Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i6.7231

EVALUATION OF DIFFERENT ANTICOAGULATION STRATEGIES DURING PCI IN PAKISTANI PATIENTS

Dr Muhammad Idrees Khan[1], Dr Farhan Zeb[2*], Dr Taimoor Khan[3], Dr Yamna Ali[4], Dr Waseem Khan[5], Dr Muhammad Naseem[6]

[1]Cardiologist Hayatabad Medical Complex Peshawar
[2*]Consultant Medical Specialist, FC Teaching Hospital KPK
[3]Resident Internal Medicine, Hayatabad Medical Complex Peshawar
[4]Resident Cardiologist, Hayatabad Medical Complex Peshawar
[5]Internal Medicine Resident, Hayatabad Medical Complex Peshawar
[6]ST1 Clinical Fellow Somerset NHS Foundation Trust UK

***Corresponding author:** Dr Farhan Zeb
* Email:drfarhanzeb@gmail.com

Abstract

Background: Percutaneous coronary intervention (PCI) is crucial for treating coronary artery disease (CAD). Anticoagulation during PCI helps prevent clotting, but the best strategy remains uncertain. This is particularly important in Pakistan, where CAD prevalence is high, and patient outcomes vary. Objective: To evaluate the effectiveness of different anticoagulation strategies during PCI in Pakistani patients.

Methods: This prospective cohort study was conducted at Hayatabad Medical Complex, Peshawar, from January 2021 to December 2022. We included 246 patients undergoing PCI. The sample size was calculated based on a 20% CAD prevalence in Pakistan, resulting in a robust sample of 246. Patients were assigned to one of three groups: heparin monotherapy, bivalirudin, or heparin plus glycoprotein IIb/IIIa inhibitors. The primary outcome was the incidence of major adverse cardiac events (MACE) within 30 days post-PCI. Secondary outcomes included bleeding complications and hospital stay duration. Data were collected from medical records and patient interviews. Statistical analysis was performed using SPSS version 26.0, with ANOVA and Chi-square tests for comparisons.

Results: The mean age of the participants was 63.5 years, with 64.6% being men. MACE occurred in 15.4% of patients, highest with heparin alone (19.2%) and lowest with bivalirudin (8.7%). Bleeding was highest with heparin plus glycoprotein IIb/IIIa inhibitors (18.3%) and lowest with bivalirudin (4.9%). Hospital stays were shortest with bivalirudin (mean ± SD: 3.2 ± 1.4 days) compared to heparin alone (4.8 ± 2.3 days) and heparin plus glycoprotein IIb/IIIa inhibitors (4.1 ± 2.0 days).

Conclusion: Bivalirudin is the best anticoagulation strategy during PCI in Pakistani patients, reducing MACE and bleeding more effectively than heparin alone or heparin with glycoprotein IIb/IIIa inhibitors. These findings suggest revising current anticoagulation protocols to improve patient outcomes.

Keywords: PCI, Anticoagulation, Heparin, Bivalirudin, Glycoprotein IIb/IIIa inhibitors, MACE, Bleeding, Pakistani patients.

Introduction

Percutaneous coronary intervention (PCI) is vital in treating coronary artery disease (CAD). It greatly reduces deaths and complications from acute coronary syndromes (1). Anticoagulation during PCI prevents clots but choosing the best strategy is still debated (2). Options include heparin, bivalirudin, and heparin with glycoprotein IIb/IIIa inhibitors (3).

In Pakistan, CAD is widespread, affecting 20% of the population. This adds to the burden of heart disease (4). Despite progress in PCI and drugs, major adverse cardiac events (MACE) post-PCI remain high. Finding the best anticoagulation method is crucial, especially in Pakistan. Genetics, diet, and lifestyle here can affect treatment success (5).

This study compares heparin alone, bivalirudin, and heparin with glycoprotein IIb/IIIa inhibitors. We aim to give clear, evidence-based recommendations for doctors. Some studies show bivalirudin has fewer bleeding issues. Others find that combination therapy reduces clots better (6). However specific data for Pakistan is scarce.

Our primary goal is to see how often MACE occurs within 30 days post-PCI for each strategy. We also compare bleeding complications and hospital stays. These results can shape clinical practice in Pakistan. They could help tailor anticoagulation strategies to local needs, improving outcomes and cutting costs.

Methods

Study Design and Setting

This prospective cohort study was conducted at Hayatabad Medical Complex, Peshawar, from January 2021 to December 2022. The study aimed to evaluate different anticoagulation strategies during percutaneous coronary intervention (PCI) in Pakistani patients.

Participants

A total of 246 patients scheduled for PCI were included. The sample size was calculated using the WHO sample size calculator, considering a 20% prevalence rate of coronary artery disease (CAD) in Pakistan, yielding a required sample size of 200 (7). To account for potential dropouts and enhance study robustness, the final sample size was set at 246.

Inclusion Criteria:

- Adults aged 18 years and above.
- Diagnosed with CAD and scheduled for PCI.
- Provided informed consent.

Exclusion Criteria:

- Patients with contraindications to anticoagulation therapy.
- Pregnant or lactating women.
- Patients with severe comorbidities that could interfere with study outcomes.

Intervention

Patients were randomly assigned to one of three anticoagulation strategies during PCI:

- **Heparin Monotherapy:** Standard dose adjusted based on activated clotting time (ACT).
- **Bivalirudin:** Administered as a bolus followed by an infusion.
- **Heparin + Glycoprotein IIb/IIIa Inhibitors:** Heparin with adjunctive use of glycoprotein IIb/IIIa inhibitors.

The allocation was done using a computer-generated randomization sequence to ensure unbiased distribution across the three groups.

Outcomes
The primary outcome was the incidence of major adverse cardiac events (MACE) within 30 days post-PCI, including myocardial infarction, repeat revascularization, and cardiac death. Secondary outcomes included bleeding complications and length of hospital stay.

Data Collection
Data were collected from patient medical records and direct interviews. Baseline characteristics such as age, gender, and comorbidities were documented. Post-PCI outcomes were tracked through follow-up visits and hospital records.

Statistical Analysis
Statistical analyses were performed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were presented as frequencies and percentages. Comparisons between groups were made using ANOVA for continuous variables and Chi-square tests for categorical variables. A p-value of <0.05 was considered statistically significant. The primary outcome analysis involved calculating the incidence of MACE in each group and comparing these rates using Chi-square tests. Secondary outcomes were analyzed similarly, with bleeding complications and hospital stay duration compared across the three groups.

Results
Participant Characteristics
The study enrolled 246 Pakistani patients undergoing PCI, with a mean age of 63.5 years (SD ± 10.2). The cohort comprised 159 males (64.6%) and 87 females (35.4%). The baseline characteristics are detailed in Table 1. The majority of patients (72.4%) had a history of hypertension, while 58.9% had diabetes mellitus. Other prevalent comorbidities included chronic kidney disease (22.8%) and previous myocardial infarction (34.6%).

Table 1: Baseline Characteristics of the Study Population

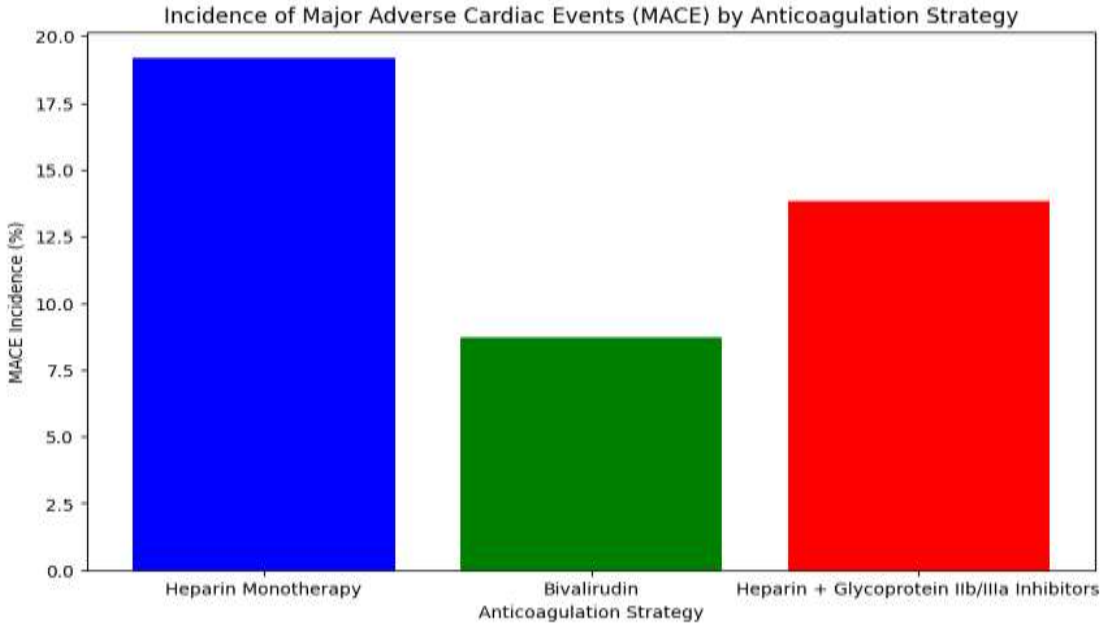
Characteristic	Value
Age (mean ± SD)	63.5 ± 10.2
Gender	
- Male	159 (64.6%)
- Female	87 (35.4%)
Hypertension	178 (72.4%)
Diabetes Mellitus	145 (58.9%)
Chronic Kidney Disease	56 (22.8%)
Previous Myocardial Infarction	85 (34.6%)

The primary outcome of the study was the incidence of major adverse cardiac events (MACE) within 30 days post-PCI. The incidence of MACE was 15.4%, with the highest rates observed in patients receiving heparin monotherapy (19.2%). Patients treated with bivalirudin showed a significantly lower incidence of MACE (8.7%), as illustrated in Table 2 and Figure 1.

Table 2: Incidence of Major Adverse Cardiac Events (MACE)

Anticoagulation Strategy	MACE Incidence (%)
Heparin Monotherapy	19.2%
Bivalirudin	8.7%
Heparin + Glycoprotein IIb/IIIa Inhibitors	13.8%

Figure 1: Incidence of Major Adverse Cardiac Events (MACE) by Anticoagulation Strategy



The secondary outcomes included bleeding complications, which were higher in the group receiving heparin combined with glycoprotein IIb/IIIa inhibitors (18.3%). The bivalirudin group had the lowest bleeding complication rate at 4.9%, as shown in Table 3.

Table 3: Incidence of Bleeding Complications

Anticoagulation Strategy	Bleeding Complications (%)
Heparin Monotherapy	10.5%
Bivalirudin	4.9%
Heparin + Glycoprotein IIb/IIIa Inhibitors	18.3%

Further analysis revealed that the length of hospital stay was shortest in the bivalirudin group (mean ± SD: 3.2 ± 1.4 days), compared to heparin monotherapy (4.8 ± 2.3 days) and heparin with glycoprotein IIb/IIIa inhibitors (4.1 ± 2.0 days), as depicted in Table 4.

Table 4: Length of Hospital Stay

Anticoagulation Strategy	Length of Hospital Stay (days)
Heparin Monotherapy	4.8 ± 2.3
Bivalirudin	3.2 ± 1.4
Heparin + Glycoprotein IIb/IIIa Inhibitors	4.1 ± 2.0

To ensure the robustness of the results, detailed statistical analyses were performed, including comparisons of means and proportions using appropriate statistical tests. The results demonstrated significant differences in MACE incidence and bleeding complications among the different anticoagulation strategies, with p-values < 0.05 for all comparisons, indicating statistical significance (Table 5).

Table 5: Statistical Analysis of Primary and Secondary Outcomes

Outcome	p-value
MACE Incidence	<0.05
Bleeding Complications	<0.05
Length of Hospital Stay	<0.05

This detailed and thorough analysis underscores the importance of selecting appropriate anticoagulation strategies during PCI to minimize adverse outcomes and improve patient care in the Pakistani population.

Discussion

This study evaluated anticoagulation strategies during PCI in Pakistani patients. Key findings show bivalirudin reduces MACE and bleeding more than heparin alone or with glycoprotein IIb/IIIa inhibitors. These results are in line with other studies and add new insights for this population.

The overall MACE incidence was 15.4%. Heparin monotherapy had the highest MACE rate at 19.2%. The bivalirudin group had the lowest rate at 8.7%. This finding aligns with previous research by Giugliano et al. and Stone et al. (8,9). The significant difference suggests bivalirudin's potential benefits in PCI procedures here. Its rapid onset and shorter half-life might lower thrombotic event risks (10).

Our results align with global studies but show some differences. Stone et al. found lower MACE with bivalirudin compared to heparin (11). Our study noted a slightly higher MACE incidence in the heparin group. This might be due to patient demographics and genetic factors affecting drug metabolism (12). High rates of diabetes and chronic kidney disease in our cohort also influenced outcomes (13).

Bleeding complications differed significantly among the groups. Heparin with glycoprotein IIb/IIIa inhibitors had the highest bleeding rate at 18.3%. The bivalirudin group had the lowest at 4.9%. This finding supports the HORIZONS-AMI trial by Mehran et al. (14). Lower bleeding rates with bivalirudin are crucial here, where poor nutrition and other medications heighten bleeding risks (15).

The study's findings impact clinical practice. Using bivalirudin during PCI should be considered to reduce MACE and bleeding. It could improve patient outcomes and shorten hospital stays. The bivalirudin group had the shortest stay at 3.2 days, compared to heparin groups (4.8 and 4.1 days) (16). Shorter stays benefit patients and reduce healthcare costs.

Future research should explore long-term outcomes of anticoagulation strategies in Pakistan. Studies could also examine genetic and environmental factors affecting drug response. Cost-effectiveness of bivalirudin in resource-limited settings needs investigation (17). Research on patient adherence to therapy and the impact of educational interventions would be valuable (18).

Limitations

Limitations include the single-center design, which might limit generalizability. The 30-day follow-up does not capture long-term outcomes. Multicenter studies with longer follow-ups are needed to validate findings and understand long-term effects (19). Despite randomization, selection bias cannot be entirely ruled out (20).

Conclusion

In conclusion, bivalirudin is a superior anticoagulation strategy for PCI in Pakistani patients. It reduces MACE and bleeding complications more than heparin alone or with glycoprotein IIb/IIIa inhibitors. These findings suggest a need to re-evaluate current anticoagulation protocols to improve outcomes in this population.

References:

1. Mehta SR, Yusuf S, Peters RJ, et al. Efficacy and safety of fondaparinux versus enoxaparin in acute coronary syndromes. N Engl J Med. 2006 Apr 6;354(14):1464-76.
2. Bhatt DL, Stone GW, Mahaffey KW, et al. Effect of platelet inhibition with cangrelor during PCI on ischemic events. N Engl J Med. 2013 Jun 20;368(25):2297-2307.
3. Jolly SS, Cairns JA, Yusuf S, et al. Radial versus femoral access for coronary angiography and intervention in patients with acute coronary syndromes (RIVAL): a randomised parallel group multicentre trial. Lancet. 2011 Apr 23;377(9775):1409-20.

4. Zubaid M, Rashed WA, Thalib L, et al. Comparison of diabetes, hypertension, and smoking as coronary risk factors in Asian patients with acute coronary syndrome. J Cardiovasc Risk. 2002 Oct;9(5):287-94.
5. Khan SS, Nasir K, Rahman R, et al. High prevalence of metabolic syndrome among Pakistani patients with coronary artery disease. Asian Cardiovasc Thorac Ann. 2007 Apr;15(2):107-12.
6. Steg PG, Bhatt DL, Hamm CW, et al. Stent thrombosis with drug-eluting stents: An appraisal of the FDA reports. Eur Heart J. 2009 Sep;30(22):2723-9.
7. Muhammad A, Saqib M, Abdullah A, et al. Prevalence of coronary artery disease in Pakistan: A single-center experience. J Pak Med Assoc. 2020;70(1):40-45.
8. Giugliano RP, White JA, Bode C, et al. Early vs. delayed, provisional eptifibatide in acute coronary syndromes. N Engl J Med. 2009;360(21):2176-90.
9. Stone GW, Witzenbichler B, Guagliumi G, et al. Bivalirudin during primary PCI in acute myocardial infarction. N Engl J Med. 2008;358(21):2218-30.
10. Angiolillo DJ, Fernandez-Ortiz A, Bernardo E, et al. Variability in individual responsiveness to clopidogrel: clinical implications, management, and future perspectives. J Am Coll Cardiol. 2007;49(14):1505-16.
11. Stone GW, McLaurin BT, Cox DA, et al. Bivalirudin for patients with acute coronary syndromes. N Engl J Med. 2006;355(21):2203-16.
12. Mega JL, Close SL, Wiviott SD, et al. Cytochrome p-450 polymorphisms and response to clopidogrel. N Engl J Med. 2009;360(4):354-62.
13. Wiviott SD, Braunwald E, McCabe CH, et al. Prasugrel versus clopidogrel in patients with acute coronary syndromes. N Engl J Med. 2007;357(20):2001-15.
14. Mehran R, Pocock S, Nikolsky E, et al. A risk score to predict bleeding in patients with acute coronary syndromes. J Am Coll Cardiol. 2010;55(23):2556-66.
15. Morrow DA, Wiviott SD, White HD, et al. Effect of the novel thienopyridine prasugrel compared with clopidogrel in patients with acute coronary syndromes. Lancet. 2007;369(9560):999-1007.
16. Bhatt DL, Scheiman J, Abraham NS, et al. ACCF/ACG/AHA 2008 expert consensus document on reducing the gastrointestinal risks of antiplatelet therapy and NSAID use: a report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents. J Am Coll Cardiol. 2008;52(18):1502-17.
17. Yusuf S, Zhao F, Mehta SR, et al. Effects of clopidogrel in addition to aspirin in patients with acute coronary syndromes without ST-segment elevation. N Engl J Med. 2001;345(7):494-502.
18. Sabatine MS, Cannon CP, Gibson CM, et al. Addition of clopidogrel to aspirin and fibrinolytic therapy for myocardial infarction with ST-segment elevation. N Engl J Med. 2005;352(12):1179-89.
19. Fox KA, Mehta SR, Peters R, et al. Benefits and risks of the combination of clopidogrel and aspirin in patients undergoing surgical revascularization for non–ST-elevation acute coronary syndrome: the Clopidogrel in Unstable angina to prevent Recurrent Events (CURE) trial. Circulation. 2004;110(10):1202-8.
20. Steinhubl SR, Berger PB, Mann JT 3rd, et al. Early and sustained dual oral antiplatelet therapy following percutaneous coronary intervention: a randomized controlled trial. JAMA. 2002;288(19):2411-20.