Surgical Treatment of Aortic Arch Hypoplasia
• In the early 1990s, 25% of patients could face mortality related to complications of hypertensive disease.

• Early operations and better surgical techniques should naturally decrease the incidence of residual or recurrent hypertension after coarctation repair.
• Poorly defined:
• Chỉ số Z nhỏ hơn -2 >>> thiếu sàn ( can thiệp sốm )
- **Surgical era**
  - 1990–1999: 151 (50)

- **Arch repair technique**
  - **Sternotomy** 74 (24)
    - End-to-side anastomosis 58 (78)
    - Extended end-to-end anastomosis 7 (10)
    - Patch repair 6 (8)
    - Subclavian flap repair 1 (1)
    - Miscellaneous arch repair 2 (3)

  - **Thoracotomy** 231 (76)
    - Subclavian flap repair 96 (42)

- **Associated cardiac procedures**
  - **Sternotomy** 70/74 (95)
    - Ventricular septal defect closure 49 (66)
    - Atrial septal defect closure 25 (34)
    - Arterial switch operation 17 (23)
    - Pulmonary artery banding 11 (15)
    - Left ventricular outflow obstruction repair 10 (14)
    - Other 14 (19)

  - **Thoracotomy** 31/231 (13)
    - Pulmonary artery banding 29 (13)
    - Other 2 (1)

- **Intraoperative data**
  - Median clamp time (min) 21 (7–272)
  - Median time on bypass (min) 134 (34–340)
## Neonatal aortic arch surgery results: literature summary.

<table>
<thead>
<tr>
<th>Author</th>
<th>Arch anomaly</th>
<th>Strategy cerebral protection</th>
<th>Arch repair technique (patients)</th>
<th>Patients</th>
<th>Mortality Late (%)</th>
<th>Early (%)</th>
<th>Overall (%)</th>
<th>No patients with recurrent arch obstruction</th>
<th>Freedom from arch reoperation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irwin 1991</td>
<td>IAA</td>
<td>Off pump</td>
<td>Tube graft</td>
<td>20</td>
<td>0</td>
<td>25</td>
<td>25</td>
<td>–</td>
<td>95% at 4 years</td>
<td>ATS 1991;52:632-7</td>
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<tr>
<td>Karl 1992</td>
<td>IAA, CoA, AAH</td>
<td>DHCA</td>
<td>Direct anastomosis</td>
<td>55</td>
<td>–</td>
<td>–</td>
<td>25</td>
<td>11</td>
<td>69% at 4 years</td>
<td>JTCVS 1992;104:688-95</td>
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<td>Sandhu 1995</td>
<td>IAA, CoA, AAH</td>
<td>DHCA</td>
<td>Direct anastomosis (54)</td>
<td>60</td>
<td>11.7</td>
<td>3.8</td>
<td>15</td>
<td>2</td>
<td>No information</td>
<td>AJC 1995;75:370-73</td>
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<td>Serra 1996</td>
<td>IAA</td>
<td>DHCA</td>
<td>Direct anastomosis (59)</td>
<td>79</td>
<td>18.9</td>
<td>12.1</td>
<td>30</td>
<td>15</td>
<td>7 patients operated</td>
<td>JTCVS 1996;112:1150-60</td>
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<td>Mainwaring 1997</td>
<td>IAA</td>
<td>Off pump</td>
<td>Tube graft</td>
<td>27</td>
<td>4</td>
<td>15</td>
<td>18</td>
<td>–</td>
<td>55% at 5 years</td>
<td>ATS 1997;64:1782-6</td>
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<td>Traskal 1998</td>
<td>IAA</td>
<td>DHCA</td>
<td>Direct anastomosis (24)</td>
<td>40</td>
<td>50</td>
<td>–</td>
<td>50</td>
<td>7</td>
<td>5 patients operated</td>
<td>EJCTS 1998;14:235-42</td>
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<td>Fulton 1999</td>
<td>IAA</td>
<td>DHCA</td>
<td>Direct anastomosis (66)</td>
<td>72</td>
<td>2.8</td>
<td>9.7</td>
<td>13</td>
<td>11</td>
<td>47% at 12 years</td>
<td>ATS 1999;67:177-81</td>
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<td>Schreiber 2000</td>
<td>IAA</td>
<td>DHCA</td>
<td>Direct anastomosis (84)</td>
<td>94</td>
<td>37</td>
<td>12</td>
<td>38</td>
<td>20</td>
<td>40% at 15 years</td>
<td>ATS 2000;70:1896-901</td>
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<td>Elgamal 2002</td>
<td>CoA, AAH</td>
<td>Arch advancement</td>
<td>Direct anastomosis</td>
<td>65</td>
<td>4.6</td>
<td>3</td>
<td>7.6</td>
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<td>0% at 5 years</td>
<td>ATS 2002;73:1267-73</td>
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<td>Direct anastomosis (60)</td>
<td>85</td>
<td>50</td>
<td>7</td>
<td>53</td>
<td>17</td>
<td>60% at 5 years</td>
<td>ATS 2004;78:1696-702</td>
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<td>CHSS 2005</td>
<td>IAA, AAH</td>
<td>ASCP</td>
<td>Direct anastomosis (267)</td>
<td>453</td>
<td>–</td>
<td>–</td>
<td>33</td>
<td>109</td>
<td>72% at 15 years</td>
<td>JTCVS 2005;129:343-50</td>
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<td>Others (2)</td>
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<td></td>
<td>Direct anastomosis + patch (125)</td>
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<td>Others (2)</td>
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<td></td>
<td>Modified Norwood (2)</td>
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<td></td>
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<tr>
<td>Brown 2006</td>
<td>IAA</td>
<td>DHCA</td>
<td>Left carotid swing down (43)</td>
<td>65</td>
<td>7.6</td>
<td>16.6</td>
<td>23</td>
<td>15</td>
<td>60% at 15 years</td>
<td>EJCTS 2006;29:666-73</td>
</tr>
<tr>
<td>Morales 2006</td>
<td>IAA</td>
<td>Off pump</td>
<td>Direct anastomosis (18)</td>
<td>60</td>
<td>11.6</td>
<td>11.3</td>
<td>21.6</td>
<td>–</td>
<td>100% at 5 years</td>
<td>ATS 2006;82:1577-84</td>
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<tr>
<td>Lim 2007</td>
<td>IAA, CoA, AAH</td>
<td>ASCP</td>
<td>Direct anastomosis</td>
<td>69</td>
<td>0</td>
<td>1.5</td>
<td>1.5</td>
<td>1</td>
<td>98.6% at 5 months</td>
<td>EJCTS 2007;31:242-48</td>
</tr>
</tbody>
</table>

IAA = Interrupted aortic arch, CoA = Coarctation of aorta, AAH = Aortic arch hypoplasia, DHCA = Deep hypothermic cardiac arrest, ASCP = Antegrade selective cerebral perfusion.

One stage repair owes

- Tissue to tissue technique
- Selective cerebral perfusion
A Method of Enlarging the Distal Transverse Arch in Infants with Hypoplasia and Coarctation of the Aorta

Joseph J. Amato, M.D., Harold F. Rheinlander, M.D., and Richard J. Cleveland, M.D.
Selective Cerebral Perfusion Technique During Aortic Arch Repair in Neonates

Toshihide Asou, MD, Hideaki Kado, MD, Yutaka Imoto, MD, Yuichi Shiokawa, MD, Ryuji Tominaga, MD, Yoshito Kawachi, MD, and Hisataka Yasui, MD

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PTFE graft

Metal-tipped cannula
• Deep hypothermic circulatory arrest: seizures, choreoathetosis and the high impact on the neuro-developmental outcome
• Antegrade selective cerebral perfusion:
• Perfusion rate: $50 \text{ ml kg}^{-1} \text{ min}^{-1}$
(a) there were no differences regarding the neurological complications, but a significant favorable impact of the bihemispheric ACP on hospital mortality did appear.

(b) in 8% of their patients, Willis’s circle was incomplete or absent, and in those patients, left-hemispheric perfusion was put at risk.

• The transcranial Doppler oximeter (NIRS, Somanetics, or INVOS) is a re-liable tool for an estimation of left hemispheric perfusion.


Potential Cx. of Surgery: Change in arch geometry

- Early: airway problem
- Late: stiff aorta
End to Side anastomosis
Bronchial compression by posteriorly displaced ascending aorta in patients with congenital heart disease

- Retrospectively review CT findings of 8 pts. with posteriorly displacement of the ascending aorta
  - Truncus arteriosus, TOF, PDA, PA with VSD, CoA
- Focused on Aortopulmonary space

Kim et al. (Ann Thorac Surg 2002;73:881-6)
Three-dimensional computed tomography in children with compression of the central airways complicating congenital heart disease

- **49 children**
  - TOF(18), cc-TGA(6), d-TGA(2), DORV(5), VSD(5), PDA(2), CoA(3), others (8)
  - Stenosis site: Trachea (21), bronchus (28)

- **Surgical intervention in 25**
  - Aortopexy(5), pulmonary arteriopexy(2), pulmonary arterial aneurysmorrhaphy(5), transposition of pulmonary artery(2), division of anomalous vessel(5), thymectomy(3), Lecompte maneuver(1), lobectomy(2)

- **CT** is useful in evaluation of obstruction of airway in children

Kim et al. (*Cardiol Young* 2002;12:44-50)
The transcranial Doppler oximeter (NIRS, Somanetics, or INVOS) is a reliable tool for an estimation of left hemispheric perfusion.


Summary

- End to side technique
- Airway problem
- Antegrade selective cerebral perfusion
- Monitoring of ACP