TGA
Surgical techniques: tips & tricks
(Arterial switch operation)

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Surgical History

• 1951 Blalock and Hanlon, atrial septectomy
• 1954 Mustard et al. arterial switch op
  (monkey lung, 7 patients, 19 days old)
• 1958 Senning, Atrial switch operation
• 1963 Mustard, Mustard operation
• 1966 Raskind and Miller, Balloon atrial septostomy
• 1969 Rastelli, Rastelli operation
• 1975 Jatene, first successful ASO in patients with TGA and large VSD
• 1977 Yacoub et al. two stage repair
• 1983 Quaegebeur and Castaneda, primary repair in neonate
• 1988 Boston group, rapid two-stage ASO
The wide range of spatial relationships between the great arteries in TGA

- d-TGA
- Taussig-Bing (DORV)
- Posterior TGA
Complete Transposition of the Great Arteries

- Ventriculoarterial discordance
- Also known as d-TGA (d = dextroposition of the bulboventricular loop)
- Aorta on the right and anterior
• Morphogenesis

  – Failure of the septum to spiral
    • Straight septum
    • Parallel arrangement of RVOT and LVOT
  – Abnormal growth and development of subaortic infundibulum
  – Absence of subpulmonic infundibulum growth
Major coexisting anomalies

* About 75% of neonates presenting TGA have no other cardiac anomalies, other than PFO or ASD and 20% have VSD and only 5% have LVOTO.

1 VSD

Conoventricular (not necessarily juxtapulmonary)  55~60%
Juxtaaortic  5%
Juxtaarterial  5%
Inlet septal  5%
  Juxtaticuspid
  Juxtacrucial : straddling
muscular  25~30%

2 LVOTO

It occurs 0.7% in TGA + IVS at birth and 20% in TGA+VSD, and may develop after birth in others and so reach an overall prevalence of 30%.
Dynamic type  - leftward bulging of septum
Anatomic type  - subvalvar fibrous ridge, fibrous tags, aneurysm, muscular (malalignment) or fibromuscular obstruction, valvar hypoplasia, combined. abnormal fibrous or chordal tissue.
Minor cardiac anomalies

1. **PDA**
   Patent in 50% at two weeks of life, usually functionally closed at one month.

2. **Aortic obstruction**
   It occurs rare in IVS, but occurs in 7~10% with VSD when the VSD is juxtapulmonary or PA is overriding. And if there is associated coarctation (IAA, arch hypoplasia), underdevelopment of RV sinus is common.

3. **Right aortic arch**
   5%, but more common with VSD.

4. **Leftward juxtaposition of the atrial appendage**
   2.5%, but more common with underdevelopment of RV sinus.

5. **Right ventricular hypoplasia**
   Some degree in 17% of necropsy series

6. **Others**
   Congenital valvar aortic stenosis, TAPVR, complete AV canal defects
Arterial switch operation
Considerations in arterial switch operation

- Coronary anatomy
  - Usual course
  - Intramural course
  - Anterior posterior looping
  - Single sinus double orifice

- Relationship and size of the great arteries

- Pulmonary artery reconstruction

- Associated cardiac defects
  - VSD
  - Atrioventricular valve anomalies
  - Aortic arch obstruction
  - Subaortic stenosis
• Transection of arterial trunks
  – Aorta
    • midpoint between the clamp and STJ
  – PA
    • Leave a good quantity of native tissue on the pulmonary bifurcation
    • Reduce the length of the future aortic root, permitting the Lecompte maneuver
Lecompte Maneuver
-Full mobilization of RPA and LPA
Coronary artery patterns

The coronary arteries tend to follow the shortest pathway to reach the desired distribution.
Common Coronary Patterns

In more than 99% of the cases, "facing sinuses"
Aorta moved posteriorly (LeCompte maneuver)

Short neo-pulmonary artery

Long neo-aorta
Arterial Switch Operation

- trap-door transfer

Neo-Aorta
Every effort to avoid kinking, stretching

Fig. 4. Frequently, the right coronary button is relocated above the aortic suture line.
Commissural malalignment

A

B

C

D

A

B

C

D

Trap door incision

Bovine Pericardium

Single Ostium

2LCxR
2RLCx
2CxRL
1RLCx
Single Coronary artery

Intramural Patterns

[Diagram showing intramural patterns with labels such as Ao, LCA, Pu, RCA, LCX, LAD, Cx, L, R, and P.]
Case

- M/ 3wks
  - GA 39 + 4 wks, 3.6kg
  - No perinatal problems

- Complete TGA with VSD, PFO, and Huge PDA
  - AP relationship of great arteries
  - Single sinus origin (2LCxR)
  - Intramural left main coronary artery
Operation

Bwt : 3.6kg

Complete TGA

RCA

LCx

LAD
(Intramural course)

Single-button excision

Neo-aorta

Fixed Autopericardium

Quaegebeur technique, 1992
Postoperative course

• Post-op. Echocardiography
  – Coronary flow was not identified.
  – But both ventricular function were good.

• Discharge without complication on POD#18.
Postoperative course

3 mon Vent. rate 167 BPM
Male PR interval 106 ms
21in 8lb QRS duration 56 ms
Room PED QT/QTc 258/430 ms
Loc 200 P-R-T axes 59 54 32

*** Poor data quality, interpretation may be adversely affected

******* Pediatric ECG Analysis *******

Normal sinus rhythm
Normal ECG
OPD visit \((7\text{yrs after op.})\)

- 7 years old

- Chief complaint
  - Syncope after excessive exercise
Hospital course

- ECG
- Holter monitoring, Treadmill test, Head up tilt test

**Pediatric ECG Analysis**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>72 BPM</td>
</tr>
<tr>
<td>PR interval</td>
<td>116 ms</td>
</tr>
<tr>
<td>QRS duration</td>
<td>76 ms</td>
</tr>
<tr>
<td>QT/QTc</td>
<td>360/394 ms</td>
</tr>
<tr>
<td>P-R-T axes</td>
<td>41 50 43</td>
</tr>
</tbody>
</table>

No abnormal findings
OPD visit *(6 months later)*

- Chief complaint
  - Anterior chest discomfort, cold sweating after exercise
  - No syncope event
Hospital course

- **Echocardiography**
  - No ASD, VSD leakage
  - Single coronary sinus
    - Dominant RCA, proximal os 3.9mm
    - Intramural course of LCA, proximal os 1.9mm
  - No AI, MR, TR
  - LVEF 62.8% by M-mode

- **Cardiac Catheterization**
  - Tight stenosis of LMCA (intramural course)
  - Good both ventricular function
Hospital course
Operation

Complete TGA, VSD, ASD, PDA
Coronary artery anomaly (2R; 2AD,Cx)
- Common orifice, separate origin
- Left coronary artery : intramural course, juxtaommissural origin

s/p Balloon atrial septostomy (2005.2.16)
s/p Arterial switch operation (2005.2.17)
Coronary artery transfer (modified Aubert technique)
M / 8 mo.
(s/p Arterial switch op. at neonate)
Case with single sinus double orifice

- ASO when all three major coronary arteries arise from sinus 2
Management of single coronary artery
Management of single coronary artery
Management of intramural coronary artery
Modification of trap-door transfer

Bay window technique
Pulmonary artery reconstruction
Thanks you for your attention!