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APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN CARDIOVASCULAR MEDICINE

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Abstract. Artificial intelligence (AI) is described as a collection of algorithms and intelligence that attempt to replicate human intelligence. Deep learning is one of the machine learning approaches. The use of AI in healthcare systems, including hospitals and clinics, provides numerous potential benefits and future opportunities. AI applications in cardiovascular medicine include machine learning approaches for diagnostic processes such as imaging modalities and biomarkers, as well as predictive analytics for tailored medicines and improved results. AI-based systems have discovered new uses in cardiovascular medicine, including risk prediction for cardiovascular illnesses, cardiovascular imaging, predicting outcomes following revascularization treatments, and identifying new therapeutic targets. AI, such as machine learning, has partially resolved and supplied prospective solutions to unfulfilled requirements in interventions. Due to significant successes in the organization of medical care for patients with ST-segment elevation ACS (ST ACS), the introduction of percutaneous coronary interventions (PCI) into widespread practice, over the past few years, it has been possible to reduce in-hospital mortality from this pathology [3]. Artificial Intelligence (AI) lies at the core of many activity sectors that have embraced new information technologies [1]. While the roots of AI trace back to several decades ago, there is a clear consensus on the paramount importance featured nowadays by intelligent machines endowed with learning, reasoning and adaptation capabilities. It is by virtue of these capabilities that AI methods are achieving unprecedented levels of performance when learning to solve increasingly complex computational tasks, making them pivotal for the future development of the human society [2]. The sophistication of AI-powered systems has lately increased to such an extent that almost no human intervention is required for their design and deploymentHowever, the mortality rate of patients with ACS, especially with cardiogenic shock, is still high [4, 5]. Moreover, most of the deaths occur in the early stages of the onset of ACS, i.e., in the first 24 hours of the patient's hospitalization [3]. For this reason, when ST-elevation ACS or non-ST-elevation ACS (ST-elevation) develops, the physician needs a "tool" to predict the risk of death, in order to make quick decisions and optimize patient management. To date, such a "tool" for assessing the risk of an adverse outcome in patients is scales based on multivariate analysis, the strength and significance of which are confirmed by ROC analysis [4]. Currently, there are many scales and methods for assessing the risk of death (GRACE, TIMI, PURSUIT, EuroSCORE II, RECORD), however, they mainly take into account well-known "classical" risk factors [8, 9]. However, when analyzing the research data, it should be noted that the search for universal predictors for assessing the risk of in-hospital mortality continues, combining a number of criteria: ease of use, taking into account the impact of comorbidity, as well as the results of laboratory and instrumental research methods [5]. That is why the establishment of a set of prognostic factors can help optimize risk stratification and accurately assess the probability of death at the hospital stage.

Key words: ACS, AI, predictors, lethality, comorbidity.

Materials and methods. A sequential retrospective analysis was carried out that included 212 patients with ACS (n=101 – the main group of patients who died in hospital, n=124 – the control group) hospitalized in the Department of Emergency Cardiology of the Regional Vascular Department for the period from January 2022 to July 2024. The criteria for inclusion of patients in the study were men

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and women aged 18 years and older with an established diagnosis of ST ACS or ST ACS. Exclusion criteria: acute myocardial infarction, which has become a complication of PCI or coronary artery bypass grafting. An analysis of the clinical and demographic characteristics of patients with ACS was carried out: gender, age, timing of admission to the PCI center, blood pressure (BP), heart rate (HR), etc.; general clinical and biochemical blood analysis; the results of electrocardiography with ST-segment evaluation, inversion of the T wave and the appearance of a pathological Q wave in two or more adjacent leads; data obtained by transthoracic echocardiography and coronary angiography. Statistical processing of the data was performed using Statistica version 10.0 and MedCalc version 20.0. For each sample, the hypothesis about the normality of the distribution of indicators was tested using the Shapiro-Wilk test.

Results. As a result of data processing and comparative analysis, the following statistically significant differences were obtained between the main group of patients who died in the hospital and the control group: patients from the study group were older – the mean age was 73±10.2 years versus (vs 63.2±9.2 years in the control group (they refused coronary angiography (CAG) followed by possible stenting of the infarction-associated artery, which turned out to be an independent fatal predictor for patients with ACS (OR 159.34 (95% CI 21.41–1185.49); $p<0.0001$). It was also found that CAG was not performed in 20 patients from the study group (20 (20%) patients out of 101) for other reasons, two of whom underwent TLT. Thus, the overall percentage of correctly classified cases is 88.00%, which indicates the high statistical significance of the multivariate prognostic model. This model, evaluated using ROC analysis (Fig. 1), has a high predictive potential: AUC – 0.957 (95% CI 0.921–0.979; p0.3756 increases the risk of in-hospital mortality, and the value of ≤ 0.3756 is associated with a low risk of in-hospital mortality in patients with ACS.

Discussion. Diagnosing ACS is not an easy task. Even the typical symptoms of ACS have low sensitivity and specificity. For example, among patients admitted to the hospital with chest pain characteristic of ACS, only 50% later confirmed the diagnosis of AMI or unstable angina; at the same time, 30–50% of patients with AMI do not have typical chest pain. Despite this, it is possible to assume the fact of the development of ACS in a patient only on the basis of an analysis of complaints (there are no other ways yet), but for this it is necessary to obtain the most complete anamnestic information. Analysis of the sensitivity and specificity of individual symptoms of ACS has shown that it is impossible to diagnose only one symptom. Localization and nature of pain. Typical symptoms of ACS include squeezing, tightening, pressing or burning pain behind the sternum in the depth of the chest. The pain does not have clear boundaries and is protracted - it lasts 10-20 minutes or more. Often, chest pain in ACS has a characteristic radiation to the left arm, left shoulder, throat, lower jaw, epigastric region, as well as to the back, the pain can migrate. In some cases, ACS pain is localized only in the areas of irradiation, and there is no pain in the chest.

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