Short communication

The AMA study (Multi-Arterial Atherosclerosis): correlation of malformation of cardiac and cerebral arteries

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Abstract

We are performing a study on the distribution of atherosclerosis in the arteries and during our dissections we have found arterial malformations in the brain and heart. Of these, 6 are related to the posterior cerebral arteries and 3 are related to the posterior Interventricular artery of the heart. In all these three cases, such aforementioned abnormality in the circle of Willis also occurred. It is an interesting and unexpected finding and we are still waiting for further development in our work in order to clarify these "related" malformations.

Keywords: arterial malformation, atherosclerosis, posterior cerebral artery, posterior cerebral circulation, posterior interventricular artery.

1 Introduction

We are currently performing a study on the distribution of atherosclerosis among encephalic, cardiac and renal arteries, through the dissection of the original organs from cadavers and microscopic evaluation.

Few articles have addressed this correlation throughout the world and, until now, no anatomopathological study has evaluated the correlation of atherosclerosis in these three organs at the same time (BAE, YOON and KANG et al., 2006; GROSS, KRÂMER and WAIGAND et al., 1997; NGUYEN-HUYNH, WINTERMARK and ENGLSIH et al., 2008, PARK, JUNG and SEO et al., 2004; SEO, YONG and KOH et al., 2008; WEI, LI and ZHAO, 2007).

Before dissecting, the AMA Study evaluates the arteries macroscopically, searching for malformations. We communicate now an unexpected correlation we have identified.

2 Short communication

We have already performed 24 dissections during the year of 2010; of these, six brains have shown malformations affecting the posterior cerebral arteries (PCA) in the circle of Willis. Three right PCA originated from the right internal carotid artery (ICA); one left PCA originated from the left ICA; and in two brains, both PCA originated from both ICAs.

Among these 24 dissections, we have also identified several abnormalities within the cardiac arterial bed. In three of them, the posterior interventricular artery (PIA) originated from the left, rather than from the right coronary artery. In all three cases, we have also found the abovementioned abnormalities in the circle of Willis: in two, both PCA originated from the ICAs; and in one, the right PCA originated from the right ICA.

Below we show the picture of a heart with right ventricular hypoplasia (Figures 1 and 2) and its respective brain, whose basilar artery established no connection with the circle of Willis (Figures 3 to 5), in contrast to another brain, whose PCA originated from the ICAs and established connections to the basilar artery through three thin vessels (Figures 6 and 7). The respective heart is not shown.

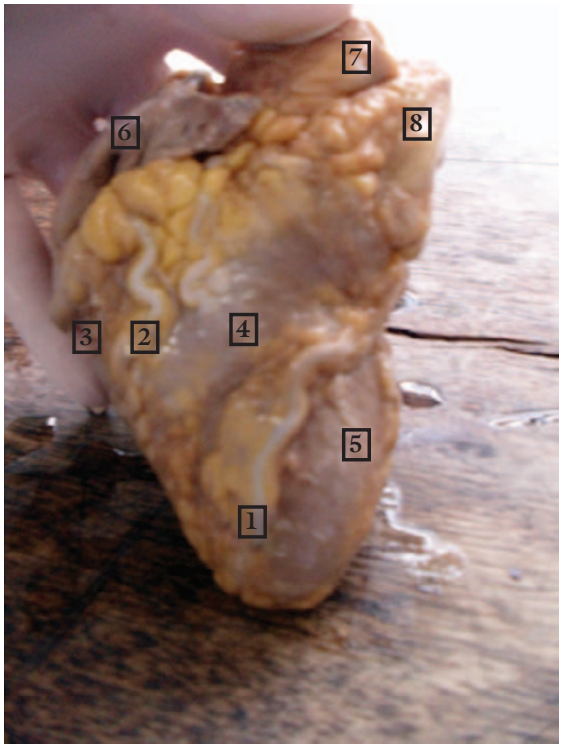

Figure 1. Anterior view of the heart. 1) Anterior Interventricular artery; 2) Diagonal Arteries; 3) Right Ventricle; 4) Interventricular septum; 5)Left ventricle; 6) Right auricular; 7) Aorta and 8) Pulmonary arteries.

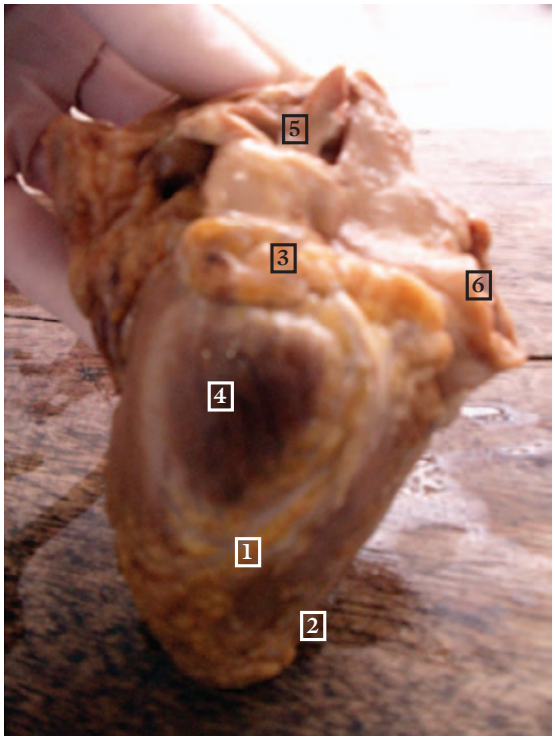

Figure 2. Posterior view of the heart. 1) Posterior Interventricular artery; 2) Marginal artery; 3) Left coronary artery; 4) Left ventricle; 5)Left atrium and 6) Right atrium.

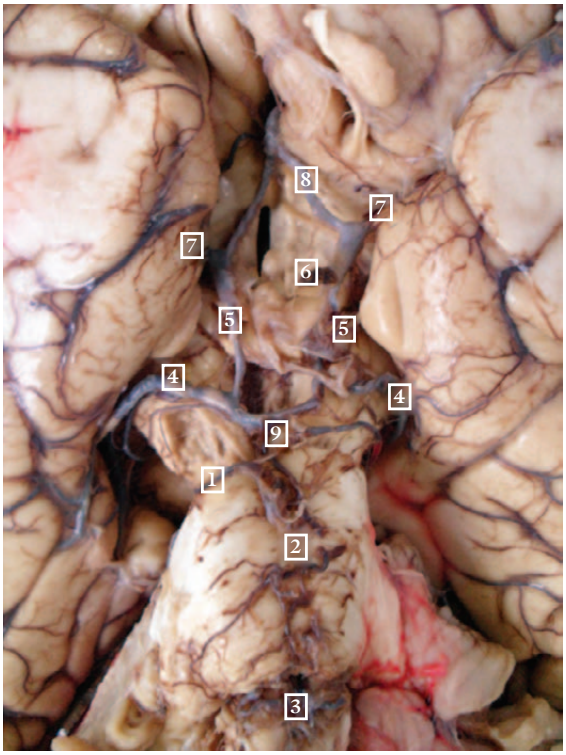

Figure 3. Inferior view of the encephalon. 1) Anterior superior cerebellar artery; 2) Basilar artery (partially cut); 3) Posterior inferior cerebellar arteries; 4) Posterior cerebral arteries; 5) Posterior communicant arteries; 6) Internal carotid (cut); 7) Medium cerebral arteries; 8) Anterior cerebral arteries and 9) Arterial malformation connecting both posterior cerebral arteries.

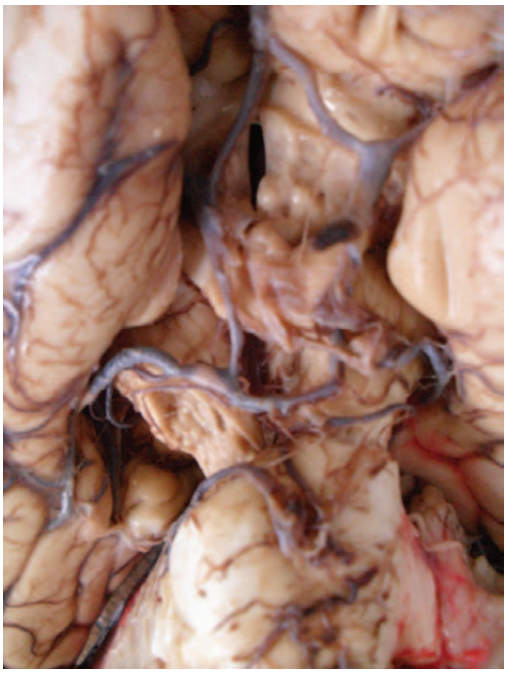

Figure 4. Close up on the Circle of Willis.

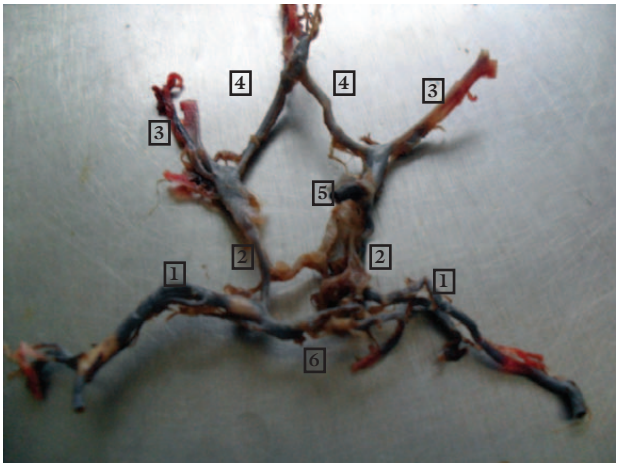

Figure 5. Dissected Circle of Willis. 1) Posterior cerebral arteries; 2) Posterior communicant arteries; 3) Medium cerebral arteries; 4) Anterior cerebral arteries; 5) Internal carotid and 6) Vascular malformation connecting both posterior cerebral arteries (no signs of previous anastomosis to the basilar artery).

3 Discussion

Defects in the arteries composing the circle of Willis are quite common; MERKKOLA, TULLA and RONAKAINEN et al., 2006, found that 22% of the anterior communicant arteries (ACoA) and 46% of the posterior communicant arteries (PCoA) are missing in the general population. So far, in 24 autopsies, we have found no abnormalities in the ACoA, whereas 13 PCoA in total (4: both; 1: left; 4: right) were missing. These abnormalities are especially important when performing surgery in the thoracic aorta or the carotids, when brain perfusion must be maintained by only one side of the circle of Willis.

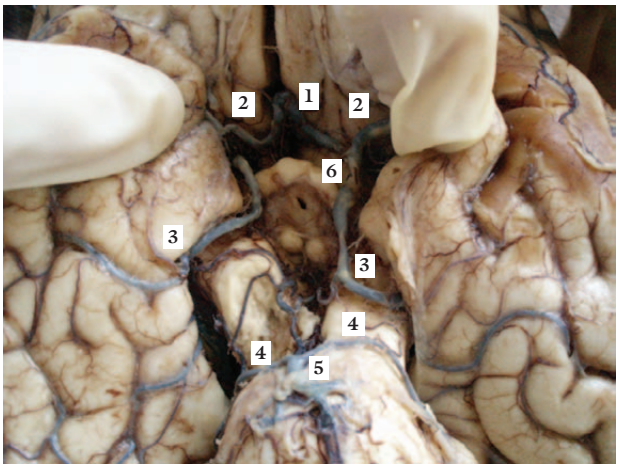

Figure 6. Inferior view of the encephalon. 1) Anterior cerebral arteries; 2) Medium cerebral arteries; 3) Posterior cerebral arteries; 4) Anterior superior cerebellar arteries; 5) Basilar artery and 6) Internal carotid (cut).

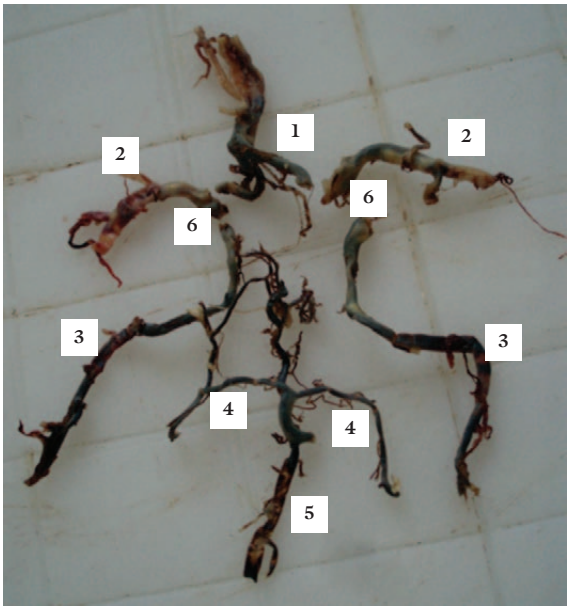

Figure 7. Dissected Circle of Willis. 1) Anterior cerebral arteries; 2) Medium cerebral arteries; 3) Posterior cerebral arteries; 4) Anterior superior cerebellar arteries; 5) Basilar artery and 6) Internal carotid arteries (cut).

One case report (RUMBOLDT, CASTILLO and SOLANDER, 2003) has incidentally found an 11-year-old child with bilateral carotid congenital agenesis. In this case, brain perfusion depended solely on the vertebral arteries and integrity of the circle of Willis.

Our finding was quite unexpected and the number of arterial malformations we have found is still too small to statistically guarantee the correlation between an abnormal origin of the PIA and the PCA. However, it is interesting to mention that there was a correlation: for every heart whose PIA originated from the left coronary artery, there was a respective brain with malformations in the posterior circulation of the circle of Willis. We are still waiting for further development in our work in order to clarify this finding.

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