

† 193 COMPARISON OF ISOLATED VENTRICULAR MYOCYTES FROM THREE-WEEK OLD AND ADULT RABBITS. Rashid Nassar, Mary C. Reedy and Page A.W. Anderson. Duke University Medical Center, Durham, N.C. 27710

Single, quiescent, electrically stimulatory, calcium-tolerant ventricular myocytes isolated by enzymatic digestion from 3-week old (W cells) and 3-month old (M cells) rabbits were examined using a differential interference contrast light microscope. The image of the contracting cell was recorded on video tape and sarcomere length measured. The cell was then fixed and examined with electron microscopy. No evidence of ultrastructural damage was found. Mean length of M cells (N=26) was  $147 \pm 25$  (s.d.)  $\mu\text{m}$  and diameter was  $21 \pm 15$   $\mu\text{m}$ . M cells had square or stepped ends. W cells (N=12) were generally smaller: mean length  $112 \pm 40$   $\mu\text{m}$  and diameter  $14 \pm 9$   $\mu\text{m}$ . Several types of W cell were found in the same heart: large cells resembling M cells, and small cells with tapered ends and fewer, larger myofibrils. W cells had widely varying levels of development of transverse tubules and sarcoplasmic reticulum. Rest sarcomere lengths were  $1.91 \pm 0.09$   $\mu\text{m}$  for M cells and  $1.83 \pm 0.07$   $\mu\text{m}$  for W cells. W cells that had M-cell ultrastructure had sarcomere shortening like that of M cells. Ultrastructurally immature cells had depressed amount and velocity of sarcomere shortening. The amount and velocity of W sarcomere shortening was  $.17$   $\mu\text{m}$  and  $.63$   $\mu\text{m/s}$  and that of M sarcomere shortening was  $.29$   $\mu\text{m}$  and  $1.30$   $\mu\text{m/s}$ . Thus the ventricle of the three-week old rabbit has cells at various stages of development both structurally and functionally. This inhomogeneity must complicate the assessment of developmental changes of myocardial contractility using measurements obtained from multicellular preparations.

194 CARDIOVASCULAR EFFECTS OF KETAMINE IN YOUNG ANIMALS. Jim B. Norton, Frederick A. Burrows, James E. Fewell and William P. Fiser, (Spon. by Robert H. Fiser, Jr.), Departments of Pediatrics, Anesthesia, Physiology and Surgery, University of Arkansas for Medical Sciences/Arkansas Children's Hospital, Little Rock, AR.

This study was undertaken to assess the cardiovascular (CV) effects of Ketamine (K) in unsedated young animals. Four lambs and 4 piglets were instrumented under general anesthesia and not studied before the third postoperative day. Pulmonary flow (Qp), systemic (Pao) and pulmonary (Ppa) arterial, and left atrial (Pla) pressures were monitored before and after K was given at doses of 1 and 2 mg/kg IV. In each lamb the Qp rose, usually within 2, but always within 4 minutes, and in each piglet the Qp remained unchanged or fell. In only one lamb did the Pao rise  $>10\%$ , and in the others it remained unchanged or increased  $<10\%$ . The Ppa remained the same or fell slightly. The systemic (Rs) and pulmonary (Rp) resistances fell slightly in each lamb. In the piglets the fall in Qp was associated with a rise in Pla and a rise in Rs. The Rp increased slightly in 3 and fell in one. Tachypnea was a consistent finding most marked within 2 minutes. Heart rate increased in 3 of 4 lambs and was not affected in the piglets. There is considerable species variability in the CV effects of K which may be related to variations in sympathetic responses. In piglets less sympathetic response allows more apparent myocardial depression to be manifest. Importantly, and in contrast to reports in adults, no consistent rise in Rp was noted in these young animals.

195 SUDDEN DEATH IN A PEDIATRIC CARDIAC POPULATION WH Neches, CY Miao, DR Fischer, LB Beerman, SC Park RA Mathews, PJ Fricker, CC Lenox, JR Zuberbuhler.

University of Pittsburgh School of Medicine, Pittsburgh, Pa. Sudden death (SD) occurred in 46 of 280 non-surgical deaths (16.4%) over a 10 year period. 11 pts had myocardial disease (MYO) while 20 had open heart operations (OH) and 15 did not (NOH). SD was common in MYO (30.6%) and OH (43.5%) as compared to NOH (7.6%) patient deaths. The mean ages at SD were 14.6 (MYO), 14.9 (OH) and 7.9 (NOH) yrs. SD was characterized as anticipated (SAD) or unexpected (SUD) depending upon the presence of other contributing factors.

Eight of the 11 MYO pts had SUD. Four of these 8 had premature ventricular contractions (PVC) noted prior to death and 2 of these 4 had a terminal dysrhythmias. Eleven of the 15 NOH pts had SUD and none of the 11 had prior DYS. Of the 4 (NOH) pts with SAD 3 had prior DYS; 2 with atrial flutter and 1 with PVC. No terminal dysrhythmias was noted in the NOH group.

14 of 20 OH cases had SUD. 6 of these SUD had prior PVC and 3 of the 6 had terminal DYS. 3 of the other 8 with SUD had documented terminal DYS but did not have PVC prior to death. 7 of the 14 OH pts with SUD had tetralogy of Fallot or postop Rastelli and 4 of these had documented terminal DYS. Two of these 4 and 1 other had PVC prior to death. PVC's were found in 27 of 180 (15%) survivors of OH for tetralogy of Fallot.

In conclusion, death is commonly sudden in pts dying in OH and MYO groups. It is unexpected 75% of the time. PVCs prior to death were found in 30% of SUD. The frequency of tetralogy of Fallot is alarming and this group bears further close scrutiny.

† 196 SUDDEN UNEXPECTED CARDIAC DEATH IN A DEFINED COMMUNITY, AGES 1-21. Daniel R. Neuspiel and Lewis H. Kuller (Spon. by William H. Neches). University of Pittsburgh, Department of Epidemiology, Pittsburgh, Pennsylvania.

A population-based study of sudden (demise less than 24 hours) and unexpected nontraumatic death (SUND) between ages 1-21 was done to delineate the descriptive epidemiology of these events. All deaths of residents of Allegheny County, Pennsylvania, ages 1-21, dying between 1972-1980 were evaluated by review of available records. Patients with previous open heart surgery were excluded.

196 cases of SUND were identified, with an autopsy rate of 87%. 47/196 were classified as cardiac, using conservative criteria. The most frequent diagnoses of these were myocarditis (14) and cardiomyopathy (8). Less common were myocardial fibrosis, coronary artery abnormalities, aortic aneurysm, Ebstein anomaly, endocarditis, prolonged Q-T syndrome, myocardial infarction and several other dysrhythmias and structural defects. Of the cardiac cases with complete information, 88% (30/34) were instantaneous and 81% (17/21) had prodromal symptoms. 31% (11/35) were associated with physical exertion, but only one case was related to formal school athletics. Of the non-myocarditis cases, 93% (27/29) had known cardiac disease prior to demise. Of all cases of SUND, the cardiac group comprised 53% of the instantaneous deaths and 65% of those related to exertion.

Prevention of fatal events by identification of risk factors, better treatment of known disease or successful cardiopulmonary resuscitation may be possible.

197 EFFECTS OF HYPOXEMIA (H) ON CARDIOVASCULAR RESPONSES TO ISOPROTERENOL (ISO) IN NEONATAL SWINE. Dov B. Nudel, Barbara J. Peterson, Barbara J. Buckley, Norman Gootman, Schneider Children's Hospital, Long Island Jewish-Hillside Medical Center, New Hyde Park, NY. Piglets,  $3.3 \pm 0.3$  (Gr I) and  $15.6 \pm 0.4$  (Gr II) days of age, were anesthetized, ventilated and paralyzed; the ductus arteriosus was ligated. ECG, aortic (AO) and LV pressures, LV dP/dt max, and phasic pulmonary (cardiac output, CO) and superior mesenteric (Mes) arterial flows were continuously recorded; resistance (R) was calculated. Sequential 10 min infusions of ISO (0.05, 0.1, 0.2 mcg/kg/min) were given during normoxemia (NO,  $\text{PO}_2$   $99 \pm 3$  mm Hg) and repeated during moderate (M) H ( $\text{PO}_2$   $58 \pm 1$  mm Hg) or severe (S) H ( $\text{PO}_2$   $38 \pm 1$  mm Hg) in 13 piglets. In 18 age-matched controls saline was infused instead of ISO and no significant changes were observed. Mean  $\pm$  SE to 0.2 mcg/kg/min ISO are presented. In Gr I MH diminished increases in LV dP/dt max ( $54 \pm 10$  vs  $19 \pm 7$ ,  $p < 0.01$ ), CO ( $22 \pm 6$  vs  $9 \pm 6$ ,  $p < 0.02$ ) and HR ( $28 \pm 5$  vs  $14 \pm 3$ ,  $p < 0.02$ ). In contrast MH augmented increases in LV dP/dt max ( $51 \pm 8$  vs  $68 \pm 9$ ,  $p < 0.02$ ) and did not alter dose-dependent increases in HR (29 $\pm$ 7) and CO ( $32 \pm 12$ ) in Gr II. In Gr I, SH attenuated increases in HR ( $34 \pm 5$  vs  $13 \pm 3$ ,  $p < 0.01$ ) and LV dP/dt max ( $43 \pm 11$  vs  $3 \pm 6$ ,  $p < 0.01$ ) but not in CO. In Gr II, SH reduced increases in LV dP/dt max ( $38 \pm 9$  vs  $10 \pm 8$ ) in all animals and in HR ( $36 \pm 11$  vs  $10 \pm 3$ ) in 6 of 7 animals. ISO had no significant effect on AO pressure during NO, MH or SH in Gr I and II. MesR was not significantly affected by ISO during NO but decreased ( $15 \pm 4$ ,  $p < 0.02$ ) during MH in Gr I. However, in Gr II MesR decreased ( $15 \pm 3$ ,  $p < 0.01$ ) during NO, but increased ( $23 \pm 7$ ,  $p < 0.02$ ) during MH. During SH, ISO had variable effects on MesR in Gr I and II. The results indicate that cardiovascular responses to ISO in newborn swine are significantly affected in magnitude and direction by arterial  $\text{PO}_2$  level and postnatal age.

198 THE EFFECT OF VARYING PATTERNS OF PRESSURE DELIVERY DURING POSITIVE PRESSURE VENTILATION (PPV) ON CARDIAC OUTPUT (CO). Mark D. Reller, Edward F.

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CO decreases with increasing mean airway pressure (MAP) during PPV. Since MAP can be varied by altering inspiratory pressure (IP), expiratory pressure (EP), or the I/E time ratio, and since E during PPV may be a time for recovery, differing patterns of pressure delivery at the same MAP may produce differing effects on CO. CO (microspheres) and left ventricular end diastolic dimension (LVED by echo) as an estimate of LV volume were measured in 10 paralyzed newborn dogs during PPV. Baseline (B) ventilation was produced by using the least IP and EP to maintain normocarbica (rate 50, I/E of 1/3). Each animal had 4 experimental ventilatory variations: 1 at B, and 3 at a MAP 3X B produced by independently varying IP, I/E or EP.

Results: (Mean $\pm$ SD)	B	IP	I/E	EP
*MAP (cmH2O)	$3.2 \pm 0.9$	$9.3 \pm 2.3$	$9.1 \pm 2.4$	$9.7 \pm 2.2$
Peak IP/EP (cmH2O)	12/2	31/3	12/3	15/8
I/E	1/3	1/3	3/1	1/3
*LVED (cm) n=6	$0.78 \pm 0.06$	$0.61 \pm 0.08$	$0.59 \pm 0.07$	$0.63 \pm 0.07$
*CO (cc/kg/min)	$203 \pm 40$	$155 \pm 45$	$159 \pm 37$	$153 \pm 37$
*Str. Vol (cc/kg)	$0.97 \pm 0.22$	$0.77 \pm 0.22$	$0.80 \pm 0.28$	$0.80 \pm 0.27$

\*Differences among IP, I/E, and EP are n.s. by ANOVA

The similar reductions in LVED, CO, and stroke volume seen with a 3-fold increase in MAP are due primarily to a decrease in pre-load. We conclude that these reductions are independent of the pattern of pressure delivery.