TWIN TWIN COMPLICATIONS

Beth M. Kline-Fath, MD
Professor of Radiology
Chief of Fetal and Neonatal Imaging
Department of Radiology
Cincinnati Children’s Hospital Medical Center
DISCLOSURES: NONE
Fetal Brain Injury

- Not clearly known
  - 1/10,000
- Undiagnosed
  - Symptoms after 1st year life
- Factors
  - Duration hypoperfusion
  - Gestational age
- Chronic > acute
Ischemic Injury Etiology

- Unknown
- 45%
  - *Hematologic
    - Alloimmune thrombocytopenia
  - *Trauma
  - Placental thrombosis/vasculopathy
  - Monochorionic twins
  - Fetal anemia
  - Metabolic disorders
<table>
<thead>
<tr>
<th></th>
<th>DiAmniotic DiChorionic Separate placentae</th>
<th>DiAmniotic DiChorionic Fused placentae</th>
<th>DiAmniotic MonoChorionic Single placenta</th>
<th>MonoAmniotic MonoChorionic Single placenta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>35%</td>
<td>27%</td>
<td>36%</td>
<td>2%</td>
</tr>
<tr>
<td>Mortality</td>
<td>13%</td>
<td>11%</td>
<td>32%</td>
<td>44%</td>
</tr>
</tbody>
</table>

Cerebral Findings in Monochorionic

- **Anomalies**
  - 2-3 X higher singleton or dichorionic twins

- **Ischemic**
  - 10 x higher dichorionic
  - TTTS
  - 3 - 41% overall incidence

Why MRI in Monochorionic Twins?

- **Adjunct to US**
  - Central nervous system
    - Brain injury
    - Brain malformations
  - Improves counseling
- **Useful prior to fetal surgery**
  - 3D pregnancy
Fetal MR Twin Imaging Protocols

- Placental Imaging
  - 2D Fiesta
    - Axial/Sag/Cor

- Brain imaging
  - SS-FSE ★
  - T1
  - Diffusion

- Abdomen
  - Axial
    - SS-FSE and/or Fiesta
Monochorionic Vascular Anastomosis
TTTS

- Donor
  - Hypovolemic
  - Oliguria
  - Oligohydramnios
  - Growth restriction

- Recipient
  - Hypervolemic
  - Polyuria
  - Polyhydramnios
  - Cardiac dysfunction
# Fetal MRI Findings in TTTS

<table>
<thead>
<tr>
<th></th>
<th>Donor</th>
<th>Recipient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amniotic Fluid</td>
<td>Oligohydramnios (100%)</td>
<td>Polyhydramnios (100%)</td>
</tr>
<tr>
<td></td>
<td>Stuck configuration (42%)</td>
<td></td>
</tr>
<tr>
<td>Urinary</td>
<td>No or small bladder (96%)</td>
<td>Bladder distention (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pelvocalyceal distention (63%)</td>
</tr>
<tr>
<td>Cardiac</td>
<td></td>
<td>Cardiomegaly (63%)</td>
</tr>
<tr>
<td>Cerebral</td>
<td>Cerebral Malformation (8%)</td>
<td>IVH/ischemia (8%)</td>
</tr>
<tr>
<td></td>
<td>Cerebral venous sinus enlargement (8%)</td>
<td>Cerebral venous sinus enlargement (8%)</td>
</tr>
<tr>
<td>Other</td>
<td>Growth restriction (63%)</td>
<td>Lung lesion (4%)</td>
</tr>
<tr>
<td></td>
<td>Hydrops (8%)</td>
<td>Hydrops (8%)</td>
</tr>
<tr>
<td>Outcome</td>
<td>Demise (4%)</td>
<td>Demise (4%)</td>
</tr>
</tbody>
</table>

Types of Brain Injury

- Intracranial hemorrhage
  - Germinal matrix
- Parenchyma
  - Acute ischemia
    - Arterial infarct
  - Chronic
Hemorrhage - Recipient 26 w
Hemorrhage - Recipient 21 w
Hemorrhage - Recipient 21 w
Hemorrhage - Donor 25 w
Cerebellar Hemorrhage - Donor 23 w
Acute Arterial – Recipient 22w
Acute Ischemia- Recipient 20w
Acute Edema - Recipient 25w
Chronic Parenchyma- Donor 18w
Chronic Parenchyma- Donor 18w
Malformations - Donor
Malformations - Donor
Brain Injury After Laser Surgery

- 1,023 TTTS after SLFP
- 2% with brain injury
  - 82% sequential ultrasound (5.8 weeks after surgery)
  - MR 30-32 weeks
  - Higher recurrent TTTS or TAPS
Post Laser Bleed - Donor

19w

20w
Fetal MR imaging in TTTS

- Controversial
  - Limited studies
  - Limited comparison with US

- True incidence brain pathology
  - Prior to laser therapy
Cerebral Findings in TTTS

- 270 twin gestations with TTTS

- 32 (12%) cerebral pathology
  - Mean gestational age 21 w
  - 30 prenatal US
Cohort of Cerebral Pathology

- 36 fetuses cerebral pathology
  - 24 (75%) Donors
    - 13 (54%) anomalies
    - 11 (46%) bleed/ischemic injury
  
  - 12 (25%) Recipient
    - 3 (25%) anomalies -mild unilateral ventriculomegaly
    - 9 (75%) bleed/ischemic injury
Brain Anomalies

- Donor pathology more common
- ? due to early ischemic hit
Brain Ischemia

• Donor
  • Supratentorial parenchymal volume loss
    – ? low blood flow affecting germinal matrix

• Recipient
  • Germinal matrix hemorrhage
    – ? venous hypertension in presence of heart disease
Brain Injury in TTTS

• Cerebral pathology in 12% of TTTS pregnancies, of which 7% bleed/ischemic.

• Patterns of cerebral pathology are seen in TTTS.

• Fetal MRI can provide useful information prior to laser intervention.

Kline-Fath, et al. TTTS and Cerebral Pathology: A Comparison of Fetal MRI and Ultrasound, SPR 2016
Conclusion

- Monochorionic twins
  - CNS injury
  - CNS malformations
- TTTS predisposes to injury
- Counseling prior to intervention