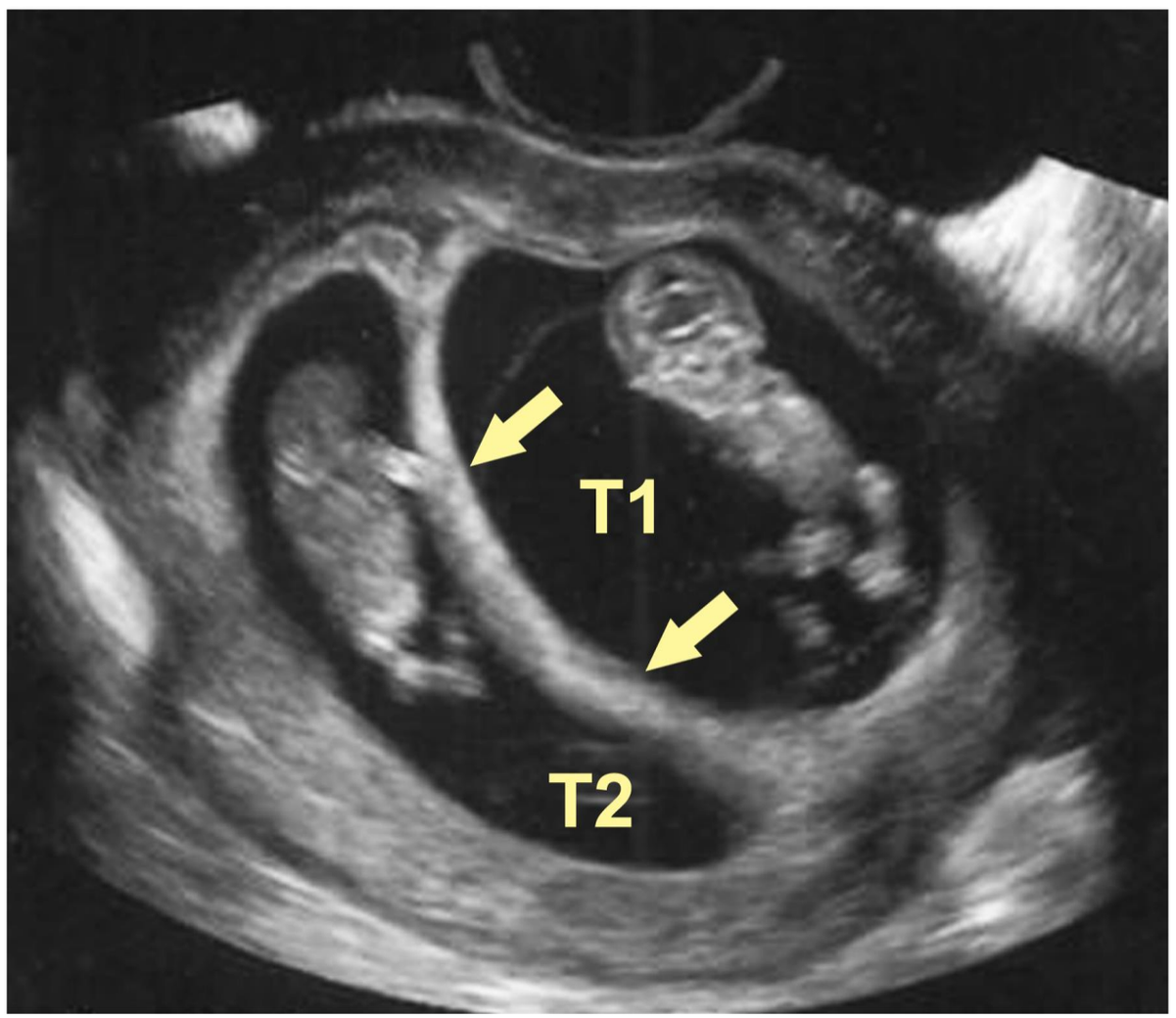
- Identification on membrane indicates a diamniotic gestation
- Interfetal membrane > 2 mm suggestive of dichorionicity
- Fetal sex: if 1 male + 1 female = dizygotic
  if same sex, zygosity cannot be determined
- *Twin peak* or *lambda* sign is diagnostic of di/di gestation
- Absence of these signs cannot be used a predictor of chorionicity

SONOGRAPHIC EVALUATION – 2ND & 3RD TRIMESTER



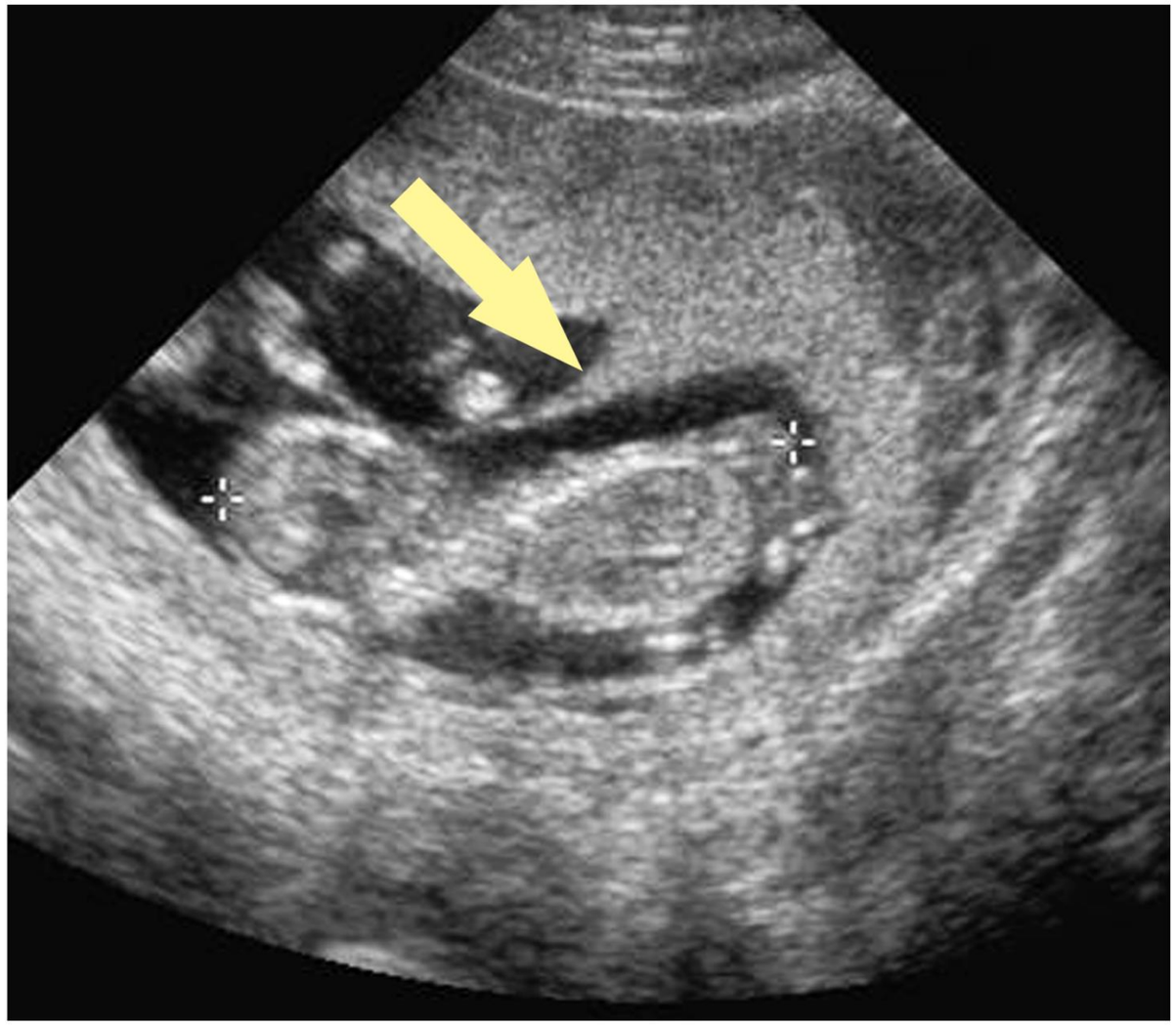
Identification of a membrane

SONOGRAPHIC EVALUATION – 2ND & 3RD TRIMESTER



Interfetal membrane > 2 mm

SONOGRAPHIC EVALUATION – 2ND & 3RD TRIMESTER



Lambda or “twin peak” sign

Abnormalities of Multiple Gestations

- Primarily occur on mono/mono twinning and include:
  - Vanishing twin
  - Twin-twin transfusion syndrome
  - Twin reversed arterial perfusion syndrome (TRAP)
  - Twin embolization syndrome
  - Stuck twin (*fetus papyraceous*)
  - Cord entanglement
  - Conjoined twin

Vanishing Twin

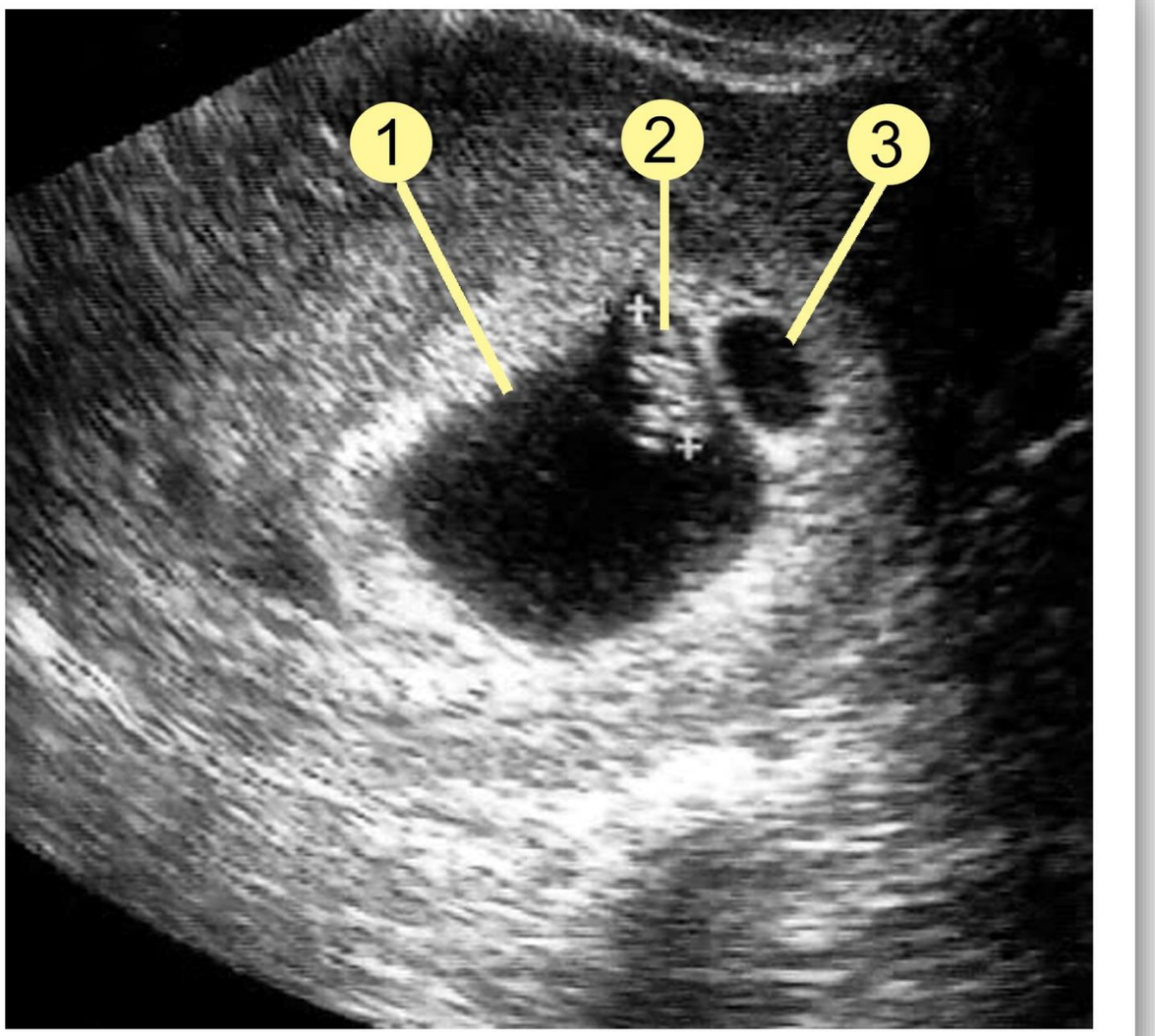
- Disappearance of a nonviable gestation initially seen on 1st trimester EV sonography
- Subsequent imaging reveals presence of a singleton gestation
- Demised co-twin may be completely or partially resorbed

Vanishing Twin

- Sonographic findings include:
  - US demonstration of twin gestation in early 1st trimester
  - Failure to demonstrate multiple gestations on subsequent US
  - Failure of sac growth in a twin
  - Irregularly marginated sac

VANISHING TWIN

1 = normal GS
2 = living embryo
3 = nonviable GS

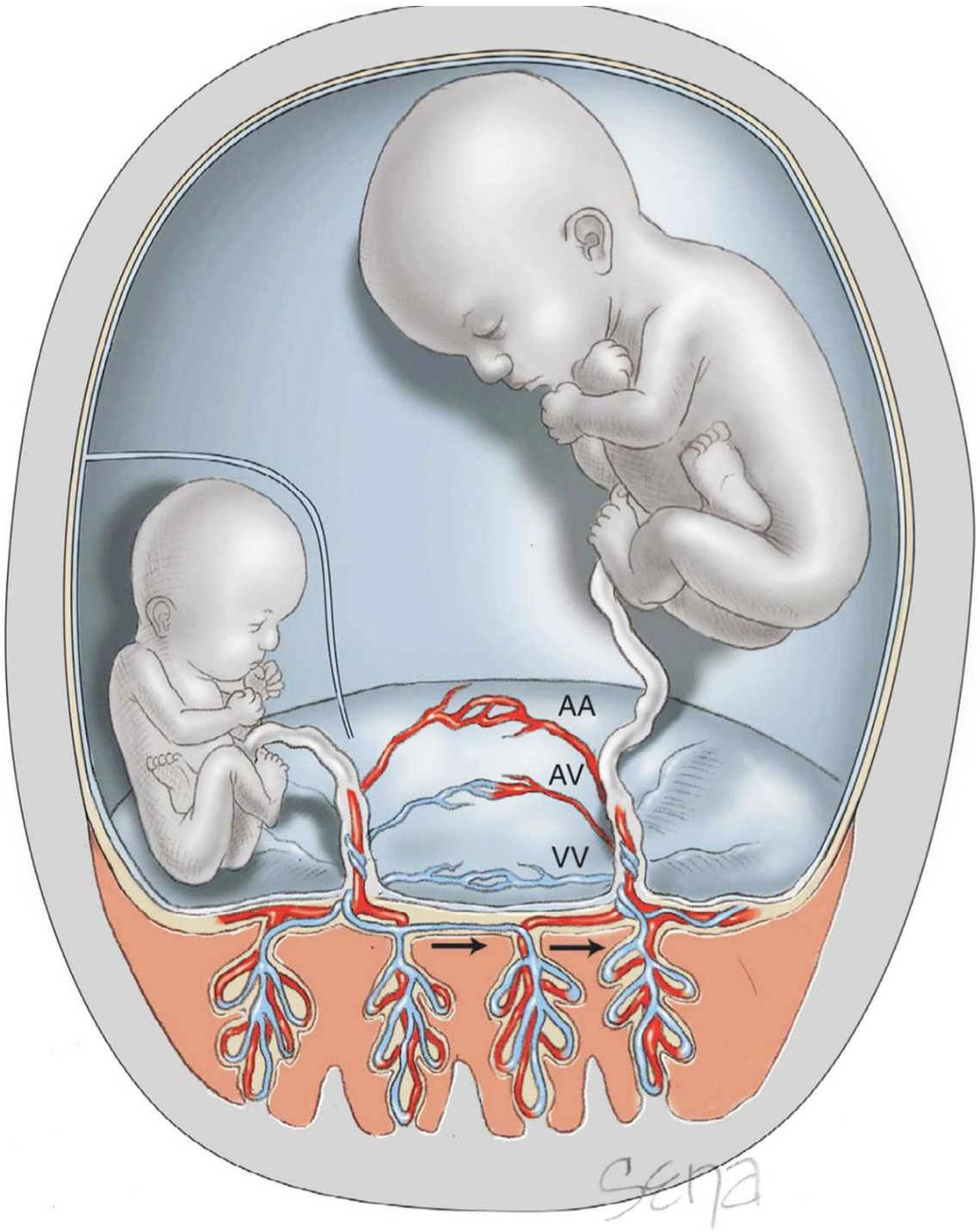


Failure of sac growth in a twin

Twin-Twin Transfusion Syndrome

- Abnormal artery-vein anastomosis in a shared placenta shunts blood away from *donor twin* to *recipient twin*
- Occurs ≈ 15 – 20% in mono/mono twinning
- If untreated, 60 – 100% mortality especially for donor twin

TWIN-TWIN TRANSFUSION SYNDROME



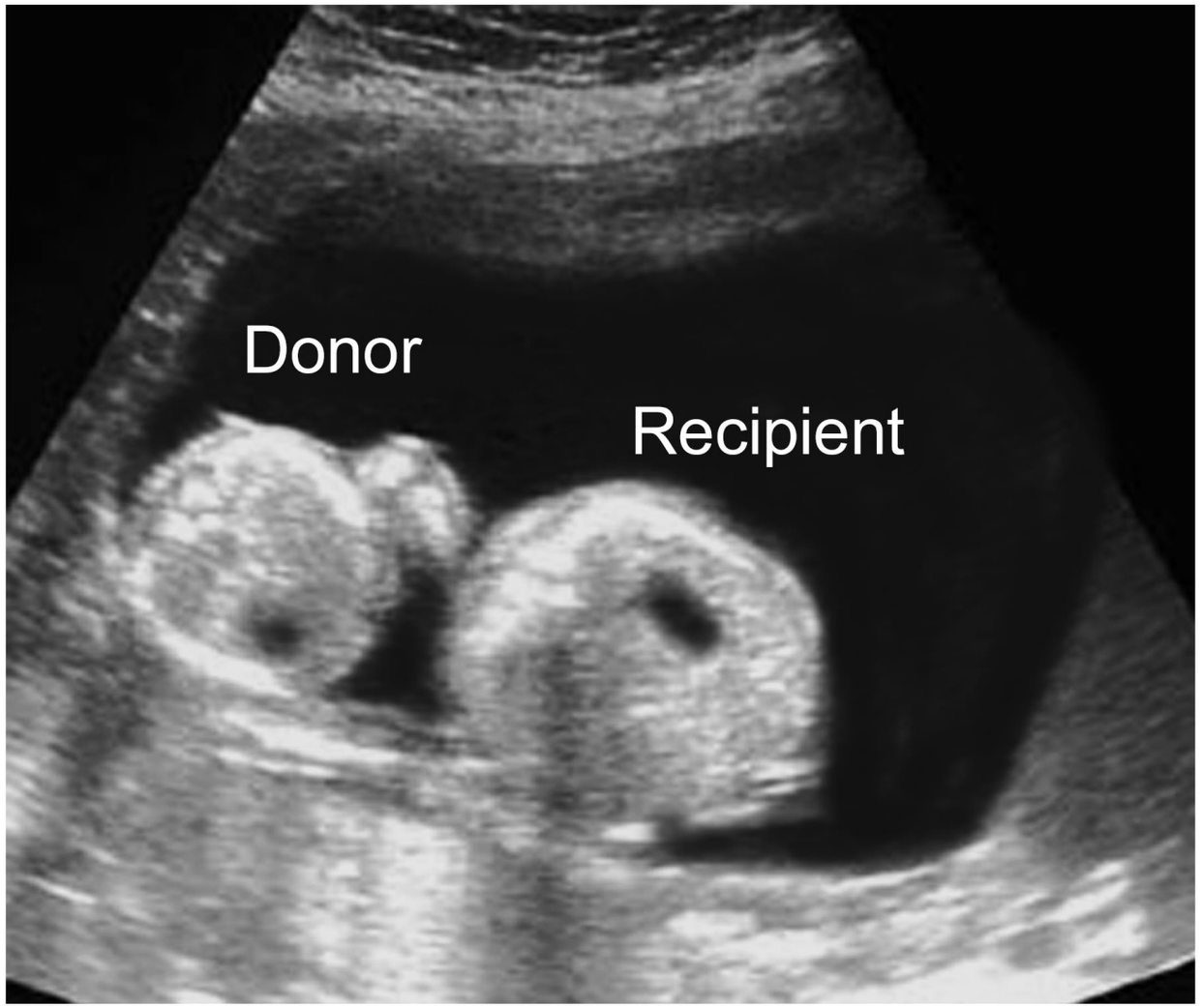
Twin-Twin Transfusion Syndrome

- General sonographic findings include:
  - Gender concordance
  - Monochorionic placentation
  - AFI discrepancy
    - Donor twin MVP: < 2 cm
    - Recipient twin MVP: > 8 cm

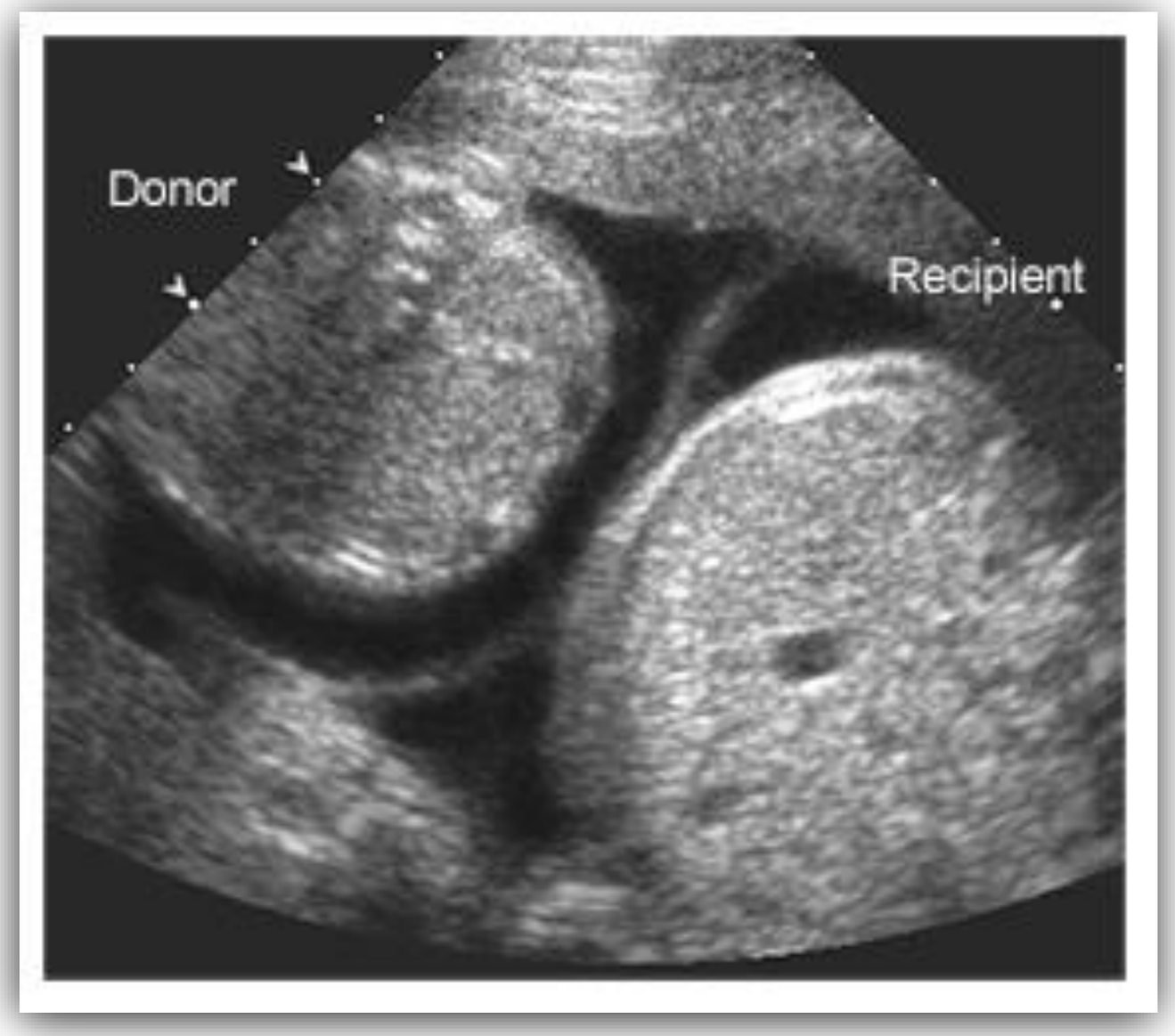
Twin-Twin Transfusion Syndrome

- Sonographic findings in *donor twin* include:
  - Small for dates
  - Oligohydramnios
  - "Stuck twin" with empty bladder and restricted movement
- Sonographic findings in *recipient twin* include:
  - Hydropic changes
  - Ascites
  - Enlarged liver, heart, kidneys
  - Polyhydramnios

TWIN-TWIN TRANSFUSION SYNDROME



TWIN-TWIN TRANSFUSION SYNDROME



Twin Reversed Arterial Perfusion (TRAP)

- Variant of twin-twin transfusion syndrome
- Grossly abnormal co-twin (a hydropic mass) is maintained by a normal co-twin (*pump twin*)
- Vein-to-vein and artery-to-artery anastomoses causes blood to flow toward one twin via umbilical arteries
- Recipient twin receives only deoxygenated blood
- Sever upper body anomalies, i.e., *acardia*

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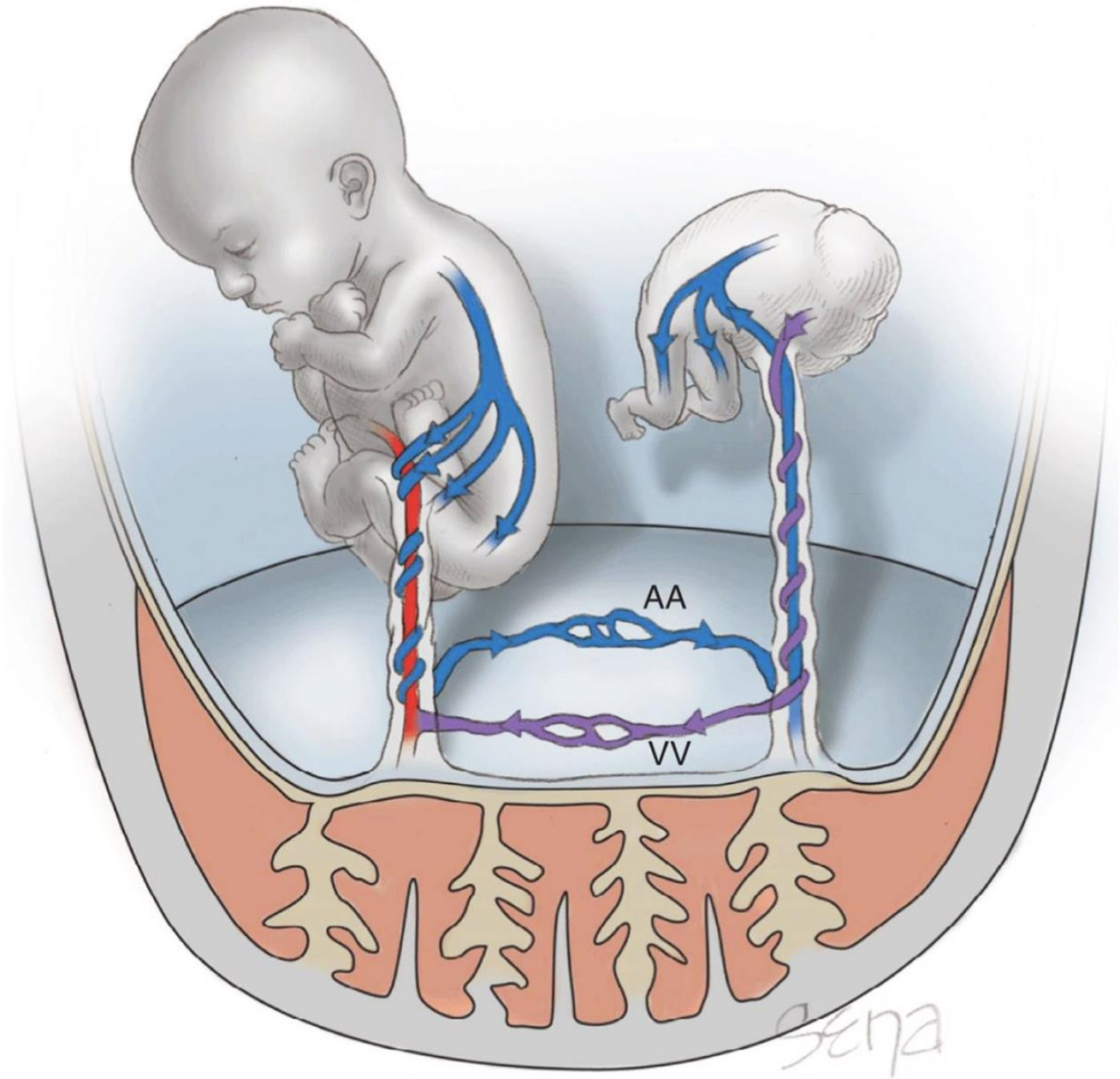
Twin Reversed Arterial Perfusion (TRAP)

- Other anatomic abnormalities include:
  - Anencephaly
  - Holoprosencephaly
  - Absent or hypoplastic torso and limbs
  - Cystic hygroma
  - Two-vessel cord

TRAP SYNDROME



Twin Reversed Arterial Perfusion (TRAP)

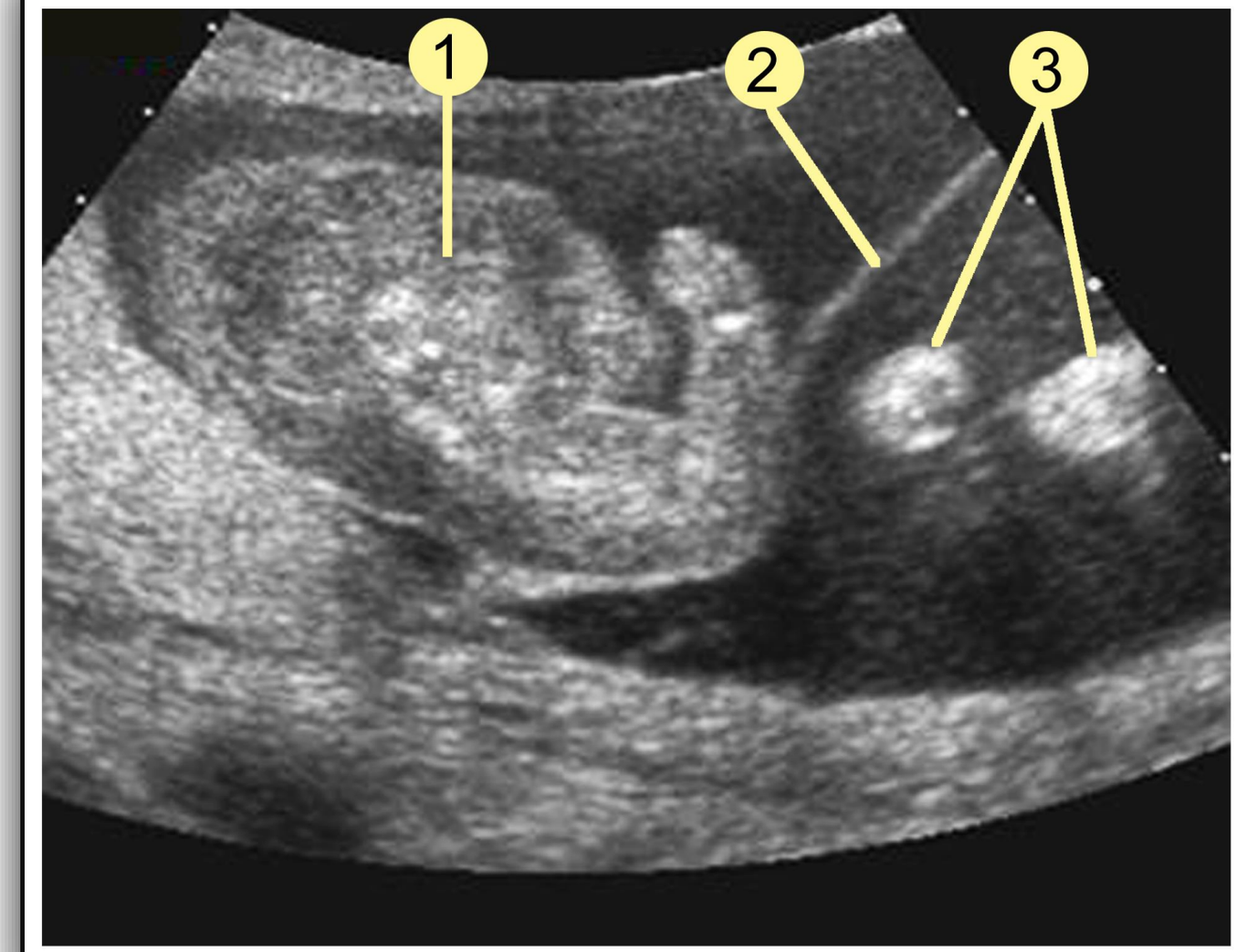
- Sonographic findings in *recipient twin* include:
  - Acardia (absent heart)
  - Absent upper body
  - Absent head or other intracranial abnormalities
  - Cystic hygroma

Twin Reversed Arterial Perfusion (TRAP)

- Sonographic findings in pump twin include:
  - Frequently normal appearing fetus
  - Signs of heart failure (hydrops fetalis)
  - Polyhydramnios
  - Reversed flow in umbilical artery (Doppler)

TRAP SYNDROME

1 = acardiac twin
2 = separating membrane
3 = pump twin extremities



Acardiac twin

TRAP SYNDROME

Acardiac twin

Twin Embolization Syndrome

- Passage of thromboplastic material from a demised co-twin to the remaining living co-twin *or*
- Severe shunting of blood away from living co-twin to the demised twin resulting in severe hypoperfusion
- Presents serious, life-threatening sequelae to the living twin
- Broad spectrum of CNS and somatic abnormalities can result in living co-twin

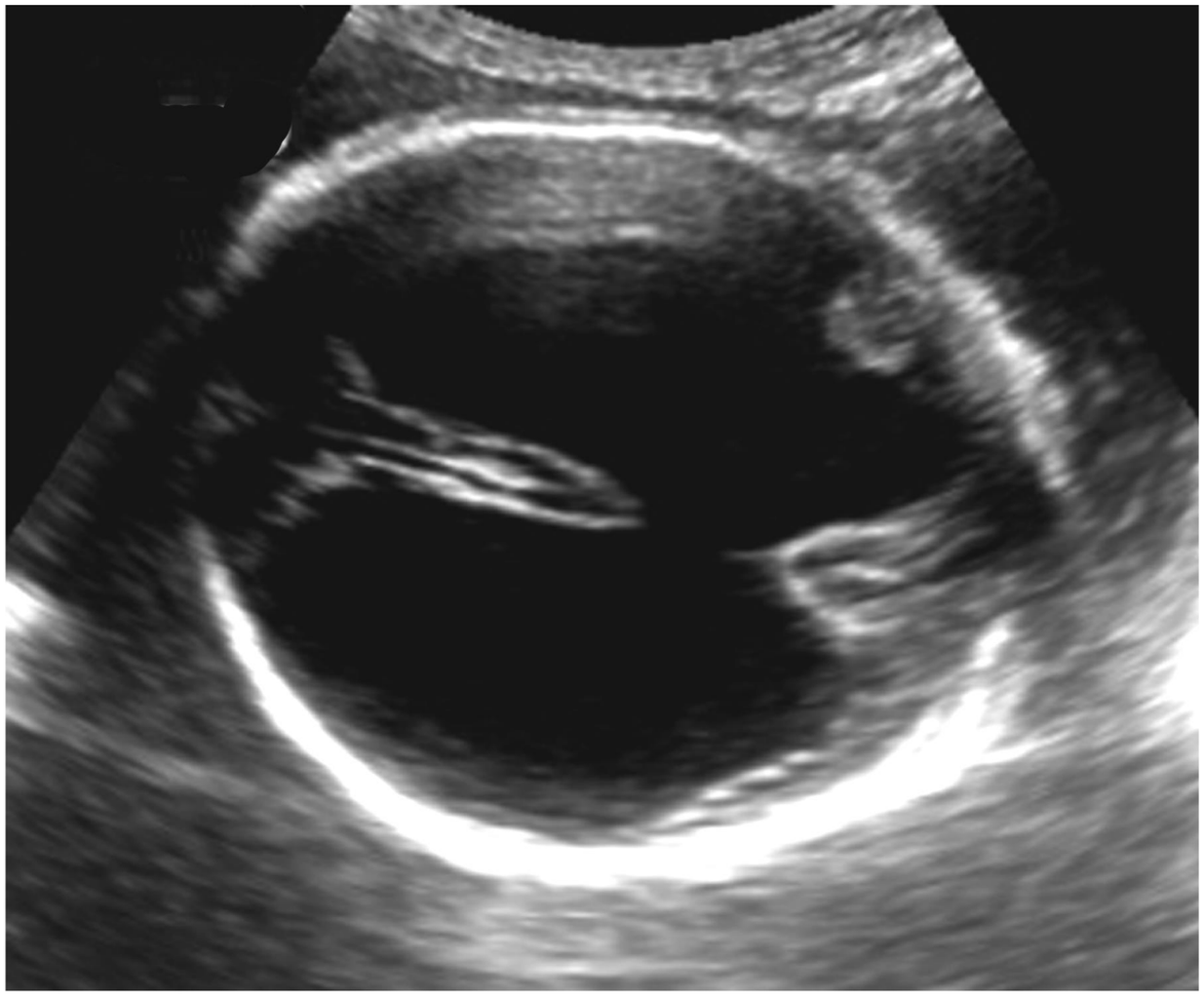
Twin Embolization Syndrome

- CNS abnormalities may include:
  - Ventriculomegaly
  - Porencephalic cysts
  - Diffuse cerebral atrophy
  - Hydranencephaly
  - Microcephaly
  - Cystic encephalomalacia

Twin Embolization Syndrome

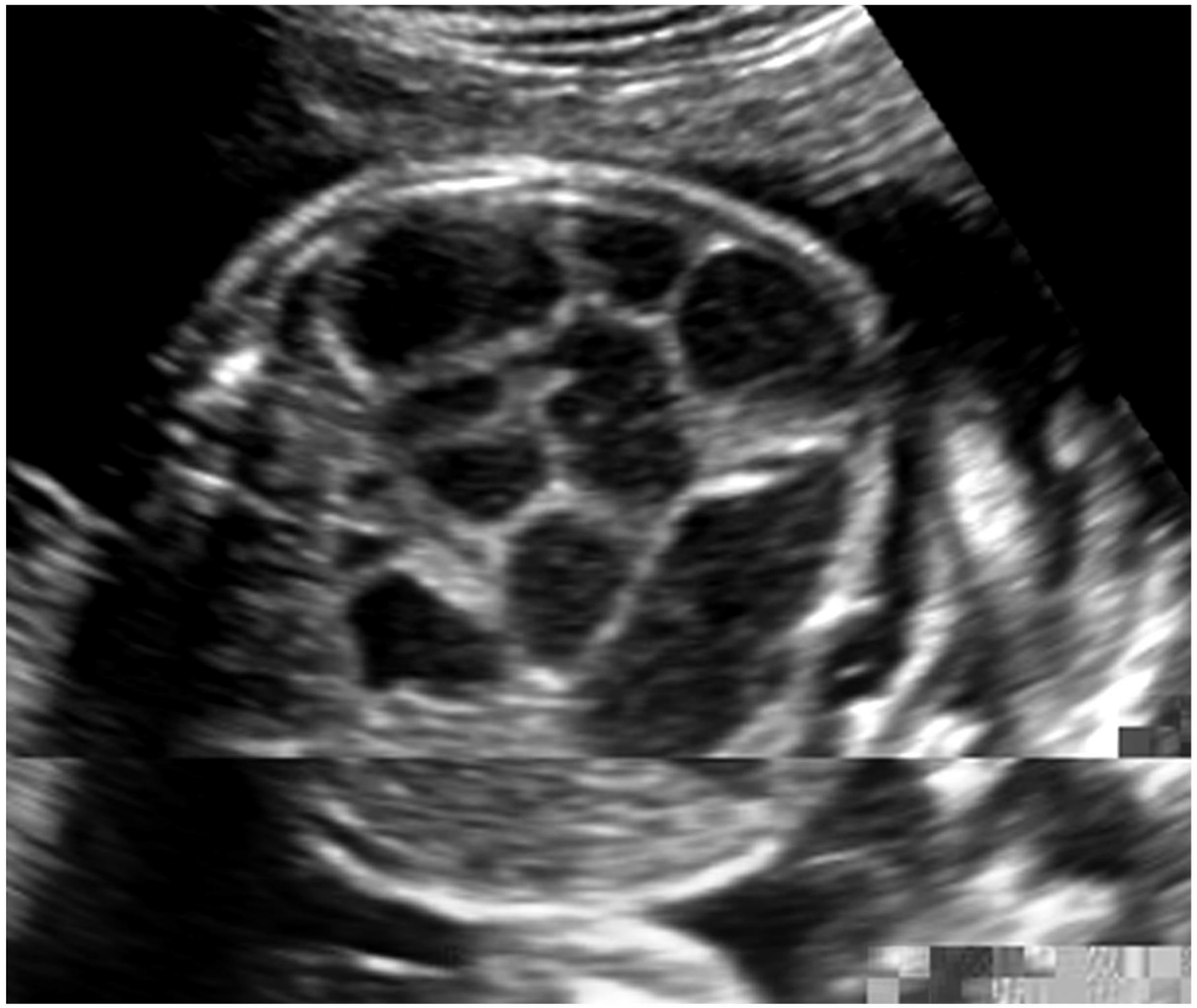
- Somatic abnormalities may include:
  - Hepatic & splenic infarcts
  - GI atresia
  - Gastroschisis
  - Fetal hydrothorax
  - Enlarged, echogenic kidneys
  - Terminal limb defects

TWIN EMBOLIZATION SYNDROME



Hydranencephaly

TWIN EMBOLIZATION SYNDROME



GI atresia

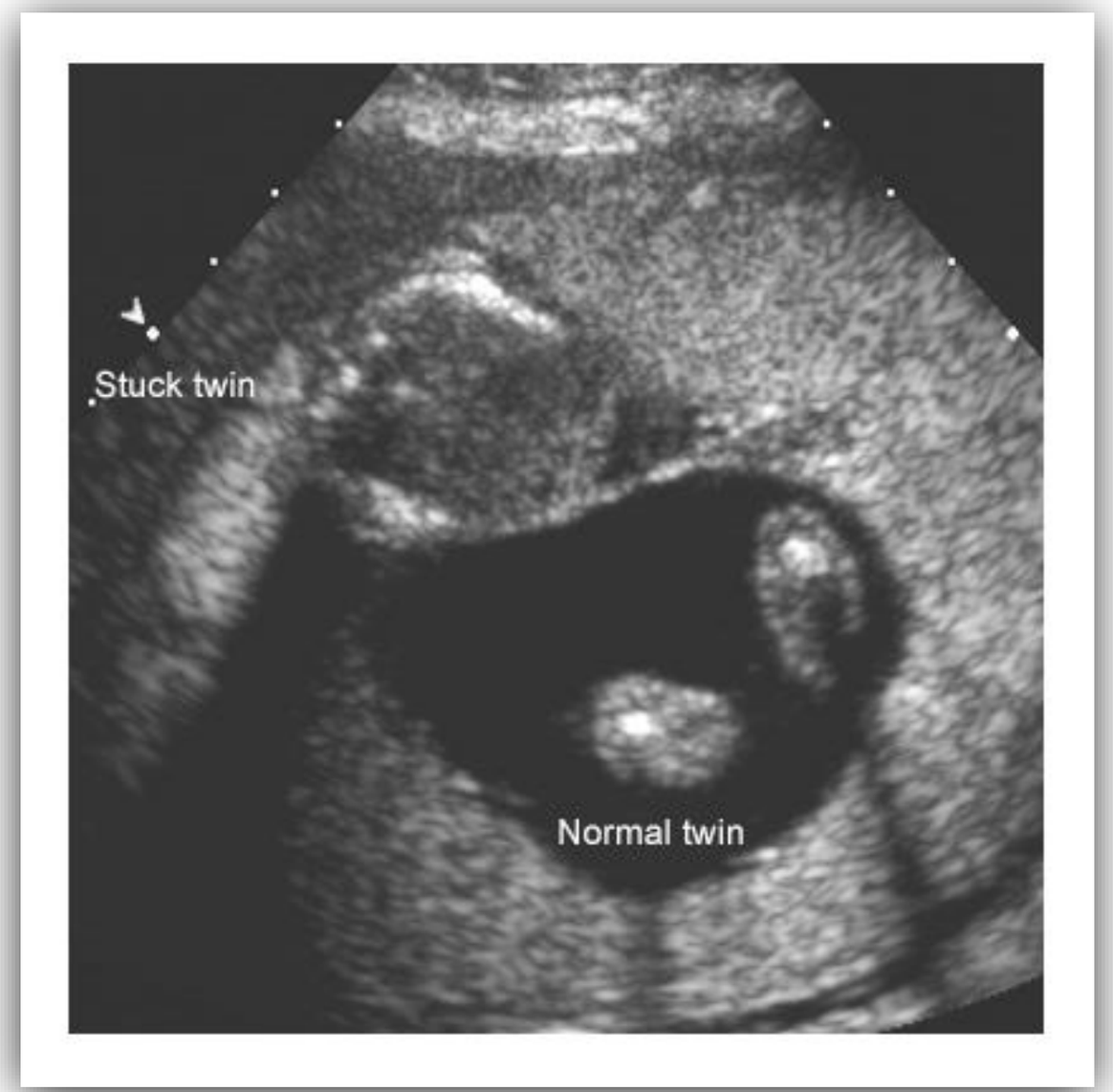
Stuck Twin (Fetus Papyraceous)

- Growth restricted co-twin in oligohydramniotic sac
- May be result of twin-twin transfusion syndrome
- Results in affected co-twin “stuck” or adherent to uterine wall
- Demised fetus may become desiccated and mummified
- Resembles small doll made of papyrus, thus, *papyraceous*

Stuck Twin (Fetus Papyraceous)

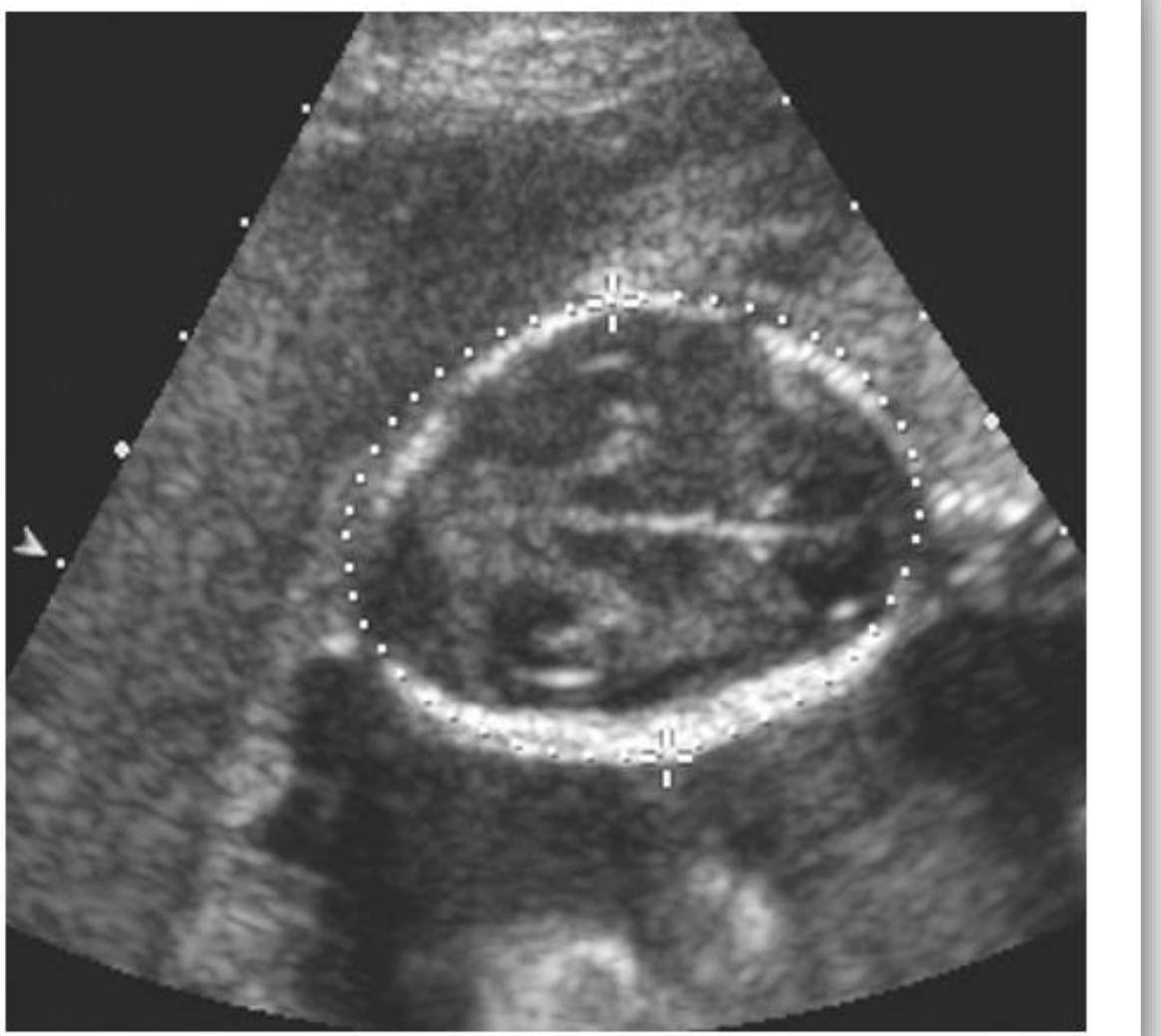
- Sonographic findings include:
  - Twin gestation
  - One twin in sac with normal fluid
  - One twin in sac with oligohydramnios
  - Smaller twin compressed against uterine wall
  - Restricted movement of stuck twin

STUCK TWIN



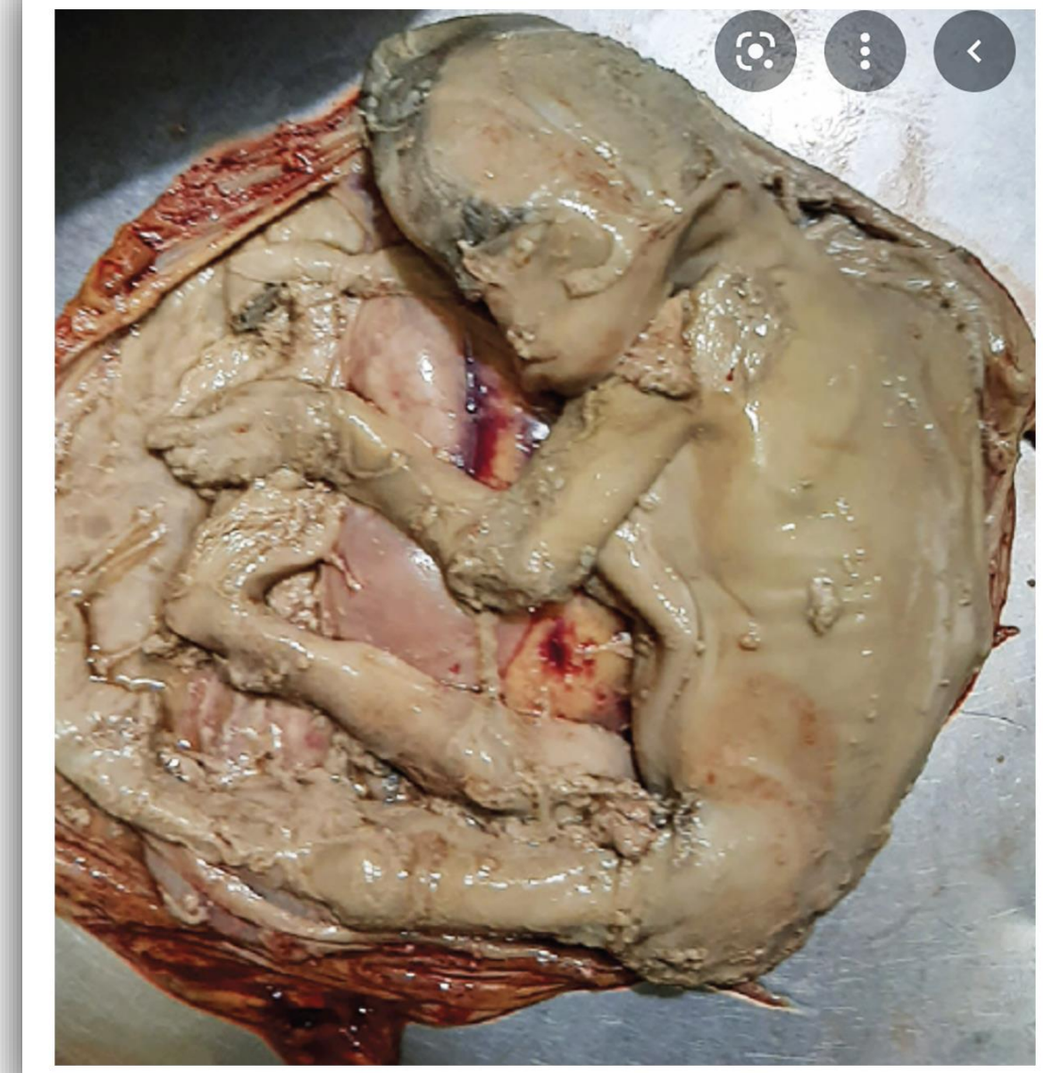
Stuck twin - abdomen

STUCK TWIN



Stuck twin - head

STUCK TWIN



Fetus papyraceous

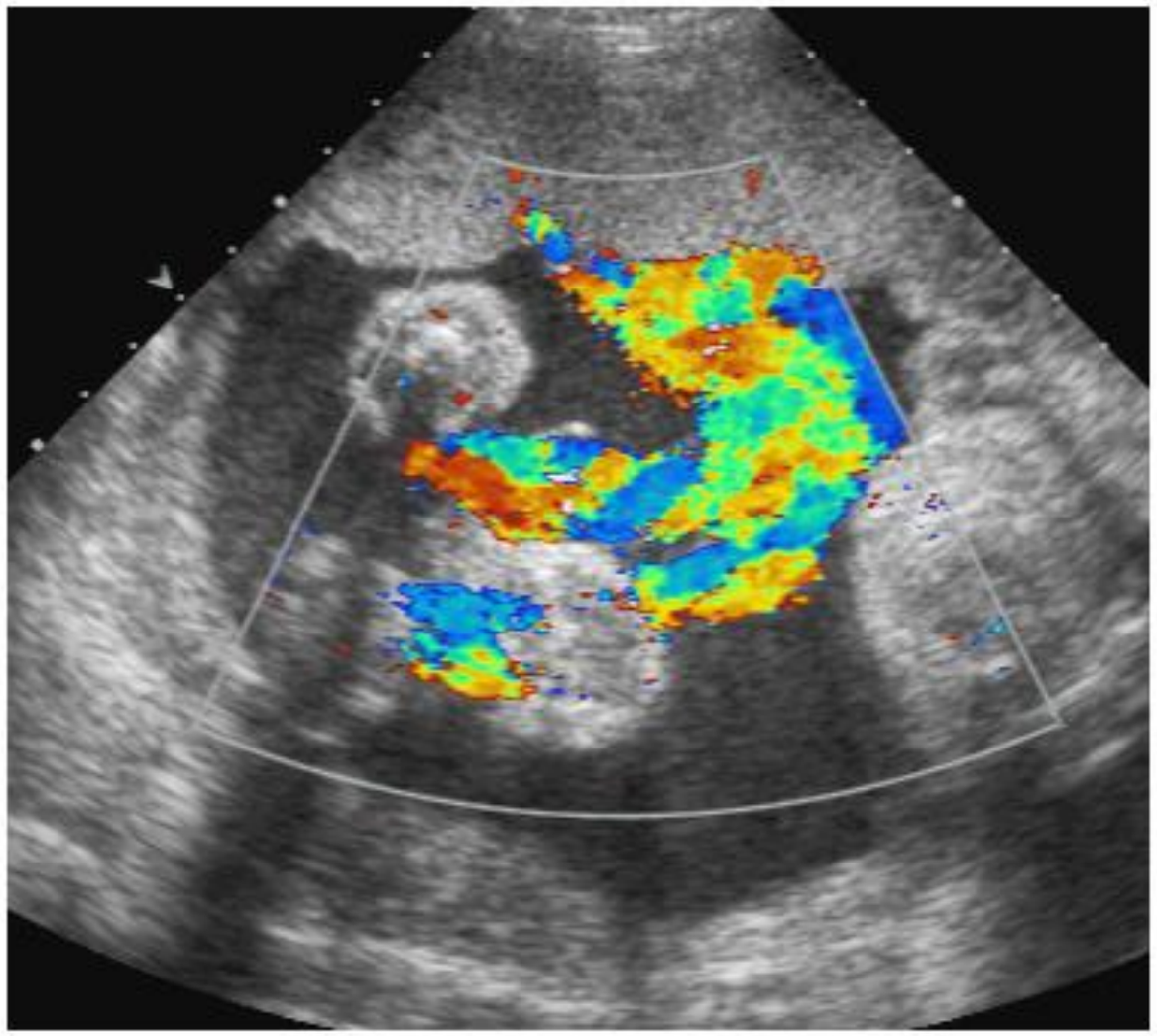
Cord Entanglement

- Mono-mono twins and their cords reside in a single sac
- Entanglement of cords is substantial contributor to high mortality rate in mono/mono twinning
- Some entanglement is expected
- Complications occur when compression of umbilical vessels yields a hemodynamically significant reduction in perfusion to one or both twins

Cord Entanglement

- Sonographic findings include:
  - Gray scale demonstration of a convoluted, intertwined cord
  - Color Doppler demonstration of arterial and venous flow in this mass
  - Notch in umbilical artery waveform velocity with spectral Doppler
  - Evidence of two different heart rates in two segments of cord

CORD ENTANGLEMENT



Convoluted mass with color Doppler flow

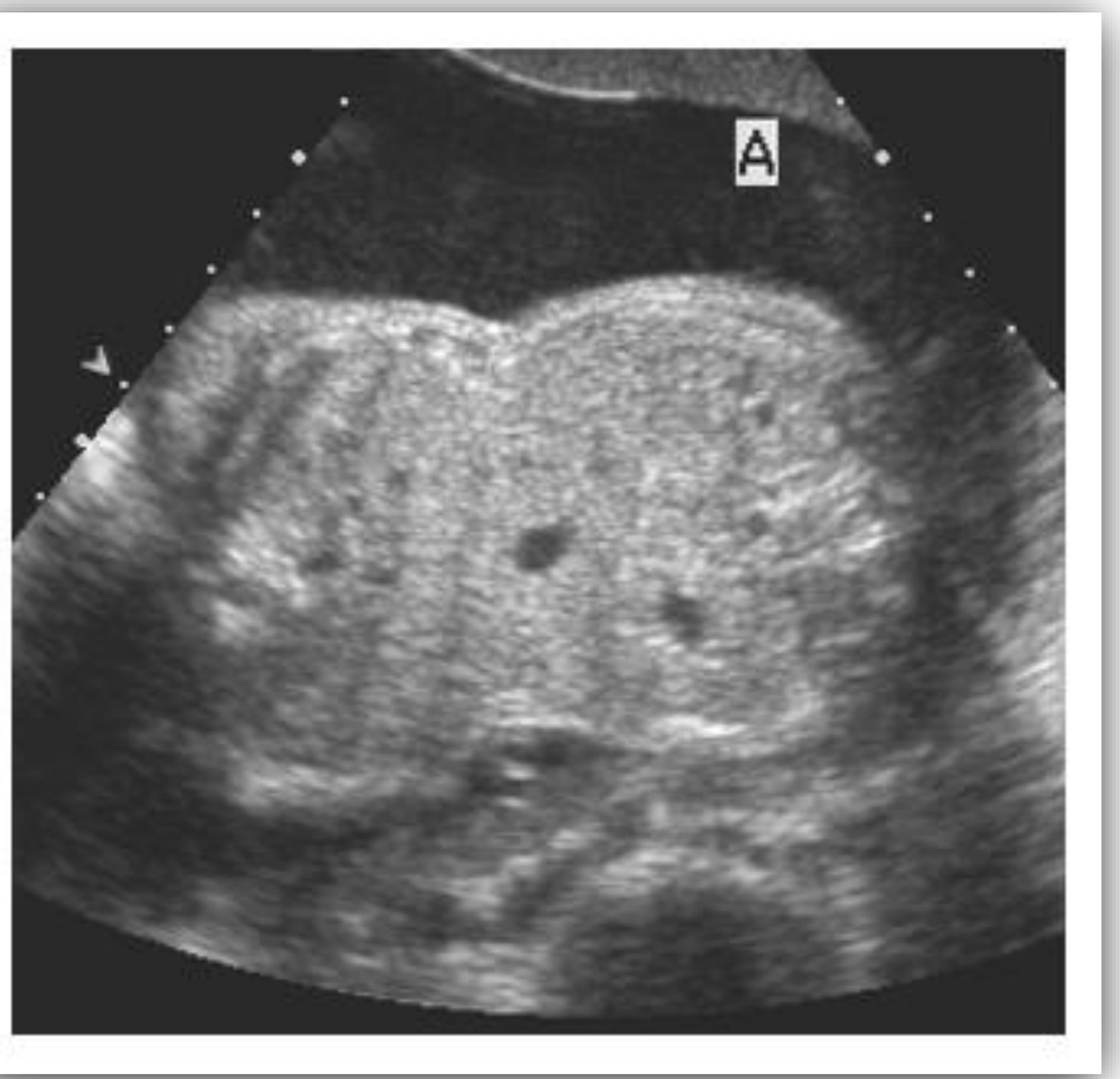
Conjoined Twins

- Result from incomplete division of fertilized ovum after 13 days post-conception
- Nomenclature based on site of union:
  - Thoracopagus (thorax ≈ 40%)
  - Omphalopagus (abdominal wall ≈ 33%)
  - Craniopagus (head ≈ 2%)
  - Pygopagus (sacrum < 1%)
  - Ischiopagus (pelvis < 1%)

Conjoined Twins

- Sonographic findings include:
  - Dramatically abnormal fetal appearance
  - Movement in unison; no independent major movements
  - Single thorax: thoracopagus
  - Fused abdomen: omphalopagus
  - Fused head: craniopagus
  - Fused sacrum: pygopagus
  - Fused pelvis: Ischiopagus

VANISHING TWIN



Omphalopagus

VANISHING TWIN

Thoracopagus

VANISHING TWIN

Craniopagus

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Multiple Gestations