

121

EFFECTS OF PULMONARY ARTERY DISTENSION ON SYSTEMIC VASCULAR RESISTANCE (SVR). Jay M. Milstein, Boyd W. Goetzman, and Stephen H. Bennett. Dept. of Pediatrics, University of California, Davis, Ca.

Some newborns with pulmonary hypertension (PHN) have been noted to have increased SVR. To assess whether this is a reflex response to an increase in pulmonary artery pressure (PPA), we acutely produced balloon distension of the left PA. Fourteen lambs (1-3 days) were anesthetized with chloralose and instrumented to enable measurement of systemic blood flow (Qs), (PPA), aortic pressure (PAo), heart rate (HR), and right atrial pressure (PRA). PA distension was performed 47 times in 14 lambs (1-7/lamb). The mean PAo (\pm S.D.) increased from 55 \pm 13 mmHg to 58 \pm 15 mmHg (p<0.05) and the SVR increased from 82 \pm 20 mmHg/L/min to 84 \pm 19 mmHg/L/min (p<0.05) while the mean Qs and PRA did not change. In two lambs, alpha-blockade eliminated any changes in SVR. In another lamb, neither beta-blockade nor right vagotomy obliterated the changes whereas a left vagotomy did, suggesting that the reflex is under autonomic control.

In conclusion, some reflex interdependence appears to exist between the systemic and pulmonary vascular beds. The magnitude of the systemic changes is small and probably of no clinical significance when triggered acutely postnatally in infants with normal vasculature. However, if there is long standing PA distension in utero, it may account for the increase in SVR observed in some newborns with PHN. We postulate that the reflex changes in the systemic vascular bed may be most important in fetal life when it may affect redistribution of cardiac output in the hypoxic fetus.

122

COUPLING OF VENTRICULAR FUNCTION IN LAMBS. Jay M. Milstein, Boyd W. Goetzman and Stephen H. Bennett. Dept. of Pediatrics, Univ. of California, Davis, CA.

The effects of increased right ventricular afterload (RVAL) and increased left ventricular afterload (LVAL) on contractility of the opposite ventricle were assessed in newborn lambs. Six lambs (1-3 days) were anesthetized with chloralose and instrumented to enable measurement of pulmonary blood flow (Qp), pulmonary arterial pressure, aortic pressure, heart rate (HR), and, via transducer tipped catheters placed transmurally, RV and LV pressures and RV or LV dp/dt. With the pericardium closed, RVAL was induced 18 times in 6 lambs with alveolar hypoxia (2-5/lamb). LV contractility increased significantly (p<0.05) with stroke work (SW)(\pm S.D.) increasing from 169 \pm 114 mmHg-ml to 232 \pm 200 mmHg-ml and LV dp/dt increasing from 545 \pm 182 mmHg/sec to 739 \pm 336 mmHg/sec. Qp, HR, and stroke volume (SV) did not change significantly. LVAL was induced 13 times in 5 lambs with an aortic cuffed vascular occluder (2-3/lamb). No significant changes occurred in Qp, HR, SV, SW, or RV dp/dt. The effect of alveolar hypoxia on RV function was also assessed 18 times in 4 lambs. RV dp/dt, RV SW, RV SV, and Qp all increased significantly (p<0.05).

We concluded that in the presence of acute LVAL, RV function was unaffected whereas with an acute RVAL, LV function actually increased. This suggests that the LV dysfunction observed in some human newborns with pulmonary hypertension is not due to mechanical coupling of the ventricles. The contrasting findings for the two ventricles in the presence of contralateral VAL may be related to interventricular septal motion or to the nature of the VALs themselves.

123

SEQUENTIAL AORTIC (AO) & PULMONARY (PA) PULSE-DOPPLER VELOCITIES IN THE FIRST THREE DAYS OF LIFE. ROBERT MIRRO & PETER GRAY (SPON. BY P. FITZHARDINGE) UNIV. OF TORONTO: MT. SINAI HOSP: PERINATOLOGY: TORONTO, CANADA.

The Doppler principle provides a noninvasive measure of blood velocity by quantitating changes in reflected sound wave frequencies. Velocity (V) is related to flow (Q) by: Q = V * vessel area. Using this technique we measured great vessel velocities in 30 healthy, term infants (mean wt. = 3390 gm) from birth through closure of fetal shunts. Within the first six hours of life and again 24 and 48 hrs later we recorded mean velocities from the ascending AO (suprasternal) and the main PA (mid-sternum). Velocity spectrum were also recorded. The group was divided equally according to sex and route of delivery. AO mean velocities (cm/sec) were unchanged from the first study (10.5 \pm 3.7 SD) through the two subsequent exams (11.5 \pm 2.8 : 10.8 \pm 2.5). PA velocities were also unchanged but more difficult to quantitate. PA flow patterns, however, were useful in detecting shunts when diastolic flow was seen. Heart rate (HR) remained constant.

Conclusions: 1) Despite major changes in the circulatory system AO velocity and therefore flow is unchanged during the first three days of life. (This finding correlates with a fetal study which found that AO velocity remained constant through the third trimester: Erskine BJOG in press). 2) Diastolic flow is lost by 48 hrs of life 3) the route of delivery does not affect AO velocity or closure of fetal shunts and 4) this technique is reproducible and has the potential to assess cardiovascular function in the neonate.

124

INCREASED SENSITIVITY OF THE IMMATURE MYOCARDIUM TO ETHANOL George R. Noren, Nancy A. Staley, and Stanley Einzig, University of Minnesota, Department of Pediatrics, Minneapolis, Minnesota.

When fed ethanol (Et) from hatch turkeys develop altered Ca⁺⁺ flux of the isolated cardiac sarcoplasmic reticulum (SR) and depressed LV shortening fraction (SF). This study was done to investigate the effect in turkeys of a modest intake of Et (2%) on SR Ca⁺⁺ flux and SF when given for the 1st 28 d of life compared to control (C) fed water. Similar studies were also done at 56 d comparing results of birds fed 2% Et for 56 d, for the 1st 28 d only, and for the 2nd 28 d and 56 d C.

	SR Ca ⁺⁺ Flux			SF %
	UPTAKE nmol/mg Pr/min	BINDING nmol/mg Pr/4 min	ATPase μ mol/mg Pr/10 min	
28d C	160 \pm 18*(8)	46 \pm 3(6)	1.5 \pm 0.3(6)	53 \pm 8(51)
28d Et	113 \pm 27(8)*	43 \pm 2(8)	1.3 \pm 0.2(8)	44 \pm 4(17)*
56d C	165 \pm 14(8)	45 \pm 3(8)	1.5 \pm 0.2(8)	54 \pm 6(45)
56d Et	117 \pm 29(8)*	33 \pm 2(8)*	2.4 \pm 0.4(8)*	48 \pm 7(16)*
56d (Et 1st mo)	118 \pm 14(10)*	48 \pm 8(13)	2.2 \pm 0.4(22)*	52 \pm 6(25)
56d (Et 2nd mo)	160 \pm 20(10)	46 \pm 7(10)	1.5 \pm 0.2(10)	56 \pm 7(16)

+ =SD * = p < 0.01 compared to C

Ingestion of Et for the 1st 28 d of life results in altered SR Ca⁺⁺ flux and decreased SF which is not enhanced by Et for 56 d. Persistence of altered SR Ca⁺⁺ flux is observed at 56 d despite abstinence from Et for 28 d. Et(2%) intake after 28 d of life does not affect SF or SR Ca⁺⁺ flux.

125

DIAGNOSIS OF TOTAL ANOMALOUS PULMONARY VENOUS RETURN COMBINED WITH PULSED DOPPLER, M-MODE AND TWO-DIMENSIONAL ECHOCARDIOGRAPHY Soraya Nouri and Alan Waggoner (Sponsored by Jen Yih Chu), St. Louis University School of Medicine, Department of Pediatrics, St. Louis, Missouri

Depiction of an echo-free space (EFS) behind the LA by M-mode and 2D echo is suggestive of total anomalous pulmonary venous return (TAPVR). 2D often shows that pulmonary veins do not drain into the LA but the pulmonary venous connections are difficult to image in respiratory distress. 2D may identify the drainage site of the common venous channel (CV). However, in TAPVR into coronary sinus (CS), dilated CS may be confused with LA. Pulsed Doppler (PD) improves the accuracy of the echo evaluation. We studied 10 patients with TAPVR with M-mode, 2D, and PD echo, before angiography. Ages ranged 1-135 days (median 19.2); 8/10 less than 7 days old. M-mode demonstrated an EFS behind LA in 6/10; LA size was small in 7/10; LV size was small in 10/10 and RV size was enlarged in 7/10; 4 had paradoxical septal motion. 2D showed EFS behind LA in 7/10 and the drainage site of the CV was identified in 7/10. PD detected continuous turbulent flow in the CV and/or at its entry site in 9/10. All were confirmed at surgery or autopsy. In one pt with TAPVR to the CS, 2D showed large RV, a small LA and LV but not EFS; PD didn't demonstrate unusual or continuous flow disturbance. Conclusion: M-mode and 2D identify the EFS representing the CV in a majority of pts with TAPVR and 2D may demonstrate drainage site of the CV. M-mode reveals a small LV in all and a small LA and large RV in a majority. Addition of PD to M-mode and 2D enhanced accuracy of detection of TAPVR and the site of drainage.

126

DESCENDING AORTOGRAPHY WITH BALLOON INFLATION: A TECHNIQUE FOR EVALUATION OF THE SIZE OF PATENT DUCTUS ARTERIOSUS IN INFANTS WITH LARGE VENTRICULAR SEPTAL DEFECTS. P. Syamasundar Rao, King Faisal Specialist Hospital and Research Centre, Department of Pediatrics, Riyadh, Saudi Arabia

Selective ascending aortic angiography (AAA) has been recommended in all patients with large ventricular septal defect (VSD) to detect a coexisting patent ductus arteriosus (PDA). We have previously shown that AAA does not uniformly detect PDA in the presence of a large VSD and suggested that the PDA is best diagnosed by passing a catheter across it and probing for it. However, its size cannot be assessed by this method. The purpose of this communication is to demonstrate an angiographic technique by which the exact size of the PDA can be determined.

Six infants aged 2 to 8 months underwent AAA and descending aortic angiography (DAA) during diagnostic catheterization; the latter was performed with balloon inflation. Renografin, 1 ml/kg, was injected during both AAA and DAA. During AAA there was a faint or partial opacification of PDA in five infants and no opacification in the sixth. During DAA, the PDA was opacified in all infants and was more clearly seen and appeared much larger in each case. It is concluded that DAA with balloon inflation during the initial phases of angiography is a useful and safe technique in the evaluation of the size of the PDA in patients with large VSD.