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An Overview of Percutaneous Coronary Intervention (PCI): Opened-Heart Surgery and Stents

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Abstract

Ischemic heart disease is the primary cause of death in the aged population, with acute coronary syndrome accounting for more than 30% of deaths. The rate of population growth among the elderly has surged dramatically and will continue to do so in the future. Clinical trials investigating the obstacles and effects of more invasive treatment techniques such as Percutaneous Coronary Intervention (PCI) for that specific portion of the population have been scarce in the past. However, the safety, efficacy, and results of PCI in the elderly have begun to receive more attention, resulting in certain patterns shifting

Interventional cardiologists are more hesitant to refer the elderly to PCI for a variety of reasons. Most of these difficult aspects are examined in this review, including the intricacy of coronary lesions, frailty, and hematological and vascular alterations. Furthermore, more advanced technologies such as second- and third-generation stents have been introduced to the PCI platform, several alternative approaches have been adopted, such as the transradial approach and the use of bivalirudin instead of heparin and GP IIb/IIIa inhibitor, and several imaging modalities have been optimized to assess patients outcome and prognosis more accurately, and several imaging modalities have been optimized to assess patients' outcome and prognosis more accurately. Several recent studies have demonstrated that when these tactics are used, better results are achieved. This review also discusses the most recent recommendations for doing PCI in the elderly.

Keywords: Percutaneous coronary intervention; Coronary artery disease; Acute coronary syndrome; Coronary stents

Introduction

The major goal of treatment for ST-Elevation Myocardial Infarction (STEMI) is to reanalyze the blocked artery and restore perfusion to the myocardium. Early reperfusion has been demonstrated to offer superior benefits. There are a variety of treatments for reperfusion, but the two most prevalent are thrombolytic therapy and Primary Percutaneous Coronary Intervention (PPCI). In compared to thrombolysis in the treatment of STEMI, PPCI has been shown to be a more successful and efficient technique of treatment in terms of mortality, stroke, and reinfection in a variety of studies across diverse demographics [1].

The application of PPCI in relevant subjects reduces both mortality and morbidity rates across a number of sub-groups with various risk levels when combined with result-oriented pharmaceutical interventions, providing considerable benefits to the field of medicine. PCI is now the treatment of choice for a larger number of patients around the world with a wider spectrum of lesion complexity, thanks to ongoing improvements and evolutions in both device technology and antithrombotic therapy. The trans femoral or transradial approaches can be used for PPCI [2]. The transradial method is gaining popularity since it has less bleeding issues, but there is a steep learning curve to mastering transradial skills.

Despite its long history, cardiologists prefer the trans femoral method over the transradial approach, and its use has been limited to a small niche operation due to physicians lack of requisite training, expertise, and exposure to the technique, as well as the limits of existing technology. Until recently, a small number of studies evaluating the history of the transradial technique had been conducted, and there was very little literature promoting its usage in routine PCI operations. There is now mounting evidence that using the transradial approach for PCI rather than the trans femoral method is associated with a significant reduction in post-procedure bleeding complications. With more expertise with the transradial approach, the rate of procedural failures has decreased [3]. An annual volume of transradial cases was found to be correlated with significant reductions in failure to access, insertion time of the sheath, and cumulative time of the procedures in a study.

Transradial approach for PPCI is gaining rapid acceptability among the cardiologists in our part of the world; however, there is a significant learning curve, and data on the safety of transradial approach for PPCI of patients with STEMI in our demographic is inadequate. As a result, the dearth of research in the field provides an ideal platform and reason for conducting a study that could aid in evaluating the rates of death and complications associated with PPCI using a transradial technique [4].

Percutaneous Coronary Intervention Adverse Events

As a result of the aforementioned considerations, PCI outcomes in older patients are projected to be worse than in the general population. Death would, without a doubt, be the most dreadful event. Although studies have shown reasonable short and long-term PCI outcomes in the elderly, all-cause mortality rates in the hospital, 30 days, and even 1 years to 5 years follow-up are still higher. Aside from mortality, elderly fragile patients are more likely than younger patients to encounter a number of problems as a result of this treatment, which might influence the patient's clinical outcome and quality of life [5].

Cardiogenic shock acute MI, acute Ventricular Septal Rupture (VSR), iatrogenic coronary dissection, coronary perforation, and stent thrombosis are only a few of the cardiac problems that have been reported. Hemorrhage, acute renal injury, stroke, and access site issues including femoral or radial dissection and/or hematoma have all been documented as non-cardiac consequences. One of the consequences linked to a poor clinical result is major bleeding [6]. Data from 5 different trials that were part of the resolute study programmer and included 5130 patients undergoing PCI with the resolute zotarolimus-

eluting stent showed that rates of some complications, such as MI and repeat revascularization, were similar in 1675 patients aged 70 years or older (33%), but significant bleeding events were more common in the older population [7].

In hospital and 1 month follow-up bleeding problems occurred in 1.3% and 1.6% of patients aged 70 and older, and 0.3% and 0.5% of younger patients, respectively (P=0.009 and 0.014). Death occurred in 26% of elderly patients who had bleeding events, with a median period between the bleeding incident and death of 21 days. Another study found that patients receiving PCI in their eighties had a 2.4% higher overall rate of bleeding events than younger patients [8]. PCI has been linked to a variety of bleeding problems, including access site bleeding, pericardial hemorrhage that can lead to tapenade, retroperitoneal bleeding, and gastrointestinal bleeding.

Many other factors, in addition to the patient's age, have been shown to be an independent predictor of an adverse result in the elderly having PCI. Reduced cardiac function, defined as a Left Ventricular Ejection Fraction (LVEF) of less than 40%, Fillip class 3 or worse, cardiogenic shock, and hypotension, defined as a Systolic Blood Pressure (SBP) of less than 100 mmHg, have all been found to be independent predictors of 1-year mortality [9]. In addition, after PCI, the Activity of Daily Living (ADL) of elderly patients can be utilized to predict death.

Higuchi et al. looked examined ADL evaluation using the Barthes Index (BI) at the time of admission and discharge to see if it could predict 1 year mortality in very old patients receiving PCI for ACS [10]. They discovered that a lower BI at discharge can predict increased death in individuals aged 85 and up, with each 5 units fall in BI being related with a 1.1 times increase in 1 year mortality risk.

Type of stent

As previously stated, coronary lesions in the elderly are more complex and widespread, making them only appropriate for Plain Old Balloon Angioplasty (POBA) due to stent delivery failure or difficulty to stent lesions in distal or small diameter veins. Stenting technology, on the other hand, has advanced significantly during the last century. Drug-Eluting Stents (DES) have been used more frequently than Bare Metal Stents (BMS) since their initial effective clinical use in 2002, as they have been linked to lower rates of stent restenosis, significant adverse cardiac events, and revascularization of target lesions.

The stent design of the second generation DES is even superior to the first-generation DES, with a thinner strut and more biocompatible polymers, resulting in improved efficacy and fewer problems. However, using DAPT for at least a year to avoid stent thrombosis associated with DES raises concerns about increased bleeding risk, particularly in populations with a high risk of bleeding, such as the elderly. Some studies have showed that shortening the DAPT to 3 months-6 months could reduce the likelihood of numerous unfavorable clinical outcomes. Recent evidence suggests that DES is underutilized in older patients having PCI with stenting.

The characteristics and clinical results of 1564 high bleeding risk patients aged 75 and up who took part in the leader's free study and had PCI with either polymer free DES or comparable BMS with only 1 month of DAPT were studied. In both groups, there was a significant but equivalent rate of bleeding. Patients who had DES stenting had lower rates of death, stent thrombosis, MI, and target lesion revascularization than those who had BMS stenting, indicating superior safety and effectiveness benefits. Furthermore, in the XIMA study, severe bleeding rates were not substantially different between elderly patients who got PCI with BMS and only a 1 month required DAPT and those who received DES plus a 1 year course of DAPT.

In addition, when compared to first generation DES, the use of second generation DES has been linked to better outcomes in the elderly, with a hazard ratio of 0.40 (95% CI: 0.19-0.82) and a P=0.012 for a lower risk of MI in the following year among patients aged 70 years or older. Most recently, the SENIOR study found that older patients who underwent PCI and received third generation DES with bio absorbable polymer and a short term DAPT had reduced rates of 1 year all-cause mortality, MI, stroke, and revascularization than those who received BMS. In the same trial, the duration of DAPT was decided before patient's random assignment to the two different types of stents and it was recommended to be 1 month for stable patients and 6 months for unstable ones, however, the bleeding complications were comparable in both study arms.

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