Twin Gestation: Blessing or Curse?

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Objectives

- Understand trends in the twinning process
- Understand the genetic background to distinguish dizygotic vs. monozygotic twins
- Understand the increased complications in twins over singleton pregnancies
- Describe the new management guidelines for monochromatic twins

Introduction of the Twinning Process

- **Frequency of twinning in U.S.**
  - –Twins occur in 32/1000 (3.2%) live births
  - –This equates to 1:32 live births
- **Frequency of twinning worldwide**
  - –13-15/1000 (1.3-1.5%) live births
  - –Varies by region
    - Central Africa: 22-25/1000
    - Asia/Latin America: 8-12/1000
  - –Interestingly – appears to decrease with distance from equator

Changes in frequency in U.S. Through 1990-2020s

U.S. Twin Rate

1990 - 18.9/1000 live births

2009 (peak) - 33.3/1000 live births

2014-2020 (slight decrease) 32.1/1000 live births

Key Drivers Leading to Increase in Twin Birth Rates

- **Assisted Reproductive Technologies (ART)**
  - –Invitro fertilization (IVF)
  - –Ovulation Induction Methods
- **Delayed Childbearing / Increased Maternal Age**
  - –Maternal age > 35yo increases dizygotic twins 4x over < 25yo
- **Recent Stabilization / Decline in twins**
  - –ART guidelines now favor single embryo transfer this decreases iatrogenic twinning

Complication Rates in Twin vs Singleton Pregnancy

Complication	Twins	Singleton	Risk Comparison
Preterm birth (PTB) <37wks	60%	~ 10%	6X higher
Very Preterm birth <32wks	12-14%	1.6%	7-8x higher
Low birthweight (<2500gms)	55%	6%	9x higher
Fetal Growth Restriction (IUGR)	Common (esp. TTTS)	Rare	Significantly higher
Preeclampsia	12-20%	3-5%	3-4x higher
Gestational Diabetes (GDM)	6-12%	6-8%	Slightly higher
Cesarean Delivery	~ 75%	30%	2.5x higher
Intrauterine Fetal Demise (IUFD)	2-3%	<1%	Increased (esp. > 34wks)

Neonatal Outcomes:
Twins vs Singletons (matched for gestational age)

Outcomes	Twins	Singletons	Notes
NICU admissions	Higher	Lower	50-60% of twins get admitted
Respiratory Distress Syndrome (RDS)	-	-	Similar at matched gestational age
APGAR Scores	Slightly Lower	Slightly Higher	
Neonatal mortality	Higher overall	Lower	Primarily from prematurity
Neurodevelopmental Outcomes	Slightly higher cerebral palsy rater	Lower	Prematurity Mediated

Frequency of Types of Twins

Dizygotic (2 eggs/2 sperm)	Monozygotic (1 egg/ 1 sperm)
Roughly 1:80 (variable) Incidence affected by: • Age • Race • Heredity • Maternal Age • Parity • ART	1:250 (fixed) Only slightly increased by zygotic splitting in ART process

New SMFM Consult Series #72

- “Twin-Twin Transfusion Syndrome (TTTS) and Twin-Anemia Polycythemia Sequence (TAPS)”
- The most important distinction is determining the chorionicity of the twins
  - Dichorionic (DC) vs Monochorionic (MC)

Complication Rates: Dichorionic vs Monochorionic Twins

Complications	DCDA Twins	MCDA Twins	Risk Difference
Twin-Twin Transfusion Syndrome (TTTS)	0%	10-15%	Unique to MC twins
Twin-Anemia Polycythemia Sequence (TAPS)	Rare	3-5%	MC specific chronic transfusion
Selective IUGR (sIUGR)	5-10%	20-30%	Unequal placental sharing
Congenital Anomalies	1-2x general population	2-4x general population	Due to monozygotic origin
Cord Entanglement	none	Only seen in mono-amniotic (~70%)	< 1% twins
IUFD	1-2%	5-10% (mostly late $2^{nd}/3^{rd}$ Trimester)	Mostly due to TTTS
PTB < 37wks	55-60%	65-70%	Higher in MC
Very PTB < 32 weeks	10%	15-18%	Due to IUGR and TTTS
Preeclampsia	10-15%	15-20%	Slight Increase
C/S	75%	80-90%	Most MC twins are elective delivery via C/S
NICU Admission	50%	60-70%	Due to early Delivery

Making the Diagnosis
Dichorionic (DC) vs Monochorionic (MC) Twins

Ultrasound findings (ideally before 14-16 weeks GA)

Ultrasound Feature	Dichorionic (DC)	Monochorionic (MC)
Number of Placentas	2 (can be fused)	Always 1
Membrane Insertion (T-sign)	Lambda (λ) or Twin Peak	T-sign
Intertwin Membrane Thickness	> 2mm	< 2 mm
Number of Layers in Dividing Membrane	4 (2 amnion, 2 chorion)	2 (amnion only)
Sex of Fetus	Can be different	Always the same
Membrane Insertion Angle	Wide Angle λ	Thin perpendicular (T sign)

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SMFM Consult Series #72

- Twin-Twin Transfusion Syndrome and Twin Anemia-Polycythemia Sequence
- Established the importance of determining chronicity of twins
- Essentially this is s new “medico-legal document” setting a standard of care and outlining a management strategy.

Management of Monochorionic Twins

Once monochorionic diamniotic (MCDA) twin gestation is confirmed by first trimester ultrasound (up to 14wks), the following management protocol should be incorporated

Gestational Age	Surveillance
16 weeks	Begin US q2wks, fetal growth Q4, Amniotic Fluid (MVP) in each sac, Bladder filling in each fetus, Cord insertions/Anatomy
16-26 weeks	Focus on detection of TTTS q2wks
26-34 weeks	q2wk Scan, Add dopplers if IUGR or growth discordance develops
32-36 weeks	Begin fetal Monitoring (NST)
36 weeks	Delivery Planning

Surveillance Parameters to Assess for Twin-Twin Transfusion Syndrome (TTTS)

Parameter	How Measured	Threshold for TTTS
Amniotic Fluid Volume (AFV)	Maximal Vertical Pocket (MVP)	> 8cm recipient < 2cm donor
Bladder	US Size	Recipient – full Donor – empty/collapsed
Fetal Size (discordance)	EFW	Commonly > 20%
Doppler Studies **- Umbilical Artery (VA)** **- Ductus Venosus (DV)**	UA/DV doppler	Quintero Staging III/IV
Hydrops	US findings Skin edema, Ascites Pleural/Pericardial Effusions	Quintero Stage IV

Quintero Staging Classification for Twin-Twin Transfusion Syndrome (TTTS)

Stage	Finding
I	Poly-Oly Fluid Sequence
II	Donor Bladder not Seen
III	Abnormal Dopplers (UA/DV)
IV	Hydrops of one Fetus
V	Death of one Fetus

Surveillance Parameters for Twin Anemia – Polycythemia Sequence (TAPS)

Definition of TAPS by SMFM

- Chronic form of feto-fetal transfusion causing imbalance of red cell transfusion leading to anemic donor and polycythemia recipient.
- Small vessels in placenta involved with low rate of flow and transfusion (roughly 5-15cc/day) – thus AFV, bladders, and growth unaffected

Main Parameter for Surveillance to Diagnose TAPS

Peak Systolic Velocity of the Middle Cerebral Artery (PSV-MCA)

- When PSV-MCA > 1.5 MoM (Donor-Anemia)
- When PSV-MCA < 1.0 MoM (Recipient-polycythemia)

STAGE	FINDING
Stage I	Donor > 1.5 MoM/Recipient < 1.0 MoM
Stage II	Same with visible cardiac changes in donor (Echogenic/thickened ventricles)
Stage III	Abnormal Ductus Venosus (DV) flow
Stage IV	Hydrops of one fetus
Stage V	Death of one fetus

Summary of TTTS vs TAPS

FINDING	TTTS	TAPS
Main Diagnostic Tool	Amniotic Fluid Volume (AFV)	MCA Doppler
Onset	16-26 weeks (most commonly)	Any gestational age and post ablation
Key Finding	MVP > 8cm recipient MVP < 2cm donor	PSV-MCA 1.5 MoM donor 1.0 MoM recipient
Bladder Filling	Donor bladder – Empty/Collapsed Recipient – full or overdistended	Usually normal
Fluid Discordance	Present (Poly-Oligo)	Usually absent (normal)

What is the treatment for TTTS?

*Should be referred to experienced Fetal Care Center

Stage I

- Expectant Management
- Weekly Fetal Surveillance (doppler, fluid)
  - –30-40% stabilized/regressed
  - –59% progressed to stage II-IV

Stage II-IV

- Between 16-26 weeks
- Fetoscopic Laser Surgery
  - –Dual survivors 50-70%
  - –1 Survivor 20-30%
  - –No survivors 10-20%
  - –4-18% Major Neurologic Morbidity in Pediatric Survivors > 2 years old

What is the treatment for TTTS?

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- **Stage I (before 32-34 wks**)
  - –Close surveillance (Dopplers/Fluid/Growth)
  - –Generally preferred strategy
- **Stage I (after 32-34 wks)**
  - –Antenatal Corticosteroids
  - –Delivery Planning

- **Advanced Stage TAPS (>II after 16-32 wks)**
  - –Optimal management is unknown and should be individualized
    - »Expectant management
    - »Fetoscopic Laser Surgery
    - »Intrauterine Transfusion
    - »Selective Fetal Reduction
    - »Delivery

**No published randomized controlled trials exist comparing outcomes/management strategies for TAPS at this time.*

Conclusion

SMFM Consult Series #72 - TTTS and TAPS

- Monochorionic twins are at increased risk for perinatal morbidity/mortality
  - Much is attributable to
    - Shared placenta
    - Intertwin placental circulation
- TTTS and TAPS represent two types of feto-fetal transfusion syndromes
  - Imbalanced blood flow across intertwin placental anastomoses
- Frequent Sonographic Monitoring early in mid-trimester (16wks)
  - Can identify early
  - Provide “opportunities” for individualized management options

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