157 QUANTITATIVE MORPHOMETRIC EVALUATION OF PULMONARY ARTERIOLAR DISEASE(PAD)BY LUNG BIOPSY IN PATIENTS(PTS) WITH VENTRICULAR SEPTAL DEFECT(VSD). Marlene Rabinovitch, Amnon Rosenthal, Aldo R. Castaneda and Lynne Reid. Harvard Medical School, Children's Hospital Medical Center, Department of Cardiology, Pathology and Surgery, Boston, Massachusetts.

PAD was assessed from lung biopsy obtained at surgery in 12 pts with VSD ranging in age from 2 months(mo)to 30 years(yrs)(median=15 mo)and correlated with clinical and hemodynamic data. Biopsy was taken from the right upper lobe and fixed in 1:2 gluteraldehyde-formaldehyde solution. Lung sections were treated with elastic tissue stain. The pulmonary arterioles were microscopically evaluated by three age related morphometric criteria (I)extension of muscle into smaller vessels(EMSV)(II)percentage wall thickness(%WT)(III)alveolar/arterial(a/A)ratio per unit area.

Abnormal EMSV(<50μ diameter)was present in 10/12 pts, with muscle evident in alveolar wall vessels. The 2 pts without EMSV were older and had small shunts. Percent WT was increased in 11/12 pts (mean 32±6)and normal(<10)in 1 pt. Pulmonary vascular resistence (PVR)<2.5 u/M^2 was associated with mean %WT of 16±2 and PVR>2.5u/M^2 with %WT of 32±6(p<.0025). An abnormal a/A ratio(>1.5:1)was observed in 3/12 pts(mean 39±4:1); those with the highest PVR among the group(3.6, 4.2, 12.5u/M^2)(p<.005). In 1 pt, aged 2 yrs with PVR 4.2 u/M^2, EMSV, %WT of 40 and a/A ratio 45:1, VSD closure resulted in unrelieved pulmonary hypertension and death. We conclude that lung biopsy is useful in quantitating PAD in pts with VSD. EMSV is present in all infants. When the VSD is large, it is associated with progressive increase in %WT and in pts with advanced PVR with increased a/A ratio.

158 ECHOCARDIOGRAPHIC ASSESSMENT OF LEFT VENTRICULAR FUNCTION IN CHILDREN WITH SICKLE CELL ANEMIA: Allan Rees, Miltiadis Stefadouros, William Strong, Max Miller, Judy Rigby, Priscilla Gilman, Judith McFarlane, Dept. Pediatrics, Medical College of Georgia, Augusta.

Left ventricular (LV) performance was determined by echocardiography in 44 black children with sickle cell anemia (SS), and a control group of 28 age-matched healthy black children (N). The SS children were divided into two subgroups according to the absence (I) or presence (II) of dyspnea and/or fatigue on mild effort. The results are:

	End-diastolic LV dimension index(mm/m^2)	LV ejection fraction	Circumferential fiber shortening rate(circ/sec)	Percent minor LV axis shortening	Cardiac index (L/min/m^2)
N	41±9	0.65±0.06	1.32±0.25	37±4.3	4.1±1.3
I	46±10*	0.63±0.04*	1.2±0.08*	38±5.5*	5.1±1.5*
II	48±7+	0.57±0.11+	1.15±0.25+	32±7+	5.7±1.6+

* P >0.05, + P <0.01, + P <0.05 (in comparison to N)

Thus LV function was normal in asymptomatic SS children but was depressed in a significant proportion of symptomatic children with sickle cell anemia. Echocardiography can be used to identify the presence of LV dysfunction and establish the need for treatment of heart failure which coexists with and is partially responsible for the congested circulatory state frequently observed in sickle cell anemia.

159 MYOCARDIAL CONTRACTILE PROTEINS IN LAMBS: MATURATIONAL CHANGES IN ENZYMATIC FUNCTION. Thomas A. Riemenschneider, Robert A. Brenner, Douglas P. Burks, Jr., Dean T. Mason and Joan Wikman-Coffelt, Dept. of Peds. UC Davis, CA. 95616. (Sponsor: F.H. Adams)

Myosin (M) ATPase activity of contractile proteins (CP) has been shown to be an index of muscle energy utilization. Under certain conditions, a relationship exists between ATPase activity and contractile velocity. In the adult dog, mild chronic systolic pressure overload is associated with increases in M ATPase activity and contractile element velocity. We have previously demonstrated an increase in contractile element velocity (mechanical Vmax) in the left ventricle (LV) of the newborn lamb. To determine the enzymatic response of CP to hemodynamic alterations of the transitional circulation, we examined cardiac M ATPase activity in six lambs and four adult sheep. Tissue was obtained from the lateral wall of the LV; myosin was isolated by previously developed purification techniques utilizing $(NH_4)_2SO_4$ fractionation of CP. Concentration of pure myosin was determined by the Lowry method and potassium activated ATPase activity was determined by phosphate assay as described by Fiske and SubbaRow. From the data obtained, we calculated enzymatic Vmax values as follows:

Age (days)	4-6	15-16	38	Adult
K+ATPase Vmax (μM PO_4/mg·min)	1.87	2.17	3.22	2.70
% of Adult Value	69	80	119	-

The newborn LV responds to increasing demands of the transitional circulation with increases in energy utilization.

160 MYOCARDIAL ULTRASTRUCTURE IN LAMBS:COMPARISON OF SARCOMERE LENGTH AND INTRACELLULAR ORGANIZATION. Thomas A. Riemenschneider, Douglas P. Burks, Jr., and Robert A. Brenner, Department of Pediatrics, UC Davis, CA. 95616.

The ultrastructural basis of Starling's law is well established in the adult. We have demonstrated age-related changes in left (LV) and right (RV) ventricular function in the newborn lamb. To determine whether these changes in function were related to maturational changes in sarcomere length (SL), we assessed myocardial ultrastructure in 12 lambs (1-22 days). Representative sections were excised from mid-lateral walls of LV and RV following cardiac arrest with KCL. Tissue was fixed in modified Karnofsky solution and paraformaldehyde, post-fixed in OsO_4, dehydrated in acetone and imbedded in Epon 812. Sections were examined by light microscopy for longitudinal orientation. Electronmicrographs were prepared from representative areas. At birth LV and RV myocardium was poorly organized with small thin myofibrils and a large proportion of non-contractile elements (mitochondria, nuclei and glycogen). With maturation, organization and relative proportions of contractile material increased more rapidly for LV than RV. Myofibrillar diameter (MFD) also increased more rapidly for LV than RV (MFD-4 weeks/MFD-NB=1.8 for LV; 1.2 for RV). At all ages, RV and LV SL were the same (1.7 1.85 microns). Thus, previously shown age-related differences in LV and RV function are not the result of maturational changes in sarcomere length.

(Sponsor: F.H. Adams)

161 CARDIAC PUMP PERFORMANCE IN LAMBS:MATURATIONAL DIFFERENCES OF LEFT AND RIGHT VENTRICULAR FUNCTION. Thomas A. Riemenschneider, Douglas P. Burks, Jr., and Robert A. Brenner, Dept. Peds., UC Davis, CA. 95616.

We examined the pump performance of the newborn heart by determining the contribution of the Frank-Starling principle to both left (LV) and right (RV) ventricular function in 16 open chested lambs (1-44 days) anesthetized with alpha chloralose and instrumented with aortic and pulmonary flow probes and pressure catheters, and left and right ventricular microtransducers. Alterations in ventricular filling pressure (VFP) were induced by venous infusion of warmed (37°C) saline (60 cc/kg/2min). Ventricular function curves were constructed relating stroke volume (SV) and stroke work (SW) to VFP. With maturation, LV responded to increasing VFP by delivering progressively larger SV. Older animals showed a greater change from resting to peak stroke volume (ΔSV) and stroke work (ΔSW), and peak SVs were achieved at higher VFP. Results for the LV were:

Age (days)	1-7	12-16	21-24	28-44
ΔSV(%)	30-75	75-95	100-120	120-150
ΔSW(%)	35-60	70-100	100-120	120-140
VFP at peak SV	14-18	18-20	20-22	22-26

In contrast, at all ages, RV had a limited response to increased VFP (ΔSV=30-35%) (SW=28-40%), and peak SV was achieved at lower VFP (11-16 mmHg). An age-related increase in pump performance was found for LV, while RV retained functional characteristics of the newborn.

(Sponsor: F.H. Adams)

162 CARDIAC MUSCLE PERFORMANCE IN LAMBS: DISPARITY BETWEEN CONTRACTILE ELEMENT VELOCITY OF LEFT AND RIGHT VENTRICLES, T. A. Riemenschneider, D. T. Mason, D. P. Burks, Jr., and R.A. Brenner, Dept. Peds., UC Davis, CA. 95616.

We assessed muscle performance of the newborn heart by examining left (LV) and right (RV) ventricular myocardial mechanics in 18 open chested lambs (ages 1-40 days) anesthetized with alpha chloralose and instrumented with aortic and pulmonary artery flow probes and pressure catheters and high-fidelity LV and RV microtransducers. In each animal, ventricular pressure (VP) and its first derivative (dp/dt) were recorded from both ventricles. To obtain measurements of contractile state of LV and RV, pressure-velocity curves were constructed relating: 1) contractile element velocity of shortening, V_{CE}=(dp/dt)/(32•IP),to total isovolumic pressure (IP), to obtain maximal velocity of contractile element shortening (Vmax); and 2) contractile element velocity of shortening, V_{CE}=(dp/dt)/(32•DP),to developed pressure (DP=IP-end-diastolic pressure) to obtain V_{CE10}. Vmax values are presented in the table; DP-obtained Vmax values (V_{CE10}) paralleled these results:

Age (days)	1-3	5-11	14-17	21-23	28-40
LVmax (ML/sec)	6.2	4.1	3.9	3.5	3.5
RVmax (ML/sec)	2.2	2.4	2.3	2.2	2.1

This data demonstrates an increased LV contractile state in the newborn lamb which exceeds Vmax values for the adult sheep LV and declines with maturation. In contrast, the RV shows a lower contractile state which approximates that of the adult sheep RV and does not change with age. (Sponsor: F.H. Adams)