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THE MORPHOLOGY AND THE ARTERIES OF THE HEART IN THE MOLLE RAT *(SPALAX LEUCODON)*

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The morphology, topography and arteries of the heart in the molle rat were investigated in this paper.

The heart lies in the middle of the mediastinal space of the pectoral cavity, between the third and sixth rib. The base of the heart is situated in the horizontal plane which passes through the middle part of the first rib. The apex of the heart reaches to the sixth rib, left of the median plane, about 5 mm distant from the sternum. The heart is enclosed in the pericardium. The apex of the pericardium is fixed to the sternum and the diaphragm.

The interventricular grooves are unclear. The right atrium is larger than the left one. In the right ventricle there are three septal papillary muscles. In the left ventricle two papillary muscles exist in the form of muscular strands which extend from the apex of the heart to the base of it.

The cranial vena cava is double. The right coronary artery with its branches (Ramus coni arteriosi, Ramus proximalis et Ramus distalis atrii dextri) supply the walls of the right atrium and the right ventricle. The left coronary artery and its branches (Ramus proximalis atrii sinistri and Ramus septalis) supply the walls of the left atrium, left ventricle and interventricular septum.

Key words: molle rat, heart, pericardium, morphology, topography, arteries.

INTRODUCTION

The molle rat is a rodent, used in experiments in immunology, parasitology and biology. Investigations of the heart in the molle rat have not been described in the available literature except for one account about the heart of the molle rat in a doctor's thesis (Blagojević, 1981.). This was the reason for the present investigation of the morphology, topography and arteries of the heart in the molle rat. Our results are analysed by comparison with corresponding results for other experimental rodents such as: the rabbit (Barone et al. 1973., Terentiev

et al. 1953., Dumas, 1953.), the ground squirrel (Stanojević, 1965.) and the rat (Hebel and Stromberg, 1976.). Knowledge of the topographical position of the heart in the molle rat may be used when drawing out blood from the heart.

MATERIAL AND METHODS

This study of the heart in the molle rat was carried out on 20 animals of both sexes and various ages. These animals were caught in the period of June-August and killed by bleeding. After sacrifice, gelatincoloured with minium was injected into the arteries. The morphology and topography of the heart were studied on fresh and preserved organs. A solution of 4% formaldehyde was injected into the cavity of the heart as a preservative. After that, the heart and arteries were prepared.

RESULTS AND DISCUSSION

The heart in the molle rat is a hollow muscular organ, enclosed in the pericardium. It occupies the middle of the mediastinal space. The heart is covered by the lungs, except in its ventral part. The long axis is directed caudoventrally and left. The base of the heart lies in the longitudinal plane which passes through the middle part of the first rib. The apex of the heart lies in the area of the sixth rib, about 5 mm, distant from the sternum. Cranially the heart reaches up to the third rib and caudally down to the sixth rib. The heart in the rabbit (Barone et al. 1973.) is situated between the first and third intrcostal space, in the ground squirrel (Stanojević, 1965.) between the fourth and sixth rib and in the rat (Hebel and Stromberg, 1976.) between the third and fifth rib.

The pericardium in the molle rat is a fibrous sac, thin and transparent. Its apex is connected with the sternum and diaphragm by the sterno-phreno pericardiac ligament. The apex of the pericardium in the rabbit (Barone et al. 1973.) and in the rat (Hebel and Stronberg, 1976.) is attached to the sternum but in the ground squirrel (Stanojević, 1965.) to the diaphragm.

The right ventricular border is convex and curves ventrocaudally. The left ventricular border is turned caudally some what left words. As in the rat. (Hebel and Stromberg, 1976.) the interventricular grooves in the molle rat are hard to recognize but in the ground squirrel (Stanojević, 1965.) these grooves are clear.

The right atrium (Figure 4Ad) forms the right cranial part of the base of the heart. It lies dorsal to the right ventricle, right and cranial to the left atrium. The right atrium is larger than the left one. Inside, its walls are crossed in various directions by muscular ridges and the wall of the auricle by the pectinate muscles. The sinus venosus of the right atrium receives the right cranial vena cava craniodorsally, the caudal vena cava (Figure 2,3) caudodorsally, the left cranial vena cava (Figure 2,2) from the left and cranially by means of the coronary sinus and two cardiac veins (V. cordis sinistra et V. cordis dextra) from the right and ventrally. The auricle is relatively voluminous.

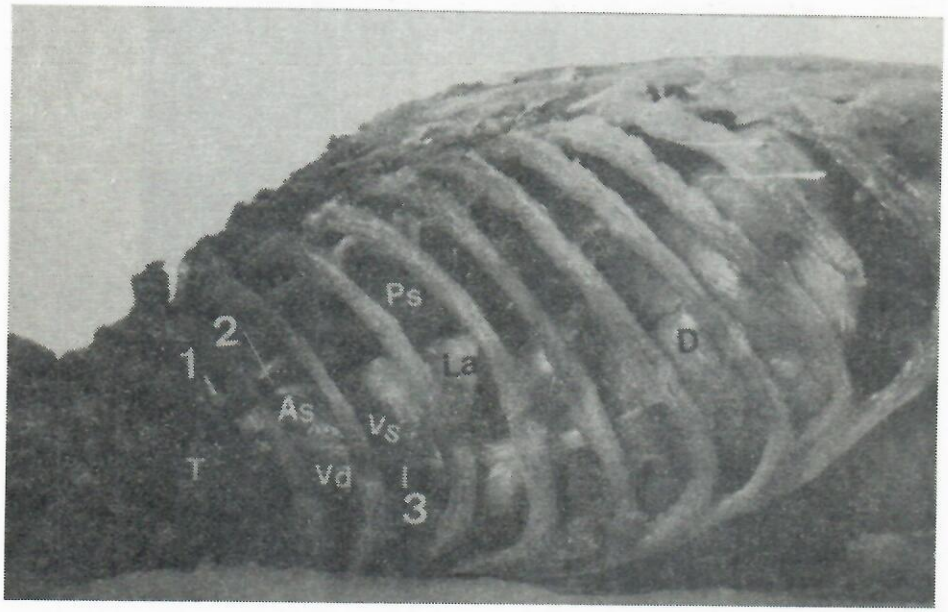

Figure 1. The topographical position of the heart in the molle rat The left side
1-Aorta, 2-V. cava cranialis sinistra, 3-N. phrenicus sin., As-Atrium sinistrum, Vs-Ventriculus sinister, Vd-Ventriculus dexter, Ps-Pulmo sinister, La-Lobus accessorius, T-Timus, D-Diaphragma

The left atrium (Figure 1As) in the molle rat, similar to the rabbit (Barone et al. 1973), Dumas, 1953.), is smaller than the right one. The cavity of the atrium is smooth, with the exception of the auricle in which the pectinate muscles are present. In the molle rat the common trunk of the 5-7 pulmonary veins open into the dorsal wall of the atrium, as in the ground squirrel (Stanojević, 1965.) which has 5-6 pulmonary veins.

The right ventricle (Figure 1Vd) constitutes the right cranial part of the ventricular mass. It forms almost all of the cranial border of the heart. The right interventricular groove of the heart of the molle rat and rat Hebel and Stromberg, 1976.) is unclear. However, in the ground squirrel (Stanojević, 1965.) the right interventricular groove is clear and extends straight to the apex of the heart and is named Sulcus longitudinalis rectus. The right ventricle in the molle rat extends toward the apex of the heart but it is shorter than the left one.

The septal wall is convex and faces obliquelycranially and to the right. The right atrioventricular orifice is guarded by the right atrioventricular valve which has three large cusps. Three papillary muscles are present in the right ventricle of the molle rat, similar to the rat (Hebel and Stromberg, 1976.) and the ground squirel (Stanojević, 1965.). All of them are septal (Mm. papilares septales). Sometimes, only two papillary muscles are present in the right ventricle of the molle rat. In this case Chordae tendineae are attached to the

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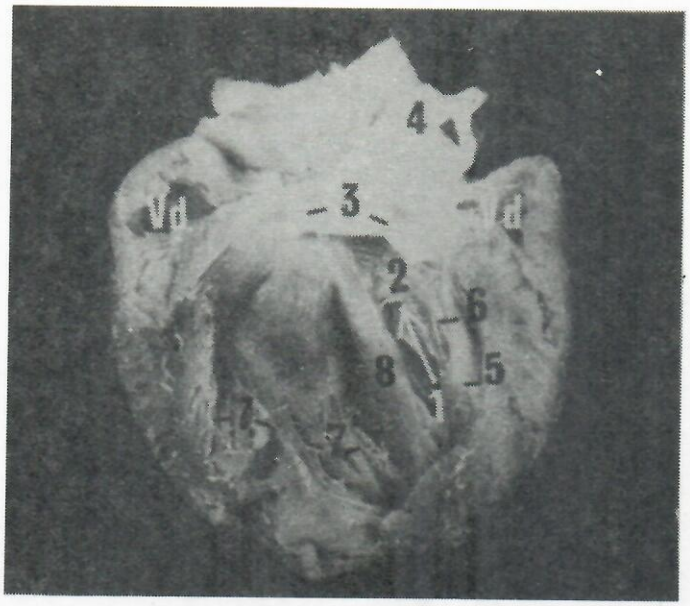

Figure 2. The right atrium and the right ventricle of the molle rat 1-Ostium truncus pulmonalis, 2-Ostium V. cavae cranialis sin., 3-Ostium V. cavae caudalis, 4-Valva atrioventricularis dextra, 5-Chordae tendineae, 6-M.papillaris septalis, 7,7'-Trabeculae carneae

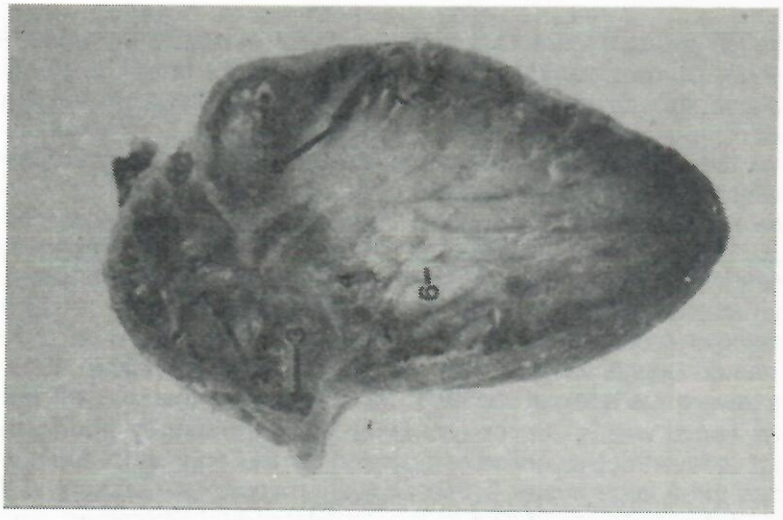

Figure 3. The left ventricle of the heart of the heart in the molle rat 1-Ostium atrioventriculare sinistrum, 2-Valva atrioventricularis sinistra, 3-Valva aortae, 4-Aorta, 5,8-Muscular strands 6-Chordae tendineae, 7-Trabeculae carneae, Vd-Ventriculus dexter

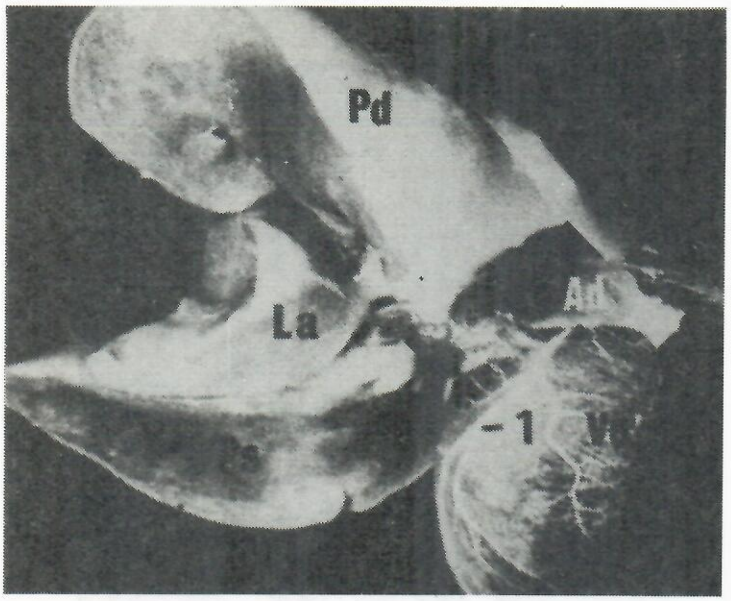

Figure 4. The heart and pulmo in the molle rat (The arteries are injected with gelatin stained by minium)
1-A.cordis dextra, Ad-Atrium dextrum, Vd-Ventriculus dexter, Pd-Pulmo dexter, Ps-Pulmo sinister, La-Lobus accessorius

interventricular septum. The septal papillary muscles in the rabbit (Dumas, 1953.) divide into 2-3 branches. In the ground squirrel (Stanojević, 1965.) there are also three septal papillary muscles but only one of them (M.papillaris subarteriosus) is not divided into branches.

The walls of the ventricle bear trabeculae carneae (Figure 2,7,7,) which extend from the septum to the opposite wall and they are named Trabeculae septomarginales. The pulmonary orifice lies dorsally and left of the right atrioventricular orifice. On this place the wall of the right ventricle protrudes (Conus arteriosus). The pulmonary orifice is circular and guarded by the pulmonary valve, composed of three semilunar valve flaps.

The left ventricle (Figure 1Vs) is in the form of a funnel. It forms all of the caudal contour of the ventricular part and the apex of the heart. The left interventricular groove is hard to recognize in the molle rat but in the ground squirrel (Stanojević, 1965.) it is clear and extends cranially, turns to the right and extends near to the apex of the heart (Sulcus longitudinalis obliquus). The muscular wall of the left ventricle is about three time as thick as that of the right ventricle, but it is thin at the apex. The septal wall is concave. The left atrioventricular orifice is guarded by the left atrioventricular valve with two cusps. The papillary muscles are represented by two muscular crests (Figure 35,8) which protrude from the caudal and cranial aspect of the lateral wall. They give an attachment

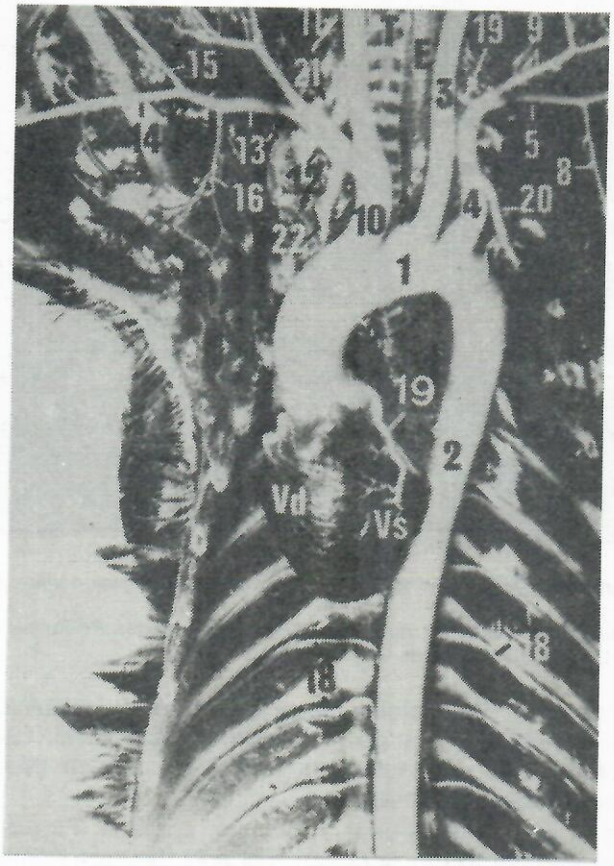

Figure 5. The arcus of the aorta in the molle rat
Vd-Ventriculus dexter, Vs-Ventriculus sinister, 1-Arcus aortae, 2-Aorta thoracica, 19-a. cordis sinistra

to the hordae tendineae. Trabeculae carneae (Figure 3,7) extend along the interventricular septum and the lateral wall of the left ventricle.

The aortic valve is composed of three semilunar pockets. The coronary arteries (A. cordis dextra et A. cordis sinistra) of the heart in the molle rat are the first branches of the aorta. A. cordis dextra tigmens comes from the aorta above the right semilunar pocket in the rat (Hebel and Stromberg, 1976). It is covered with the right auricle. More branches arise from the right coronary artery. One of these branches (Ramus coni arteriosi) runs to the conus ateriosus and supplies the wall of the right ventricle. Other branches of the right coronary artery (Ramus proximalis atrii dextri and Ramus distalis atrii dextri) enter the

wall of the right atrium (Blagojević, 1981.). The right coronary artery continues ventrocaudally towards the apex of the heart supplying the right wall of the heart. The left coronary artery (Figure 5 19) in the molle rat is similar to that in the rat (Hebel and Stromberg, 1976.) and the ground squirrel (Stanojević, 1965.)and passes around the pulmonary trunk (Figure 2 1) to the left ventricular wall. Still under the left auricle it sends a twig to the left atrium (Ramus proximalis atrii sinistri). Other branches of the left coronary artery supply the ventricular wall, except for one which supplies the interventricular septum.

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MORFOLOGIJA I ARTERIJE SRCA SLEPOG KUČETA (SPALAX LEUCODON)

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SADRŽAJ

U radu su ispitivani morfologija, topografija i arterije srca slepog kučeta. Srce leži u srednjem medijastinalnom prostoru grudne duplje, između trećeg i šestog rebra. Baza srca leži u horizontalnoj ravni koja prolazi kroz sredinu prvog rebra. Vrh srca dopire do šestog rebra, levo od medijane ravni, udaljeno oko 5 mm od grudne kosti. Srce je obavijeno srčanom kesom čiji je vrh pričvršćen za dijafragmu i za grudnu kost. Međukomorni žlebovi nisu jasni. Desna pretkomora je veća nego leva. U desnoj komori nalaze se tri septalna papilarna mišića. U levoj komori postoje dva papilarna mišića u vidu mišićnih greda koje se pružaju od vrha srca do baze.

V. cava cranialis je dupla. Desna koronarna arterija preko svojih grana dovodi krv u zidove desne pretkomore i desne komore. Leva koronarna arterija preko svojih grana (Ramus proximalis atrii sinistri i Ramus septalis) dovodi krv u zidove leve pretkomore, leve komore i međukomorni žleb.