

Electronic Journal of Polish Agricultural Universities is the very first Polish scientific journal published exclusively on the Internet, founded on January 1, 1998 by the following agricultural universities and higher schools of agriculture: University of Technology and Agriculture of Bydgoszcz, Agricultural University of Cracow, Agricultural University of Lublin, Agricultural University of Poznan, Higher School of Agriculture and Teacher Training Siedlce, Agricultural University of Szczecin, and Agricultural University of Wroclaw.



**ELECTRONIC
JOURNAL
OF POLISH
AGRICULTURAL
UNIVERSITIES**

**2000
Volume 3
Issue 1
Series
VETERINARY
MEDICINE**

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SKOCZYLAS B. 2000. CORTICAL BRANCHES OF MIDDLE CEREBRAL ARTERY IN DOMESTIC PIG (*Sus scrofa f. domestica*)
Electronic Journal of Polish Agricultural Universities, Veterinary Medicine, Volume 3, Issue 1.
Available Online <http://www.ejpau.media.pl/>

CORTICAL BRANCHES OF MIDDLE CEREBRAL ARTERY IN DOMESTIC PIG (*Sus scrofa f. domestica*)

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ABSTRACT

The anatomical structure of the middle cerebral artery in domestic pig (*Sus scrofa f. domestica*) was defined using 88 cerebral hemispheres. It was observed that the artery ramified into ten permanent branches. Two rhinal arteries supplied the area of cerebrum on the border between the old and the new cerebral cortex. The other eight branches bifurcated into three branches going into the frontal area, two branches - the parietal area and three temporal branches which supplied the new cerebral cortex exclusively. In domestic pig, most frequently, 38.7 %, the rostral cerebral artery gave rise to two and, in 59.1%, three independent branches. In one hemisphere (1.1%) the rostral cerebral artery gave rise to one main trunk of the middle cerebral artery. Similarly in one individual there were observed six independent branches of that artery.

Key words: Mamalian brain vaskularization. Middle cerebral artery

INTRODUCTION

The literature reports on the research into the structure and variability of the arteries of the cerebral base in domestic pig and in wild boar (Wiland Maliński 1968, Jabłoński, Brudnicki, Wiland 1989). The authors observed that in that species the middle cerebral artery was a multiple vessel, yet they do not report on the further cortical branching.

The papers were found which investigate the division of middle cerebral artery into respective branches in different animal species (Walinczus 1973, Chadzypanagiotis 1975, Wiland 1991, Węgrzyn & Roskosz 1983, Jabłoński & Roskosz 1997, Jabłoński et al 1996) as well as in humans (Lang Dehling 1980, Jachnowicz-Wiśniewska et al 1984). The multiple middle cerebral arteries reported by these authors were observed to be sporadic being rare vascular vessels. A common occurrence of multiple middle cerebral arteries was earlier found in wild boar (Skoczylas & Wiland 1999).

MATERIALS AND METHODS

The investigations were carried out on 44 animals of domestic pig (*Sus scrofa f. domestica*); 88 middle cerebral arteries have been described. The arteries were being filled with liquid latex through a common carotid artery. The preparations were being fixed with a 5 % formalin. Having decalcified the bones with a 5 % hydrochloric acid, cerebra were taken out and vessels filled with the matter injected were being displayed. Then the branches of the middle cerebral artery were being described and photographed.

RESULTS

In domestic pig, descending from the rete mirabile supraduralis embracing the hypophysis towards the base of the cerebrum, the internal carotid artery was found (a. carotis interna [Fig. 1-ci.](#)) The internal carotid artery, having perforated into the dura mater split into the rostral cerebral artery (a. cerebri rostralis -cr) and the caudal communicating artery (a. communicans caudalis).

The cerebral rostral artery was first observed in the abdominal area of the ophthalmic nerve and, having passed it, it ran towards the intermedial cerebral fissure. On the surface of the ophthalmic nerve, it gave rise to the rostral choroidea artery (a. choroidea rostralis -[Fig.1-ch](#)), and then the middle cerebral artery (a. cerebri media).

Independently of their branching out from the main trunk of the middle cerebral artery to supply the respective areas of the cortex, there were always observed the same branches descending. The permanent branches included, as follows:

The anterior rhinal artery (a. rhinalis anterior - [Fig. 1-1](#)), the branch going towards the rostral area of the lateral rhinal sulcus. Its marginal branches appeared occasionally from the lateral rhinal sulcus and they supplied the area of the cortex over the sulcus.

The posterior rhinal artery (a. rhinalis posterior - [Fig. 1-2](#)) - descended into the caudal part of the lateral rhinal sulcus and its marginal branches supplied the part of the cortex immediately over the sulcus.

The orbital branch (r. orbitalis - [Fig. 1-3](#)) - having passed the lateral rhinal sulcus, went towards the Presylvian sulcus and branched out on both sides.

The inferior frontal branch (r. frontalis inferior - [Fig. 1-4](#)) - went towards the middle part of the rostral Suprasylvian sulcus.

The superior frontal branch (r. frontalis superior - [Fig. 1-5](#)) ran towards the cerebral arch and was found over the ascending branch of the Sylvian fissure.

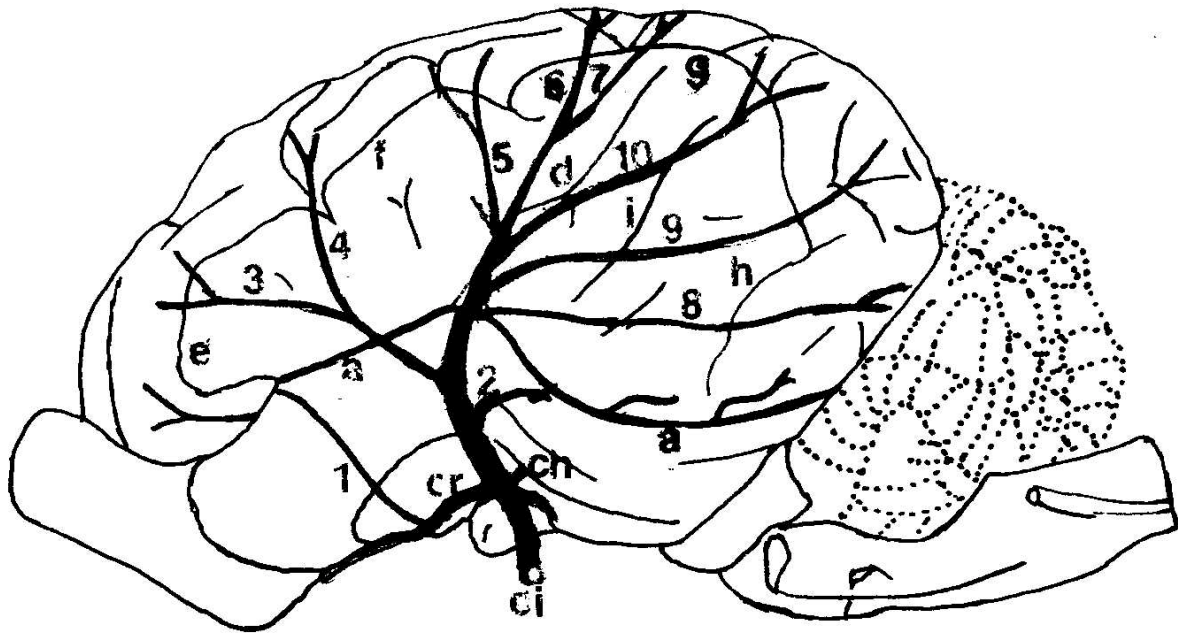
The anterior and posterior parietal branches (r. parietalis anterior et r. parietalis posterior - [Fig. 1-6,7](#)) remained thin vessels which originated from the branch within the ascending branch of the Sylvian fissure. Having got up onto the surface of the cortex, they branched out towards the arch. Having passed the middle Suprasylvian sulcus, they ran towards the ansatus and marginal sulci. Only their few terminal branches pass the sulci.

The inferior temporal branch (r. temporalis inferior - [Fig. 1-8](#)) branched out in the cortex area below the complex of the caudal ectosylvian sulcus. It ran towards the caudal suprasylvian sulcus, having passed it, the terminal branches went beyond the lower-posterior margin of the hemisphere and also branched out on its occipital surface.

The medial temporal branch (r. temporalis medius - [Fig 1-9](#)) went through the centre of the caudal ectosylvian sulcus and towards the upper part of the caudal suprasylvian sulcus and the final part of the marginal sulcus. The terminal branches could also get onto the occipal surface of the cortex.

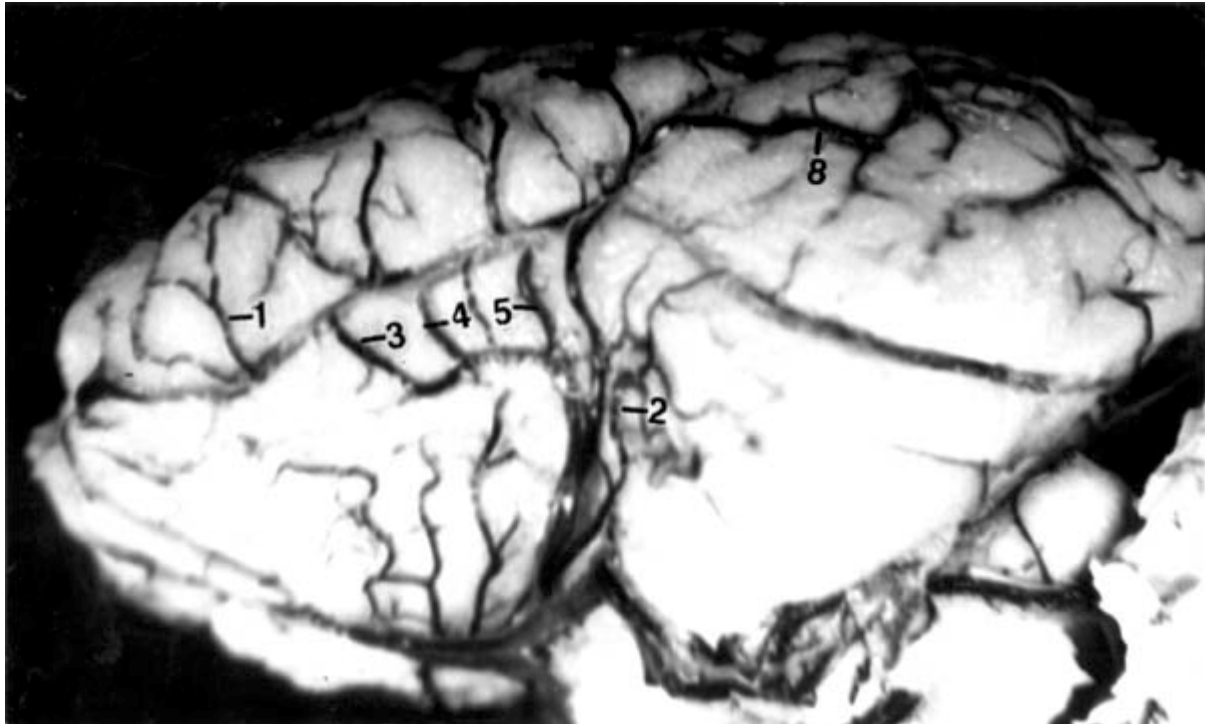
The superior temporal branch (r. temporalis superior - [Fig. 1-10](#)) remained the final branch of the middle cerebral artery which emerged from different places of the final part of the ascending branch of the Sylvian fissure. Then, having passed the marginal sulcus, its terminal branches reached the endomarginal sulcus yet they did not go beyond it.

Figure 1. Fig. 1. Diagram of branching out of the middle cerebral artery on the surface of the cortex in domestic pig: anterior rhinal artery (a. rhinalis anterior) -1, posterior rhinal artery /a. rhinalis posterior/ -2, orbital branch /r. orbitalis/ -3, inferior frontal branch /r. frontalis inferior/ -4, superior frontal branch /r. frontalis superior/ - 5, anterior parietal branch / r. parietalis anterior/ -6, posterior parietal branch / r. parietalis posterior/ -7, inferior temporal branch /r. temporalis inferior/ - 8, medial temporal branch /r. temporalis medium/ - 9, superior temporal branch /r. temporalis superior/ - 10, internal carotid artery /a. carotis interna/ -ci, rostral cerebral artery /a. cerebri rostralis/ -cr, rostral choroideal artery /a. choroidea rostralis/ -ch, lateral rhinal sulcus / sulcus rhinalis lateralis/ -a, ascending branch of the Sylvian fissure /ramus ascendens fissura Sylvia / -d, presylvian sulcus /sulcus presylvius / - e, suprasylvian rostral sulcus / sulcus suprasylvius rostralis/ -f, meadial suprasylvian sulcus /sulcus suprasylvius medius/ -g, caudal suprasylvian sulcus /sulcus suprasylvius caudalis/-h, caudal ectosylvian sulcus /sulcus ectosylvius caudalis/-i.



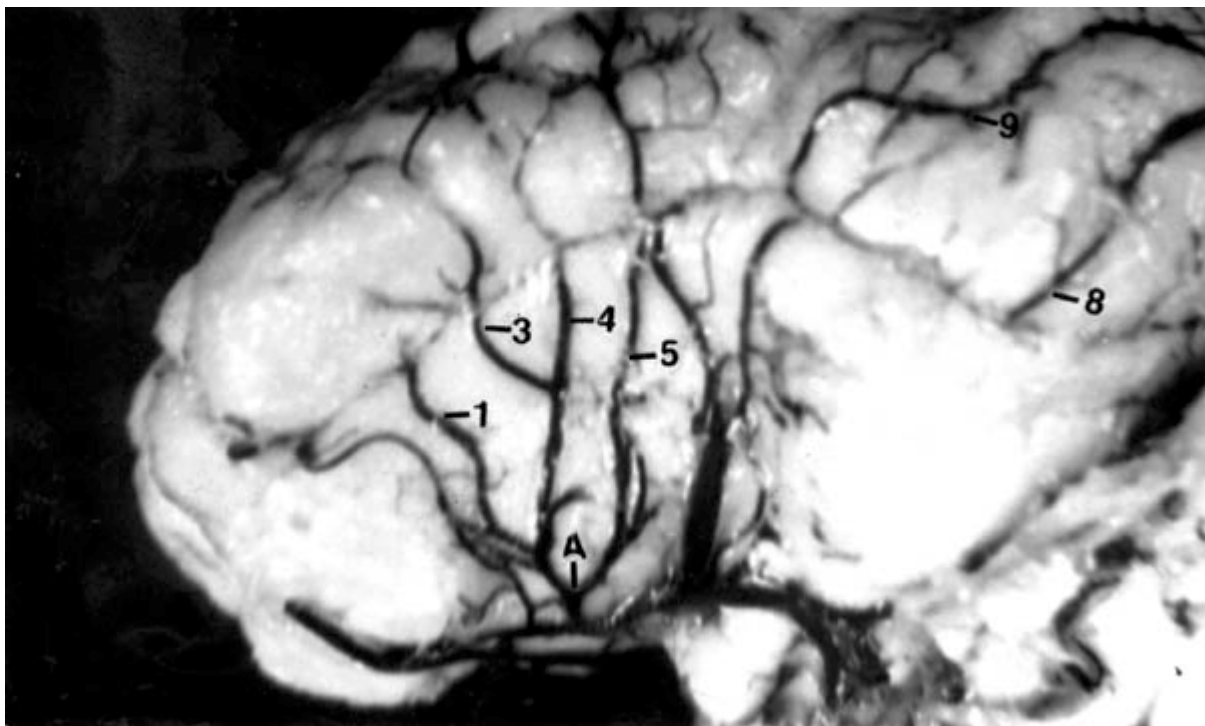
The rostral cerebral artery showed variations in branching of the above-specified branches. In one hemisphere there was observed a single medial cerebral artery which, having separated from the olfactory cerebral artery, gave rise to further cerebral branches ([Photograph1](#)).

Photograph 1. Case of single ascending of the trunk of the middle cerebral artery-giving rise to all the cortical branches. Cortical branches: anterior rhinal artery -1, posterior rhinal artery -2, orbital branch-3, inferior frontal branches: inferior -4, superior-5, inferior temporal branch -8.



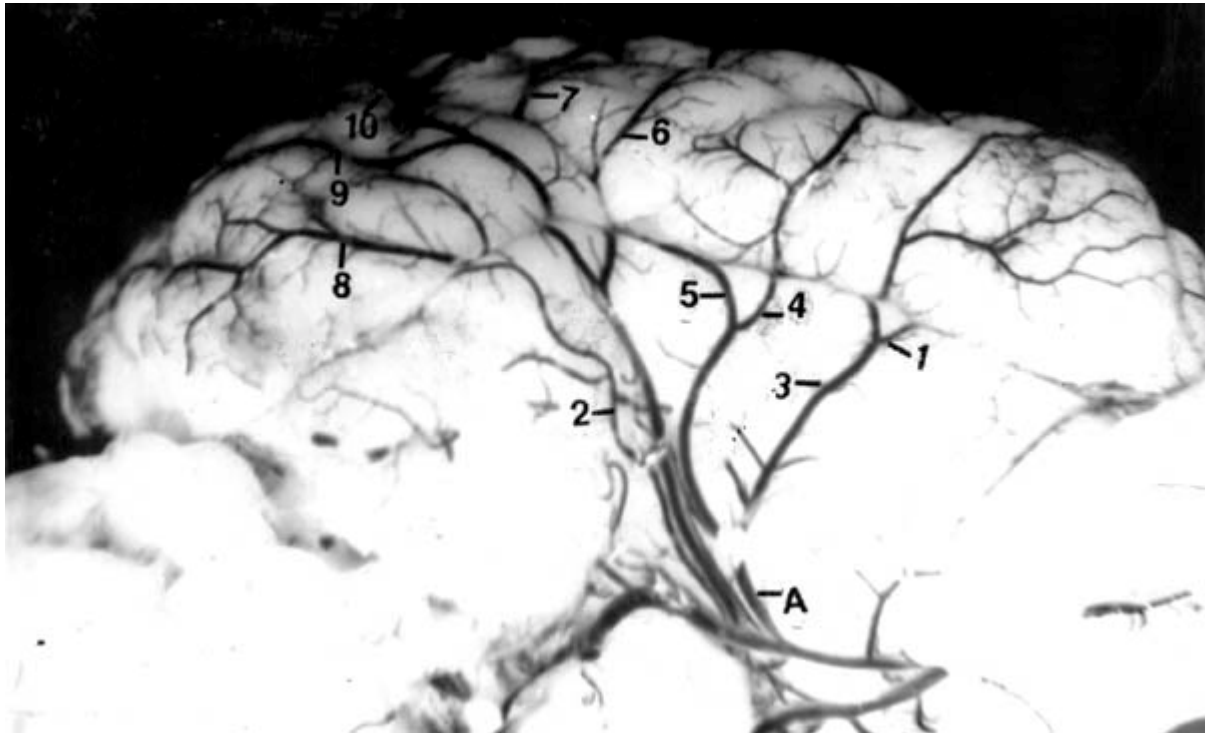
In 34 cases, the rostral cerebral artery gave two branches of the middle cerebral artery. Ascending rostrally, the second branch remained a common branch for the anterior rhinal artery, orbital branch and the inferior and superior temporal branches ([Photograph 2](#)).

Photograph 2. Case of two ascending branches: the rostral branch being the anterior middle cerebral artery -A, which bifurcates into the anterior rhinal artery -1, orbital branch -3 and frontal branches: 4,5. Caudally a common trunk for the cortical branch created.



The division of the middle cerebral artery into three independent branches was observed in two variants. In 36 hemispheres, the first branch constituted a common trunk for the anterior rhinal artery, orbital branch and the frontal inferior and superior branches. That branching was defined as the anterior middle cerebral artery (a.cerebri media anterior; [Photograph 3-A](#)). The other branch consisted of a common trunk for both parietal and temporal branches, while the third one of the posterior rhinal artery which separated independently from the rostral cerebral artery.

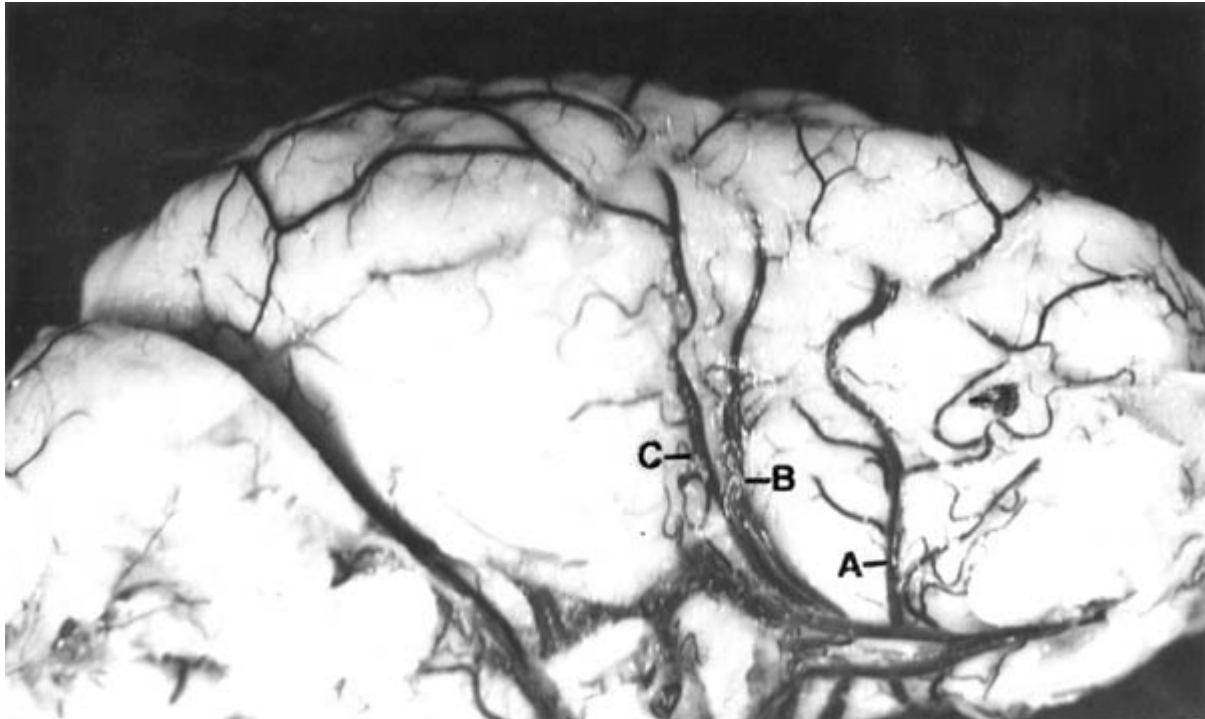
Photograph 3. Case of three branches of the middle cerebral artery ascending from the rostral cerebral artery: anterior middle cerebral artery -A, which gives rise to the anterior rhinal artery -1, orbital branch -3 and frontal branches: 4,5. The second independent branching consists of the common trunk of parietal branches -6,7 and temporal branches -8,9,10. The third branching - posterior rhinal artery -2.



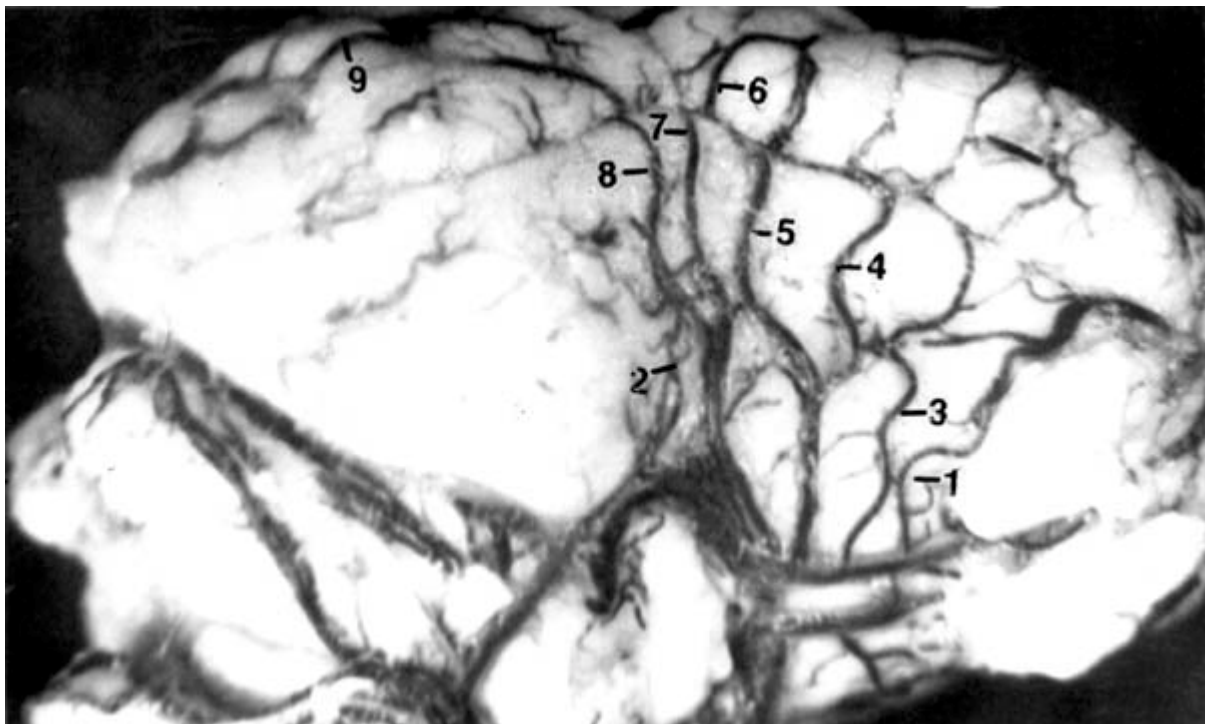
In the remaining 16 preparations there was observed a departure of three parallel branches. It was a common descend for frontal branches being the middle cerebral artery (a. cerebri media anterior), a common descend for parietal branches being the superior middle cerebral artery (a. cerebri media superior) and the terminal descend - a common trunk for the temporal branches marked as the posterior middle cerebral artery (a. cerebri media posterior); ([Photograph 4-A,B,C](#)).

In one case it was observed that the rostral cerebral artery gave rise to six branches of the middle cerebral artery. The first descending artery was noted to be the posterior rhinal artery, then a common trunk for the temporal branches. The consequent branch consisted of the trunk of temporal branches, rostrally to it, there was noted the common descend of the superior and inferior frontal branches. The hemisphere was also observed to possess an independent branching of the orbital branch and the posterior rhinal artery ([Photograph 5](#)).

Photograph 4. Three corresponding branches of the anterior middle cerebral artery ascending from the rostral cerebral artery -A, superior middle cerebral artery -B, posterior middle cerebral artery -C.



Photograph 5. Case of the rostral cerebral artery bifurcating into six branches of the middle cerebral artery: posterior rhinal artery -2, common trunk of temporal branches: 8,9, common trunk for parietal branches: 6,7, common descend of frontal branches: 4,5, independent descend of the orbital branch -3 and anterior rhinal artery -1.



DISCUSSION

The middle cerebral artery in domestic pig supplies the same cerebral areas as observed in the mammal species investigated and in humans and it bifurcated into 10 branches.

There were observed no discrepancies, as compared with the descriptions presented in the papers Chadzypanagiotis 1975, Jabłoński et al. 1996, Jabłoński 7 Roskosz 1997, Skoczylas 7 Wiland 1999, Walinczus 1973, Węgrzyn 7 Roskosz 1983, Wiland 1991.

The differences concerned the mode of respective branchings from the rostral cerebral artery. In domestic pig there was observed a division of the middle cerebral artery into two branches in 34 (38.7%); into three branches in 52 (59.1%) cases researched. A division of the middle cerebral artery into three branches was found in wild boar 38% (Skoczylas and Wiland 1999).

It seems interesting that in domestic pig, out of 86 (97.8%) hemispheres, frontal branches bifurcated from as the anterior middle cerebral artery. Similarly Skoczylas and Wiland 1999 observed it in wild boar in 38% of the cases researched.

In the other mammal species researched, there was noted an even considerably lower percentage of similar cases. A division of the middle cerebral artery into 6 branches descending independently from the rostral cerebral artery was found in domestic pig exclusively.

The observations carried out revealed that the mode of bifurcation of the main branches of the middle cerebral artery in domestic pig was similar to the one observed in wild boar. However in pig the division of the artery into subsequent branches was more varied.

CONCLUSIONS

The middle cerebral artery in domestic pig split up along its course into the anterior and posterior rhinal branches as well as three frontal branches, two parietal branches and three temporal branches.

Frontal, parietal and temporal branches occasionally gave rise to three branches; the middle cerebral artery divided up into the anterior, superior and inferior middle cerebral arteries.

In domestic pig most frequently there was observed a division of the trunk of the middle cerebral artery into three main branches.

The vascular variations meant an independent descend from the rostral cerebral artery of six branches of the middle cerebral artery.

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