"OVIDIUS" UNIVERSITY

DOCTORAL SCHOOL OF THE FACULTY OF MEDCINE

MORPHOLOGICAL ASPECT OF THE AORTIC ARCH

THESIS ABSTRACT

SCIENTIFIC LEADER

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CONTENTS

INTRODUCTION

It is known that heart and vascular illnesses now occupies first place in the pathology of modern society, which has led, rightly declaring them as public enemy number one.

The increased frequency and suffering of high blood pressure, especially traumatic, degenerative and congenital, invalidates the active age, long-term and progressive nature of this disease, severe , aggravating and complicated, here are some features of cardiovascular diseases vascular.

The etiology of these diseases is between many factors, from genetic inheritance of the individual on whose behalf a variety of items like macro and the micro climate, infection, trauma, etc.

Risk factors as rapid deployment of life, responsibility, excitement, failure of sequential rest, nervous strain, in a word, "stresses of the day" which is doubled by the toxic consumption (tobacco, alcohol, drugs), which creates consensus, a sphere wich is proper for development and progression of these diseases.

Incidentally, this is why literature currently presents a variety of interpretations, viewpoints, varied and multiple classifications, explanations, and multifactorial different interpretation.

The problem lies in the cardio-vascular medical world, in OMS there is a section that deals with the prevention and combating cardiovascular disease. In almost all countries of the world there are divisions, departments and even institutions cardiovascular disease and most of them benefit from national or European programs.

In the study of cardiovascular diseases, knowledge of anatomy and pathophysiology of the heart, aorta and its branches, represent any prerequisite and research in this area is extensive evidence of the large number of treaties and articles appearing in various publishing houses and magazines worldwide. Organized scientific cardiovascular theme, involving a large number of specialists, communications presented with a wide audience and interesting the medical world. A proof of the importance of cardiovascular diseases is the great interest of drug manufacturers and specialized surgical material, whose products are made in close connection with research in the field.

Cardiovascular surgery (open heart surgery) had an impressive development in recent years due to new acquisitions of the explorers and new operational techniques and equipment through the use of increasingly refined and sophisticated, leading to unexpected performance, impressive and positive changes in the patient very short period of time.

Cardiology thus became one of the medical disciplines whose developments are most impressive and nowadays it has reached a remarkable effectiveness. The evidence is irrefutable, cardiovascular disease mortality decreased appreciably in recent years, but nevertheless remains the most frequent cause of death. Étienne May (quoted Bounhouré) said that "medical advances are the result of a long process, with failures and errors, undecided battles, and glorious battles." Surprisingly, the mechanisms of circulation and respiration, without which life can not exist, were not clearly understood until centuries of fanciful error and totally irrational. Cardiology term was first used in 1847 by Christpher Lawrence including situations, under this name the diagnosis and treatment of diseases of the heart and vessels, name later enlarged anatomy, physiology and methods for exploring all cardiovascular system. It is undeniable that the findings and descriptions of anatomical parts of cardiovascular system contributed to the development and achievements in this field. And now ,alerts of morphological features of any kind, brings their contribution to the development of cardiovascular science.

All this led me to choose the topic of my PhD thesis morphology of the aortic arch and its branches, focusing more on the actual aortic arch and origin of arterial branches that fall from its level. This anatomical and surgical study that we conducted, in addition to analysis and synthesis of knowledge of treaties and magazines, make some personal observations, comparing them with those already in the literature, all of which have been described by other authors, classical and contemporary, which helped in interpreting the results and finalize conclusions.

The great Chapter of the current state of knowledge about the aortic arch, after a brief history of aortic arch study over time,presenting its notions of embryological development are the described aspects origin, path, relationships, collateral branches, types of aortic arch morphology and morphometry of aortic arch and its branches at their origin. Collateral branches of the aortic arch were studied only in terms of their origin, morphometry and relationships established between them at the origin. All these are based on anatomy, classic and recent, of well-known authors: Test, Rouvière, Paturet, Gray, Chevrel, Bouchet, Kamina, Schunk, Moore, etc. To these are added anatomy atlases (Netter, Sobotta, Clemente) and specialist medical journals, of which a large part of very recent.

In the personal part, are presented the methods and material of work, meaning dissection, plastic injection followed by dissection or corrosion and modern methodologies represented by simple and CT angiography.

Then,the personal results are presented from the study conducted, exemplified by personal image appealing to eloquent and convincing graphs and tables.

The following statements are made by comparing the results with existing data in the literature, highlighting the similarities and differences between different morphological landmarks pursued that may point out some features about the area. The results were used by the publication of two articles in full in "Ars Medica Tomis" journal indexed BDI and oral presentations and poster at national and international scientific meetings.

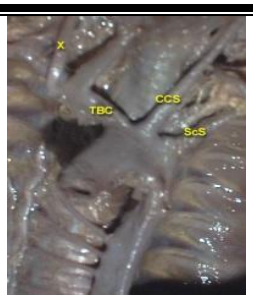
In the general presentation i respected anatomy terminology, published in 1998 and edited by Federal Commitee on Anatomical Terminology.

To achieve this thesis i have benefited from colleagues at the anatomy lab of the Faculty of Medicine Constanța and Diagnostic Imaging Centers Medimar and Pozimed, whom I thank from my heart. Finally I want to thank Professor PETRU BORDEI , scientific leader of this work, for guidance and for permanent help.

METHODS AND WORKING MATERIALS

My study of aortic arches was carried out in a total of 228 cases. As a working method we used dissection in 64 cases and plastic injection followed by corrosion or dissection in 46 cases. Were also consulted simple angiography 58 and 60 angioCT.

TABLE NO. I - METHODS USED AND NUMBER OF CASES

Nr.	Method	Nr. cazuri	Foto
1.	dissection	64	
2.	plastic injection	46	
3.	Simple Angiography	58	
4.	AngioCT	60	
	Total	**228**	

We used the method of dissection study, both fresh and anatomical formalinized and the plastic injections. Dissection was performed on a total of 64 cases, of which 36 cases of adult and fetal human cadavers in the dissection rooms of anatomy laboratories of the Faculty of Medicine Constanța, and the remaining 28 cases studied of aortic arch and branches and its components was performed on harvested forensic lab in Constanta. Plastic injection substance was made only with fresh anatomical preparations in the ascending aorta or descending thoracic aorta.

For plastic injection we used Technovit 7143, and after plastic injecting ,dissection and less corrosion with NaOH .

Angiography that I had the opportunity to examine ,came from Medimar center exploration of the Emergency Hospital in Constanta and Diagnostic Imaging Center Euromedic constantly being performed on a GE LightSpeed 16 Slice CT scanner. We also had available and executed angiography in Diagnostic Center Pozimed being performed on a GE LightSpeed CT scanner VCT64 Slice CT.

RESULTS

ANATOMY OF THE AORTIC ARCH

MORPHOMETRY OF THE AORTIC ARCH

The study was conducted by consulting angioCT scans and practiced measurements of aortic arch at the following levels: the origin of the aorta, the middle portion upward above the origin of brachiocephalic trunk, right subclavian artery after the origin. Measurements were made of the caliber arteries emerging from the aortic arch, the entire study was performed on a total of 33 angioCT scans, nine of the females and 24 in males.

The diameter of the ascending aorta above the origin of the coronary arteries we found between 25.8 to 37.6 mm. In women does not exceed over 29 mm in diameter, ranging from 27 to 28.9 mm. In males, it was 25.8 to 37.6 mm range, in one case with 25.8 mm diameter. In 9 cases the diameter was between 27.3 to 28.4 mm and 14 cases had values ranging from 32.4 to 37.6 mm.

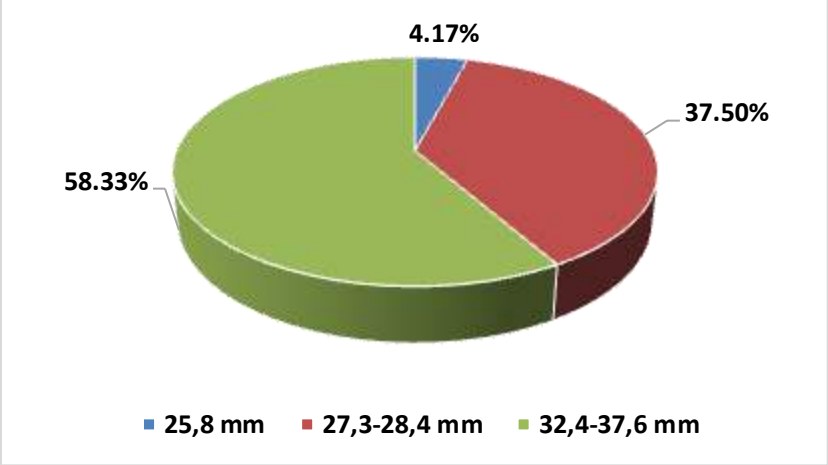
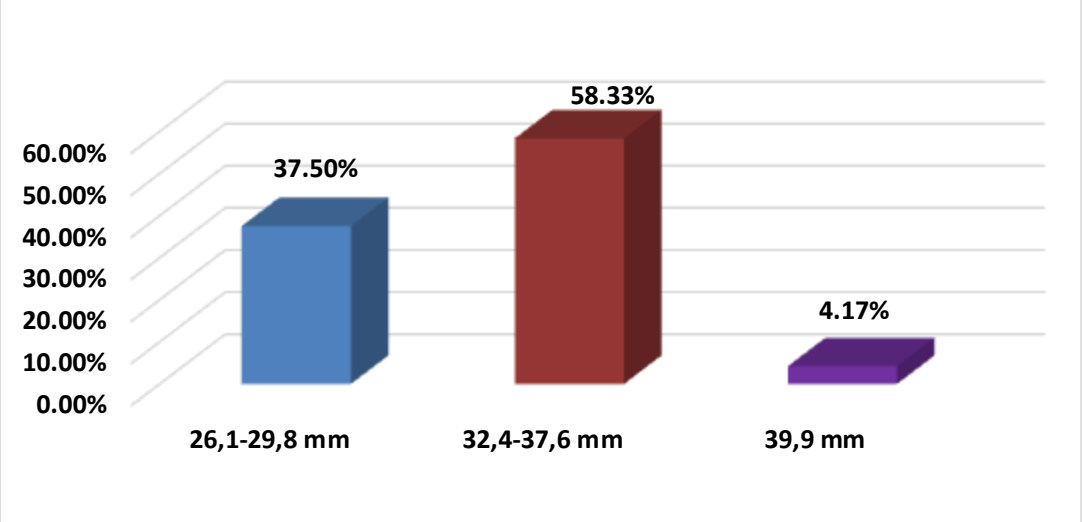


CHART NO. 1 - DIAMETER OF ITS ORIGIN IN THE ascending aorta in males.

Ascending aorta diameter at its middle segment we founded between 26.1 to 39.9 mm. The females have between 28 to 30.2 mm diameter and males 26.1 to 39.9 mm diameter.



SCHEDULE NO. 2 - diameter of the ascending aorta MIDDLE LEVEL segment in males.

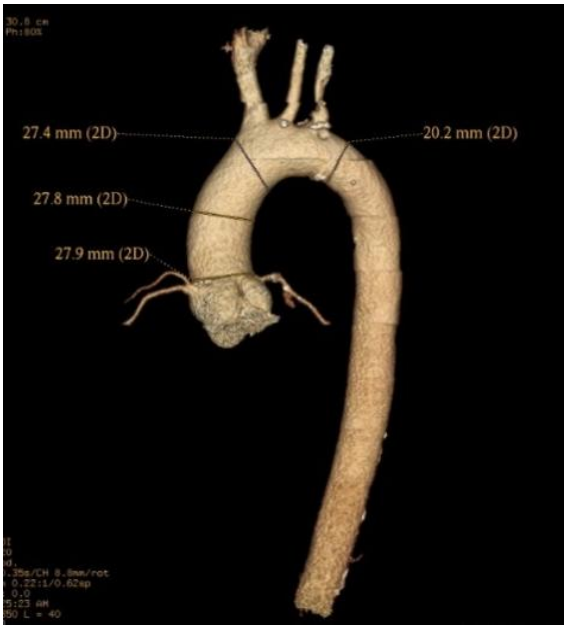
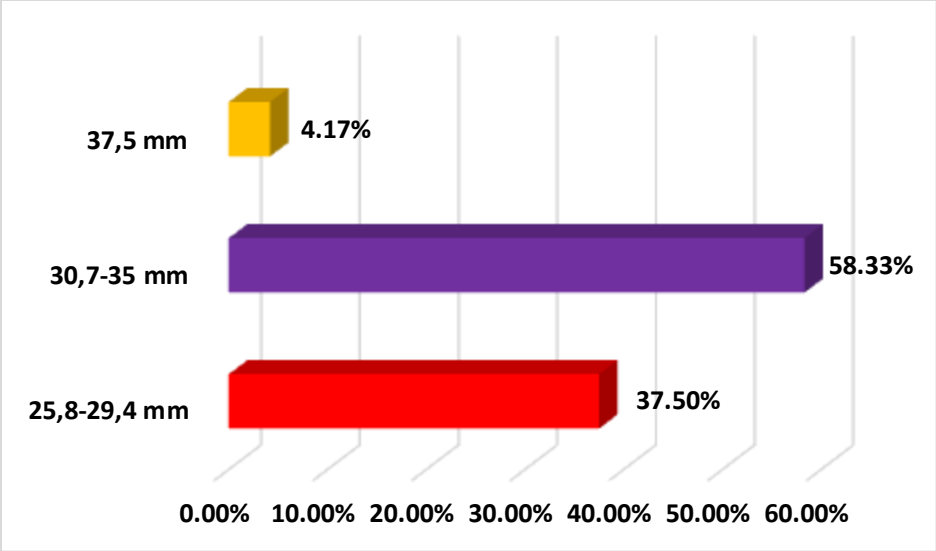


Fig. 22 - The diameter of the ascending aorta and aortic arch in males: the ascending aorta arises from 27.9 mm, 27.8 mm portion to middle and 27.4 mm above the origin of brachiocephalic trunk; subclavian artery to the origin of the posterior aortic arch has a diameter of 20.2 mm.

The diameter of the aortic arch above the origin of the brachiocephalic arterial trunk it, I founded in the range from 25.8 to 37.5 mm. In females was 26.4 to 29.4 mm range and males from 25.8 to 37.5 mm.



SCHEDULE NO. 3 - diameter of the ascending aorta previous of the origin of brachiocephalic trunk in males.

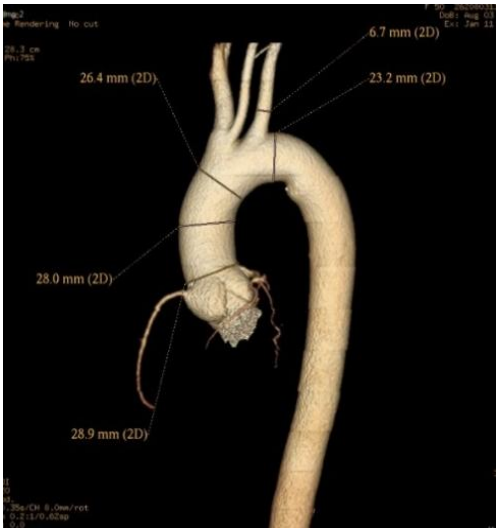


Fig. 23 - The diameter of the ascending aorta and aortic arch in women: the ascending aorta arises from 28.9 mm, 28.0 mm portion to middle and 26.4 mm above the origin of brachiocephalic trunk; posterior from the origin of subclavian artery the aortic arch has a diameter of 23.2 mm.

The diameter of the aortic arch, posterior from the origin of the left subclavian artery (in the aortic isthmus), we found between 20.2 to 28.4 mm, which corresponds to the limits found in men, in women the aortic diameter is between 21.3 to 24.1 mm.

TABLE NO. 2 - aortic diameters originally aorta in the aortic arch upward.

AUTORUL	ORIG.AO.	AO.ASC.	ORIG.AA	TERM.AA.
Nguyen	-	25-30mm	30mm	18-20mm
Testut	-	25-28mm	-	18-20mm
Paturet	-	-	25mm	18-20mm
Gray	30mm	-	28mm	20mm
Bouchet	-	25-30mm	-	-
Gorun	-	-	25-30mm	20-25mm
Personal cases	*F:27-28,9mm M:25,8-37,6mm*	*28-30,2mm 26,1-39,9mm*	*26,4-29,4mm 25,8-37,5mm*	*21,3-24,1mm 20,4-28,4mm*

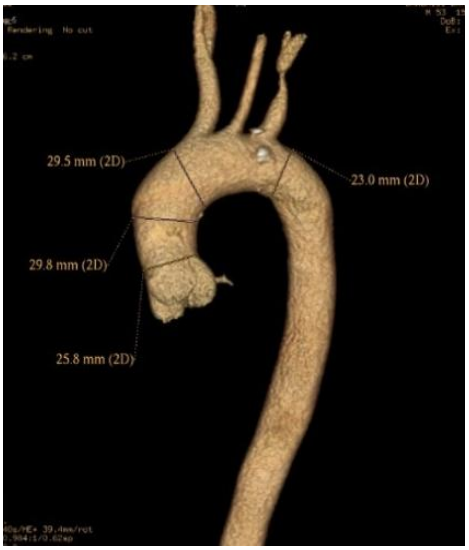


Fig. 24 - The diameter of the ascending aorta and aortic arch in males: the ascending aorta arises from 25.8 mm, 29.8 mm portion to middle and 29.5 mm above the origin of brachiocephalic trunk; subclavian artery to the origin of the posterior aortic arch has a diameter of 23.0 mm.

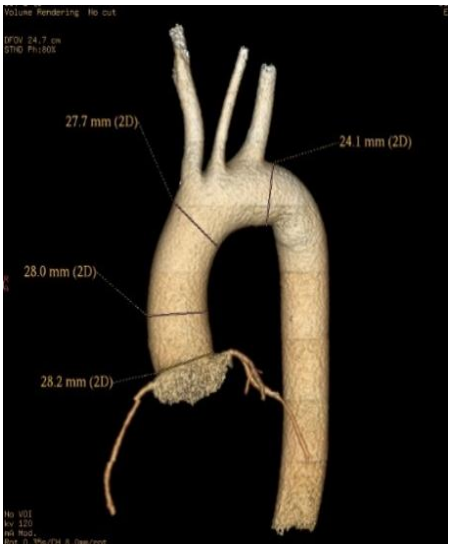


Fig. 25 - The diameter of the ascending aorta and aortic arch in males: the ascending aorta arises from 28.2 mm, 28.0 mm portion to middle and 27.7 mm above the origin of brachiocephalic trunk; subclavian artery to the origin of the posterior aortic arch has a diameter of 24.1 mm.

Comparing the caliber of the ascending aorta (at the three levels that we measured) and size of the aortic arch by gender i found that if the diameter of the ascending aorta at its origin, in women the difference between the minimum and maximum diameter is only one 9 mm and in males and this difference is 11.8 mm. Comparing the maximum diameter of the aorta in the two sexes, the difference is 8.7 mm for males and for the minimum diameter, it was higher in females by 1.2 mm.

Comparing the maximum diameter in women with diameters found in males, we found that in 55.56% of cases it was lower by 3.3 to 7.3 mm difference, and in 44.44% cases it was the larger with a differences of 0.5-1.6 mm.

Maximal diameter met in males was higher than the values found in women with differences between 8.7 to 10.6 mm .

The minimum diameter in females compared to males i found diameters smaller in 88.89% of cases, with differences from 0.3 to 10.6 mm. The minimum diameter of males compared with diameters encountered in women was lower in 100% of cases, with differences from 1.2 to 3.1 mm.

In the middle portion of the ascending aorta we found that males have differences between the minimum and maximum diameter up to 13.8 mm, while in women the differences were up to 2.2 mm. The difference between the maximum diameters of the two sexes was 9.7 mm for males, and the minimum diameter was 1.9 for females.

The maximal values met in males was higher than the values found in women with difference in diameters of 9.7 to 11.9 mm. The minimum diameter in females compared to males encountered diameters were higher in 22.22% of cases, with differences from 0.2 to 1.9 mm in 77.78 of cases is higher in males with differences from 1.8 to 11.9 mm. The minimum diameter of males compared with diameters encountered in women was lower in 100% of cases, with differences from 1.9 to 4.1 mm.

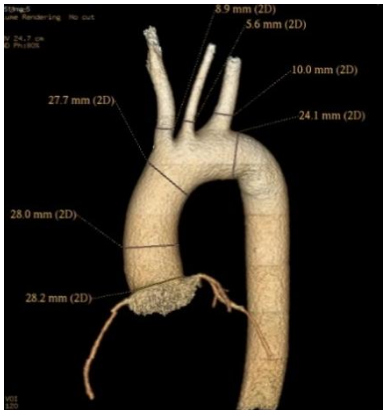


Fig. 26 - The diameter of the aorta and aortic arch in females

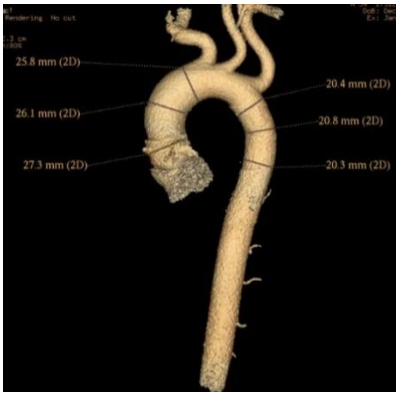


Fig. 27 - The diameter of the aorta and aortic arch in males.

Previously to the origin of arterial brachiocephalic trunk in male , the aorta had a difference between the maximum and minimum diameters of 11.7 mm, in women this difference is 3 mm. The difference between the maximum diameter was 8.1 mm for males, and the difference between the sexes for the minimum diameter was 0.6 mm for females.

Maximal diameters of women compared to males was higher in 22.22% in favor to females and differences of 2 to 3.6 mm in 77.78% of the males is greater than the differences of 0, 1 to 8.1 mm.

Maximal diameters of male versus female sex was higher in males with differences from 9.8 to 11.1 mm.

The minimum diameter found in females compared to males were found diameters greater in one case, only 0.6 mm, while in other cases being higher in men with differences from 1 to 11.1 mm. The minimum diameter of males compared with diameters encountered in women was lower in 100% of cases, with differences from 1.9 to 4.1 mm.

In the aortic isthmus (posterior of the origin of the left subclavian artery) we found that males had differences between the minimum and maximum diameter up to 8.2 mm, while in women the differences were up to 2.8 mm. The difference between the maximum diameters of the two sexes was 4.3 mm for males, and the minimum diameter was 1.1 mm in women.

Maximal diameters of women compared to males was higher in 55.55% for females with differences of 1.1 to 3.9 mm, and in 44.44% of cases is greater in males with difference between1.5-4.3 mm. Maximal diameters of male versus female sex was higher in males with differences from 4.3 to 7.1 mm.

The minimum diameter in females compared to males encountered that diameters were higher in 22.22% of cases and in 77.78% of cases is higher in males with differences from 1.3 to 7.1 mm.

The minimum diameter of males compared with diameters encountered in women was lower in 100% of cases, with differences from 1.1 to 3.9 mm.

On a number of 31 cases, 22 males and 9 females, we compared the size of the ascending aorta (at the three levels that we measured) and the aortic arch caliber, and we find a number of features of their size, issues that we have not fully found in the literature cited.

In 12 cases we encountered progressively decrease in size of the ascending aorta from the origin to the origin of aortic arch (before thenorigin of the brachiocephalic arterial trunk), 6 cases were in males and 6 cases in women. Thus, between the origin of the aorta and mid ascending aorta the diameter decreased with 0.1 to 1.2 cm , in females, the decrease being 0.2-0.9 mm in women, and 0.1-1,2 mm in males. Between mid ascending aorta and the origin of brachiocephalic trunk the diameter decreased between 0.3 to 1.6 mm, in females from 0.3 to 1.6 mm and in males from 0.3-0.4 mm.

Between the origin of the brachiocephalic trunk and the aortic isthmus (posterior from the origin of the left subclavian artery) I met a decrease in the diameter of the aortic arch between 3.2 to 7.2 mm, in females the decrease being 3.2-3.6 mm, and from 5.4 to 7.2 mm in male.

In only three cases, all males, I met a progressive increase in the diameter of the ascending aorta and a decrease of the aortic arch diameter. Thus, between the origin of the ascending aorta and its middle the diameter grew between of 3.2-3.5 mm and between the mid ascending aorta and the origin of brachiocephalic trunk the diameter increased by 0.6-0.9 mm ; between brachiocephalic trunk and aortic isthmus diameter declined by 8.4 to 9.1 mm.

In 16 cases), 3 cases in women and 12 cases in males there is an increase in the diameter of the ascending aorta between the origin of the aorta and its middle and a decrease in diameters of the two other levels considered. Thus, between the origin of the ascending aorta and its middle I found an increase of 1.8 to 4 mm diameter, in women increased from 1.8 to 3.2 mm and in males from 1.8 to 4 mm.

Between mid aorta and brachiocephalic arterial trunk origin, these cases showed a decrease from 0.3 to 6.4 mm diameter range, the female being 1.9-2.8 mm, and the decrease in males was 0, 3 to 6.4 mm.Between the brachiocephalic trunk and the origin of the aortic isthmus, the aortic arch diameter decreased from 6.1 to 8.6 mm, in women was found a decrease in the diameter of 6.1 to 6.4 mm and in males between 6.5 to 8.6 mm.

On a number of 31 cases, 22 cases for males and 9 for females), we found that between the origin of brachiocephalic trunk (right above it) and immediately after the origin of the left subclavian artery, there is a decrease in the diameter of the aortic arch from 3.2 to 9.1 mm, in males this decrease being between 5.4 to 9.1 mm and in women the size reduction ranging from 3.2 to 6.1 mm.

On a number of 33 cases, 24 cases in males and 9 in females, we measured the distance between the ascending aorta (above the origin of the coronary arteries) and downward arc of the segment (below the aortic isthmus), finding a range between 33 ,9 to 68.6 mm.

In males the distance was between 40 to 68.6 mm, while in women, the range was 33.9 to 38.5 mm .

When the two branches, the ascending aorta and the descending segment of the arc are closer, less than 50 mm in males and less than 37 mm in women, the aortic arch is reduced in width, "tight" with sharp convexity and its horizontal portion is short, there is also the possibility that the left subclavian artery to originate from the top of the aortic arch or from the descending segment core of brachiocephalic

artery in the terminal portion of the ascending aorta. When the two segments are far apart (over 50 mm in males and over 37 mm in women), convexity is reduced, this segment is really horizontal the aortic arch is "wide", the distance between the conventional three branches of the arch is higher.

ANATOMY BRANCHES OF THE AORTIC ARCH

BRACHIOCEPHALIC ARTERIAL TRUNK

I have fallowed the origin and the path of the brachiocephalic arterial trunk on number of 189 cases.

I found that in 168 cases the brachiocephalic trunk originated in the aortic arch, in these cases the origin is located strictly in the aortic arch in 114 cases, and in 54 cases the origin was located at the limit of ascending aorta with the initial segment of the aortic arch.

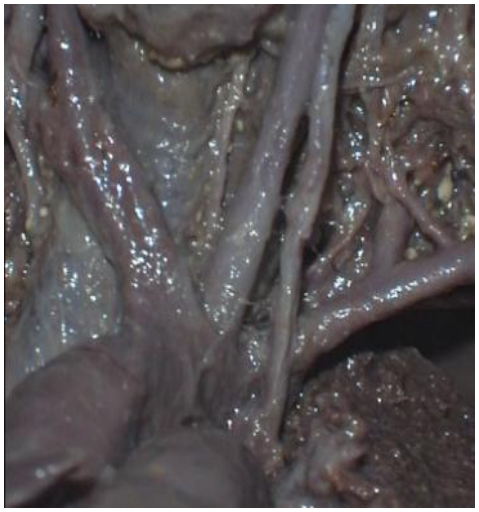


Fig .55 – The origin of brachiocephalic trunk of the aortic arch.

Fig. 57 - The origin of the brachiocephalic trunk at the limit between the ascending aorta and aortic arch.

In 21 cases (11.11% of cases) the brachiocephalic trunk origin was located in the terminal segment of the ascending aorta.

I have studied the origin of the brachiocephalic trunk in relation to its position against the trachea, in a number of 49 cases. In 12 cases (24.49% of cases), the origin was located on the front right

anterolateral of trachea , in 15 cases (30.61% of cases) in front of the trachea and in 22 cases (44.90% of cases) on the front left anterolateral trachea.

Fig. 61 - brachiocephalic trunk is straight paths oblique upper-right side.

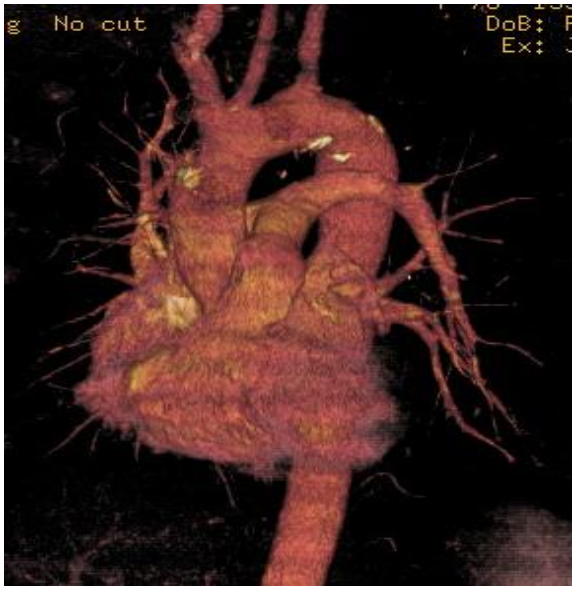


Fig. 64 - brachiocephalic trunk is initially oblique paths upper-right side, then becomes vertical.

In 33 cases, the brachiocephalic trunk had a supero-lateral oblique path to the left, describing two variants, and in 3 cases initially had a left supero-medial oblique path ,after that became oblique supero-lateral to the right.

Fig. 65 – The brachiocephalic trunk has a straight path oblique upper-left side

Fig. 67 – The brachiocephalic trunk has an initial path upper-left side, then gets oblique supero-lateral presenting a high termination ..

I found a diameter of the brachiocephalic trunk of 9.1 to 14.5 mm, in males having a diameter of 9.1 to 14.5 mm and in women the brachiocephalic trunk diameter ranged from 8.9 to 10 mm.

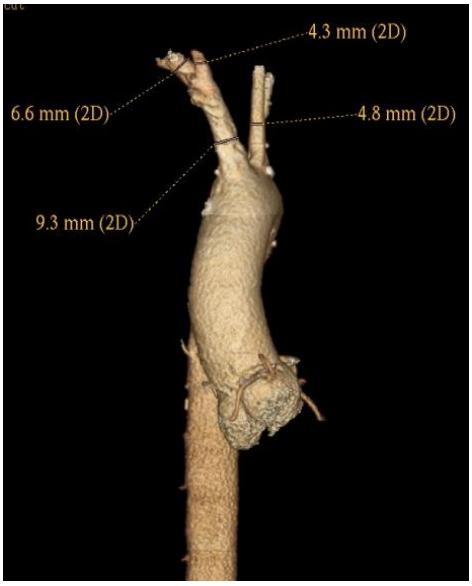


Fig. 68 - brachiocephalic arterial trunk has a diameter of 9.3 mm, 4.3 mm has the right common carotid, right subclavian artery 6.6 mm, and 4.8 mm the left common carotid (in males).

The maximum diameter of the brachiocephalic trunk that I found in females is 15.5 mm and 14.5 mm in males.Because it was only in one case, I got out just below this value, the females being 9.3 mm and 12.8 mm in males.

TABLE NO. 3 – DIAMETER of the brachiocephalic arterial trunk.

AUTORUL	TR.B.C
Paturet	13 mm
Kamina	13 mm
Bouchet	13 mm
Shin Young	11,4 mm
Testut	12-15mm
Gorun	14mm
personal cases	*F:8,3-15,5mm* *M:9,1-14,5mm*

On a number of 218 cases I have followed the terminal branching of the arterial brachiocephalic trunk, describing it in relation to its length: 126 cases presented medium length ranging between 2-3.5 cm (average of brahiocefalic trunk), in 63 cases there was a high brachiocephalic trunk, with more than 3.5 cm, and in 29 cases present a low end, with a length of 1.2 cm, short brachiocephalic trunk.

LEFT COMMON CAROTID ARTERY

The origin of the left common carotid artery have studied a number of 149 cases, of which 108 cases left common carotid artery had its origin in the aortic arch, describing the three variants: in 68 cases artery origin was located in the middle portion of initial segment of the aortic arch, 24 of the case in the right half of the initial segment of the aortic arch and 16 of the cases on left half of the initial segment of the aortic arch. In 41 cases the left common carotid artery originated at different levels of arterial brachiocephalic trunk.

Fig. 82 - The origin of the left common carotid artery is located in the middle portion of the initial segment of the aortic arch.

Fig. 83 - The origin of the left common carotid artery is located in the right half of the initial segment of the aortic arch.

Fig. 85 - The origin of the left common carotid artery from brachiocephalic arterial trunk, near its origin from the aortic arch.

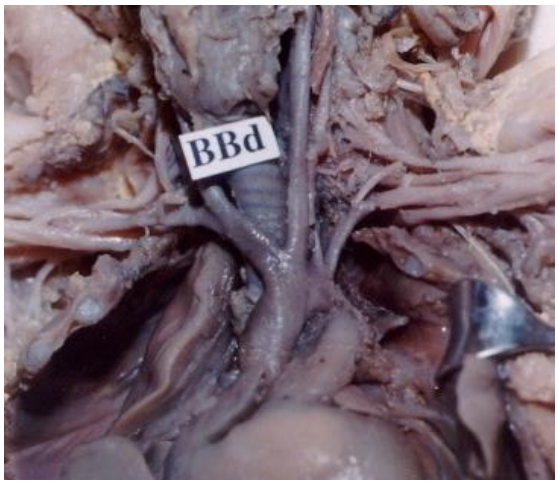


Fig. 90 - Left common carotid artery originating from the brachiocephalic trunk with vertical trajectory.

In a number of 33 cases we have studied the left common carotid artery caliber and we found that this artery diameters are between 4.6-7.4 mm; in females left common carotid diameter ranging from 4.6 to 5, 7 mm, the value of 4.6 mm is for the left common carotid artery originating from the brachiocephalic trunk. The left common carotid artery present in males is between 5.2 to 8 mm in diameter.

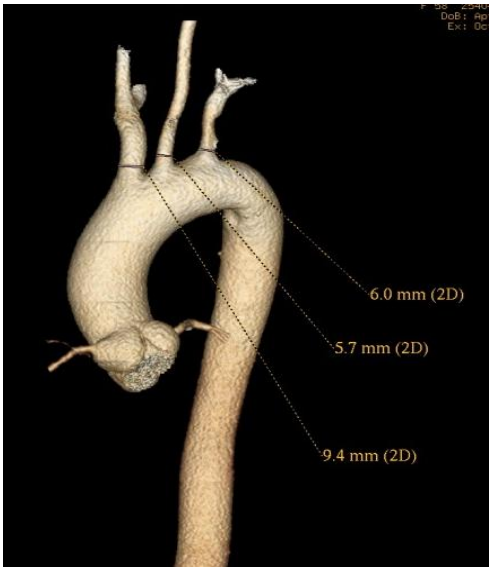


Fig. 97 - left common carotid artery has a size of 5.7 mm, the left subclavian artery has a size of 6.0 mm, and the brachiocephalic arterial trunk has a size of 9.4 mm (in women).

TABLE NO. 4 – LEFT COMMON CAROTID ARTERY DIAMETER.

AUTHOR	C.C.St.
Paturet	9-10 mm
Kamina	9 mm
Bouchet	8 mm
Shin Young	9,5 mm
Turgut	13 mm
Gorun	9 mm
PERSONAL CASES	*F:4,6-5,7 mm* *M:5,1-5,8 mm*

Between the left common carotid artery caliber and the caliber of the ascending aorta above the origin of the brachiocephalic arterial trunk, on a number of 33 cases, 24 cases of male and 9 female, I have found that the left common carotid artery had a lower caliber of 19.6 to 30.7 mm, which is smaller (17.26 to 24.03 percent). In males the differences were between 19.6 to 30.7 mm, which represent the differences were lower, from 17.26 to 24.03 percent, and in women the diameter was lower ,from 21.8 to 23.7 mm, , which represents 17.42 to 22.22 percent.

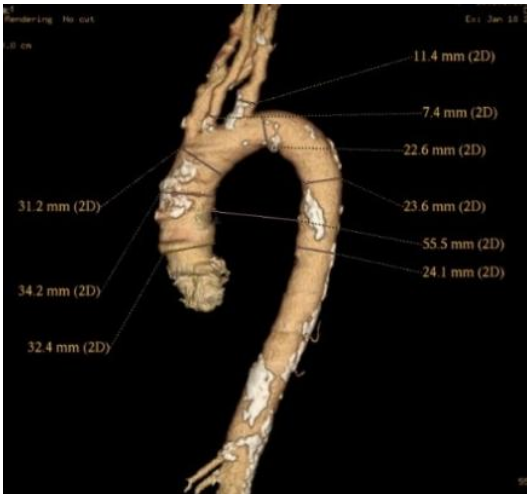


Fig. 99 - Size of the left common carotid artery is smaller than the size of the ascending aorta above the origin of the brachiocephalic arterial trunk with 23.8 mm (23.71%) males.

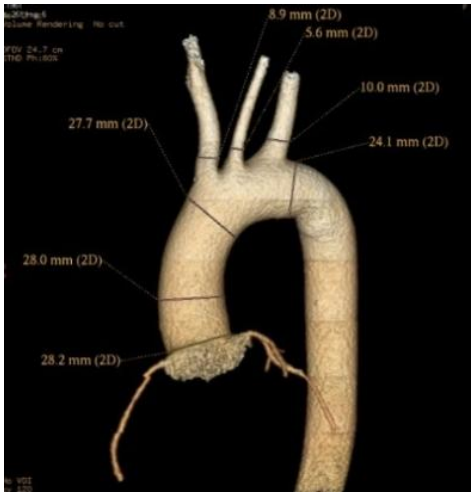


Fig. 100 - Size of the left common carotid artery is smaller than the size of the ascending aorta above the origin of the brachiocephalic arterial trunk with 22.1 mm (22.22%) in women.

LEFT SUBCLAVIAN ARTERY

1. The origin of the left subclavian artery I have studied on a number of 172 cases, always located at the aortic arch, describing four variants: in 86 cases originated in the left half of the aortic arch; 54 is rooted in the top of the descending aortic arch segment; in 28 cases originated in the middle portion of the initial segment of the aortic arch and in 4 cases originated in the right half of the initial segment of the aortic arch.

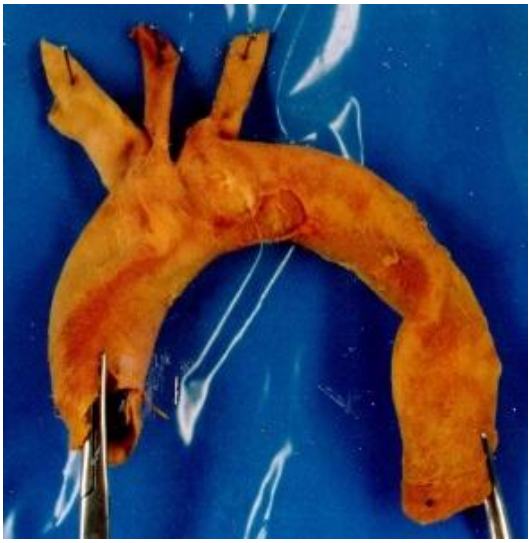


Fig. 115 - Left subclavian artery originating from the right half of the aortic arch.

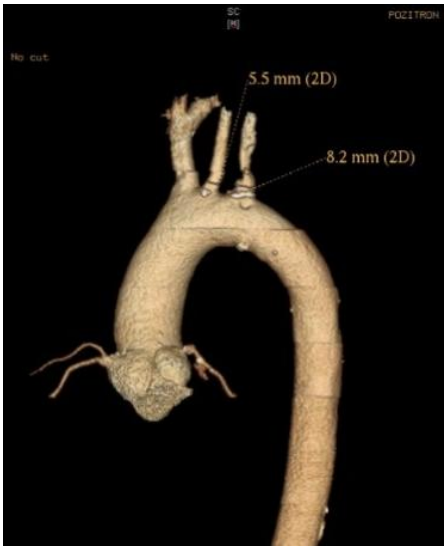


Fig. 119 - Left subclavian artery has a size of 8.2 mm, and the left common carotid artery has a size of 5.5 mm (in males).

For the left subclavian artery we found a caliber of 5.3 to 12.8 mm; in females the diameter was from 5.3 to 10 mm and in males the diameter was between 7.7 to 12.8 mm,

TABLE NO. 5 – LEFT SUBCLAVIAN ARTERY DIAMETER .

AUTHOR	S.Cl.St.
Paturet	9-10 mm
Kamina	9-10 mm
Bouchet	9-10 mm
Shin Young	10,6 mm
Gorun	10 mm
PERSONAL CASES	*F: 5,3-10 mm* *M: 7,7-12,8 mm*

We compared the diameter of the two subclavian arteies, right and left and we found that in 22 cases the left subclavian artery was biger in diameter, from 0.1 to 3.9 mm compared to the right subclavian artery. In males ,in all of the 18 cases the left subclavian artery diameter was greater than the diameter of the right subclavian with 0.1 to 3.9 mm, and in women only four case the left subclavian artery had a larger diameter than the right subclavian with 0,8- 1.4 mm.

VARIATIONS OF THE BRANCHES OF AORTIC ARCH

Of the 228 cases that we've studied, we found 66 cases in which the aortic arch branches presented variants, in 159 cases the aortic arch showed three branches, in 47 cases showed two branches and in 22 cases showed four branches.

Of the 47 cases with two branches (68.12% of all variants) in 41 cases (17.98% of all cases and 59.42% of all variants) left common carotid artery originated from the brachiocephalic arterial trunk . In the remaining 6 cases (2.63% of all cases and 8.70% of all variants) were two brachiocephalic arterial trunks.

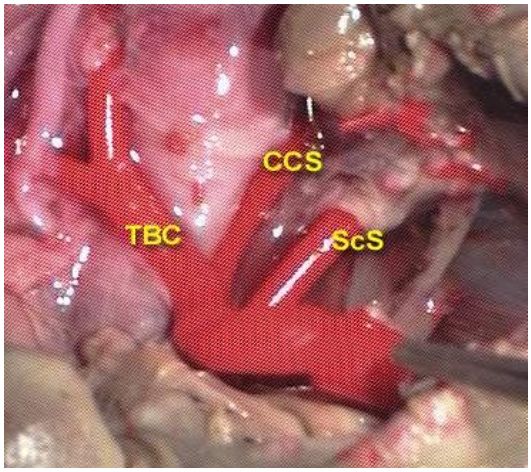


Fig. 124 - Left common carotid artery originating from the brachiocephalic arterial trunk.

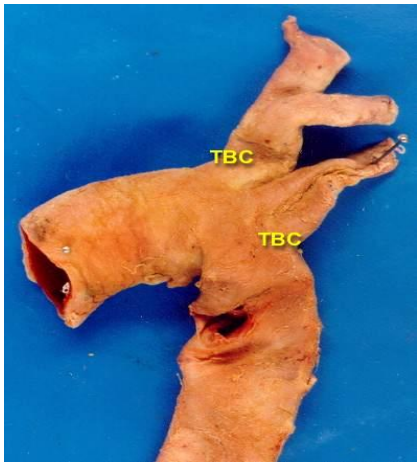


Fig. 125 - Two brachiocephalic arterial trunks.

Of the 22 cases with four branches there are many variations: in 6 cases we found right subclavian artery with retroesofagian trajectory;

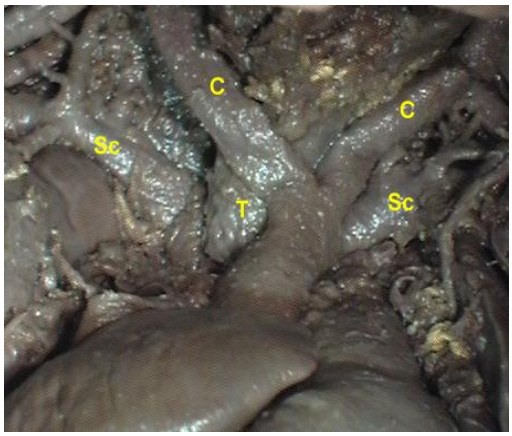


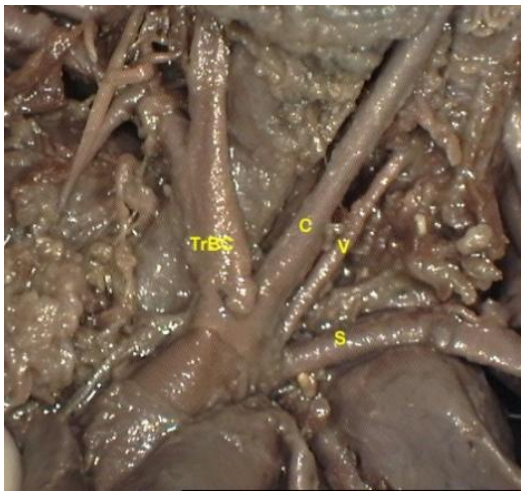
Fig. 126 - right subclavian artery with retroesofagian trajectory.

Fig. 127 - the origin of inferior thyroid artery into the aortic arch.

• also in 6 cases there was a lower thyroid artery originating from the aortic arch;

-in 5 cases there is a left vertebral artery originating from the aortic arch;

- In 3 cases we encountered no brachiocephalic trunk, the four branches being created directly from the aortic arch, right subclavian artery having normal trajectory;



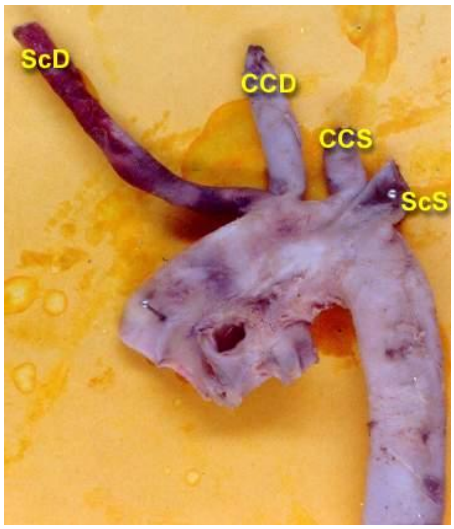


Fig. 128 - left vertebral artery originating from the aortic arch. Fig. 129 - Absence of brachiocephalic arterial trunk.

• In two cases there is a left ascending cervical artery originating from the aortic arch;

Fig. 130 - Ascending cervical artery originating from the aortic arch.

CONCLUSIONS

The aortic arch and its collateral branches, because of the importance that it shows, had been studied since ancient times and the surgical needs require an update and a deeper study on the morphology of these arteries. Must be notified and reports any variations in the number, origin, path or distribution of these arteries, which are quite numerous variants because of the complexity embryological development.

The study of arterial segment has a particular interest in terms of morphology, part of the great vessels of the body, physiological interest, in view of his functions, pathophysiological and clinical interest due to the frequency of diseases (congenital or acquired) at this level, radiological interest, through frequent CT scans and angiography simple medical practice and surgical interest by developing impressive cardiovascular surgery, the heart and aortic grafts, the coronary bypass sites, the ligatures and grafts of the carotid etc. This demonstrates, as shown the historically large number of works and studies dedicated to the aortic arch and its side branches, works whose number increases from year to year. It can naot be performed any medical intervention within the sector, with accurate and detailed prior to the knowledge of this vascular sector of morphology.

The level of the origin of aortic arch branches is highly variable in the statistics presented in the literature. Thus Grande findings , brachiocephalic trunk is the most commonly to originate from the ascending segment of the aorta, its percentage presented is with 49.89% higher than that the one that I found. Even with the cases that I found ,the origin of brachiocephalic trunk is at the limit of the ascending aorta -aortic arch, there is a difference of 21.32%. I found a higher percentage that the left subclavian artery originates from the downward arc segment ,20.29% higher than brachiocephalic trunk variants that originated in the ascending aorta.

As Grande, we found that there is a direct relationship between the diameter of the aortic arch and origin of its collateral branches. Relative caliber of arterial branches of the aortic arch depends on the position of their origin from the aortic arch: in the arches whose branches had their origins in the horizontal segment, the first branch was the largest, being more bulky than where they originated in the upward segment. But, contrary to Grande I did not find any case in which the third branch of the aortic arch is the most voluminous. We also found that the left common carotid artery caliber is reduced when originates from the brachiocephalic trunk, compared to the cases werw the origin is the aortic arch. In case of the left subclavian artery, its size is often more voluminous than the cases that originated in descending segment of the aortic arch. I didn't find considerable differences in the right subclavian artery, whith the two origins which may appear, the brachiocephalic trunk or directly from the aortic arch.

After Kamina, the aortic arch shape depends on the morphology of the individual type, at the sagittal subject type, the aortic arch is narrow and located close to the sagittal plane and at the frontal subject is wider and located in a more front level.

The Morphometry (length and caliber of vessels studied) and frequency of variations posed by aortic arch branches, allow me to conclude that they generally differ from traditional data sometimes long enough (in most cases are higher), which makes me assume that the classical anatomical studies undertaken more than 100 years ago, there were some changes, not very important, but very useful to be known. Elif and Young states that any change in the morphology of the aortic arch and its branches is

reported to be known to prevent some inconvenience to the numerous interventions that runs across this vascular sector . From here results the importance of an accurate preoperatively diagnosis for selecting an appropriate surgical strategy in patients with abnormalities of the aortic arch vessels. Magnetic resonance angiography and three-dimensional computer tomography may be useful diagnostic tools in these patients. As frequently are asymptomatic, their discovery may be surprises during morphological exploration made for a problem often unrelated to the aortic arch after Guillem's statement.

I believe that in any work with anatomical containing the International Anatomical Nomenclature must be respected, even if it should be reviewed not just for aortic arch chapter. Even recent treaties of anatomy is still uses French nomenclature, considering that the ascending aorta is a segment of the aortic arch.I also consider that it's not conformaly to reality using the name of a horizontal segment for the first segment of the arch, that it is less commonly horizontal and more frequently oblique.

Statistical differences between the results found by myself and existing data in the literature is due primarily to the total number of cases on which the work was done and also the work methods used. I think I worked on a significant number of cases (228 cases), which is a rich case law compared with many other authors, who sometimes conclusions drawn from a study of a number of under 50 cases . We also used various methods of working, morphometry was performed only angioCT exams, electronic measurements (length, caliber) as precise as possible. Variants of the branches of the aortic arch described are varied and wide, as exemplified by suggestive pictures of study results by all methods used: cadaver dissection and drawn parts, plastic injections followed by corrosion, simple and angioCT angiography.

Different percentages of existing literature are certainly due to the existence of characteristics related to the geographical area and the human race. The literature consulted by me uses both the white race results and the yellow and black races, both Europeans and Asians, Africans and Americans. I can also add that vascular-nervous variability, would depend in the same area because of some environmental factors that act during organogenesis. This would explain the morphological differences seen in the population of the same geographical area in different time periods. Also, large statistical differences between different authors are due different criteria use to assess the collateral branches of the aortic arch detachment and methods of measurement of various parameters followed.

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