Twin Gestations
Twice the Fun, or Double Trouble?
BIOL 6505

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Brown University
Women & Infants’ Hospital
Twin Gestations

- Introduction
- Types of Twins
- Causes of Twin Gestation
- Incidence of Twin Gestation
- Perinatal Morbidity and Mortality
- Prenatal Diagnosis in Twins
- Special Considerations in Twins
Types of Twins

- Identical vs. Non-identical
- Monozygous vs. dizygous
- Monochorionic vs dichorionic
- Monoamnionic vs. diamnionic
Types of Twins, and Their Causes

- Monozygous: a single ovum is fertilized, and at some point following fertilization the cell mass splits.
Monozygous Twinning

- Split post-ov day 1-3: 2 chorions and 2 amnions; **dichorionic/di**amnionic
- Split post-ov day 3-8: 1 chorion and 2 amnions: **mono**chorionic/**di**amnionic
- Split post-ov day 8-13: 1 chorion and 1 amnion: **mono**chorionic/**mono**amnionic
Dizygous Twinning

- Genetic component (mutation on chromosome 3)
- Increased levels of gonadotropins in Yoruba tribe in Nigeria
- Increases with advancing maternal age until 35 years, then drops quickly
- Increased with increasing frequency of intercourse
- Increases with increasing parity
- Increased within first three months of marriage
- Decreased during periods of famine
## Incidence of Multiple Gestations

<table>
<thead>
<tr>
<th>Year</th>
<th>Twins</th>
<th>Triplets</th>
<th>Quads</th>
<th>&gt; 5</th>
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<td>1991</td>
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<td>3121</td>
<td>203</td>
<td>22</td>
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<td>1992</td>
<td>95,372</td>
<td>3547</td>
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<td>1993</td>
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<td>3834</td>
<td>277</td>
<td>57</td>
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<td>1994</td>
<td>97,094</td>
<td>4233</td>
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<td>1995</td>
<td>96,736</td>
<td>4551</td>
<td>365</td>
<td>57</td>
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<td>1996</td>
<td>100,750</td>
<td>5298</td>
<td>560</td>
<td>81</td>
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<tr>
<td>1997</td>
<td>104,137</td>
<td>6148</td>
<td>510</td>
<td>79</td>
</tr>
<tr>
<td>1998</td>
<td>110,670</td>
<td>6919</td>
<td>627</td>
<td>79</td>
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<tr>
<td>1999</td>
<td>114,307</td>
<td>6742</td>
<td>512</td>
<td>67</td>
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<td>2000</td>
<td>118,916</td>
<td>6742</td>
<td>506</td>
<td>77</td>
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Determining Chorionicity

Ultrasound Assessment

- **Same gender**
- **Different Gender** → Dichorionic (confirmed)
  - **Single Placenta**
  - **Separate Placentas** → Dichorionic (confirmed)
    - **Twin Peak Absent**
    - **Twin Peak Present** → Dichorionic (likely)
      - **2-layer Membrane**
      - **3 / 4 - layer Membrane** → Dichorionic (likely)
        - **Membrane < 2mm**
        - **Membrane > 2mm** → Dichorionic (likely)
          - **Monochorionic (likely)**
**Twin-Associated Mortality**

<table>
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<tr>
<th></th>
<th>stillborn</th>
<th>Neonatal death</th>
<th>Perinatal death</th>
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<td><strong>Di/di</strong></td>
<td>36/1000</td>
<td>103/1000</td>
<td>139/1000</td>
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<tr>
<td>separate</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Di/di fused</strong></td>
<td>27/1000</td>
<td>56/1000</td>
<td>83/1000</td>
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<tr>
<td><strong>Mono/di</strong></td>
<td>75/1000</td>
<td>152/1000</td>
<td>227/1000</td>
</tr>
<tr>
<td><strong>Mono/mono</strong></td>
<td>200/1000</td>
<td>250/1000</td>
<td>450/1000</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td>43/1000</td>
<td>96/1000</td>
<td>139/1000</td>
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# Prenatal Diagnosis in Twin Gestations

<table>
<thead>
<tr>
<th>Maternal Age</th>
<th>Trisomy 21</th>
<th>All Chrom Abn</th>
<th>Twins</th>
<th>Trisomy 21</th>
<th>All Chrom Abn</th>
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<td>1/1533</td>
<td>1/481</td>
<td>1/833</td>
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<td>1/826</td>
<td>1/1202</td>
<td>1/447</td>
<td>1/650</td>
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<tr>
<td>27</td>
<td>1/769</td>
<td>1/943</td>
<td>1/415</td>
<td>1/509</td>
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<td>1/719</td>
<td>1/740</td>
<td>1/387</td>
<td>1/398</td>
<td></td>
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<tr>
<td>29</td>
<td>1/680</td>
<td>1/580</td>
<td>1/364</td>
<td>1/310</td>
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<tr>
<td>30</td>
<td>1/641</td>
<td>1/455</td>
<td>1/342</td>
<td>1/243</td>
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<tr>
<td>31</td>
<td>1/610</td>
<td>1/357</td>
<td>1/324</td>
<td>1/190</td>
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<tr>
<td>32</td>
<td>1/481</td>
<td>1/280</td>
<td>1/256</td>
<td>1/149</td>
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<tr>
<td>33</td>
<td>1/389</td>
<td>1/219</td>
<td>1/206</td>
<td>1/116</td>
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<tr>
<td>34</td>
<td>1/303</td>
<td>1/172</td>
<td>1/160</td>
<td>1/91</td>
<td></td>
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<tr>
<td>35</td>
<td>1/237</td>
<td>1/135</td>
<td>1/125</td>
<td>1/71</td>
<td></td>
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Special Considerations in Twins

- Monoamnionic twins
- Acardiac Twins
- Twin-to-twin transfusion
Monoamnionic Twins

- 1% of MZ gestations
- Dx: no inter-twin membrane; entangled umbilical cords
Monoamnionic Twins

- Frequent fetal testing starting at viability
  - Daily

- When to deliver?
  - Two series of 44 sets of MA twins showed no fetal loss after 32 weeks
Monoamnionic Twins

- Sometimes a plus!
  - 1 twin with LUTO
  - Co-twin ok, and
  - Made enough urine for both
Acardiac Twins

- 1% of MZ twins
- 1:35,000 – 1:150,000 births
- TRAP: Twin Reversed Arterial Perfusion Sequence
- Results from early development of arterio-arterial anastomosis between the umbilical arteries of two twins
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- 1% of MZ twins
- 1:35,000 – 1:150,000 births
- TRAP: Twin Reversed Arterial Perfusion Sequence
- Results from early development of arterio-arterial anastomosis between the umbilical arteries of two twins
- Reversal of blood flow in the recipient twin with an umbilical artery bringing deoxygenated blood from the pump twin to the acardiac twin.
- Asymmetric, with hypoperfusion of the upper part of the acardiac twin
Twin-to-twin Transfusion

Definition: net transfusion of blood from one twin to another through vascular anastomoses in the placenta

- Poly/oli; S/LGA; anemia; hypoproteinemia

- Epidemiology
  - Incidence of TTTS: 0.1-0.9/1,000
  - 10% of all identical twins
  - Cause of death in 15-17% of twins
BEFORE WE INTERVENE

- Do we understand the natural history of this disorder?
  - Can we predict the course of the disorder?
- Would prenatal intervention change the outcome?
- Is there an intervention that is effective?
- Does the intervention create more risk than it prevents?
Twin-to-twin Transfusion

- **Outcome**
  - If < 24 weeks: 80-100% mortality
  - Donor twin: growth retardation, death
  - Recipient twin: heart failure, death
  - If one fetus dies:
    » hypotension in survivor
    » 27-33% CNS damaged co-twin
# Vascular Anastomoses in Monochorionic Placentas

<table>
<thead>
<tr>
<th></th>
<th>A-A</th>
<th>V-V</th>
<th>A-V</th>
<th>&gt; 1 type</th>
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<tbody>
<tr>
<td><strong>Benirschke</strong></td>
<td>60%</td>
<td>13%</td>
<td>48%</td>
<td>85%</td>
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<tr>
<td><strong>Strong</strong></td>
<td>79%</td>
<td>36%</td>
<td>74%</td>
<td>90%</td>
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<tr>
<td><strong>Galea</strong></td>
<td>71%</td>
<td>9%</td>
<td>6%</td>
<td>69%</td>
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<tr>
<td><strong>Arts</strong></td>
<td>74%</td>
<td>9%</td>
<td>65%</td>
<td>87%</td>
</tr>
<tr>
<td><strong>Sekiya</strong></td>
<td>75%</td>
<td>41%</td>
<td>48%</td>
<td>--</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td>70%</td>
<td>23%</td>
<td>48%</td>
<td>83%</td>
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</table>
The Hydraulics of TTTS
US Diagnosis of TTTS

- Similar gender twins
- Thin inter-twin membrane
- Single placental mass
- Donor twin w/ maximum vertical pocket < 2 cm
- Recipient w/ maximum vertical pocket > 8 cm
- Appearance of “stuck twin"
- Small or non-visualized bladder in donor
- Large bladder in recipient
- Hydrops
- Abnormal Dopplers
Stuck Twin in TTTS
Discordant Twins in TTTS
Quintero Staging of TTTS

- **Stage 1:** MVP > 8 in recipient and < 2 cm in donor
- **Stage 2:** stage 1 and bladder not seen in donor
- **Stage 3:** stage 2 and critically abnormal Dopplers
- **Stage 4:** stage 3 and hydrops
- **Stage 5:** stage 4 and demise
Quintero Staging of TTTS

- Stage 1: MVP > 8 in recipient and < 2 cm in donor
- Stage 2: stage 1 and bladder not seen in donor
- Stage 3: critically abnormal Dopplers (D or R)
- Stage 4: hydrops (D or R)
- Stage 5: demise (D or R)
Critically Abnormal Doppler Findings

- Absent or reversed and diastolic flow in the umbilical artery
- Pulsatile umbilical venous flow
- Reversed fetal ductus arteriosus flow
- Fetal tricuspid regurgitation
Tricuspid Regurgitation
Absent/Reversed End-Diastolic Flow
Absent/Reversed End-Diastolic Flow
Absent/Reversed End-Diastolic Flow
Pulsatile UV Flow
Interventions for TTTS

- Reduction amniocentesis.
  - Insertion of 18- or 20-gauge spinal needle and removal of amniotic fluid sufficient to bring recipient maximum vertical pocket down to < 8 cm.
  - Decreases incidence of preterm labor.
  - ? Re-establish favorable placental hemodynamics.
  - Risks: PROM, infection, abruption.
Interventions for TTTS

- Septostomy
  - Intentional creation of a rent in the membrane overlying the smaller, oligohydramniotic donor twin
  - ? Re-establish normal placental hydraulics
  - Risks: pseudo monoamniotic twins
  - NO LONGER ACCEPTABLE TREATMENT
Interventions for TTTS

- Fetoscopic laser ablation of chorioangiopagus vessels (FLOC)
  - 400 -600 μm laser fiber introduced via 1.3 mm operating endoscope
  - Crossing/ unpaired vessels photocoagulated
  - Risks: PROM, infection, PTL, abruption, membrane separation
The Eurofoetus Trial

Study design:

- Randomized, 2-arms:
  » (Serial) amnioreduction
  » Endoscopic laser ablation

- Inclusion criteria:
  » Stage II and above
  » <26 weeks gestation
The Eurofoetus Trial

Study design:

– **Primary outcome measures**
  » Perinatal survival/survival at 7-12 months
  » Neurological outcome at 12 months

– **Secondary outcome measures**
  » PPROM
  » Maternal complications
  » Preterm labor requiring tocolysis
  » Neonatal morbidity (*incl* neuro)
The Eurofoetus Trial

Results:

- Study stopped at 142 patients

  » Clear advantage of laser:

  - 76% vs. 56% survival of at least 1 twin at 1 mo
  - 6% vs. 14% incidence of PVL
  - 52% vs. 31% free of neurologic complications @ 6 mo

  » Termination of pregnancy:

  - 11 in amnio group vs. none in laser group