6997
Pediatric Cardiology: Ventricular

Wednesday, March 27, 1996, 9:00 a.m.-11:00 a.m.
Orange County Convention Center, Hall E
Presentation Hour: 9:00 a.m.-10:00 a.m.

6997-8
Left Ventricular Contractility in a Cyanotic,
Univentricular Swine Model
Robert J.M. Klautz, Gary S. Haas, Jan Baan, David F. Teitel. University of California, San Francisco, CA; University Hospital Leiden, The Netherlands

To study the effects of right ventricular exclusion and cyanosis (RVX) on left ventricular (LV) function, we created a swine model of tricuspid atresia with a bidirectional Glenn shunt by diverting inferior vena cava blood to the left atrium (IVC-LA) and superior vena cava blood to the pulmonary artery using Gore-Tex shunts. One month later we studied baseline contractility, hemodynamics and LV contractile response to frequency (atrial pacing) and \( \beta \)-adrenergic (dobutamine) stimulation. Contractility was assessed by the slope of the end-systolic pressure-volume relationship (ESPVR). LV volume was measured by the conductance catheter method. The RVX data \((n = 7)\) were compared to non-surgical controls \((n = 7)\) and a cyanotic group \((n = 7)\), which had undergone only the IVC-LA connection. All 3 groups had similar baseline hemodynamics and contractility. All had significant increases in contractility in response to atrial pacing and dobutamine. Despite this, all groups had a similar chronotropic response to dobutamine, the contractile reserve in response to atrial pacing and dobutamine. But, although all groups had a similar chronotropic response to dobutamine, the contractile reserve in response to both the RVX and cyanotic groups was significantly less than that in controls (graph).

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6997-9
Preload Dependence of the End-Systolic Wall Stress-Velocity of Fiber Shortening Relation in the Neonatal Left Ventricle
Michael J. Davies, Renée L. Quarterman, Steven S.L. Tsui, Ross M. Ungerfelder, William Gaynor. Duke University Medical Center, Durham, NC

The left ventricular (LV) end-systolic wall stress-rate corrected mean velocity of fiber shortening relation (ESS-Vcf) has been utilized as a single-best, load-insensitive index of contractility in children. To assess the effects of changes in preload on the ESS-Vcf relation in the neonatal LV, 22 piglets (age \( \pm 7\) days, weight \(2.9 \pm 0.2\) kg) were instrumented with epicardial ultrasonic dimension transducers and a LV micromanometer. After autonomic blockade, preload was varied by transient veno cavalc occlusions (VCO). End-diastolic volume fell \(20 \pm 6\%\) and end-diastolic pressure fell \(66 \pm 40\%\) (both \(p < 0.001\)) during VCO. ESS fell \(45 \pm 15\%\) and the Vcf fell \(71 \pm 26\%\) (both \(p < 0.001\)) during VCO resulting in a significant shift in the ESS-Vcf relation as shown for one typical animal.

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6997-10
Administration of Intravenous Triiodothyronine Has a Positive Inotropic Effect on the Neonatal Left Ventricle
Reinier Quarterman, Michael J. Davies, Louis R. DiBernard, Paul M. Kirshhoff, Ross M. Ungerfelder, William Gaynor. Duke University Medical Center, Durham, NC

Intravenous triiodothyronine (T3) has been advocated as a positive inotropic agent. However, there is controversy as to whether T3 exerts a positive inotropic effect or whether it improves cardiac performance by altering loading conditions. The possible inotropic effects of T3 have not been previously evaluated in the immature heart. The cardiac response to T3 was examined in 16 neonatal piglets (7-9 days old, 2.6 \(\pm 0.1\) kg) instrumented with epicardial ultrasonic dimension transducers and a left ventricular (LV) micromanometer. After autonomic blockade, data acquisition was performed at steady state and during transient inferior vena caval occlusions. Control animals \((n = 8)\) received no drug; T3 animals \((n = 8)\) received 1.2 \(\mu\)g/kg of T3 as an intravenous bolus. The slope of the preload recruitable stroke work (PRSW) relationship, a load-independent index of ventricular function, was used to evaluate changes in LV isotropic state. At baseline, heart rate (HR), mean ejection pressure (MEP), end diastolic pressure (EDP), end diastolic volume (EDV) and end diastolic pressure-volume (EDP-V) were measured. The EDP, MEP, EDV, and EDP-V were not significantly different between groups \((p > 0.05)\). There was a trend towards a lower EDP \(3.6 \pm 1.9\) vs \(5.8 \pm 1.5\) mmHg) with an increased CO \((329 \pm 52\) vs \(285 \pm 48\) mmHg min\(^{-1}\)) and MEP \((62 \pm 7\) vs \(53 \pm 6.5\) mmHg) in the T3 animals which did not reach statistical significance \((p > 0.05)\). However, the slope of the PRSW relationship did not show any significant change in the T3 group compared to the control animals \((61.0 \pm 14.1\) vs \(46.3 \pm 9.0\) erg-cm\(^{-2}\) \(\cdot\) \(10^{-6}\) \(\cdot\) \(10^{-2}\), \(\rho < 0.05\)) indicating an increase in isotropic state. These data demonstrate that T3 administration has a positive inotropic effect on the neonatal left ventricle.

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6997-11
Left Ventricular Function Following Apical Left Ventricle Computation for Closure of Muscular Ventricular Septal Defects
Lizbeth M. Lanford, Roger P. Vermillion, Barry L. Shulkin, Edward L. Bove. University of Michigan, Ann Arbor, MI

Left ventriculotomy in children is believed to cause severe myocardial injury with reports of up to 50% mortality and significant morbidity. Thirteen children had a limited apical left ventriculotomy for closure of apical muscular ventricular septal defects (VSDs) at the University of Michigan between January 1988 and December 1994. All are alive without significant cardiac symptoms by parental report. Nine patients were prospectively assessed with an echocardiogram, a 24 hour Holter monitor scan, radionuclide angiography using multiple gated acquisition (MUGA), and an echocardiogram, at a mean follow-up of 47 months after surgery (range 12-84 months). Left ventricular ejection fraction (LVEF) measured by echocardiography using the biplane Simpson's method ranged from 44-63% (median 56%). LVEF measured by MUGA ranged from 39-70% (median 54%). Three children had a LVEF by echocardiography of \(\leq 50\%, 0\) of whom also had a LVEF by MUGA \(\leq 50\%\). No significant residual VSDs were identified. Two patients had tiny muscular VSDs imaged. No patient had ST-T wave changes indicative of myocardial ischemia but 3 children had ST-T wave changes due to bundle branch block. There were no ventricular rhythm disturbances beyond grade II ventricular ectopy on Holter scans. One child with Wolff-Parkinson syndrome had complete heart block and one child had an intermittent junctional escape rhythm.

Apical left ventriculotomy for closure of apical VSDs yields a satisfactory outcome and should be considered as a therapeutic option in infants and children with significant apical muscular VSDs when other surgical approaches are not satisfactory.

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6997-12
Pulmonary Atresia With Intact Septum: Growth of the Right Ventricle and Tricuspid Valve Following Primary Procedure

The initial surgical strategy for PAWS is critical not only for survival but also for the growth potential of the right ventricle (RV) and tricuspid valve (TV). As part of the UK and Eire Collaborative Study of PAWS (an on-going population based study of all children born in the UK and Eire since 1/1/1981) we examined the growth of the TV and RV following primary procedure. Serial echocardiograms were reviewed in 61 children both pre- and post-primary procedure (mean 17 months post-procedure, range 2-45). The TV annulus and RV inlet length were measured in the 4 chamber view. Z scores were derived.