KLINIK TIBBIYOT

EKSPERIMENTAL BIOLOGIYA VA TIBBIYOT

THE RELATIONSHIP BETWEEN CORONARY CALCIUM AND THE LEVEL OF CORONARY ARTERY STENOSIS ACCORDING TO CORONARY ANGIOGRAPHY

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Abstract. *Coronary heart disease is the leading cause of death worldwide, particularly in Uzbekistan. Early diagnosis of coronary heart disease is one of the primary tasks of clinical medicine. The coronary calcium index is considered one of the strongest tools for predicting the risk of coronary heart disease. Due to the ease of implementation, cost-effectiveness and practically no contraindications, the determination of the calcium index has become widespread, especially during screening in patients with suspected coronary heart disease. The CC index correlates with the level of CA stenosis according to CAG data. This method is included in the American and European recommendations for the diagnosis of coronary heart disease, it has proven its high prognostic value, especially with CI = 0, and can serve as a starting point in changes in recommendations for prescribing statins to asymptomatic patients.*

Key words: *Agatston index, MSCT, coronary calcium, cardiovascular diseases, coronary angiography, coronary arteries.*

KORONAR KALSIY VA KORONAR ANGIOGRAFIYA BO'YICHA KORONAR ARTERIYALAR STENOZI DARAJASI O'RTASIDAGI BOG'LIQLIK

Annotatsiya. *Yurak ishemik kasalligi butun dunyoda, shu jumladan, O'zbekistonda o'limning etakchi sababidir. YuIK ning erta diagnostikasi klinik tibbiyotning asosiy vazifalaridan biridir. Koronar kalsiy ko'rsatkichi koronar yurak kasalligi xavfini prognozlashning kuchli vositalaridan biri hisoblanadi. Tufayli amalga oshirish, iqtisodiy samaradorligi va kontraendıkasyonlar deyarli yo'qligi soddaligi uchun, kaltsiy indeksi aniqlash, ayniqsa, koronar arteriya kasalligi shubha bilan bemorlarning skrining, keng tarqalgan edi. KK ko'rsatkichi ka ga ko'ra ka stenozining darajasi bilan bog'liq. Ushbu usul AQSh va Evropa koronar arter kasalligi diagnostikasi bo'yicha tavsiyalarga kiritilgan bo'lib, u yuqori prognostik qiymatini, ayniqsa KI=0da isbotladi va asemptomatik bemorlarga statinlarni tayinlash bo'yicha tavsiyalarni o'zgartirish uchun boshlang'ich nuqta sifatida xizmat qilishi mumkin.*

Kalit so'zlar: *Agatston indeksi, MSCT, koronar kaltsiy, yurak-qon tomir kasalliklari, koronar angiografiya, koronar arteriyalar.*

ВЗАИМОСВЯЗЬ МЕЖДУ КОРОНАРНЫМ КАЛЬЦИЕМ И УРОВНЕМ СТЕНОЗА КОРОНАРНЫХ АРТЕРИЙ ПО ДАННЫМ КОРОНАРОАНГИОГРАФИИ

__Аннотация.__ Ишемическая болезнь сердца (ИБС) является ведущей причиной смертности во всем мире, в том числе и в Узбекистане. Ранняя диагностика ИБС представляет одну из первостепенных задач клинической медицины. Показатель коронарного кальция (КК) считается одним из сильных инструментов прогнозирования риска развития коронарной болезни сердца. В связи с простотой выполнения, экономичностью и практически отсутствием противопоказаний, определение кальциевого индекса получило широкое распространение, особенно, при скрининге у пациентов с подозрением на наличие ИБС. Показатель КК коррелирует с уровнем стеноза КА по данным КАГ. Данный метод включен в американские и европейские рекомендации по диагностике ИБС, он доказал свою высокую прогностическую ценность, особенно при КИ=0, и может служить отправной точкой в изменениях рекомендаций по назначению статинов бессимптомным пациентам.

__Ключевые слова:__ индекс Агатстона, МСКТ, коронарный кальций, сердечно-сосудистые заболевания, коронарография, коронарные артерии.

Relevance. Cardiovascular diseases (CVD) is the leading cause of mortality in the world and causes over 17.5 million deaths per year. Among CVD in the structure of mortality of the population, the first place is occupied by coronary heart disease (CHD). In Uzbekistan, CHD is also the main cause of death among the adult population. The analysis shows that 53% of deaths among the population of the Republic of Uzbekistan aged 30-70 years are associated with CVD. They are diagnosed in about 4 million people, which is 12% of the total population.

CHD is an acute or chronic dysfunction resulting from an absolute or relative decrease in the supply of arterial blood to the myocardium. The share of CHD among all causes of mortality of the population is more than 30%. The main etiological factor of CHD is atherosclerosis of the coronary arteries (CA), in 95% of patients with CHD.

Calcification of the CA is a characteristic sign of coronary atherosclerosis, which is often detected by computed tomography (CT) of the chest organs. The standardized method for assessing coronary calcification is the calcium index (CI) according to the Agatston method. A semi-quantitative assessment of coronary calcium (CC) with electrocardiographic synchronization is considered a strong prognostic factor for the occurrence of coronary events in asymptomatic patients. Zero CI can serve as the strongest negative risk factor for the development of cardiovascular events for 10-15 years. According to international recommendations, CI should be used in intermediate-risk and low-risk patients with a cardiovascular family history, as well as in diabetics over 40 years of age.

The aim of the study: to compare the Agaston index (CC) and the level of CA stenosis according to coronary angiography (CAG); to increase the early detection of coronary artery disease by determining the indicators of CC.

Material and methods of research. The study was conducted in the Tashkent Medical Academy and Republican Specialized Scientific and Practical Center of Cardiology. The study involved 54 people (25 women, 29 men) aged 45-65 years, with complaints of pain and discomfort behind the sternum. All patients underwent multispiral computed tomography (MSCT) with the determination of CC, CAG. The CC assessment was carried out using the Philips Ingenuity Core 64 MSCT.

The results of the study. The Agaston index is a semi-automatic method for calculating the degree of calcification of CA using low-dose non-amplified CT, which is routinely used in CT examination of the heart. Due to the extended study, this method allows us to identify the early risk of CHD in patients with an Agaston index of more than >160. Although this method does not allow to evaluate soft-tissue non-calcified plaques, it still correlates well with the data obtained by CT angiography using contrast agents [3].

Calculation method. The calculation is performed by multiplying the weighted density (density factor) for a zone with high radiation attenuation (plaques with high values in Hounsfield units [HU]) by the area of the calcified plaque.

Density factor:
• 130-199 HU: 1
• 200-299 HU: 2
• 300-399 HU: 3
• 400+ HU: 4

For example, if a calcified plaque has a maximum attenuation of 400 HU and occupies an area of 8 mm^2, its CC will be equal to 32. The index of each zone/plaque is summed up giving a total index [2].

Gradation of coronary vascular lesions based on the total coronary calcium index:
• there are no signs of damage: the coronary calcium index is 0
• minimum maintenance: coronary calcium index from 1 to 10
• minor lesion: coronary calcium index from 11 to 100
• moderate lesion: coronary calcium index from 101 to 400
• severe lesion: coronary calcium index >400

Quantitative assessment of the Agatston index
• Agatston index 0
o Ca - Calcium score is not determined

o The risk of developing CHD is minimal
o Applicable to men and women over 40 years of age
o Recommendations - General preventive measures
• Agatston index 1-10
o Ca score - Minimum calcification
o Risk of coronary heart disease - The development of coronary heart disease is unlikely
o Indications for treatment based on gender and age - Applicable to men and women over 40 years of age.
o Recommendations - General preventive measures
• Agatston index 11-100
o Ca score - Minor calcification
o Risk of coronary heart disease - Minimal stenosis is possible
o Indications for treatment taking into account gender and age - The highest clinical value if the indicator is >75 percentiles
o Recommendations - Exclusion of risk factors
• Agatston index 101-400
o Ca score - Moderate calcification
o Risk of coronary heart disease - Hemodynamically insignificant stenoses are likely
o Indications for treatment taking into account gender and age - The highest clinical value if the indicator is >75 percentiles
o Recommendations - Exclusion of risk factors. Cardiological follow-up examination
• Agatston index > 400
o Assessment of Ca - Pronounced calcification
o Risk of coronary heart disease - High probability of hemodynamically significant stenoses
o Indications for treatment taking into account gender and age - The highest clinical value if the indicator is >75 percentiles

o Recommendations - Exclusion of risk factors. Stress ECG, Stress Echo. Coronarography if necessary.

o Comparison of the coronary calcium index and the level of stenosis according to CAG:

• coronary calcium index 27-88 corresponds to >20% of stenosis according to CAG

• coronary calcium index 89-127 corresponds to >30% of stenosis according to CAG

• coronary calcium index corresponds to >40% of stenosis according to CAG

• coronary calcium index corresponds to >50% of stenosis according to CAG

• coronary calcium index >371 corresponds to >70% of stenosis according to CAG [6]

Grading of the lesion of the spacecraft according to the Agaston index: 0 – no signs of lesion (group 1); 1-10 – minimal lesions (group 2); 11-100 – minor lesions (group 3); 101-400 – moderate lesion (group 4); more than 400 – severe lesion (group 5). Of the studied patients, 3 (5.6%) were included in group 2, CAG was not performed; 21 (38.9%) were included in group 3, CAH revealed hemodynamically insignificant CA stenosis; 27 (50%) were included in group 4, with CAG in 19 patients - 50-60% CA stenosis and 8 – more 70% CA stenosis; 3 (5.6%) patients were included in group 5, with CA more than 70% CA stenosis. 11 patients underwent angioplasty with stent placement.

Conclusion: CI is considered one of the strongest tools for predicting the risk of CHD. Due to the ease of implementation, cost-effectiveness and practically no contraindications, the definition of CI has become widespread, especially during screening in patients with suspected CHD [5]. For several decades, a large amount of evidence-based information has accumulated not only about the diagnostic, but also the prognostic value of CI. This method currently confidently occupies its niche among the methods for the early preclin-

ical diagnosis of CHD. It should be noted that the method is included in the American and European recommendations for the diagnosis of CHD, it has proven its high prognostic value, especially with CI = 0, and can serve as a starting point in changes in recommendations for prescribing statins to asymptomatic patients [4]. The calculation of CI by CT is not inferior in accuracy to the standard Agatston method with ECG synchronization both in absolute values and when assigning patients to a particular risk group according to CI 0.1-100, 101-400, 401-1000 and >1000. The combination of CT (including low-dose) with the calculation of CI can significantly enhance the significance and effectiveness of screening programs, not only from a diagnostic point of view, but also from an economic point of view. Simultaneous early detection of such socially significant diseases as lung cancer and CHD is a promising stage in the further development of modern radiology [1,2].

The CC score is an independent marker of risk for cardiac events, cardiac mortality, and all-cause mortality [8]. In addition, it provides additional prognostic information to other cardiovascular risk markers. The well-established indications for the use of the CC score include stratification of global cardiovascular risk for asymptomatic patients: intermediate risk based on the Framingham risk score (class I); low risk based on a family history of early CHD (class IIa); and low-risk patients with diabetes (class IIa) [9,10]. In symptomatic patients, the pre-test probability should always be given weight in the interpretation of the CC score as a filter or tool to indicate the best method to facilitate the diagnosis. Therefore, the use of the CC score alone is limited in symptomatic patients. In patients with diabetes, the CC score helps identify the individuals most at risk, who could benefit from screening for silent ischemia and from more aggressive clinical treatment.

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