Twin Twin Transfusion Syndrome: What are the Outcomes?

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Professor and Vice Chair
University of Cincinnati
Fetal Care Center of Cincinnati
TWIN-TWIN TRANSFUSION SYNDROME

Unsolved problem

• Most common complication in MC twins
• 4-35% of all MC gestations in US
• 0.1-0.9 per 1000 births
• 17% of all perinatal mortality in twins
• Mortality of 80-100% if untreated
• Mortality of 15-63% even with treatment
TWIN TROUBLES

Fetal Care Center of Cincinnati

1118 sets of twins

- 27 Conjoined twins
- 198 Anomalous Co-twins
- 67 TRAP Sequence
- 826 TTTS
Twin-Twin Transfusion Syndrome

**Diagnostic Criteria**

<table>
<thead>
<tr>
<th>Neonatal criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discordant cord blood Hgb &gt; 5 g/dl</td>
</tr>
<tr>
<td>Discordant birth weight &gt; 20%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-TTTS meeting criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>19/130 had Hgb &gt; 5 g/dl</td>
</tr>
<tr>
<td>Growth restriction without TTTS</td>
</tr>
<tr>
<td>Fetal acidosis, hypoxemia</td>
</tr>
<tr>
<td>Polycythemia</td>
</tr>
</tbody>
</table>

| Discordant Hgb rare in TTTS |
| Discordant weight common in TTTS |
| ? threshold of >20% |
Quintero Staging of TTTS

Stage I: Discordant amniotic fluid: DVP >8 cm & < 2 cm

Stage II: Absent bladder in the donor

Stage III: Doppler velocimetry changes in UA, UV, DV

Stage IV: Hydrops

Stage V: Death of one fetus
Twin-Twin Transfusion Syndrome

Diagnostic Evaluation:

- Echocardiogram
- Fetal MRI
- Ultrasound
  - Monochorionic gestation
  - Oligohydramnios DVP < 2 cm
  - Polyhydramnios DVP > 8 cm
  - Doppler velocimetry changes
    - Donor
      - AEDF in UA
      - Complete absence of DF in UA
    - Recipient
      - Pulsatile UV
      - AEDF in UA
      - DV: decreased, absent, reversed a wave
  - Growth discordance
TTTS DIAGNOSIS OF EXCLUSION

- 15% cases not TTTS
- TTTS mimicked by:
  - Placental insufficiency
  - Dichorionic gestation
  - Discordant anomaly
  - Discordant viral infection
## Fetal MRI Findings in TTTS

<table>
<thead>
<tr>
<th></th>
<th>Recipient Cases DCVS</th>
<th>Donor Cases DCVS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrops/Ascites</td>
<td>15%</td>
<td>6%</td>
</tr>
<tr>
<td>Brain Bleed/Ischemia</td>
<td>15%</td>
<td>3%</td>
</tr>
<tr>
<td>Demise</td>
<td>4%</td>
<td>6%</td>
</tr>
</tbody>
</table>
Twin-Twin Transfusion Syndrome

**TTTS Cardiomyopathy**
- Cardiac decompensation
- More afterload pathology
- Not volume stress
- Isolated tricuspid regurgitation
- RV hypertension  Systolic P> 80 mmHg
- Pulmonary outflow tract obstruction
- Pulmonary insufficiency
- Pulmonary atresia/intact ventricular septum
Echocardiographic Findings in TTTS

- Myocardial hypertrophy RV > LV
- Decreased compliance RV > LV
  - Monophasic inflow
- AV valve incompetence TV > MV
- Poor compliance/ AV valve incompetence reflected in
- DV abnormalities
  - Decrease in a wave
  - Absence of a wave
  - Reversal of a wave
- Acquired congenital heart disease
  - Pulmonic valve stenosis, insufficiency, atresia
  - Not reversible with treatment of TTTS
Treatments for Twin-Twin Transfusion Syndrome

- Maternal Digoxin
- Maternal Indocin
- Amnioreduction
- Selective fetocide
- Hysterotomy for cord ligation
- Blood letting of recipient
- Septostomy
- Microseptostomy
- Non-selective Laser photocoagulation
- Selective Laser photocoagulation
- Fetoscopic cord ligation
- Fetoscopic RFA
- Fetoscopic cord coagulation
Twin-Twin Transfusion Syndrome

Amniocentesis

- Standard therapy in US
- Initially treated maternal symptoms
- Survival of 50%
  - Moise Semin Perinatol 1993
- Survival in aggressive amnioreduction
  - 37% to 83%
- Minimal maternal or fetal risk
- Incidence of neurologic abnormalities
  - 18 to 26% of survivors
Twin-Twin Transfusion Syndrome

- International Registry on TTTS Treated by Amnioreduction
- 223 pregnancies < 28 weeks
- Average number of amnioreductions 2
- Complications-mostly fetal
  - PPROM 6.2%
  - Labor 3.1%
  - Fetal demise 3.4%
  - Placental abruption 1.3%
  - Chorioamnionitis 0.9%
  - Miscarriage 0.4%

Twin-Twin Transfusion Syndrome

International Amnioreduction Registry
Mari et al

- Survival to birth 78%
- Survival to 4 weeks of age 60%
SEPTOSTOMY

- Single amnioreduction paradox
- Inadvertent septostomy
- Saade et al Fetal Diagn Ther 13:868-93
  - 12 patient
  - Survival 83% at GA of 31 wks
  - 7 patients
  - Survival 57%
  - Single institution: 7 cases AR; 7 cases septostomy
  - Survival for AR 64%:
  - Survival for septostomy 71%
- Moise et prospective trial comparing AR to septostomy
  - 65% survival with AR and with septostomy
TEMPORIZING MICROSEPTOSTOMY

- Eliminates repeated amnioreductions
- Decreased risk of chorioamniotic separation
- Resuscitation of “stuck” twin
- Temporizing measure in TTTS
- Lose oligo/poly as sign
- TTTS’s hemodynamic derangement
  - Serial ultrasounds
  - Serial echocardiograms
- Microseptostomies
  - 1/3 stabilized
  - 2/3 progressed hemodynamically
DETECTING PROGRESSION OF TTTS

• ULTRASOUND FINDINGS
  – Serial examinations
  – Hydrops
  – Progressive growth discordance-2 wk

• DOPPLER VELOCIMETRY
  – Absent or reversed diastolic flow in UA
  – Reversal of flow in Ductus Venosus

Ductus Venosus
Flow Reversal
Umbilical Artery
Absent Diastolic flow
FETAL ECHOCARDIOGRAPHIC SIGNS OF PROGRESSION OF TTTS

- Development or worsening TR
- Development or worsening MR
- Development of PI/PS
- Worsening ventricular hypertrophy
- Reduced ventricular fractional shortening
- Tei myocardial performance index
Twin-Twin Transfusion Syndrome

Non-Selective Fetoscopic Laser Photocoagulation

1990 DeLia
- Obstet Gynecol 75:1046, 1990

1995 DeLia
  - 53% survival
  - 96% “developing normally”

1995 Ville
- N Engl J Med 332;224, 1995
  - 53% survival
  - Survivors “developing normally”

Inter-twin Membrane
# Twin-Twin Transfusion Syndrome

## Non-Selective or Semi-Selective Fetoscopic Laser Photocoagulation

<table>
<thead>
<tr>
<th></th>
<th>Fetal Survival</th>
<th>At least 1 Survivor</th>
</tr>
</thead>
<tbody>
<tr>
<td>DeLia ‘95</td>
<td>52.8%</td>
<td>69.2%</td>
</tr>
<tr>
<td>DeLia ‘99</td>
<td>69%</td>
<td>82%</td>
</tr>
<tr>
<td>Ville ‘98</td>
<td>54.5%</td>
<td>73.5%</td>
</tr>
<tr>
<td>Senat ‘04</td>
<td>57%</td>
<td>76%</td>
</tr>
</tbody>
</table>

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*Inter-twin Membrane*
Sequential Selective Fetoscopic Laser Photocoagulation
Quintero et al J Matern Fetal Neonatal Med 2007

- Donor AV first, then Recipient AV then A-A then VV
- Favorable results
- Likely due to detailed mapping
- Shorter duration of laser use
- Comparable results to FCC
Twin-Twin Transfusion Syndrome

Selective Fetoscopic Laser Photocoagulation

- 1998 Quintero et al
- 1999 Hecher et al
    - 73 Fetoscopic laser
    - 43 Amnioreduction
    - Survival: Laser 61% AR 51%
  - Both in same pregnancy 54%
  - One or both survive 79% vs 60%
  - Abnormal brain US 6% vs 18%
**Twin-Twin Transfusion Syndrome**

**Selective Fetoscopic Laser Photocoagulation**

<table>
<thead>
<tr>
<th>Study</th>
<th>Fetal Survival</th>
<th>At least 1 Survivor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hecher ‘99</td>
<td>61%</td>
<td>79%</td>
</tr>
<tr>
<td>Hecher ‘00</td>
<td>68%</td>
<td>81%</td>
</tr>
<tr>
<td>Quintero ‘00</td>
<td>61.3%</td>
<td>83%</td>
</tr>
<tr>
<td>Quintero ‘03</td>
<td>64.2%</td>
<td>83.2%</td>
</tr>
<tr>
<td>Huber ‘04</td>
<td>70%</td>
<td>83%</td>
</tr>
<tr>
<td>Huber ‘06</td>
<td>71.5%</td>
<td>83.5%</td>
</tr>
<tr>
<td>Crombleholme ‘07</td>
<td>77%</td>
<td>91.7%</td>
</tr>
</tbody>
</table>

![Diagram](image-url)
Cincinnati Mapping protocol

Team
Pediatric surgeon
Maternal Fetal Medicine
Sonographer
Recorder

1st
Identification of all vascular connection and recorded the findings.

2nd
Confirmation of the vascular connection and laser photocoagulation.

3rd
No vascular connection was missed and no vessel had recanalized.
Positioning and Set Up
Twin-Twin Transfusion Syndrome

Anesthetic Options

- Local with IV sedation
  - Posterior placentas only
  - Psychologically prepared
  - Calm and cooperative disposition
  - English speaking
- Epidural with IV sedation
  - Standard approach
- General anesthetic
  - Reserved for those with contraindications to regional or local anesthesia
Twin-Twin Transfusion Syndrome

- All have sequential compression stockings
- All pressure points well padded
- Posterior placenta
  - Bump for uterine displacement
  - Side of recipient up
- Anterior Placenta
  - Full lateral decubitus position
  - Flex the bed
  - Approach from side opposite donor with a window
  - Window between Pelvis and the costal margin
Fetoscopes Used in Laser Procedure

- Storz fetoscopes
- 3.3 mm
- 1.8 mm semirigid lens
- Must be hand curved to ~ 3- degrees
- Laser port 600µ endostat
- Side port for Level I Rapid Infusor
- Remote head scope requires an
  Humanitarian exemption from the FDA
- Can be inserted with or without a
  separate sheath 10 Fr Cook Introducer
Choice of Laser Used in Fetoscopic Procedure

- **Neodymium-doped yttrium aluminium garnet**
  - nd: YAG (Nd:Y₃Al₅O₁₂) crystal
  - Wavelength 1164 nm

- **Diode laser**
  - Semiconductor
  - Wavelength 980 nm
Intraoperative Complications

• **Bleeding obscuring view**
• **Level I amnioinfusion**
  - Trocar insertion n=1
  - Chorionic plate n=1
  - Vessel laceration
    • 3 all controlled with Level I and Laser
Obscured Fetoscopic View

- Mountainous topography
- May be seen in prior AR
- Amniostomy may flatten surface and facilitate visualization
- Amniostomy may move donor twin or flatten the intertwin membrane onto the chorionic plate
- Facilitate visualization of anterior placentas
Intraoperative Complications

- Loss of amniotic cavity volume
- Fracture of laser fiber
- Loss of laser efficiency
  - Tangential angle
  - Through intertwinned membrane
  - Endostat problem
    - Debris
    - Fracture of the tip
    - Laser mal-alignment
Intraoperative Complications

- Laser Microseptostomy?
- Risk of monoamniotic gestation
  - Thought to be high with ultrasound guided needle
- Risk of laser microseptostomy
- 600 µ diameter width of laser fiber
- Monoamniotic gestation
  - Fetoscopy alone 1.3%
  - Microseptostomy in addition 1.3%
  - Does it help?
  - Restores fluid more quickly
  - Change in survival?
Minimizing Vascular Shifts During Laser Photocoagulation

- Sequential SFLP
- AV, AA, VV
- Requires detailed mapping
- Improved survival
- Cincinnati mapping protocol
- No laser of any vessel until the mapping is complete
- Minimize laser time (usually ~ 5 minutes)
- Similar results
Post-operative Course

- Admit to FCC for tocodynamometric monitoring
- Sequential compression stockings, foley
- Clear liquid and advance
- Tocolysis nifedipine with rate patient having Terbutaline
- Ultrasound POD #1
- Discharge to from FCC in Cincinnati
- Follow up fetal echocardiogram and ultrasound at POD #3
Quintero Staging of TTTS

Stage I: Discordant amniotic fluid: DVP >8 cm & < 2 cm

Stage II: Absent bladder in the donor

Stage III: Doppler velocimetry changes in UA, UV, DV

Stage IV: Hydrops

Stage V: Death of one fetus
Acute Cardiac Changes in TTTS

Quintero Staging

I II III IV V

Donor Recipient
AEDF in UA Severe biventricular failure
Reversal of flow in DV
Reversal of flow in DV
Severe TR/MR
Reversal of flow in UA rec

Early TTTS Endstage TTTS

Staging is heavily weighted toward the donor Recipient findings on in advance stage III and IV
# NIH TTTS Trial

## Logistic Regression Analysis of Covariates

### Cardiovascular Profile Score (CVPS)

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>-1 point</th>
<th>-2 points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydrops</strong></td>
<td>None</td>
<td>Ascites, pleural pericardial effusion</td>
<td></td>
</tr>
<tr>
<td><strong>Venous Dopplers</strong></td>
<td>Normal</td>
<td>DV atrial reversals</td>
<td>Venous pulsations</td>
</tr>
<tr>
<td><strong>CT Ratio</strong></td>
<td>≤ 0.35</td>
<td>&gt; 0.35 &lt; 0.5</td>
<td>&gt; 0.5</td>
</tr>
<tr>
<td><strong>Abnormal myocardial function</strong></td>
<td>Vent SF &gt; 0.28</td>
<td>SF &lt; 0.28</td>
<td></td>
</tr>
<tr>
<td><strong>Abnormal Arterial Dopplers</strong></td>
<td>No AV regurg</td>
<td>TR or semi lunar valve regurg</td>
<td>TR +dysfunction any MR</td>
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</table>

NIH Sponsored TTTS Trial

Logistic Regression Analysis of Covariates on Survival

- **Recipients**
  - Cardiovascular Profile Score*
  - Most predictive of poor recipient outcome
    - OR = 3.025/point
    - \( p = 0.05 \)

- **Donors**
  - Most predictive models of poor outcome
  - Increased Stage
    - OR = 0.446/stage \( p = 0.124 \)
  - Earlier Gestational Age
    - OR = 1.052/day \( p = 0.097 \)

*Huhta et al
Impact of Fetal Echocardiographic Findings on Recipient Survival

- Cardiovascular Profile Score (CVPS)

- 62 consecutive recipient twins with TTTS
  - All patients treated by SFLP
  - All patients had pre-operative echo evaluated
  - Blinded to outcome

Recipient Survival Based on Pre-Operative CVPS

SFLP

CVPS

% Recipient Survival

100
90
80
70
60
50
40
30
20
10
0
10 of 10
9 of 10
8 of 10

p < 0.03

p < 0.008

Fetal Care Center of Cincinnati
Problem with the CVPS

<table>
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<tr>
<td>Hydrops</td>
<td>None</td>
<td>Ascites, pleural</td>
<td>skin edema</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pericardial effusion</td>
<td></td>
</tr>
<tr>
<td>Venous Dopplers</td>
<td>Normal</td>
<td>DV atrial reversals</td>
<td>Venous pulsations</td>
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<td></td>
<td>No AV regurg</td>
<td>TR +dysfunction any MR</td>
<td></td>
</tr>
<tr>
<td>Abnormal Arterial Dopplers</td>
<td>Normal</td>
<td>AEDF</td>
<td>REDF</td>
</tr>
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</table>


Not sensitive enough
TTTS Cardiomyopathy

• Fetal hypertensive cardiomyopathy

  – AV valve competence
    • Mild, moderate, severe TR/MR

  – Hypertrophy
    • End-diastolic LV, RV, Septum

  – Myocardial dysfunction
    • Tei myocardial performance index
Cincinnati Modification of Quintero TTTS Staging

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td></td>
</tr>
<tr>
<td>Stage II</td>
<td></td>
</tr>
<tr>
<td>Stage III</td>
<td></td>
</tr>
<tr>
<td>IIIA</td>
<td>Mild cardiomyopathy</td>
</tr>
<tr>
<td>IIIB</td>
<td>Moderate cardiomyopathy</td>
</tr>
<tr>
<td>IIIC</td>
<td>Severe cardiomyopathy</td>
</tr>
<tr>
<td>Stage IV</td>
<td></td>
</tr>
<tr>
<td>Stage V</td>
<td></td>
</tr>
</tbody>
</table>
## Fetal Care Center of Cincinnati

### Cincinnati Modification of Quintero TTTS Staging

| Stage I |  
| Stage II |  
| Stage III |  
| IIIA | RV MPI > 0.5 (Z+2) / LV MPI > 0.42 (Z+2)  
Mild ventricular hypertrophy (Z for RV/LV >2)  
Mild AV valve regurgitation  
| IIIB | RV MPI > 0.56 (Z+3) / LV MPI > 0.53 (Z+3)  
Moderate ventricular hypertrophy (Z for RV/LV >3)  
≥ Mod AV valve regurgitation  
| IIIC | RV/LV > Z+4  
Critical Doppler changes in RT (reversed DV, rUA)  
Severe TR/MR, severe dysfunction  
| Stage IV |  
| Stage V |  

Echocardiographic Features of TTTS by Stage

Incidence of TR and MR

![Bar chart showing the incidence of tricuspid and mitral regurgitation by Cincinnati Stage.](chart.png)
Echocardiographic Features of TTTS by Stage

Biventricular Hypertrophy

Incidence of Biventricular Hypertrophy

<table>
<thead>
<tr>
<th>Cincinnati Stage</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>0</td>
</tr>
<tr>
<td>IIIA</td>
<td>0</td>
</tr>
<tr>
<td>IIIB</td>
<td>10</td>
</tr>
<tr>
<td>IIIIC</td>
<td>30</td>
</tr>
<tr>
<td>IV</td>
<td>100</td>
</tr>
</tbody>
</table>

Cincinnati Stage

Biventricular Hypertrophy
Assessing Recipient TTTS Cardiomyopathy


Assessing Recipient TTTS Cardiomyopathy

Tei Myocardial Performance Index

* Identify subtle alteration in ventricular function
* Difficult to accurately measure
* Inter-observer variability can be high
* FCC echocardiographers 10% variation
* Minimal change is >10%
* Method to detect progression of TTTS during trial of AR
* Underestimates dysfunction in moderate TR/MR
* Can confirm post-treatment arrest of TTTS
Echocardiographic Features of TTTS by Stage

Tei Index

<table>
<thead>
<tr>
<th>Tei Index</th>
<th>LV MPI</th>
<th>RV MPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.7</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>0.8</td>
<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td>0.9</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>1.0</td>
<td>0.6</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Cincinnati Stage

- III
- IIIA
- IIIB
- IIIC
- IV

Myocardial Performance Index

- LV MPI
- RV MPI
Fetal Care Center of Cincinnati

TTTS cases since NIH Trial
Closed May 2005

570 TTTS patients

Stage
I 17.2%
II 10.3%
III 11.5%
IIIA 25.3%
IIIB 18.4%
IIIC 4.6%
IV 6.9%
V 5.7%

48.3% 59.8%
Distribution by Quintero Stage of TTTS Patients: The Fetal Care Center of Cincinnati

May 2005-January 2009
570 patients
Shift in Stage Distribution Comparing Quintero and Cincinnati Staging Systems

May 2005-January 2009
570 patients

Quintero vs Cinc
Percentage of Cases by Stage
Upstaged by Echocardiographic Findings

May 2005-January 2009
570 patients

<table>
<thead>
<tr>
<th>Stage</th>
<th>Percent Upstaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0</td>
</tr>
<tr>
<td>II</td>
<td>60</td>
</tr>
<tr>
<td>III</td>
<td>90</td>
</tr>
</tbody>
</table>

Quintero Staging

St %
I 250
II 100
III 150
IV 200
V 220

0 10 20 30 40 50 60 70 80 90
Echocardiographic Upstaging of Stage I

Upstaging of Quintero's Stage I

70 patients

- Stage I: 39%
- Upstaged: 61%
- Stage IIIA: 27%
- Stage IIIB: 14%
- Stage IIIC: 20%

Legend:
- Stage I
- Stage IIIA
- Stage IIIB
- Stage IIIC
Echocardiographic Upstaging of Stage I

Upstaging of Quintero's Stage II

40 Patients

- Stage II: 36%
- Upstaged: 64%

- Stage IIIA: 16%
- Stage IIIB: 25%
- Stage IIIC: 23%

Legend:
- Stage II
- Stage IIIA
- Stage IIIB
- Stage IIIC
Trial of Amnioreduction vs Selective Fetoscopic Laser Photocoagulation

- 175 patients stages I-IIIA
- Normal fetal echocardiograms
- Trial of AR with serial fetal echocardiographic assessment
  - 40% response to AR alone
  - 60% progressed
Trial of Amnioreduction vs Selective Fetoscopic Laser Photocoagulation

- **AR responders survival**
  - 82.2% overall survival
  - 90.7% 1 or both surviving
  - 75% both surviving

- **AR non-responders-SFLP**
  - 79.5% overall survival
  - 89.9% 1 or both surviving
  - 70% both twin survive
Twin-Twin Transfusion Syndrome

Selective Fetoscopic Laser Photocoagulation

- Stage Some IIIB, IIIC, IV
- Fail trial of AR
- Severe placental insufficiency
Acute Effect of SLFP on Tei Myocardial Performance Index

- Pre and Post SFLP Echos
  - >10% improvement in Tei Index
    - 100% recipient survival
    - Confirmation of arrest of TTTS

- Improved Dopplers
  - Restored EDF in Donor UA
  - Improved a wave in DV
  - Improved UV pulsatility

Habli et al
Am J Obstet Gynecol Nov 2008
Overall Survival and Survival of One or Both Twins by Cincinnati Staging

Selective Fetoscopic Laser Photocoagulation

% Survival

Cincinnati Stage

SURVIVAL of 1 or 2  Overall Survival
Post-Operative Complications in TTTS

<table>
<thead>
<tr>
<th>Complication</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPROM ≤ 7 day</td>
<td>5%</td>
</tr>
<tr>
<td>PPROM &gt; 7 day</td>
<td>22%</td>
</tr>
<tr>
<td>Chorioamnionitis</td>
<td>2.3%</td>
</tr>
<tr>
<td>Transplacental trocar</td>
<td>47%</td>
</tr>
<tr>
<td>Recurrent TTTS</td>
<td>14%</td>
</tr>
<tr>
<td>TAPS</td>
<td>13%</td>
</tr>
<tr>
<td>PPROM</td>
<td>17%</td>
</tr>
</tbody>
</table>

Yamamoto et al.
*Am J Obstet Gynecol.* 2005 Sep;193(3 Pt 2):1110-6

Robyr et al.

- Iatrogenic monoamniocity
- Vascular accident
- Amniotic band syndrome
AIMS

• Incidence of complications after SFLP.

• Distinguish early and late complications.
Methods


- 249 patients evaluated
- Retrospective review

- SFLP (152)
- Amnioreduction alone (77)
- Radiofrequency ablation (14)
- No treatment (6)
Methods

Complications (maternal and fetal):

- No complication
- Early complication: ≤ 7 day after the procedure.
- Late complication: > 7 day after the procedure.
- Early and late.
SFLP = 152 patients

Twins: 149 (98%)
Triplets: 3 (2%)
Result

Serious complication or maternal deaths (0%)

Overall Fetal survival (77%)

Survival of one or both twins (88%)

Recipient survival (83%)

Donor survival (73%)
Complication

- **No complication**: 40%
- **Early complication**: 21%
- **Late complication**: 29%
- **Early and late complication**: 10%
Complication

Early complication

- 8% (12/152) PPROM.
- 1.3% (2/152) Chorioamnionitis.
- 1.3% (2/152) Maternal peritoneal leak.
Complication

Late complication
- 17.8% (27/152) PPROM
- 8% (12/152) Abruption
- 3.3% (5/152) ABS
- 2% (3/152) TAPS
- 2% (3/152) TTTS
- 1.3% (2/152) Iatrogenic monoamniotic sac
- 0.7% (1/152) Fetal hand necrosis due to vascular disruption sequence
## Impact of Complications on Survival

<table>
<thead>
<tr>
<th></th>
<th>No complication</th>
<th>Early complication</th>
<th>Late complication</th>
<th>Both</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GA at procedure</strong></td>
<td>21.0 ± 2.5</td>
<td>21.3 ± 2.6</td>
<td>21.1 ± 2.4</td>
<td>22.2 ± 2.5</td>
<td>N.S</td>
</tr>
<tr>
<td><strong>GA at delivery</strong></td>
<td>31.4 ± 4.1</td>
<td>28.3 ± 5.7</td>
<td>30.1 ± 3.1</td>
<td>29.8 ± 3.8</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>(weeks)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Numbers DA-RV</strong></td>
<td>6.8 ± 6</td>
<td>4.5 ± 3.5</td>
<td>6.9 ± 4.4</td>
<td>3.7 ± 1.9</td>
<td>p=0.01</td>
</tr>
<tr>
<td><strong>anastomoses</strong></td>
<td></td>
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<tr>
<td><strong>Total number of</strong></td>
<td>13.4 ± 8.5</td>
<td>9.9 ± 6.4</td>
<td>14.3 ± 8.9</td>
<td>9.57 ± 6.4</td>
<td>N.S</td>
</tr>
<tr>
<td><strong>anastomoses</strong></td>
<td></td>
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<tr>
<td><strong>coagulated</strong></td>
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<tr>
<td><strong>Survival of one</strong></td>
<td>96.7%</td>
<td>70.2%</td>
<td>84.7%</td>
<td>53.3%</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>or both twins**</td>
<td></td>
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<tr>
<td><strong>Recipient</strong></td>
<td>92%</td>
<td>59.6%</td>
<td>83.1%</td>
<td>46.7%</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td><strong>survival</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Donor survival</strong></td>
<td>88.5%</td>
<td>48.9%</td>
<td>66.1%</td>
<td>33.3%</td>
<td>p&lt;0.001</td>
</tr>
</tbody>
</table>
Conclusions

• SFLP → Early, late and both early and late complications impact survival

• Stringent placental mapping protocol → Low rate of
  – TAPS (2%),
  – Recurrent/persistent TTTS (2%).

• This information is important for counseling patients.
Pathophysiology of Recipient Cardiomyopathy

- Volume over load
- Fetal systemic hypertension
  - Estimates of ventricular pressures based flow velocity of tricuspid regurgitation jet
Will Treating TTTS Cardiomyopathy Change Survival in Recipients?

- Empiric treatment of TTTS cardiomyopathy with nifedipine 20 mg q 6 hours
- Stages IIIA, IIIB, IIIC, IV
- 20 mg q 6 hours 24-48 hours
- 141 TTTS cases
- 152 stage and GA matched controls
- Significant reduction in tocolytics
Effect of Nifedipine on Survival in TTTS Treated by SLFP

- Nifedipine 20 mg q 6 h
- Pre-op treatment 24-48 h
- Case control study
- Matched for GA and Cincinnati stage
- Survival to birth
- Significant effect on overall survival
- Significant effect on recipient survival
- No effect on Donor survival
Overall Survival and Survival of One or Both Twins in Stage IV TTTS

Selective Fetoscopic Laser Photocoagulation

Nifedipine effect?
Challenges in TTTS

- Define the etiology
- Improving survival
  - Develop targeted medical therapies
  - Adjunctive medical therapy in AR
- Reducing morbidity
  - Defining cases to treat
  - Extend the length of gestation
- Convincing the Obstetrical community
Fetal Care Center of Cincinnati

- Maternal-Fetal Medicine
  - Mounira Habli MD
  - William Polzin, MD
  - Kim Brady, MD
  - Jim VanHook, MD
  - Ronal Jackle, MD
  - David Lewis, MD
- Fetal Echocardiography
  - Erik Michelfelder, MD
  - James Cnota, MD
  - William Gottliebson, MD
  - Allison Divanovic, MD
  - Haleh Hadarian, MD
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  - Robert Defore, MD
  - Elizabeth Jackson, MD
- ENT
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  - Paul Willging, MD
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  - Beth Kline-Fath, MD
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  - Eva Rubio, MD
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  - Stacy Ruth
  - Tracy Heidrich
  - Latressa Ratner
  - Curtis Johnson
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  - Judy Hostiuck
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  - Howard Saul, MD
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- Administrative
  - Rachel Jones
  - Emmie Beyer
  - Cheryl Snell
- Level III L&D Nurses
  - Good Samaritan Hospital
- Nurse Midwife
  - Karen McGirr