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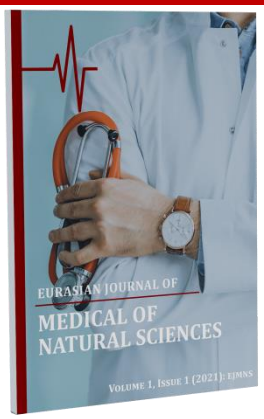

CLINICAL EXPERIENCE AND FEATURES OF THE BRAIN PERFUSION MSCT TECHNIQUE FOR SURGICAL CORRECTION OF COMBINED LESIONS OF THE CORONARY AND CAROTID ARTERIES

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ABSTRACT

Perfusion multislice computed tomography (PMDCT) of the brain is used in surgery of combined lesions of coronary and carotid arteries for diagnosis and evaluation of cerebral circulation. This method allows to reveal the severity of steno-occlusive lesions of brachiocephalic arteries and provides important information for the development of surgical tactics. In our experience of using PMDCT, we noted its significance in early diagnosis and monitoring of patients with acute and chronic cerebral circulatory disorders, as well as in planning surgical intervention.

Introduction. Data from the World Health Organization indicate that cardiovascular disease is the leading cause of death worldwide. In 2016, 17.9 million people died from CVDs, accounting for 31% of all deaths worldwide. Coronary heart disease (CHD) continues to be the leading cause of death, leading to more than 9.0 million deaths in 2019 alone.

The combination of atherosclerosis in the coronary, carotid, and peripheral arteries is not uncommon. One of the most challenging assignments cardiovascular surgeons face is determining the extent and staging of surgery in patients with combined coronary and cerebral artery lesions. For example, surgeons performing aortocoronary bypass in patients with severe carotid artery lesions have significant difficulty maintaining adequate cerebral perfusion.

However, many tactical and technical issues remain unresolved, including the choice of operative access and its volume. Patients undergoing aortocoronary bypass surgery have a high risk of perioperative stroke due to low mean arterial blood pressure values and systemic vasodilatory response.

According to research data, in 28% of patients who underwent coronary artery bypass grafting, additional coronary artery bypass surgery is indicated. Hemodynamically significant stenotic lesion of the carotid artery with a degree of stenosis of more than 80% was detected in 12% of patients with indications for coronary revascularization.

At the moment, there are no clear recommendations regarding the treatment strategy for patients with combined atherosclerosis of the coronary and brachiocephalic arteries. In

accordance with the recommendations of the European Society of Cardiology and the European Society of Vascular Surgeons on the diagnosis and treatment of peripheral Artery diseases in 2017, carotid artery revascularization in patients requiring coronary artery bypass grafting should be considered individually with the participation of a multi-professional team of specialists, including a neurologist.

There is still no consensus between national and international recommendations on reducing the risk of postoperative neurological complications.

The aim of the study was to evaluate the tactical and technical aspects of surgical treatment of patients with coronary heart disease with combined atherosclerotic vascular lesions of the brain.

Research materials and methods. We examined 15 patients in the period 2022-2024 in the Department of Surgery of the State Medical Institution "RSNPMC named after Academician V. Vakhidova" coronary heart disease and its complications. The research methods are different. ECG examinations, EchoCG: MSCT signs of a moderate decrease in perfusion indices, more on the right. Dyscirculatory encephalopathy. The site of cystic degeneration is periventrically on the right (consequences of lacunar infarction).

Results of the study: When using perfusion multilayer computed tomography of the brain in surgery of combined lesions of the coronary and carotid arteries, our experience is based on the following clinical experience.

A clinical case

Example 1: Symptomatic patient, CT perfusion with signs of circulatory disorders. Operation: simultaneous CEE + CABG in IR + hyperperfusion.

Patient K., 66 years old, was admitted on 06.01.20 to the Department of Surgery for coronary heart disease and its complications of the State Medical Institution "RSNPMC named after Academician V. Vakhidova" with complaints of pain in the heart, shortness of breath, a feeling of lack of air that occurs with minor physical exertion, decreased quality of life, general weakness, tinnitus. From the anamnesis: GB has been suffering for many years, with a maximum rise in blood pressure to 240/120 mmHg. In 08/20/2019, he suffered AMI anterior-septum, apical localization with coverage of the lateral wall of the LV. He denies having a medical history.

On examination: the general condition of the patient is of moderate severity, consciousness is clear. The skin and visible mucous membranes are of normal color. In the lungs, vesicular breathing is carried out on both sides, there is no wheezing. The frequency of respiratory movements is 18 per minute. A slight systolic noise is detected in the projection of the main vessels. From the side of the heart, the tones are muted, the rhythm is correct. A faint systolic murmur is heard in the apex area and in the projection of the aortic valve. Heart rate is 70 beats. per minute, rhythmic. Blood pressure is 160/100 mmHg on both hands. The abdomen is symmetrical, participates in the act of breathing, is soft and painless on palpation. Liver along the edge of the costal arch.

The patient has been examined. On the ECG, the rhythm is sinus, the heart rate is 63 beats/min. The normal position of the EOS. Cicatricial changes in the LVL, the septum area, and the tip of the LV. NCC in the area of the septum, apex, and lateral wall of the LV.

According to EchoCG data: KDO 98 ml. CSR 41 ml, UO 57 ml, PV 58%. Hypokinesia of the apical septum wall of the LV. The aortic valve (AoC) is not a significant fibrosis, the systolic pressure gradient is 10mm.Hg.

According to duplex scanning of CA: on the right, local heterogeneous ASB is visualized in the bifurcation region (stenosis 50%), with a transition to ICA (stenosis 70%) and NSA (stenosis 56%). On the left, in the bifurcation area, stenosis is 35% with a transition to ICA (stenosis 58%) and NSA (stenosis 58%), and local heterogeneous ACB with stenosis 46% is also visualized in the lumen of the OCA.

According to the coronarography data: PKA – in p /3 stenosis 95%. ZMZHV – in n/3 stenosis is 95%, the distal bed is passable. LKA is a trunk of features. The PHC is occluded from the mouth, the distal channel is contrasted by intra- and intersystem collaterals. The ovum is diffusely thinned – in n/3 80% stenosis, the distal bed is passable. VTK is passable without hemodynamically significant stenoses. The right type of myocardial blood supply.

Figure 1. Coronarography: a) the PKA system, b) the LKA system.

According to MSCT angiography of extra-, intracranial arteries – subclavian artery – 50% stenosis on the right at the mouth, 25% stenosis on the left at the mouth. OCA – on the right in c/3 stenosis is up to 30%, in the bifurcation area stenosis is 26%. Stenosis is 40% on the left at the mouth, followed by areas of stenosis up to 30%. ICA – on the right: stenosis up to 85% in the mouth area, stenosis 99% at a distance of 10 mm from the mouth. On the left: in the area of the mouth – stenosis up to 48%. NSA – 52% stenosis at the mouth from the right to the left: the vertebral artery is occluded at the mouth, then 3.5 mm – Throughout the lumen is unevenly narrowed to 0.4-0.7 mm. The circle of Willis is not closed.

MSCT perfusion of the brain – during dynamic perfusion computed tomography, there are discrepancies in perfusion parameters on the right (Fig. 2). MSCT shows signs of a moderate decrease in perfusion parameters, more on the right. Dyscirculatory encephalopathy. The site of cystic degeneration is periventrically on the right (consequences of lacunar infarction).

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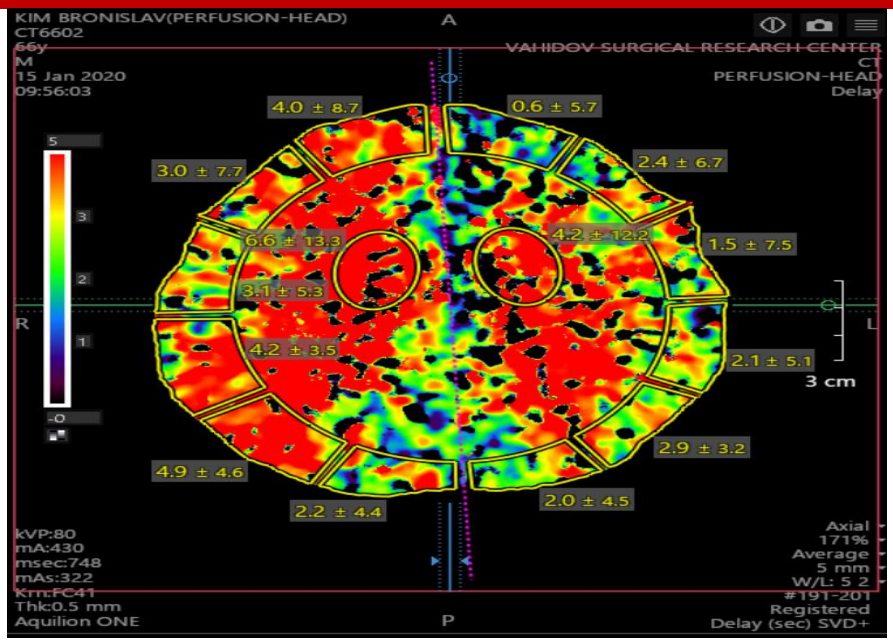

Fig. 3 MSCT brain perfusion before surgery.

Based on the examination and instrumental examination methods, a diagnosis was made.

The main one: Multifocal atherosclerosis, coronary heart disease. Angina pectoris of FC III art. PEAKS (from 08/20/19). Stenosis of the carotid arteries on both sides. Complication: NC IIA. FC III by NYHA. Chronic insufficiency of cerebral circulation.

Concomitant: hypertension 3 st. Arterial hypertension III st. Risk IV.

Taking into account the multivessel lesion of the coronary bed, as well as the hemodynamically significant lesion of the carotid bed with a decrease in perfusion parameters of the brain, with signs of chronic cerebral insufficiency, it was decided to perform a simultaneous operation – carotid endarterectomy on the right + CABG in IC and CP conditions using hyperperfusion.

On January 21, 2020, a simultaneous operation was performed: Classical carotid endarterectomy of OCA and ICA on the right + MCSH-PMJV, CABG–ZMJV and VTK in conditions of IC and CP.

Features of the operation: the first stage in conditions of controlled hypertension and drug protection of the brain was performed by CEE from the OCA with a transition to the mouth of the ICA on the right (Fig. 4). The time of clamping the OCA was 9 minutes.

Fig. 4. Intraoperative photo: a - CEE from OCA and ICA b – macropreparation

The second stage was performed 3 coronary bypass surgery in IC conditions using hyperperfusion (average blood pressure 93.1±6.8 mmHg, moderate hypothermia (32 ° C) and pharmacoholodic protection of the myocardium.

The postoperative period was stable. From the moment of admission to the ICU, the patient was extubated after 5 hours, without neurological complications. The next day, the patient was transferred to the department of coronary heart disease surgery for further observation by the attending physician.

On the control ECG: sinus rhythm, heart rate 68 beats/min. The normal position of the EOS. Cicatricial changes in the LVL, in the area of the septum, the apex.

On the control echocardiogram: BWW – 102 ml. FW – 57%. LV contractile function in dynamics without deterioration. The aortic valve (AK) is not a significant fibrosis, the systolic pressure gradient is 10mm.Hg.

On the control MSCT of cerebral perfusion, there are signs of relatively symmetrical perfusion indices in the PMA and SMA basins on both sides (Fig. 5). Dyscirculatory encephalopathy. The site of cystic degeneration is periventrically on the right (consequences of lacunar infarction).

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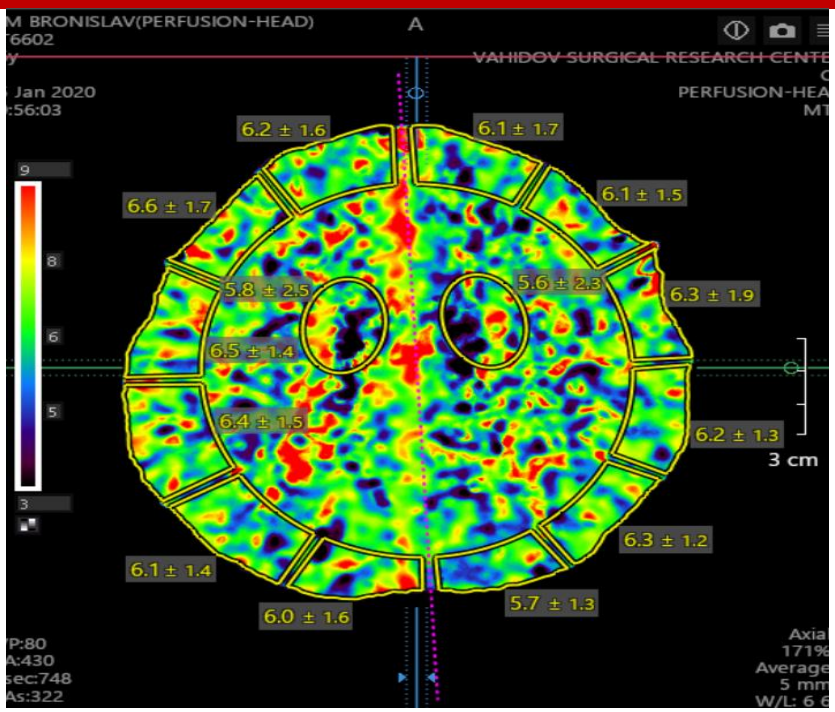

Fig. 5. MSCT perfusion of the brain after surgery.

The wound was healed by primary tension. The patient was discharged home in a satisfactory condition on the 10th day after the operation.

This report presents a case of successful simultaneous surgical treatment of a patient with combined atherosclerotic lesions of the brachycephalic and coronary arteries.

Conclusions: Thus, the experience presented by us of performing simultaneous correction of carotid and coronary artery stenosis testifies to the high efficiency and safety of performing a simultaneous operation. The use of modern diagnostic methods for determining tissue circulatory insufficiency of the brain using MSCT perfusion before surgery allows you to more accurately determine the degree of cerebral circulatory disorders, thereby allowing you to more objectively determine the indications for simultaneous surgery in each specific case. The improvement of tissue perfusion of the brain in the postoperative period indicates the effectiveness of the operation. The use of the hyperperfusion method during IC also avoids neurological complications in the postoperative period.

The use of modern diagnostic methods for determining the tissue circulation of the brain using MSCT perfusion before surgery makes it possible to more accurately determine the degree of cerebrovascular accident, thereby allowing a more objective determination of indications for a phased operation in each specific case. The absence of a decrease in tissue perfusion of the brain after surgery indicates the high efficiency and safety of using hyperperfusion during IC as a method to avoid neurological complications in the postoperative period of isolated coronary bypass surgery.

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