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Percutaneous Coronary Intervention: An Overview

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Description

Percutaneous coronary intervention (PCI) is a non-surgical treatment for treating coronary artery disease, which causes constriction of the heart's coronary arteries. Combining coronary angioplasty with stenting, which is the implantation of a permanent wire-mesh tube that is either drug eluting (DES) or made of bare metal, is the method (BMS). The angioplasty catheter's stent delivery balloon is inflated with media to force contact between the stent's struts and the vessel wall (stent apposition), resulting in a wider blood channel width. The method involves cardiac catheterization to visualise the blood arteries on X-ray imaging after accessing the blood stream through the femoral or radial artery. An interventional cardiologist can then perform a coronary angioplasty, in which a deflated balloon is inserted into the obstructed artery and inflated to relieve the narrowing; certain devices, such as stents, can then be installed to maintain the blood vessel open. Other operations can also be carried out [1].

Primary PCI refers to the use of PCI in persons who have had an acute heart attack and have evidence of cardiac damage on an electrocardiogram. PCI is also utilised in persons who have had another type of myocardial infarction or have unstable angina and are at high risk of having another episode. Finally, persons with stable angina pectoris may benefit from PCI, especially if their symptoms are difficult to manage with medication. PCI is a non-surgical alternative to coronary artery bypass grafting (CABG), which bypasses stenotic arteries by grafting vessels from other parts of the body. CABG may be preferable in certain cases, such as significant obstructions or a history of diabetes.

PCI is a procedure that is utilised to unblock a blocked coronary artery and restore arterial blood flows to heart tissue without the need for open-heart surgery. PCI may be the best option for patients with a constricted or blocked coronary artery to restore blood flow and prevent angina (chest discomfort), myocardial infarctions (heart attacks), and death. Stents, such as bare-metal stents, drug-eluting stents, and totally resorbable vascular scaffolds, are often used in PCI nowadays (or naturally dissolving stents). Stents are only needed for the first three months following PCI; beyond that, the artery can stay open on its own. This is the idea behind bioresorbable stents, which disintegrate spontaneously after they're no longer needed. The appropriateness of PCI use is determined by a variety of criteria. Patients with stable coronary artery disease who satisfy certain criteria, such as having any coronary stenosis more than 50% or angina symptoms that are refractory to medicinal therapy may be candidates for PCI. Although PCI may not be any more effective than oral medicine in avoiding death or myocardial infarction in people with stable coronary artery disease, it is likely to provide better angina relief [2].

PCI may be appropriate in patients with acute coronary syndromes; recommendations and best practises are always changing. PCI can be crucial to survival in patients with significant blockages, such as ST-segment elevation myocardial infarction (STEMI), because it reduces mortality, myocardial infarctions, and angina when compared to medicines. Treatment with medication and/or PCI for individuals with non-ST-segment elevation myocardial infarction (nSTEMI) or unstable angina is determined by the patient's risk assessment. Hospitals utilise the door-to-balloon time as a quality measure to gauge the timeliness of primary PCI. Coronary angioplasty is a popular procedure with a number of hazards; nonetheless, serious procedural problems are rare. An interventional cardiologist, a medical specialist who specialises in the treatment of the heart, usually performs coronary angioplasty using invasive catheter-based techniques.

Angioplasty is normally performed while the patient is conscious, and chest discomfort is possible. The patient remains awake in order to keep track of his or her symptoms. If symptoms indicate that the procedure is causing ischemia, the cardiologist may change or stop a portion of it. Bleeding at the insertion point in the groyne (femoral artery) or wrist (radial artery) is common, thanks in part to antiplatelet medications. As a result, some bruising is to be expected, although a hematoma may form on rare occasions. This may cause a delay in hospital discharge because the artery into the hematoma may continue to flow (pseudoaneurysm), requiring surgical correction. Infection at the site of the skin puncture is unusual, as is dissection (tearing) of the access blood artery. It is possible to have an allergic reaction to the contrast dye employed, but this has been reduced with the newer agents. Patients with pre-existing kidney disease may experience deterioration of kidney function, but kidney failure requiring dialysis is uncommon. When the treatment is conducted through the radial artery, vascular access problems are less prevalent and less significant [3].

Death, stroke, ventricular fibrillation (non-sustained ventricular tachycardia), myocardial infarction (heart attack, MI), and aortic dissection are the most serious hazards. In 0.3 percent of instances, a heart attack happens during or shortly after the procedure, necessitating emergency coronary artery bypass surgery. In up to 30% of all PCI operations, heart muscle damage defined by increased levels of CK-MB, troponin I, and troponin T may occur. Elevated enzymes have been linked to a higher risk of death, further MI, and the necessity for repeat revascularization treatments in the future. Angioplasty performed soon after a MI increases the risk of a stroke, however this risk is lower than the risk of a stroke after thrombolytic medication therapy.

Procedure

The term "balloon angioplasty" refers to the process of inflating a balloon within a coronary artery to compress plaque into the artery's walls. Although balloon angioplasty is still used in nearly all percutaneous coronary procedures, it is rarely the only treatment used.

Other procedures done during a percutaneous coronary intervention include:

- Stents are placed in the arteries.
- Strategies for debulking
- Brachytherapy
- Coronary intravascular lithotripsy (IVL)

Types of stent

Traditional bare-metal stents (BMS) provide a mechanical structure that keeps the artery wall open and prevents coronary artery stenosis (narrowing). Traditional stents with a polymer covering containing medications that suppress cell proliferation are now known as drug-eluting stents (DES). The antiproliferative medications are steadily given over time to assist prevent tissue growth that can clog the artery, which may occur in reaction to the stent. These stents have been proven to help prevent arterial restenosis through

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physiological mechanisms that rely on tissue development suppression at the stent site as well as local control of the body's inflammatory and immunological responses. The paclitaxel-eluting stent and the sirolimus-eluting stent were the first two drug-eluting stents to be used, and both were approved by the US Food and Drug Administration. Sirolimus (also known as rapamycin), everolimus, and zotarolimus are used in the majority of FDA-approved drug-eluting stents now on the market. Biolimus A9-eluting stents made of biodegradable polymers have been approved outside of the United States.

Newer PCI approaches are designed to lower the risk of late stent thrombosis and other long-term complications. Some DES products advertise a biodegradable polymer coating, claiming that DES's persistent polymer coatings cause long-term irritation. Other options include: A more recent study suggests that, in the case of people with diabetes mellitus, a therapy with a paclitaxel-eluting balloon followed by BMS may minimise the risk of coronary restenosis or myocardial infarction when compared to BMS given alone [4].

Thrombus aspiration: Angiography may reveal thrombus (blood clots) within the coronary arteries during primary PCI. Several studies have been conducted to see if aspirating these clots (thrombus aspiration or manual thrombectomy) is helpful. There is no evidence that routine clot aspiration improves outcomes at this time.

Complex lesions: In terms of balloon angioplasty, lesions with a significant degree of calcium deposition within the vessel wall, especially if the calcium is circumferential, are considered difficult to dilate. Because complex lesions are one of the most important predictors of poor outcome in percutaneous coronary intervention (PCI), calcium lesion reduction is required prior to stent insertion. The goal is to induce fissures in the calcium within the vessel wall in order to increase the chances of the stenosis expanding and the final stent being delivered successfully. Balloon angioplasty or debulking methods such as rotational, orbital, and laser atherectomy have historically been used to achieve this. However, employing acoustic shockwaves to treat superficial and deep calcium in the arterial wall, coronary intravascular lithotripsy is a unique method [5].

Conflict of Interest

None.

References

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