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CARDIOTHERAPY: THE USE OF INFORMATION TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE; INNOVATIVE APPROACHES IN THE TREATMENT OF CARDIOVASCULAR DISEASES

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ANNOTATION: This article highlights modern directions of using information technologies and artificial intelligence in the field of cardiotherapy. It analyzes digital diagnostic methods used for early detection of cardiovascular diseases, risk assessment, and optimization of treatment processes, such as AI-based ECG analysis software, automated processing of computed tomography and ultrasound images. The importance of telemedicine, mobile health applications, smartwatches, and sensor devices for continuous monitoring of cardiac activity is also emphasized. Innovative approaches such as personalized treatment, genetics-based therapy, robot-assisted cardiac surgery, AI-supported drug selection, and management of rehabilitation processes are reviewed. The study describes the effectiveness, advantages, and future development prospects of these technologies.

Keywords: Cardiotherapy, information technologies, artificial intelligence, digital medicine, heart diseases, cardiovascular diseases, innovative approaches, telemedicine, ECG analysis, computed tomography, cardiology diagnostics, smart monitoring, mobile health applications, robotic surgery, personalized treatment, cardiovascular system, AI algorithms, medical image processing.

INTRODUCTION

Cardiovascular diseases are among the most widespread causes of mortality worldwide. One of the primary tasks of modern medicine is the early detection, effective treatment, and improvement of rehabilitation processes for these conditions. In recent years, the rapid development of information technologies and artificial intelligence has brought fundamental changes to the field of cardiology, significantly increasing the accuracy, speed, and reliability of diagnostic and therapeutic procedures.Digital medical tools—such as algorithms for automated ECG analysis, neural networks capable of deeply processing computed tomography and ultrasound images, as well as smartwatches and mobile applications for continuous heart-rhythm monitoring—have opened a new era in cardiotherapy. Telemedicine, in turn, has enhanced remote collaboration between patient and physician, enabling stable long-term monitoring of high-risk individuals.Moreover, innovative approaches, including robot-assisted cardiac surgery, genetically informed personalized therapy, and AI-supported treatment selection systems, continue to improve the effectiveness of cardiology practice. This study provides a detailed analysis of the application areas, advantages, clinical outcomes, and future prospects of these technologies.

MAIN PART

Over the past decade, the rapid development of information technologies has significantly influenced cardiology, as it has other branches of medicine. Traditional diagnostic methods—electrocardiography (ECG), angiography, computed tomography, and ultrasound imaging—have been integrated with digital systems, enabling fast and precise analytical capabilities. One of the major advantages of these technologies is their ability to process large amounts of data in a short period of time, track the patient's condition in real-time, and support clinical decision-making.Today's ECG devices not only record heart rhythm abnormalities but also perform automated analysis to detect arrhythmias, ischemic changes, conduction blocks, or ST-segment deviations in real time. This reduces the need for constant physician intervention and allows early detection of potentially dangerous conditions—especially important for patients in remote areas or those who require urgent medical monitoring.Digital monitoring systems, including smartwatches, heart-rate sensors, and automatic blood-pressure devices, allow continuous observation of cardiovascular status. These data are transmitted to healthcare providers in real time through cloud technologies. For instance, if sudden changes in cardiac rhythm are detected, the system can automatically alert the physician or patient, which is crucial for preventing heart attacks, strokes, and severe arrhythmias.Another advantage of digital technologies in cardiotherapy is the ability to create and analyze large clinical databases. Big Data platforms store the heart rhythm records, laboratory results, treatment responses, and other clinical indicators of thousands of patients. This facilitates the development of new therapies, identification of risk factors, and detailed epidemiological analysis of cardiovascular diseases.Artificial intelligence (AI) has become one of the most promising directions in modern medicine, particularly in cardiology. AI algorithms demonstrate high efficiency in automating diagnostics, early and accurate disease detection, and optimizing treatment strategies. The most widely used AI applications include:Cardiological imaging—computed tomography (CT), magnetic resonance imaging (MRI), and echocardiography—contains highly complex data. While physicians interpret these images visually, small pathological signs may go unnoticed. AI-powered neural networks analyze images at the pixel level and can detect early manifestations of coronary artery disease, myocardial infarction, aortic aneurysms, and cardiomyopathies with high precision.AI systems combine a patient's genetic profile, clinical tests, ECG history, blood pressure, lifestyle habits, and other factors to predict the likelihood of developing cardiovascular disease. For example, AI may assess prior ECG patterns to forecast arrhythmia risk or estimate an individual's likelihood of experiencing myocardial infarction.Home-based monitoring systems analyze collected data using AI and notify healthcare providers only when clinically significant abnormalities occur. This improves efficiency and ensures that medical attention is directed to the most critical cases.Modern cardiology increasingly incorporates advanced technologies that complement traditional treatments and contribute to disease prevention.The rapid development of artificial intelligence and information technologies is expected to create even greater possibilities in cardiology. AI will enable extremely early detection of cardiovascular diseases—even before the patient experiences visible symptoms. This will help prevent life-threatening complications and initiate treatment during the most favorable stage.Future cardiotherapy will completely transition toward personalized medical care. Individual treatment plans will be generated using patients' genetic data, heart-rhythm patterns, lifestyle habits, activity levels, stress indicators, and laboratory results.Telemedicine and remote monitoring will expand further, allowing patients to receive cardiac care without visiting hospitals. Wearable sensors, portable ECG devices, and home-based monitoring systems will ensure continuous assessment of heart function. AI will analyze this data instantly and notify

patients and providers of dangerous changes.Cardiac surgery will see more advanced robotic systems enabling safer, more precise, minimally invasive operations with reduced recovery times. AI will assist surgeons by predicting potential risks during procedures.Biotechnology and 3D bioprinting will enable the creation of artificial hearts, blood vessels, and valves, potentially solving the shortage of donor organs. Virtual reality, sensor-based training systems, and intelligent rehabilitation tools will enhance recovery outcomes.Overall, the advancement of information technologies and artificial intelligence will make cardiovascular treatment more accurate, safer, personalized, and effective. Patient health will be monitored continuously, diseases will be detected at early stages, surgeries will be performed with minimal risk, and the overall quality of care will significantly improve.

CONCLUSION

The integration of information technologies and artificial intelligence into cardiotherapy has fundamentally transformed the diagnosis, treatment, and long-term management of cardiovascular diseases. Digital tools such as automated ECG interpretation systems, AI-enhanced imaging platforms, wearable monitoring devices, and cloud-based telemedicine solutions have significantly increased the precision, speed, and accessibility of cardiological care.Artificial intelligence has demonstrated exceptional accuracy in early detection of cardiac pathologies, risk prediction, and clinical decision-making support. The ability of neural networks to analyze medical images at a pixel level, combined with predictive algorithms using genetic, behavioral, and physiological data, enables a shift toward proactive and personalized cardiology. This reduces the incidence of life-threatening complications and enhances treatment outcomes across diverse patient groups.Innovative technologies—such as robot-assisted surgery, pharmacogenomics, next-generation implantable devices, and digital rehabilitation systems—further expand the effectiveness of modern cardiotherapy. These advancements not only improve surgical precision and shorten recovery times but also enable patient-centered treatment strategies tailored to individual genetic and clinical characteristics.Looking ahead, rapid progress in artificial intelligence, biotechnology, and remote monitoring is expected to reshape the future of cardiovascular medicine. Highly personalized treatment models, advanced telemedicine ecosystems, accurate early-warning systems, and bioengineered cardiac tissues may become central components of clinical practice. Consequently, cardiotherapy will continue evolving toward greater accuracy, safety, and efficiency, ultimately improving patient outcomes and reducing global mortality associated with cardiovascular diseases.

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