

## CLINICAL CASE REPORTS

# CHANGES IN THE LEVEL OF CARDIOMARKERS IN THE DEVELOPMENT OF ACUTE MYOCARDIAL INFARCTION ON THE BACKGROUND OF CHEMOTHERAPY OF A PATIENT WITH TONGUE CANCER

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## ABSTRACT

Cancer is one of the leading causes of death and disability worldwide. Timely diagnosis and the introduction of new effective treatments, including intensive radiation and chemotherapy regimens, have significantly improved survival forecasts in recent years. At the same time, the use of these types of treatment increases the risk of complications, one of which includes chemotoxic cardiopathies. In this regard, timely detection and treatment of complications from the cardiovascular system in patients receiving chemotherapy courses in combination with surgical methods of treatment is important. This paper presents an assessment of the significance of the use of cardiomarkers in the early diagnosis of acute myocardial infarction that developed during chemotherapy in a patient with tongue cancer with a complicated cardiac history. Patient M., 45 years old, was admitted for surgical treatment for cancer of the tongue St. IVA, T4aN1M0, cl. gr. 2. Planned laboratory and instrumental studies were performed. Contraindications for surgical treatment were not identified. A preoperative course of chemotherapy was performed, against the background of which the patient's condition worsened with symptoms of acute cardiopathy. A second ECG was urgently performed, as a result of which an increase in the ST segment in III, aVF was established, as well as a study of the concentration of cardiomarkers: highly sensitive troponin I, N-terminal propeptide of natriuretic hormone, creatine phosphokinase MB, myoglobin, the dynamics of changes in the level of which indicated the development of acute coronary syndrome. The complex application of diagnostic procedures, including the determination of the level of cardiomarkers, made it possible to timely diagnose the development of acute type 1 myocardial infarction in a patient with tongue cancer on the background of chemotherapy. When analyzing the entire array of clinical and laboratory data, the leading initiating factor that played a decisive role in the development of myocardial infarction in this case was, in our opinion, a preoperative course of polychemotherapy with paclitaxel and carboplatin, which have cardiotoxicity. Thus, the category of patients with an initial unfavorable background, due to a common malignant process and the presence of a history of cardiodysfunction, requires more careful preparation for preoperative courses of polychemotherapy, including cardiotropic therapy with mandatory monitoring of the level of the main cardiomarkers. The most significant changes were in the levels of creatine phosphokinase MB, troponin I, and myoglobin, which were recorded in the first hours of myocardial infarction. An association was found between an increase in troponin I concentration and an increase in the ST segment of the electrocardiogram.

## Keywords:

myocardial infarction, cardiomarkers, creatine phosphokinase MB, myoglobin, troponin I, natriuretic propeptide.

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## ИЗМЕНЕНИЕ УРОВНЯ КАРДИОМАРКЕРОВ ПРИ РАЗВИТИИ ОСТРОГО ИНФАРКТА МИОКАРДА НА ФОНЕ ХИМИОТЕРАПИИ БОЛЬНОГО РАКОМ ЯЗЫКА

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### РЕЗЮМЕ

Онкологические заболевания являются одной из основных причин смертности и инвалидизации во всем мире. Своевременная диагностика и внедрение новых эффективных методов лечения, включающих интенсивные схемы химиотерапии, значительно улучшили прогнозы выживаемости. Вместе с тем, применение химиотерапии увеличивает риск осложнений, к одним из которых относят химиотоксические кардиопатии. В этой связи актуально своевременное выявление и лечение осложнений со стороны сердечно-сосудистой системы у пациентов, получающих курсы химиотерапии в комплексе с хирургическими методами лечения. В данной работе представлена оценка информативности изменений уровня отдельных кардиомаркеров при развитии острого инфаркта миокарда на фоне химиотерапии больного раком языка с осложненным кардиологическим анамнезом. Пациент М., 45 лет поступил на оперативное лечение по поводу рака языка St. IVA, T4aN1M0, кл. гр.2. Выполнены плановые лабораторные и инструментальные исследования. Противопоказаний для проведения хирургического лечения не выявлено. Проведен предоперационный курс химиотерапии, на фоне которого у пациента отмечено ухудшение состояния с симптомами развития острой кардиопатии. В срочном порядке выполнены повторная ЭКГ, в результате которой установлен подъем сегмента ST в III, aVF, а также исследование концентрации кардиомаркеров: высокочувствительного тропонина I, N-концевого пропептида натрийуретического гормона, креатинфосфокиназы MB, миоглобина, динамика изменения уровня которых указывала на развитие острого коронарного синдрома. Комплексное применение диагностических процедур, в числе которых немаловажное значение имело определение уровня кардиомаркеров, позволило своевременно диагностировать развитие острого инфаркта миокарда 1 типа на фоне проведения предоперационного курса химиотерапии у больного раком языка. При анализе всего массива клинико-лабораторных данных ведущим инициирующим фактором, сыгравшим решающую роль в развитии инфаркта миокарда в данном случае, явился, на наш взгляд, предоперационный курс полихимиотерапии паклитакселом и карбоплатином, обладающими кардиотоксичностью. Таким образом, категория больных с исходным неблагоприятным фоном, обусловленным распространенным злокачественным процессом и наличием в анамнезе кардиодисфункции, требует более тщательной подготовки к проведению предоперационных курсов полихимиотерапии, включающей кардиотропную терапию с обязательным мониторингом уровня основных кардиомаркеров. Наиболее показательными были изменения уровня тропонина I, креатинфосфокиназы MB, и миоглобина, которые регистрировались в первые часы развития инфаркта миокарда.

### Ключевые слова:

инфаркт миокарда, кардиомаркеры, тропонин I, креатинфосфокиназа MB, миоглобин, натрийуретический пропептид.

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## RELEVANCE

Oncological diseases (OD) are one of the main causes of mortality and disability worldwide [1, 2]. However, in recent years, mortality statistics have begun to improve due to timely diagnosis and the introduction of new effective treatment methods that have significantly improved survival forecasts. This includes intensive radiation and chemotherapy regimens. However, the use of these types of treatment increases the risk of complications, one of which includes chemotoxic cardiopathies, including myocardial dysfunction, heart failure, hypertension, vasospastic and thromboembolic ischemia, arrhythmias of various types and sudden cardiac death [3, 4]. In this regard, timely detection and treatment of complications from the cardiovascular system (CCC) in patients receiving chemotherapy courses in combination with surgical methods of treatment is important. Currently, the diagnosis of CCC disorders includes a number of studies: instrumental-electrocardiographic (ECG), ultrasound (EchoCG), cardiometric (CM), X-ray, magnetic resonance imaging, positron emission tomography, cardiac catheterization and laboratory-hematological, biochemical, coagulological, immunochemical methods [5]. A special place for early detection of cardiovascular disorders in oncological hospitals and intensive care units is occupied by determining the level of cardiac biomarkers, such as highly sensitive troponin I, N-terminal propeptide of natriuretic hormone, creatine phosphokinase MB, myoglobin [6].

The aim of the study was to assess the informative value of changes in the level of individual car-

diomarkers in the development of acute myocardial infarction against the background of chemotherapy in a patient with tongue cancer with a complicated cardiological history.

## Clinical Case Report

Patient M., at the age of 45 years, was admitted to the Department of Head and neck tumors of the Ministry of Health of the Russian Federation at the Department of Head and Neck tumors on 17.02.2021 for surgical treatment for tongue cancer, St. IVA, T4aN1M0, cl. gr. 2. From the anamnesis: suffers from coronary heart disease: angina pectoris, II FC; hypertension II art. I did not receive treatment. Planned laboratory and instrumental studies were carried out. There are no contraindications for surgical treatment and chemotherapy.

On 18.02.2021, the patient was consulted by a chemotherapist: a preoperative course of poly-chemotherapy (PCT) was recommended according to the scheme: carboplatin AUC5 655 mg, paclitaxel 350 mg intravenously against the background of pre-and postmedication with dexamethasone-8 mg intravenously, which was performed from 18.02.2021 to 24.02.2021. The administration of the drugs was carried out satisfactorily, he did not complain.

On 24.02.2021, at 9:15, a planned ECG was performed in preparation for surgical treatment: sinus rhythm, normasystole with a heart rate of 61 beats/min, there are no rhythm disturbances, left ventricular myocardial hypertrophy with signs of systolic overload.

At 16:00, a deterioration of the condition was noted, the patient complained of pressing pain behind

Table 1. Results of cardiomarkers level measurement in patient M. in dynamics

Studied indicators/units of measurement	Research stages		Referent values
	I	II	
Troponin I, ng/ml	0.0	0.01	<0.03
N-terminal propeptide of natriuretic hormone, pg/ml	42.3	43.1	15–128.3
Myoglobin, ng/ml	30.5	47.4	8.95–48.8
Creatine Phosphokinase MB, ng/ml	9.77	11.2	2.0–4.99

the sternum, weakness, sticky sweat. The patient underwent a repeated ECG. The ST segment lift is set to III, aVF. Due to the deterioration of the patient's condition, he was urgently transferred to the department of anesthesiology and intensive care. Studies of the level of cardiomarkers were urgently performed: highly sensitive troponin I (Abbott i-STAT critical condition analyzer, USA), N-terminal propeptide of natriuretic hormone, creatine phosphokinase MB, myoglobin (PATHFAST immunochemiluminescent analyzer, Japan). The studies were conducted twice with an interval of 40 minutes. The results of the study of the level of cardiomarkers are presented in Table 1.

In the first study, 2 hours after the patient's complaints, an increase in the level of creatine phosphokinase MB by 2 times in comparison with the upper limit of the reference interval was noticed. However, there were no changes in the level of other cardiomarkers – troponin I, N-terminal propeptide of natriuretic hormone and myoglobin at this stage.

The results of the second study showed a tendency to increase the values of the analyzed group of indicators, with the exception of the N-terminal propeptide of natriuretic hormone. Thus, there was an increase in the level of troponin I within the reference

interval, the concentration of creatine phosphokinase MB by 2.2 times in comparison with the upper limit of the reference interval and by 1.2 times with the result of the I-th study. The level of myoglobin increased within the reference values, similar to troponin I, and was 1.6 times higher than the data of the first study. An increase in the concentration of myoglobin at this stage of observation of the patient may be due to the expansion of the area of ischemic myocardial lesions. In general, the dynamics of changes in the levels of the studied markers indicated the development of acute coronary syndrome.

The obtained laboratory data corresponded to the patient's clinical condition, the indications of an ECG performed after the patient complained, and the results of cardiological monitoring conducted in the intensive care unit.

The ECG revealed negative dynamics in comparison with the initial study: sinus bradycardia with a heart rate of 55 beats / min. ST segment elevation in leads II, III st and aVF, pronounced depression of ST segment I, aVL, V1 – V6 – (discordant myocardial changes). Conclusion: acute myocardial injury of the posterior-lower parts of the left ventricle (Fig. 1).

According to the results of cardiological monitoring carried out in the department of anesthesiology

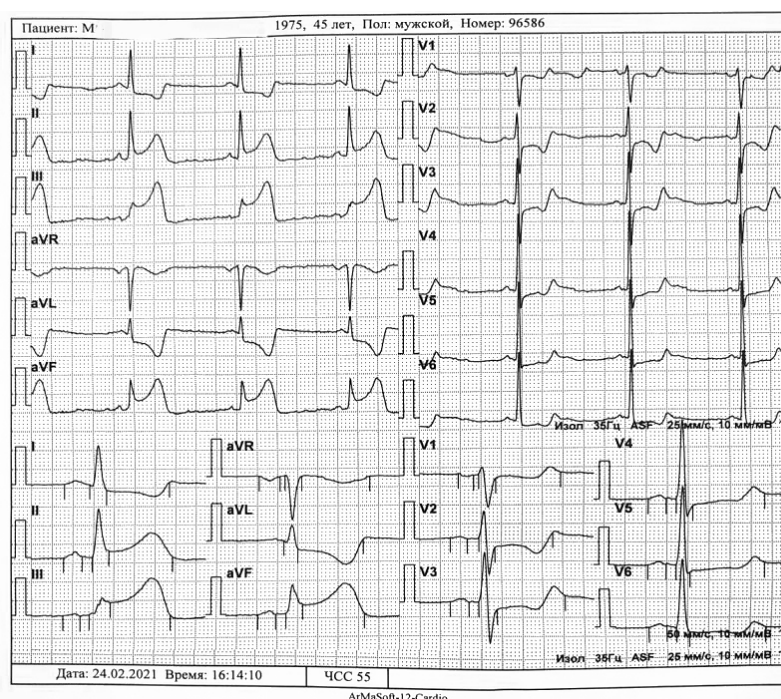


Fig. 1. ECG of patient M. with a significant ST segment elevation on leads II, III and aVF.



and intensive care, there was a preservation of ST wave rises in leads II, III st and aVF, sinus bradycardia with a heart rate of 54 beats/min, which indicated an increase in ischemic injuries. Increases in the ST segment of the teeth were associated with changes in the level of the analyzed cardiomarkers, mainly creatine phosphokinase MB, troponin I and myoglobin, which made it possible to establish the diagnosis of acute myocardial infarction type 1 in the shortest possible time. A complex of therapeutic measures was performed that led to an improvement in the patient's condition: relief of pain syndrome, stabilization of hemodynamic parameters, which made it possible to urgently transfer the patient for further treatment and percutaneous surgery to the cardiology department of the Emergency Hospital. After the treatment and rehabilitation, the patient continued treatment of the underlying disease at the FSBI "NMRC Oncology" of the Ministry of Health of the Russian Federation.

## DISCUSSION

According to the Russian clinical guidelines for the diagnosis and treatment of acute myocardial infarction with ST-segment elevation of the electrocardiogram (MOH of the Russian Federation 2020), the primary treatment strategy is based on the clinical picture and ECG. For the final confirmation of the diagnosis, it is necessary to determine cardiomarkers. There are cases of a connection between changes in the ST segment of the electrocardiogram and an increase in the concentration of troponin I in patients with acute myocardial infarction and the possibility of assessing the volume of myocardial necrosis by the degree of changes in the level of troponin I [7]. Nevertheless, despite the high specificity, troponins are "late" markers of myocardial necrosis, the peak of growth is recorded after 6-8 hours from the onset of the disease, reaching a maximum by 24 hours [8]. It is also known that it is extremely difficult to measure the concentration of troponin in the blood, since it is normally extremely low [9]. Therefore, the recorded increase in the patient's troponin I level, which does not go beyond the reference boundaries, is significant, in our opinion, since according to the available data, even the smallest increase in their level in the blood is dangerous and may indicate a myocardial infarction [10].

According to International recommendations, studies of an early cardiomarker, creatine phosphokinase MB, are performed in addition to troponin I for patients admitted within 6 hours from the onset of pain syndrome. An increase in the level of creatine phosphokinase MB in the blood is specific for myocardial damage [11]. In our observation, an increase in the level of the indicator in the patient's blood was noted almost from the moment of filing complaints.

The informative value of the use of myoglobin is shown to exclude the diagnosis of acute myocardial infarction [12]. An increase in myoglobin is noted during the first 3.5 hours from the onset of the attack with a maximum of values by 6-12 hours and a return to the initial level within 24-36 hours [13], which explains the absence of changes in the patient's myoglobin level in the first study. However, after 40 minutes, an increase in the indicator was noted in comparison with the initial value, which confirms the expediency of using myoglobin in this case.

Thus, the ECG data, along with the study of the level of creatine kinase MB, myoglobin, troponin I, made it possible to establish the development of acute type 1 myocardial infarction in the patient in the shortest possible time. At the same time, there is evidence that the N-terminal propeptide of natriuretic hormone, not being a direct indicator of necrosis, characterizes the functional capabilities of the myocardium [14], and is also effective in assessing the development of chronic heart failure in cancer patients on the background of chemotherapy [15] and as a prognostic factor for adverse outcomes [16]. The absence of changes in the indicator in the presented case does not contradict these data, but requires additional observations.

When analyzing the entire array of clinical and laboratory data, the question was also raised about the factors that played a decisive role in the development of myocardial infarction. One of the reasons can be attributed to the initial unfavorable background caused by a widespread malignant process and accompanied by cancer intoxication. However, this is the case in most cancer patients. In our opinion, the leading initiating factor was the preoperative course of polychemotherapy with paclitaxel and carboplatin, which have cardiotoxicity, the main mechanism of which is acute vasospasm leading to ischemic

complications [17]. At the same time, the presence of the patient's initial cardiodysfunction, namely, coronary heart disease, stable angina pectoris, arterial hypertension, could certainly serve as an aggravating factor.

## CONCLUSION

The complex application of diagnostic procedures, including the determination of the level of cardiomarkers, made it possible to timely diagnose the development of acute myocardial infarction of type

1 in a patient with tongue cancer on the background of chemotherapy. Informative, along with troponin I, were changes in the level of creatine phosphokinase MB and myoglobin, which were recorded in the first hours of the development of myocardial infarction. The high sensitivity of the cardiovascular system to drug therapy due to tumor progression requires more thorough preparation of patients for preoperative courses of polychemotherapy, including cardiotropic therapy with mandatory monitoring of the level of the main cardiomarkers, especially in persons with a burdened cardiological history.

### Authors contribution:

Guskova N.K. – the concept and design of the study, systematization and analysis of the data obtained, writing the text of the manuscript, scientific editing.

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Skopintsev A.M. – collection of clinical data, consultation.

Golomeeva N.V. – collection of clinical data.

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