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INFLUENCE OF PULSE DOPPLER AND 2D ECHO ON PREOPERATIVE CARDIAC CATHETERIZATION IN CONGENITAL HEART DISEASE.*
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The influence of echocardiography on the number of cardiac catheterizations (CC) performed prior to cardiac surgery was assessed in a retrospective analysis comparing two 12 month periods (Jan.-Dec. 1983 and July 1985-June 1986) when pulse doppler (PD) was added and a new pediatric tertiary centre was established. Of the 245 cardiac surgical procedures in 1983, 200 (82%) had pre-operative CC compared to 163 catheterizations prior to 239 surgical procedures (68%) in 1985/86. This significant reduction in CC ($p < .001$) was present in both open (87/87 v 90/103; $p < .001$) and closed (113/158 v 73/136; $p < .001$) heart procedures. There were similar reductions in CC proportions prior to closed palliative (65/66 v 53/65; $p < .001$) and closed curative (48/92 v 20/71; $p < .001$) surgical procedures. Neonates and children undergoing closed surgical procedures all experienced significant reductions in pre-operative CC except neonates undergoing curative procedures and infants having closed palliative surgery. The closed surgical procedures with the greatest reductions in pre-operative CC were ligation of PDA and repair of coarctation. Of the various age groups undergoing open heart surgery, only children had significantly less CC, the greatest reduction occurred in closure of ASD. Other less frequent lesions did not have CC. There were 22 diagnostic failures (technically inadequate or misinterpretations) of 245 echos (9%) in 1983 compared to 11 of 239 (4.6%) echos in 1985/86 ($p < .05$). Thus PD and 2DE has become more accurate and resulted in a reduction of preoperative CC.

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EXTRACELLULAR BODY FLUID VOLUMES IN CHRONICALLY HYPOXEMIC LAMBS. Michiel Dalinghaus, Alie M Gerding, Jan H Koers, Jan Willem C Gratama, Jaap R Kuipers (Spon. by Abraham M Rudolph). Dept. of Pediatric Cardiology, University Hospital, Groningen, The Netherlands.

The extent to which body fluid volumes change as a consequence of chronic hypoxemia is not exactly known. Therefore we measured extracellular and plasma volumes in 5 chronically hypoxic lambs. Before the 10th day of life we placed an inflatable balloon around the pulmonary artery, performed an atrial septostomy and inserted catheters. On days 3-4 after surgery the balloon was gradually inflated. In another 7 lambs only catheters were placed. At 5 weeks of age the lambs were studied. We used single injections of ferro-cyanide and Evans blue to measure extracellular and plasma volumes, respectively.

The hypoxic lambs had a lower aortic oxygen saturation (69 ± 9 (SD) vs $92 \pm 2\%$, $p < 0.01$), and a higher hemoglobin concentration (142 ± 17 vs 97 ± 10 g.l⁻¹, $p < 0.001$) and hematocrit (43 ± 5 vs $29 \pm 6\%$, $p < 0.01$). Total extracellular fluid volume (320 ± 31 vs 273 ± 17 ml.kg⁻¹, $p < 0.01$) and blood volume (134 ± 33 vs 80 ± 12 ml.kg⁻¹, $p < 0.05$) were increased in hypoxic lambs. This was also true for plasma volume (81 ± 22 vs 58 ± 5 ml.kg⁻¹) and interstitial fluid volume (238 ± 29 vs 215 ± 18 ml.kg⁻¹), although these differences did not reach statistical significance.

These results show that total extracellular fluid volume and blood volume are both increased in hypoxic lambs, and that total hemoglobin mass is even more increased than the hemoglobin concentration would lead us to expect.

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THE ROLE OF ATRIAL NATRIURETIC PEPTIDE (ANP) IN CONGENITAL HEART DISEASE Alan L. Davis, David S. Goldstein, Stephen Shapiro and Murray M. Pollack (Spon by Glenn C. Rosenquist) George Wash Univ, Child Hosp Natl Med Ctr, Depts of Anesth, Card and Peds, Wash., D.C. and Hypert/Endoc. Br. NHLBI, NIH, Bethesda, Md.

This study examines the relationship of ANP to right and left atrial pressures, intracardiac shunts and compares patients with congenital heart disease (N = 11) to a group of normal children (N = 34). During cardiac cath, right and left atrial ANP levels, intracardiac pressures, and cardiac output were measured and shunt and direction of the shunt were calculated. All ANP results (RIA technique) are in pg/ml (mean \pm SD). Of the 11 children, 4 had no intracardiac shunting, 5 had left to right shunts and 2 had right to left shunts. Right and left atrial ANP levels were significantly ($p < .005$) elevated when compared to the normal control (6.5 ± 4.9). Right atrial ANP (103.9 ± 98.0) was not different from left atrial ANP (101.6 ± 95.4). Seven children with elevated right atrial pressures (RAP ≥ 9 mm Hg) had higher ANP levels than 5 children without elevated RAP (154.9 ± 106.5 vs 42.6 ± 38.0 , $p < .03$). In patients without shunts (N = 4) RAP and ANP levels were highly correlated ($R = 0.930$). Left atrial ANP levels were also highly correlated with RAP ($R = 0.945$). Children with intracardiac shunts had poor correlation between ANP and atrial pressures but significantly ($p < .05$) higher ANP in the right atrium (166.4 ± 111.5 , N = 5) than patients without shunt (40.9 ± 24.6 , N = 4). **CONCLUSION:** These unique data indicate that ANP in children is: (1) primarily produced in the right atrium and is correlated with RAP, (2) elevated in congenital heart disease, and (3) is further elevated in children with left to right shunts.

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ONTOGENY OF BLOOD PRESSURE (BP) IN THE INBRED DAHL HYPERTENSION-SENSITIVE (S/JR) AND -RESISTANT (R/JR) RAT. Prasad Devarajan, Lorraine Persan, Frederick J. Kaskel, Charles J. Juno, James A. McCaughan, Jr., and Leon C. Moore. (Spon. by Leonard I. Kleinman). School of Medicine, SUNY Stony Brook, NY.

The inbred S/JR rat is characterized by a genetic predisposition to NaCl-induced hypertension (HT). Although mature S/JR but not R/JR rats develop HT when fed a high NaCl-containing diet, this effect has not been examined in the pre-weaning state. S/JR and R/JR dams were maintained on 0.15% (w/w) or 8% (w/w) NaCl diets throughout gestation and lactation. Measurements of abdominal aortic blood pressure (MAP, mmHg) were obtained in anesthetized (Ketamine 25 mg/kg and Xylazine 3 mg/kg i.p.) offspring at 5, 15 and 25 days of age. Values = mean \pm SEM; n = 8-14 rats/group.

Age	R/JR				S/JR			
	0.15% BW(g)	MAP	8.0% BW	MAP	0.15% BW	MAP	8.0% BW	MAP
5	9+5*	25+1*	12+8	30+1*	12+2*	32+2	10+5	35+2
15	34+1	48+2*	34+2	56+2	34+2	68+2	NA	NA
25	62+2	72+2*	61+4	77+2	67+2	86+2	NA	NA

* $p < .05$ vs. age-matched S/JR on same diet; + $p < .05$ vs. strain- and age-matched rats on 8% diet; S/JR exposed to 8.0% died (NA). A hypertensinogenic effect of 8% NaCl was seen in R/JR rats at 5 and 15 days. BP in S/JR rats was consistently higher. Ontogeny of BP may be determined by pre- and postnatal dietary NaCl.

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EBSTEIN'S ANOMALY: PRE AND POSTOPERATIVE EXERCISE CARDIORESPIRATORY FUNCTION
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To determine the effects of definitive operation for Ebstein's anomaly upon rest and exercise cardiorespiratory function, we performed cycle exercise studies on 38 patients with Ebstein's anomaly prior to operation and 10 patients after operation. All but 2 of the postop studies represented a maximal cardiorespiratory effort. Mean age of the preop group was 15.5 years and the postop group 13.6 years. Atrial septal defects were present in 31 of 38 preop and 0 of 10 postop patients. Seven of 10 postop patients had tricuspid valvuloplasty and 3 had valve replacement. All existing atrial septal defects were closed. Comparing pre to postop studies exercise duration increased* from 49.5 ± 21 to $77.9 \pm 15\%$ of predicted and maximum oxygen consumption increased* from 20.9 ± 7 to 27.2 ± 7 cc/kg/min. Rest systemic arterial oxygen saturation increased* from 87 ± 9 to $96 \pm 3\%$ and exercise saturation increased* from 77 ± 15 to $94 \pm 3\%$. Maximum exercise heart rate was 80 ± 11 preop and $84 \pm 13\%$ of predicted postop. Rest ventilatory equivalent for oxygen (\dot{V}_E/\dot{V}_{O_2}) decreased* from 48 ± 13 preop to 38 ± 6 postop and exercise \dot{V}_E/\dot{V}_{O_2} decreased* from 53 ± 23 preop to 38 ± 6 postop. Definitive operation (tricuspid valvuloplasty or replacement and ASD closure) results in significant improvement of exercise tolerance and normalization of systemic arterial oxygen saturation, and reduction of excess ventilation at rest and during exercise.

* = $P < 0.05$ \pm = standard deviation

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REVERSIBLE PULMONARY ARTERY BANDING: DISSOLVABLE POLYDIOXANONE MESH VS SEGMENTED SILASTIC BANDS
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Development of a reliable reversible pulmonary artery band (PAB) might obviate the need for a second cardiac surgical procedure in children with some forms of congenital heart disease. We evaluated dissolvable polydioxanone (PDS) mesh and 4 mm wide segmented silastic bands (SSB) sewn together with 7-0 PDS suture for use as a reversible PAB. Seven mongrel puppies (P), average wt=7.7 kg, were divided into 2 groups (Grp): Grp I (4 P) received SSB, Grp II (3 P) received PDS mesh. No immediate pressure gradient resulted from PAB placement. All P underwent cardiac catheterization monthly. Three months after PAB placement Grp I right ventricular (RV) systolic pressure varied between 30 and 60 mmHg with systolic pressure gradient between 13 and 27 mmHg (mean=19.3); in Grp II, none developed gradients over 10 mmHg. Grp I P underwent balloon angioplasty (BA) with decrease in average gradient from 21.3 to 7.3 mmHg and average RV systolic pressure from 46.7 to 27 mmHg. All P were sacrificed and the PAB site examined grossly and microscopically. No evidence of PDS mesh or fibrous scarring was found in Grp II P. In Grp I P a fibrous capsule enveloped the SSB with no evidence of remaining PDS suture. P undergoing BA had fracture of the capsule without evidence of injury to the pulmonary artery.

Our data demonstrates that a reversible PAB is feasible and that SSB is superior to PDS mesh.