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INTRASPECIFIC ANATOMICAL ASPECTS OF CARDIAC ARTERIES (AA. CORONARIA) IN THE DOG

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Abstract

By injecting the coronary arteries in common breed dogs of various ages, we have underlined certain modifications concerning the path, the caliber and the structure of the cardiac vessels. In this paper we will refer exclusively to the anatomical aspects of these vessels. In young subjects, both the cardiac arterial trunks and their branches present in general well traced paths, without changes in the arterial walls. Compared to this situation, in aged animals, we have both anatomical modifications of vascular paths and of their lumen's caliber, as well as the varicose aspect of their walls. These morphological aspects also imply alterations of the differentiated vascular perfusion of the myocardium, while facilitating clinical interpretation in canine cardiac pathology.

Key words*: heart, coronary artery, dog.*

INTRODUCTION

The present paper focuses on certain morphological aspects of the coronary arteries in the common breed domestic dog. We have underlined certain features representing vascular modifications occurring as the animal ages. The former are strictly limited to anatomical data, from which we can deduce some observations regarding the modifications suffered by the structure of the vascular walls, and consecutively, on the blood supply to the myocardium and on the complex cardiac formations. These morphological aspects can surely lead to clinical interpretation with regards to this animal species.

Data from the consulted literature refer to the normal anatomical aspects of the coronary arteries in different animal species, and implicitly in humans, having a mostly didactical orientation. These aspects are assuredly presented and interpreted in a different manner within the framework of human cardiac physiology and pathology. The origins, paths and distribution of the coronary arteries are described in the domesticated animal species in the consulted literature data (Gheţie, 1967; Nikel şi col, 1968; Andretto şi col, 1973; Sisson şi col., 1975; Pop D. Popa, 1982; Pastea şi col., 1985; Popovici şi col., 1998; Barone, 1996; Coţofan şi col., 2000; Ellemberger W.H. Baum, 1984; Chirilean, 2004; Chirilean, 2006)

We must mention that the aforementioned bibliographic sources do not refer to the features of animal cardiac arteries regards to their age. The present research was suggested by this bibliographic study which has highlighted the fact that comparative anatomy still needs to clarify certain possibly existing morphological aspects of cardiac vessels in animals.

MATERIALS AND METHODS

Our observations of the cardiac circulatory system were made on 43 samples of fresh hearts from common breed dogs of both sexes, with ages between 1 to 2 month (15 items of the total sample group), adults and even seniors. The subjects were clinically examined and the sampling complied with all deontological measures regarding euthanasia and exsanguination.

In order to highlight the coronary arteries and their myocardial branches, the vascular bed was flushed prior to the injection of a contrast agent, composed of a plastic mass commercially named Palux and of red dye. Both coronary arteries were injected after the opening of the aortic bulb and after the

placement of the intravascular injection cannulas in the coronary ostia (Figure 1).
During the dissection of the blood vessels, photos were taken, which constitutes the iconographic documentary part of the paper.

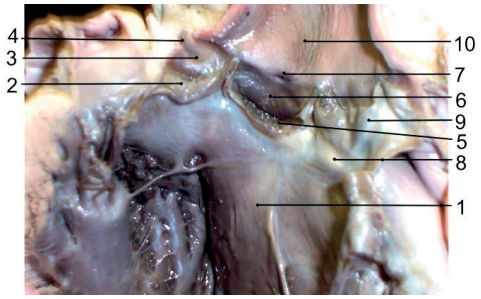

Figure 1. Valsalva sinuses and coronary ostia in the dog
Left ventricle cavity; 2. Left semilunar cusp of the aorta; 3. Left Valsalva sinus; 4. Left coronary artery ostium of origin; 5. Anterior or septal semilunar cusp (cut); 6. Anterior Valsalva sinus; 7. Right coronary artery ostium of origin; 8. Right semilunar cusp; 9. Right Valsalva sinus; 10. Aortic bulb.

RESULTS AND DISCUSSIONS

By means of the process of in vitro injecting of the coronary arteries in dogs of various ages, we have highlighted certain anatomical particularities worthy of notice in physiological and implicitly in pathological assessments of this animal species. From this point of view, we are referring to the blood supply of the myocardium
We will first present through images the most prominent particularities featured by the coronary arteries on hearts sampled from subjects of various ages.
In young subjects, we have underlined the coronary arteries, free, in their majority, from the subepicardial conjunctive tissue. The topography of the vascular paths corresponds to anatomical norms, obvious both in the main trunks and in their secondary branches and their respective myocardial trunks (Figure 2, Figure 3, Figure 4 and Figure 5). These particularities are obvious both in the left coronary artery and in the right coronary artery (Figure 6). It is worth mentioning that in young animals the aforementioned vascular particularities are also obvious in the deep, septal, myocardial vascular branches (Figure 7).
In light of the foregoing, the vascular walls did not present any irregularities, which indicates that their lumen is not modified, maintaining the normal anatomical ratio according to the type of blood vessel.
Compared to the anatomical situation registered in young individuals, most adult and senior subjects have presented certain aspects worthy of notice. The subepicardial adipose tissue, of varying quantities, was extremely adhesive to the vascular walls. As show in Figure 8 and in Figure 9, the vascular paths are very flexuous and their walls present numerous irregularities, resembling varicose vessels. The functional consequences on the blood supply to the myocardium, according to the morphological changes presented in the present paper, can serve the conclusive interpretation of physiology, clinical and canine pathology specialists.

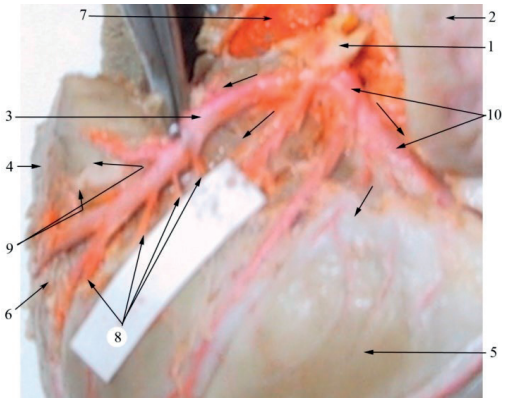

Figure 2. Deep collateral branches of the paraconal and left circumflex arteries in the dog
1. Left coronary artery (A coronaria sinistra); 2. Left atrium; 3. Paraconal artery (A. paraconalis); 4. Right ventricle; 5. Left ventricle; 6. Paraconal groove; 7. Pulmonary arterial trunk; 8. Deep collateral branches of the paraconal artery for the left ventricle; 9. Collateral branches for the right ventricle; 10. Left circumflex artery (A. circumflexa sinistra).

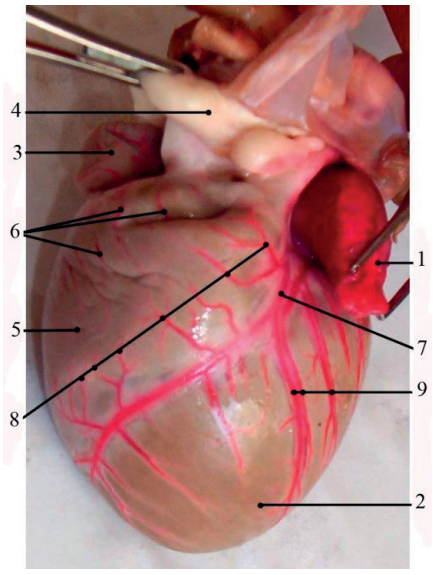

Figure 3. Paraconal artery in the pup
1. Left atrium; 2. Right atrium; 3. Left ventricle; 4. Right ventricle; 5. Pulmonary arterial trunk; 6. Paraconal artery (A. paraconalis); 7. Collateral branch of the felt atrium; 8. Collateral branches for: a. the base of the pulmonary trunk b. the right ventricle; 9. Collateral branches for the left ventricle; 10. Collateral branches of the right coronary artery for the right atrium; 11. Collateral branches of the right coronary artery for the right ventricle.

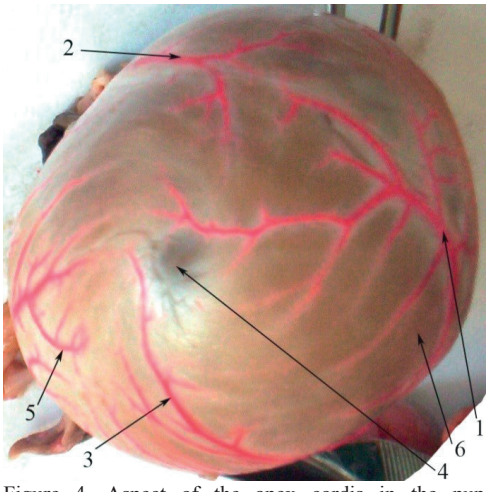

Figure 4. Aspect of the apex cordis in the pup (arterioles of the apex)
1. Paraconal artery (A. paraconalis); 2. Infrasinusal artery (A. subsinusalis s. interventricularia dextra); 3. Collateral branches of the paraconal artery; 4. Apex of the heart; 5. Terminal branches of the left circumflex artery; 6. Left ventricle.

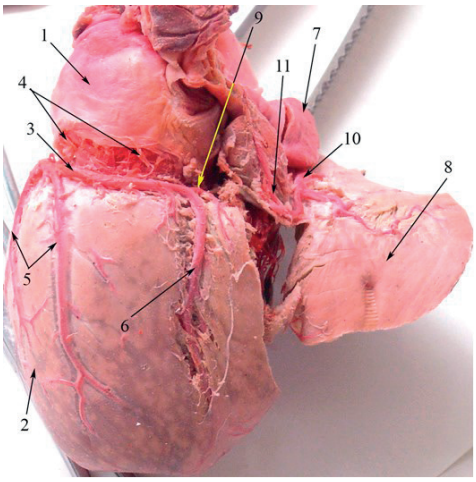

Figure 5. Mediastinal (infrasinusal) side and dorso-caudal border of the heat in the adult dog
1. Left atrium; 2. Left ventricle; 3. Left circumflex artery (A. circumflexa sinistra); 4. Deep collateral branches for the left atrium; 5. Superficial intermediary collateral branches; 6. Infrasinusal artery (A. subsinuosa); 7. Right atrium; 8. Lateral wall of the right ventricle (detached); 9. Terminal branch of the left circumflex artery for the interatrial septum and base of the right ventricle; 10. Right coronary artery (A. coronaria dextra); 11. Terminal ascending branch of the right coronary artery.

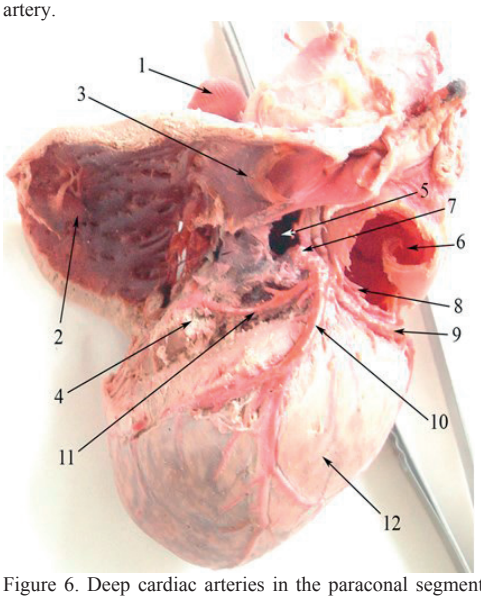

Figure 6. Deep cardiac arteries in the paraconal segment of the heart in the adult dog
1. Right atrium; 2. Right ventricle (opened); 3. Conus arteriosus (opened); 4. Cardiac interventricular septum; 5. Aorta (opened aortic bulb); 6. Left atrium; 7. Left coronary artery (A. coronaria sinistra); 8. Deep collateral branch of the left coronary artery for the left atrium; 9. Left circumflex artery (A. Circumflexa sinistra); 10. Paraconal artery (A. Paraconalis s. interventricularia sinistra); 11. Septal artery (A. septalis); 12. Left ventricle.

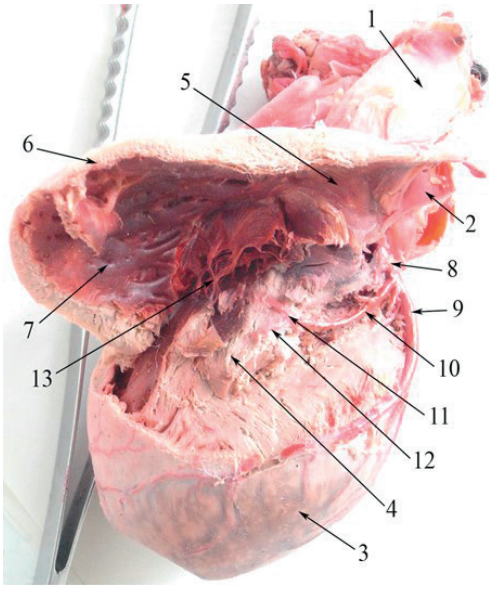

Figure 7. Left ventricle cavity in the dog
1. Descending aorta; 2. Pulmonary trunk (opened); 3. Left ventricle; 4. Interventricular septum of the heart; 5. Conus arteriosus; 6. Right ventricle wall; 7. Right ventricle cavity; 8. Left coronary artery (A. coronaria sinistra); 9. Paraconal artery (A. paraconalis); 10. Septal artery (A. septalis); 11. Cusp branch of the septal artery; 12. Papillary branch of the septal artery; 13. Tricuspid valve.

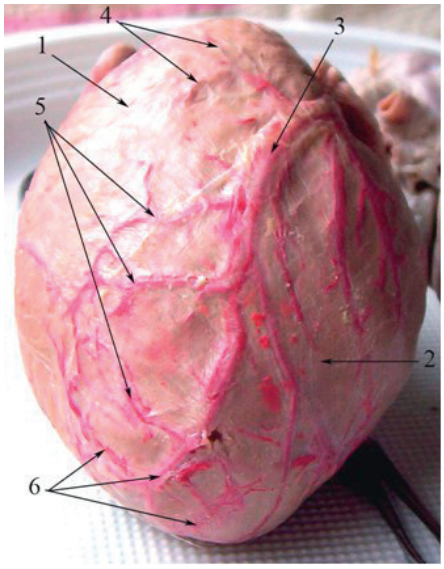

Figure 8. Aspect of the apex
of the heart in an adult dog
1. Right ventricle; 2. Left ventricle; 3. Paraconal artery (A. paraconalis); 4., 5. Collateral branches of the paraconal artery for the right ventricle; 6. Terminal branches of the paraconal artery in the region of the apex (arterioles of the apex).

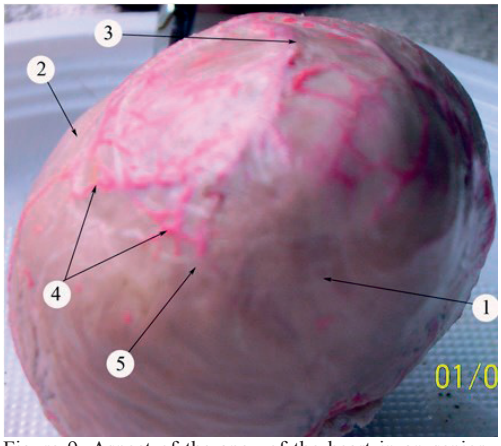

Figure 9. Aspect of the apex of the heart in an senior dog
1. Left ventricle; 2. Right ventricle; 3. Paraconal artery (A. paraconalis); 4. Terminal branches of the paraconal artery; 5. Apex of the heart.

CONCLUSIONS

No anatomical modifications were present in the origin orifices of the coronary arteries

In young subjects, the coronary arteries have well delimited paths, with regard to the known anatomic topography.

The vascular walls of the trunks and of their branches are well delimited, without any perivascular adipose deposits.

In senior subjects, the vascular paths are modified, generally presenting a flexuous, varicose and irregular aspect, being covered by a very adhesive subepicardial adipose tissue.

We estimate that the modifications of the vascular walls include all of the elements composing the vascular structure, including the lumen of the vessel; these aspects need to be taken into account with regards to myocardial blood supply.

The observations made by our study represent morphological realities that do not exclude the fact that a small number of the examined subjects, regardless of age, do not present the mentioned particularities. From this point of view, we consider other determining factors as well, excluding the age.

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