

COMPARATIVE BIBLIOGRAPHIC STUDY REGARDING THE COLLATERALS OF ASCENDING AORTA AND AORTIC CROSS IN HUMANS, SWINE AND EQUINE

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Abstract

*The blood is a fluid absolutely indispensable to life. It is responsible for the transportation of all nutrients to cells and tissues in the body. A very important segment in this process represents the cardiovascular system, also known as the circulatory system. The main blood vessel from the body is the aorta. This is the widest blood vessel which branches into several different arteries to serve all tissues in the body. Since the requirements for nutrients and oxygen differ according to species, we considered interesting to realise a synthesis of aortic branches, namely its ascending part and the aortic arch (Arcus aortae) in humans, swine (*Sus scrofa domestica*) and equine (*Equus caballus*). The present study involves the systematic evaluation of each vascular aortic segment focusing on: the confirmation of the presence of ascending aorta and aortic arch; similarities regarding the number and origin of collateral arteries. Following the review of the literature we found numerous differences in the studied species. First, we noted the absence of ascending aorta segment in pigs compared with humans and horses, where it is present. Further we identified differences regarding the coronary arteries (Aa. coronaria), differences that implies the origin of the artery openings. There were also different numbers of collaterals branches in the aortic arch: 3 in human, 2 in swine and only one in equine. Another interesting observation was the origin of carotid arteries from pigs and horses which is represented by the bi-carotid trunk, segment that is missing in humans.*

Key words: aorta, swine, human, aortic arch, coronary arteries.

INTRODUCTION

Blood is the life-maintaining fluid that circulates through the body. This essential fluid carries out the critical functions of transporting oxygen and nutrients to the cells and getting rid of carbon dioxide, ammonia, and other waste products. An important role in this process plays the cardiovascular system. By this system, the blood reaches in every organ or tissue through numerous blood vessels (Gheție et al, 1967). The size of these blood vessels is directly proportionate to the quantity of transported blood; those which are closer to the heart are larger, while the collaterals, situated peripheral, are smaller. Thus, the closer to the

heart the vessels are, the more blood they supply to the organ. The aorta is the largest and principal artery in the body. Its branches lead to all the organs of the body, being different in each species. The aim of this paper was to study and observe the peculiarities of aortic branches in its ascending segment and aortic arch. These specific features were observed in humans (*Homo sapiens*), swine (*Sus scrofa domestica*) and horses (*Equus caballus*).

RESULTS AND DISCUSSIONS

Following the review of the literature we found numerous differences regarding the aortic

branches, namely ascending segment and aortic arch in the studied species. In order to identify all the differences we performed a systematic evaluation of each vascular aortic segment focussing on: the confirmation of the presence of ascending aorta and aortic arch; similarities regarding the presence, number and origin of collateral arteries (Coțofan et al., 2000). Regarding the systematization of aorta artery at the studied species, we found out that the ascending aorta is missing in swine, but is well individualised in humans and horses. In pigs, the origin of the aorta is at the pericardial sinus (Popovici, 2000). It leaves the pericardium to pass dorsal cranial, between the two layers of the mediastinum in an oblique direction. After a short portion of 4-6 cm, it divides into two branches which constitute the left brachial trunk and brachiocephalic trunk. In this segment it furnishes some insignificant twigs to the pericardium and mediastinum. In horses and humans were identified both the ascending aorta segment and the aortic arch. Further, we observed the peculiarities regarding the collateral branches. Thus, in the ascending aorta segment, the first branches are represented by the coronary arteries, aspect confirmed in all three species. They are constituted by the left coronary artery (*Arteria coronaria sinistra*) and right coronary artery (*Arteria coronaria dextra*). Differences were observed regarding their origin. In humans, right coronary artery (*Arteria coronaria dextra*) has its origin at the right semilunar valve, while in pigs and horses it arises at the anterior semilunar valve (Damian, 2001). This fact can be explained due to the lack of right semilunar valve aperture, as it can be seen in figure 1. Regarding the left coronary artery (*Arteria coronaria sinistra*), no differences were noted. Its origin is the same in all three studied species, namely left semilunar valve. Subsequent, we observed the aortic arch (*Arcus aortae*). Significant differences were seen in all three species regarding the collateral branches in this segment. The first difference was observed in the number of branches. Thus, in human the aortic arch has three arterial

branches (Figure 2), in swine two and in horses is present only one (Figure 3).

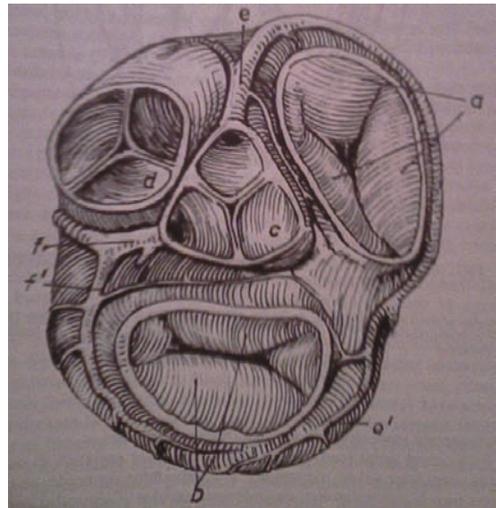


Figure 1. Transversal section through horse heart.

a. Right atrioventricular valve; b. Left atrioventricular valve; c. Aortic aperture and semilunar valve; d. Pulmonary aperture and semilunar valve; e. Right coronary artery; f. Left coronary artery; f¹. Left circumflex artery.

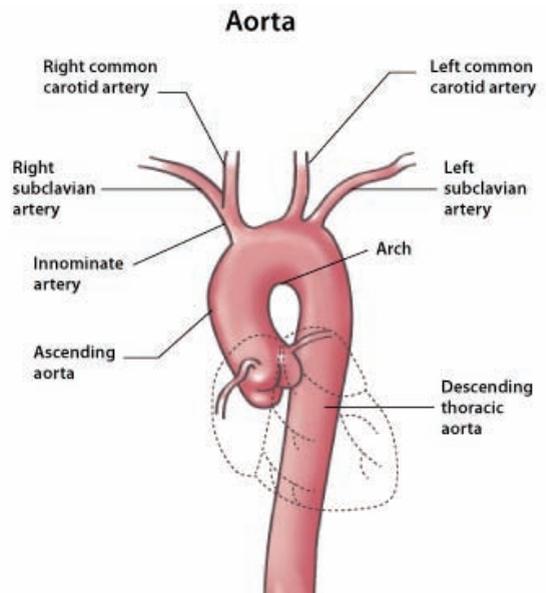


Figure 2. Aortic branches in human

The brachiocephalic trunk is present in the three species and it represents the first branch of the arterial arch. The second branch of the aortic arch, present only in human and pigs, is the left subclavian artery. In horses, the left subclavian artery arises from the brachiocephalic trunk (Sisson et al, 1964). In the human, there is another collateral branch represented by the left common carotid. The left common carotid arises from the highest part of the transverse portion of the aortic arch, through a separate aperture, between the brachiocephalic trunk and the left subclavian artery. In animals, the carotid arteries do not arise directly from the aortic arch, but through a collateral - brachiocephalic trunk. Another interesting aspect seen at carotid arteries from pigs and horses is that they have its origin in the bi-carotid trunk, whereas in human this is missing..

In human, the brachiocephalic breaks into the right subclavian and the right common carotid artery, while the left carotid artery arises singly from the aortic arch

The role of different disposition of aortic trunk branches is linked to the importance of ensuring a larger quantity of blood in a shorter time for the essential organs such as the heart and brain. The intense neurological activity of the brain in humans is superior to other animals, thus we can explain the requirement for a greater amounts of blood to reach this level. The proper blood velocity is assured by a short path between heart and the organ/tissue and a small number of branches which can reduce the blood flow.

CONCLUSIONS

In equine and humans were observed both the ascending aortic segment and aortic arch.

In swine, the ascending aortic segment is missing.

After a short portion of 4-6 cm, aorta divides into two branches - left brachial trunk and brachiocephalic trunk.

The first branches in the ascending aorta segment are represented by the coronary arteries, in all three species.

In humans, right coronary artery has its origin at the right semilunar valve, while in pigs and horses it arises at the anterior semilunar valve.

Left coronary artery has its origin at the left semilunar valve in all three studied species.

In human and pigs left subclavian artery is the second aortic arch branch in humans and pigs.

In the human, there is another collateral branch represented by the left common carotid which has a separate aperture in the aortic arch.

Carotid arteries have their origin at the bi-carotid trunk.

In human bi-carotid trunk is missing, thus the right carotid artery arises from brachiocephalic trunk and left carotid artery arises directly from the aortic arch.

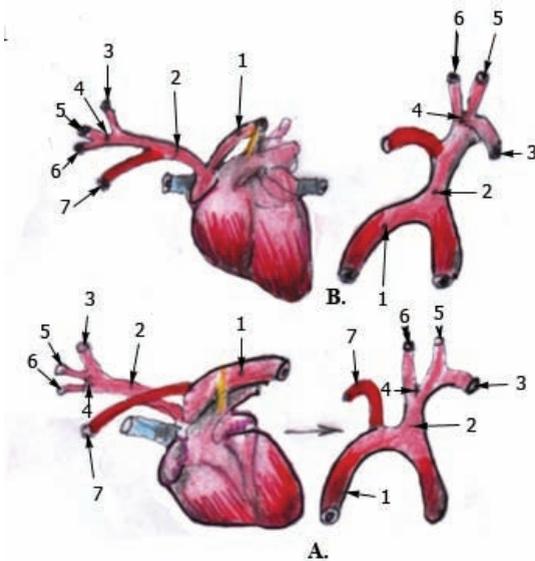


Figure 3. Aortic branches in swine (A) and equine (B)

1. Aortic arch (*Arcus aortae*); 2. Brachiocephalic trunk (*Truncus brachiocephalicus*); 3. Right subclavian artery (*Artera subclavia dextra*); 4. Bi-carotid trunk (*Truncus bicaroticus*); 5. Right common carotid artery (*Artera carotis communis dextra*); 6. Left common carotid artery (*Artera carotis communis sinistra*); 7. Left subclavian artery (*Artera subclavia sinistra*).

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