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Variations of the Cerebral Arterial Circle. Morphological and Clinical Analysis

Variaciones del Círculo Arterial Cerebral. Análisis Morfológico y Clínico

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SUMMARY: The variations knowledge of the cerebral arterial circle (CAC) is relevant due to its influence on the development of ischemic encephalic disorders. Among these variations, when the external diameter of the posterior communicating artery exceeds the posterior cerebral artery caliber, we have a fetal conformation of this circle. The aim of this study was to describe the variations of the CAC in Chilean individuals and to know the type of arterial conformation. Thirty adult brains were used to measure lengths and caliber of the pre-communicating segments of the anterior (A1) and posterior (P1) cerebral arteries, and the anterior (ACoA) and posterior (PCoA) communicating arteries. The arterial conformation type was established, and the length and caliber of these vessels were compared according to the right or left side. It was observed that 76.6 % of the CACs presented aplasia and / or hypoplasia. Of its components, PCoA was hypoplasic in 53.3 %, appearing bilaterally in 40 % of the subjects. The comparison according to the side, indicated that the mean length of A1 and PCoA on the right side was slightly higher. In the case of caliber, the mean of A1, P1 and PCoA was higher on the left side. Regarding P1 and PcoA caliber, 33 % of the CACs presented unilateral fetal conformation. Regardless of the variability presented by the CAC, there is consensus that PCoA exhibits the greatest variability. The understanding of this variability requires an analysis of the embryonic aspects that can explain the fetal conformation of the CAC in the adult.

KEY WORDS: Anatomy; Blood supply; Cerebral Arterial Circle; Hypoplasia; Anatomical variations.

INTRODUCTION

The cerebral arterial circle (CAC) is one of the most relevant anastomotic systems in the human body, since it offers to our brain a series of potential derivations, in the event that occlusions or spasms of its main vessels occur (Jones *et al*., 2021). This vascular formation is made up of branches originated from the internal carotid arteries and the basilar artery. Specifically, the Anatomical Terminology (FIPAT, 2019) considers as part of this circle the pre-communicating segment (A1) of the anterior cerebral artery, the anterior communicating artery (ACoA), the communicating portion of the internal carotid artery, the posterior communicating artery (PCoA) and the pre-communicating portion of the posterior cerebral artery (P1) (Standring, 2016).

The arrangement of this arterial circle is subject of multiple variations, such as aplasia, hypoplasia and duplication of its main components (Okahara *et al*., 2002; Kapoor *et al*., 2008; Dimmick & Faulder, 2009). In this sense, variations of this classic pattern are frequent, the presence of hypoplasia and /or aplasia would be linked to the development of ischemic encephalic disorders (Hoksbergen *et al*., 2003; Karatas *et al*., 2016; Zhou *et al*., 2018; Stojanovic *et al*., 2019; Jones *et al*.). Following this line, the hypoplasia of these vessels are considered as the existence of less than 1 mm external caliber, for both, the A1 and P1 arterial segments and for the ACoA and PCoA (Eftekhar *et al*., 2006; Karatas *et al*.; El Falougy *et al*., 2018; Jones *et al*.). This hypoplasia is considered a risk factor in the development of brain ischemic strokes and

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is directly related to the embryonic development of these blood vessels (Hoksbergen *et al*.; Menshawi *et al*., 2015). In this sense, these caliber variations, and particularly those that affects PCoA, determine three conformations of the CAC: a) an adult conformation, in which the PCoA caliber is smaller than the P1 caliber, b) a fetal conformation, where the PCoA caliber is greater than the P1 caliber and c) a transition conformation, where both calibers are equal(Karatas *et al*.; El Falougy *et al*.).

Another biometric aspect of circle´s functional relevance is the length of its vessels. The foregoing, based on the fact that the volume of blood flow through an artery is inversely proportional to its length and directly proportional to its caliber, therefore, the blood flow will be more efficient if it passes through shorter and wide arteries (Kamath, 1981). Moreover, Orlandini *et al*. (1985), in a study of 100 cadavers, reported the presence of a greater significant difference in the diameter of the arteries of the left half of the CAC.

Based on what has been described, the objective of this study was to characterize the biometric variations of the components and the type of conformation in Chilean individuals of CAC. The knowledge of these biometric aspects and their main variations pretend to make an important morphological contribution for clinical procedures in the areas of neurosurgery and brain vascular imaging.

MATERIAL AND METHOD

To conduct this study, 30 brains of Chilean adult individuals (24 men and 6 women) were used, all the brains were provided by the Morphology Department of the Medical School of the Andrés Bello University, Viña del Mar, Chile. To get the correct data acquisition, all the cadaver brains that revealed evidence of macroscopic pathology of head and neck, and those that had previous dissections in the interest area, were excluded.

This research was quantitative, non-experimental, transectional and correlational study. For this study it was necessary to perform the complete brain extraction from each of these cadavers, allowing the visualization of the inferior face of the brain. Next, photographic records of the arterial components of the CAC were made, with a digital camera Canon ® Rebel XTI, we obtained photography records "in situ", of the arterial components of CAC, incorporating a milimetric measuring ruler (mm) as a reference. Subsequently, using the images obtained, we determine the presence of complete CAC or a classic pattern, as well as CAC that presented anatomic variations.

Using the Image J ® software on each of the selected image, the biometric characteristics of length and caliber were measured in the pre-communicating segment of the anterior cerebral arteries (A1), the anterior communicating artery (ACoA), the posterior communicating arteries (PCoA) and the pre-communicating segment of the posterior cerebral arteries (P1).

Once the biometric measurements were obtained, frequency tables related to variations of the components of the CAC (aplasia, hypoplasia and duplication) and its conformation type (adult, fetal or transitional) were made. After the statistical evaluation of normality, using the Shapiro-Wilk test, the means, median, standard deviation, and minimum and maximum ranges of both the length and the caliber of each of these arterial components were established. Likewise, the comparison of the right side with the left side was made according to the length and caliber of each of these arterial components, using the parametric t-Student test for independent population samples with equal variances. All statistical tests were analyzed in the STATA version 15 ® software, considering a level of significance a = 0.05 and a confidence interval (CI) of 95%.

RESULTS

Biometric measurements were performed in 30 CAC, observing the presence of all its components in 87% of the cases (Fig. 1). Moreover 24% of the arterial circles with all of their vascular components did not reveal the existence of any anatomical variation. In particular, segment A1 and ACoA were present in all of the CAC analyzed. On the other hand, 77% of the cases there were anatomical variations, both aplasia and/or hypoplasia (Figs. 2A and 2B). It is relevant that in this study there were no cases of duplication of any arterial components analyzed. Regarding the hypoplasias analyzed in this study, PCoA presented this variation in 53.3 % of the 60 vessels analyzed.

Ongoing in the study, the hypoplasia of the PCoA was observed unilaterally in 13 % of the cases (n = 5 right, n = 3 left) and bilaterally in 40% of the CAC studied (Figure 2B). It should be notice that 10 % of the samples presented hypoplasia ACoA and the P1 segment, coexisting both, in only one case. For these same vessels, no cases of aplasia or duplication were observed. The data referring to the anatomical variations of the segments A1, P1 and the PCoA, according to the total sample and laterality, are summarized in Table I.

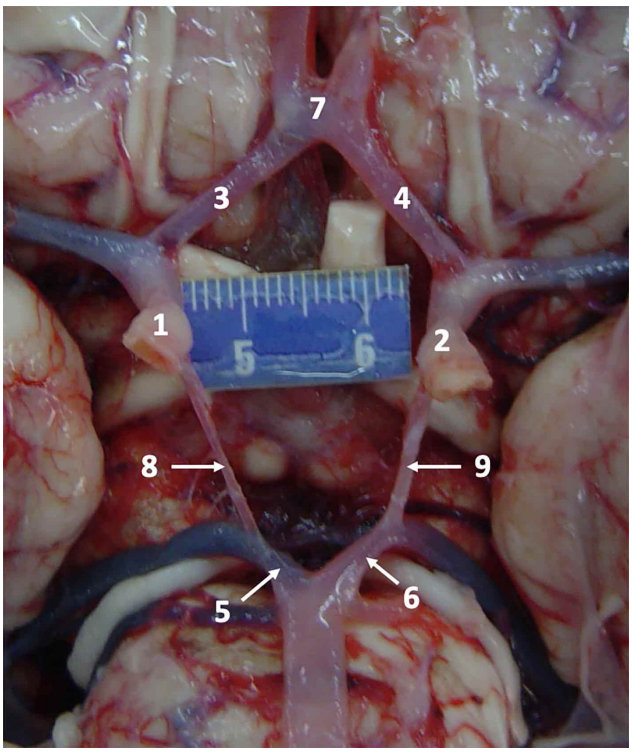
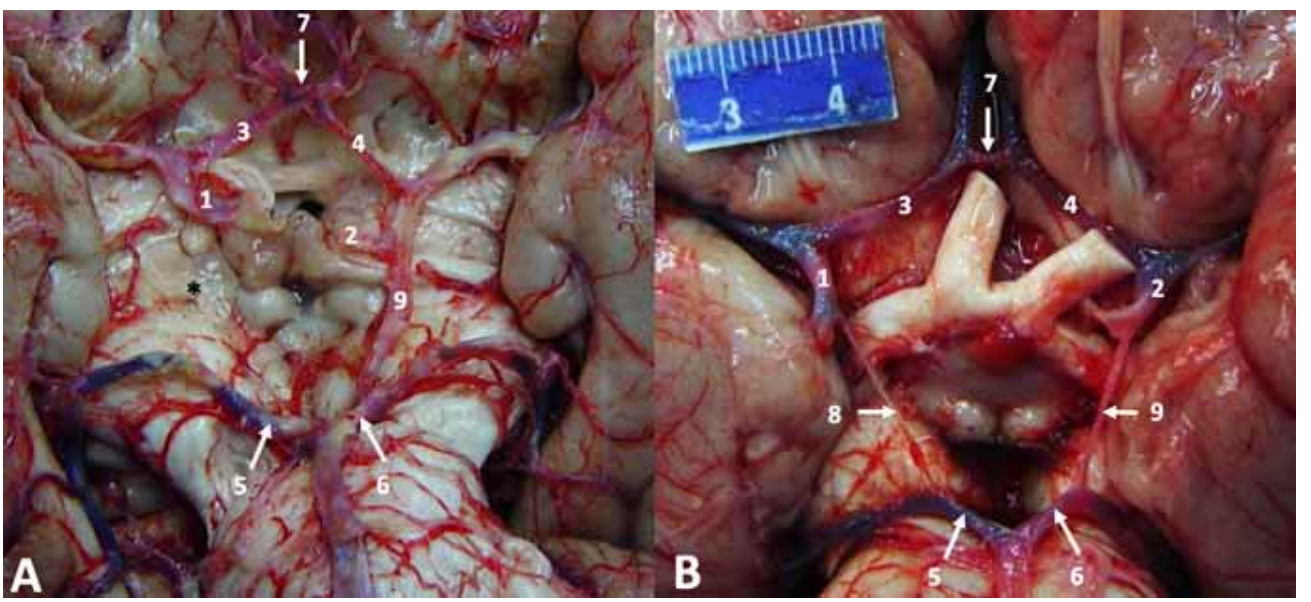


Fig. 1. Cerebral arterial circle - Bilateral adult conformation: 1: Right internal carotid artery, 2: Left internal Carotid artery, 3: Right anterior cerebral artery (A1), 4: Left anterior cerebral artery (A1) 5: Right posterior cerebral artery (P1), 6: Left posterior cerebral artery (P1), 7: Anterior communicating artery, 8: Right posterior communicating artery, 9: Left posterior communicating artery.

In relation to biometric measurements, the longest arterial component corresponded to the PCoA, which reached a mean of 15.9 ± 4.47 mm. On the contrary, the ACoA was the one with the shortest length with a mean of 2.06 ± 0.97 mm. When analyzing the caliber of these vessels, inverse results were obtained, since the artery with the major caliber was the ACoA, which presented a mean of 2.43 ± 1.19 mm, whereas the PCoA reported the minor caliber, reaching a mean of 1.11 ± 0.50 mm. All the biometric measurements of length and caliber, including the median, minimum and maximum ranges are summarized in Table II.

Comparing biometric measurements of the right side with the left side, indicated that the mean length of the segments A1 and PCoA on the right side were slightly higher, while the mean length of segments P1 was greater on the left side. In the case of the calibers studied, for A1 and P1 as for PCoA segments, the mean was higher in the left side. Comparisons of the differences in the means of t length and caliber of these vessels according to the right or left side, werenot statistically significant. The details of these biometric measurements according to their SD and the applied CI are summarized in Table III.

By analyzing the caliber of the PCoA and the P1 segment, it was possible to establish the adult, fetal or transitional conformation of these arterial circles. In this sense, if we consider the 30 CAC, 67% presented an adult conformation in both the right and left half of this circle



Figs. 2. A. Cerebral arterial circle with aplasia of the right posterior communicating artery, B. Cerebral arterial circle with hypoplasia of the right and left posterior communicating arteries. 1: Right internal carotid artery, 2: Left internal carotid artery, 3: Right anterior cerebral artery (A1), 4: Left anterior cerebral artery (A1) 5: Right posterior cerebral artery (P1), 6: Left posterior cerebral artery (P1), 7: Anterior communicating artery, 8: Right posterior communicating artery, 9: Left posterior communicating artery, *: Aplasia of the right posterior communicating artery.

Table I. Anatomical variations of the arteries of the cerebral arterial circle, depending on the total sample and the right or left sides.

Arterial component /Variation	Total sample	Right	Left
	% (n)	% (n)	% (n)
Anterior cerebral artery (A1)			
Aplasia	-	-	-
Hypoplasia	8.3 (5)	10 (3)	6.7 (2)
Normal	91.7 (55)	90 (27)	93.3 (28)
Posterior cerebral artery (P1)			
Aplasia	-	-	-
Hypoplasia	5.0 (3)	3.3 (1)	6.7 (2)
Normal	95 (57)	96.7 (29)	93.3 (28)
Posterior communicating artery (PCoA)			
Aplasia	6.7 (4)	10 (3)	3.3 (1)
Hypoplasia	53.3 (32)	56.7 (17)	50 (15)
Normal	40 (24)	33.3 (10)	46.7 (14)

Table II. Length (mm) and caliber (mm) of arteries of the cerebral arterial circle (n = 30)

Biometric measurements	Mean	DS	p25	p50	p75	Min.	Max.
Anterior cerebral artery length (Segment A1)	14.6	2.84	13.0	14.6	16.1	6.23	21.7
Anterior communicating artery length	2.06	0.97	1.37	1.91	2.68	0.38	4.58
Posterior cerebral artery length (Segment P1)	6.83	2.08	5.63	6.61	7.83	2.98	12.8
Posterior communicating artery length	15.9	4.47	13.1	15.5	18.5	8.79	35.8
Anterior cerebral artery caliber (Segment A1)	1.78	0.58	1.36	1.72	2.2	0.84	3.34
Anterior communicating artery caliber	2.43	1.19	1.73	2.22	3.09	0.63	5.28
Posterior cerebral artery caliber (Segment P1)	1.94	0.64	1.12	1.87	2.51	0.81	3.21
Posterior communicating artery caliber	1.11	0.50	0.76	0.97	1.25	0.43	2.55

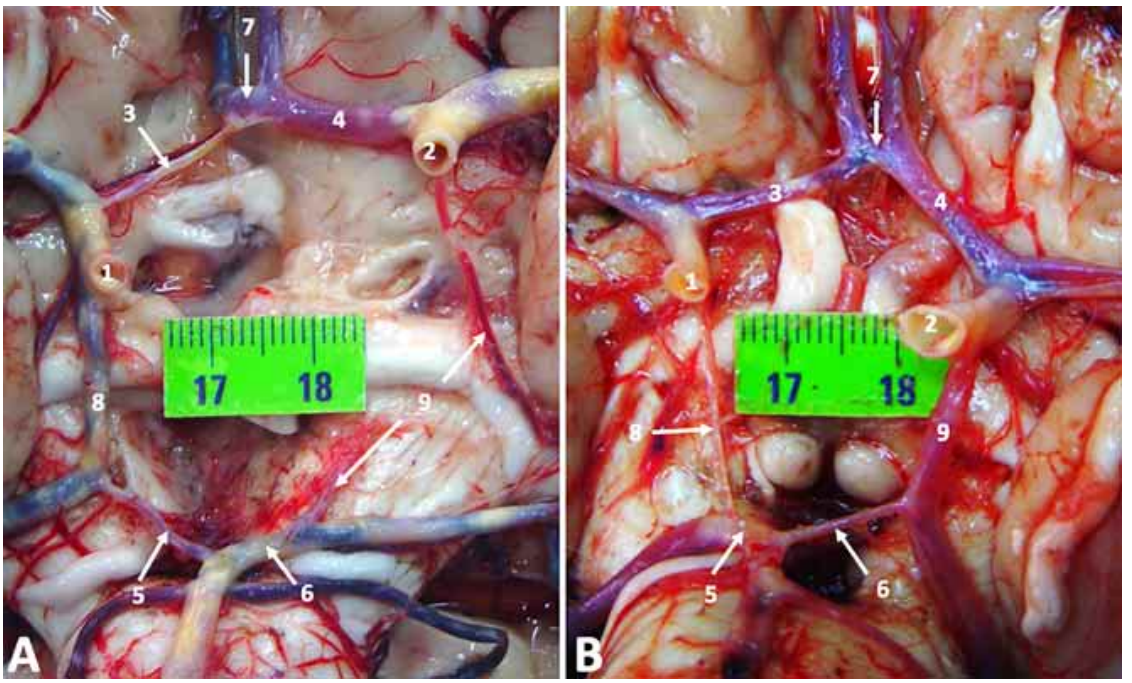
Abbreviations. p25: 25th percentile; p50: 50th percentile; p75: 75th percentile; Min.: minimum; Max.: maximum.

Table III. Comparison of length (mm) and calipers (mm) of arteries of the Cerebral Arterial Circle according to the right and left side.

Biometric measurements	Right				Left				*p*-value
	Mean	DS	IC 95%		Mean	DS	IC 95%		
Anterior cerebral artery length (A1)	15.1	3.04	14.0	16.3	14.2	2.59	13.2	15.1	0.10
Posterior cerebral artery length (P1)	6.56	2.12	5.70	7.42	7.06	2.05	6.30	7.83	0.19
Posterior communicating artery length	16.3	3.75	14.8	17.8	15.5	5.07	13.6	17.4	0.26
Anterior cerebral artery caliber (A1)	1.74	0.53	1.55	1.94	182	0.63	1.59	2.06	0.30
Posterior cerebral artery caliber (P1)	1.92	0.60	1.69	2.15	1.96	0.68	1.70	2.21	0.41
Posterior communicating artery caliber	1.02	0.49	0.82	1.22	1.19	0.50	0.99	1.37	0.11

Abbreviations. CI: confidence interval. [1] Student's t-test for independent population samples with equal variances.

(Fig. 1). In the remaining 33% it was observed that this circle presented fetal conformation in its right or left half. We can mention that in this study, no bilateral fetal or transitional CAC were found. When examining the conformation of these arterial circles according to laterality, the percentage of fetal presentation reaches 13.3 % (n = 4) on the right side and 20 % (n = 6) on the left side (Figs. 3A and 3B). It should be noted that in one of the samples it was observed that the origin of the right posterior cerebral artery was from the right internal carotid artery (Fig. 4).



Figs. 3. A. Cerebral arterial circle of right fetal conformation, B. Cerebral arterial circle of left fetal conformation. 1: Right internal carotid artery, 2: Left internal carotid artery, 3: Right anterior cerebral artery (A1), 4: Left anterior cerebral artery (A1) 5: Right posterior cerebral artery (P1), 6: Left posterior cerebral artery (P1), 7: Anterior communicating artery, 8: Right posterior communicating artery, 9: Left posterior communicating artery.

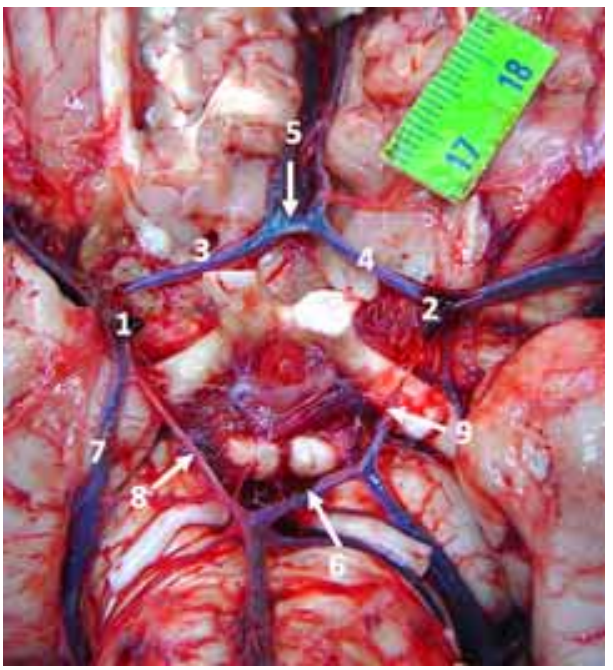


Fig. 4. Cerebral Arterial Circle with right posterior cerebral artery originating from the internal carotid artery, 1: Right internal carotid artery, 2: Left internal carotid artery, 3: Right anterior cerebral artery (A1), 4: Left anterior cerebral artery (A1), 5: Anterior communicating artery, 6: Left posterior cerebral artery (P1), 7: Right posterior cerebral artery, 8: Right posterior communicating artery, 9: Left posterior communicating artery.

DISCUSSION

The cerebral arterial circle is widely recognized as one of the main vascular groupings that allow maintaining a perfusion of the encephalic structures. Thus, Quijano & García (2020), stated the fact that the CAC plays an important role in the control of systolic pressure, protecting the brain from structural damage through energy dissipation. If we consider that these functions are key to brain indemnity, the alteration of biometric parameters or the absence of any of the arterial components of this circle are relevant in the etiology of various brain hypoperfusion disorders (Hoksbergen *et al*.; Kapoor *et al*.; Eftekhar *et al*.; Machasio *et al*., 2019). Zhou *et al*., proposed the existence of a classic pattern of CAC gives a protective factor to patients, that lies in a greater capacity for collateral reperfusion in scenarios of cerebral ischemia. Along these lines, although 86.6 % of our CAC presented all their vascular components, only 23.3 % lacked anatomical variations such as aplasia, hypoplasia or duplication of these arteries. Although, this last account is lower than that reported by Kapoor *et al*.; Machasio *et al*.; and Zaki *et al*. (2019), (45%, 37.2 % and 38 %, respectively), and is similar to that reported by Karatas *et al*., who described a classic pattern in 91% of their series. Regarding this last study, it must be considered that the percentage of classic pattern decreased to 8% when considering only the CAC without hypoplasia in its vascular components.

Truly, the figure presented agrees with that established by Jones *et al*., who indicates that this classic pattern can be present in a wide range, which extends from 4.8 % to 85.4 % of the cases. In equal manners, our figure of 77 % of CAC with anatomical variations is similar to 68.2 % reported as mean prevalence in the literature review described by Jones *et al*., which considered 26 studies.

Nevertheless, of the wide variability of CAC, there is a consensus that exists the greatest change in arterial component is the PCoA, a situation that also occurred in our series (Kamath, 1981; Eftekhar *et al*.; Karatas *et al*.). Following, Jones *et al*. described that 96.8% of the studies in their review reported that the same communicating vessel is the most variable, yet the study by Quijano & García, carried out in 50 CAC of the Colombian population, indicated that its greatest variability was in the vessels of the anterior circulation, which contrasts with the fact in our research the ACoA did not present any anatomical variation and the pre-communicating segment of the anterior cerebral artery (A1) was found to be hypoplasia in only 8.3% of the sample. Still, it is important analyze which is the optimal measure when determining hypoplasia of the vessels that form the CAC yet, we agree with most of the studies that indicate so, when the analyzed artery has a caliber of less than 1 mm, it should be considered hypoplasia (Karatas *et al*.; El Falougy *et al*.; Jones *et al*.). For Kamath, this hypoplasia was defined as the existence of an external caliber of less than 1 mm for arterial segments A1 and P1 and 0.5 mm for ACoA and PCoA, while for Machasio *et al*., this determination in imaging studies, it should be applied to vessels with calibers less than 0.8 mm. These discrepancies were approached by Jones *et al*., who concluded that there were no significant differences between the prevalences of hypoplasia reported in both cadaveric and imaging studies. Along these lines, we share what was reported by Eftekhar *et al*., who described that a 1 mm caliber is adequate for the irrigation of limited territories of the brain but, stressed that it is necessary to analyze in vivo the ability of these vessels to deliver collateral blood flow in situations of cerebral ischemia.

Thus, the analysis of the biometric variations of the PCoA, 40 % of our CAC presented bilateral hypoplasia of the PCoA, this account exceeds the 3.6% reported by Kapoor *et al*., the 4.1 % reported by Quijano & García and the 16.7 % indicated by El Falougy *et al*. In contrast, our findings are similar to the 33 % and 37 % described by Eftekhar *et al*. and Karatas *et al*., respectively. This same similarity is evidenced analyzing the presence of unilateral hypoplasia of this communicating vessel, since our measure of the 23 % is close to the 27 % reported by Eftekhar *et al*., and the 24 % described by Karatas *et al*. In the same way, if we compare the prevalence of PCoA hypoplasia with Jones *et al*. measurements, our unilateral hypoplasia is similar to the 19.45 % reported by them, however, our numbers of bilateral hypoplasia practically doubles the 22.85 % described in this review. Besides, Jones *et al*., pointed out the mean prevalences of their study presented high standard deviations, which can be attributed to the differences in the sample sizes of the studies considered or to the various methodologies implemented at the time of establishing the diameters of the CAC vessels.

Nevertheless, the reasons that explain the differences in reported prevalence, the presence of hypoplasia and aplasia of these arteries are related to various clinical disorders. Thus, Hoksbergen *et al*., indicated, patients with cerebral ischemias present in CAC with greater frequency of defective collateral pathways, being more damaging the compromise of the ACoA. This complication derived from the incomplete formation of this arterial circle which was endorsed in the study by Zhou *et al*., who concluded that the recovery rate of patients with cerebral stroke is lower in those who present aplasia of the ACoA and PCoA. Likewise, there are reports that establish an association between the development of migraine and incomplete CAC, there is a greater association when this circle is altered in its posterior half (Henry *et al*., 2015). plus, what is reported by Karatas *et al*., and Stojanovic *et al*., who indicated that an asymmetric CAC significantly increases the possibility of rupture of cerebral aneurysms.

Still the length and caliber of the arteries analyzed, the results of our study agree with the premise described by Kamath, who pointed out that blood flow advances with less resistance in the vessels of the left half of the CAC, since these present less length and larger caliber. Thus, if we compare the vessel´s length in our series, it is greater in segment A1 and in the right PCoA, while in the caliber´s case, it was higher both for segments A1 and P1 and for PCoA of the left side. These differences agree with the results presented by Karatas *et al*., who reported the length of its components A1, P1 and PCoA was greater on the right side, which it added the calibers of A1 and P1 were higher on the left side (Table IV). Following, our results also coincide with Quijano & García, who reported that the A1, P1 and PCoA calibers were higher on the left side. All the same reported by Mandiola *et al*. (2007), who also studied CAC of Chilean corpses, found similarities in the lengths of component A1, however, there are differences with Mandiola *et al*. (2006), who reported that the caliber of P1 was greater on the right side, while the caliber of the PCoA did not present differences (Table IV). Although there is a tendency finding vessels on the left side with shorter length and greater caliber, it is complex to establish that this factor is determinant in the development of ischemic disorders, however, when in the

Table IV. Length (mm) and mean caliber (mm) of arteries of the Cerebral Arterial Circle in cadaveric studies according to country.

Authors	Number of cerebral arterial circles	Country	Anterior communicating artery		Anterior cerebral artery (Segment A1)			Posterior cerebral artery (Segment P1)				Posterior communicating artery			
			Length	Caliber	Right length	Right caliber	Left length	Left caliber	Right length	Right caliber	Left length	Left caliber	Right length	Right caliber	Left length	Left caliber
Kamath	100	India	2.5	1.9	14.7	2.2	13.8	2.4	6.8	2.1	6.9	2.2	13.5	1.5	13.3	1.4
Mandiola *et al.*	36	Chile	--	--	--	--	--	--	9.43	2.56	8.82	2.32	17,.51	1.08	16.9	1.08
Mandiola *et al.*	36	Chile	--	--	12.86	2.37	12.62	2.42	--	--	--	--	--	--	--	--
Karatas *et al.*	100	Turkey	1.95	1.43	14.44	1.87	13.72	1.96	6.09	1.91	6.04	1.96	1549	0.90	15.08	0.90
El Falougy *et al.*	185	Slovakia	--	--	--	--	--	--	5.48	1.78	5.78	1,87	10.62	1.1	10.48	1.04
Zaki *et al.**	100	Egypt	--	1.4	--	2.2	--	2.3	--	2.0	--	2.0	--	1.6	--	1.7
Quijano & Garcia	24	Colombia	--	1.75	--	2.29	--	2.33	--	1.89	--	1.9	--	1.59	--	1.62
Riveros *et al.*	30	Chile	2.06	2.43	15.1	1.74	14.2	1.82	6.56	1.92	7.06	1.96	16.3	1.02	15.5	1.22

right side, present smaller caliber vessels can be considered the existence of high resistance blood flow may influence the ability of these vessels to deliver collateral flows in ischemic events.

Nevertheless, the type of conformation of the CAC, it is interesting to analyze the percentage and embryonic reasons that explain a circle of fetal conformation, a disposition that in our study reached 33% (13% on the right side and 20% on the left side), only one-sided presentation. In this sense, although our percentage is higher than those reported by Kapoor *et al*., Karatas *et al*. and El Falougy *et al*. (10.6%, 9%, and 13.2%, respectively), we consider that the optimum would be to compare the percentage of unilateral presentation, an element not indicated by these authors. In this sense, our numbers are similar to those reported by Eftekhar *et al*., who reported a fetal conformation of 26% on the right side and 28% on the left, adding our agreement in the fact that this conformation was observed with a greater presence on the left side.

In trying to understand this fetal conformation, it is necessary to refer to the embryonic arguments that explain this particular disposition. In this sense, Menshawi *et al*., pointed out that during the third week of the gestation process, the irrigation of our central nervous system is dependent on the newly formed internal carotid artery, which will be in charge in a first period of the irrigation of the entire respective cerebral hemisphere. Accordance to this, in this period an anterior and a posterior division are generated from the internal carotid artery, originating from the above the posterior cerebral artery and the posterior choroidal artery (Puchades-Orts *et al*., 1975; Menshawi *et al*.). Along these lines, it should be noted this last description explains the origin of the posterior cerebral artery from the internal carotid that is observed in our Figure 4.

In parallel to the growth of the posterior elements of our brain, two parallel arterial axles developed, intimately connected with the respective internal carotid arteries through embryonic connections that will regress in the following weeks. We refer to the vertebro-carotid anastomosis known as the trigeminal, otic, hypoglossal and proatlantal arteries (Kapoor *et al*.; Dimmick & Faulder; Menshawi *et al*.; El Falougy *et al*.; Machasio *et al*.). In later stages, the formation of the basilar artery and the involution of the vertebro-carotid anastomosis establish a change in the posterior conformation of the CAC, generated by the connection of the basilar artery with the posterior cerebral artery that previously originated from the internal carotid artery and the consequent reduction in the caliber of what will later become the PCoA (first segment of the original fetal posterior cerebral artery) (Takakuwa *et al*., 2016; Menshawi *et al*.). Yet, it is suggested that if the involution of the vertebro-carotid anastomosis does not occur, mainly of the trigeminal artery, the fetal conformation of the CAC is maintained in the later stages of embryonic development (Puchades-Orts *et al*.; Okahara *et al*.; Kapoor *et al*; Dimmick & Faulder; Menshawi *et al*.). Notwithstanding, there are reports that support the existence of changes in the arterial caliber of the CAC in more advanced stages of the embryonic process, many of them linked to environmental factors, which even determine the appearance of these changes after birth (Kapoor *et al*.; Karatas *et al*., Furuichi *et al*., 2018).

Finally, we can establish that the results reported in this study allow us to indicate that the CAC presents countless variations, with PCoA hypoplasia standing out for its frequency. Following this path, it is necessary for medical teams to be aware of the existence and prevalence of these variations, as well as their eventual clinical repercussions, generated by a lower collateral reperfusion capacity that this arterial set must offer in brain ischemia scenarios.

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RIVEROS, A.; VEGA, C.; NEGRONI, M.; VILLAGRÁN, F.; BINVIGNAT, O. & OLAVE, E. Variations of the cerebral arterial circle. Morphological and clnical analysis. *Int. J. Morphol., 40(3)*:632-639, 2022.

RESUMEN: El conocimiento de las variaciones del círculo arterial cerebral (CAC) resultan relevantes por su influencia en el desarrollo de trastornos isquémicos encefálicos. De estas variaciones, los cambios del calibre de la arteria comunicante posterior (ACoP) determinan una conformación fetal de este círculo. El objetivo de este estudio fue describir las variaciones del CAC en individuos chilenos y conocer el tipo de conformación arterial. Se utilizaron 30 encéfalos adultos a los que se midieron las longitudes y calibres de los segmentos precomunicante de las arterias cerebrales anteriores (A1) y posteriores (P1), y de las arterias comunicante anterior (ACoA) y ACoP. Se estableció el tipo de conformación arterial y se comparó la longitud y calibre de estos vasos según lateralidad. Se observó que el 76,6 % de los CAC presentaron agenesias y/o hipoplasias. De sus componentes, la ACoP fue hipoplásica en el 53,3 %, presentándose bilateral en el 40 %. La comparación según lateralidad indicó que la longitud media de A1 y ACoP del lado derecho fueron levemente superiores. En el caso de los calibres, la media de A1, P1 y ACoP fue superior en el lado izquierdo. Respecto de los calibres de P1 y ACoP, el 33 % de los CAC presentaron conformación fetal unilateral. Independientemente de la variabilidad que presenta el CAC, existe consenso de que la ACoP exhibe la mayor variabilidad. La comprensión de esta variabilidad requiere un análisis de los aspectos embrionarios que pueden explicar la conformación fetal de esté círculo arterial en el adulto.

PALABRAS CLAVE: Anatomía; Irrigación; Círculo arterial cerebral; Hipoplasia; Variaciones anatómicas.

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