Journal of Health and Rehabilitation Research 2791-156X JHRR

For contributions to JHRR, contact at email: editor@jhrlmc.com

Original Article

Long Term Outcome of Percutaneous Coronary Intervention in Patients with Unprotected Left Main Disease

Nasir Farooq[1]*, Muhammad Osama[2], Atta Ul Wadood[2]

[1]Registrar, Peshawar Institute of Cardiology, KPK, Pakistan.
[2]TMO, Peshawar Institute of Cardiology, KPK, Pakistan.
[3]Assistant Professor, Peshawar Institute of Cardiology, KPK, Pakistan.
Corresponding Author: Nasir Farooq; Registrar; Email: nasirfarooq_k@yahoo.com

Conflict of Interest: None.

Farooq N., et al. (2024). 4(1): DOI: https://doi.org/10.61919/jhrr.v4i1.419

ABSTRACT

Background: The management of unprotected left main coronary artery disease (LM CAD) poses a significant clinical challenge. Percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG) have been extensively compared, with PCI emerging as a viable option for specific patient subsets. Advancements in interventional cardiology, including drug-eluting stents and intravascular ultrasound, have improved PCI outcomes, yet long-term efficacy remains a subject of investigation.

Objective: This study aims to evaluate the long-term outcomes of PCI in patients with unprotected LM CAD, focusing on all-cause mortality, cardiac deaths, myocardial infarction, revascularization, and stroke.

Methods: A descriptive cross-sectional study was conducted at the Peshawar Institute of Cardiology, KPK, from November 2022 to October 2023. A total of 120 patients aged 55-70 years with LM disease undergoing PCI were included. Long-term outcomes were assessed after five years. Data analysis was performed using SPSS version 23, focusing on frequency and association of outcomes with gender.

Results: The study observed all-cause mortality in 15.0% (n=18) of the patients, cardiovascular mortality in 6.7% (n=8), myocardial infarction in 7.5% (n=9), revascularization in 14.2% (n=17), and stroke in 4.2% (n=5). Gender analysis revealed no significant difference in all-cause mortality (P=0.73), with a notable gender disparity in cardiovascular mortality favoring females (P=0.04). Revascularization and stroke rates did not significantly differ by gender.

Conclusion: PCI presents a favorable and safe long-term treatment option for patients with unprotected LM CAD, with significant outcomes in terms of mortality, myocardial infarction, revascularization, and stroke. The study supports the continued use of PCI in clinical practice, highlighting the necessity for further comparative research with CABG to optimize patient outcomes.

Keywords: Percutaneous coronary intervention, Left main coronary artery disease, Long-term outcomes, Coronary artery bypass grafting, Myocardial infarction, Revascularization.

INTRODUCTION

Coronary artery disease (CAD) remains a significant global health burden, leading to substantial morbidity and mortality. Among the various coronary arteries, the left main coronary artery stands out due to its critical role in supplying blood to a vast majority of the myocardium. Historically, coronary artery bypass grafting (CABG) has been the gold standard for treating significant obstructions within the left main coronary artery. However, recent decades have witnessed a paradigm shift with the evolution of percutaneous coronary intervention (PCI), which has emerged as a viable and increasingly preferred treatment modality for certain patients with left main disease (1-5).

Left main disease, characterized by significant stenosis or obstruction due to atherosclerosis in the left main coronary artery, poses a high risk for adverse cardiovascular outcomes, including myocardial infarction and death (6). The complex anatomical and clinical profile of the left main artery necessitates a careful treatment approach, traditionally favoring CABG. Yet, the advent of drug-eluting stents and advances in PCI techniques have significantly altered the management landscape of left main disease, challenging the traditional treatment hierarchy (7, 8).

Journal of Health and Rehabilitation Research 2791-156X JHRR

Approximately 3-5% of all coronary angiograms reveal the presence of left main stenosis. A stenosis exceeding 50% in the left main coronary artery correlates with a heightened risk of mortality, given that a significant lesion in this area jeopardizes at least 75% of the myocardium (9, 10). The early attempts to address left main PCI with plain old balloon angioplasty and bare-metal stents were met with less favorable outcomes (11, 12). However, the continuous advancements in PCI technology and methodology have marked a significant milestone in cardiovascular medicine. The integration of technological innovation, robust clinical research, and personalized patient care strategies have expanded the applicability of PCI as an alternative to CABG in selected cases.

This evolution reflects not just a technical advancement but a deeper understanding of patient-specific factors that influence treatment outcomes. The ongoing research and development in this field aim to further integrate PCI into the spectrum of therapeutic options for left main disease, offering customized and effective treatment solutions for a broader patient population afflicted with CAD. The objective of this study is to evaluate the long-term outcomes of percutaneous coronary intervention in patients with unprotected left main disease, thereby contributing to the refinement of treatment protocols and enhancing patient care in this high-risk population.

MATERIAL AND METHODS

This study, designed as a descriptive cross-sectional analysis, was carried out at the Peshawar Institute of Cardiology, KPK, spanning from November 2022 to October 2023, following the receipt of ethical approval from the hospital's ethical committee. The investigation targeted a cohort of 120 patients diagnosed with left main (LM) disease, with an age range of 55 to 70 years, encompassing both genders. The inclusion criteria were strictly adhered to, selecting only those patients who underwent percutaneous coronary intervention (PCI), performed in accordance with established interventional protocols by a seasoned cardiovascular surgeon with over five years of experience. Exclusion criteria were applied to patients deemed medically unfit for the surgical procedure. LM disease was meticulously defined as myocardial ischemia evidenced by a stenosis of 50% or greater in the left main coronary artery, in conjunction with the absence of a functioning bypass graft to either the left anterior descending or left circumflex arteries.

Data collection encompassed the systematic recording of patient demographics, clinical presentations, and procedural outcomes. The primary focus of the study was the long-term outcomes post-PCI, evaluated over a five-year period, specifically observing incidence rates of all-cause mortality, stroke, myocardial infarction, cardiac-specific death, and any instances of revascularization. Ethical considerations were paramount, with all participants providing informed consent prior to their inclusion in the study, ensuring compliance with ethical standards and respect for patient autonomy and confidentiality.

The data analysis was conducted utilizing SPSS version 23, employing appropriate statistical methods to examine the collected data. This included descriptive statistics to summarize the demographics and clinical characteristics of the patient population, as well as inferential statistics to explore the associations between PCI and the long-term outcomes of interest. The analysis aimed to identify significant predictors of adverse events following PCI in patients with LM disease, thereby contributing valuable insights into the efficacy and safety of this intervention in a high-risk patient population.

RESULTS

The study investigated the long-term outcomes of percutaneous coronary intervention in patients with unprotected left main disease, revealing significant findings regarding all-cause fatality, cardiovascular mortality, myocardial infarction, revascularization, and stroke.

One hundred twenty patients with LM PCI were selected for this study. Mean age was 62.87±4.58 years. Mean BMI was 27.25±1.50 kg/m2. Gender distribution showed that 71 (59.2%) were male while 49 (40.8%) were females. Frequency of diabetic patients was 29 (24.2%). Hypertensive patients' frequency was 51 (42.5%). Smokers were 22 (18.3%).

The frequency of these outcomes, detailed in Table 1, demonstrates that 15.0% (n=18) of the patients experienced all-cause mortality, while a majority, 85.0% (n=102), did not. Cardiovascular mortality was observed in 6.7% (n=8) of the cohort, with the remaining 93.3% (n=112) surviving without such events. Myocardial infarction was reported in 7.5% (n=9) of the cases, contrasting with 92.5% (n=111) who did not suffer from this complication. The need for any form of revascularization was noted in 14.2% (n=17) of the patients, whereas 85.8% (n=103) did not undergo further revascularization procedures. Stroke incidence was the lowest among the outcomes, affecting only 4.2% (n=5) of the patients, with 95.8% (n=115) remaining stroke-free.

Journal of Health and Rehabilitation Research 2791-156X JHRR

Table 1 Frequency of Long-Term Outcomes

Long-Term Outcomes	Number (N)	Percentage (%)
All-Cause Fatality		
Yes	18	15.0
No	102	85.0
Cardiovascular Mortality		
Yes	8	6.7
No	112	93.3
Myocardial Infarction		
Yes	9	7.5
No	111	92.5
Any Revascularization		
Yes	17	14.2
No	103	85.8
Stroke		
Yes	5	4.2
No	115	95.8

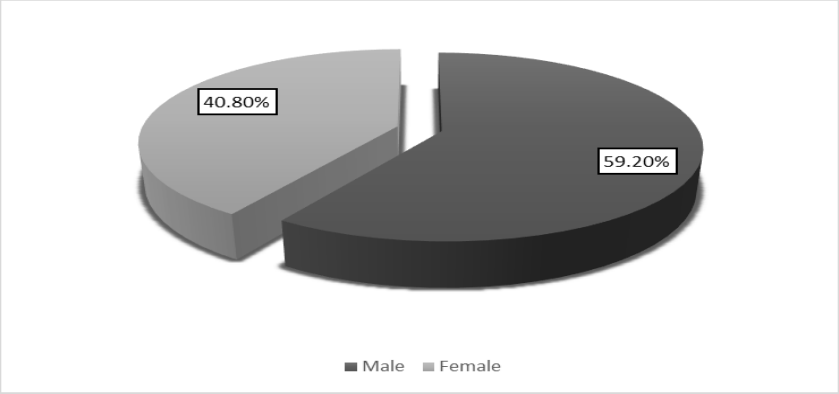

Figure 1 Gender

Table 2 Association Between Long-Term Outcomes and Gender

Long-Term Outcomes	Gender	Male (N, %)	Female (N, %)	P value
All-Cause Fatality	Yes	10 (55.6%)	8 (44.4%)	0.73
	No	61 (59.8%)	41 (40.2%)	
Cardiovascular Mortality	Yes	2 (25.0%)	6 (75.0%)	0.04
	No	69 (61.6%)	43 (38.4%)	
Myocardial Infarction	Yes	6 (66.7%)	3 (33.3%)	0.63
	No	65 (58.6%)	46 (41.4%)	
Any Revascularization	Yes	8 (47.1%)	9 (52.9%)	0.27
	No	63 (61.2%)	40 (38.8%)	
Stroke	Yes	2 (40.0%)	3 (60.0%)	0.37
	No	69 (60.0%)	46 (40.0%)	

The association between these long-term outcomes and gender, as shown in Table 2, provides an insightful perspective into the impact of gender on post-PCI prognosis. All-cause fatality was nearly evenly distributed between males (55.6%, n=10) and females (44.4%, n=8), with a P value of 0.73, indicating no significant gender difference. However, cardiovascular mortality exhibited a notable gender disparity, with 75.0% (n=6) of the events occurring in females compared to 25.0% (n=2) in males, resulting in a statistically significant P value of 0.04. Myocardial infarction rates appeared higher among males (66.7%, n=6) than females (33.3%, n=3), though the difference was not statistically significant (P=0.63). The need for revascularization was similarly distributed between genders,

with 47.1% (n=8) in males and 52.9% (n=9) in females (P=0.27). Lastly, stroke outcomes showed a slight female preponderance (60.0%, n=3) over males (40.0%, n=2), yet this difference did not reach statistical significance (P=0.37).

These findings underscore the variability in long-term outcomes following PCI for left main disease, highlighting the role of gender as a potential factor in the prognosis. Importantly, the significant difference in cardiovascular mortality between genders suggests that female patients may exhibit a higher risk, warranting further investigation into gender-specific management strategies and interventions.

DISCUSSION

In the realm of treating unprotected left main coronary artery disease (LM CAD), percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG) have been extensively compared through randomized controlled trials (RCTs). Despite the variability in outcomes from these trials, PCI is universally recognized as an effective intervention for LM CAD, except in specific scenarios such as bifurcated lesions requiring a two-stent strategy (13). Over the past two decades, the field of interventional cardiology has seen remarkable advancements, notably with the introduction of drug-eluting stents (DESs) and the adoption of invasive imaging technologies like intravascular ultrasound (IVUS). These developments have significantly enhanced PCI outcomes for LM disease, improving procedural success and reducing complications associated with stent deployment (14).

However, concerns persist regarding the long-term efficacy of PCI in LM CAD, particularly due to complications like stent underexpansion, malapposition, and the resultant risks of stent thrombosis and in-stent restenosis, which could lead to severe adverse events including mortality (14). Historically, studies have indicated that patients with LM disease receiving PCI exhibit superior immediate outcomes compared to those undergoing CABG or medical therapy alone. Yet, the long-term follow-up results introduce a level of uncertainty, with findings that are both contradictory and divergent, making it challenging to reach definitive conclusions in this clinical domain (15).

Our descriptive analysis of 120 LM PCI patients aimed to shed light on long-term outcomes post-procedure. The mean age of participants was 62.87±4.58 years, with a predominance of male patients (59.2%), which aligns with the demographics reported in similar studies (16). The observed long-term outcomes included a 15% all-cause mortality rate, cardiac deaths in 6.7% of patients, myocardial infarction (MI) in 7.5%, revascularization in 14.2%, and stroke in 4.2% of cases. These findings are comparable to those of another study, which reported slightly different rates for cardiac deaths, MI, and revascularization, potentially attributable to variations in sample size, demonstrating the need for further research to understand these discrepancies better (17). Another randomized trial found a lower incidence of stroke in LM PCI patients but similar rates of revascularization, supporting the safety and efficacy of PCI in this patient population (18).

Our study adds to the body of evidence suggesting favorable and safe long-term outcomes for LM PCI patients in terms of all-cause mortality, cardiac deaths, MI, revascularization, and stroke. The consistency of our findings with previous research highlights the continued improvement and reliability of PCI as a treatment modality for LM CAD. However, it's crucial to recognize the limitations inherent in our study, such as its descriptive nature, the specific patient population, and the potential for selection bias. The variation in outcomes when compared to other studies underlines the importance of patient selection, procedural expertise, and post-procedural care in determining long-term success.

Given these considerations, we advocate for further comparative research between LM PCI and LM CABG to explore long-term outcomes comprehensively. Such studies should aim to include diverse patient populations, utilize standardized protocols for intervention and follow-up, and consider the evolving landscape of interventional cardiology technologies and techniques. Addressing these gaps in the literature could provide more definitive guidance for clinicians navigating the complex decision-making process involved in treating patients with LM CAD, ultimately enhancing patient care and outcomes in this high-risk population.

CONCLUSION

This study underscores the effectiveness and safety of percutaneous coronary intervention (PCI) as a treatment for patients with unprotected left main coronary artery disease, demonstrating favorable long-term outcomes in terms of all-cause mortality, cardiac deaths, myocardial infarction, revascularization, and stroke. The findings align with and extend existing literature, reinforcing PCI's role in the therapeutic landscape for this high-risk population. However, the observed variability in outcomes compared to other studies highlights the need for ongoing comparative research, particularly between PCI and coronary artery bypass grafting (CABG), to refine patient selection criteria, optimize procedural techniques, and enhance post-procedural care. These efforts are critical to advancing clinical practice and improving patient outcomes in the management of left main coronary artery disease.

Journal of Health and Rehabilitation Research 2791-156X JHRR

REFERENCES

1. Shao C, Wang J, Tian J, Tang YD. Coronary artery disease: from mechanism to clinical practice. Coronary Artery Disease: Drug Discov Ther. 2020:12(5):17-25.

2. Khan AR, Golwala H, Tripathi A, Riaz H, Kumar A. Meta-analysis of percutaneous coronary intervention versus coronary artery bypass grafting in left main coronary artery disease. Am J Card. 2017;119(12):1949-56.

3. Stone GW, Kappetein AP, Sabik JF, Pocock SJ, Morice MC, Puskas J, et al. Five-year outcomes after PCI or CABG for left main coronary disease. N Engl J Med. 2019;381(19):1820-30.

4. Kwok CS, Gale CP, Curzen N, De Belder MA, Ludman P, Lüscher TF, et al. Impact of the COVID-19 pandemic on percutaneous coronary intervention in England: insights from the British Cardiovascular Intervention Society PCI database cohort. Circ Cardiovasc Interv. 2020;13(11):e009654.

5. Doenst T, Haverich A, Serruys P, Bonow RO, Kappetein P, Falk V, et al. PCI and CABG for treating stable coronary artery disease: JACC review topic of the week. J Am Coll Cardiol. 2019;73(8):964-76.

6. Fajadet J, Capodanno D, Stone GW. Management of left main disease: an update. Eur Heart J. 2019;40(18):1454-66.

7. Hyun J, Kim JH, Jeong Y, Choe K, Lee J, Yang Y, et al. Long-term outcomes after PCI or CABG for left main coronary artery disease according to lesion location. Cardiovascular Interventions. 2020 ;13(24):2825-36.

8. Kosmidou I, Chen S, Kappetein AP, Serruys PW, Gersh BJ, Puskas JD, et al. New-onset atrial fibrillation after PCI or CABG for left main disease: the EXCEL trial. J Am Coll Cardiol. 2018;71(7):739-48.

9. Stone PH, Goldschlager N. Left main coronary-artery diseasereview and appraisal. Cardiovasc Med. 1979;4:165.

10. Kalbfleisch H, Hort W. Quantitative study on the size of coronary artery supplying areas postmortem. Am Heart J. 1977;94(25):183-8.

11. Mäkikallio T, Holm NR, Lindsay M, Spence MS, Erglis A, Menown IB, et al. Percutaneous coronary angioplasty versus coronary artery bypass grafting in treatment of unprotected left main stenosis (NOBLE): a prospective, randomised, open-label, non-inferiority trial. Lancet. 2016;388(10061):2743-52.

12. Holm NR, Mäkikallio T, Lindsay MM, Spence MS, Erglis A, Menown IB, et al. Percutaneous coronary angioplasty versus coronary artery bypass grafting in the treatment of unprotected left main stenosis: updated 5-year outcomes from the randomised, non-inferiority NOBLE trial. Lancet. 2020;395(10219):191-9.

13. Neumann F.J, Sousa-Uva M, Ahlsson A, Alfonso F, Banning A.P, Benedetto U, et al, ESC Scientific Document Group; et al. 2018 ESC/EACTS Guidelines on myocardial revascularization. Eur. Heart J. 2019, 40, 87–165.

14. Thuijs D.J.F.M, Kappetein A.P, Serruys P.W, Mohr F.-W, Morice MJ, et al. SYNTAX Extended Survival Investigators; et al. Percutaneous coronary intervention versus coronary artery bypass grafting in patients with three-vessel or left main coronary artery disease: 10-year follow-up of the multicentre randomised controlled SYNTAX trial. Lancet 2019, 394, 1325–1334.

15. Stone, G.W, Kappetein, A.P, Sabik, J.F, Pocock, S.J, Morice, Steve M.C, et al, Brown, W.M., II; EXCEL Trial Investigators; et al. Five-Year Outcomes after PCI or CABG for Left Main Coronary Disease. N. Engl. J. Med. 2019, 381, 1820–1830.

16. Dores H, Raposo L, Almeida MS, Brito J, Santos PG, Sousa PJ, et al. Percutaneous coronary intervention of unprotected left main disease: five-year outcome of a single-center registry. Rev Port Cardiol. 2013;32(12):997-1004.

17. Gao L, Gao Z, Song Y, Guan C, Xu B, Chen J, et al. Long-Term Clinical Outcomes of Unprotected Left Main Percutaneous Coronary Intervention: A Large Single-Centre Experience. J Interv Cardiol. 2021 Jan 12;2021:8829686.

18. Bajraktari G, Zhubi-Bakija F, Ndrepepa G, Alfonso F, Elezi S, Rexhaj Z, et al. Long-Term Outcomes of Patients with Unprotected Left Main Coronary Artery Disease Treated with Percutaneous Angioplasty versus Bypass Grafting: A Meta-Analysis of Randomized Controlled Trials. J Clin Med. 2020;9(7):2231.

19. Moț ȘD, Șerban AM, Achim A, Dădârlat-Pop A, Tomoaia R, Pop D. Clinical Characteristics and Outcomes following Percutaneous Coronary Intervention in Unprotected Left Main Disease: A Single-Center Study. Diagnostics. 2023 Apr 3;13(7):1333.

20. Kim TO, Kang DY, Ahn JM, Kim MJ, Lee PH, Kim H, Choi Y, Lee J, Lee JM, Jo HH, Park YS. Impact of Target Lesion Revascularization on Long-Term Mortality After Percutaneous Coronary Intervention for Left Main Disease. Cardiovascular Interventions. 2024 Jan 8;17(1):32-42.