Surgical B-T Shunt vs. percutaneous ductal stenting: which is better for branch pulmonary artery growth and patient survival

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Hetz Project
Introduction

- Prevalence of congenital heart disease is 8/1000 live births
- Congenital heart defects can change the way blood flows through the heart and lungs
- Non-oxygenated blood is pumped out to the body without going through the lungs to pick up oxygen
- Less oxygen delivered to the body and can cause cyanosis
- Approximately 5 g/dL of unoxygenated hemoglobin in the capillaries generates the dark blue color appreciated clinically as cyanosis
- If not treated on time might be life threatening
PDA

Fetal circulation

Postnatal circulation

Diagram showing the differences between fetal and postnatal circulation. The images illustrate the pathways of blood flow through the heart during these two stages.

Key terms:
- Ductus arteriosus
- Pulmonary artery
- Aorta
- Foramen ovale
- RA (Right Atrium)
- LA (Left Atrium)
- RV (Right Ventricle)
- LV (Left Ventricle)
- Umbilical cord
- To placenta
Blalock-Taussig shunt

- Surgical procedure used to increase pulmonary blood flow for palliation in duct dependent CHD
Blalock-Taussig-Thomas shunt

Relieve cyanosis and allow for growth of the pulmonary arteries
Indications for BT shunt

- The first area of application was Tetralogy of Fallot:
Indications for BT shunt

**Biventricular circulation**
- Tetralogy of Fallot with severe pulmonary stenosis or atresia
- Transposition of great arteries with pulmonary stenosis
- Severe Ebstein’s Anomaly

**Univentricular circulation**
- Tricuspid atresia
- Pulmonary atresia, intact ventricular septum
- Complex single ventricle with duct dependent pulmonary circulation
- Hypoplastic left heart syndrome
<table>
<thead>
<tr>
<th></th>
<th>Modified</th>
<th>Classic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rise in SaO₂</td>
<td>Greater</td>
<td>Smaller</td>
</tr>
<tr>
<td>Post-shunt increase in the pulmonary arterial index (mm²/m²)</td>
<td>158 ± 21</td>
<td>117 ± 52</td>
</tr>
<tr>
<td>Post-shunt pulmonary arterial index (mm²/m²)</td>
<td>431 ± 188</td>
<td>189 ± 106</td>
</tr>
<tr>
<td>Pulmonary arterial distortion (%)</td>
<td>6.1–50</td>
<td>17–75</td>
</tr>
<tr>
<td>Postoperative diaphragmatic paralysis requiring subsequent operation for placation (%)</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Interval for an additional shunt/repair (month)</td>
<td>12.4</td>
<td>26.1–27.7</td>
</tr>
<tr>
<td>Adequate overall palliation (%)</td>
<td>98 (at eight months), 91(at 12 months), 58 (at 18 months)</td>
<td>87 (&gt; one month of age) and 54 (&lt; one month of age) (at four years)</td>
</tr>
<tr>
<td>The freedom from cardiac event (%)</td>
<td></td>
<td>80.5 (at one year)</td>
</tr>
<tr>
<td>Shunt patency (%)</td>
<td>88.8 (three and five years)</td>
<td>54.9 (at three years)</td>
</tr>
<tr>
<td>Early shunt failure (%)</td>
<td>20.8</td>
<td>51.7</td>
</tr>
<tr>
<td>Reoperation (%)</td>
<td>15.4</td>
<td></td>
</tr>
<tr>
<td>Overall hospital mortality (%)</td>
<td>3.1–11</td>
<td>2.3–8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 (&lt; two weeks of age)</td>
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<td>28 (two weeks to six months of age)</td>
</tr>
</tbody>
</table>
Percutaneous PDA stent
Initial Results and Medium-Term Follow-Up of Stent Implantation of Patent Ductus Arteriosus in Duct-Dependent Pulmonary Circulation

Mazen Alwi, MRCP, K. K. Choo, MRCP, Haifa Abdul Latiff, MD, Geetha Kandavello, MRCP, Hasri Samion, MD, M. D. Mulyadi, MD

Kuala Lumpur, Malaysia

51 patients

22 (43.1%)
Single ventricular physiology

9 PAIVS
5 TA/PA
2 Univentricular heart/PA
2 DILV/TGA/PA
1 Mitral atresia/PA
1 TA/TGA/PS
1 TA/PS
1 TS

29 (56.9%)
Biventricular physiology

21 Tetralogy of fallot/PA
5 ccTGA/VSD/PA
2 TOF
1 TGA/VSD/PA

51 Successful stent implantation

48 survivors

3 Mortality (2 in-hospital, 1 late)

59 (81.2%)
Widely patent stent

8 (16.7%)
Stent stenosis/inadequate PDA flow
(6 in-stent stenosis, 2 stenosis at unstented PDA)
(BT shunt 3, Re-stenting 2, Balloon dilatation 3)

32 No branch PA stenosis

7 worsening of pre-existing branch PA stenosis
(RPA stenosis 1, LPA stenosis 6)
(BT shunt 5)
Objectives

- Assessment of:
  - Morbidity and mortality associated with BT shunt at our institution
  - Frequency and severity of pulmonary artery stenosis associated with BT shunt
- Subgroup comparison to PDA stenting
Methods

- Retrospective study following patients who underwent BT shunt and patients who underwent PDA stenting at our institution
- Clinical data of patients were collected:

<table>
<thead>
<tr>
<th>Diagnosis</th>
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<tbody>
<tr>
<td>Patient demographics (gender, age at operation, weight)</td>
</tr>
<tr>
<td>Percentage of complicated cases (prematurity/heterotaxy/genetics/low birth weight)</td>
</tr>
<tr>
<td>Circulation type (univentricular or biventricular physiology)</td>
</tr>
<tr>
<td>Early mortality and survival to second operation</td>
</tr>
<tr>
<td>Presence of antegrade pulmonary blood flow</td>
</tr>
<tr>
<td>Non cardiac diagnoses</td>
</tr>
<tr>
<td>Complications</td>
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</tbody>
</table>
Methods

- Review of imaging including: echocardiogram, angiography and CT/MRI before the procedure and at set intervals in follow up
- Hypoplastic left heart syndrome patients were excluded
Initial results

- 149 patients were reviewed, 140 following BTS and 9 after PDA stenting (1 after both).
- 127 underwent modified BTS and 13 underwent classical BTS.

<table>
<thead>
<tr>
<th></th>
<th>BTS</th>
<th>PDA stent</th>
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<tbody>
<tr>
<td><strong>Number</strong></td>
<td>140</td>
<td>9</td>
</tr>
<tr>
<td><strong>Gender M/F (%)</strong></td>
<td>59/41</td>
<td>67/33</td>
</tr>
<tr>
<td><strong>Survival (%)</strong></td>
<td></td>
<td></td>
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<tr>
<td>Survival to second surgery</td>
<td>54</td>
<td>44.5</td>
</tr>
<tr>
<td>Waiting for second surgery</td>
<td>2</td>
<td>44.5</td>
</tr>
<tr>
<td>Early mortality after procedure</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Late mortality after procedure</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Unknown</td>
<td>28</td>
<td>0</td>
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</table>
Summary

- Both procedures are good for pulmonary artery growth
- There is a high percentage of pulmonary arterial distortion and stenosis after BT shunt
- Therefore, our study examines the effect on the pulmonary arteries and examines the option of alternatives for the surgical BT shunt
Thank you!