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ASSESSMENT OF CHANGES IN THE DIAMETERS OF COMMON CAROTID ARTERIES AND THICKNESS OF THE INTIMA-MEDIA COMPLEX IN THE EVENS OF THE ARCTIC ZONE OF THE REPUBLIC SAKHA (YAKUTIA) IN THE AGE AND GENDER ASPECTS DURING ULTRASONIC MEASUREMENTS

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An ultrasound study was conducted to study the anatomical and morphological structure of the common carotid artery and intima-media thickness of the common carotid artery among evens of the Arctic zone of the Republic of Sakha (Yakutia) of different ages and genders. 210 patients were examined, aged from 21 to 74 years, average age is 47 years. The thickness of the IMC was measured along the back side of vessel relatively to the sensor by 1 - 1.5 cm proximal to the CCA bifurcation. Measurements of the CIMT thickness were taken three times, then the arithmetic mean value was calculated. In the presence of thickening, the IMC was measured in the zone of maximum visual thickening. It has been established that the diameter of the left CCA is larger than the diameter of the right CCA; the increase in the thickness of the IMC CCA oc-curs more with age in the left CCA in both genders, average age at which thickening of the inti-ma-media complex to 1.0 mm and more occurs, in general, for all groups was 58.73 years, which is 5,2 years later than for residents of central Russia.

Keywords: common carotid artery, thickness of intima-media complex, brachycephalic arteries, ultrasound scanner, Arctic zone, Evens.

Introduction. The relevance of the study of the carotid arteries is linked to the fact that the thickness of the intima - media of the common carotid artery, according to numerous interna-tional and Russian studies, is an early preclinical marker for the development of coronary athero-sclerosis.

Ultrasound examination of the carotid artery allows non-invasive detection of minimal changes in the arterial wall in the form of a thickening of the intima-media complex [3]. Moreo-ver, even in young patients with a low risk of cardiovascular diseases on the FRS scale (<5%), an initial atherosclerotic change is detected by ultrasound of the carotid arteries, which may be an indirect indication of the presence of coronary atherosclerosis [17].

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The study of the extracranial part of the brachycephalic arteries with the measurement of the thickness of the intima-media complex (IMT) is the method of choice for non-invasive screening to detect subclinical manifestations of atherosclerosis [3]. This technique is easily re-peatable and well reproducible, provides information about the common carotid artery (CCA), the area of the CCA bifurcation, the internal (ICA) and the external carotid arteries (ECA). Measurement of the mean and peak intima-media thickness of the carotid arteries is an important part of the study. The thickness of the intima-media complex (IMC) of the carotid arteries varies according to age, gender and ethnicity. IMT is measured as the distance between two echogenic lines separated by echo-negative space in the artery wall [17].

In 1986, Pignoli together with colleagues reported for the first time connection between thickness of aortic wall and atherosclerosis. Since then numerous studies have proved the link between thickness of the intima – media complex of the carotid artery and development of cardi-ovascular diseases (CVD). According to the results of foreign studies, a proportional relationship has been established with the risk of myocardial infarction and the thickness of the intima – me-dia carotid artery (CIMT) in different groups of the population [13,14]. In particular, a 0.1 mm thickening increased the future risk of a heart attack by 13–18%, and myocardial infarction by 10–15% [13-15].

The average values of IMT averaged over the entire distance are less susceptible to releases, while the maximum value of IMT may reflect advanced stages of focal thickening in the di-rection of plaque formation.

Taking into account the fact, that cardiovascular diseases continue to be a serious public health problem throughout the world and are leading among the causes of death and primary dis-ability of the population, one of the main aims is to prevent the development of the disease. Therefore, the search for new markers of coronary atherosclerosis remains relevant, primarily using instrumental methods of research [11].

The severity and rate of development of atherosclerosis among people living in different climatic-geographical regions, as well as among people of different nationalities of the same re-gion [6], has an unequal frequency and prevalence. At the same time, the features of structure of the arterial vessels in the age and ethnic aspects remain poorly studied [11].

Studying and acknowledging the anatomical and morphological features during life peri-od of the structure of the carotid arteries, distinctive to Evens of the Arctic zone of Yakutia, us-ing ultrasound scanning, would reveal the morphological

structure of the carotid arteries in the age-specific aspect and predict the epidemiological situation regarding CVD. Scientific literature on this topic has not been found.

On the basis of written above, the purpose of the study was to study the diameter of the common carotid arteries and the thickness of the intima-media complex in the Evens of the Arc-tic zone of the Republic of Sakha (Yakutia), depending on age and sex using ultrasound scan-ning.

Methods and materials of study. The study was conducted in the areas of the Arctic zone of the Republic of Sakha (Yakutia) (Anabarsky, Abyisky, Verkhoyansk, Momsky and Eveno - Bytantaysky) in the period from 2015 to 2016. 210 people were examined, of whom 106 men (50.5%) and 104 women (49.5%) aged from 21 to 74 years (mean is 47 years). According to the WHO recommendations, the examined men and women were divided into three age groups (Ta-ble 1).

All examined are permanent residents of the republic, belonging to the Even nationality without mixed blood.

The study of brachiocephalic arteries at the extracranial level was conducted on a VIVID I ultrasound scanner (GE Medical Systems, Israel) with a linear format sensor in the frequency range from 5 to 10 MHz. During the study, the passability of the carotid arteries and the presence of intraluminal formations were

Survey Distribution depending on age and gender

Age groups	Men	Women
1 group	21 – 35 years old	21 – 35 years old
2 group	35 - 60 years old	36- 55 years old
3 group	61 – 74 years old	56 – 74 years old

evaluated. The assessment of status of CCA (qualitative and quantitative parameters) was carried out at B-mode. The structural characteristic included the analysis of echogenicity and the degree of differentiation into layers of the intima-media complex.

The ultrasound image of the arterial wall structures is based on the difference in the acoustic density of the arterial wall tissues and the reflection of the ultrasound beam from the interface of the tissues of different ultrasonic density. The upper edge of the first echo-positive line histologically corresponds to the interface of the vessel lumen - intima, the upper edge of the second echo-positive line corresponds to the border between media and adventitia, the thickness of the far-side intima-media complex can be measured as the distance between the upper borders of the first and second layers of the image. The echogenicity of the tissues surrounding the vessel was taken as the conditional standard in assessing intimal echogenicity, media - vessel lumen echogenicity. The thickness of the intima media was measured along the back wall relative to the sensor to the vessel wall by 1–1.5 cm proximal to the CCA bifurcation [9]. To reduce the opera-tor-dependent measurement error, the scanning plane was oriented strictly perpendicular to the longitudinal axis of the vessel. In the presence of thickening, the IMC was measured in the zone of maximum visual thickening. To assess the compliance of the vessel diameter with a specific phase of the cardiac cycle, ECG monitoring was performed.

Statistical processing of the results was carried out by standard methods. Quantitative data are presented in the form of M + g or mean (depending on the nature of the distribution), as well as the minimum and maximum values of the indicators. Differences were considered signif-icant at p <0.05.

Results and discussion. Analysis of the results of ultrasound examination of morphological structure of common carotid arteries (CCA) among the Evens in the age and gender aspect re-vealed that the average CCA diameter among men was 0.61-0.63 cm (0.06 + 0.09), among wom-en - 0, 51-0.62 cm (0.03 + 0.1). At the same time, in all age groups, diameter of the common ca-rotid arteries on the left was larger than on the right (Fig.1): among men by 0.01 cm, and among women - by 0.02 cm.

A comparative analysis of diameter of left common carotid artery among men in the age aspect showed that this indicator was greater in the 1 age group (21-35 years). The dynamics of changes in diameter of left CCA among men showed that this parameter slightly decreased by the second mature period, and then towards to old age there was a tendency to a slight increase. In the 2 group, this indicator was 0.62 cm, which is significantly less than the 1 group by 0.02 cm, and with the 3 age group by 0.01 cm. At the same time, the indicators of the 3 group re-mained significantly less than those of the 1 group by 0.01 cm (Fig. 1, a). A similar dynamics of changes in the diameter of the common carotid artery was observed among elderly men and to the right. Thus, the diameter of right common carotid artery in the 2 group was 0.61 cm, this pa-rameter was significantly less in comparison to the 1 group by 0.02 cm, and 0.01 cm less than in the 3 age group (Fig. 1, b).

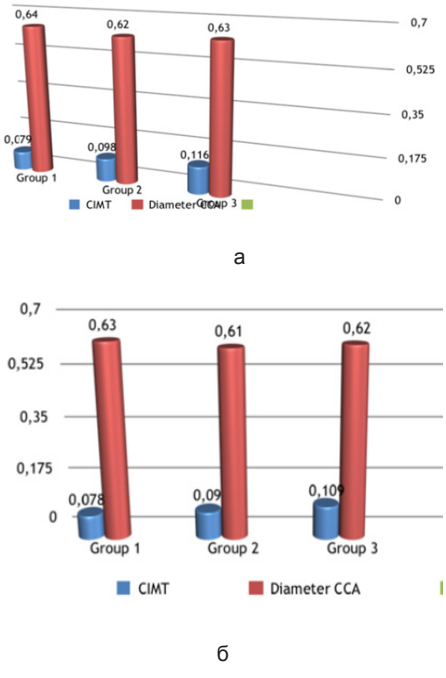

Fig. 1. Diameter of left (a) and right (b) CCA and thickness of left (a) and right (b) CIMT in groups of men

Female analysis of dynamics of parameters of the common carotid arteries in the age aspect showed a gradual increase in their diameters both on the left and on the right. In the 2nd age group, the CCA diameter on left was significantly more (by 0.04%) compared to the 1st age group. By 56-74 years (group 3), diameter of left common carotid artery becomes 0.62 cm, which is more by 0.12% compared with group 1 (Fig. 2). A similar trend was observed in right common carotid artery. Thus, in 1st age group diameter was 0.51 cm, in the 2nd age group it was more by 0.04% than in group 1, and in group 3 it increased by 0.15% (Fig. 2,b).

A comparative analysis of obtained dimensions of thickness of the intima-media complex of common carotid arteries revealed that thickness of the intima-media complex of left common carotid artery is slightly larger than on right, both in male and female population. Among men there were a gradual increase in intima-media thickness which was observed both on left and on right, depending on age. Thus, increase in thickness of the intima-media complex of left common carotid artery in group 2

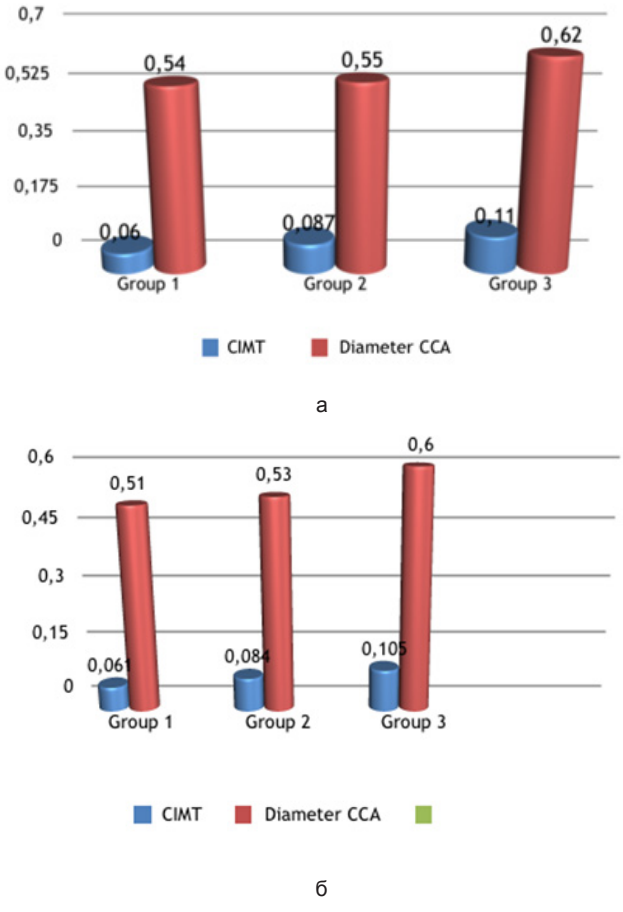

Fig. 2. Diameter of left (a) and right (b) CCA and left (a) and right (b) CIMT in groups of women

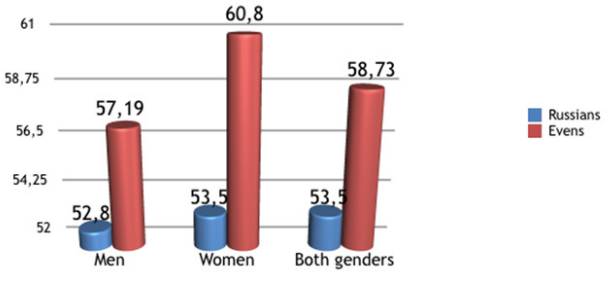

Fig. 3. A comparative diagram of the thickening of the intima - media complex up to 1 mm and more of Evens and Russians, according to V.G. Lelyuk, S.E. Lelyuk.

was 0.19%, and in group 3 it was 0.31% compared to group 1. In right common carotid artery increase in thickness of the intima-intimal-media complex was revealed: by the 2nd group it was 0.13%, and in age group 3 it was 0.28% compared to group 1 (Fig. 1).

Nevertheless, among women increase in thickness of the intima-media complex was faster than among men. Thus, intima-media thickness in left common carotid artery significantly increased by 0.31% (0.027 cm) by the 2nd age group, by 0.45% (0.05 cm) in the 3rd group (compared to 1 group). A similar thickening of the intima-media thickness was observed with age in right common carotid artery. In group 2, increase in IMT compared with group 1 was for 0.22% (0.019 cm), in group 3 for 0.41% (0.044 cm) (Fig. 2).

It should be noted that the average age at which there was a thickening of the intima-media complex up to 1.0 mm and more, for all studied groups was 58.7 years. At the same time, for men the average age of the IMC thickening up to 1.0 mm and more was 57.2 years, for women - 60.8 years. When comparing with the data of V.G. Lelyuk, S.E. Lelyuk (2003) [9] IMC thickening up to 1.0 mm or more among men of even nationality comes later by 4.4 years and among women by 7.3 years compared with residents of Central Russia (Fig. 3).

Summary

1. Diameter of left common carotid arteries in all age groups of recipients of the Even na-tionality of the Arctic zone is larger than diameter of the common carotid arteries on the right, among men it is more for 0.01 cm and among women it is for 0.02-0.03 cm.

2. For men the smallest diameter of the common carotid arteries is observed in the 2nd age period, the largest is in the 1st age group. While among women, diameter of the common carotid arteries gradually increases with age. These changes may be caused by the presence of age-related involutional changes in persons over 60 years of age and the gender characteristics of the organism.

3. There is an uneven gradual increase in thickness of the intima-media complex for both men and women of Evens in the Arctic zone of the Republic of Sakha (Yakutia). Here-with, the IMT of the left common carotid arteries "grows" faster than on right in both groups. At the same time, women revealed a greater thickening of the intima-media com-plex in the older age group, compared to men.

4. For men the average age of IMC thickening up to 1.0 mm and more was 57.2 years, for women - 60.8 years. When comparing to Russian indicators, the thickening of IMC to 1.0 mm or more among men of Even nationality comes later for 4.4 years, but for women later for 7.3 years compared to residents of central Russia.

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