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Postnatal Changes in the Cardiac Ventricles of the Pig.* (31087)

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The ratio of the right ventricular weight to total ventricular weight (RV/T) is greater in the newborn human than in the adult. However, within the first month of life, the ratio decreases rapidly and nearly approaches the adult value. Keen(1) is of the opinion that the change is due to a relatively slower weight gain of the right ventricle as contrast to the left and that there is no evidence to suggest postnatal atrophy of the right ventricle. Emery and Avinash(2) report similar findings but Recavarren and Arias-Stella(3) state that postnatal atrophy of the right ventricle does occur as indicated by a weight reduction as great as 23.9%.

Concomitant with a decreasing RV/T ratio in the first month of life, the left ventricular to total ventricular ratio (LV/T) increases. Following this period, a more gradual change occurs in the infant until at 6 months of age the left ventricle has attained a degree of preponderance which no longer changes with increasing age. These observations were essentially confirmed and similarly reported by Emery and Avinash(2).

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In newborn animals, such as the lamb(4) and puppy(5,6), it has been reported that the left ventricle in both species is slightly heavier at birth than the right ventricle. Averill, Wagner and Vogel(7) observed that during the first week of life in the puppy, the right ventricular pressures fell rapidly to adult levels along with a parallel decline in the RV/T ratio. Their data suggest that the RV/T relationship is a sensitive indicator of right ventricular and pulmonary arterial pressure.

In swine, the normal weight relationship of the right ventricle has been determined for adult animals(8,9). To our knowledge, ventricular weight ratios in the newborn piglet have not been determined. It is, therefore, the purpose of this study to report postnatal changes in the ventricular weight ratios of the piglet.

Methods and materials. A total of 75 Yorkshire, Hanford miniature† and York-

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shire-Hanford miniature crossbred piglets of both sexes were studied during 1963-65. The pigs were reared under specific pathogen-free conditions at Colorado State University at an altitude of approximately 5,000 feet above sea level. Body weights ranged from 315 g to 70 kg with a span in age from birth to 5 months. Newborn piglets were stillborn or had been killed by the dam. Animals over one week of age were normal and were obtained after inadvertent death from experimental surgical procedures.

Ventricular weight ratios were determined using the Müller(10) method for dividing the components of the myocardium. As soon as possible after death of the animals, the heart was dissected without prior placement in formalin or other tissue fixatives and weighed to the nearest 0.1 g. The weight of the right ventricle (RV), septum (S), left ventricle (LV) as well as the combined or total weights (T) of these 3 components were obtained for determining the ratios.

Results and discussion. Soon after birth, the right ventricular ratio (RV/T) of the pig began to decrease (Table I and Fig. 1). Because of the small number of animals in the 1- to 12-day age range and due to variability in their body weights, it was difficult to determine from this study whether or not a postnatal atrophy of the right ventricle had occurred.

The mean RV/T ratio of the newborn pig declined from 0.382 to 0.253 by 7 days of age; the latter value is near that reported for mature swine by Hultgren *et al*(8). In man, Keen(1) reported that the RV/T ratio of the newborn ranged from 0.36-0.53 with a mean and standard error of the mean of 0.441 and 0.0061, respectively, and between 4-16 years of age the RV/T ratio was 0.272. In adults,

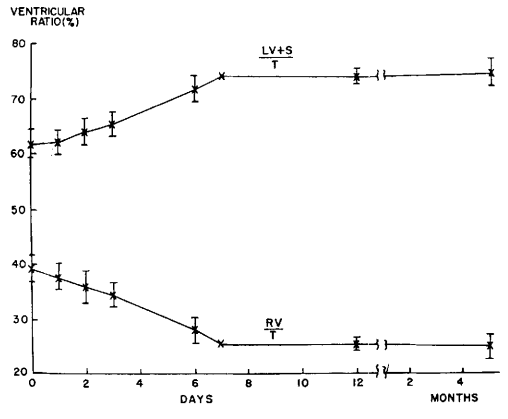

FIG. 1. Postnatal changes of the RV/T and LV+S/T ratios are related to age (in days or months) for 75 pigs. Except for the 7-day-old pigs, one standard deviation above and below the mean (X) is indicated.

TABLE I. Postnatal Change in Ventricular Ratios* of Swine.

Age (days)	No. of animals	Body wt (kg)	RV/T	S/T	LV/T	RV/LV+S	LV+S/T	S/LV	LV/RV
Birth	32	.315– 1.24	.382 ± .027	.292 ± .019	.326 ± .032	.620 ± .069	.618 ± .027	.911 ± .130	.860 ± .140
1	5	.546– .932	.378 ± .023	.313 ± .027	.309 ± .027	.611 ± .062	.621 ± .026	1.024 ± .150	.818 ± .110
2	6	.783– 1.07	.359 ± .026	.302 ± .021	.339 ± .029	.561 ± .067	.641 ± .026	.898 ± .120	.949 ± .118
3	4	.714– .823	.343 ± .023	.325 ± .037	.331 ± .032	.525 ± .053	.657 ± .023	.996 ± .190	.967 ± .118
6	6	.978– 1.29	.281 ± .024	.288 ± .014	.431 ± .016	.392 ± .047	.719 ± .024	.669 ± .040	1.548 ± .184
7	2	1.88 – 2.13	.253	.289	.457	.338	.748	.634	1.812
9–12	4	2.24	.260 ± .017	.278 ± .016	.462 ± .022	.351 ± .028	.740 ± .017	.602 ± .060	1.789 ± .180
1–5 (mo)	16	10.4 –70.0	.248 ± .024	.312 ± .020	.440 ± .028	.332 ± .044	.752 ± .024	.712 ± .080	1.791 ± .260

* Expressed in mean values along with one standard deviation.

Fulton *et al*(11) reported a value of 0.269. The values for man do not appear to be too dissimilar to those observed in swine.

The LV + S/T ratio increased simultaneously with the decline in RV/T ratio (Fig. 1). Increase of this ratio was due principally to an increase in the left ventricular weight. The LV/RV ratio increased concomitantly, with an increase in the LV + S/T ratio. At birth the mean LV/RV ratio for the piglet is 0.860. This ratio increased to 1.812 at 7 days of age indicating that the left ventricle weighs nearly twice that of the right. Although the right ventricular pressure was not measured, the decline in the RV/T ratio in the piglet probably reflects a reduction in this pressure similar to that reported in the dog by Averill and co-workers(7). The data from the present study suggest that, in addition to weight ratios, the pulmonary arterial and systemic arterial pressures should be obtained to possibly relate pressure and ventricular weight changes.

Summary. Postnatal changes in the cardiac ventricles of 75 piglets are reported. The RV/T ratio reclines from a mean of 0.382 to 0.253 by 7 days of age. Concomitant with this decline the LV + S/T and the LV/RV ratios increased. Although such changes occur after birth more rapidly in the pig than in man, the magnitude of change in the swine cardiac ventricles appears to be quite similar to that reported for man.

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Evidence for the Existence of Human Growth Hormone-Ribonucleic Acid Complex in the Pituitary. (31088)

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Several widely different procedures for extracting human growth hormone (HGH) have been reported. Three of these procedures are quite drastic; for example, glacial acetic acid, $Ca(OH)_2$ and 0.1 N NaOH have been used (1,2,3). In another procedure, Lewis and Brink(4) extracted pituitaries with 0.3 M KCl at pH 5.5. The latter demonstrated that a further yield of HGH could be obtained from the insoluble residue by extraction at pH 11 in 0.3 M KCl. Elrick *et al*(3), in a more detailed study showed that a 2-hour extraction of acetone-dried pituitaries with 0.3 M KCl and 0.1% thioethanol at pH 5.5 resulted in a yield of about 6% of the HGH activity. Extraction for 20 hours increased the yield to about 25%. Treatment of the residue with 0.1 N NaOH solubilized the remaining 75% of the HGH. Because 25% of the HGH was extracted under mild condition and treatment of the residue with alkali yielded a HGH preparation which is soluble at neutral pH, it could be inferred that most of the HGH is present in the pituitary in an insoluble form which is hydrolyzed or cleaved by the more drastic procedures. If such were the case, HGH acitvity obtained by drastic procedures would be associated with different molecular species depending upon the degree of hydrolysis or cleavage. That the biologi-