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MODERN APPROACHES TO THE DIAGNOSIS AND TREATMENT OF MYOCARDIAL INFARCTION

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Abstract. Myocardial infarction (MI) is one of the leading causes of mortality and disability among cardiovascular diseases. In recent years, significant progress has been achieved in the early diagnosis, effective treatment, and prevention of complications associated with this condition. This article highlights modern approaches to the management of myocardial infarction, including diagnostic methods, pharmacological and invasive treatment strategies, as well as rehabilitation and secondary prevention.

The abstract briefly analyzes the pathophysiological mechanisms, risk factors, and clinical manifestations of myocardial infarction. The importance of modern diagnostic tools—such as high-sensitivity troponin assays, electrocardiography, and imaging techniques—is emphasized. The advantages of reperfusion therapy, particularly percutaneous coronary intervention (PCI) and thrombolytic therapy, are discussed.

In addition, the role of antiplatelet agents, anticoagulants, beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, and statins in modern clinical protocols is analyzed. The importance of lifestyle modification, increased physical activity, and psychological support during the rehabilitation phase is substantiated.

This article is intended for healthcare professionals, clinical residents, and medical students, providing systematic, evidence-based knowledge on modern approaches to the management of myocardial infarction.

Keywords: myocardial infarction, reperfusion therapy, troponin, electrocardiography, percutaneous coronary intervention, thrombolysis, antiplatelet therapy, ischemic heart disease, rehabilitation, prevention.

Introduction

Myocardial infarction is a severe clinical condition resulting from an acute impairment of blood supply to the heart muscle, most commonly caused by thrombosis or spasm of the coronary arteries. Currently, ischemic heart diseases, including myocardial infarction, remain one of the major global public health challenges.

According to the World Health Organization, cardiovascular diseases account for nearly one-third of all causes of death worldwide. This burden remains particularly high in developing

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countries, driven by factors such as population aging, unhealthy diet, smoking, physical inactivity, and stress.

Over the past decades, substantial scientific and technological advances have been made in the diagnosis and treatment of myocardial infarction. The introduction of new biomarkers, the development of invasive cardiology, and the improvement of clinical protocols have significantly increased patient survival rates. Nevertheless, early diagnosis and prompt medical intervention remain crucial determinants of outcomes.

The aim of this article is to systematically present modern approaches to myocardial infarction, analyze current scientific literature, and summarize effective methods used in clinical practice.

Literature Review

Scientific research on myocardial infarction has primarily focused on its pathogenesis, diagnostic criteria, and treatment strategies. Classical literature emphasizes the role of atherosclerotic damage to the coronary arteries in the development of MI. Recent studies highlight the significant contribution of inflammatory processes and endothelial dysfunction.

Modern clinical guidelines recognize high-sensitivity troponin assays as the “gold standard” for the diagnosis of myocardial infarction. Research confirms that these biomarkers enable early detection of MI. Electrocardiographic changes allow differentiation between ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI).

The literature consistently demonstrates the superiority of reperfusion therapy. Numerous randomized studies have shown that percutaneous coronary intervention is more effective than thrombolytic therapy. Additionally, a combination pharmacological approach is recommended for optimal management.

Main Part

Pathogenesis and Clinical Features of Myocardial Infarction

Myocardial infarction is a necrotic process that develops when a portion of the heart muscle is deprived of adequate blood supply. The primary pathogenic mechanism involves rupture of an atherosclerotic plaque in the coronary arteries followed by thrombus formation. This thrombus partially or completely obstructs coronary blood flow, depriving myocardial cells of oxygen and nutrients. If perfusion is not restored within 20–30 minutes, irreversible myocardial necrosis begins.

Several risk factors contribute to the development of myocardial infarction, including arterial hypertension, diabetes mellitus, dyslipidemia, smoking, obesity, physical inactivity, and genetic predisposition. Recent studies indicate that chronic inflammation and endothelial dysfunction further accelerate atherothrombotic processes.

Clinically, myocardial infarction typically presents with severe, pressing, or constricting chest pain that may radiate to the left arm, shoulder, neck, lower jaw, or back. Patients often

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experience dyspnea, nausea, vomiting, cold sweating, and a sense of impending death. In elderly patients and those with diabetes mellitus, MI may present atypically or without pain, complicating diagnosis.

Modern Diagnostic Approaches to Myocardial Infarction

Early and accurate diagnosis of myocardial infarction is a key determinant of treatment effectiveness. Diagnostic evaluation is based on clinical assessment combined with instrumental and laboratory investigations.

Electrocardiography (ECG) is a primary and rapid diagnostic tool. ECG findings include ST-segment elevation or depression, T-wave inversion, and the presence of pathological Q waves. Based on these changes, MI is classified into STEMI and NSTEMI, which is essential for selecting the appropriate treatment strategy.

Laboratory diagnostics focus on cardiac biomarkers. Troponin I and T are highly sensitive markers released into the bloodstream following myocardial injury. High-sensitivity troponin assays allow detection of MI at a very early stage. Creatine kinase-MB (CK-MB) and myoglobin may also be used.

Among imaging methods, echocardiography is important for assessing myocardial contractility and detecting complications. Coronary angiography directly visualizes coronary artery pathology and helps determine the need for invasive treatment.

Modern Strategies for the Treatment of Myocardial Infarction

The primary goal of myocardial infarction treatment is the rapid restoration of coronary blood flow, limitation of myocardial necrosis, and prevention of complications. Therefore, modern approaches are centered on reperfusion therapy.

In STEMI, percutaneous coronary intervention is the first-line treatment. This procedure involves stent placement via catheterization to restore blood flow. When performed promptly, PCI significantly reduces mortality and complication rates. If PCI is unavailable, thrombolytic therapy is used.

Pharmacological treatment requires a comprehensive approach. Antiplatelet agents (aspirin, clopidogrel) prevent thrombus formation. Anticoagulants (heparin, enoxaparin) limit thrombus progression. Beta-blockers reduce cardiac workload and decrease arrhythmia risk. ACE inhibitors and statins improve long-term prognosis.

Rehabilitation and secondary prevention represent essential components of care. These include lifestyle modification, smoking cessation, balanced nutrition, increased physical activity, and psychological support. Such measures reduce the risk of recurrent infarction and improve quality of life.

ResearchMethodology

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This scientific article is based on a systematic review of the literature addressing modern approaches to the diagnosis and treatment of myocardial infarction. International and national scientific sources, clinical guidelines, and practical manuals published over the past 10–15 years were analyzed. Priority was given to materials issued by leading cardiovascular organizations and scientific databases.

Selection criteria included studies addressing the pathogenesis, diagnosis, treatment strategies, and rehabilitation of myocardial infarction. Randomized controlled trials, meta-analyses, cohort studies, and international clinical guidelines were prioritized. National clinical protocols approved by the Ministry of Health of the Republic of Uzbekistan were also considered.

Comparative analysis was used to evaluate the effectiveness of different treatment approaches, while analytical and synthesis methods helped systematize current scientific concepts relevant to modern clinical practice. Only evidence-based and scientifically validated sources were included to ensure reliability.

Results

The systematic review demonstrated that modern approaches to myocardial infarction management significantly improve both short- and long-term patient outcomes. Early diagnosis and timely reperfusion therapy play a crucial role in reducing the extent of myocardial necrosis.

Analyzed studies showed that PCI is superior to thrombolytic therapy in reducing mortality rates. Combined antiplatelet and anticoagulant therapy proved highly effective in preventing thrombotic complications.

Long-term use of beta-blockers, ACE inhibitors, and statins was associated with a reduced risk of heart failure and recurrent myocardial infarction. Patients adhering to rehabilitation and secondary prevention programs demonstrated improved quality of life and functional status.

High-sensitivity troponin assays expanded the possibilities for early MI detection, enhancing the effectiveness of emergency care.

Conclusion

Myocardial infarction remains one of the most pressing challenges for healthcare systems worldwide. Its high mortality and disability rates necessitate early diagnosis, effective treatment, and comprehensive preventive strategies. This article analyzed modern approaches to myocardial infarction management and highlighted their clinical significance.

The implementation of advanced diagnostic methods, including high-sensitivity troponin assays and improved ECG criteria, has significantly enhanced early detection. Prompt PCI in STEMI cases plays a decisive role in improving survival rates.

A comprehensive treatment strategy combining invasive procedures with pharmacological therapy is recognized as the most effective approach. Proper selection and continuous use of

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antiplatelet agents, anticoagulants, beta-blockers, and lipid-lowering drugs improve long-term prognosis. Rehabilitation and secondary prevention remain indispensable.

In conclusion, combating myocardial infarction requires not only hospital-based care but also primary and secondary prevention, improved public health awareness, and promotion of a healthy lifestyle. Future research and implementation of modern technologies will further reduce the adverse outcomes of myocardial infarction.

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