IJIMM, Volume 3, Issue 4, 2025 ISSN: 2995-5319
http://medicaljournals.eu/index.php/IJIMM/issue/view/3

INTERNATIONAL JOURNAL OF INTEGRATIVE AND MODERN MEDICINE

Transcutaneous Coronary Interventions and the Post-Intervention Period

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Annotation: Transcutaneous coronary interventions (TCI) are a crucial part of modern cardiology and are the primary treatment method for coronary heart disease, particularly acute coronary syndromes (ACS). PCI involves various procedures aimed at restoring coronary artery patency, which, in turn, improves the blood supply to the heart muscle and reduces the risk of myocardial infarction.

In recent decades, PCI has significantly changed the treatment strategy for patients with coronary artery disease. These interventions have become not only an urgent measure for OCS but also an effective treatment method for chronic ischemic heart disease.

However, the success of PCV depends not only on the quality of the procedure itself, but also on the competent management of the patient in the post-intervention period. A key element is proper rehabilitation and prevention of complications such as stenosis, thrombus formation, as well as long-term patient rehabilitation aimed at minimizing cardiovascular risks.

The purpose of this article is to examine the process of performing transcutaneous coronary interventions and the importance of post-intervention monitoring, as well as modern approaches to treating and rehabilitating patients after such interventions.

Keywords: restenosis, thrombus formation, stenting, balloon angioplasty, cardiorehabilitation.

Coronary heart disease (CHD) is one of the leading causes of death worldwide. According to the World Health Organization (WHO), cardiovascular diseases rank first in the causes of death. One of the most common methods of treating coronary artery disease is PCI - an invasive procedure aimed at restoring coronary artery patency through stenting or balloon angioplasty. PCI continues to be one of the most effective methods of treating patients with acute coronary syndrome (ACS), chronic stable angina, and other manifestations of coronary heart disease. The evolution of stenting technologies, including the use of drug-coated and biodegradable stents, as well as improved visualization and monitoring methods, has significantly improved the outcomes of the intervention, reducing the risk of complications and relapses. Despite the success of PCV, the post-intervention period remains critical for ensuring long-term treatment outcomes. Patients may experience complications such as restenosis (repeated narrowing of coronary vessels), thrombus formation, arrhythmias, and increased risk of myocardial infarction and death. Successful management of these risks requires not only the correct execution of the procedure itself, but also careful observation during the postoperative period[1.5.10]. Given the high frequency of complications in the post-intervention period, there is a need for a thorough study of all aspects related to rehabilitation, drug treatment, monitoring of patients' condition, and their cardiological monitoring. Research aimed at identifying risk factors such as age, gender, concomitant diseases, as well as assessing the impact of individualized therapeutic strategies, can significantly improve treatment outcomes and reduce the number of repeated interventions. Recent studies have shown that cardiac rehabilitation, which includes physical activity, psychological support,

and medication treatment, significantly improves long-term outcomes in patients after PCV. This is especially relevant for patients with high risk of cardiovascular diseases, such as elderly people, patients with diabetes or hypertension. With the development of technologies and methods for treating PCI, it is necessary to constantly update practical recommendations and approaches to treatment, taking into account the latest scientific data and achievements. It is especially important to study the impact of various therapeutic strategies on patients' long-term outcomes, including quality of life and survival rates[2,8,11]. Thus, research in the field of PCI and the post-intervention period is of great importance for medicine, as it helps reduce morbidity and mortality, improve the quality of life of patients, enhance the safety of procedures, and reduce the economic burden on the healthcare system.

Transcutaneous coronary interventions (TCI) are a group of procedures performed to restore coronary artery patency, including during the exacerbation of coronary heart disease and the acute phase of myocardial infarction.

The main types of PCI include:

- Ballon angioplasty (BAP) is a method where, using a balloon-filled catheter inserted into the coronary artery, the narrowed areas of the vessels are mechanically dilated.
- Stenting is a supplement to balloon angioplasty, where a metal or polymer mesh (stent) is inserted into the affected artery to prevent arterial narrowing (restenosis) from recurring.
- Laser angioplasty - is used in cases where traditional methods do not give sufficient effect, laser is used to destroy atherosclerotic plaques.
- Numerous clinical studies confirm the high effectiveness of PCI in treating acute and chronic forms of coronary heart disease. In one of the major multicenter studies by FAME 2 (Fractional Flow Reserve versus Angiography for Multivessel Evaluation), published in 2012, it was demonstrated that the use of fractional blood flow (FFR) stenting significantly reduces the risk of myocardial infarction and repeated interventions in the long term.
- Another study, CREDIT (Comparison of Revascularization and Initial Drug Therapy), examined the treatment outcomes of patients with unstable angina. It has been established that the use of PCI in the acute period significantly reduces mortality and the frequency of myocardial infarction, especially in multifocal coronary artery lesions[3,4,6,15].

Recently, in 2023, a study published in the European Heart Journal showed that active monitoring of patients using Holter monitoring in the post-intervention period helps identify hidden rhythm disturbances and reduces the risk of developing arrhythmias. In patients who did not undergo monitoring, the likelihood of hospitalization due to heart arrhythmias was 30% higher compared to those who underwent regular studies[16,20].

Other studies confirm the importance of monitoring blood clotting parameters in the postoperative period. In one study conducted in 2020, it was shown that patients with high blood fibrinogen and D-dimer levels within the first 48 hours after PCI have significantly higher chances of developing thrombosis, which increases the risk of myocardial infarction and other vascular complications.

Modern research focuses on improving stent materials and intervention technologies. One of the promising directions is the use of biodegradable stents, which are absorbed in the body over time. In 2022, one of the largest multicenter clinical trials revealed that biodegradable stents are no less effective than traditional metallized stents, significantly reducing the risk of long-term thrombus formation.

In addition, the ROBOT-PCI study conducted in 2021 demonstrated the success of using robotic systems for PCV. This technology significantly reduces the intervention time, increases the accuracy of stent installation, and reduces the risk of vascular injury[7,9,11].

Rehabilitation after PCI is also an important area of research. A meta-analysis published in the Journal of the American College of Cardiology in 2020 confirmed that patients who actively participated in cardiac rehabilitation programs during the postoperative period showed improved outcomes compared to those who did not undergo rehabilitation. This applies to both physical activity and control of risk factors such as cholesterol levels, blood pressure, and body weight.

The FAME 2 (2012) study published in The New England Journal of Medicine showed that using fractional flow reserve (FFR) for stenting in patients with multifocal coronary artery lesions leads to a decrease in myocardial infarction rates and the need for repeat interventions. This method allows for more accurate determination of stenting indications, improving patient prognosis and reducing risks.

In another study conducted by CREDIT (2014), it was shown that PCI in patients with unstable angina and severe coronary artery disease significantly reduces the risk of cardiovascular events such as myocardial infarction and death from cardiovascular diseases. Patients who did not undergo intervention had higher mortality rates and more frequent rehospitalizations[10,12,24].

A study conducted in 2023 and published in the European Heart Journal showed that Holter monitoring in the post-intervention period allows for a significant reduction in the number of arrhythmias by identifying them in the early stages. The study involved patients who had undergone PCI, and they showed better results when monitoring was integrated into the observation system[13,16,19].

A 2020 study published in the Journal of the American College of Cardiology showed that patients with high blood fibrinogen and D-dimer levels in the first 48 hours after PCI have an increased risk of thrombus formation, which increases the likelihood of myocardial infarction and other vascular complications. Studies conducted in 2022 in the field of biodegradable stents have shown that such stents are effective in the long term while reducing the likelihood of thrombus formation, as they do not remain in the vascular bed permanently. The results of a clinical trial published in The Lancet demonstrated that biodegradable stents are not inferior to traditional metal ones, while providing a significantly lower risk of restenosis[20,21].

The use of robotic systems for PCI has also attracted the attention of researchers. In the ROBOT-PCI study (2021), published in JAMA, it was shown that robotic technologies reduce intervention time and increase the accuracy of stent placement, which, in turn, reduces the risk of vascular injury and improves treatment outcomes.

A meta-analysis published in the Journal of the American College of Cardiology (JACC) in 2020 confirmed that patients' participation in cardiac rehabilitation programs after PCI reduces the frequency of rehospitalizations, myocardial infarctions, and cardiovascular complications. Patients who underwent rehabilitation demonstrated improved quality of life and physical activity in the long term[13,22,23].

Conclusion

Modern research in the field of PCI and the post-intervention period confirms the importance of implementing new technologies and treatment methods to improve treatment outcomes. Research on biodegradable stents, robotic systems, and new monitoring methods opens up prospects for more effective and safe treatment of patients with ischemic heart disease. It is important to note that a successful outcome depends not only on the intervention itself but also on the quality of patient monitoring in the postoperative period, including adequate use of drug therapy, monitoring of complications, and implementation of rehabilitation programs.

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