SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |19-02-2026|

CORONARY STENT PLACEMENT, TYPES OF STENTS, AND CAUSES LEADING TO CORONARY STENT IMPLANTATION

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ABSTRACT

This article describes modern stents developed using 21st-century technologies, their types, the causes leading to coronary stent implantation, the patient's condition after stent placement, and recommendations for developing a healthy lifestyle. This article serves as a practical guide for medical professionals and patients.

Keywords: Coronary stenting, drug-eluting stents (DES), bare-metal stents (BMS), bioresorbable stents, specialized stents, atherosclerosis, angioplasty, rehabilitation, antiplatelet therapy, healthy lifestyle, interventional cardiology.

INTRODUCTION

Cardiovascular diseases are currently one of the leading causes of mortality worldwide. According to the World Health Organization (WHO), tens of millions of people die each year due to ischemic heart disease. Individuals with sedentary lifestyles and unhealthy dietary habits are more prone to a condition known as atherosclerosis. Atherosclerosis is characterized by the accumulation of plaque within the arterial walls. This plaque leads to narrowing and blockage of the arteries, thereby reducing blood flow. When atherosclerosis affects the arteries that supply blood to the heart (coronary arteries), it is referred to as coronary artery disease. Coronary angioplasty with stent placement is considered a primary treatment method for such patients. Since the heart muscle constantly requires oxygen and nutrients, any restriction in blood flow weakens myocardial contractility, resulting in conditions such as angina pectoris, myocardial infarction, or even heart failure. Therefore, early diagnosis of ischemic heart disease and restoration of adequate blood flow are among the most important priorities of modern cardiology. In recent decades, interventional cardiology has developed rapidly to address these challenges. One of the most effective methods is percutaneous coronary intervention (PCI), which includes coronary angioplasty and stent implantation. This procedure is aimed at reopening narrowed coronary arteries and preventing their re-narrowing. Stenting involves the placement of a special metal or bioresorbable tube (stent) inside the narrowed or blocked coronary artery to restore blood flow. Initially, bare-metal stents were widely used; however, drug-eluting stents (DES) are now more commonly applied. These stents reduce the risk of plaque reformation within the vessel wall and significantly improve long-term clinical outcomes. Nevertheless, the success of stent implantation is not limited solely to the technical performance of the procedure. Its effectiveness also depends on the patient's preoperative preparation, adherence to intraoperative protocols, and proper postoperative rehabilitation. Coronary angioplasty with stent placement is considered a highly effective and safe procedure. It has been performed for approximately 50 years and has undergone significant improvements over time. However, like any invasive procedure, it carries certain risks. Complications associated with angioplasty are relatively rare, occurring in approximately 1 out of every 100 procedures.

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MAIN PART

Coronary angioplasty with stent placement is a minimally invasive procedure that was first performed in Switzerland in 1977. The pre-procedural preparation stage is an important step before coronary stent implantation. This process allows accurate assessment of the degree of coronary artery stenosis, plaque localization, and vascular morphology through comprehensive diagnostic examinations. The main diagnostic methods include: Electrocardiography (ECG): evaluates the electrical activity of the heart muscle, detects conduction abnormalities, and identifies signs of myocardial ischemia.

Echocardiography: provides information about the size of the cardiac chambers, ejection fraction, valvular condition, and wall motion abnormalities. Coronary angiography: is considered the "gold standard" diagnostic method before stent implantation, providing precise visualization of coronary arteries using contrast media. The patient's general condition is also evaluated, including blood pressure, heart rate, blood glucose level, kidney function (creatinine, glomerular filtration rate – GFR), coagulation parameters (INR, APTT), and allergic history. In addition, antiplatelet therapy (aspirin combined with clopidogrel or ticagrelor) is initiated at least 24 hours before the procedure to prevent thrombus formation. If the patient has chronic conditions such as diabetes mellitus, hypertension, chronic obstructive pulmonary disease (COPD), or renal insufficiency, these conditions must be stabilized prior to the procedure. Furthermore, the patient is provided with detailed information about the procedure, its risks and benefits, and informed consent is obtained. In the initial stage of the procedure, intravenous (IV) lines are established, and analgesic and sedative medications are administered to reduce pain and anxiety and to help the patient remain calm. Local anesthesia is applied at the incision site to numb the area. The surgeon then makes a small incision, usually in the radial artery (wrist) or femoral artery (groin), where the arterial pulse can be easily palpated. Through this incision, a thin, flexible tube called a catheter is inserted into the artery. The cardiologist carefully guides the catheter to the site of blockage. X-ray imaging and contrast dye are used to visualize the blood vessels and accurately guide the catheter. Once the catheter reaches the target location, a guidewire is inserted through it, followed by a small balloon mounted on the catheter. The balloon is inflated and deflated several times, compressing the plaque against the arterial wall and widening the narrowed vessel. This process is known as balloon angioplasty. The next step is stent deployment. The stent is positioned at the site of the blockage and expanded to support the arterial wall and prevent re-narrowing. After successful stent placement, the cardiologist removes the catheter and guidewire. The final stage involves applying a vascular closure device or manual pressure to prevent bleeding. The incision site is then covered with a sterile dressing to ensure proper healing.

Types of stents:

1. **Bare-Metal Stents (BMS):** These stents are made of stainless steel or cobalt-chromium and provide structural support to keep the artery open. They act as a mechanical scaffold to maintain adequate blood flow through the vessel.
2. **Drug-Eluting Stents (DES):** These stents are coated with medications that are gradually released into the arterial wall to prevent excessive cell proliferation. They significantly reduce the risk of restenosis and are widely used in modern interventional cardiology.
3. **Bioresorbable Stents:** These stents are made of materials that gradually dissolve over time. They provide temporary structural support and eventually allow the artery to return to its natural state without leaving permanent metallic components.
4. **Specialized Stents:** Specialized stents, such as covered stents, are used in cases of aneurysms or arterial perforations. Dual-therapy stents combine drug elution with enhanced healing properties to improve clinical outcomes and vascular recovery.

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Coronary angioplasty with stent placement is an effective method for improving heart health. However, long-term lifestyle modifications are essential to prevent future arterial blockages and ensure optimal outcomes. By following several important recommendations, patients can significantly improve the success of the procedure.

Heart-healthy diet: Limit the intake of added sugars, saturated fats, trans fats, and cholesterol-raising foods. Emphasize fruits, whole grains, vegetables, and lean protein sources. Regular physical activity: Engage in at least 30 minutes of moderate-intensity physical activity daily to improve cardiovascular function and overall health. Stress management: Chronic stress is a significant risk factor for cardiovascular diseases. Healthy stress management techniques such as yoga, meditation, and spending time in nature can help maintain heart health. Smoking cessation: Smoking is a major risk factor for cardiovascular and many other diseases. Quitting smoking is one of the most important steps a patient can take to improve heart health. With proper medical care and appropriate lifestyle modifications, recovery after coronary angioplasty with stent placement can be smooth and successful. Maintaining a positive attitude and adhering to a healthy lifestyle play a crucial role in ensuring long-term cardiovascular health and overall well-being.

CONCLUSION

Coronary stent implantation is one of the most significant achievements of modern cardiology, playing a crucial role in saving the lives of patients with cardiovascular diseases and improving their quality of life. This procedure is not merely a technical manipulation, but a carefully planned, step-by-step comprehensive treatment strategy. The preoperative preparation stage ensures proper evaluation of patient risk factors, comprehensive assessment of cardiac and other organ functions, and the selection of an appropriate treatment strategy. The procedure itself requires high precision and professional expertise, as accurate stent placement not only restores adequate blood flow but also reduces the risk of future restenosis. Coronary angioplasty with stent implantation is a minimally invasive and highly effective procedure that restores blood flow to the heart muscle by reopening blocked arteries. It can significantly relieve symptoms such as angina pectoris and improve overall cardiac function, allowing patients to lead a more active and fulfilling life. Timely diagnosis and early intervention are key factors in achieving successful treatment outcomes. Therefore, patients experiencing symptoms of cardiovascular disease should seek medical attention promptly. Healthcare professionals can develop individualized treatment plans to maintain optimal cardiovascular health. Strict adherence to antiplatelet therapy, proper control of blood pressure and lipid levels, maintenance of a healthy diet, and regular physical activity are essential for ensuring long-term positive outcomes after stent implantation. Furthermore, psychological support and regular follow-up with a cardiologist are integral components of the rehabilitation process and contribute significantly to improving long-term prognosis and overall patient well-being.

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