732 Pediatric Cardiac Surgury

Tuesday, March 21, 1995, 8:30 a.m.–10:00 a.m.
Ernest N. Morial Convention Center, Room 103

8:30

732-1 An Institutional Experience with Second and Third Stage Palliative Procedures for Hypoplastic Left Heart Syndrome: The Impact of the Bidirectional Cavopulmonary Shunt

Joseph M. Forbess, Nancy Cook, Alain Serraf, Redmond P. Burke, John E. Mayer, Jr., Richard A. Jonas. *Children's Hospital, Boston, MA*

We reviewed 71 consecutive pts who underwent stage II and III operations following stage I palliation for hypoplastic left heart syndrome (HLHS) at our institution since 1983. 6 surgeons participated in the care of these pts. Follow-up is 97% complete. We examined 17 potential risk factors for mortality, including preoperative anatomic and physiologic factors, and procedural features of the stage II operation. Multivariate analysis revealed that the only significant risk factor for stage II mortality was the performance of a non-fenestrated completion Fontan procedure ($p < 0.001$). There were 9 hospital deaths (69%) in the 13 pts undergoing the Fontan procedure at stage II. In contrast, 49 pts underwent bidirectional cavopulmonary shunting (47) or hemi-Fontan procedure(2) as an intermediate step to the Fontan procedure with 4 (8%) early deaths. The first bidirectional cavopulmonary shunt was performed in this population in 1988. Median age at this stage II procedure was 8.4 months. Surgical augmentation of the pulmonary arteries was performed in 18 (37%) pts at the time of stage II surgery and was not associated with increased operative risk. Also, HLHS anatomic subtype was not a risk factor for stage II mortality or pre-stage III attrition. There have been 2 (4%) intermediate deaths prior to the performance of a stage III procedure, which at our institution is the fenestrated Fontan procedure. This has been performed in 25 pts at a median age of 30 months with 1 early death and no mortality at a median follow-up of 22 months. There are presently 34 HLHS pts who have modified Fontan anatomy following a course of surgical palliation performed entirely at this institution. Follow-up in this group ranges up to 92 months, with a median of 28 months. 33 of these patients are NYHA class 1 or 2. 2 pts have required pacemaker implantation, but there have otherwise been no surgical reinterventions in pts who have completed palliation. We conclude that the incorporation of the bidirectional cavopulmonary shunt into a course of surgical palliation for HLHS has dramatically reduced mortality in this challenging group of pts, allowing them to undergo the modified fenestrated Fontan procedure with low operative mortality and good intermediate outcome.

8:45

732-2 Extra-cardiac Conduit Total Cavopulmonary Anastamosis: Early and Mid Term Results of Further Modification of Fontan Procedure

V. Mohan Reddy, Hiranya A. Rajasinghe, Gary S. Haas, Frank L. Hanley. *University of California San Francisco, San Francisco, CA*

Lateral tunnel modification of Fontan procedure (LTF) is widely practiced based on the advantages of better hydrodynamics and fewer atrial complications. We have routinely employed extra-cardiac conduit Fontan (ECCF) because of the following potential advantages: 1) it avoids the atrium completely in the Fontan path, 2) it can be performed on a perfused beating heart without cross clamping the aorta thereby completely avoiding ischemic insult to the myocardium, and 3) it provides improved laminar flow. From 7/92 to 8/94, 35 patients (pts) aged 1.7 to 44.2 years (median 6.52 years) underwent ECCF, including revision of a failing Fontan to ECCF in 7 pts. Principal diagnoses were tricuspid atresia (n:14), double inlet ventricle (n:10), corrected transposition of the great arteries (SLL) with left atrioventricular valve atresia (n:4) and other forms of single ventricle in the rest (n:7). An avenge of 2.3 previous operations were done per patient. Surgical procedure included extracardiac total cavopulmonary anastomosis using a ePTFE conduit (16 to 22 mm) or a nonvalved aortic homograft conduit (18 to 25 mm). Pop off fenestration between the conduit and the atrium was provided by a 4 – 5 mm ePTFE tube graft (n:20) or a side to side anastomosis with the atrium (n:4). Additional surgical procedures included ligation of systemic shunts (n:17), pulmonary arterioplasty (n:15), enlargement of bulboventricular foramen (n:4), mitral valve repair (n:1), and cryoablation of junctional ectopic focus (n:1). The only early death in the series was a pt of a failing Fontan with chronic massive ascites, pleural effusions, and cachexia who was not a candidate for heart transplant due to social reasons. Early complications included prolonged pleural and/or pericardial effusion in 6/34 pts (18%) and transient arrythmias in 6 pts. Permanent pacemaker was implanted in 4 pts: 2 pts with pre-existing CHB and 1 pt following VSD enlargement and 1 pt with SLL. At a follow-up of 1 to 22 months (median 11) there were no significant new arrythmias, one pt required reoperation for thrombosis of left pulmonary artery and 3 pts required pericardioperitoneal window for effusion, and one pt died following re-do sternotomy.

ECCF is an excellent alternative to LTF with good early and midterm results. However, late follow up is essential to evaluate its potential advantages.

9:00

732-3 Improved Results After Nonfenestrated Fontan Operation in Patients Less than 4 Years Old

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Early mortality (EM) after nonfenestrated Fontan operation (NF) has been reported to be higher for young pts, specifically those less than 4 yrs old. In our recent experience, overall EM has decreased markedly. In order to determine if the risk of EM after NF is still significantly increased for young pts, we reviewed all 839 pts who had NF at our institution between 1973–92. During this period, 123 (15%) pts younger than age 4 yrs had a NF. EM for this group of pts was 22/123 (18%). During the last 20 yrs, EM after NF for pts younger than 4 yrs has decreased progressively at our institution: 1973–77 = 50%, 1978–82 = 32%, 1983–86 = 20%, 1987–92 = 12% ($p < 0.04$). In the 3 early time periods, EM was consistently greater in pts younger than 4 yrs than in older pts. However, in our recent experience (1987–92), EM after NF for pts younger than 4 yrs [8/69 (12%)] is not significantly different from EM after NF for older pts [22/270 (8%)]. Many factors have contributed to the improved early outcome in young pts. Among these are the fact that in our earlier experience (1973–86), pts younger than 4 yrs frequently had NF on a non-elective basis [20/54 (37%)] due to progressive clinical deterioration. Also, in the more recent period, selection criteria for NF have become more stringent and staging operations (i.e. cavopulmonary connections) have been more widely utilized.

Several institutions have advocated atrial baffle fenestration to improve survival for high-risk Fontan pts including those less than 4 yrs old. However, our results with nonfenestrated Fontan operations indicate that with careful pt selection, children younger than age 4 yrs, have an operative risk which is not only improved, but similar to that observed in older pts. Therefore, any technical modification of the Fontan procedure must be evaluated in light of these recent improved results.

9:15

732-4 Infundibular Diameter Predicts the Presence of Right Ventricular-Coronary Communications in Pulmonary Atresia with Intact Ventricular Septum

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In patients with pulmonary atresia and intact ventricular septum (PA/IVS), the presence of right ventricular to coronary communications (RVCC) dictates surgical management (right ventricular (RV) decompression). Previously, tricuspid valve annulus size-Z score (TV-Z), and RV morphology have been used to predict the presence of RVCC. We hypothesize that pulmonary infundibular diameter better predicts the presence of RVCC than TV-Z score.

Methods: From 2/91 to 7/94, 24 neonates with PA/IVS referred to our institution were studied (6 of which were prospectively evaluated). Four were excluded: 1 with associated Ebstein's anomaly and 3 with incomplete data. In the remaining 20 pts., echocardiographic measurements of the TV annulus and infundibular diameter were made, and angiograms were reviewed for the presence and extent of RVCC. Statistical analysis was performed using a two tailed student's t test.

Results: Eleven pts with RVCC had significantly smaller infundibular diameter (2.3 ± 0.7 mm) than nine pts without RVCC (6.5 ± 1.6 mm), $P < 0.0001$. All patient with RVCC had infundibular diameter < 3.4 mm. All patients without RVCC had infundibular diameter > 5.0 mm. While, the TV Z-score was also significantly smaller: -3.52 ± 1.3 vs. -0.76 ± 1.0, respectively, $p < 0.001$, there was significant overlap between the groups. In all six cases studied prospectively, the presence of RVCC was predicted correctly, using the infundibular diameter.

Conclusion: The infundibular diameter measured by Echo accurately predicts the presence of RV-coronary communications in neonates with PA/IVS. This method better distinguishes the presence or absence of RVCC than TV-Z score.