Hypoplastic aortic arch in newborns rapidly adapts to post-coarctectomy circulatory conditions

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RESULTS

Normal (n = 20) and hypoplastic (n = 14) arch groups could be formed using the ratio of the transverse arch and descending aorta diameters (0.88 (0.25) vs 0.42 (0.06); p < 0.0001) at a cut off point of 0.5. Each group had nearly normal distribution and were matching in all other characteristics but bodyweight (3.67 (0.67) vs 2.8 (0.07); p = 0.041) and associated atrial septal defect (4/20 vs 14/14; p < 0.0001).

Impaired ventricular function (in emergencies LVSF 0.26 (0.04) vs non-emergencies 0.39 (0.05); p < 0.0001) at presentation was the main indication for an emergency operation (within six hours of the diagnosis) in 15/34 cases. In no case did the end to end anastomosis reach proximally beyond the left carotid artery. All patients were extubated within 48 hours of the surgery with no right radial to femoral artery pressure systolic gradients > 15 mm Hg. No mortality or morbidity occurred in the series. Follow up was 14.1 (2.4) months (range 7–18 months). In two cases of obstruction at suture line level successful balloon dilations were performed postoperatively at 4 and 4.5 months respectively. All patients are symptom-free. Event-free survival of the arch repair is 94.11% (95% confidence limits (CL) 81% to 97%) at 18 months postoperatively.

At least three different measurements of postoperative two dimensional Doppler echocardiography were available for each patient. No regional wall motion abnormalities were observed and LVSF could be determined in every case. LVSF showed a gradual increase over the series. LVSF on the first postoperative day was lower in the hypoplastic group (0.39 ± 0.08) vs 0.32 (0.07); p = 0.01). No descending aorta diastolic antegrade flow (diastolic gradient) was observed in any patient. All peak flow velocities but DAVF in the hypoplastic arch group showed an increase parallel to an improving LVSF over the entire immediate postoperative period. Conversely, DAVF in the hypoplastic arch group exhibited a descending

Abbreviations: AAFV, ascending aorta peak flow velocity; DAFV, descending aorta peak flow velocity; LVSF, left ventricle shortening fraction.
slopes (postoperative day 1, 2.73 (0.33) vs day 3, 2.55 (0.35); p = 0.038; day 5, 2.49 (0.29); p = 0.23).

Post-coarctectomy tranverse arch remodelling was quantified by comparing normal and hypoplastic arch data of the DAFV and AAFV difference indexed to the LVSF. The difference between the two groups disappeared beyond the fifth postoperative day (fig 1).

DISCUSSION
Previous studies have demonstrated that tranverse arch and descending aorta are independent variables, therefore a ratio of their diameter better signifies tranverse arch hypoplasia than that of tranverse arch ascending aorta. We found an empiric cut off point between normal and hypoplastic arch groups at 0.5 with equal distribution of anomalies, excepting uniform association of atrial septal defect to hypoplastic group.

An arch incision extended beyond the origin of the left carotid artery was proposed as mandatory optimal reconstruction of the hypoplastic aortic arch. It is generally acknowledged that the transverse aortic arch grows after coarctation repair so most centres now perform it with limited extensity. Postoperative remodelling is also recorded. The purpose of this study was to investigate the time frame within which it occurs.

We observed a uniformly and significant increase of LVSF in the post-coarctectomy period. Initial LVSF increase may partly be explained by the disappearance of an obstacle in the arterial circuit, whereas a further increase can signify increasing cardiac output that is paralleled by higher AAFV and DAFV. LVSF and peak flow velocities are independent variables. We chose LVSF as a surrogate to index the change of cardiac output.

We hypothesise that the peak flow velocity difference between the descending and ascending aorta is caused by the convective acceleration that occurs in the transverse arch, and is determined by its diameter and compliance. The difference of the transverse arch convection acceleration indexed to the LVSF between normal and hypoplastic arch groups in the early post-coarctectomy period represent a valid difference—that is, in the hypoplastic arch group the transverse arch is smaller and less compliant. The diminishing difference is a direct indicator of arch remodelling so that the arch dilates to accommodate increasing cardiac output. The arch adaptation (remodelling) is fairly rapid as the difference equalises by the fifth postoperative day (fig 1). We conclude that extensive direct enlargement of the hypoplastic tranverse arch is not usually necessary.

REFERENCES

IMAGES IN CARDIOLOGY

Large coronary artery aneurysms following sirolimus eluting stent implantation

A 75 year old woman underwent an uneventful coronary angioplasty with stenting of the proximal left anterior descending (LAD) artery for acute coronary syndrome in August 2003. A 3.0 x 13 mm sirolimus eluting Cypher stent (Cordis Europa, NV) was used with good result (panels A and B). The patient started complaining of dyspnoea with angina (New York Heart Association functional class II) four months after the initial procedure. The symptoms became NYHA class III at the time of presentation six months after the initial procedure. A repeat angiography was performed which showed large aneurysms at both the proximal and distal ends of the stent, with evidence of significant stenosis at the inflow of proximal and outflow of distal aneurysm (panels C and D).

The patient underwent surgery. The operative findings showed pronounced inflammation and fibrosis around the area of proximal LAD with plastering of tissues, which were very hard in consistency. No dissection of this area was done and the distal LAD was grafted using a left internal mammary artery. The patient is doing well and symptom-free after three months of follow up.

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