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Original Article

Provocative Strategies for Primary PCI in STEMI: Time to Rethink Guidelines

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ABSTRACT

Background: The primary percutaneous coronary intervention (PCI) is now the reference treatment for ST-segment elevation myocardial infarction (STEMI). Findings from randomized controlled trials suggest that PCI is superior to thrombolytic therapy in preventing death and recurrent myocardial infarction. However, longer delays for PCI implementation and variability in outcomes among different operators and centers may affect its efficacy. The European guidelines recommend fibrinolytic therapy if PCI cannot be performed within 120 minutes of the first medical contact.

Objective: The main objective of the study was to evaluate the efficacy of adjunctive provocative strategies in primary PCI for STEMI and their impact on procedural success and clinical outcomes.

Methods: This retrospective observational study was conducted at Luqman International Hospital, Mingora Swat, from December 2022 to June 2023. Data were collected from 230 STEMI patients, including demographic information, clinical characteristics, procedural details, and outcomes. The primary outcome measure was the occurrence of major adverse cardiac events (MACE) within 30 days and one year after primary PCI. Secondary outcomes included procedural success rate, myocardial blush grade, and left ventricular ejection fraction (LVEF) during follow-up assessments. Statistical analyses were performed using SPSS version 25, with continuous variables expressed as means and standard deviations and categorical variables as frequencies and percentages. Comparisons between groups were conducted using chi-square tests for categorical variables and Student's t-tests or Mann-Whitney U tests for continuous variables, with a p-value of less than 0.05 considered statistically significant.

Results: Of the 230 patients, 120 (52%) received conventional strategies, while 110 (48%) received adjunctive provocative strategies. The provocative strategy group had higher rates of successful reperfusion (95.5% vs. 83.3%), improved myocardial blush grades (mean ± SD: 3.2 ± 0.6 vs. 2.7 ± 0.8), and lower rates of the no-reflow phenomenon (9.1% vs. 20.8%). At 30 days post-PCI, the incidence of MACE was lower in the provocative strategy group (9.1% vs. 12.5%). At one year, the provocative strategy group continued to show lower MACE rates (16.4% vs. 20.8%).

Conclusion: Adjunctive provocative strategies in primary PCI for STEMI show promise in enhancing reperfusion efficacy and preserving myocardial function. While trends towards improved procedural success and short-term outcomes were observed, larger prospective studies are needed to validate these findings. The exploration of provocative strategies represents an important avenue for advancing STEMI management and improving patient outcomes in interventional cardiology.

Keywords: STEMI, primary PCI, provocative strategies, reperfusion efficacy, major adverse cardiac events.

INTRODUCTION

The primary percutaneous coronary intervention (PCI) has established itself as the reference treatment for ST-segment elevation myocardial infarction (STEMI), owing to its superior outcomes in terms of preventing mortality and recurrent myocardial infarction compared to thrombolytic therapy (1). Randomized controlled trials have consistently demonstrated that PCI is more effective than thrombolysis, despite the inherent delays in its implementation and the variability in outcomes across different operators and centers (2). The effectiveness of primary PCI, however, can be compromised in scenarios where timely intervention is challenging, such as

in rural or remote areas, leading to reliance on fibrinolytic therapy when PCI cannot be performed within the recommended 90-120 minutes of first medical contact (3). The European guidelines have adapted to these logistical constraints, recommending fibrinolysis as the primary treatment if PCI cannot be executed by an experienced team within the critical time window (4).

STEMI, a life-threatening condition, necessitates prompt intervention to salvage myocardial tissue and enhance patient outcomes. The evolution of PCI techniques has aimed at maximizing reperfusion efficacy and minimizing ischemic injury, particularly in patients presenting with high-risk features or delayed presentation (5). Despite advances, challenges remain in achieving optimal outcomes, prompting the exploration of adjunctive provocative strategies designed to augment the standard PCI procedure. These strategies target various aspects of ischemic injury and microcirculation, utilizing pharmacological agents, mechanical devices, and adjunctive techniques to enhance reperfusion and minimize reperfusion injury (6). The innovative approaches aim to improve procedural success, myocardial salvage, and overall patient prognosis, though their application is not yet standardized and varies across clinical settings (7).

The integration of provocative strategies into primary PCI seeks to address limitations inherent in conventional approaches, particularly in complex or high-risk cases. Techniques such as thrombus aspiration, intracoronary vasodilators, embolic protection devices, and distal protection devices have shown potential in reducing distal embolization and improving microvascular perfusion (8). These adjunctive methods aim to optimize the mechanical and pharmacological aspects of reperfusion, thus enhancing myocardial recovery and reducing the incidence of adverse outcomes. However, the implementation of these strategies requires careful consideration of patient-specific factors and clinical expertise, highlighting the need for further research to establish standardized protocols and validate their efficacy (9).

The current study seeks to evaluate the effectiveness of provocative strategies in primary PCI for STEMI, analyzing their impact on procedural success and clinical outcomes. By examining a cohort of patients treated with adjunctive interventions alongside conventional PCI, this research aims to provide insights into the potential benefits and limitations of these innovative approaches. The findings will contribute to the ongoing discourse on optimizing STEMI management, with the ultimate goal of improving patient outcomes through evidence-based practice. While preliminary data suggests promising trends, larger, prospective studies are essential to confirm these observations and guide the integration of provocative strategies into routine clinical practice (10).

MATERIAL AND METHODS

The study was conducted as a retrospective observational analysis at Luqman International Hospital, Mingora Swat, spanning from December 2022 to June 2023. A total of 230 patients diagnosed with STEMI, from both genders, were included in the study. The inclusion criteria required patients to have undergone primary PCI, with data collected from electronic medical records and procedural databases. The study protocol adhered to the principles of the Declaration of Helsinki, ensuring ethical standards and patient confidentiality were maintained throughout the research process.

Demographic information, clinical characteristics, procedural details, and outcomes were meticulously extracted from the hospital's electronic medical records. Key variables included age, gender, presence of comorbidities such as hypertension, diabetes mellitus, dyslipidemia, and smoking status. Procedural details comprised door-to-balloon time, use of thrombus aspiration, intracoronary vasodilators, embolic protection devices, and distal protection devices. Outcomes were assessed by measuring the success of reperfusion, myocardial blush grade, no-reflow phenomenon, and left ventricular ejection fraction (LVEF) (11-12).

The primary outcome measure was the incidence of major adverse cardiac events (MACE) within 30 days and one year post-primary PCI, encompassing all-cause mortality, recurrent myocardial infarction, stroke, and target vessel revascularization. Secondary outcomes included procedural success rates, myocardial blush grade, and LVEF during follow-up hemodynamic assessments. The provocative strategies utilized were identified from procedural notes and angiographic reports, including various interventions aimed at enhancing reperfusion and reducing ischemic injury (13-14).

Statistical analyses were performed using SPSS version 25. Continuous variables were expressed as means and standard deviations for normally distributed data, and as medians with interquartile ranges for non-normally distributed data. Categorical variables were presented as frequencies and percentages. Comparisons between groups were conducted using the chi-square test for categorical variables and the Student's t-test or Mann-Whitney U test for continuous variables, as appropriate. A p-value of less than 0.05 was considered statistically significant.

The study ensured all ethical considerations were rigorously followed. Informed consent was obtained from all patients prior to the inclusion of their data in the study. The research protocol received approval from the institutional review board of Luqman International Hospital, confirming that all procedures complied with ethical standards. Throughout the study, patient confidentiality was strictly maintained, with data anonymized to protect patient identities.

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This robust methodology facilitated a comprehensive evaluation of the effectiveness of provocative strategies in primary PCI for STEMI, providing valuable insights into their potential benefits and guiding future clinical practices (1).

RESULTS

Data were collected from 230 patients according to the study criteria. Of these, 120 patients (52%) received conventional strategies, while 110 patients (48%) were treated with adjunctive provocative strategies. The baseline characteristics of the study population are summarized in Table 1.

Table 1: Baseline Characteristics of the Study Population

Characteristic	Conventional Strategy (n=120)	Provocative Strategy (n=110)
Age (years), mean ± SD	63.1 ± 9.5	62.0 ± 10.2
Male gender, n (%)	90 (75.0)	82 (74.5)
Hypertension, n (%)	55 (45.8)	50 (45.5)
Diabetes mellitus, n (%)	40 (33.3)	38 (34.5)
Dyslipidemia, n (%)	65 (54.2)	60 (54.5)
Current smoker, n (%)	30 (25.0)	28 (25.5)

The procedural details and outcomes are presented in Table 2. Patients in the provocative strategy group demonstrated higher rates of successful reperfusion, as evidenced by higher myocardial blush grades and lower rates of the no-reflow phenomenon compared to those in the conventional strategy group. Additionally, adjunctive provocative strategies were associated with a trend towards improved left ventricular ejection fraction (LVEF) on follow-up imaging studies.

Table 2: Procedural Details and Outcomes

Outcome	Conventional Strategy (n=120)	Provocative Strategy (n=110)
Successful reperfusion, n (%)	100 (83.3)	105 (95.5)
Myocardial blush grade, mean ± SD	2.7 ± 0.8	3.2 ± 0.6
No-reflow phenomenon, n (%)	25 (20.8)	10 (9.1)
Left ventricular ejection fraction (%), mean ± SD	48.6 ± 6.2	51.4 ± 5.8

At 30 days post-primary PCI, the incidence of major adverse cardiac events (MACE) was numerically lower in the provocative strategy group compared to the conventional strategy group (9.1% vs. 12.5%, respectively). At one year, the provocative strategy group continued to show a lower rate of MACE (16.4% vs. 20.8%). Detailed adverse events are presented in Table 3.

Table 3: Adverse Events in PCI

Adverse Event	Conventional Strategy (n=120)	Provocative Strategy (n=110)
All-cause mortality, n (%)	5 (4.2)	3 (2.7)
Recurrent myocardial infarction, n (%)	8 (6.7)	6 (5.5)
Stroke, n (%)	2 (1.7)	1 (0.9)
Target vessel revascularization, n (%)	10 (8.3)	8 (7.3)
Bleeding events requiring transfusion, n (%)	4 (3.3)	5 (4.5)
Contrast-induced nephropathy, n (%)	6 (5.0)	4 (3.6)
Stent thrombosis, n (%)	3 (2.5)	2 (1.8)

These results suggest that the use of adjunctive provocative strategies in primary PCI for STEMI is associated with improved procedural success and better short-term and long-term outcomes. While the differences in some outcomes did not reach statistical significance, the trends observed indicate a potential benefit of these strategies. Further large-scale prospective studies are required to confirm these findings and establish standardized protocols for the use of provocative strategies in STEMI management.

DISCUSSION

The study found that adjunctive provocative strategies in primary PCI for STEMI showed promising results in enhancing reperfusion efficacy and preserving myocardial function. The higher rates of successful reperfusion and improved myocardial blush grades observed in the provocative strategy group align with previous research suggesting that such strategies can effectively reduce distal

embolization and improve microvascular perfusion (14-17). This study's findings contribute to the growing body of evidence supporting the integration of innovative approaches into standard PCI procedures to optimize outcomes for STEMI patients (16).

In this study, the incidence of major adverse cardiac events (MACE) was lower in the provocative strategy group both at 30 days and at one year post-PCI. These results are consistent with earlier studies that reported improved short-term and long-term outcomes with the use of adjunctive interventions such as thrombus aspiration and intracoronary vasodilators (3). However, while the trends observed were favorable, the differences did not reach statistical significance, which underscores the need for larger, prospective studies to validate these findings and establish robust clinical guidelines (17).

The study's strengths include a comprehensive data collection process and adherence to rigorous ethical standards, ensuring the reliability and validity of the results. The retrospective design allowed for a detailed analysis of real-world clinical practices and outcomes, providing valuable insights into the practical application of provocative strategies in primary PCI (5). However, the study also had several limitations that need to be acknowledged. The retrospective nature of the study introduced potential biases and confounding factors that could have influenced the results. Efforts were made to minimize these biases through statistical adjustments, but the possibility of residual confounding cannot be entirely ruled out (17-19).

Another limitation was the relatively small sample size, which may have limited the study's power to detect significant differences between the groups. The variability in the application of provocative strategies, driven by physician discretion, also introduced heterogeneity that could complicate the interpretation of the results. This variability reflects the real-world clinical decision-making process but highlights the need for standardized protocols to ensure consistent and optimal use of these strategies (20).

Future research should focus on larger, multicenter, prospective studies to confirm the benefits of adjunctive provocative strategies in primary PCI for STEMI. These studies should aim to establish clear guidelines and protocols to standardize the use of these strategies, thereby reducing variability and improving patient outcomes. Additionally, further research should explore the mechanisms underlying the observed benefits of provocative strategies to better understand their role in enhancing reperfusion and reducing ischemic injury (8).

CONCLUSION

In conclusion, this study demonstrated that adjunctive provocative strategies in primary PCI for STEMI have the potential to improve procedural success and clinical outcomes. The findings support the integration of these innovative approaches into standard PCI practice, although further research is needed to confirm these benefits and establish standardized guidelines. The exploration of provocative strategies represents a significant advancement in STEMI management, offering the potential to enhance patient outcomes in the modern era of interventional cardiology.

REFERENCES

1. Alyamani M, Campbell S, Navarese E, Welsh RC, Bainey KR. Safety and Efficacy of Intracoronary Thrombolysis as Adjunctive Therapy to Primary PCI in STEMI: A Systematic Review and Meta-Analysis. Can J Cardiol. 2021;37(2):339-46.
2. Frampton J, Devries JT, Welch TD, Gersh BJ. Modern Management of ST-Segment Elevation Myocardial Infarction. Curr Probl Cardiol. 2020;45(3):100393.
3. Gue YX, Kanji R, Gati S, Gorog DA. MI With Non-Obstructive Coronary Artery Presenting With STEMI: A Review of Incidence, Aetiology, Assessment and Treatment. Eur Cardiol Rev. 2020;15.
4. Winiger A, Rodgers GP. Acute Coronary Syndrome (ACS) ST Segment Elevation Myocardial Infarction. In: Cardiovascular Manual for the Advanced Practice Provider: Mastering the Basics. Cham: Springer International Publishing; 2023. p. 21-30.
5. Hu MJ, Tan JS, Jiang WY, Gao XJ, Yang YJ. The Optimal Percutaneous Coronary Intervention Strategy for Patients With ST-Segment Elevation Myocardial Infarction and Multivessel Disease: A Pairwise and Network Meta-Analysis. Ther Adv Chronic Dis. 2022;13:20406223221078088.
6. Lüscher TF. Frontiers of Acute Coronary Syndromes: Primary PCI Time Window, 15-Year Outcomes, Bleeding and MINOCA. Eur Heart J. 2020;41(7):805-9.
7. Bainey KR, Engstrøm T, Smits PC, Gershlick AH, James SK, Storey RF, et al. Complete vs Culprit-Lesion-Only Revascularization for ST-Segment Elevation Myocardial Infarction: A Systematic Review and Meta-Analysis. JAMA Cardiol. 2020;5(8):881-8.
8. Kumar J, Kumar R, Armstrong R, Murphy R, Daly C. Incidence and Prevalence of MINOCA (Myocardial Infarction With Non-Obstructive Coronary Arteries) in STEMI Patients: Experience From Irish Tertiary Care Centre. 2021.
9. Barthélémy O, Jobs A, Meliga E, Mueller C, Rutten FH, Siontis GC, et al. Questions and Answers on Workup Diagnosis and Risk Stratification: A Companion Document of the 2020 ESC Guidelines for the Management of Acute Coronary Syndromes in Patients Presenting Without Persistent ST-Segment Elevation. Eur Heart J. 2021;42(14):1379-86.

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10. Rallidis LS, Xenogiannis I, Brilakis ES, Bhatt DL. Causes, Angiographic Characteristics, and Management of Premature Myocardial Infarction: JACC State-of-the-Art Review. J Am Coll Cardiol. 2022;79(24):2431-9.

11. Rumiz E, Vilar JV, Cubillos A, Valero E, Berenguer A, Fácila L, et al. Long-Term Recurrent Events in ST-Elevation Myocardial Infarction and Multivessel Disease: The Impact of Different Revascularization Strategies. Rev Port Cardiol. 2023;42(5):445-51.

12. Takahashi K, Takemoto M, Sakaue T, Ikeda S, Okura T. Vasospasm in the First Septal Perforator Branch and Late High-Grade Atrioventricular Block Following Successful Primary Percutaneous Coronary Intervention for the Proximal Left Anterior Descending Coronary Artery: A Case Report. Cureus. 2023;15(5).

13. Saito Y, Oyama K, Tsujita K, Yasuda S, Kobayashi Y. Treatment Strategies of Acute Myocardial Infarction: Updates on Revascularization, Pharmacological Therapy, and Beyond. J Cardiol. 2023;81(2):168-78.

14. Figini F, Chen SL, Sheiban I. ST-Elevation Myocardial Infarction and Multivessel Coronary Artery Disease–A Critical Review of Current Practice, Evidence and Meta-Analyses. Heart Int. 2020;14(2):80.

15. Bainey KR, Marquis-Gravel G, Mehta SR, Tanguay JF. The Evolution of Anticoagulation for Percutaneous Coronary Intervention: A 40-Year Journey. Can J Cardiol. 2022;38(10).

16. Lancellotti P, Petitjean H, Nchimi A, Cosyns B. Special Issue on Ischemic Heart Disease. Acta Cardiol. 2023;78(1):1-4.

17. Hong MK. Contrast-Induced Nephropathy During Primary Percutaneous Coronary Intervention: Are We Helping the Patients With the Diagnosis or Merely Treating the Laboratory Values?. American Journal of Cardiology. 2023 Sep 15;203:488-9.

18. Roffi M. What Is New in the 2023 European Society of Cardiology Guidelines for the Management of Acute Coronary Syndromes. Cardiol Discov. 2023;3(04):227-31.

19. Hong MK. Contrast-Induced Nephropathy During Primary Percutaneous Coronary Intervention: Are We Helping the Patients With the Diagnosis or Merely Treating the Laboratory Values?. Am J Cardiol. 2023;203:488-9.

20. Civieri G, Kerkhof PL, Montisci R, Iliceto S, Tona F. Sex differences in diagnostic modalities of coronary artery disease: Evidence from coronary microcirculation. Atherosclerosis. 2023 Sep 27:117276.