211 CARBOHYDRATE METABOLISM IN THE IMMATURE HEART.

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Metabolic activity of the heart is best observed using a system in which the heart is isolated from other organs but is allowed to support a work load comparable to that in the living animal. A model is described in which the isolated heart of a newborn piglet is perfused in a manner reproducing fetal flow patterns and work loads. Perfusion is carried out using Krebs-Henseleit buffer equilibrated with O_2 95%, CO_2 5% supplemented with glucose (glu) 10 mM(n=7), pyruvate(pyr) 20 mM(n=5) or lactate (lact) 20 mM(n=5) in a 250 cc recirculating system for 1 hr. Buffer is infused via the inferior vena cava and mean pressure in both great arteries is adjusted to 60±3 mmHg with left atrial pressure 6±2 mmHg paced at 180/min. Pressure development and total cardiac output were stable over 1 hr. In glu-perfused hearts, O_2 uptake ($\dot{V}O_2$)=2572±323, glu uptake=439±44 and lact production= 24±31 µmol/hr/g dry heart. In pyr-perfused hearts $\dot{V}O_2$=2725±297, pyr uptake=929±90 and lact production=112±50 µmol/hr/g dry heart. In lact-perfused hearts VO_2=2082±180, lact uptake=690±111 µmol/hr/g dry heart. Tissue ATP and creatine phosphate following perfusion were 20.4±0.6 and 19.1±1.1 µmol/g dry heart, respectively, after pyr and lact perfusion for 1 hr. Glycogen content after 1 hr working perfusion with pyr was 166±20 µmol glu equivalent/g dry heart. These results quantify O_2 requirements of the newborn heart and indicate normal function may be supported without significant contribution from anaerobic glycolysis.

212 MYOCARDIAL PERFUSION DURING EXERCISE IN DOGS WITH LEFT VENTRICULAR OBSTRUCTION ABOVE AND BELOW CORONARY ARTERIES;

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Strenuous exercise is thought to induce global myocardial ischemia in the presence of left ventricular hypertrophy (LVH) and normal coronary arteries. Myocardial perfusion (MBF) and cardiac index (CI) were measured in dogs with chronic LVH due to outflow tract obstruction. LVH was induced by banding the ascending aorta (Sp) in 7 puppies (LV/body weight = 6.6 ± .4 gm/Kg) and plicating the posterior sinus below the coronary ostia (Sb) in 10 puppies (6.4 ± 1.1). Nine to 13 months after surgery, MBF and CI were measured at rest and during treadmill exercise (Ex) using 15u radioactive microspheres. Mean ± SEM heart rates (HR) in beats/min, CI in cc/min/Kg, and anterior left ventricular (ALV) endocardial/epicardial flow ratios (R) in Sp and Sb dogs are as follows: *p < .01 for Sp vs Sb

	HR		CI		ALVR	
	Sp	Sb	Sp	Sb	Sp	Sb
Rest	155±15	131±6	135±21	95±20	1.28±.07	1.47±.12
1st Ex	244±15	215±5	356±27	318±31	1.15±.06	1.42±.05*
2nd Ex	267±11	244±7	410±31	340±39	1.14±.07	1.36±.04*

Inferior LVR were not significantly different in Sp and Sb dogs. These data show a shift in flow away from endocardium in Sp and toward endocardium in Sb suggesting different perfusion patterns. We conclude that regional, rather than global, subendocardial ischemia occurred in Sp dogs.

● 213 β-ADRENERGIC RECEPTORS AND ADENYLATE CYCLASE IN DEVELOPING RAT MYOCARDIUM.

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β-Adrenergic receptors (BAR) were identified in rat myocardium during development with [^{3}H] dihydroalprenolol, [^{3}H] DHA and [^{125}I]iodohydroxybenzylpindolol, [^{125}I]HYP. Heart weight, protein and the number of BAR per cell increased with age, however Bmax per mg protein decreased progressively with age and was lower in adult 36.8±4.1 as compared to the neonatal rat, 58.3±7.2 fmoles·mg^{-1} protein, m±SE, p<0.01. While Na^+, K^+-ATPase, 5'-nucleotidase and adenylate cyclase (AC) increased equally to or in excess of ventricular protein; the developmental increase in [^{3}H]DHA binding per heart did not keep up with the increases in protein during growth. BAR subtypes did not change with age: 75% β_1 and 25% β_2. Guanine nucleotides (GN) decreased agonist affinity for the inhibition of [^{125}I]HYP binding equally in adult and fetal samples and enhanced the activation of AC by catecholamines. The lower specific activity (per mg protein) of BAR in adult myocardium may be related to the decreasing proportion of sarcolemmal protein as compared to total cell protein which occurs during hypertrophic cardiac growth, supporting the hypothesis that sarcolemmal area is a major determinant of BAR number. The function of BAR is mediated by GN's early in development, and observed age dependent differences in the activation of AC by GTP and Gpp(NH)p may relate to developmental differences in the properties of GN dependent factors which mediate receptor occupancy and c-AMP production "coupling".

214 VENTRICULAR INTERDEPENDENCE IN CYSTIC FIBROSIS (CF).

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A two-dimensional echocardiographic study using short axis, long axis and four chamber views was performed to evaluate right ventricular (RV) and left ventricular (LV) geometry and interrelationships in 10 CF patients with severe obstructive lung disease and secondary cor pulmonale. All patients had clinical scores less than 50, vital capacity less than 55% of predicted, evidence of RV failure, hypoxia, and were receiving diuretics. Six patients were receiving digoxin. RV end-diastolic dimension (RVED), RV outflow tract (RVOT), ratio of RVOT to aortic root (AO) and ratio of RVED to LV end-diastolic dimension (LVED) were significantly ($p < 0.005$) larger than predicted normal values derived from M-mode studies. LVED was smaller than predicted. The massively enlarged RV encroached on the LV in all patients. This resulted in persistently abnormal interventricular septal configuration with bulging of the septum into the LV, an eccentric oval shaped LV chamber, and flat or paradoxic septal motion. This was associated with dyskinetic contraction and relaxation of the LV chamber, which could contribute to diminished performance. Thus massive RV enlargement may be a major factor in producing LV dysfunction in chronic cor pulmonale.

	Patients		Predicted Normal
	Mean	Range	Mean ± 2 S.D.
RVED (cm)	4.1	3.0-5.5	1.78 ± 0.49
RVOT (cm)	5.4	4.0-7.5	1.91 ± 0.37
LVED (cm)	3.0	1.3-4.3	4.39 ± 0.38

● 215 ANAEROBIC THRESHOLD AS A PREDICTOR OF ATHLETIC PERFORMANCE IN YOUNG FEMALE RUNNERS.

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While maximum voluntary oxygen consumption (VO_2max) is an excellent standard of cardiopulmonary fitness in adults and children, it is not a discrete predictor of endurance athletic performance. The anaerobic threshold (AT) has proven to be a more discriminate method for predicting high-level endurance athletic performance in adults. AT and VO_2 max were evaluated in 10 young (11-13 years) female cross country runners and compared to their individual performance records and to a group of unconditioned controls.

Correlation of team performance in the runners with measured parameters using the Kendall correlation coefficient yielded a P of 0.005 for %AT of exercise time, P 0.005 for %AT max heart rate, P 0.05 for VO_2 max, and P 0.1 AT% VO_2 max.

VO_2 max/kg (51.3 cc/kg vs 39.6 cc/kg) and %AT of exercise time (67.3 vs 52.5) were both higher in the conditioned groups. Striking overlap of VO_2 max was noted between the two groups, while none occurred with %AT of exercise time.

AT appears to be a useful intergroup discriminator of endurance athletic performance in childhood and affords a sharper definition between fit and unfit children.

216 EFFECTS OF HYPOXIA AND REOXYGENATION ON MITOCHONDRIAL FUNCTION IN THE NEWBORN MYOCARDIUM.

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This study was designed to evaluate the effect of hypoxia (N_2) and reoxygenation (re-O_2) on mitochondrial function (MF) in the newborn (NB) and adult (A) rabbit heart. The heart was isolated, arterially perfused with Krebs-Henseleit solution, and maintained at 27°C. After hypoxia or hypoxia and reoxygenation, the mitochondria was isolated and MF was determined by polarographic technique. In the oxygenated perfused muscle (control), state 3 respiration (QO_2) and respiratory control index (RCI) in NB (QO_2=128 ±6 nAO/min/mg protein; RCI=16.0 ± 0.8; n=8) were significantly ($P < 0.001$) greater than the values in the A (QO_2= 86 ± 4; RCI= 9.2 ± 0.7; n=9). After 40 or 60 min N_2, QO_2 decreased significantly ($P < 0.01$) to 78 ± 5% of control in the NB (n=10) and 67 ± 13% of control in the A (n=8). During reoxygenation following 40 min N_2, QO_2 was not significantly different from control in both the NB and A. Reoxygenation following 60 min N_2, however, did not improve MF and QO_2 in the NB (51 ± 6% of control) and A (59 ±6%) remained significantly ($P < 0.001$) less than control. The changes in RCI were similar to QO_2 in all groups. The ADP/O ratio was not significantly different from control in all groups. These data indicate that the depression in mitochondrial function is reversible after 40 min N_2 but is irreversible after 60 min N_2, and there was no difference between the NB and A hearts.