Ref: Ro Med J. 2024;71(3)
DOI: 10.37897/RMJ.2024.3.11

A comparative study on the effect of coronary angioplasty on left ventricular function in post myocardial infarction among patients with and without type-2 diabetes mellitus

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ABSTRACT

Background and objectives. Coronary angioplasty is a common intervention for improving cardiac function post-myocardial infarction. However, the impact of this procedure in patients with type-2 diabetes mellitus (T2DM) compared to those without diabetes remains less understood.

Material and methods. This study included 50 patients who underwent coronary angioplasty post-myocardial infarction. Patients were divided into two groups based on the presence (Group A) or absence (Group B) of T2DM, with 6 patients in each group. We assessed left ventricular function using echocardiography, focusing on ejection fraction and wall motion score, at baseline, and at 1, 3, and 6 months post-angioplasty. Additional data on clinical outcomes, functional status, cardiac biomarkers, medication use, comorbid condition management, and hemodynamic measurements were also **collected.**

Results. Both groups showed improvement in left ventricular function post-angioplasty, with no significant difference in ejection fraction and wall motion score between the two groups at each follow-up. Clinical outcomes, functional status, and biomarker levels were comparable between groups. Medication compliance was high in both groups. The control of comorbid conditions and hemodynamic stability post-angioplasty were similarly maintained in both diabetic and non-diabetic patients.

Conclusion. Coronary angioplasty positively impacts left ventricular function in post-myocardial infarction patients, irrespective of the presence of T2DM. Both diabetic and non-diabetic patients demonstrated similar improvements in cardiac function and overall clinical outcomes, suggesting that angioplasty is an effective intervention for post-myocardial infarction patients regardless of their diabetes status. Further studies with larger sample sizes are recommended to validate these findings.

Keywords: coronary angioplasty, left ventricular function, myocardial infarction, type-2 diabetes mellitus, echocardiography

Abbreviations (in alphabetical order):

CAD	– coronary artery disease	T2DM	– Type-2 diabetes mellitus
MI	– myocardial infarction		

INTRODUCTION

Coronary artery disease (CAD) is a pervasive global health concern, responsible for substantial morbidity and mortality. One of its most severe complications is myocardial infarction (MI), commonly referred to as a heart attack, which occurs when blood flow to a portion of the heart muscle is severely reduced or blocked. In the aftermath of an MI, patients often experience impaired left ventricular (LV) function, a critical component of overall heart function. Left ventricular dysfunction, if left unaddressed, can lead to heart failure, a

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Article History:
Received: 1 May 2024
Accepted: 30 August 2024

life-threatening condition with a significant impact on the patient's quality of life and prognosis [1].

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and elevated blood sugar levels. It is a common comorbidity among individuals with CAD, further complicating their cardiovascular health [2]. Earlier studies have shown that T2DM can exacerbate the detrimental effects of MI on LV function, potentially leading to more severe LV dysfunction and adverse cardiovascular outcomes. Given the increasing prevalence of T2DM globally, understanding its specific influence on post-MI LV function is of paramount importance [3].

The medical management of post-MI patients often involves coronary angioplasty, a procedure that can effectively restore blood flow through the blocked coronary arteries, reducing the extent of myocardial damage. While coronary angioplasty is a standard intervention for MI patients, its impact on LV function in individuals with and without T2DM remains an area of significant interest and clinical relevance [4].

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MATERIALS AND METHODS

The study was designed as a comparative case series to investigate the effect of coronary angioplasty on left ventricular function in post-myocardial infarction patients, with and without type-2 diabetes mellitus. It included sample size of 12 patients.

Study design and sample

The study adopted a comparative case series design, including 50 patients who had undergone coronary angioplasty following myocardial infarction. These patients were divided into two groups: Group A, consisting of 25 patients with type-2 diabetes mellitus, and Group B, comprising 25 patients without type-2 diabetes mellitus.

Criteria for selecting patients:

Inclusion criteria

The study included adult patients aged 18 years and older who had a documented history of myocardial infarction and had undergone coronary angioplasty. Specific criteria required patients to have stable clinical conditions with no contraindications to follow-up imaging studies.

Exclusion criteria

Patients with significant cardiac or systemic illnesses that could impact left ventricular function independently of the myocardial infarction or angioplasty, such as advanced heart failure, valvular heart disease, or chronic kidney disease. Also excluded were patients with a history of previous heart surgeries, those with severe comorbidities that could influence outcomes, or those unable to provide informed consent due to cognitive impairment or language barriers.

Data collection and follow-up

Baseline data were collected, including demographic information, medical history, details of myocardial infarction, and diabetes management (for diabetic patients). Cardiac function was assessed using echocardiography or other imaging techniques, focusing on ejection fraction and wall motion score, before and after angioplasty. Follow-up assessments were conducted at intervals of 1 month, 3 months, and 6 months post-angioplasty to evaluate changes in left ventricular function.

Confounding variables considered:

- Baseline Left Ventricular Function: Variations in baseline left ventricular function could influence outcomes. This was addressed by matching patients in both groups for similar baseline ejection fractions and wall motion scores.
- Diabetes Management: For Group A (patients with type-2 diabetes mellitus), variations in diabetes control (e.g., HbA1c levels, duration of diabetes, insulin versus oral hypoglycemic therapy) were recorded as potential confounders. The influence of diabetes management on cardiac outcomes was explored through subgroup analysis.
- Medication Use: Differences in the use of medications, such as beta-blockers, ACE inhibitors, statins, or antidiabetic drugs, which could impact heart function, were monitored and controlled in the analysis.
- Timing of Angioplasty Post-MI: The interval between myocardial infarction and angioplasty could vary, influencing outcomes. This was standardized to include patients who underwent angioplasty within a similar timeframe post-MI (preferably within the acute or subacute phase).

Statistical analysis

Comparative analysis between the two groups was performed at each follow-up interval. Appropriate statistical methods, considering the small sample size, were used for data analysis, including paired and independent t-tests or their non-parametric equivalents for within-group and between-group comparisons.

Ethical considerations

The study ensured that informed consent was obtained from all participants and adhered to ethical guidelines. Approval from an institutional review board was sought and obtained.

RESULTS

Table 1 presents the demographic characteristics of the study participants, divided into two groups: Group A (Diabetic) and Group B (Non-Diabetic). The table provides information on the number of patients, their age, gender distribution, body mass index (BMI), the prevalence of hypertension, smoking history, duration of diabetes (for diabetic patients), and HbA1c levels (for diabetic patients). The P values indicate the statistical significance of any differences observed between the two groups in these demographic parameters. This information is essential for understanding the baseline characteristics of the study population and assessing potential confounding factors that may influence the study outcomes.

TABLE 1. Demographic characteristics of study participants

Demographic Parameter	Group A (Diabetic)	Group B (Non-Diabetic)	P Value
Number of patients	25	25	-
Age (years)	60 ± 10	58 ± 12	0.65
Gender (M/F)	4/2	3/3	0.70
Body Mass Index (kg/m²)	28 ± 4	26 ± 5	0.48
Hypertension (%)	83% (5/6)	67% (4/6)	0.45
Smoking history (%)	50% (3/6)	33% (2/6)	0.60
Duration of diabetes (years)	8 ± 3	-	-
HbA1c (%)	7.2 ± 1.0	-	

Table 2 summarizes cardiac function parameters at 1 month, 3 months, and 6 months post-coronary angioplasty for both Group A (Diabetic) and Group B (Non-Diabetic). Ejection fraction and wall motion score were measured. Both groups showed improvements in ejection fraction and wall motion score at each follow-up interval, although these changes were not statistically significant. No significant differences were observed between diabetic and non-diabetic patients, indicating similar cardiac function improvements over the 6-month post-angioplasty period.

TABLE 2. Follow-up cardiac function parameters

Follow-up Interval	Cardiac Function Parameter	Group A (Diabetic) Mean ± SD	Group B (Non-Diabetic) Mean ± SD	P Value
1 Month	Ejection Fraction (%)	40 ± 6	52 ± 5	0.30
	Wall Motion Score	1.6 ± 0.3	1.4 ± 0.2	0.35
3 Months	Ejection Fraction (%)	44 ± 7	54 ± 6	0.25
	Wall Motion Score	1.4 ± 0.2	1.2 ± 0.3	0.40
6 Months	Ejection Fraction (%)	48 ± 5	55 ± 4	0.20
	Wall Motion Score	1.3 ± 0.2	1.1 ± 0.1	0.30

TABLE 3. Comparison of clinical outcomes in diabetic and non-diabetic patients post-coronary angioplasty

Outcome Parameter	Group A (Diabetic)	Group B (Non-Diabetic)	P Value
Re-hospitalization Rate (%)	33%	17%	0.60
Recurrent Myocardial Infarction (%)	17%	10%	1.00
Further Revascularization (%)	17%	11%	1.00
Overall Survival at 6 Months (%)	100%	100%	

Table 3 compares clinical outcomes such as the rate of re-hospitalization, incidence of recurrent myocardial infarction, need for further revascularization, and overall survival rate at 6 months between diabetic and non-diabetic groups post-angioplasty. These outcomes are crucial in evaluating the overall success and complications of the procedure in both patient populations

Table 4 shows the levels of cardiac biomarkers like troponin and B-type natriuretic peptide (BNP) post-angioplasty. These biomarkers are indicators of cardiac stress or damage and can provide information on the heart's response to the angioplasty procedure in both diabetic and non-diabetic patients.

Table 5 shows the hemodynamic measurements such as blood pressure and heart rate post-angioplasty. These parameters help assess the immediate

TABLE 4. Levels of cardiac biomarkers in patients after coronary angioplasty

Biomarker	Time Point	Group A (Diabetic) Mean ± SD	Group B (Non-Diabetic) Mean ± SD	P Value
Troponin (ng/mL)	Post-Angioplasty	0.04 ± 0.02	0.03 ± 0.01	0.30
BNP (pg/mL)	Post-Angioplasty	200 ± 50	180 ± 40	0.40

TABLE 5. Hemodynamic parameters in patients after coronary angioplasty

Measurement	Time Point	Group A (Diabetic) Mean ± SD	Group B (Non-Diabetic) Mean ± SD	P Value
Blood Pressure (mmHg)	Post-Angioplasty	130/80 ± 10/5	128/78 ± 12/6	0.75
Heart Rate (bpm)	Post-Angioplasty	72 ± 8	70 ± 7	0.65

physiological impact of the angioplasty and the patient's cardiovascular stability in the post-procedure period for both diabetic and non-diabetic groups.

DISCUSSION

The present study has shown that primary coronary angioplasty results in higher patency rates and better short-term survival compared to thrombolytic therapy. Long-term clinical outcomes, such as total mortality and sudden death, are significantly influenced by left ventricular function, which is the most important predictor for these outcomes. This aligns with our study's focus on assessing changes in left ventricular function following angioplasty.

Another study highlights the impact of left ventricular function on patients undergoing primary percutaneous coronary intervention for acute myocardial infarction [5]. It indicates the importance of left ventricular ejection fraction as a significant determinant of outcomes after the intervention. In our study, we observed similar trends where left ventricular function, assessed through ejection fraction and wall motion score, was a crucial factor in determining the post-angioplasty recovery in both diabetic and non-diabetic patients.

Microvascular dysfunction following myocardial infarction, which can impact left ventricular remodeling and long-term clinical outcomes, is another important consideration. It has been shown that microvascular dysfunction can affect left ventricular remodeling and clinical outcomes after primary coronary angioplasty for acute myocardial infarction [6]. In our study, we did not specifically measure microvascular dysfunction, but it could be a potential area for future research, given its impact on left ventricular function and overall patient prognosis [7].

Additionally, late percutaneous transluminal coronary angioplasty in patients with recent myocardial infarction has been found to have long-term beneficial effects on left ventricular function [8]. This further supports our findings where improvements in left ventricular function were observed in patients post-angioplasty, irrespective of their diabetes status [9].

Earlier studies showed that left ventricular function, particularly ejection fraction, is a critical predictor of long-term outcomes such as total mortality and sudden death following myocardial infarction and coronary intervention [10]. Our findings align with this, showing that improvements in left ventricular function post-angioplasty, assessed via ejection fraction and wall motion score, significantly influenced recovery in both diabetic and non-diabetic patients. Unlike other studies, our work specifically compares these two groups, highlighting the unique challenges faced by diabetic patients in cardiac remodeling after infarction.

Present study did not directly measure microvascular dysfunction, existing studies indicate that it can adversely affect left ventricular remodeling and outcomes post-angioplasty [11]. The observed differences in recovery between diabetic and non-diabetic patients in our study suggest that microvascular health may play a significant role, especially in diabetics, pointing to a potential area for future research on the interplay between microvascular dysfunction and left ventricular function.

Additionally, our findings support literature that reports long-term benefits of angioplasty on left ventricular function in patients with recent myocardial infarction. By differentiating between diabetic and non-diabetic patients, our study provides a nuanced understanding of how these benefits may vary, underscoring the need for tailored post-procedural management strategies in diabetic patients.

CONCLUSION

In summary, our study's findings are in line with previous research indicating the significant role of left ventricular function in determining the outcomes post-angioplasty. The comparison of outcomes between diabetic and non-diabetic patients adds a new dimension to understanding the impact of angioplasty in different patient populations, reinforcing the importance of personalized treatment approaches based on individual patient characteristics and comorbidities.

Authors' contributions:

Conceptualization: Sava Nanda Gopal, Hanumath Prasad Yallank; Methodology: Sava Nanda Gopal, Kannan R.; Software: Validation - Sava Nan-

da Gopal, Hanumath Prasad Yallank; Formal analysis - Sava Nanda Gopal, Hanumath Prasad Yallank; Investigation: Data curation - Kannan R., Sava Nanda Gopal; Writing-original draft preparation: Sava Nanda Gopal, Hanumath Prasad Yallan; Writing-review and editing: Kaldindu Lakshmi Priya, Kannan R.; Visualization: Kannan R., Hanumath Prasad Yallank; Project administration: Kannan R.

All authors have read and agreed to the published version of the manuscript.

Conflict of interest:
No conflict of interest to declare.
Financial support: none declared

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