Twin Gestation

Twin Gestation: Objectives

- Definition
- Embryology: Chorionicity/Amnionicity
- Epidemiology
- Maternal / Fetal Complications
- Monochorionic twin gestation
- Detecting growth discordance
- Management

What causes twinning? (definition)

- There are two types of twins:
  - Monozygotic (MZ)
    - Formed when a single fertilized ovum splits into two individuals who are almost always genetically identical unless there is a spontaneous mutation after their division
  - Dizygotic (DZ)
    - Formed when two separate ovaries are fertilized by two different sperm resulting in genetically different individuals
Incidence of types of twins

- Monozygotic (21%–33%)
  - D/D: (15%–25%)
  - MC/MA: (7%–12%)
  - Conjoined (C2M1)
- Dizygotic (67%–80%)
  - D/D: (40%–50%)

DI/DI twins can be from either origin: monozygotic or dizygotic

Timing of zygote division (monozygotic)
Monozygotic twinning can take 4 different directions depending on cleavage date.

Embryology

- The major difference between the dizygotic and monozygotic twins involves the placenta.
- All dizygotic twins have dichorionic placentas.
- Monozygotic twins may have either dichorionic or monochorionic placentas.

Zygosity vs. Chorionicity

- Zygosity can ONLY be determined by DNA fingerprinting.
- Chorionicity can be determined by ultrasound ideally by the 9th (8-10th) week of gestation.
Chorionicity/Amnionicity

- Seeing two yolk sacs is confirmation of diamniotic twins
- A single yolk sac requires further confirmation before the diagnosis of monoamniotic twins should be made
- The only criteria diagnostic of monochorionic-monoamniotic twins is the finding of a single amniotic cavity

True or False?

- All dizygotic twins are dichorionic?
- All monochorionic twins are monozygotic?
- Not all monozygotic twins are monochorionic?

Epidemiology

- MZ twinning occurs at a constant rate of about 4 per 1000 (1/250)
- DZ twinning rates vary with the individual’s characteristics, such as race (low in Asians, high in African Americans), age (increases with advanced maternal age), parity (increases with parity), and family history (especially on maternal side)
Twins: Role of Sonography

- Early Diagnosis - first trimester is ideal
- Determine Zygosity
- Diagnose Anomalies
- Diagnose Weight Discrepancy
- Guide Procedures
- Intrapartum Management (presentation)

Twin ultrasound

- Determination of chorionicity by early (preferably first trimester) ultrasound is of paramount importance for appropriate management of multiple gestations
- Ultrasound is 100% accurate in diagnosing multiple gestations
  - The best time for accurate diagnosis is the first trimester as this is the optimum time to determine not only fetal number, but especially chorionicity and amnionicity

Type of twins

- Determination of chorionicity is important for correct risk assessment, counselling, and management of complications (e.g., TTTS, FGR, single fetal death)
Why is it important to assess chorionicity and amnionicity?
Because mortality and morbidity of the twin pregnancy depends upon the type of placenta.

Chorionicity/Amnionicity?
1. Are two separate placentas present?
2. Is the gender different?
3. If a separating membrane is present, is it thick or thin?

Determination of chorionicity & amnionicity in the 1st trimester
Determination of chorionicity and amnionicity AFTER the first trimester

Chorionicity determination

Early determination of chorionicity & amnionicity:

- Di-Di
- Mo-Di
- Mo-Mo

Chorionicity & amnionicity are optimally determined at 8-10 wks.

Chorionicity determination

T/Y signs — placental edge of the septum:

  - timing: 10-14 wks
  - applied to the placental edge
  - approximately 100% accuracy
Lambda sign, dichorionic

Dichorionic/diamniotic
Dating of twin pregnancy

- Twin pregnancies should ideally be dated when the crown-rump length (CRL) measurement is between 45 and 84mm (i.e. 11+0 to 13+6 weeks of gestation).
- In pregnancies conceived spontaneously, the larger of the two CRLs should be used to estimate gestational age.
Complications

- The incidence and severity of complications is related to chorionicity and amnionicity
- ART pregnancies are associated with a higher incidence of fetal/neonatal and maternal complications
- Complications are more common in all types of multiple gestations compared to singleton gestations

Fetal complications

- Spontaneous Pregnancy Loss
  - A significant number of multiple gestations diagnosed in the first trimester undergo spontaneous reduction of one sac in the first trimester, referred to as the "vanishing twin"

- Higher Rates of Chromosomal and Congenital Anomalies
  - Due to the increased number of fetuses, particularly dizygotic, the risk of having one fetus affected by a trisomy is increased above the baseline risk of a singleton
  - Down’s syndrome risk of a 35-year-old singleton mother is obtained in twins at about age 21 to 33, and for triplets, this risk is obtained at about age 28
  - Structural defects occur two to three times more commonly in live-born MZ twins than in DZ twins or singletons
  - In 5% - 20% both MZ twins affected
Fetal complications

Fetal Growth Restriction and Discordant Growth
- Discordant growth of multiples is usually defined as a 20%–25% reduction in EFW of the smaller compared to the larger fetus (difference of larger minus smaller EFW, divided by larger EFW)
- Approximately 14% of DCDA twins have 20% discordance
- Discordance may be a marker for structural or genetic anomalies, infection, twin-twin transfusion syndrome, or placental issues
- It is not the discordance per se, but evidence of FGR of one fetus that predicts adverse neonatal outcome
- The risk of mortality or neonatal morbidity is higher among neonates in SGA-discordant twins than in AGA-discordant twins (20% vs. 6%)

Fetal complications

Single Fetal Demise in Multiple Gestations
- Up to 5% of twins and 17% of triplets in the second or third trimester undergo spontaneous loss of one or more fetuses
- This has been associated with a slight increase in risks of preterm birth and growth restriction in the remaining fetus

Fetal complications

PPROM & Preterm Birth (PTB)
- PTB is the main reason for the increased morbidity and mortality associated with multiples
- Increasing numbers of fetuses are inversely associated with gestational age at birth
- ~ 90% of twins deliver preterm
- The way the multiples were conceived plays a role in determining the gestational age of delivery because twins conceived after in vitro fertilization are more likely delivered prior to 32 weeks than spontaneously conceived twins
Twins: Cord & Placental Abnormalities

- Single umbilical artery
  - 3 times more common in twins, identified in 1.5% of twins
  - Increased risk of fetal anomalies - cardiac, CNS, GI most common
- Placental previa
  - 40% higher in twin births

Twins: Cord & Placental Abnormalities

- Abnormal placental cord insertion
  - Velamentous PCI in 10% of twins vs 1% singletons
  - Marker for sIUGR and TTTS in MC twins
  - 2% associated with vasa previa
  - ~ 50% perinatal mortality in undiagnosed cases
  - < 5% in cases identified prenatally

Perinatal Mortality

- Perinatal mortality is ~ 6 x higher in twins than in singletons
  - MC MA 50 - 60 % (improved with inpt care & delivery at 32 weeks)
  - MC DA 25% at 34 weeks
  - DC DA 4% - 8% overall
Maternal complications

- Abruption (3x risk)
- Anemia/thrombocytopenia
- Cesarean Delivery (50%)
- Labor Dystocia
- Hemorrhage
- Polyhydramnios
- Preeclampsia
- PPROM
- Hyperemesis gravidarum
- Gestational DM
- Postpartum depression
- Acute fatty Liver dz

MONOCHORIONIC “T SIGN”
Why should this worry you?

Potential Complications in Monochorionic Twins

- Monoamniotic twins
- Conjoined twins
- Twin reversed arterial perfusion (TRAP) sequence
- Twin-twin transfusion syndrome (TTTS)
- Twin anemia-polycythemia sequence (TAPS)
- Unequal placental sharing with discordant twin growth or selective intrauterine growth restriction (sIUGR)
- Single twin demise in the second or third trimester
Monoamniotic Twins: Diagnostic Pearls

- Lack of separating membrane on serial exams
- Cord entanglement documented with color Doppler, present in >80% of cases
- Single placenta with two cord insertions in very close proximity
- Associated congenital anomalies in 10% of cases

Monochorionic/Monoamniotic Twins

- Present in ~1% of all twins
  - 5% of MC twins
- Loss rate ~ 50-70%
- Complications:
  - Conjoined twins
  - Acardiac twin
  - Discordant growth
  - Fetal malformations, preterm delivery and cord entanglement

Monoamniotic Twins

- First trimester US is ideal
- Daily fetal surveillance at (23) 24-26 wks inpatient
- Continuous monitoring if deceleration
- Deliver at 32 weeks
- C/S
Conjoined Twins: Diagnostic Pearls

- Monoamniotic placentation
- Same relative positions of twins to each other in all views
  - Do not move apart
  - Extreme extension of the fetal spines
- Shared organs, vascular communications, associated anomalies
  - Omphalopagus and thoracopagus twins most common
Conjoined Twins
US Findings / Clues

- Polyhydramnios common
- Single cord with > 3 vessels may be clue
- Unusual positioning or posture
- Must be MC / MA

Chang twins 1800’s

What are all of the Ts?

- Twin reversed arterial perfusion (TRAP) sequence
- Twin-twin transfusion syndrome (TTTS)
- Twin anemia-polycythemia sequence (TAPS)
Twin Reversed Arterial Perfusion Sequence (TRAP): Diagnostic Pearls

- 75% diamniotic, 25% monoamniotic
- Asymmetric circulation leads to abnormal development of one twin without a cardiac pump (acardiac)
  - Perfused by normal (pump) twin
  - Paradoxical arterial flow toward the acardiac twin from pump twin confirms the diagnosis

TRAP: “Acardiac Twin”

- Acardius acephalus most common
  - May have rudimentary cardiac structure with pulsations
- Pump twin is at risk for
  - Structural anomalies (5 - 10%)
  - Two vessel cord (65%)
  - Aneuploidy (10%)
  - Hemodynamic compromise (30%)
- 50% donor twins die of CHF or severe prematurity
- All perfused twins die

Acardiac /pump twin AC ratio

- <50%
  - If no signs of cardiac failure in pump twin
    - Reassess in 2 weeks
  - If increase in size or persistent increase in vascularity of acardiac twin
    - Refer for prompt treatment
- >50%
  - Signs of cardiac failure?
    - If yes - emergency treatment
    - If no - may do prompt treatment with bipolar cord occlusion therapy
Sonographic Features of Acardiac Twinning

Acardiac Twin
- Absent or rudimentary heart
- Absent or malformed head
- Absent or malformed upper extremities
- Subcutaneous edema
- Two-vessel cord (common)
- Reversed flow in umb. artery

Pump Twin
- Normal or increased AFI
- May be hydropic

TRAP
TTTS & TAPS

Monochorionic placenta

- All monochorionic pregnancies have one placenta only, all with anastomoses of artery-to-artery (AA), vein-to-vein (VV), and artery-to-vein (AV) of the two twins.
  - An imbalance of arterial circulation of one twin (donor) to the venous circulation of another (recipient) probably through an AV anastomosis can lead to TTTS.
- TTTS may not occur in MC/MA gestations because of more AA and less AV anastomoses than in MC/DA gestations.

Vascular Anastomoses in the MC placenta

- Arterio-venous (AV)
  - Unidirectional flow
  - Placental cotyledon is perfused by an artery from one fetus, but drained by a vein going to the other one
- Arterio-arterial (AA) and veno-venous (VV)
  - Direct connections
  - Can transport blood in either direction
  - Important compensatory role
Twin-Twin Transfusion Syndrome (TTTS)

- TTTS occurs in about 10% of MC/DA pregnancies
- Rare cases have been reported in MC/MA and DC/DA pregnancies

TTTS

- More than 50% of TTTS placentas have ≥1 velamentous cord insertion, possibly associated with the vascular imbalance
- The donor twin develops anemia and resultant effects (e.g., FGR, oligohydramnios), and the recipient twin has polyhydramnios, becomes polycythemic, and can develop heart failure
Twin-Twin Transfusion Syndrome

- Antepartum dx requires US
- Polyhydramnios (MVP >8cm) - oligohydramnios (MVP <2cm) sequence necessary for the diagnosis
- Untreated TTTS developing before the third trimester has a perinatal mortality rate of >70%
- 15-50% risk of handicap in survivors
- Fetoscopic laser photocoagulation is therapy of choice between 16-25 6/7 weeks
  - Improved survival and neurologic outcomes

TTTS Quintero Staging

<table>
<thead>
<tr>
<th>Stage</th>
<th>Ultrasound Assessment</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Amniotic fluid</td>
<td>MVP &lt;2 cm in donor sac; MVP &gt;8 cm in recipient sac</td>
</tr>
<tr>
<td>II</td>
<td>Fetal bladder</td>
<td>Nonvisualization of fetal bladder in donor twin over 60 minutes of observation</td>
</tr>
<tr>
<td>III</td>
<td>Doppler studies</td>
<td>Absent or reversed umbilical artery diastolic flow, reversed ductus venosus a-wave flow, pulsatile umbilical vein flow</td>
</tr>
<tr>
<td>IV</td>
<td>Fetal hydrops</td>
<td>Hydrops in one or both twins</td>
</tr>
<tr>
<td>V</td>
<td>Fetal cardiac activity</td>
<td>Fetal demise in one or both twins</td>
</tr>
</tbody>
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TTTS

- Acquired CHD
  - Biventricular hypertrophy
  - >50% recipient twins
  - Pulmonary stenosis
  - 5% recipient twins
DONOR TWIN- DRAPING MEMBRANE “saran wrap”

“STUCK TWIN” Donor twin

Screening for TTTS
Management of TTTS

TTTS

- **STAGE I**
  - The natural history of stage 1 TTTS is that more than 75% of cases regress or remain stable without intervention with a perinatal survival rate of 86%
  - Therefore, expectant management with close follow-up at least weekly is the treatment of choice

- **STAGES II, III, and IV**
  - Fetoscopic laser coagulation
  - Best approach to treating advanced disease in continuing pregnancies less than 26 weeks
  - Laser therapy involves coagulation of the placental vessels transferring blood from the donor to the recipient twin
  - It is important to counsel the patient that laser treated TTTS has a 30%–50% chance of perinatal death and a 5%–20% risk of long-term neurologic handicap
  - Steroids for fetal maturation should be considered at 24 0/7 to 33 6/7 weeks, particularly in pregnancies complicated by stage III TTTS and those undergoing invasive interventions
Fetal hydrops/ascities

• The woman should be counseled regarding cotwin 10% risk of death and 10%–30% risk of neurologic complications
• Expectant management is usually considered unless gestational age is near-term or term

hydrops

TTTS

• STAGE V
  • The woman should be counseled regarding cotwin 10% risk of death and 10%–30% risk of neurologic complications
  • Expectant management is usually considered unless gestational age is near-term or term
**Twin Anemia Polycythemia Sequence (TAPS)**

- Spontaneous in 3-5% of MCDA twins
- Tends to present late in gestation
- Iatrogenic in 10-15% of TTTS cases post-laser
- Residual anastomoses in 5-20% of cases
- Polyhydramnios-oligohydramnios sequence is absent
- Diagnosis is suspected antenatally by difference in MCA PSVs
  - Elevated PSV-MCA in one twin = anemia
  - Decreased PSV-MCA in co-twin = polycythemia
- Management and outcome depend on gestational age
- Untreated TAPS >75% survival

**TTTS & TAPS**

<table>
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<tr>
<th>Stage</th>
<th>TTTS</th>
<th>TAPS</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Recipient MSH = 10 cm, donor MSH = 12 cm</td>
<td>Recipient MCA PSV &gt;3.0 m/s, donor MCA PSV &gt;5.5 m/s</td>
<td>TTTS, mild volume imbalance; TAPS, mild high discordance</td>
</tr>
<tr>
<td>II</td>
<td>Neonatal lethargy/dysfunction</td>
<td>Neonatal MCA PSV &gt;3.0 m/s, donor MCA PSV &lt;2.5 m/s</td>
<td>TTTS, progressive volume imbalance; TAPS, increasing high discordance</td>
</tr>
<tr>
<td>III</td>
<td>Critically abnormal Doppler (UA, MDV, UV)</td>
<td>Critically abnormal Doppler (UA, MDV, UV)</td>
<td>Both diseases progress to cardiovascular dysfunction</td>
</tr>
<tr>
<td>IV</td>
<td>Hydrops</td>
<td>Hydrops</td>
<td>Overt heart failure</td>
</tr>
<tr>
<td>V</td>
<td>Single/both demise</td>
<td>Single/both demise</td>
<td>High risk for secondary organ damage if one co-twin survives</td>
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**“Selective” growth restriction**

- Relationship between birth weight and placental territory discordance is influenced by presence and direction of AV anastomoses
- Rescue transfusion can occur
- Twin with a smaller share of placental recruits oxygenated blood by means of AV anastomoses such that the net venous flow is toward the smaller twin
Selective growth restriction

- sIUGR pregnancies with balanced AV anastomoses or with rescue transfusion had worse perinatal survival in absence of AA anastomoses
- Emphasizes the equilibrating role of the AA anastomoses in improving perinatal outcome
- Survival is decreased when the IUGR fetus is compromised by:
  - Significantly smaller placental territory
  - Limited means by which to recruit oxygenated blood from its co-twin
  - Absence of AA anastomoses

Key concepts in the MC placenta

- TTTS: imbalance in flow between twins with more unidirectional flow from smaller to larger twin that is not able to be compensated for by other anastomoses
- sIUGR: balanced communications but very limited number of anastomoses between the normal twin and the twin with the smaller portion of the placental mass
  - Limits the smaller twin's ability for rescue transfusions

Single fetal death

- Single fetal death is associated with significant complications for the remaining twins
- Dichorionic gestation
  - <12 weeks: Usually no consequences, no intervention needed
  - >12 weeks: Immediate delivery has no benefit for the remaining fetus
Single fetal death

- Monochorionic gestation
  - <12 weeks: Associated with high risk of loss of other twin
  - >12 weeks: Due to vascular anastomoses, 10% risk of intrauterine death and additional 25% risk of neurologic complications in other twin
  - Spontaneous transfer of blood from the viable twin to the demised twin, which results in profound hypotension in the survivor
  - At the time the demise is discovered, the greatest harm has most likely already occurred in the remaining fetus
    - No benefit in immediate delivery, especially if the surviving fetus(es) are very preterm and otherwise healthy
    - In such cases, allowing the pregnancy to continue may provide the most benefit

Twin management

- Early US to determine chorionicity
- FTS at 11-13 weeks
- Detailed anatomy US at 18-20 weeks
- Fetal echo (monochorionic) at 22 weeks
- Interval growth ultrasounds
- Antenatal testing at 32 weeks
Twins: Management Growth

- Increased risk of FGR
  - 4 x higher in Monochorionic
  - Discordant growth if > 20%

Twins: ACOG & SMFM recommendations: monochorionic

- Serial sonographic evaluation q 2 weeks beginning at 16 weeks should be considered for all MC gestations
  - Surveillance < every 2 weeks is associated with a higher incidence of later stage diagnosis of TTTS
  - Serial sonographic evaluations should include at least MVP of each sac and the presence of a bladder in each fetus
  - Consider MCA Dopplers q 2 weeks beginning at 18 weeks

Timing of delivery

- Di-Di: 38 - 39 6/7
- Di-Di w/ FGR: 36 - 37 6/7
- Di-Di with FGR and concurrent co-morbidity (PES, CHTN): 32 - 34 6/7
- Mono-Di: 34 - 37 6/7
- Mono-Di w/ FGR: 32 - 34 6/7
Mono – mono management

- 1st trimester screening with NT measurement
- Fetal echocardiography at 22-24 weeks
- Ultrasound q 3 weeks to assess fetal biometry and cord entanglement

- Admission at (23) 24–26 weeks with very frequent fetal monitoring can be offered, as well as steroids for fetal maturity
- Cesarean section at around 32–34 weeks is the preferred mode of delivery due to the risk of fetal interlocking and cord entanglement
  
  - Avoid the risk of premature placental separation, and cord prolapse of the second twin during the delivery of the 1st twin

TWINS: Delivery Route

- A vx / B vx  Vag. del. (Most attempt)
- A vx / B br  Vag with version
- A Non vx  All C/S
TWINS: VAG.DEL.

- O.R./Double Set Up
- Twin Fetal Monitor
- Real Time U.S.
- Oxytocin/methergine/hemabate
- Blood Available
- Clamps/equipment
"NAME THAT TWIN PREGNANCY"

Quadrachorionic Quadruplets

There is no diagnosis of "twins"
Questions?

References

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