Morphological description of the anterior cerebral artery and its branches in cadavers' samples

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SUMMARY

The diverse morphological expression of the anterior cerebral artery (ACA), described in several population groups, generates a complex spectrum of clinical signs when embolic or hemorrhagic strokes occur. This study evaluated the ACA and its branches in 162 cerebral hemispheres extracted from corpses at the Institute of Legal Medicine in Bucaramanga, Colombia. The proximal segments of the internal carotid and vertebral arteries were bilaterally perfused with semisynthetic resin dyed with red-colored minerals. The qualitative and morphometric characteristics of the ACA and its branches were recorded.

The length of the A1 segment was 12.4±2.5 mm, with a diameter 2.4±0.6 mm. The medial orbitofrontal branch (MOF) originated from the A2 segment in 144 cases (93.5%), and in 41 specimens (26.6%), it formed common trunks with the frontopolar branch (FP) or with the anterior medial frontal branch (AMF). The length and diameter of the marginal callosal branch (MC) were 59.7±18.8 mm and 1.6±0.5 mm, respectively. The sixteen cases (10.4%) of observed medial frontal branches stemmed from the ACA and not from the MC. In thirty-three cases (21.4%), the branch of the paracentral lobule (PcL) emerged from the A3 segment; in 81 samples (52.6%) from the MC; and in 40 (26%) from the A4 segment. This study found great variability in the emergence of the ACA branches, especially the MC, the MF, and the PcL. Knowing the origin, unique or branched pathways, and territories irrigated by the ACA and its branches enriches the diagnosis, management, and interventions when these structures are compromised in clinical events.

Key words: Anterior cerebral artery – Callosomarginal branch – Hypoplasia – Agenesis – Frontopolar branch

INTRODUCTION

The anterior cerebral artery (ACA) usually arises from the anterior medial side of the internal carotid artery (ICA) and goes laterally to the optic chiasm and inferior to the anterior perforated substance, continuing anteriorly to the interhemispheric fissure. Then, this artery is anastomosed with contralateral ACA through the anterior communicating artery to form the anterior portion of the arterial circle of the brain (Ferre et al., 2013; Mandiola et al., 2005; Martinez et al., 2004; Mavridis et al., 2012; Uchino et al., 2016; Ishiguro,

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Submitted: July 10, 2024. **Accepted:** August 22, 2024

https://doi.org/10.52083/NKYD3761

2024). The ACA and its branches irrigate the medial segment of the base of the frontal lobe, most of the medial aspect of the cerebral hemisphere, except the medial aspect of the occipital lobe, and through its branches reach the upper border of the hemisphere and irrigate a strip of 10-15 mm of the outer aspect of the cerebral hemisphere (Martinez et al., 2004; Mavridis et al., 2012; Uchino et al., 2016).

Five segments of the ACA have been topographically described (Cilliers et al., 2017; Martinez et al., 2004; Mavridis et al., 2012; Uchino et al., 2016; Wolman et al., 2022). Initially, the precommunicating segment (A1) has a posteroanterior path and a diameter of 1.5-2.4 mm and a length of 9.6-17.3 mm; from this segment, the basal branches arise to penetrate the anterior perforated substance. Segment A2 begins after the anastomosis with the contralateral ACA, advances vertically over the subcallosal gyrus, and ends at the knee level of the corpus callosum. In this path, the medial orbitofrontal (MOF) and frontopolar (FP) branches emerge, while in their most proximal part, the medial striate branch (MS) usually stems. The A3 segment surrounds the knee of the corpus callosum and gives rise to the marginal callosum branch (MC), from which the medial frontal branches originate, and it may end as a branch of the paracentral lobule (PcL) (Afifi et al., 2021; Martinez et al., 2004). The A4 segment is called the pericallosal branch (PC) and runs above the corpus callosum and stems into the branches for the cingulate gyrus; it ends by giving the precuneal branch that irrigates the homonymous gyrus (Martinez et al., 2004; Mavridis et al., 2016; Uchino et al., 2016). Finally, the A5 segment runs towards the distal portion of the corpus callosum near the splenium; there, the medial inferior parietal branch emerges (MIP).

The ACA also has cortical branches with a defined origin, trajectory, and irrigated territories. The small and constant MS emerges from the base of the ACA, being usually the longest of the medial lenticulostriate arteries that originate from the ACA (Dimitriu et al. 2013; El Falougy et al., 2013). The MOF branch normally originates in the A2 segment of the ACA and irrigates the orbital gyrus at the base of the frontal lobe and a part of the septal area (Perlmutter et al., 1976; Agarwal et al., 2022); it can also sometimes be found as a common trunk with the FP branch (Gasca-Gonzáles, 2011), although this anatomical expression has not been quantified. Its duplication has been described in 6% of cases (Agarwal et al., 2022; Cilliers et al., 2017). The FP branch irrigates most of the pole of the frontal lobe, and the emergence of the AMF has been reported from the FP (Cilliers et al., 2017; Perlmutter et al., 1976; Stefani et al., 2000).

The PC constitutes the A4 segment, runs on the homonymous groove, and ends in a precuneal branch that irrigates the homonymous gyrus of the parietal lobe. During its trajectory, it gives small branches to the corpus callosum and to the cingulate gyrus. The medial superior parietal branch (MSP) as collateral of the A4, and the medial inferior parietal branch (MIP) for the A5 segment have been described as contributing vessels for the irrigation of the precuneal gyrus (Cilliers et al., 2017; Perlmutter et al., 1976; Stefani et al., 2000; Wolman et al., 2022). The MC is considered the largest branch of the ACA, originating from A3. During its trajectory, it runs upward on the gyrus of the cingulate to continue through the callosomarginal sulcus, usually ending as PcL. Frequently, from this artery arise the anterior medial frontal (AMF), the middle medial frontal (MMF), and the posterior medial frontal (PMF) branches. These latter branches can emerge directly from the A3, so the MC branch in these cases reduces its irrigated territory (Agarwal et al., 2022; Martinez et al., 2004). These final branches can be grouped together in common trunks or emerge individually, resulting in a wide range of variability. The MC branch has been reported to end in a range of 53.6-100% PcL (Agarwal et al., 2022; Cavalcanti et al., 2010; Ferré et al., 2013; Mavridis et al., 2012; Stefani et al., 2000; Ugur et al., 2006).

Vascular lesions in the territory irrigated by the ACA produce hemiparesis and contralateral hemianesthesia, disorders in the level of alertness, dysexecutive syndrome, disinhibition, impulsivity, and difficulties in the onset of language. Of acute ischemic strokes, those involving the territory of the ACA have a reported incidence of 0.3-4.4%. Therefore, studies with large population samples evaluating ACA infarction are scarce

(Arboix et al., 2009; Vemmos et al., 2000; Matos Casano et al., 2023).

Anatomical expressions of ACA have been described by classical dissection techniques, injections of its vascular beds, or imaging studies in different population groups (Cavalcanti et al., 2010; Ferré et al., 2013; Mavridis et al., 2012; Stefani et al., 2000; Ugur et al., 2006). The ethnic configuration is a critical factor in the development of various vascular structures. Since there is a lack of literature on the ACA in the Latin American mestizo population, this study conducted on cadaveric specimens offers valuable insights that improve anatomical knowledge. These findings can be applied in diverse scenarios involving the ACA and its branches and contribute to better translational applications.

MATERIALS AND METHODS

This descriptive study evaluated the anatomical characteristics of the ACA and its branches in 162 cerebral hemispheres extracted from fresh corpses of individuals who underwent necropsy at the Institute of Legal Medicine of Bucaramanga, Colombia, who did not present blunt and/or penetrating cranioencephalic trauma. The inclusion criteria were the Mestizo population, reflecting the predominant racial mixture of Amerindian, Caucasian, and Afro-descended ancestries found in Colombia and many other Latin American countries. The sample included male subjects aged 20-80 years (female cases were not evaluated due to the small number of forensic autopsies performed on women) and without acute or chronic pathologies involving the central nervous system.

The following procedure was performed on each cadaveric specimen: a “V”-shaped incision was made from the mastoid process to the jugular incision, with compression of the skin and subcutaneous cellular tissue. The anterior and lateral regions of the neck were dissected bilaterally, exposing the muscular component. Then, the sternocleidomastoid muscles were disinserted at the level of the proximal origin, and the clavicles were repositioned bilaterally. Subsequently, the proximal segment of the vertebral artery (VA) and each of the structures of the neurovascular bundle of the neck were dissected.

Each of the components of the neurovascular package of the neck was individualized, and the VA was dissected. Next, the proximal segments of the ICA and VA were bilaterally channeled. After that, the vascular beds were rinsed with saline, and 3% formaldehyde was used to fix the brain through them. Subsequently, 100 cc of semisynthetic resin (mixture of palatal E210®, Basf 80 cc, and styrene 20® cc) impregnated with mineral red color was perfused. Once the polymerization of the resin was obtained (in 30 minutes), the brain was excised, and then the sample was fixed with 10% formaldehyde for 15 days.

With adequate brain fixation, the leptomeninges were cleaned, a maneuver to fully identify each of the emerging segments and branches of ACA. A digital calibrator (Mitotuyo ®) was used to measure the medial and lateral length and diameter (D) of each of the segments and branches of the ACA. The different anatomical expressions of the emerging branches were described according to their location in the segment of the ACA in which they originated, and their distribution as single branches or as part of vascular trunks of varied trajectories. Similarly, cases of the agenesis of these branches were recorded. Due to their wide variability in their origin and distribution, the internal frontal branches were typified according to Cavalcanti’s criteria (Mavridis et al., 2016): Type I when the AMF-MMF-PMF branches originate from the MC branch separately; Type II, the common trunk of the AMF-MMF branches; Type III, the common trunk of MMF-PMF branches; Type IV, the trunk of PMF-AMF branches; and Type V, when the AMF-MMF-PMF branches originated from a common trunk. Type VI, when the AMF-MMF-PMF branches originate from ACA segments and not from the MC branch.

The findings of each of the samples were photographed with a digital camera (Canon EOS T7I). The results of the format were recorded into an Excel spreadsheet for statistical analysis using SIGMA STATA 4.0. software. The statistical tests were the t-test and U-Mann-Whitney test for parametric and non-parametric data, respectively, accepting an alpha error of up to 5%. Because the study sample was for convenience (availability of cadaveric specimens from forensic autopsies), the data was nonparametric, and the U Mann-Whitney test was used.

RESULTS

The ACA from 79 right hemispheres (48.8%), and 83 from left hemispheres (51.2%) were evaluated. Firstly, the length of the A1 segment was 12.4±2.5 mm, and its diameter was 2.4±0.6 mm. Secondly, the A2 segment, with its trajectory on the medial septal area in the direction of the straight gyrus and olfactory groove, presented a diameter of 2.3±0.6 mm and a length of 16.1±3.5 mm. Next, the A3 segment measured 27.2 ±5.4 mm and had a diameter of 2.1 ±0.6 mm. Lastly, the A4 and A5 segments had a length of 26.4±4.3 mm and 18.5±2.9 mm, respectively.

The MOF branch was observed in all specimens. It had a total bilateral length of 55±12.31 mm and a diameter of 0.73±0.3 mm (Table 1). It originated from the A2 segment in 144 cases (93.5%), in 41 cases (26.6%) it stemmed from forming the common trunks with the PMF branch or with the AMF branch, while in the remaining 73.4% it emerged as a single main trunk. On the other hand, the FP branch presented a length of 54±12.9 mm with a diameter of 0.9±0.3 mm. It originated from A2 in 78 cases (50.6%) (Fig. 1) and from A3 in 63 cases (50%) (Table 1). The MC branch presented a trajectory on the homonymous sulcus parallel to the trajectory of the A4 segment of the ACA (Fig. 2). Its length and diameter were, respectively, 59.7±20 mm and 1.6±0.5 mm.

The length of the AMF branch was 47±13.9 mm, with a diameter of 0.9±0.3 mm. This branch originated from A3 in 80 cases (52.3%), from the MC branch in 57 (37.3%), and from A2 in 16 specimens (10.5%). The length of the MMF branch was 42.3±9.7 mm, with a diameter of 0.8±0.4. Agenesis of this branch was found in 7.8% of cases, and it originated from A2 in 3 cases (2.1%), from A3

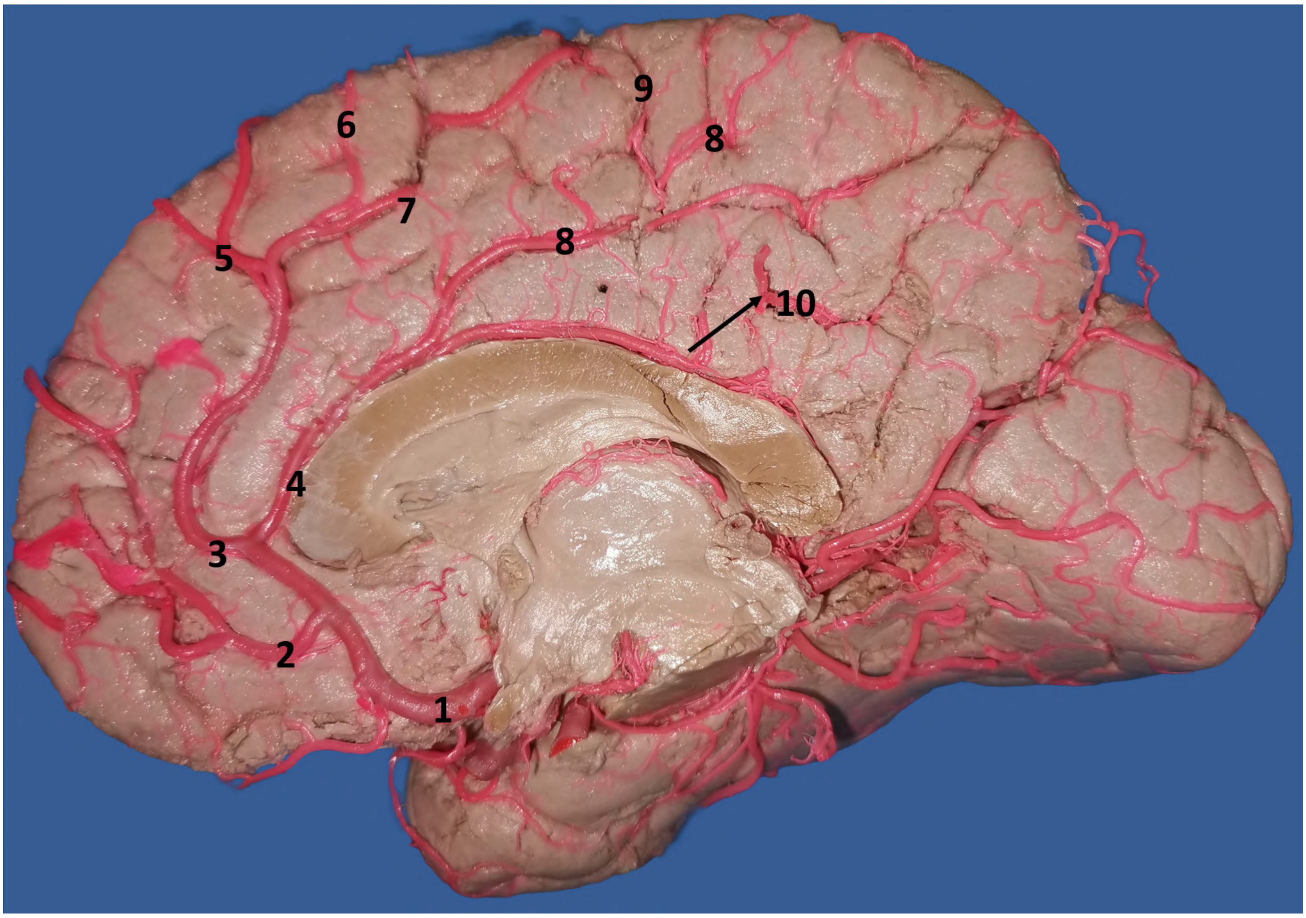

Fig. 1.- Anterior cerebral artery and its variant branches. Right hemisphere. segment A2 (1); Frontopolar branch (2) emerging from A2; Callous Marginal ramus (3) emerging from A3 from which emerge Medial Frontal branches (5) Anterior, (6) Middle, (7) Posterior; Segment A4 (4) trunk for Paracentral Lobule branch (9) and Superior Medial Parietal branch (8); Medial Inferior Parietal Branch (10) emerging direct from segment A5.

Table 1. Statistical summary of the biometric variables of branches of the anterior cerebral artery according to the presentation side and level of emergency.

Artery		D n=79	I n=83	TOTAL	p	Presence	EMERGENCY %					
							A1	A2	A3	MC	A4	A5
MOF	LM	40.6±10.4	40.5±10.1	40.5±10.2	0.794	100	0.7	93.5	0.6	5.2	-	-
	LL	15.6±5.5	14.6±4.4	15.1±4.9	0.514							
	LT	55.6±13.1	54.5±11.7	55±12.31	0,602							
	D	0.8±0.3	0.6±0.3	0.73±0.3	0.089							
FP	LM	38.7±11.3	39.7±10.6	39.2±10.9	0.468	100	0.6	50.6	50	7.8	-	-
	LL	14.4±5.4	15.7±8	15.1±6.9	0.208							
	LT	52.5±13	55.4±12.8	54±12.9	0.165							
	D	0.9±0.3	0.9±0.3	0.9±0.3	0.843							
AMF	LM	30.6±12.3	31.1±11.2	31.4±11.7	0.354	99.4	-	10.5	52.3	37.3	-	-
	LL	15.4±5.1	16.5±6.1	16±5.6	0.433							
	LT	45.6±14	48.3±13.8	47±13.9	0.296							
	D	0.9±0.3	0.8±0.4	0.9±0.3	0.270							
MMF	LM	27.5±8.5	10.29.1±.7	28.3±.9.7	0.508	92.2	-	2.1	50	46.5	1.4	-
	LL	14.7±6	14.8±5.6	14.7± 5.8	0.802							
	LT	41.8±11.6	42.9±12.5	42.3± 12	0,592							
	D	0.8±0.4	0.8±0.4	0.8±.0.4	0.938							
PMF	LM	31.9±10.4	11±32.6	32±11	0.862	98.7	-	1.3	36.2	50	12.5	-
	LL	15.2±6.2	14.4±5.8	15±6	0.899							
	LT	46.1±14.2	45.9±12.8	46±13.5	0.941							
	D	0.9±0.3	0.9±0.3	0.9±0.3	0.655							
PcL	LM	39.8±12.5	41±13.2	40.4±12.8	0.425	100	-	-	21.4	52.6	26	-
	LL	15.1±6.1	13.9±5.4	14.5±5.7	0.244							
	LT	54.2±13.2	52.7±15.9	53.4±14.7	0.515							
	D	1±0.3	0.9±0.3	0.9±0.3	0.133							
MSP	LM	49.2±14.8	48.6±14.9	48.9±14.8	0.821	96.7	-	-	4.1	17.6	64.2	14.2
	LL	12.4±3.7	12.9±3.8	12.7±3.7	0.631							
	LT	53.2±15.8	54.1±16.5	53.6±16.1	0.747							
	D	1±0.3	0.9±0.4	0.9±0.3	0.597							
MIP	LM	33.7±17.3	12.1±31.8	32.4±15.2	0.630	94.8	-	-	1.4	6.8	7.5	84.2
	LL	15.3±7.1	16.2	15.6±5	-							
	LT	34.3±18.5	31.4±13.3	32.8±16.1	0.630							
	D	0.6±0.3	0.7±0.3	0.7±0.3	0.232							
MC	L	61.3±18.8	58±21.5	59.7±20	0.208							
	D	1.6±0.6	1.6±0.5	1.6±0.5	0.887							
A4	L	70.7±12.1	70.6±10.1	70.7±11	0.935							
	D	1.49±0.5	1.4±0.5	2±0.43	0.376							
MS	L	20.6±1.3	20.1± 4	20.3±4.1	0.333							
	D	0.5± 0.2	0.5± 0.2	0.5± 0.2	0.563							

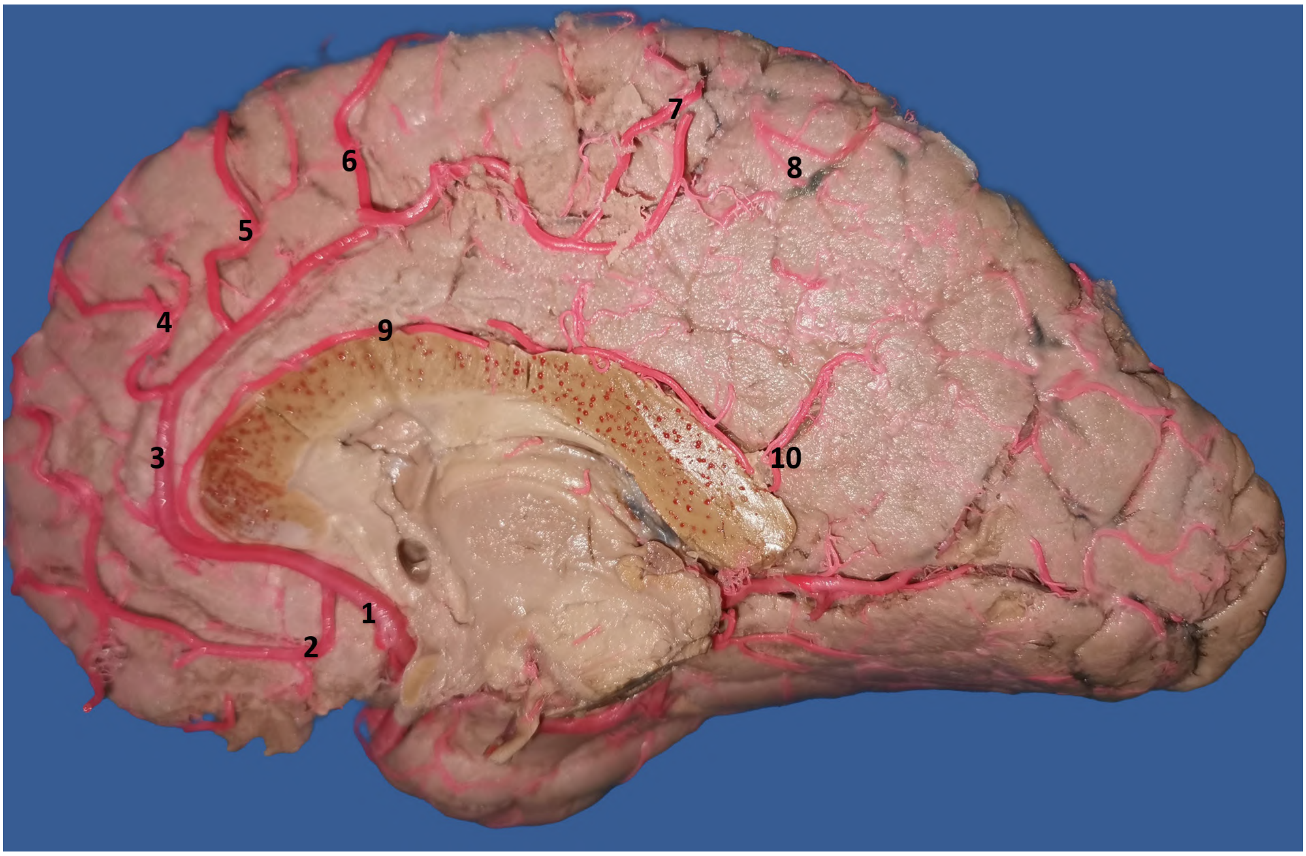

Fig. 2.- Anterior cerebral artery and its variant branches. Right hemisphere. segment A2 (1) from which the Medial Frontopolar (2) and Callosomarginal (3) branches emerge; from the callosomarginal (3) emerge the Anterior Medial Frontal (4), Media (5) and Posterior (6) branches, as well as the branch for the Paracentral Lobule (7) and the Medial Superior Parietal branch (8); from segment A5 emerges the Inferior Medial Parietal branch (10).

in 71 (50%), while from the MC branch, it originated in 66 samples (46.5%) and from A4 in two cases (1.4%). The PMF branch presented a length of 44.6±13.5 mm and a diameter of 0.9±0.3 mm. Agenesis was found in 1.3% of cases. It was observed that the PMF branch, along with the other medial frontal branches, presented a variable origin and distribution, from single origins to forming trunks (Fig. 1). The origin of medial frontal branches from the ACA branch and not from the MC was seen in 16 cases (10.4%) (Table 2).

The PcL branch had a length of 53.6±16.1 mm and a diameter of 0.9±0.3 mm. In 33 cases originated (21.4%) from the A3 segment (Fig. 3), in 81 samples (52.6%) from the MC branch, and 40 cases (26%) from the A4 segment (Table 3). Additionally, truncal formation of the PMF-LP c branches was found in 25 cerebral hemispheres (16.4%). The MSP branch had a length of 53.6±16.1 mm and a diameter of 0.9±0.3 mm. It originated from the A3 in 6 cases (4.1%), from the MC branch in 26 cases (17.6%), from the A4 in 95 (64.2%) (Fig. 4),

Table 2. Classification of the internal frontal branches of ACA according to their origin. Number of cases and percentage (%).

Classification	Hemispheres (%)		
	D	I	Total
Type I: AMF-MMF-PMF have separated origin from the MC.	14(18,6)	13 (16,5)	27 (17)
Type II: AMF-MMF common trunk	11 (14,7)	15 (19,2)	26 (17)
Type III: MMF-PMF common trunk	15 (22,1)	12 (16.2)	27(19)
Type IV: PMF-AMF trunk	15 (20)	12 (15,4)	27 (17)
Type V: AMF-MMF-PMF originate from a common trunk	8 (10,7)	11 (14,1)	19(12)
Type VI: AMF-MMF-PMF originate from segments of the ACA and not from the MC	7 (9,3)	9(11,4)	16 (10,4)

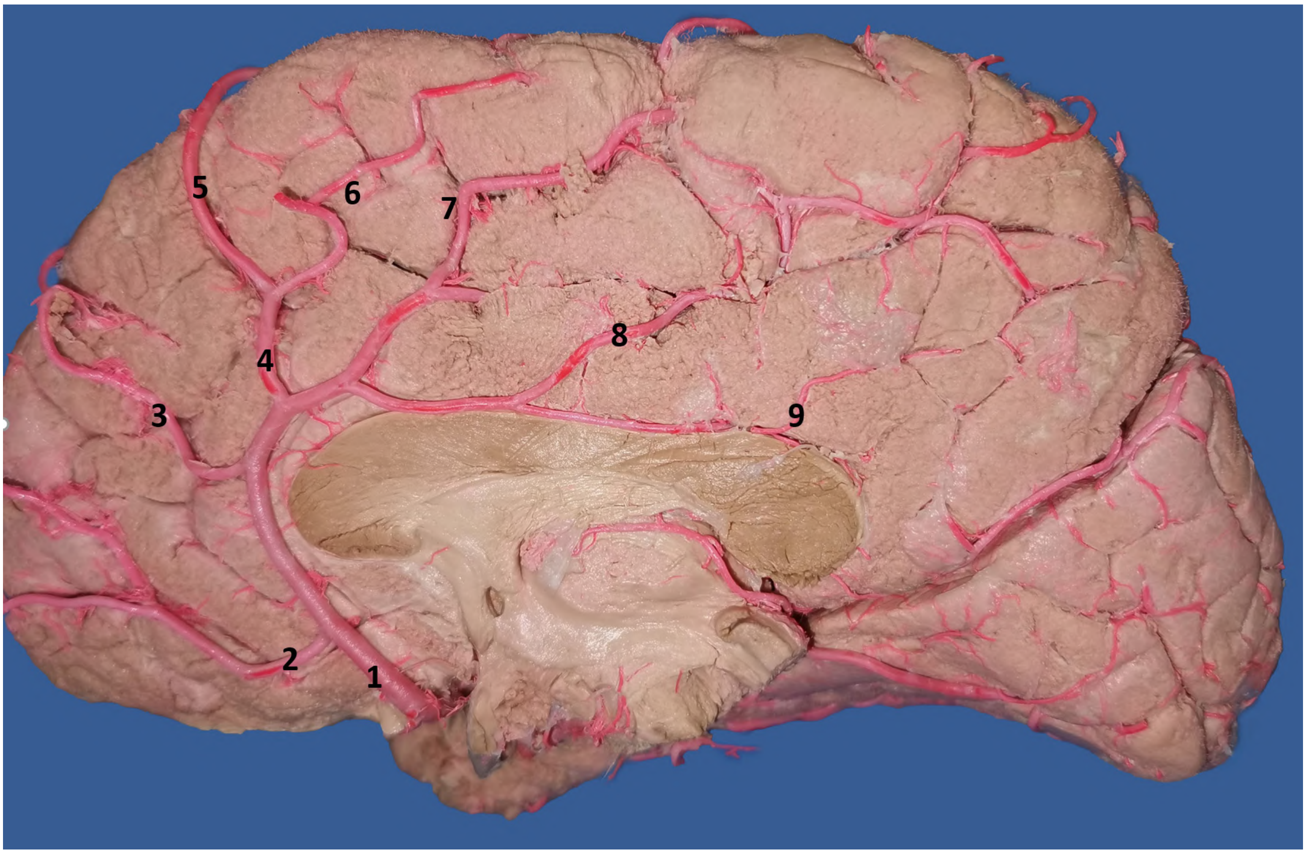

Fig. 3.- Anterior cerebral artery and its variant branches. Right hemisphere. Frontopolar branch (2) emerging from A2 (1); Anterior Medial Frontal branch (3) and trunk (4) for Medial Frontal Medial (5) and Posterior Medial (6) branches emerging from A3; branch for Paracentral Lobule (7) emerging direct at end of A3; Superior Medial Parietal Branch emerging from A4 (8); and Inferior Medial Parietal (9) branch emerging from A5.

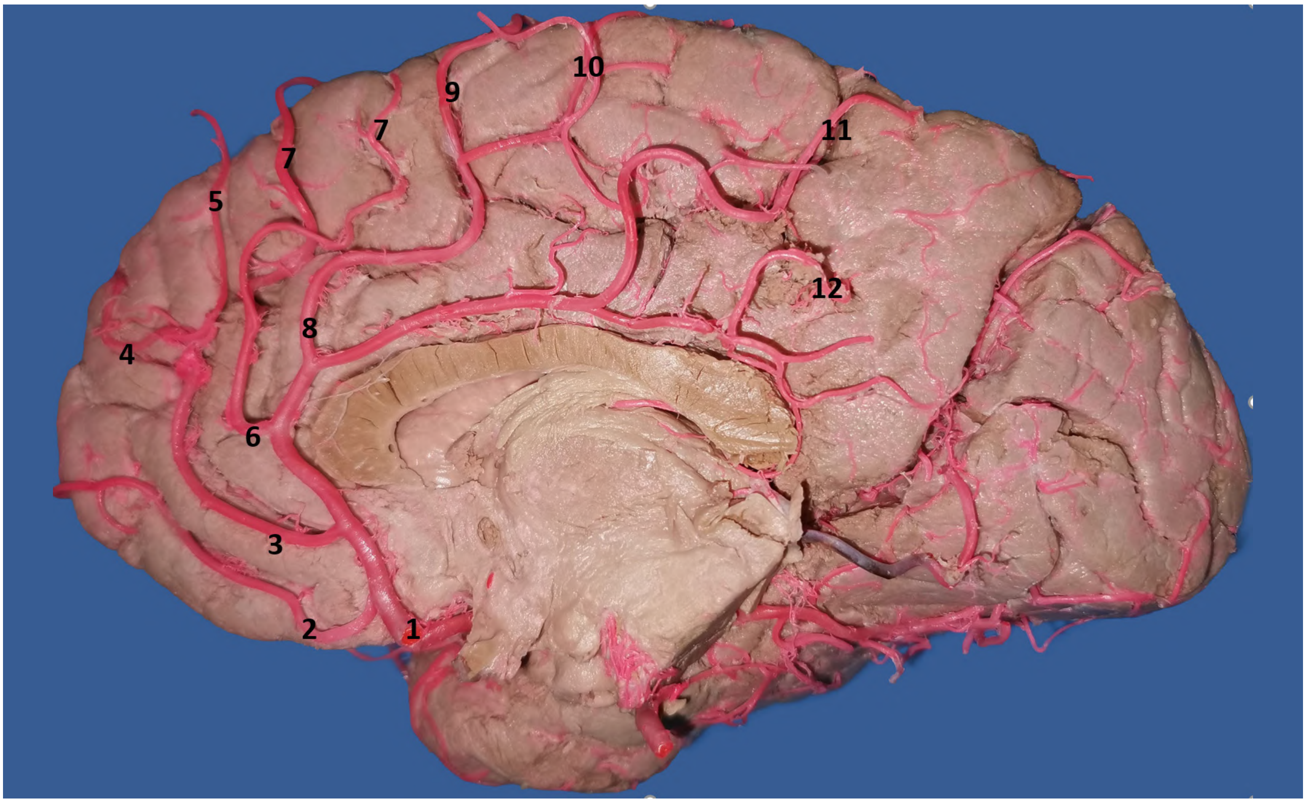

Fig. 4.- Anterior cerebral artery and its variant branches. Right hemisphere. Medial Frontobasal branch (2) emerging from A2 (1) ; Frontopolar branch (4) emerging from A2 in a trunk (3) with the Anterior Medial Frontal branch (5); Callosomarginal branch emerging from A3 (6) from which the Middle Medial Frontal Branch (7) originates; Posterior Medial Frontal branch (9) and the Paracentral Lobule branch (10) emerge in a common trunk (8); Medial Superior Parietal branch emerging at the end from A4 (11); Medial Inferior Parietal Branch Emerging from A5 segment (12).

and the A5 in 21 cases (14.2%) (Table 1). On the other hand, 5.2% of the cases have agenesis of the PIM branch, and in two cases (1.4%) its origin was from the A3 segment, with a length of 32.8±16.1 mm, from the A4 in 11 (7.5%); and it emerged from the A5 segment in 123 specimens (84.2%); and from the MC branch in 10 (6.8%) cases.

DISCUSSION

The morphology of the ACA and its branches has been well described due to their clinical importance. The MOF caliber of our findings (0.7 mm) was larger than those reported. (Cavalcanti et al., 2010; Kedia et al., 2013; Stefani et al., 2000). The dimensions of its trajectory through the medial (40.5 mm) and lateral (15.1 mm) faces of the hemisphere are larger than those reported in a previous study (Stefani et al., 2000; Mavridis et al., 2016). This discrepancy may be determined by the measurement site (proximal, intermediate, or distal) used in the diverse morphometric studies and the quality of the vascular perfusion, which causes biases in the measurement of the calibers and dimensions of arterial structures.

The diameter of the FP branch (0.9 mm) found in the present study is in an intermediate range in relation to what was previously reported (range of 0.46-1.4mm) (Cavalcantial et al., 2010; Kedia et al., 2013; Kizhisseri et al., 2023; Stefani et al., 2000; Ugur et al., 2006). A previous study reported a shorter vessel length of 21.6 mm (Stefani et al., 2000), whereas, in our findings, a longer length of 40.2 mm was recorded on the medial aspect of the cerebral hemisphere. The severity of impairments in higher mental functions is determined by the type of lesions of the MOF and the FP that irrigate a wide surface of the prefrontal areas. Furthermore, the damage to the orbitofrontal cortex affects learning by causing a functional imbalance between the right and left orbitofrontal cortex, which is seen as the inability to maintain attention or the speed of information processing (Mavridis et al., 2016; Szatkowska et al., 2007; Rolls et al., 2023).

Similarly, we found a slightly longer length of the MC branch (54 mm) than those previously reported (43-48 mm) (Perlmutter et al., 1976; Stefani et al., 2000). The reasons for understanding the differences among the reports of the arterial lengths are the site of origin, the tortuous trajectories, and the irrigation of non-usual cortical areas due to the hypoplasia of neighboring vascular branches (Cilliers et al., 2017).

The AMF, the MMF, and the PMF branches have been reported emerging individually from the MC branch or trunks from each other. The MMF-PMF trunk expression with the higher incidence, as well as the frequency data of the AMF-MMF and the AMF-MMF-PMF trunks found in our study, are similar to those reported in another population sample. A significantly lower incidence of 7.1% has been reported (Cavalcanti et al., 2010), compared to what was observed in our series of the PMF-PcL branch trunk. The diameter of the medial frontal branches found in the present study is within a medium range, in relation to what has been reported in the literature (0.3-1.4 mm), while its length was located close to the smallest dimensions in previous records (41.3-73.0 mm) (Cavalcanti et al., 2010; Kedia et al., 2013; Stefani et al., 2000; Ugur et al., 2006).

Additionally, previous studies failed to specify whether the measurement of the length of the cortical branches of the ACA included the assessment of its trajectory in the two faces of the cerebral hemispheres; this scenario holds significant clinical importance, as the extension of these branches in the upper segment of the external face of the cerebral hemisphere plays a crucial role in either amplifying or reducing the intensity of the clinical manifestations of ischemic or hemorrhagic strokes affecting the ACA or its branches. The documented lengths of the PcL, the MSP, and the MIP branches are greater than those previously reported, while their diameters remain similar (Cilliers et al., 2017; Perlmutter et al., 1976; Stefani et al., 2000).

The wide range of variability observed in our study regarding the origin, course or trajectory, arrangement of emerging branches, and its termination in the central lobule of the MC branch should be considered in the radiological interpretation of its structure, assessment of the clinical signs indicating its involvement, and planning of surgical procedures affecting the upper middle segment of the medial aspect of the hemisphere. For instance, in its usual presentation through its frontal branches, it contributes to the irrigation of prefrontal, premotor, motor, and sensory areas for the contralateral lower limb and cingulate cortex. Occlusive alterations of the CM branch can determine, in addition to mild cognitive disorders and limbic activity disorders, contralateral inferior monoplegia and decreased bladder and anal sphincter control, aspects that must be considered in a correct clinical evaluation (Sharma et al., 2023). This situation may be minimized depending on the number and quality of the anastomoses that these arterial branches have with branches of the middle cerebral artery in the area adjacent to the upper border of the compromised cerebral hemisphere.

In cases of variant presentations, partial signs similar to those described may occur, cognitive signs if the vascular damage involves only the AMF and the MMF, and motor signs if the PMF and the PcL branches from the MC branch are affected (Cavalcanti et al., 2010; Kedia et al., 2013; Ugur et al., 2006). Knowing the dimensions of the calibers of the different segments of the ACA is of great utility for the design of angiographic microcatheters and guides used in endovascular procedures, being of significant importance in the activity of neurointerventional surgeons (Sharma S et al., 2023).

It can be considered a limitation of this descriptive study that it was performed in a sample of the mestizo population group, highly predominant in Colombia, leaving samples of Caucasian and Afro-American individuals without evaluation due to the very small number of individuals in these ethnic groups who undergo forensic autopsy in our country.

CONCLUSION

This study, conducted on cadaveric samples, highlights the significant variability in the anatomical configuration of the MC and its emerging branches, along with the trajectory of the ACA branches through the lateral aspect of the cerebral hemisphere (approximately 15 mm in length). A comprehensive understanding of the morphology of the ACA branches, including their origin, individual trajectories, formation of trunks, and the territories they irrigate, contributes to improved diagnosis, management, and interventions when these structures are implicated in clinical vascular events.

ACKNOWLEDGEMENTS

The authors sincerely thank those who donated their bodies to science so that anatomical research and teaching could be performed. Results from such research can potentially increase scientific knowledge and improve patient care. Therefore, these donors and their families deserve our highest respect.

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