●91 VENTRICULAR FUNCTIONAL RESERVE IN THE GROWTH ACCELERATED CHICK HEART: STAGES 21 TO 29.

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We assessed the functional capacity of the chronically afterloaded chick embryo heart. At stage 21, a 10-0 nylon loop was tied around the mid conotruncus narrowing the outflow tract. Control embryos had all procedures except the placement of the band. Embryos were returned to the incubator, and harvested at stage 24, 27, or 29 for hemodynamic and morphologic measurements. We used a servo-null pressure system to measure ventricular peak systolic pressure (PSP), end diastolic pressure (EDP) and dP/dt at base line and during brief conotruncal occlusion. We also measured embryo (edw) and ventricular (vdw) dry weight. We generated indexes of ventricular function: PSP, dP/dt, dP/dt/PSP, and dP/dt/PSP/mg dvw. N=9 for each group. The data ($\bar{x}$±SEM) were analysed by t-test. Banding increased ventricular but not embryo weight. For experimental v control prior to occlusion, PSP and dP/dt were higher; eg. stage 29, 4.5±0.2 v 3.4±0.1 mmHg, 94±8 v 66±7 mmHg/s ($p<0.05$) but EDP was unchanged, 0.9±0.1 v 0.8±0.1 mmHg ($p>0.05$). During conotruncal occlusion PSP, EDP, dP/dt increased in both groups. At stage 29, occluded dP/dt/PSP, 19±1 v 19±2 mmHg/s/mmHg were similar but occluded dP/dt/PSP/mg dvw was less in the afterload group: 74±13 v 138±28 mmHg/s/mmHg/mg ($\bar{x}$±95%CI). Thus, as ventricular mass increased to meet functional demands, this index of ventricular functional reserve decreased.

92 CHARACTERISTICS OF RIGHT VENTRICULAR ACTIVATION DETECTED BY BODY SURFACE POTENTIAL MAPPING AMONG POST-OPERATIVE TETRALOGY OF FALLOT PATIENTS WITH AND WITHOUT ARRHYTHMIA.

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In order to study myocardial activation, 15 patients with repaired Tetralogy of Fallot had body surface potential maps (BSPM) (180 electrode array). All had ambulatory EKG (H), exercise EKG (Ex) and intracardiac electrophysiology (EP). Advanced right bundle branch block (RBBB) was present in 12/15; partial RBBB in 1/15; no RBBB in 2/15. BSPM characteristics of advanced RBBB were lack of right ventricular (RV) breakthrough (12/12); low left ventricular peak to peak voltage (PPV)(1202 ± 544 UV); high RV PPV (3194 ± 1064);high T wave PPV (1549 ± 626)(consistent with "propagation" of repolarization); all significantly different from a normal population previously studied. Although advanced RBBB was "central" in 8/12 and "peripheral" in 4/12 by EP, no difference in RV activation was detected by BSPM among these two groups. Multiple RV activation centers (MC) were seen in 5/12; 5/5 having either sustained ventricular tachycardia (VT) during EP (3/5) or frequent premature ventricular contractions (PVC) on H or Ex (4/5). Without MC 1/7 had VT; 1/7 had PVC's ($p<.01$). Patients with MC had fractionation of intracardiac RV electrogram in 4/4 having EP mapping near the His bundle, (1/7 without MC) ($p<.01$). An anterior superior activation front was recognized in 8/12 with advanced RBBB, appearing 0-18 ms after initial RV activation, consistent with cell-cell propagation across the superior ventricular septum. We conclude: Within the spectrum of advanced RBBB, BSPM may show abnormalities of impulse propagation in the RV associated with ventricular arrhythmia.

93 HEART DISEASE IN THALASSEMIA HETEROZYGOTES WITH SICKLE CELL ANEMIA

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The purpose of this study was to ascertain whether thalassemia heterozygotes (∝ thal) who have sickle cell anemia (SCA) suffer fewer cardiac effects of their SCA due to an increased oxygen carrying capacity or decreased sickling. Echocardiograms and graded, maximal exercise tests were performed in 22 subjects with ∝ thal and SCA, and in 22 age and sex matched controls (C) with SCA alone. The patients ranged in age from 8-32 years. None were ill within two weeks of study. No significant differences were found for any of the following measurements: age (∝ thal 19.0 years, C 18.5); hemoglobin (∝ thal 8.8 gm%, C 8.2); hemoglobin F (∝ thal 6.6%, C 7.8); body surface area (∝ thal 1.43 M^2, C 1.45) heart rate (∝ thal 78.6, C 80.3); left ventricular (LV) dimension (∝ thal 5.38 cm., C 5.42); LV wall thickness (∝ thal 0.91 cm., C 0.92); right ventricular (RV) dimension (∝ thal 2.26 cm., C2.42); left atrial dimension (∝ thal 3.70 cm., C 3.91); shortening fraction (∝ thal 34.8%, C 36.5); and work capacity (∝ thal 7.3 kg-m/min/kg, C 8.4. Exercise induced S-T depression was noted in 8/44 (18%) of subjects. The ∝ thal group was more often affected 6/8 (NS). ∝ thal was not protective in heterozygotes with SCA. Abnormalities attributable to increased viscosity at capillary level persist in ∝ thal heterozygotes with SCA. ∝ thal homozygotes would thus be an ideal group to examine these effects independent of the manifestations of severe anemia, since they tend to have higher hemoglobins than sickle cell patients without ∝ thal.

●94 *MYOSIN ISOZYMES DURING THE REGRESSION OF CARDIAC HYPERTROPHY.*

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An early, transient decrease in cardiac function occurs during regression (R) of pressure overload (P) left ventricular hypertrophy (LVH) in rats. This may occur because of a mismatch between the LVP and the form of myosin isozymes. We compared myosin isozymes using native gel electrophoresis in control (C), hypertrophy (H), and regression (R), rat hearts. LVH was induced by partial occulsion (O) of the ascending aorta. O was released in a group of the H rats allowing R to occur. C, H, and R rats were studied 1-4 wks. after release of O. C rats had 85% V_1 myosin in all groups. H had 45% V_1, 33% V_2, 22% V_3 at R-1 wk. (3 wk of H) and 48, 32 and 20%, respectively at R-4 wk (6 wk of H). In the 1 wk R rats the relative amounts of V_1, V_2 and V_3 remained unchanged (43, 30, 27%, respectively). However, after 4 wk of R, rather than the isozymes forms returning to that of controls, the relative amount of V_3, actually increased, 36% V_1, 32% V_2, 32% V_3. At no time was there a shift back to V_1 despite complete relief of P which occurs immediately upon release of O. Regression of LVH is nearly complete by 1 wk LV/body weight C-2.67, H-4.06, R-2.80. In this study, we found an increase in the relative amount of V_3 in the absence of pressure overload in young rats after the regression of LVH. This unusual mismatch between myosin isozyme and physiologic status could be explained by an undetermined anomaly in the cardiac function during regression. A change affecting the responsive expression of V_3 could also occur.

95 ABNORMALITIES IN VENTRICULAR ACTIVATION AND REPOLARIZATION IN SICKLE CELL DISEASE AND NORMAL SIBLINGS.

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Prolongation of the QT_c interval can result from lengthening of ventricular activation and/or repolarization due to ischemia. Although we have previously reported exercise induced ischemic-like ST depression in children with sickle cell disease, the response of the QT_c interval to exercise has not been reported. We studied 68 children with various hemoglobinopathies including hemoglobin (Hgb) SS (sickle cell) disease (n=36), Hgb AS (n=15), Hgb SC (n=12) and Hgb AC (n=5) during upright cycle ergometry. Siblings (n=20) of patients with Hgb SS, who had normal Hgb, were also evaluated. The QT interval was measured at rest (R) and peak exercise (PE), and then corrected for heart rate with Bazett's Formula. These results were compared to those of 48 normal (NL) children (Hgb AA). All patients has a normal QRS duration (<0.08 sec.). (*P<0.001 vs. NL)

		Hgb TYPE				
	NL	SS	AS	AA_{sib}	SC	AC
QT_c (R) (ms)	388+27	446+38*	436+37*	419+27*	434+38*	425+9*
QT_c (PE)	359+16	442+26*	448+61*	438+56*	440+28*	433+22*

At both rest and peak exercise, patients with a hemoglobinopathy had prolongation of their QT_c interval as compared to normal. Siblings of patients with Hgb SS, who had NL Hgb, also demonstrated QT_c prolongation. We conclude that there are abnormalities of ventricular activation/repolarization suggestive of ischemia in patients with sickle cell disease and their normal family members which are independent of hemoglobin type.

96 CHARACTERIZATION OF THE QT_c INTERVAL DURING UPRIGHT EXERCISE IN CHILDREN.

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The QT_c interval which reflects ventricular activation/repolarization has not been characterized in children during exercise. We studied 60 children (ages 5-18 years) who underwent upright cycle ergometry according to a standard James protocol. These children were without known cardiac or medical problems. The QT interval was measured at rest (R); maximal exercise (MAX); immediate post exercise (IPE); and 1 (IPE1), 3 (IPE3) and 5 (IPE5) minutes post exercise. This interval was corrected for heart rate and QT_c calculated with Bazett's formula. All patients demonstrated a normal QRS duration (<0.08 sec.). Patients were assigned to one of four groups on the basis of body surface area (BSA) and sex (M,F).

	QT_c Interval (ms) (*p <.01 vs. R)					
BSA (M^2)	R	MAX	IPE	IPE1	IPE3	IPE5
>1.2 (M,N=18)	379±22	374±22	359±20	362±21	387±23	406±19*
>1.2 (F,N=18)	397±24	376±21	360±16	369±22	406±19	424±12*
1.0-1.19 (N=12)	395±22	374±13	360±14	364±24	412±20	414±13*
<1.0 (N=12)	385±29	377±17	361±12	375±20	405±12	408±25

There were no significant differences in QT_c interval on the basis of body size or sex at each level of exercise. In all but the smallest children, the QT_c interval was longer at 5 min. post exercise than at rest. This suggests that there is a modest prolongation of ventricular repolarization following exercise which is an integral part of a normal exercise response.