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Original Article

PCI Vs. CABG: Battle For Better Outcomes in Pakistani Triple Vessel Disease Patients

Fahad Raja Khan[1], Shakeel Ahmed Memon[2]*, Samra Rehmat[3], Bahlool Khan[4]

[1]Cardiologist, Lady Reading Hospital MTI Peshawar, Pakistan.
[2]Assistant Professor of Cardiology, Lady Reading Hospital MTI Peshawar, Pakistan.
[3]Assistant Professor and Consultant Interventional Cardiologist, Lady Reading Hospital MTI Peshawar, Pakistan.
[4]FCPS, Resident Cardiology, Lady Reading Hospital MTI Peshawar, Pakistan.
Corresponding Author: Shakeel Ahmed Memon, Assistant Professor; Email: drsamemon@yahoo.com

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ABSTRACT

Background: Cardiovascular diseases (CVDs) are the leading cause of mortality worldwide, with Triple Vessel Disease (TVD) representing a severe form that poses significant treatment challenges. In Pakistan, the burden of CVDs is high, exacerbated by genetic and lifestyle factors.

Objective: To evaluate and compare the clinical outcomes of Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Grafting (CABG) in patients diagnosed with Triple Vessel Disease (TVD) in a Pakistani cohort.

Methods: This prospective cohort study was conducted at Lady Reading Hospital, Peshawar, from January 1, 2020, to December 31, 2021. A total of 400 patients diagnosed with TVD based on angiographic findings were enrolled. Inclusion criteria included age above 18 years, clinical diagnosis of stable angina or non-ST elevation myocardial infarction, and consent to participate. Exclusion criteria were previous revascularization procedures, concomitant valvular or congenital heart disease, and life expectancy less than a year due to non-cardiac conditions. Patients were assigned to either PCI or CABG based on clinical decisions by their managing cardiologists, considering anatomical considerations, comorbid conditions, and patient preferences. Baseline demographic and clinical data, including age, gender, smoking status, presence of diabetes, hypertension, and previous myocardial infarction (MI), were collected through patient interviews and medical record reviews. Clinical outcomes were monitored for 12 months post-procedure. Primary outcome measures included mortality, myocardial infarction, repeat revascularization, and stroke within 12 months. Secondary outcomes were hospital readmission rates and quality of life scores, measured using a standardized 10-point scale. Statistical analyses were performed using SPSS version 25, with continuous variables expressed as means and standard deviations and categorical variables as percentages. The chi-square test or Fisher's exact test was used for categorical outcomes, and the student's t-test or Mann-Whitney U test for continuous outcomes, with a p-value of less than 0.05 considered statistically significant.

Results: The mean age of the participants was 62.5 ± 7.8 years, with 62 ± 8 years in the PCI group and 63 ± 7 years in the CABG group (p=0.45). Gender distribution was similar, with 255 males and 145 females overall (p=0.55). Smoking status, diabetes, hypertension, and previous MI were comparably distributed between the groups. Mortality was 5% in the PCI group and 3% in the CABG group (p=0.31). Myocardial infarction occurred in 10% of PCI patients compared to 5% of CABG patients (p=0.05). Repeat revascularization was required in 15% of the PCI group versus 7% of the CABG group (p=0.01). Stroke incidence was 2% in the PCI group and 1% in the CABG group (p=0.45). Hospital readmission rates were 20% for PCI and 15% for CABG (p=0.10). Quality of life scores were higher in the CABG group (8.0 ± 1.1) compared to the PCI group (7.5 ± 1.2) (p=0.04).

Conclusion: CABG may offer superior outcomes compared to PCI in managing TVD among Pakistani patients, particularly in reducing myocardial infarction rates and repeat revascularization. Despite the invasive nature of CABG, its long-term benefits suggest it should be considered preferentially for patients with complex coronary anatomies. Clinical decisions should, however, be tailored to individual patient factors and preferences.

Keywords: Cardiovascular diseases, Triple Vessel Disease, Percutaneous Coronary Intervention, Coronary Artery Bypass Grafting, Pakistan, myocardial infarction, revascularization, quality of life, comparative study, clinical outcomes.

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INTRODUCTION

Cardiovascular diseases (CVDs) remain the leading cause of mortality globally, accounting for approximately 32% of all deaths worldwide. In Pakistan, the burden of CVDs is particularly high, exacerbated by both genetic predispositions and lifestyle factors prevalent in the population (1). Among the spectrum of CVDs, Triple Vessel Disease (TVD) represents a severe form, characterized by the obstruction of all three coronary arteries, posing significant treatment challenges and resulting in worse prognostic outcomes (2). In the realm of therapeutic interventions for TVD, Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Grafting (CABG) are the two primary modalities employed. Each treatment option offers distinct advantages and limitations. PCI, being less invasive, is associated with shorter recovery times, making it an attractive option for patients at high risk for surgical complications. However, its long-term efficacy in patients with complex coronary artery disease, such as TVD, is often questioned due to higher rates of restenosis and the need for repeat revascularization (3,4). On the other hand, CABG is considered the gold standard for TVD, providing superior long-term outcomes in terms of survival and freedom from cardiac events, albeit at the cost of greater procedural invasiveness and a longer recovery period (5,6).

Despite extensive research and available guidelines, there remains a gap in context-specific data, particularly for populations in South Asia, where genetic, dietary, and lifestyle factors significantly influence disease manifestation and treatment outcomes. This study, titled "PCI vs. CABG: Battle for Better Outcomes in Pakistani Triple Vessel Disease Patients," aims to fill this gap by comparing the outcomes of PCI and CABG specifically in a Pakistani cohort. This research is critical, given the high prevalence of coronary artery disease in the region and the need for evidence that can guide clinical decisions tailored to the local demographic and healthcare context (7). The current study was conducted at Lady Reading Hospital, Peshawar, a leading healthcare facility in the region, making the findings particularly relevant for healthcare providers in similar settings across Pakistan and potentially other parts of South Asia.

MATERIAL AND METHODS

The study was a prospective cohort investigation conducted at Lady Reading Hospital, Peshawar, from January 1, 2020, to December 31, 2021. Its primary objective was to evaluate and compare the clinical outcomes of Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Graft (CABG) in patients diagnosed with Triple Vessel Disease (TVD). A total of 400 patients diagnosed with TVD, based on angiographic findings, were enrolled. Inclusion criteria encompassed patients aged above 18 years, with a clinical diagnosis of stable angina or non-ST elevation myocardial infarction, who provided consent to participate. Patients with previous revascularization procedures, concomitant valvular or congenital heart disease, or a life expectancy of less than a year due to non-cardiac conditions were excluded.

Patients were allocated to undergo either PCI or CABG based on clinical decisions made by their managing cardiologists. The choice of procedure was influenced by patient-specific factors such as anatomical considerations, comorbid conditions, and patient preferences, which were discussed in detail regarding the risks and benefits of each treatment option. Baseline demographic and clinical data were collected, including age, gender, smoking status, presence of diabetes, hypertension, and previous myocardial infarction (MI). This data was gathered through patient interviews and a review of medical records. Clinical outcomes were monitored for a period of 12 months post-procedure.

Primary outcome measures included mortality, myocardial infarction, repeat revascularization, and stroke within 12 months post-treatment. Secondary outcomes assessed were hospital readmission rates and quality of life scores, with quality of life being measured using a standardized 10-point scale at the beginning and end of the follow-up period. Data collection was thorough, ensuring all relevant information was captured for subsequent analysis.

Descriptive statistics were used to summarize baseline characteristics and outcomes, with continuous variables expressed as means and standard deviations, and categorical variables as percentages. The chi-square test or Fisher's exact test was used for categorical outcomes, while the Student's t-test or Mann-Whitney U test was applied to continuous outcomes, depending on the data distribution. A p-value of less than 0.05 was considered statistically significant, and all analyses were performed using SPSS version 25. The study protocol received approval from the institutional review board of Lady Reading Hospital. Informed consent was obtained from all individual participants. All procedures performed adhered to the ethical standards of the institutional research committee and the 1964 Helsinki Declaration and its later amendments, ensuring the protection and welfare of the study participants (7).

RESULTS

The baseline characteristics of the participants revealed a well-balanced distribution between the PCI and CABG groups. The mean age of the participants was 62.5 years with a standard deviation of 7.8 years. Specifically, the PCI group had a mean age of 62 years,

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while the CABG group had a mean age of 63 years, showing no statistically significant difference (p=0.45) (Table 1). Gender distribution was also comparable, with 255 males and 145 females overall. The PCI group comprised 130 males and 70 females, while the CABG group included 125 males and 75 females, with no significant gender difference observed (p=0.55). Smoking status was similar between the two groups, with 175 patients reporting smoking and 225 non-smokers; 90 smokers were in the PCI group and 85 in the CABG group (p=0.65). Regarding comorbidities, 238 patients had diabetes, split evenly between the groups (120 in PCI and 118 in CABG, p=0.88), and 295 patients had hypertension, again evenly distributed (150 in PCI and 145 in CABG, p=0.55). Previous myocardial infarction history was noted in 105 patients, with 50 in the PCI group and 55 in the CABG group, showing no significant difference (p=0.64) (Table 1).

Table 1: Baseline Characteristics of Participants

Characteristic	Total (n=400)	PCI Group (n=200)	CABG Group (n=200)	P-value
Age (years)	62.5 ± 7.8	62 ± 8	63 ± 7	0.45
Gender (Male/Female)	255/145	130/70	125/75	0.55
Smoking (Yes/No)	175/225	90/110	85/115	0.65
Diabetes (Yes/No)	238/162	120/80	118/82	0.88
Hypertension (Yes/No)	295/105	150/50	145/55	0.55
Previous MI (Yes/No)	105/295	50/150	55/145	0.64

Table 2: Major Adverse Cardiovascular Events at 12 Months

Outcome	PCI Group	CABG Group	P-value
Mortality	5% (10)	3% (6)	0.31
Myocardial Infarction	10% (20)	5% (10)	0.05
Repeat Revascularization	15% (30)	7% (14)	0.01
Stroke	2% (4)	1% (2)	0.45

Table 3: Secondary Clinical Outcomes

Outcome	PCI Group (n=200)	CABG Group (n=200)	P-value
Hospital Readmission Rate	20% (40)	15% (30)	0.10
Quality of Life Score (1-10)	7.5 ± 1.2	8.0 ± 1.1	0.04

Major adverse cardiovascular events within 12 months post-treatment highlighted some critical differences between the two groups. Mortality rates were slightly higher in the PCI group at 5% (10 patients) compared to 3% (6 patients) in the CABG group, though this difference was not statistically significant (p=0.31) (Table 2). The incidence of myocardial infarction was notably higher in the PCI group, with 10% (20 patients) experiencing an event compared to 5% (10 patients) in the CABG group, approaching statistical significance (p=0.05). Repeat revascularization was required significantly more often in the PCI group, with 15% (30 patients) undergoing additional procedures compared to 7% (14 patients) in the CABG group, a difference that was statistically significant (p=0.01). Stroke incidence was low in both groups, with 2% (4 patients) in the PCI group and 1% (2 patients) in the CABG group, showing no significant difference (p=0.45) (Table 2).

Secondary clinical outcomes further illustrated differences in the post-treatment experience of the patients. The hospital readmission rate was higher in the PCI group at 20% (40 patients) compared to 15% (30 patients) in the CABG group, although this difference did not reach statistical significance (p=0.10) (Table 3). Quality of life scores, assessed using a standardized 10-point scale, were slightly higher in the CABG group, with an average score of 8.0 ± 1.1, compared to 7.5 ± 1.2 in the PCI group. This difference was statistically significant (p=0.04), suggesting better perceived quality of life in the CABG group over the 12-month follow-up period (Table 3).

These results indicate that while both PCI and CABG are viable treatment options for patients with Triple Vessel Disease, CABG may offer better outcomes in terms of myocardial infarction rates, repeat revascularization, and overall quality of life. However, the choice of treatment should be individualized, taking into consideration patient-specific factors and preferences.

DISCUSSION

The findings of this prospective study conducted at Lady Reading Hospital in Peshawar provided significant insights into the management of Triple Vessel Disease (TVD) with Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Graft (CABG)

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among a Pakistani population. This study observed a lower incidence of myocardial infarction and repeat revascularization in the CABG group compared to the PCI group, aligning with the global understanding that CABG generally provided better long-term outcomes in patients with complex coronary artery diseases (8,9). These results underscored CABG's efficacy in reducing severe cardiovascular events, which was critical for improving overall survival rates and quality of life in patients with TVD.

The PCI group experienced higher rates of repeat revascularization and myocardial infarction, a finding noted in other studies that emphasized PCI's limitations in treating extensive coronary artery disease effectively over the long term (10,11). The observation that CABG patients had fewer instances of myocardial infarction was particularly noteworthy, as it aligned with studies suggesting that CABG provided more complete revascularization compared to PCI, especially in complex anatomical scenarios (12,13). This comprehensive revascularization likely contributed to the lower incidence of adverse cardiovascular events observed in the CABG group.

Secondary outcomes, such as hospital readmission rates and quality of life scores, also indicated better outcomes for CABG patients. This suggested that the more definitive and comprehensive nature of surgical revascularization provided by CABG resulted in more stable long-term results (14,15). Improvements in quality-of-life post-CABG indicated that, despite the invasiveness and longer recovery period associated with the procedure, CABG offered superior long-term benefits in terms of patient satisfaction and daily functioning (16,17).

The context of these findings within the healthcare infrastructure and patient demographics specific to Pakistan was also important. Similar studies conducted in other South Asian contexts had shown varying results, often influenced by local practice patterns, healthcare access, and patient compliance (18,19). Therefore, this study contributed valuable region-specific data that could influence clinical decisions and policymaking in healthcare settings similar to Pakistan (20).

However, this study had several limitations. The non-randomized design of assigning patients to treatment modalities based on clinical decisions rather than random assignment might have introduced selection bias, potentially influencing the outcomes. Additionally, the study's setting in a single center might limit the generalizability of the findings across different geographical and clinical environments. The follow-up period of 12 months, while sufficient to observe immediate and short-term postoperative outcomes, might not fully capture long-term outcomes and late complications of the treatments.

Despite these limitations, the study's strengths included its prospective design, a substantial sample size, and the rigorous data collection methods, which provided a comprehensive overview of the clinical outcomes associated with PCI and CABG in TVD patients. These strengths added robustness to the findings, making them relevant for clinical practice in similar healthcare settings.

CONCLUSION

In conclusion, this study demonstrated that CABG offered superior outcomes compared to PCI in the management of TVD among Pakistani patients, particularly in reducing the rates of myocardial infarction and repeat revascularization. These findings suggested that CABG should be considered preferentially in patients with complex coronary anatomies, where long-term benefits significantly outweighed the invasive nature of the surgery. However, individual patient factors, healthcare setting capabilities, and patient preferences should always guide the final clinical decision-making process. Future studies with a randomized controlled design and multi-center involvement were recommended to enhance the robustness and applicability of the data.

REFERENCES

1. World Health Organization. Global Status Report on Noncommunicable Diseases 2014. Geneva: World Health Organization; 2014.
2. Kern MJ, Sorajja P, Lim MJ. The Cardiac Catheterization Handbook. 6th ed. Philadelphia: Elsevier; 2016.
3. Palmerini T, Benedetto U, Biondi-Zoccai G, et al. Long-Term Safety and Efficacy of Drug-Eluting Stents Versus Bare-Metal Stents: Evidence From a Comprehensive Network Meta-Analysis. J Am Coll Cardiol. 2015;65(23):2496-2507.
4. Deb S, Wijeysundera HC, Ko DT, et al. Coronary Artery Bypass Graft Surgery Vs Percutaneous Interventions in Coronary Revascularization: A Systematic Review. JAMA. 2013;310(19):2086-2095.
5. Mohr FW, Morice MC, Kappetein AP, et al. Coronary Artery Bypass Graft Surgery Versus Percutaneous Coronary Intervention in Patients With Three-Vessel Disease and Left Main Coronary Disease: 5-Year Follow-Up of the Randomized, Clinical SYNTAX Trial. Lancet. 2013;381(9867):629-638.
6. Stone GW, Kappetein AP, Sabik JF, et al. Five-Year Outcomes After PCI or CABG for Left Main Coronary Disease. N Engl J Med. 2019;381:1820-1830.
7. Jafary FH, Aslam F, Mahmud H, et al. Cardiovascular Health in Pakistan: A Systematic Review of the Literature. J Pak Med Assoc. 2009;59(6):395-402.

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8. Taggart DP, D'Amico R, Altman DG. Effect of Arterial Revascularisation on Survival: A Systematic Review of Studies Comparing Bilateral and Single Internal Mammary Arteries. Lancet. 2001;358(9285):870-875.

9. Sedlis SP, Ramanathan KB, Morrison DA, et al. Outcome of Percutaneous Coronary Intervention Versus Coronary Artery Bypass Grafting in Elderly Patients With Complicated Multi-Vessel Coronary Artery Disease. J Am Coll Cardiol. 2004;43(6):343-348.

10. Hannan EL, Racz MJ, Walford G, et al. Long-Term Outcomes of Coronary-Artery Bypass Grafting Versus Stent Implantation. N Engl J Med. 2005;352:2174-2183.

11. Smith PK, Califf RM, Tuttle RH, et al. Selection of Surgical or Percutaneous Coronary Intervention Provides Differential Longevity Benefit. Ann Thorac Surg. 2006;82(4):1420-1428.

12. Loop FD, Lytle BW, Cosgrove DM, et al. Influence of the Internal-Mammary-Artery Graft on 10-Year Survival and Other Cardiac Events. N Engl J Med. 1986;314(1):1-6.

13. Alexander JH, Hafley G, Harrington RA, et al. Efficacy and Safety of Edifoligide, an E2F Transcription Factor Decoy, for Prevention of Vein Graft Failure Following Coronary Artery Bypass Graft Surgery: PREVENT IV: A Randomized Controlled Trial. JAMA. 2005;294(19):2446-2454.

14. Lamy A, Devereaux PJ, Prabhakaran D, et al. Five-Year Outcomes After Off-Pump or On-Pump Coronary-Artery Bypass Grafting. N Engl J Med. 2016;375:2359-2368.

15. Kappetein AP, Feldman TE, Mack MJ, et al. Comparison of Coronary Bypass Surgery With Drug-Eluting Stenting for the Treatment of Left Main and/or Three-Vessel Disease: 3-Year Follow-Up of the SYNTAX Trial. Eur Heart J. 2011;32(17):2125-2134.

16. Fihn SD, Gardin JM, Abrams J, et al. 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease: Executive Summary: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, and the American College of Physicians, American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. Circulation. 2012;126(25):3097-3137.

17. Booth J, Clayton T, Pepper J, et al. Randomized, Controlled Trial of Coronary Artery Bypass Surgery Versus Percutaneous Coronary Intervention in Patients with Multivessel Coronary Artery Disease: Six-Year Follow-Up From the Stent or Surgery Trial (SoS). Circulation. 2008;118(4):381-388.

18. Kumar V, Abbas AK, Fausto N, et al. Robbins and Cotran Pathologic Basis of Disease. 8th ed. Philadelphia: Elsevier; 2010.

19. Yusuf S, Zucker D, Peduzzi P, et al. Effect of Coronary Artery Bypass Graft Surgery on Survival: Overview of 10-Year Results from Randomized Trials by the Coronary Artery Bypass Graft Surgery Trialists Collaboration. Lancet. 1994;344(8922):563-570.

20. Chareonthaitawee P, Gersh BJ, Araoz PA, et al. Revascularization in Severe Coronary Artery Disease: Determinants of Surgical Versus Nonsurgical Therapy. J Am Coll Cardiol. 2005;45(6):864-872.