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REGIONAL BLOOD FLOW RESPONSE TO CHANGES IN ARTERIAL CARBON DIOXIDE TENSION ($PaCO_2$) IN NEWBORN LAMBS. Savitri P. Kumar, Angela Karathanos, Andrew M. Rabin, Ruth M. Cortner, Jonathan P. Knisely and Maria Delivoria-Papadopoulos. University of Pennsylvania, Philadelphia, Pa.

Previous studies in adults have shown that CO_2 is a major factor in cerebral blood flow regulation. The present study investigates the effect of hyperventilation on cerebral and other organs blood flow in 8 newborn lambs 15 days old. Following chronic catheterization,blood gases, Hct, Hb, pH, lactates, pyruvates, and regional blood flows using the microsphere technique were obtained prior to and following hyperventilation. Mean values for blood flow ± SD in ml/min/100g tissue at a baseline $PaCO_2$ of 36 mmHg and after hyperventilation to 20 and 12 mmHg respectively were: brain - from 118 ± 14 to 83 ± 10 to 59 ± 17 ($p < 0.05$); adrenal - from 418 ± 60 to 365 ± 45 to 303 ± 40 ($p < 0.05$); kidney - from 458 ± 49 to 408 ± 31 ($p < 0.05$) to 201 ± 42 ($p < 0.01$); heart - from 111 ± 32 to 88 ± 21 to 59 ± 15 (NS). Cardiac output did not significantly change from a mean value ± SD in ml/min/kg of 197 ± 39 to 161 ± 33 to 108 ± 24 at 20 and 12 mmHg respectively. There was no change in whole blood buffer base with acute changes in $PaCO_2$. This data demonstrates that hyperventilation reduced organ blood flow independent of cardiac output. Cerebral blood flow in the newborn lambs as in the adults seems sensitive to changes in $PaCO_2$ with the reduction being most marked (50% from baseline value) at a $PaCO_2$ of 12 mmHg. These data also suggest that a similar mechanism may be responsible for the reduction in renal and adrenal blood flows.

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HANCOCK MITRAL VALVE REPLACEMENT IN CHILDREN; A NEW COMPLICATION, Lynn Kutsche, Philip Oyer, Norman Shumway, David Baum, Stanford Univ. Hosp., Depts of Pediatrics & Cardiovascular Surgery, Stanford, California

Nine children ages 2-15 years have undergone mitral valve replacement with Hancock porcine heterograft valves at Stanford Hospital. Six patients had isolated mitral valve abnormalities (congenital or rheumatic) while 3 had complex congenital heart disease. All had severe mitral insufficiency and 5 had heart failure. Porcine mitral valve sizes utilized ranged from 19-31 mm. There were no surgical deaths, and all patients were markedly improved on discharge. Postoperative follow-up has been 1-5.5 years (mean 3.7 years). None of the children has had bacterial endocarditis, and none has had thromboembolic complications despite no long term anticoagulation. Seven of the 9 patients have remained asymptomatic. The other 2 have required valve re-replacment 3.6 and 4.8 years postoperatively because of severe fibro-calcific obstruction but are now asymptomatic 2 and 5 months later. In marked contrast, only 2 of 453 Stanford adult patients developed obstruction of heterograft mitral valves which required re-replacement. At Stanford, the Hancock valve remains the preferred valve for mitral replacement in children because it, a) can be performed with low risk, b) provides good functional improvement, and c) ordinarily requires no long term anticoagulation. Stenosis of the porcine heterograft does occur and deserves particular attention because it may be a more frequent complication in children than in adults.

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DYNAMIC ALTERATION OF THE INTERVENTRICULAR SEPTUM IN VOLUME OVERLOAD OF THE LEFT VENTRICLE Da-Hae Lee, P. Jacob Varghese, Jon P. Shematek and Catherine A. Neill, Johns Hopkins Hospital, Baltimore, Maryland.

The response of the interventricular septum(IVS) and the left ventricular(LV) posterior wall(PW) to LV volume overload was evaluated by echocardiography in 22 patients(pts.) with ventricular septal defect (Qp:Qs>2:1)(Group A) and 8 pts. with isolated mitral regurgitation(LA/AO > 1.5:1)(Group B). Both groups were compared to 47 normals ranging in age from one month to 16 years(Group C). Excursions(E) of IVS and PW were measured as the vertical length of maximal posterior motion of IVS and maixmal anterior motion of PW at the level of posterior mitral valve, respectively. Following parameters were calculated :(1)Septal fractional shortening(SFS)=IVSE/LV end-diastolic dimension(Dd), (2)Posterior wall fractional shortening(PFS)= PWE/Dd and (3)Ratio of SFS to PFS.

	SFS	PFS	SFS/PFS
A	*.24 ± .03	*.25 ± .03	*.95 ± .1
B	*.22 ± .02	*.20 ± .03	*1.1 ± .3
C	.16 ± .02	.30 ± .03	.5 ± .1

*$p < 0.001$ compared to group C

These data show that PW normally is the major dynamic component of LV contraction. With LV volume overload IVS becomes hyperdynamic and accounts for the apparent increase in the contractility of LV even with the presence of a hypodynamic LV posterior wall.

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ECHOCARDIOGRAPHIC (ECHO) STUDIES IN INFANTS OF DIABETIC MOTHERS (IDM). B.Lendrum, R.S.Pildes, M.Serratto, G. Srinivasan, B. Smulevitz, R. Yadava, V. J. Sabnis, I. Carr. Cook County Children's Hosp. Chgo, Ill.

Abnormal cardiac findings detected by echo in IDM have been emphasized but there is scant information of incidence, severity or pathogenesis. Thus, a prospective controlled study of 30 IDM and concurrent 36 normal newborns (N) was undertaken. There were no significant differences in mean ±S.E. birth wt. or gest. age of the IDM (3590±125g, 36.9±1.6 wk) compared to N (3383±899g, 39.6±3.7wk). There were 17 Class A, 13 insulin dependent IDM. Respiratory distress (RDS) was seen in 9, hypoglycemia (H) in 9 and polycythemia (P) in 9 IDM. Echos (85) were done at 24-72 hr and/or 5-7 d. Findings at 24-72 hr. are listed:

	HR beats/min	LVD mm	LVW mm	IVS mm	Vcf cir/sec	% * ΔD
IDM	123±2.9	16.2±0.5	2.5±0.2	3.7±0.2	1.19±0.09	23.2±1.6
	94-150	11.1-20.9	1.6-4.2	2.5-5.5	0.68-1.8	14.2-36.8
N	129±2.5	16.3±0.5	2.9±0.2	3.9±0.2	1.42±0.10	28.7±1.9
	102-158	12.7-22.1	1.4-5.1	2.6-5.4	0.5-2.7	11.9-47

Left vent. function, estimated from % shortening (ΔD) of LVD was depressed *$p<.01$ in IDM but were similar to N(26.8±1.3 vs 27.9±1.4 respectively)at 5-7 d . No differences were seen between IDM and N in any of the other factors including LV-PEP or RV-PEP. Class of diabetes, RDS, H or P did not influence echo findings. Thus, echo abnormalities were limited to transient and mild depression of LV function as judged by % shortening.

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ECHO EVALUATION OF CARDIAC STATUS IN HOMOZYGOUS SICKLE CELL DISEASE (SS). Lucille A. Lester, John W. Moohr, Peter Sodt, Nancy Hutcheon, Dianne Gallagher, Rene A. Arcilla. University of Chicago, Department of Pediatrics, Chicago.

Cardiac size and function were evaluated in 47 clinically-well non-hypertransfused children with SS, age 0.6 to 19 years, using echocardiography. Steady-state hemoglobin ranged from 5.5 to 10.0 gm%; in 29, ≥7 gm% (gp A) and in 16, <7 gm% (gp B). Age-matched normal children (48 Blacks, 52 Whites) were controls (N). Echo parameters included: RV dimension (RVD), LA dimension (LAD), LV dimension (LVD), LV wall thickness (W), LV mass (M), cardiac output (Q), and LV function parameters including circumferential fiber shortening velocity (VCF) and LV pre-ejection/ejection time ratio (PEP/ET). The ln of BSA was plotted against ln echo parameters except in VCF where ln heart rate was used. Data were expressed in percent of predicted normal. Increased values (>2 SD from N mean) were observed for RVD (in 22%), LAD (in 54%), LVD (in 52%), W (in 28%), M (in 61%), Q (in 50%), VCF (in 7%) and PEP/ET (in 34%). Group t-tests vs N showed significant differences ($p<0.001$) except for VCF. Gp B had greater LVD, M, and LAD than gp A ($p<0.01$ to <0.05). The degree of abnormality did not correlate with age. Children with SS have cardiac volume overload and a compensated high-output state. The abnormal LV wall and PEP/ET seen in certain patients may suggest secondary myocardial disease.

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CARDIAC EFFECTS OF HYPERTRANSFUSION THERAPY IN SICKLE CELL DISEASE (SS). Lucille A. Lester, John W. Moohr, Harry Wilson, Peter Sodt, Nancy Hutcheon, Dianne Gallagher, Rene A. Arcilla. University of Chicago, Department of Pediatrics, Chicago.

Serial echocardiography was used to assess cardiac size and function of 5 children (0.9 to 16 years) on hypertransfusion therapy (HT) for clinical problems related to SS. Satisfactory HT status, defined as total Hb levels maintained at ≥10 gm% and Hb-S at <10%, was achieved with washed packed RBC transfusion every 2-3 weeks. Iron status was monitored. Echo measurements of LV dimension (LVD), LA dimension (LAD), LV wall thickness (W), LV mass (M), cardiac output (Q), PEP/ET ratio and circumferential fiber shortening velocity (VCF) were obtained every 2-4 months during HT. These were compared to those of 100 normal children (48 Blacks, 52 Whites). Clinical improvement was dramatic. In one child (age 1 yr), the echo data remained normal before and during HT. The values in the other 4, expressed as % of predicted normal, before (C) and during HT for 8-10 mos are as follows:

	Hb	LVD	LAD	Q	M	VCF
C/HT	6.3/10.2	130%/110	148%/116	218%/127	182%/124	99%/110
t-test		p<0.001	p<0.05	p<0.01	p<0.01	p=ns p=ns

The improved clinical status during HT is accompanied by diminution of cardiac size and of the high-output state. These changes may reverse after HT is discontinued.