"OVIDIUS" UNIVERSITY CONSTANŢA
DOCTORAL SCHOOL OF THE FACULTY OF MEDICINE

ANTERIOR CEREBRAL ARTERY MORPHOLOGY AND NEUROSURGICAL IMPLICATION OF

- THESIS

abstract-

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INTRODUCERE

The aim of this study was to shed light on the presence of normal anatomic variants that are associated neurosurgical pathology and intracranial aneurysms and arteriovenous malformations.

I watched the branches that form the anterior segment of Willis arterial polygon. I wrote all their morphological peculiarity and collateral artery branches. We also made observations on the role of local anatomy and aneurysmal genesis of the risk of rupture. The findings of this systematic investigation are trying to bring a satisfactory solution to this problem .

After a brief introduction in which I described the goal that motivated this work, the method and material work, we made a short presentation on the ontogenetic development of the cerebral circulation.

We have considered it a chapter of the study generally presenting theories relates to cerebral circulation, within Willis polygon and also a have described some concepts of physiology and pathophysiology involving the anterior cerebral vascular system.

Arterial morphology description of anterior segment of Willis arterial polygon we made it by each branch detail that goes into it, the data obtained were analyzed and compared with data from the literature. Morphological studies included the description of several anatomical variants, functional anatomy of problems.

We also studied some clinical cases of vascular pathology: intracranial aneurysms and subarachnoid hemorrhage associated with it and also arterio-venous malformations.

Finally we pointed out the results of this study, important for anatomists, and especially for neurosurgeons and radiologists

General bibliography includes over 200 titles that I had the opportunity to consult, which shows that the morphology of the common iliac vessels is less debated by specialists compared with other blood vessels.

Thank, doctors Marius Popa, Constantin Ionescu, Ionut Bulbuc for whose help I received in solving problems for the realization of this work, I also thank Dr. Mariana Bardas imaging center coordinator: Medimar Imaging Services were I have made RM and CT examinations.

Finally, thank prof. Dr. Bordei Petru,, scientific leader of the thesis, to whose guidance I received during the seven years that I realized this paper.

PERSONAL RESULTS

MATERIAL AND METHODS

We have performed this study on a number of 312 cases, of which 272 cases were studied material for anatomical model as control group, it was of 87 cases of dissection, brains formalin treated 61, 26 dissected fresh brains of these, only 22 cases we performed plastic injection, 20 cases by digital subtraction angiography, CT angiography 40, 125 angiographies RM, they were made for other pathologies than the aneurysmal. Another separate group studied consisted of 45 patients who had confirmed neurosurgical vascular pathology affecting the cerebral circulation, as first step they were investigated by standard CT examination to detect possible blood accumulation followed by angio-CT examination in 35 cases or angio-RM in 10 cases and / or digital subtraction angiography 20, 30 of the patients underwent surgery for aneurysm suppression so cerebral arterial system could be evaluated prior to and during surgery. CT and MRI examinations were performed in the clinic Medimar Imaging Services Constanta. Cerebral angiography and intraoperative images were obtained courtesy of radiology and neurosurgical departments in Emergency Hospital "Prof. Dr. N. Oblu "Science and Emergency Hospital" Bagdasar - Arseniy ", Bucharest.

NEUROSURGICAL TREATEMENT

The success of surgical treatment of anterior circulation aneurysms depend on three critical elements: adequate exposure and anatomy aneurysm associated with a corresponding clipping technique and the possibility of applying other techniques for complex aneurysms that do not lend themselves to conventional clipping.

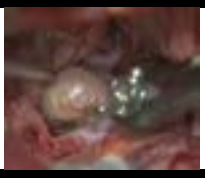
In cases of cerebral aneurysms included in this study, 27 were found with postoperative bleeding and underwent corrective surgery vascular defect. To achieve successful treatment of a cerebral aneurysm, must be mastered three important aspects, such as: a good knowledge of the local anatomy, vascular structures and their branches and relationships they establish, the second part consists of a specialized knowledge of literature regarding operators patented techniques to date and not eventually knowing how modern imaging currently provides three-dimensional reconstructions,

and a proper understanding of the pathophysiology of cerebral ischemia when make a temporary clipping of the vessel of origin.

Although not used in the patients included in the study, remember and endovascular treatment.

TABLE No. 1 – WORKING METHODS

NO.	METHOD	NO. CASES	PHOTO
1.	DISECTION	87	
1a.	Formalin treated brain disection	61	
1b.	Extracted arterial blood vessels	10	
1c.	Frash brain dissections	26	
1d.	Plastic injection	22	
2	MRA	135	

3.	CTA	75			
4.	Agiographies	40			
5.	In vivo observation	30			
	Total	317			

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PERSONAL RESULTS

Personal results are presented in two distinct phases, one for establishing the anatomical elements of the anterior segment of the cerebral arterial circle, which we'll use as a control group on a presentation of cases vascular pathology affecting the sector.

ANTERIOR CEREBRAL ARTERY:

Anterior cerebral artery is the medial division branch of the internal carotid artery and its size is less than that of the middle cerebral artery.

ORIGIN

Regarding anterior cerebral artery origin, it was in all cases of ipsilateral internal carotid artery, except in cases of agenesis of the A1 segment when the previous movement will be taken in entirely the opposite carotid artery inetrnă. If there are anterior cerebral artery, we found no case of change of its origin.

TRAJECT

There is great individual variation in the height of the horizontal segment convexity and not always indicate a saddlery or suprasellar tumor lesion. In all cases studied the anterior cerebral artery had a trajectory over the optic nerve, although in the literature have been described cases with aberrant trajectory located below the optic nerve (1, 2). Anterior cerebral artery becomes pericalosal artery after giving birth of orbitofrontal and frontal pole arteries.

LENGHT

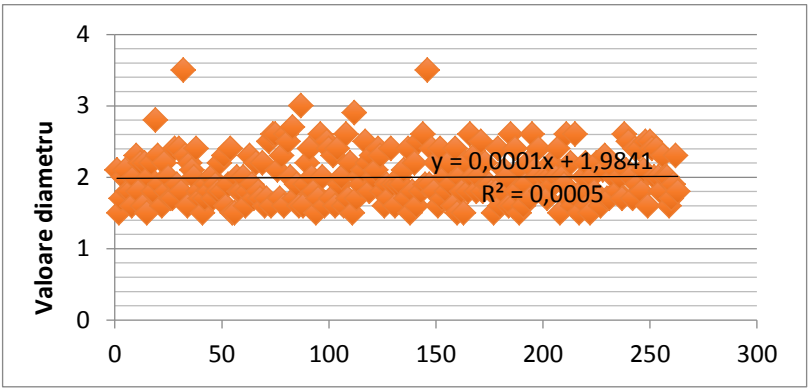
The length of the segment A1 ranged from 8 mm to 21.7 mm. The right side of the segment length was between 8.4 mm and 21.7 mm, with a mean of 14.33 mm illustrated in the chart below.

The length of the segment A1 ranged from 8 mm to 21.7 mm. The right side of the segment length was between 8.4 mm and 21.7 mm, with a mean of 14.33 mm.

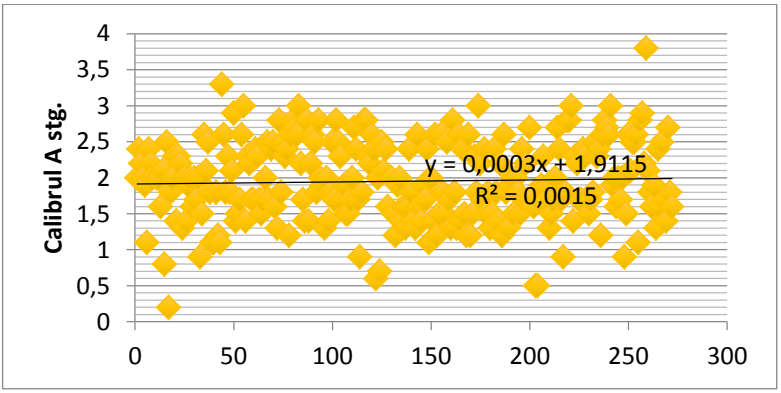
There is a mismatch in length between the two segments A1, the length of the right side is slightly higher compared to the left.

CALIBER

Variable, with a value between 0.3 mm and 3.8 mm on both sides, the right side with values between 0.3 mm and 3.5 mm with a mean of 1.82 mm for the stg. with values ranging between 0.2 mm and 3.8 mm with a mean of 1.91 mm.

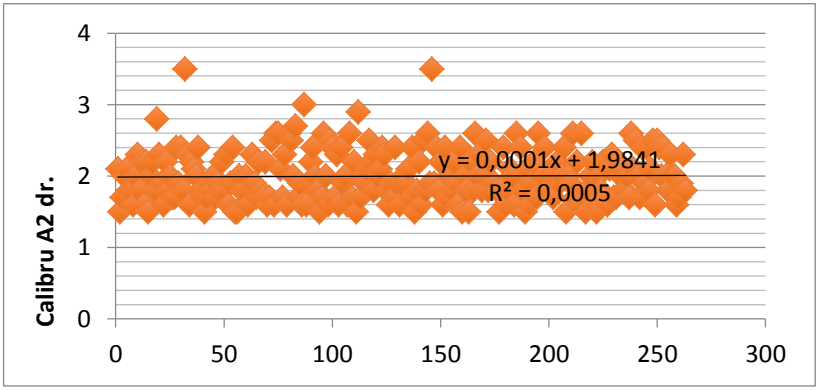


Graphic 3 – rght. A1 segment size distributions of .

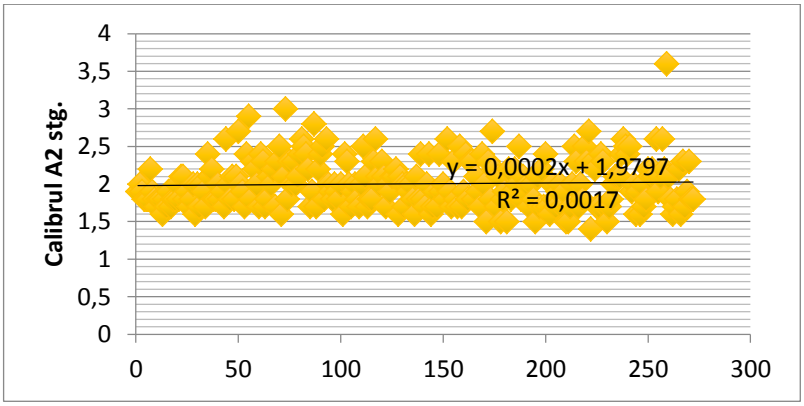


Graphic 4 – Lft A1 segment diameter size range.

A2 segment size differences right / left, they tend to disappear no longer a significant difference to the value of both relative and absolute. The junction of the two vascular axes thru anterior communicating artery the major caliber asymmetries disappear. With average values of 1.98 mm for the right and 2mm left side could be larger than A1 segment as hypoplastic vessels will be filled from the opposite side of the internal carotid artery, through the anterior communicating artery, the flux recovery is depending on the size of anetrior communicating artery.



Graphic 5 – Rght A2 calider size range.



Graphic 6 – Lft A2 caliber size range.

As we have seen from the above there is always a right-left A1 arterial segment asymmetry dimensional gauge, the most commonly grown of the left in 48 cases, 17.6% and higher than the right in 29 cases, 10.6%, the difference between the two segments is not greater than 1.5 mm, except in cases of unilateral hypoplasia.

Fig. 28 – A1 asymmetry (disection)

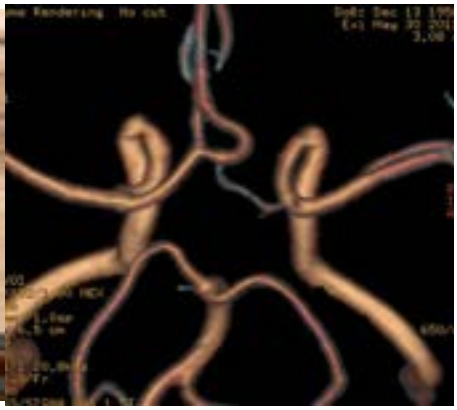


Fig. 29 - A1 asymmetry reduced gauge on right side (MRA, 3D recon)

Thus there is a slight dominance of the left asymmetries caliber of anterior cerebral arteries. These asymmetries A1 segment specific, rare caliber asymmetries remain approx. 1% supracomunicante segments in the

presence of communicating artery hypoplasia or the presence of a vascular malformation.

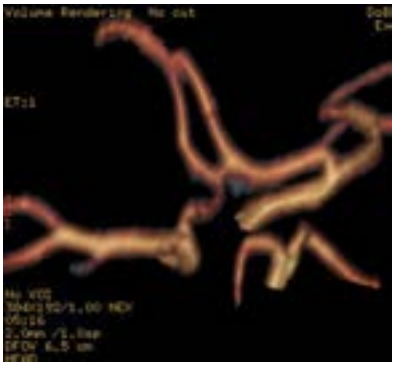


Fig. 30 - A1 asymmetry reduced gauge on right left (MRA, 3D recon)

Fig. 31 - A1 asymmetry reduced gauge on right left (disection)

Fig. 33 – Left A1 hypoplasia (disection)

Fig. 34 - – Left A1 hypoplasia (MRA, 3D recon)

In 2 cases, 0.7%, not individualized A1 segment of the left, agenesis and 1.1% in the other three cases, we found agenesis of the right A1 segment, central arteries having its origin, in this situation, from the proximal middle cerebral artery and right internal carotid artery and the communicating artery caliber was similar to anterior cerebral artery from oposite side.

Fig. 35 - Right A1 hypoplasia (MRA, 3D recon)

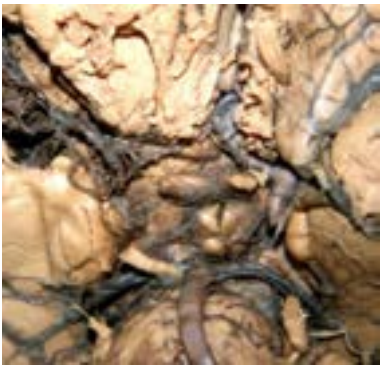


Fig. 36 - Right A1 hypoplasia (disection)

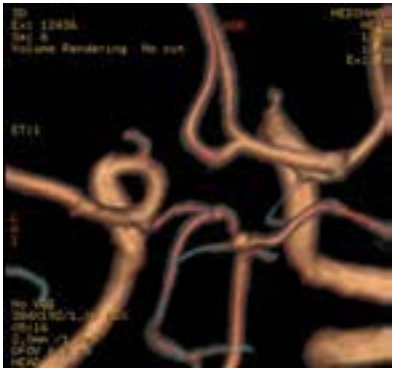


Fig. 37 – Left A1 agenesis.

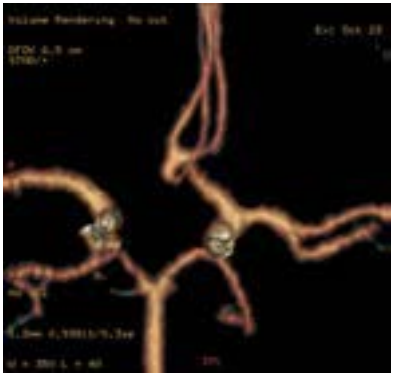
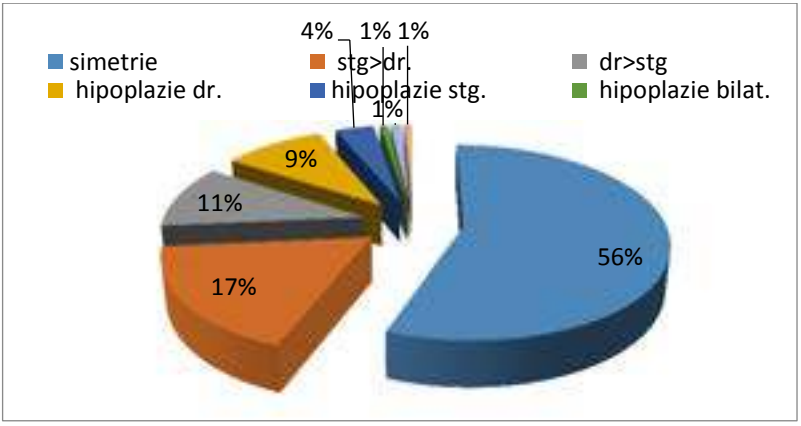


Fig. 38 - Right A1 agenesis.

The results were compared with other studies published:

TABLE No. 2 - Segment A1 variability compared with data published in the literature

STUDII	NR.	AGENESIS A1	A1 HYPOPLASIA
Piganiol (14)		1.46	4.21
Alpers (16)	350	0	2%
Fawcett (17)	700	-	-
Riggs & Rupp (15)	994		16%
Windle (18)	200	-	-
Fisher (12)	414		13%
Lazorthes şi colab. (13)	200		7.5%
Puchades (19)	62	0.8%	6.4%
Personal results	**272**	**1.8%**	**13,9% (9,55% dr., 3,65% stg., 0,7% bilateral)**



Graphic 9 – A1 gauge related variation.

Other morphological variations of A1 segment, included fenestration in 7 cases, 2.5% or A1 segment duplication, the anterior cerebral artery is branching to unite again before communicating artery anastomosis with. This situation we encountered in two cases left, 0.7% and 5 cases of the right 1.8%. These variants are apearing due to embryological formation by incomplete fusion of plexiform structure, specific for anterior brain circulation.

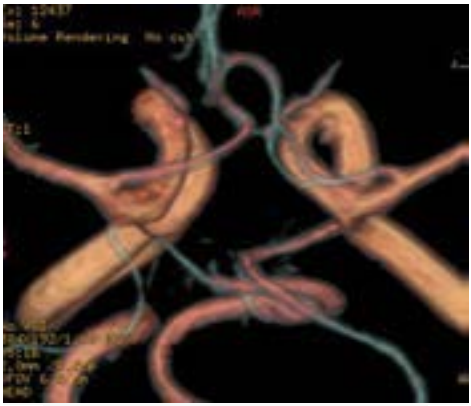


Fig. 39 – right A1 segmnet fenestration.

THE ANTERIOR CEREBRAL ARTERY COLLATERAL BRANCHES.

1. HEUBNER'S RECURENT ARTERY:

The study on recurrent artery of Heubner was limited only 112 cases, which comprise the majority, dissections, dissections followed by injection molding and only part of angiographic exam, the artery could not be observed due to reduced size, and low resolution imaging examinations.

ORIGIN:

This was found to originate from proximal horizontal segment of anterior cerebral artery in 12 cases (10.7%) of them in six cases Heubner recurrent artery origin was located 1mm from anterior communicating artery in 5 cases, 2 mm this and only in one case I found it to 3mm from the junction with ACOA. In 60 of the cases, 53.5% Heubner's recurrent artery origin was the anterior cerebral artery, the junction segments A1 to A2, in close proximity to anterior communicating artery. In 31 cases (27.6%) in the proximal portion of the segment A2, 16 of them originated approximately 1mm communicating artery distal to the previous 10-circumstances origin was located ACOA 2mm, 3mm in 3 cases it and in only 2 cases about 4mm jocţiunea with previous communicating artery.

In 2 cases we found recurrent artery of Heubner with A2 segment originated by a common trunk with fronto-orbital artery (1.8%).

Fig. 46 - A. Heubner, origin as a common trunk with orbitofrontal artery from left A1 segment.

Heubner's recurrent artery origin position, I found to be 91.5% of cases, excluding cases of absent, as being situated within a radius of 2mm around anterior communicating artery.

TABLE NR. 4 - VARIABILITATEA ORIGINII ARTEREI RECURENTE HEUBNER, COMPARATĂ CU STUDII PUBLICATE ÎN LITERATURA DE SPECIALITATE.

RAH origin (%)	A1	A1/A2 junction	A2	Common trunck with orbito-frontal artery
Martinez şi colab (5).	0	60,1	39,9	0
Yasargil (6)	11,5	38	25	0
Perlmutter şi colab. (4)	14	8	78	0
Gomes et al. (19)	8	35	57	
Suazo de la Cruz şi colab. (7)	15	30	39	0
Aydin şi colab.(8)	4	58	23	0
Loukas şi colab. (9)	14,3	62,3	23,3	0
Pai şi colab. (10)	10	60	15	0
Gasca-Gonzales (11)	5	44	41	10
Studiul prezent	11,02	55,9	25,8	1,14

TRAJECT.

After that arise from the anterior cerebral artery, in most cases, recurrent artery of Heubner parallels anterior cerebral artery A1 segment. In the present study, we found that it goes above to A1 in 84 cases, 74.1% were located in the space between the ACA and the optic nerve in 19 cases, 16.9%, ARH is superior to segment paths A1, located in the spaces between the ACA and the orbital frontal lobe in only 3 cases, 2.7% have found recurrent artery of Heubner as having a trajectory back to A1 segment of the ACA, the space between ACA and optic tract .

In 6 cases (5.3%) we identified Heubner recurrent artery, being replaced by multiple small branches that penetrate the central anterior perforated space.

TABLE No. 5 - ARH comparable studies published in the literature

%	MARTINEZ ŞI COLAB.(5)	LOUKAS ŞI COLAB.(9)	PAI ŞI COLAB.(10)	GASCA-GONZALES ŞI COLAB.(11)	STUDIUL PREZENT
The presence of ARH	96,7	94	95	93	93,9

Of the 29 cases studied, 25.9% have identified the presence of two recurrent arteries, of which 10, 9.8% were present bilaterally.

Fig. 51 – 2 ARH from A2 and A1/A2 junction

LENGHT.

Lungimea arterei recurente a lui Heubner am găsit-o variind în 14mmm şi 33mm. S-a constata o uşoara dominanţă de partea dr., ceea ce corespunde cu variaţiile constatate la nivelul segmentului A1 al ACA. De partea dreaptă având valori cuprinse între 15mm şi 33mm, cu o valoare medie de 23,1mm.

GAUGE.

Heubner's recurrent artery diameter we found at levels ranging between 0.3 mm and 1.9 mm. ON the right side was between 0.3 mm and 1.6 mm, with a mean value of 0.7 mm.

2. CENTRAL BRANCHES

Perforating arteries, we encountered a number that varied between 5 and 20, total vascular area was approximately equal so when they were present in large numbers were reduced in size, with tariect directly to the surface of the cerebral hemisphere , you had a few of them had a small diameter drilling breakout to surface hemisphere.

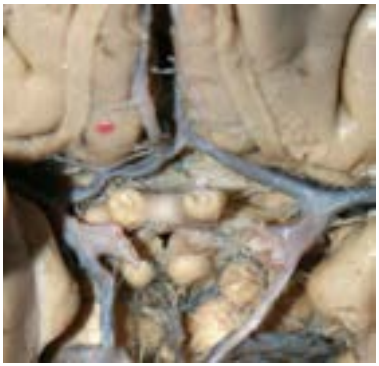


Fig. 54 – Central arteries trunks.

3. CORTICAL BRANCHES:

a. Orbito-frontal artery:

Due to the relatively small size or orbitofrontal aretra could not be studied in the whole lot, so it was included in lock with the aretrei recurrent Heubner. Orbitofrontal artery or fronto-orbital (AOF / AFO) emerges most frequently, 106 cases, 94.6% of the A2 segment, which irrigates the medial portion of the orbital lobe bulb and olfactory tract, of which emerges separately 84 cases, 75% or more by a core of fronto-polar artery in 24 cases, 21.4%.

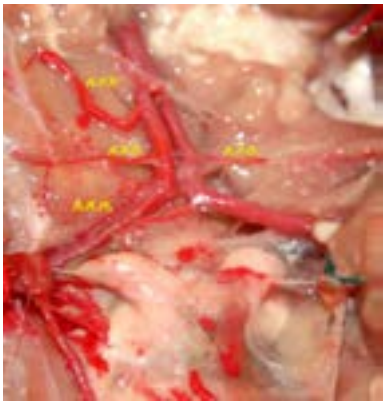


Fig. 55 – Bilateral fronto-orbital Aa. from A2.

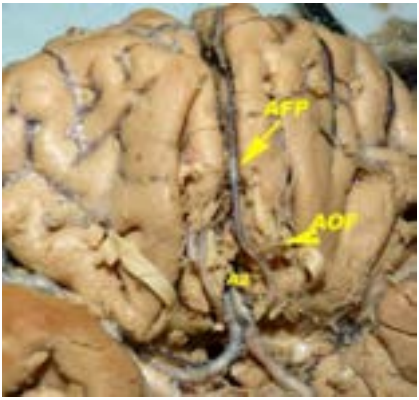


Fig. 56 – Common trunk orbito-frontal A. with fronto-polar A. from A2.

Among cases where orbitofrontal artery emerges directly from A2 segment of ACA in 19 cases were multiple, ranging between 2 and 4 arteries that distribute orbital face of the frontal lobe and olfactory bulb.

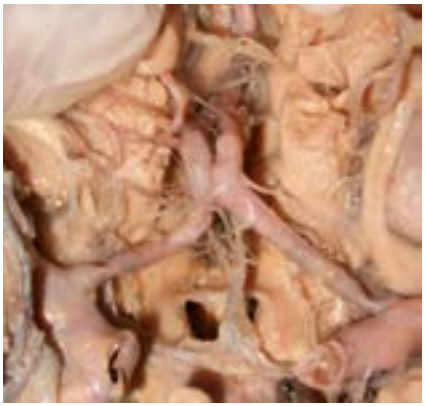


Fig. 57 – Multiple orbito-frontal arteries from right A2.

In 6 cases, 5.3% it originated from the A1 segment, direct, 3 cases or by a common trunk with Heubner recurrent artery, 3 cases.

Fig. 58 – Left FOA from A1, Right FOA origin from a stem with FPA

Fig. 59 - Fronto-orbital artery originated from a common trunk with Heubner recurrent artery

b. Fronto-polar artery (FPA)

Most commonly, 262 cases, 96.3% originated from the A2 segment, for the medial frontal lobe and frontal pole of cerebral hemisphere. Of these, in 207, 76.1% to detach the single frame, in 24 cases, 8.8% originated by a core with orbitofrontal artery in 31 cases, 11.4% of a core curriculum with previous internal frontal artery.

Fig. 60 – FPA from A2 , symmetrical.

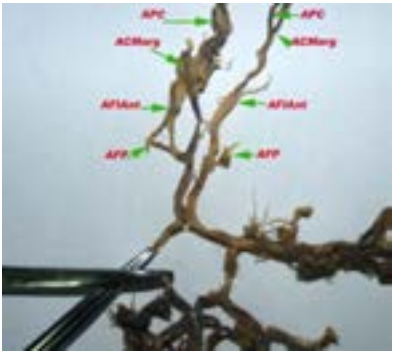


Fig. 61 - FPA from a stem formed with anterior internal fronatl artery.

In 10 cases, 3.7% have met its emergence from A1 segment.

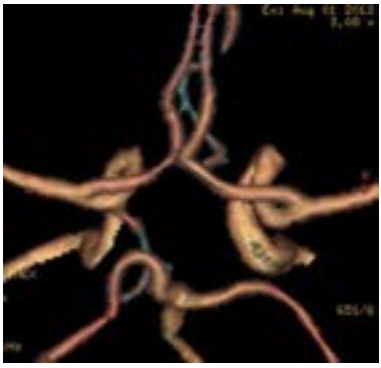


Fig. 62 – Right FPA from A1

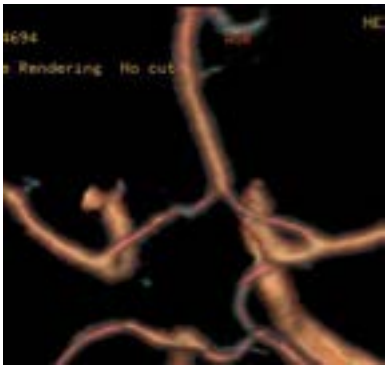


Fig. 63 – FPA origin from ACA azygos

In 5 cases, 1.8% fronto-polar artery emerges directly from an azygos anterior cerebral artery.

c. Caloso-marginal artery (CMA)

Calosomarginal artery emerges from A2/A3 segment, the origin of the difference between the two segments of the ACA, the home sits in the cingulate sulcus. From it are drawn three main domestic fronts: previous middle and rear that supply the internal frontal lobe. If caloso-marginal artery is missing, then all 3 internal frontal arteries directly detach and separate A3 segment of anterior cerebral artery.

In 265 cases have originated in segment A2, of which 255 A2 93.7% of this section of the same side, in four cases, 1.4% of the segment to the other end A2.

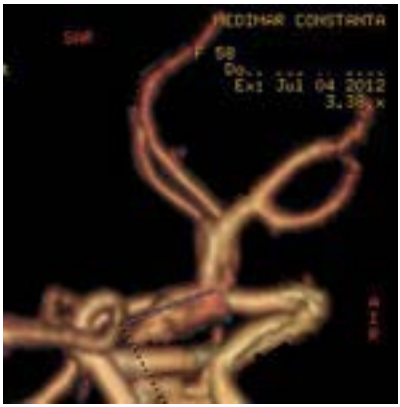


Fig. 64 - A. caloso-marginal origin of the A2 segment of the same side

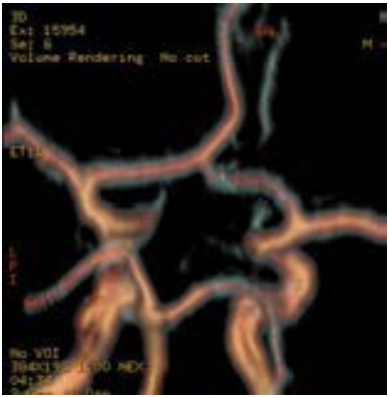


Fig. 65 - Common stem consisting of pericalosală artery and the marginal caloso-stg.

In 6 cases, 2.2% caloso-marginal artery was branch of an azygos anterior cerebral artery.

Fig. 66 - Calosomarginal Aa. origin from the azygos ACA.

We encountered 10 cases, 3.6% in the artery caloso-marginal rise from the A1 segment in 4 cases, 1.4% as single branch of a single hand, in 6 cases, 2.2% as ram ACA terminal when areterle pericaloase communicating artery originating from earlier.

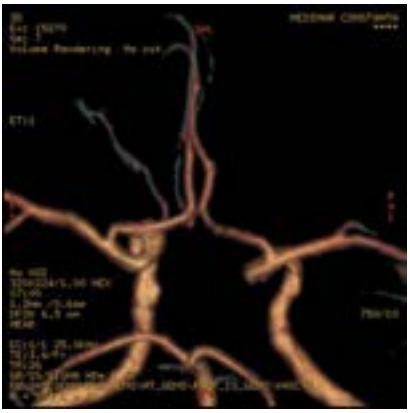


Fig. 67 - Caloso-marginal artery origin of the left A1 segment on the same side.

Fig. 68 – Calosomarginal artery as terminal branch of ACA

d. Pericallosal artery

The end branch of anterior cerebral artery is called posterior pericallosal artery is distributed to the medial parietal lobe: paracentral, superior internal parietal and inferior internal parietal artery or precuneus. This I saw in 261cazuri, 95.9%. In 4 cases, 2.2%, I met a common core consisting of arteries pericallosal artery and calosomarginal artery, which contains one of the anterior cerebral arteries with cerebral artery hypoplasia A2 segment preceding the opposite side is finished as calosomarginal artery.

Fig. 69 - Common core consisting of arteries pericallosal artery and calosomarginal artery

Rarely two anterior cerebral arteries unite to form a normal individual azygos artery, but this configuration is observed in congenital agenesis of the corpus callosum and holoprozencefal. Azygos artery formation I encountered in 6 cases (1.14%) of which 3 cases, 1.1%, arterial trunk reaching to above the corpus callosum, comprised segments A2, A3 to an adult individual, in one case associated a small aneurysm in the A3 segment without malformation association of abnormalities in the other 2 cases the union of segments A2 is a short segment located above the corpus callosum genunghiului one of whom arterio-venous malformation associated with a complex that is fed by the artery anterior cerebral stg.

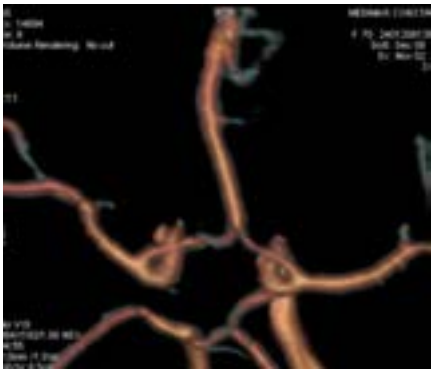


Fig. 70 – ACA azygos.

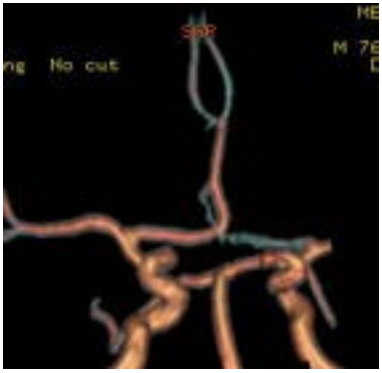


Fig. 71 – Short ACA azygos.

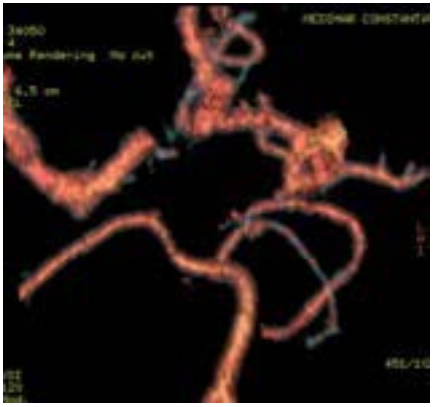


Fig. 72 – Short A2 with AVM

In 6 cases we found that pericallosal originated from artery anterior communicating artery.

e. Accesory middle cerebral artery:

In 3 cases, 1.1%, I found an arterial branch originating from the lateral edge of the A1 segment of proximal ½, bound posetrior and lateral fissure penetrating Laetrile, the valeculei, corresponding accessory middle cerebral artery.

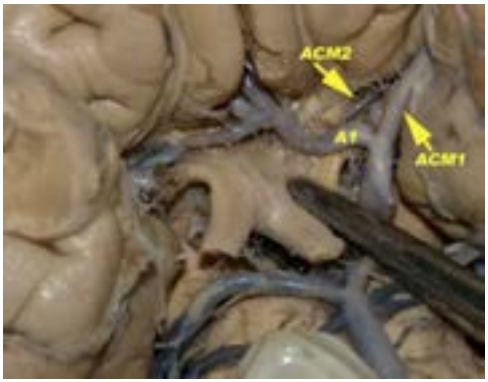


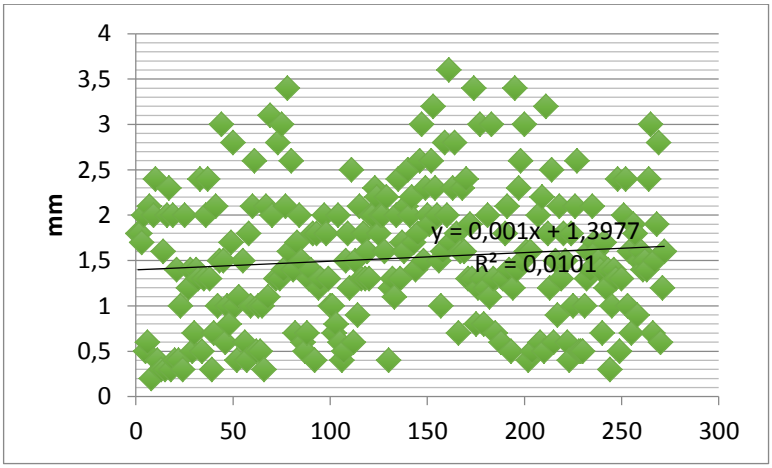
Fig. 73 – Accesory ACM from A1

ANTERIOR COMMUNICATING ARTERY

Anterior communicating artery is the artery segment that connects the two cerebral arteries before and marks the border between A1 and A2 segments thereof, has been studied by I. Grisolia, G. and R. Piganiol Sedan in 1957 (14). Artery path I always found above the optic chiasm, although in the literature are described and aberrant infrachiasmatice tracks. In relation to the optic chiasm may be in a low position, in proximity, or higher.

I found that the length of anterior communicating artery is between 0.7 to 7.1 mm, with a mean value of 2.7 mm, and only in one case (0.3%) we found 7.1 mm. Values exceeding 5mm generally complied communicating artery where the artery emerges anterior or after some authors pericalosală persistent artery of the corpus callosum environments.

I found his caliber between 0.3 to 3.6 mm, with a mean of 1.39 mm. We found only in 64 cases its size less than 1 mm, hypoplastic (23.5%).



Graphic 22 – Anterior communicating artery caliber

Fig. 74 – Anterior communicating artery hypoplasya

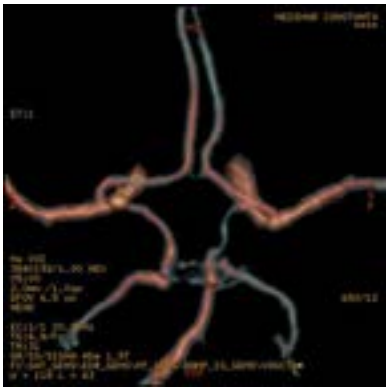


Fig. 75 - Anterior communicating artery hypoplasya

In most cases anterior communicating artery was single and straight cases, 2.2%, its path will look letter "V" or "Y" when it branched off from the common core pericaloase arteries.

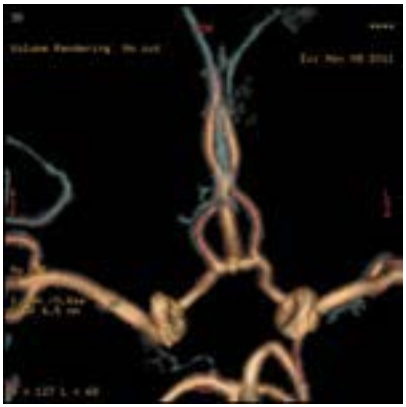


Fig. 76 – „Y" saped anetrior communicating artery with a pericallosal artery emergence

Fig. 77 – Double ACoA

Fig. 78 - Double ACoA

Of the 272 polygons studied, we found only 29 cases double anterior communicating artery (10.6%). In this case, the second communicating artery having a length of 0.5 - 4mm, size of between 0.4 and 1.8 mm (in 19 cases are hypoplastic, 7%), is placed over the first communicating artery at a distance of 1.5 to 14 mm. The position of these segments pressure was varied in most cases to arrange them in a horizontal plane was 22 cases, 8.8% facing each other in parallel or one above the other with oblique directions.

Fig. 79 - Double anterior communicating artery, located supero-inferior to the origin of the posteriorpericallosal artery

In the other 7 cases, 2.6% anterior communicating artery bifurcates, with a common core abuse anterior cerebral artery and branches anastomozându the results with the other side.

Fig. 80 – AcoA branching

Fig. 81 - AcoA branching

In five cases were triple, 1.8%, with a settlement scalariformă, in this case the three press have a length of 1.5-2.5 mm, a diameter of ~ 1 mm, was located prior to the first press 15 - 19 mm and 3-5 mm, from the second communicating artery.

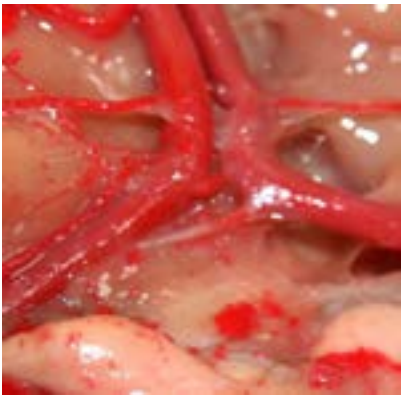


Fig. 82 – Triple ACoA

Fig. 83 - Triple ACoA

In 4 cases had plexiform appearance, 1.4% with multiple small filiform tracks which intersect in an uneven mesh network.

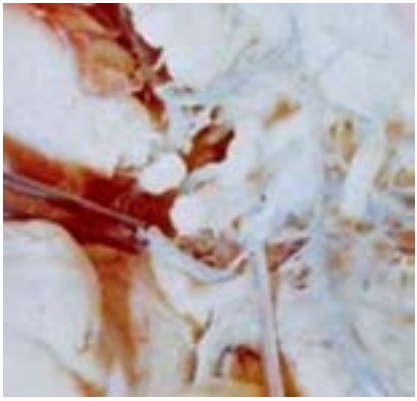


Fig. 84 – Areolar ACoA.

In 11 cases absent, 4%, being either a lateral-to-side anastomosis in four of them, 1.4%, or form a single artery ACA azygos in 4 cases or absence of anastomosis of the two anterior cerebral arteries, 3 cases 1 , 1%.

Fig. 85 – ACAs LL anastomosis

Fig. 86 - Anastomoză latero-laterală a a. cerebrale anterioare

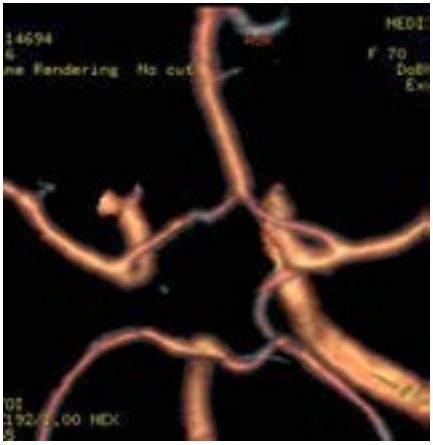


Fig. 87 – ACA azygos.

Fig. 88 – AcoA absence.

Fig. 89 – AcoA absence

In one case I encountered anterior communicating artery presence that coexists with union A2 azygos artery.

Fig. 90 - ACoA with Azygos ACA

Fig. 91 – AcoA fenestration

In 9 cases we observed a fenestrated aspect of communicating artery anterior 3.3%, with a small "gap" in the line of anterior communicating artery.

TABLE No. 6 – ACoA variants

Variante	unică	dublă	bifurcată	triplă	anastomoză latero-laterală	plexiformă	agenezie	ACA azygos	fenestrare	hipoplazie
Nr. Cazuri	143	29	7	5	4	4	3	4	9	64

TABLE NR. 7 – ACoA caliber variability comparison with other studies

STUDII	NR. CAZURI	AGENESIS	HYPOPLASIA
Alpers (16)	350	2%	3%
Fawcett (17)	700	0.14%	-
Riggs & Rupp (15)	994		27%
Windle (18)	200	1.5%	-
Fisher (12)	414		29%
Lazorthes şi colab. (13)	200		29.5%
Puchades (19)	62	3.2%	6.4%
Personal results	**272**	**4%**	**23,5%**

ANTERIOR COMMUNICATING ARTERY COLLATERAL BRANCHES

1. ***Central branches***: Their number varied between 1 and 5 branches. heading towards the optic chiasm, and septal area., can be as small rectilinear trajectory branches or trunks that branch on the way.
2. ***Pericallosal artery***, common core of pericallosal arteries, considered by some authors as persistent middle corpus callosum artery. Usually at origin this artery has a small infundibular dilatation, leading in time to the development of an aneurysm. We identified this variant anatomy in 6 cases, 2.3%.

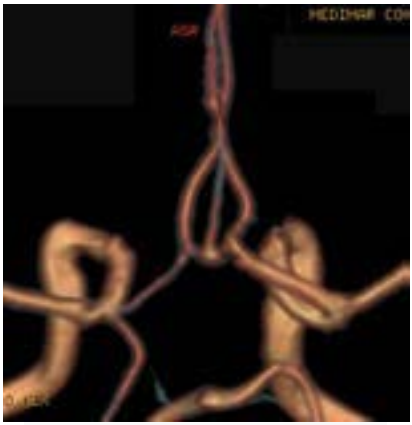


Fig. 93 – Pericallosal artey coexisting with a small aneurysm at origin

Fig. 94 – Pericallosal artery from ACoA,

3. ***Middle corpus coallosum artery*** We identified 2 cases with vascular paths communicating artery origin from the previous ending right knee in the corpus callosum, the present pericaloase arteries bilaterally, which have their origin in the ACA.

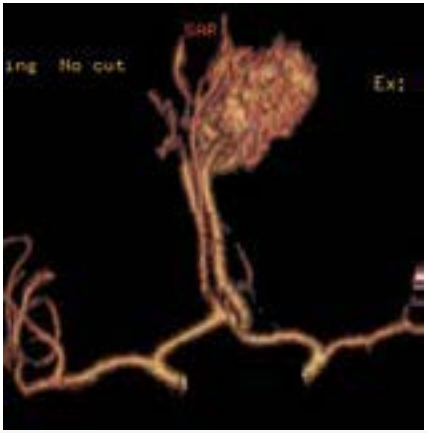


Fig. 95 – Middle corpus callosum artery coexisting with AVM

CLINICAL CASES

In this chapter will present some of the neurosurgical pathology of anterior cerebral artery. This presentation is for demonstration on how each case was treated and the criteria that were followed in this study.

Case 8

V.F., female 50 years old.

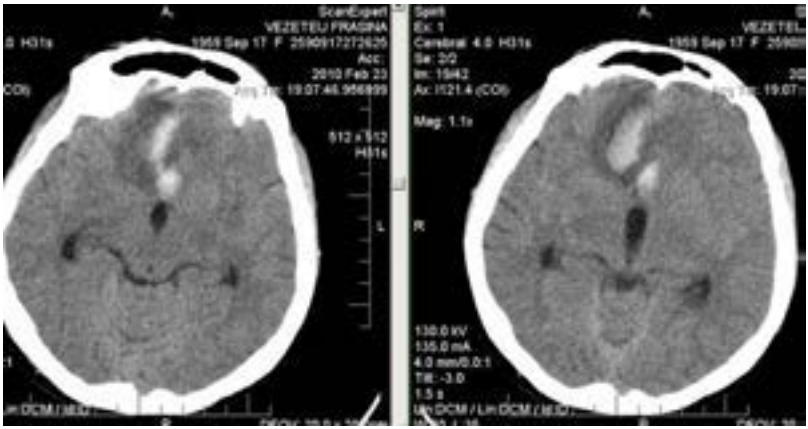
Presented brutal violent headache and vomiting with favorable spontaneous evolution.

Firs CT exam : SAH Fisher 4, acute hydrocephalia, itracerebral hematoma.

CTA: ACoA aneurysm, with a maximal diameter of 10mm, right A1 hypoplasia, of 0,7mm, comapared with left side of 1,9mm

Surgical intervention: Clipping

6 week control CT - Hydrocephalus. On the clinical memory impairment, balance disorder, headache. Decision ventriculo-peritoneal drainage. Positive development



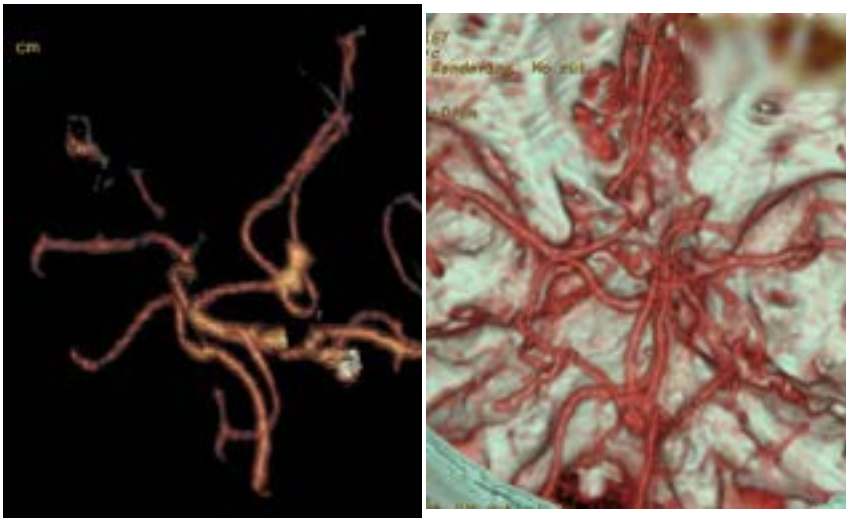


Fig. 116 – CT and CTA exams

Fig. 117 – Surgical intervention

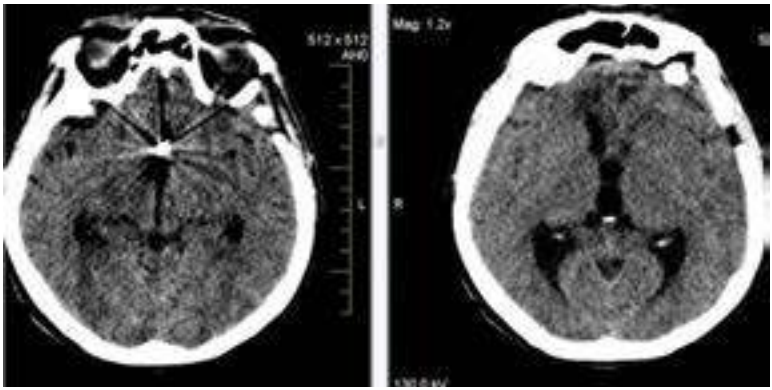


Fig. 118 – control CT

Case 13:

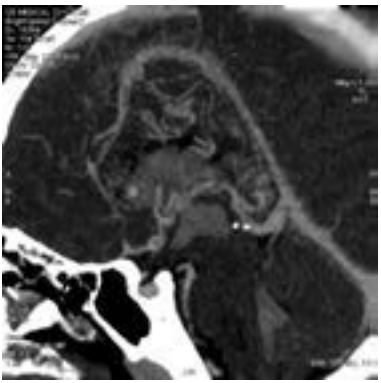
U.F.,- male 10 years old.

Presented violent headache, nausea and vomiting, and fever menigeal syndrome

CT: SAH Fisher 4, intraventricular hemorrage

CTA: FPA aneurysm, with 5mm diameter, and frontal AVM that associated azygos ACA

It was suggested a delay on surgical intervention. The pacient have been transfered to another center.



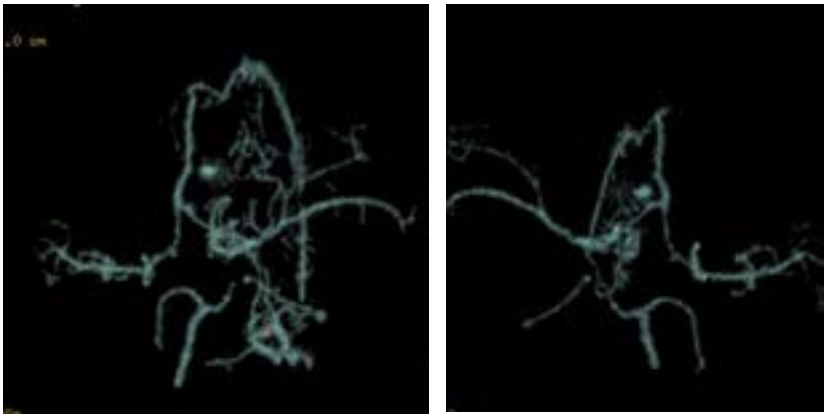


Fig. 129 – CT and CTA.

The final clinical study included 45 cases of anterior communicating artery 36 aneurysms and postcommunicating segment aneurysm 4 cases.

The study included seven arteriovenous malformation, of which only two had subarachnoid hemorrhage without following a surgical treatment, often because of the complexity and extent of the lesion, which increased the risk of intervention.

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DISCUSION

There is a wide variability in brain anterior circulation, both in terms of appearance and especially the size.

Of the cases included in the control group without subarachnoid hemorrhage or history of, I encountered 18 cases, 6.6% have identified the intracranial artery aneurysms. Of these in one case I encountered multiple sites of development, which advocates a congenital etiology. It is also observed relatively symmetric appearance of the cerebral arterial circle in this situation.

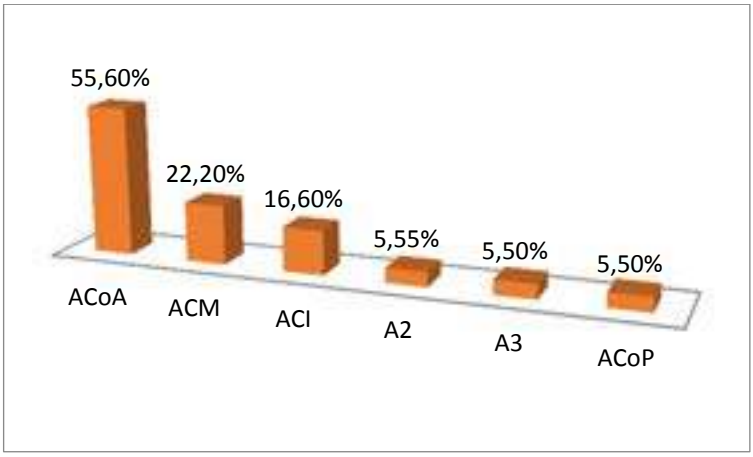
Fig. 130 - Multiple aneurysms located in the middle cerebral artery and internal carotid artery

Of the 10 cases studied were anterior communicating artery aneurysms, representing 55.6%, some of them developed at pericallosal artery origin from anterior communicating artery. in 4 cases, 22.2% have met middle cerebral artery aneurysms in 3 cases, 16.6% have found dilatation of internal carotid artery aneurysm in two anterior cerebral artery, one of which, 5.5% in A3 segment the associate and azygos cerebral artery and one case 5.5%, where I met the posterior communicating artery aneurysm in the cavernous segment of it.

Fig. 131 – ACoA aneurysm at pericallosa origin

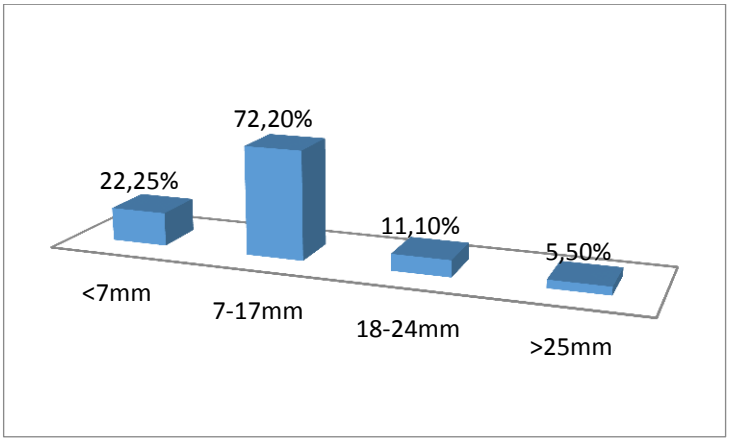
Fig. 132 – Posterior communicating artery aneurysm.

The prevalence of aneurysms according to their location in the intracranial vessels have represented a chart as follows.



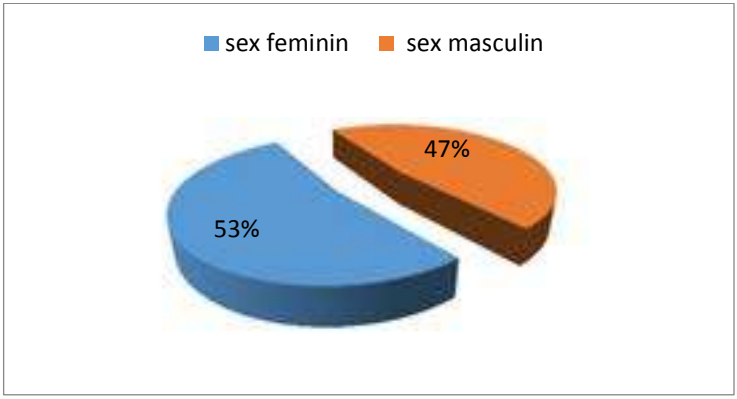
Graphic 24 – Aneurysm location

In terms of size the majority were medium-sized aneurysms between 7mm and 17mm, 13cazuri, 72.2%, 4 cases, 22.2% of small-sized aneurysms under 7 mm, 2 11.1% of large aneurysms between 18 and 25 mm, and only one, 5.5% more than 25mm.



Graphic 26 – Aneurysm diameter

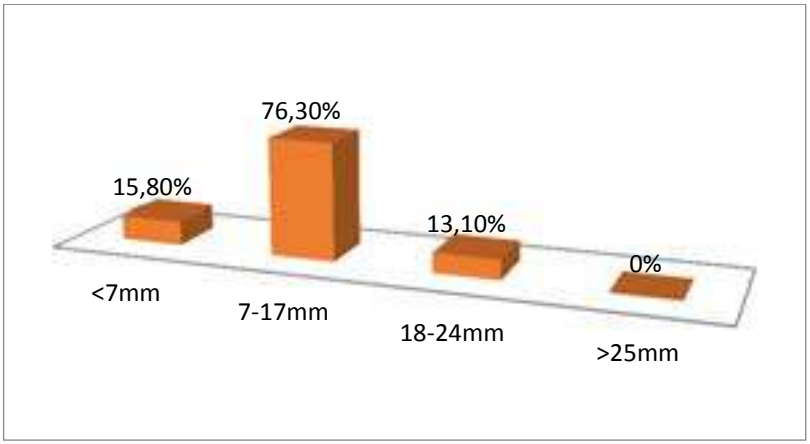
In the study of the patients with subarachnoid hemorrhage, and aneurysmal pathology confirmed, I tried to emphasize some specific features of the local anatomy.



Graphic 27 – aneurysm gender distribution.

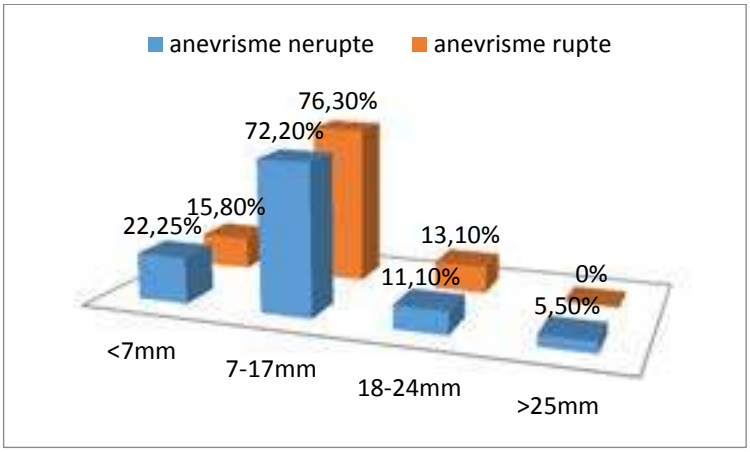
There is also a slight female predominance practically insignificant

In terms of size they were of small aneurysms of 6, 15.8%, medium sized aneurysms in nnumăr of 28, 76.3% and large aneurysms in number 5, 13.1%.



Graphic 28 – Aneurysm size related distribution.

There is a similar percentage to maintain aneurysm-like subarachnoid hemorrhage associating asymptomatic group with a discrete decrease in cases of small aneurysms and the giant aneurysms when broken.



Graphic 29 – Compared aneurysm dimension in control grup and in patients with SAH

Revealed the existence of specific locations in the arterial circle at the base of the brain that have an increased risk of small aneurysms rupture as communicating artery anterior and other locations such as the internal

carotid artery, the risk is lower (17.18, 19,20). This suggests that the size of the aneurysm oservaţii lose importance as a factor in determining the risk of rupture of an intracranial aneurysm, if not taken into account the location of the aneurysm. More likely breaking risk variability by location to link the vessel dimensions range from the practical to develop aneurysm (17,18,19,20,21,22,23).

Regarding local anatomy anomalies, the results were surprising, because in most cases there is a deviation from normal morphology anterior cerebrovascular system as: agenesis of segment A1 we found one case, 2.6% of the right and one case on the left, 2.6%, in 9 cases, 23.7% found the right A1 segment hypoplasia in 5 cases we found hypoplasia of the left A1 segment in 14 cases there was a size mismatch between segments A1 with a dominant left side in 9 cases 23.7%, a dominant right side in 5 cases 13.15%, remaining 7 cases without abnormalities of symmetry A1 segments of the cerebral arteries. In these cases, in one case we found the presence of an arterial trunk pericalosal which rise from anterior communicating artery in a case anterior communicating artery bifurcates and in one case, 2.6% was communicating artery asepct anetrioară with plexiform the formation of 2 dilated aneurysm at the origin of segments A2.

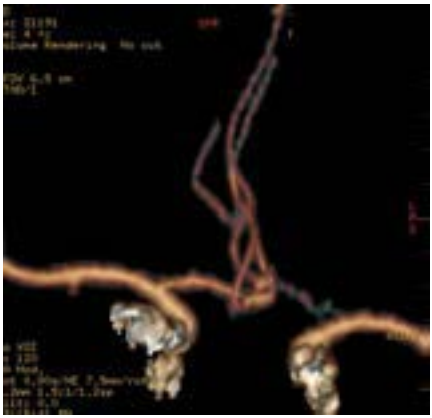
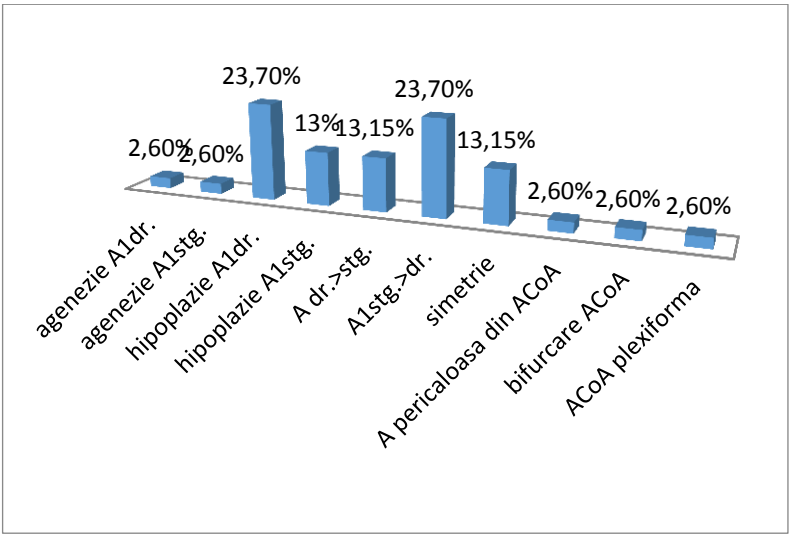


Fig. 133 – Areolar ACoA with 2 aneurysms



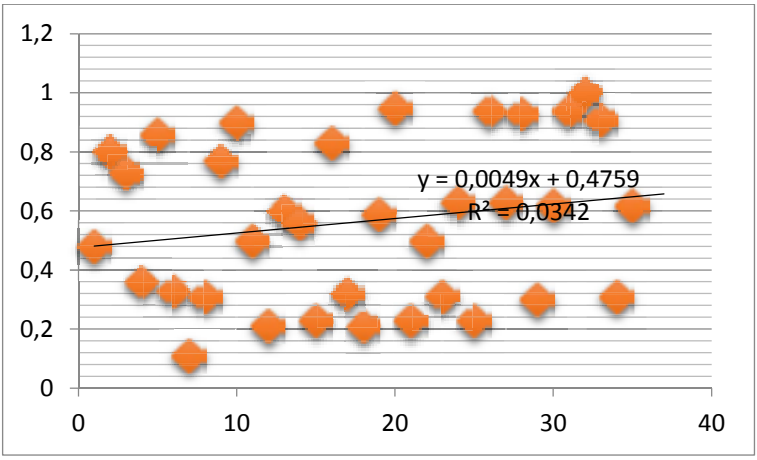
Graphic 30 – Aneurys distribution related to local anatomy.

There is basically a normal local anatomy only 13% of cases. Anatomical variants found for aneurysms located in the anterior cerebral vascular system we compared the results obtained in the standard group.

Basically there is a clear dominance of asymmetric flux distribution between cerebral artery A1 segment to the anterior communicating artery anomalies are equal percentage control group and clinical group.

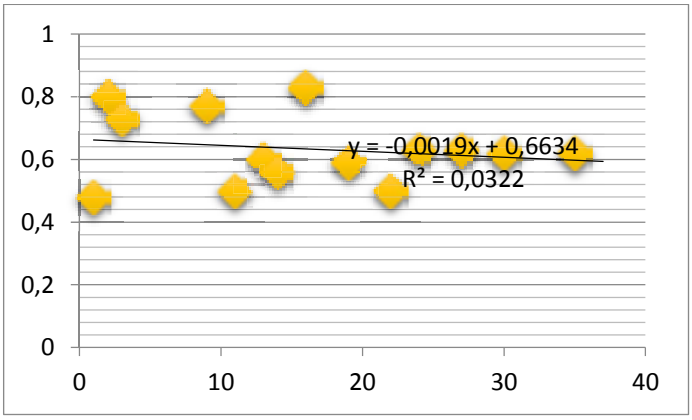
In the clinical group included ruptured aneurysms that were associated subarahnoidian hemorrhage, we calculated the ratio between the dominated vessel and the dominated vessel, thus attempting to evaluate hemodynamic vascular structures belonging to anterior circulation. These ratios compared them and got an average of 0.47.

Excluding cases of hypoplasia, which we considered vascular malformations and cases where both A1 segments were equal, the average ratio is 0.66. This value we propose casi risk value as the genesis of both the risk of rupture of an aneurysm of the anterior communicating artery.



Graphic 32 – Average ratio A1 segments in aneurysm patients..

Asymmetries in the distribution of local blood flow can cause stress and micro traumatisms on vascular walls, such an asymmetry of size A1 segments may pose a risk to dezvoltatrea or risk of aneurysm rupture, based on data obtained as a ratio between sizes consider the 2 pots of 0.65 represents a risk factor to be taken into account in assessing the appropriateness inetrvenţiei surgery.



Graphic 33 – Average ratio A1 segment excluding malformation..

Another neurosurgical pathology is the arteriovenous malformation. They have met in 4 cases, 1.5% in the control group, the

percentage may be high, because even if they have not experienced a subarachnoid or intracerebral hemorrhage, who were investigated by means of imaging had at least one episode Headache.

From clinical group only in 3 cases had intracerebral or subarachnoid hemorrhage, and the others looking ischemic events by vascular steal.

We analyzed several cases of arteriovenous malformations, most through computed tomography angiography but may quantify regional cerebral blood flow values.

Fig. 134 - AVM fed bt left ACA and ACM

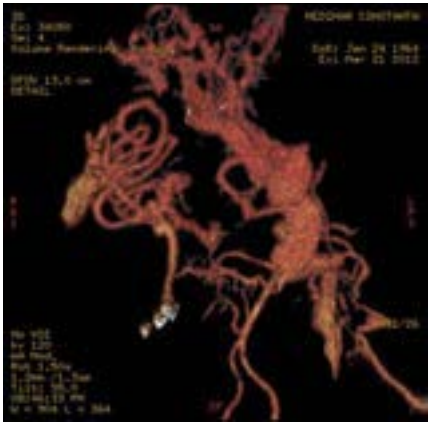


Fig. 135 - AVM fed bt left ACA and ACM

Artery that feeds the vascular malformation has increased caliber over the adjacent neighborhood branches that look hypoplastic ,are "closed", to maintain an adequate perfusion in the periphery.

Of the three cases discovered were associated other type fetal anatomical variants such as azygos anterior cerebral artery in 2 of them and a pericallosal artery that originates from anterior communicating artery.

Another interesting aspect found was that if a frontal cerebral arteriovenous malformation unilateral arteries that nourish not only consisted of the anterior cerebral artery and middle cerebral artery on the same side but also the opposite ACA, which demonstrates that that anterior cerebral arteries provide branches for both cerebral hemispheres.

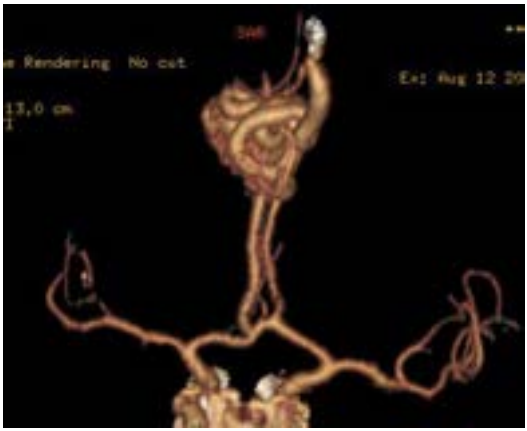


Fig. 136 - MAV fed by ACA billateral

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CONCLUSIONS

Located the union of 3 circulations: carotid and vertebral, Willis polygon has a variable morphology.

Size relative to each of the anterior communication inter-carotid segments into three segments and communications inter-carotid-basilar posterior two segments, regulates the morphology and movement causes changes in local blood flow normal.

Changes in local anatomy determine alterations in the distribution of regional cerebral blood flow and caused a turbulent flow with major implications for local vascular structures.

I found a great variability of arterial branches that constitute anterior segment arterial Willis polygon, so the size, length, aspect and collateral branches. So we met more often hypoplastic right A1 segment. In terms of appearance, the greatest variability we encountered anterior communicating artery.

The scale of the local and arterial aneurysm influences the choice of the route of approach in therapeutic cure. Also one of the main points of it, is the isolation of the lesion, this requires a good knowledge of local anatomy with the arterial branches mood changes, among them, a great interest is the recurrent artery of Heubner's vascularity whose territory encompasses the essential structures of the central nervous system functioning. This we found present in most cases, is located within a radius of about 2mm around areterei previously communicated. Given that anterior communicating artery aneurysm is the most frequent lesion encountered, the discovery and isolation of recurrent artery of Heubner's importance in postoperative evolution.

Alternatively, provision is made anterior cerebrovascular structures of fetal circulation variations, due to abnormal embryonic development, and the presence of a anterior brain Arete azygos or average aretre persistence of the corpus callosum, which in 75% of cases met the associated with the presence of arteriovenous malformation or aneurysm distal clipping of which is grafted installation of postoperative ischemic lesions.

According to these findings, we suggest another parameter to assess the risk of rupture of an aneurysm of the artery previously communicated, ie the ratio of anterior cerebral artery A1 segment, which we

consider to be the critical value of 0.65, and consider it to be an indication to surgical cure of aneurysm

I found combination of a net asymmetry caliber of anterior cerebral vessels and the presence of an aneurysm and subarachnoid haemorrhage association existing, underlines once again the role that local hemodynamics has in the genesis of aneurysmal.

It can be said that it is extremely important for the radiologist, internist and surgeon to know the cerebral vasculature in general and in particular Willis polygon, which has paramount importance in the diagnosis and prognosis of therapy cerebrovascular disease. Anatomical variability of this device is great complexity involved in the pathological manifestations of the simple migraine, it is difficult to control treatment subarachnoid hemorrhage caused by rupture of an aneurysm. The study of cerebral arterial circle may have preventive role by identifying risk devices

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