Arterial Switch Operation and Complex Coronary Patterns

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No disclosures
TGA

Coronary Anatomy
<table>
<thead>
<tr>
<th>Authors (Year)</th>
<th>Surgical or Pathological Series (Cases Examined)</th>
<th>Types of Coronary Pattern Identified, n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaher and Paddu (1966)</td>
<td>Pathological (166)</td>
<td>9</td>
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<tr>
<td>Yacoub (1978)</td>
<td>Surgical (18)</td>
<td>5</td>
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<tr>
<td>Quaegebeur (Leiden) (1986)</td>
<td>Surgical (66)</td>
<td>N/A*</td>
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<td>Gittenberg (1983)</td>
<td>Surgical (103)</td>
<td>12</td>
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<tr>
<td>Pasquini (1987)</td>
<td>Surgical (32)</td>
<td>5</td>
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</table>
Anatomy of the coronary arteries in transposition of the great arteries and methods for their transfer in anatomical correction

MAGDI H YACOUB AND ROSEMARY RADLEY-SMITH
Leiden Classification

- Normal Anatomy (1AD, Cx; 2R)
- Post. Circumflex Course (1AD, 2R, Cx)
- Post. Left Course (2R, AD, Cx)
- Intramural Coronary Course Between Ao and PA (2R, 2AD, Cx)
- Ant. Right Course Post. Left Course (1R, 2AD, Cx)
- Ant. Right Course Post. Circumflex Course (1R, AD, 2Cx)
- Commisural Origins between the Great Arteries (1AD, Cx; 2R)
- Separate Origins from the Same Aortic Sinus (1AD, 2R, 2Cx)
- Remote Circumflex Origin from Distal Right Coronary A. (1AD, 2R, Cx)
TGA – Coronary anatomy

From: Lacour-Gayet & Anderson, 2005
High risk coronary artery patterns

- Intra-mural coronary artery course
- Single coronary with inter-arterial coronary artery course
- Posterior looping courses
Single coronary from right sinus with Inter-arterial course
Juxta comissural and intramural course
Juxta comissural and intramural course
Single coronary translocation

Fig 8  Mobilisation of a disc or aortic wall around a single coronary ostium.

Fig 9  Anastomosis of upper border of mobilised disc bearing a common coronary ostium to border of transected posterior vessel.

Fig 10  Anastomosis of upper end of transected anterior vessel to lower end of posterior vessel in a fashion to include disc bearing a common coronary ostium.

We present a new approach for anatomic correction of transposition of the great arteries. The two coronary arteries, with a piece of the aortic wall attached, are transposed to the posterior artery. The two aortic openings are closed with a patch. The aorta and pulmonary artery are transected, contraposed, and then anastomosed. The interventricular septal defect is closed with a patch, through a right ventriculotomy approach, because the right ventricle is no longer part of the systemic circulation. Two patients, aged 3 months and 40 days weighing 4,200 and 3,700 grams, respectively, were operated upon with deep hypothermia and total circulatory arrest. There was good recovery from the operation, with normal cardiocirculatory conditions. Renal failure developed in the first patient, and she died on the third postoperative day. During this time the cardiocirculatory conditions were good. The second patient made an uneventful recovery. Hemodynamic studies 20 days after the operation showed complete correction of the malformation. Five and one-half months after the operation, he weighs 7,500 grams, and his development is very good. We believe that this operation will be reproducible by most cardiovascular septal defect and pulmonary hypertension.
The Development of the Arterial Switch Operation

RCA

LCA
Coronary Artery Pattern and Outcome of Arterial Switch Operation for Transposition of Great Arteries
A Meta-Analysis
Sara K. Pasquali, et al

C Two Coronary Ostia

Usual Higher

Variant Higher

Studies

Hutter
Blume
Wernovsky
Day
Yamaguchi
Planche
Quaegebeur
Combined

Event Rates

N
Var
Usu

151 26.3 15.9
206 8.8 6.7
426 8.0 7.3
59 6.3 0.0
236 16.7 18.0
111 3.4 6.1
63 16.7 15.6
1252 10.3 10.6

Odds Ratio

Circulation November 12, 2002
Coronary Artery Pattern and Outcome of Arterial Switch Operation for Transposition of Great Arteries
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Any Variant Coronary Pattern

<table>
<thead>
<tr>
<th>Studies</th>
<th>Event N</th>
<th>Var Rates</th>
<th>Usu Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretre</td>
<td>432</td>
<td>10.1</td>
<td>3.7</td>
</tr>
<tr>
<td>Hutter</td>
<td>170</td>
<td>18.4</td>
<td>15.9</td>
</tr>
<tr>
<td>Blume</td>
<td>223</td>
<td>8.1</td>
<td>6.7</td>
</tr>
<tr>
<td>Wernovsky</td>
<td>470</td>
<td>10.5</td>
<td>7.3</td>
</tr>
<tr>
<td>Lupinetti</td>
<td>126</td>
<td>10.8</td>
<td>3.4</td>
</tr>
<tr>
<td>Day</td>
<td>70</td>
<td>11.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Yamaguchi</td>
<td>265</td>
<td>26.2</td>
<td>18.0</td>
</tr>
<tr>
<td>Planche</td>
<td>120</td>
<td>13.2</td>
<td>6.1</td>
</tr>
<tr>
<td>Quaegebeur</td>
<td>66</td>
<td>19.0</td>
<td>15.6</td>
</tr>
<tr>
<td>Combined</td>
<td>1942</td>
<td>12.7</td>
<td>8.7</td>
</tr>
</tbody>
</table>
Coronary Artery Pattern and Outcome of Arterial Switch Operation for Transposition of Great Arteries

A Meta-Analysis

Sara K. Pasquali, et al

* Circulation * November 12, 2002
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Intramural Coronary Artery

Usual Higher
Variant Higher

Studies
Pretre
Hutter
Blume
Wernovsky
Day *
Yamaguchi
Planche
Combined

Event Rates
N  Var  Usu
297  25.0  3.7
138  16.7  15.9
153  25.0  6.7
302  7.7  7.3
51  25.0  0.0
207  85.7  18.0
91  44.4  6.1
1239  29.6  8.8

Odds Ratio

Circulation  November 12, 2002
Intramural coronary arteries and outcome of neonatal Arterial switch operation
Olivier Metton, et al

1987-2008
919 Jatene operation

46 pac (5%) – intramural
28 – LCA
12 – LAD
3 – RCA
3 – LCA and RCA

MORTALITY
Intramural – 28%
Other patterns – 3.9%
Intramural coronary arteries and outcome of neonatal Arterial switch operation
Olivier Metton, et al

Fig. 2. Distribution of the numbers of patients and deaths per periods of 4 years.

Intramural coronary arteries and outcome of neonatal Arterial switch operation

Olivier Metton, et al

Fig. 4. Actuarial freedom from coronary events.
Coronary Events After Arterial Switch Operation for Transposition of the Great Arteries

Survival free of coronary events – 1304 patients

Circulation. 2003;108[suppl II]:II-186-II-190.
**Coronary Events After Arterial Switch Operation for Transposition of the Great Arteries**

**TABLE 2. Risk Factors of Coronary Events**

<table>
<thead>
<tr>
<th></th>
<th>With CE</th>
<th>Without CE</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Univariate analysis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year of surgery (before 1990 versus after 1990) %</td>
<td>56.3</td>
<td>26.7</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Coronary pattern B or C versus type A, D, E, %</td>
<td>19.1</td>
<td>2.9</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Cardiopulmonary bypass time, minutes</td>
<td>191</td>
<td>155</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Major operative events, %</td>
<td>56.3</td>
<td>18</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Reperfusion time, minutes</td>
<td>66</td>
<td>47.5</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>B. Multivariate analysis</strong></td>
<td></td>
<td>Odds ratio</td>
<td>( P )</td>
</tr>
<tr>
<td>Type B or C Coronary pattern versus type A, (D+E), %</td>
<td>6.6</td>
<td></td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Major operative events</td>
<td>3</td>
<td></td>
<td>0.0024</td>
</tr>
</tbody>
</table>

CE indicates coronary events.

*Circulation. 2003;108[suppl II]:II-186-II-190.*
TABLE 4. Myocardial Ischemia Test Value

<table>
<thead>
<tr>
<th></th>
<th>ECG</th>
<th>Echo</th>
<th>Exercise Test</th>
<th>Myocardial Scintigraphy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity %</td>
<td>32</td>
<td>36</td>
<td>21</td>
<td>50</td>
</tr>
<tr>
<td>Specificity %</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>90</td>
</tr>
<tr>
<td>Positive predictive value %</td>
<td>54</td>
<td>53</td>
<td>43</td>
<td>38</td>
</tr>
<tr>
<td>Negative predictive value %</td>
<td>95</td>
<td>95</td>
<td>93</td>
<td>94</td>
</tr>
</tbody>
</table>

TABLE 5. Value of Association of Myocardial Ischemia Tests

<table>
<thead>
<tr>
<th></th>
<th>ECG + Echo</th>
<th>ECG + Echo + MS</th>
<th>ECG + Echo + ET</th>
<th>All Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>324</td>
<td>115</td>
<td>174</td>
<td>85</td>
</tr>
<tr>
<td>Sensitivity %</td>
<td>41</td>
<td>75</td>
<td>43</td>
<td>73</td>
</tr>
<tr>
<td>Specificity %</td>
<td>96</td>
<td>81</td>
<td>93</td>
<td>74</td>
</tr>
<tr>
<td>Positive predictive value %</td>
<td>41</td>
<td>31</td>
<td>33</td>
<td>23</td>
</tr>
<tr>
<td>Negative predictive value %</td>
<td>96</td>
<td>97</td>
<td>95</td>
<td>95</td>
</tr>
</tbody>
</table>

ECG indicates electrocardiography; Echo, echocardiography; ET, exercise test; MS, myocardial scintigraphy.  
Circulation. 2003;108[suppl II]:II-186-II-190.
Transposition of Great Arteries

Abr 03 – Mar 18 – 180 crianças

- Age – 3 to 180 days (18,1d)
- Weight – 2,2 to 7,5kg (3,54kg)
- L-TGA
  - 73,2% – intact septum
  - 20,6% – VSD
  - 6,2% – complex (VSD+PS; CoAo; IAA)
- Overall mortality - 5,8%
- Type A coronary (intact septum) – 2,5%
- Other coronary anomalies – 12,5%
Inferences

• Complex coronary patterns are related with higher morbidity and mortality

• Pre-op definition of the pattern is important, but not necessary

• Single ostium and intramural course are high risk patterns

• Different surgical techniques can be used, depending of the anatomical issues