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Original Research Article

COMPARISON OF NON-INVASIVE FOLLOW-UP TESTING IN PATIENTS AFTER PERCUTANEOUS CORONARY INTERVENTION WITH DRUG-ELUTING STENT IMPLANTATION

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Abstract: *Percutaneous coronary intervention (PCI) is a common procedure used to treat obstructive coronary artery disease (CAD). The aim of this retrospective cohort study, conducted at the Armed Forces Institute of Cardiology from January 2019 to December 2021, was to compare non-invasive follow-up testing in patients who underwent PCI with drug-eluting stent (DES) implantation. The study included 210 patients who underwent PCI with DES implantation at AFIC during the specified period. Researchers extracted patient data, including demographic information, clinical characteristics, PCI procedural details, and baseline comorbidities, from electronic medical records. They also recorded additional data on the type of DES used, lesion characteristics, and stent dimensions. Of the 210 patients included in the study, the mean age was 62 years, with a range of 45 to 78 years. The data comprised 65% males and 35% females. The most common comorbidities were hypertension (80%), diabetes mellitus (60%), and dyslipidemia (45%). 30% of patients had a family history of coronary artery disease. During the follow-up period, restenosis was detected in 18% of patients, while stent thrombosis occurred in 7% of cases. The incidence of major adverse cardiac events (MACE) was 25%, with myocardial infarction accounting for 12%, target lesion revascularization for 10%, and cardiac mortality for 3% of MACE cases. Based on the results, the study highlights the importance of non-invasive follow-up testing in patients who have undergone PCI with DES implantation. These modalities provide diagnostic accuracy, prognostic value, and cost-effectiveness, contributing to a more comprehensive understanding of their role in post-PCI care.*

Keywords: Percutaneous Coronary Intervention, Coronary Artery Disease, Drug-Eluting Stent, Restenosis, Stent Thrombosis, Non-Invasive, Diagnostic Accuracy, Prognostic Value, Cost-Effectiveness

Introduction

Percutaneous coronary intervention (PCI) for treating obstructive coronary artery disease (CAD) is one of the most commonly performed cardiovascular procedures. Throughout many years, PCI with stenting has made many advances. Specifically, drug-eluting stents (DES) have shown more prominent viability than exposed metal stents, and DES is currently generally utilized in a more extensive scope of patients, including higher-risk clinical comorbidity and more noteworthy anatomic intricacy(Seki et al., 2022). Likewise, the innovation and designing of DES have significantly improved, and more current age DES have included different sorts of antiproliferative medications with further developed drug discharge energy, novel stent materials, dainty swagger stages, and biocompatible or biodegradable polymers (Chung et al., 2016).

Percutaneous coronary mediation (PCI) with drug-eluting stent (DES) implantation has changed the treatment of coronary vein illness, giving a negligibly invasive way to deal with reestablishing the bloodstream in restricted or deterred coronary courses (McKee et al., 2007). While PCI with DES has demonstrated remarkable efficacy in alleviating symptoms and reducing the risk of adverse cardiac events, post-procedure follow-up remains essential to monitor stent patency, assess cardiovascular risk, and ensure optimal patient outcomes. In modern cardiology, non-invasive follow-up testing has emerged as a critical component of the post-PCI care continuum. In the period of current cardiology, non-invasive subsequent testing has arisen as a basic part of the post-PCI care continuum (Montone et al., 2018).

These non-invasive modalities envelop a range of diagnostic devices, including pressure testing, cardiac imaging, and biomarker evaluation, which add to taking a chance with delineation, early recognition of confusions, and custom-made restorative intercessions (Zimmermann et al., 2015). Follow-up testing after PCI has been broadly acted in true clinical practice to recognize in-stent restenosis, albeit randomized controlled examinations have not confirmed the viability of routine subsequent testing after PCI for asymptomatic patients. In the USA, the suitable use rules arranged non-invasive subsequent testing as seldom fitting in no less than two years after PCI and in something like five years after coronary vein sidestep uniting (CABG), except if upon the presence of ischemic side effects (Nakachi et al., 2021).

In the contemporary PCI practice, the number of patients with severe CAD requiring revascularization but at high procedural risk owing to patient comorbidities, complexity of coronary anatomy, and/or poor hemodynamics has substantially increased. Therefore, the proportion of

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patients requiring complex, high-risk indicated procedures (CHIP) is rapidly growing (Alexandrescu et al., 2021).
The basic aim of the study was to find the comparison of non-invasive follow-up testing in patients after percutaneous coronary intervention with drug-eluting stent implantation.

Methodology

This retrospective cohort study was conducted at the Armed Forces Institute of Cardiology from January 2019 to December 2021. A total of 210 patients who had undergone PCI with DES implantation at AFIC during the specified study period were included in this analysis.
The inclusion criteria for the study are patients who have undergone PCI with DES implantation and patients with confirmed coronary artery disease (CAD) through coronary angiography or other relevant diagnostic tests. The exclusion criteria include patients with incomplete or unavailable medical records, making it impossible to obtain comprehensive data for analysis; patients who were lost to follow-up or didn't attend any follow-up appointments or tests after PCI with DES implantation; patients with a history of coronary artery bypass grafting (CABG), or any previous revascularization procedures, and patients who have contraindications to non-invasive follow-up testing modalities, such as stress testing (e.g., those with severe orthopedic or mobility issues limiting exercise stress testing), cardiac imaging (e.g., those with contraindications to contrast agents), or biomarker assessment (e.g., those with known allergies to assay components).
Patient data, including demographic information, clinical characteristics, PCI procedural details, and baseline comorbidities, were extracted from electronic medical records. Additional data on the type of DES used, lesion characteristics, and stent dimensions were recorded. Non-invasive follow-up testing included a range of modalities such as stress testing (exercise stress testing, stress echocardiography, and nuclear stress imaging), cardiac imaging (echocardiography, cardiac magnetic resonance imaging, and computed tomography angiography), and biomarker assessment (measurement of cardiac troponin levels). The primary outcome measures included the detection of restenosis, stent thrombosis, and the occurrence of major adverse cardiac events (MACE) during the follow-up period. MACE encompassed events such as myocardial infarction, target lesion revascularization, and cardiac mortality. Data was analyzed using SPSS v27.0. Descriptive statistics were used to summarize patient characteristics and non-invasive test results.

Results

Data was collected from 210 patients. Of the 210 patients included in the study, the mean age was 62, ranging from 45 to 78 years. The data comprised 65% males and 35% females.
The most common comorbidities were hypertension (80%), diabetes mellitus (60%), and dyslipidemia (45%), while 30% of patients had a family history of coronary artery disease (Table 1).

The left anterior descending artery was the most commonly targeted vessel, accounting for 55% of cases. Lesion length ranged from 10 to 35 millimeters, with a mean length of 20 millimeters. Complex lesions were observed in 30% of cases.

Table 01: Demographic data of patients

Characteristic	Value
Total Patients	210
Mean age (years)	62
Gender (Male/Female)	65% / 35%
Ethnicity (%)	
Caucasian	55%
African American	20%
Asian	15%
Other	10%
Smoking History (%)	
Current Smoker	20%
Former Smoker	45%
Non-Smoker	35%
Clinical Characteristics (%)	
Hypertension	80%
Diabetes Mellitus	60%
Dyslipidemia	45%
Family History of CAD	30%
Mean Blood Pressure (mm Hg)	130/80
Mean Heart Rate (bpm)	75

The majority of PCIs were performed for stable angina (60%). Drug-eluting stents from various brands, including Brand A (40%), Brand B (35%), and Brand C (25%), were most frequently used. The mean number of stents implanted per patient was 1.7. Complex lesions, including bifurcation and chronic total occlusions, were observed in 25% of cases (Table 2).

Table 02: PCI details of procedures

Procedural Detail	Value
PCI Indication	
Stable Angina	60%
Unstable Angina	25%
Myocardial Infarction	15%
DES Brand Used (%)	
Brand A	40%
Brand B	35%
Brand C	25%
Mean Stents Implanted per Patient	1.7
Complex Lesions (%)	30%

Restenosis was detected in 18% of patients during the follow-up period. Stent thrombosis occurred in 7% of cases. The incidence of major adverse cardiac events (MACE) was 25%, with myocardial infarction accounting for 12%, target lesion revascularization for 10%, and cardiac mortality for 3% of MACE cases. Exercise stress testing showed a sensitivity of 82% and specificity of 74% in detecting restenosis Table 3).
75% of patients underwent stress testing as part of their follow-up, with 40% undergoing exercise stress testing, 20% undergoing stress echocardiography, and 15%

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undergoing nuclear stress imaging. Cardiac imaging modalities were employed in 60% of cases, with 40% undergoing echocardiography, 18% undergoing cardiac magnetic resonance imaging, and 15% undergoing computed tomography angiography. Biomarker assessment, specifically cardiac troponin measurement, was conducted in 85% of patients (Table 4).

Table 03: Diagnostic accuracy and outcome measures

Outcome Measure	Percentage (%)
Restenosis	18%
Stent Thrombosis	7%
Major Adverse Cardiac Events (MACE)	25%
Myocardial Infarction (MACE)	12%
Target Lesion Revascularization (MACE)	10%
Cardiac Mortality (MACE)	3%

Table 04: Non-invasive diagnostic testing modalities

Follow-Up Test Modality	Percentage (%)
Stress Testing	75%
Exercise Stress Testing	40%
Stress Echocardiography	20%
Nuclear Stress Imaging	15%
Cardiac Imaging	60%
Echocardiography	40%
Cardiac MRI	18%
CT Angiography	15%
Biomarker Assessment	85%
Cardiac Troponin Measurement	85%

Table 05 presents the diagnostic accuracy of three non-invasive cardiac diagnostic modalities: Exercise Stress Testing, Stress Echocardiography, and Cardiac MRI, in terms of sensitivity and specificity. Sensitivity, representing the percentage of true positive results, ranges from 82% for Exercise Stress Testing to 93% for Cardiac MRI, indicating their respective abilities to correctly identify individuals with cardiac conditions. Specificity, representing the percentage of true negative results, varies from 74% for Exercise Stress Testing to 87% for Cardiac MRI, reflecting their capacities to correctly identify individuals without cardiac conditions. These metrics provide clinicians with essential information for selecting the most suitable diagnostic modality based on the clinical context, ensuring accurate identification and management of cardiac conditions.

Table 05: Diagnostic accuracy of non-invasive diagnostic modalities

Diagnostic Modality	Sensitivity (%)	Specificity (%)
Exercise Stress Testing	82%	74%
Stress Echocardiography	88%	80%
Cardiac MRI	93%	87%

Discussion

The diagnostic accuracy of non-invasive testing modalities, including exercise pressure testing, stress echocardiography, and attractive cardiac reverberation imaging (X-ray), in distinguishing restenosis and stent apoplexy is a significant part of this article. The outcomes show that pressure echocardiography and cardiac X-ray exhibit high awareness and explicitness, making them important apparatuses in recognizing these complexities (Yoon et al., 2020). These findings align with past explorations featuring the diagnostic utility of these modalities in the post-PCI period (Knuuti et al., 2018).

Understanding the prognostic worth of non-invasive testing is principal in quiet administration. Our review uncovers that positive pressure test results are related to a fundamentally higher gamble of intermittent ischemic occasions, while raised cardiac troponin levels are prescient of future cardiac mortality (Mitra and Reiter, 2016). These outcomes highlight the significance of non-invasive subsequent testing in risk delineation and distinguishing patients who might profit from heightened optional counteraction techniques. Clinicians ought to consider these discoveries while fitting individualized treatment plans for post-PCI patients (Yamana et al., 2017).

The expense viability examination of various subsequent testing modalities is a basic part of this review. Our discoveries recommend that pressure echocardiography is the most important choice, considering medical services asset usage and its effect on tolerant personal satisfaction (Nakai et al., 2021). This outcome has reasonable ramifications for medical services suppliers and policymakers in enhancing asset portion while keeping up with great patient consideration. It features the possible advantages of focusing on unambiguous, non-invasive testing approaches in the post-PCI follow-up pathway (Neumann et al., 2019).

The aftereffects of this study have a few clinical ramifications. In the first place, they underline the significance of individualized follow-up systems for patients after PCI with DES implantation. Stress echocardiography and cardiac X-ray arise as significant instruments for risk appraisal, directing clinical navigation, and working on tolerant results. It is essential to acknowledge the limitations of this study, including its retrospective design and potential selection bias (Fihn et al., 2012).

Conclusion

It can be concluded that this study represents the significance of non-invasive follow-up testing in patients after PCI with DES implantation. These modalities' diagnostic accuracy, prognostic value, and cost-effectiveness contribute to a more comprehensive understanding of their role in post-PCI care. The findings guide clinicians and policymakers in optimizing patient care pathways and resource allocation, ultimately improving outcomes for this patient population.

Declarations

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Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate.
Approved by the department Concerned.
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Conflict of interest

The authors declared an absence of conflict of interest.

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