STM JOURNALS

Research & Reviews: A Journal of
Pharmaceutical Science

ISSN: 2229-7006
Volume 16, Issue 2, 2025
May–August
DOI (Journal): 10.37591/RRJoPS

https://journals.stmjournals.com/rrjops

Research RRJoPS

Comparative Evaluation of GPBB and CK-MB in Early Diagnosis of Acute Myocardial Infarction in Diabetic and Non-Diabetic Patients

Atul Khajuria[1,*], Gagandeep Singh[2]

Abstract

Background: *Acute myocardial infarction (AMI) continues to be a leading cause of morbidity and death among people worldwide. To lower the risk of problems, early and precise diagnosis is essential, particularly for diabetes patients. The study investigates the diagnostic value of glycogen phosphorylase BB (GPBB), a potential early biomarker of myocardial necrosis, and compares it with CK-MB, a widely used cardiac marker, in AMI diagnosis. Inflammatory markers (hs-CRP, IL-6, TNF-α) and complete blood count (CBC) profiles were also assessed to understand their role in AMI.* ***Objective:*** *To evaluate and compare the diagnostic potential of GPBB and CK-MB for early detection of AMI in both diabetic and non-diabetic patients.* ***Methods:*** *This observational study included 370 participants: 240 AMI patients (180 diabetic and 60 non-diabetic) and 130 healthy controls. Blood samples were collected at admission to measure GPBB, CK-MB, hs-CRP, IL-6, TNF-α, and CBC parameters. At various points after admission, GPBB and CK-MB were evaluated for sensitivity, specificity, area under the curve (AUC), positive predictive value (PPV), negative predictive value (NPV), and specificity. SPSS (version 20.0) was used for the statistical analysis, and a p-value of less than 0.05 was deemed statistically significant.* ***Results:*** *Significant differences in demographic and clinical parameters were found between AMI patients and controls, including elevated BMI, blood pressure, and biochemical markers in AMI patients, especially diabetics. CBC results showed altered hemoglobin, RBC, WBC, and platelet counts in AMI patients. Biochemical markers, including RBG, FBG, HbA1c, and lipid profiles, were significantly higher in diabetic AMI patients. Inflammatory markers (hs-CRP, IL-6, TNF-α) were elevated in AMI patients. GPBB demonstrated superior diagnostic performance compared to CK-MB, with the highest sensitivity (97%) and specificity (96%) at the 2nd hour post-admission, while CK-MB peaked at the 6th hour with 81.25% sensitivity and 64% specificity.* ***Conclusion:*** *GPBB shows excellent diagnostic potential, outperforming CK-MB in the early detection of AMI, particularly within the first two hours. The study also highlights the significant role of inflammatory markers and CBC in understanding the pathophysiology of AMI. These findings suggest that GPBB could be a valuable tool in the early diagnosis of AMI, especially for high-risk populations like diabetic patients.*

***Author for Correspondence**
Atul Khajuria
E-mail: directoralliedhealthsciences@deshbhagatuniversity.in

[1]Director, Desh Bhagat University, Mandi Gobindgarh, Punjab, India
[2]Assistant Professor, Faculty of Allied Health Sciences, Desh Bhagat University, Mandi Gobindgarh, Punjab, India

Received Date: April 01, 2025
Accepted Date: April 12, 2025
Published Date: June 19, 2025

Citation: Atul Khajuria, Gagandeep Singh. Comparative Evaluation of GPBB and CK-MB in Early Diagnosis of Acute Myocardial Infarction in Diabetic and Non-Diabetic Patients. Research & Reviews: A Journal of Pharmaceutical Science. 2025; 16(2): 33–37p.

Keywords: Acute myocardial infarction, glycogen phosphorylase BB, CK-MB, inflammatory markers, diabetic patients, early diagnosis

INTRODUCTION

Acute myocardial infarction (AMI) remains one of the leading causes of death and disability worldwide, with early diagnosis being critical for improving patient outcomes and reducing the risk of complications [1, 2]. The main characteristic of AMI is the blockage of blood supply to the heart muscle, which results in ischemia and myocardial necrosis [3]. Timely identification of AMI can

prevent further damage to the heart muscle, and current diagnostic approaches primarily rely on measuring cardiac biomarkers, such as creatine kinase MB (CK-MB) and troponins [4]. While these markers are widely used in clinical practice, their diagnostic accuracy is often limited by the time at which they become elevated, typically several hours after the onset of myocardial injury. In recent years, Glycogen Phosphorylase BB (GPBB) has emerged as a potential early biomarker for AMI. GPBB is released into the bloodstream during myocardial ischemia and necrosis, making it a promising tool for diagnosing AMI in its early stages. Unlike CK-MB and troponins, which rise relatively late in the disease progression, GPBB has demonstrated the potential to detect myocardial injury within the first few hours of symptom onset [5]. This early detection could be particularly beneficial in high-risk populations, such as diabetic patients, who are known to present with atypical AMI symptoms and may experience delayed diagnosis and treatment.

Additionally, the significance of inflammatory markers, such as tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), and high-sensitivity C-reactive protein (hs-CRP) in the pathophysiology of AMI is becoming more widely acknowledged [6]. These indicators offer important insights into the severity and course of the disease, in addition to reflecting the inflammatory response to myocardial damage.

In addition to investigating the function of inflammatory markers and other biochemical parameters in the diagnosis of AMI, this study aims to assess the diagnostic value of GPBB in contrast to CK-MB for the early detection of AMI, specifically in patients with and without diabetes.

MATERIALS & METHODS

Study Design and Participants

This was a comparative, observational study conducted at hospitals in Chandigarh. A total of 370 participants were enrolled, including 240 patients diagnosed with acute myocardial infarction (AMI) (180 diabetic and 60 non-diabetic) and 130 healthy controls. Diabetic patients were diagnosed based on fasting blood glucose levels, while non-diabetic participants had normal glucose levels.

Inclusion Criteria

1. Patients must be adults between the ages of 30 and 75.
2. Based on clinical symptoms, ECG results, and increased cardiac biomarkers (CK-MB and GPBB), AMI was diagnosed.
3. Individuals with diabetes who have been diagnosed under the American Diabetes Association's criteria.
4. Individuals without a history of cardiovascular disorders who do not have diabetes.

Exclusion Criteria

1. Individuals who have already experienced liver disease, chronic kidney disease, or any type of cancer.
2. Pregnant or breastfeeding women.
3. Patients who have recently undergone extensive surgery or experienced trauma.
4. Patients with chronic inflammatory conditions (other than AMI) or autoimmune diseases.
5. Individuals unable to provide informed consent.

Data Collection

Blood samples were collected from all participants upon admission for analysis of biomarkers, including GPBB, CK-MB, hs-CRP, IL-6, TNF-α, and routine biochemical parameters. All the parameters were performed on Beckman Coulter. A complete blood count (CBC) was also performed for each participant with Sysmex XN 2000, a fully automated haematology analyzer. Data on demographic and clinical parameters, such as age, sex, body mass index (BMI), blood pressure, and medical history were also recorded.

Statistical Analysis

Data analysis was done with SPSS version 25. Categorical data were displayed as percentages, whereas continuous variables were represented as mean ± standard deviation (SD). At different intervals after admission, CK-MB and GPBB were evaluated for sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and area under the curve (AUC). P-values below 0.05 were regarded as statistically significant.

RESULTS

The study involved 370 participants, including 240 AMI patients (180 diabetic and 60 non-diabetic) and 130 healthy controls. Key demographic and clinical parameters showed significant differences between AMI patients and controls, including higher BMI, blood pressure, and biochemical markers in AMI patients, particularly in diabetics. The CBC profile revealed notable changes, with decreased hemoglobin and RBC counts and increased WBC and platelet counts in AMI patients. Biochemical parameters, such as RBG, FBG, HbA1c, and lipid profiles were significantly altered in diabetic AMI patients. Inflammatory markers, including hs-CRP, IL-6, and TNF-α, were significantly elevated in both diabetic and non-diabetic AMI patients compared to controls. Cardiac marker analysis revealed that GPBB showed superior sensitivity and specificity compared to CK-MB, with the highest diagnostic performance at the 2nd hour post-admission for GPBB (97% sensitivity, 96% specificity), whereas CK-MB peaked at the 6th hour with 81.25% sensitivity and 64% specificity. The results of our study are depicted in Tables 1–6, respectively.

Table 1. Shows the distribution of study subjects.

Group	Number of Participants	Male	Female
Total subjects	370	210	160
Control group	130	65	65
AMI patients (Total)	240	145	95
– Diabetic AMI	180	120	60
– Non-diabetic AMI	60	40	20

Table 2. Illustrates demographic and clinical parameters.

Parameter	Control Group (Mean ± SD)	Non-Diabetic AMI (Mean ± SD)	Diabetic AMI (Mean ± SD)	P-Value
Age (Years)	58.50 ± 7.76	56.94 ± 8.42	55.99 ± 8.22	NS
BMI (Kg/m²)	22.30 ± 2.02	24.06 ± 1.64	22.74 ± 1.65	p < 0.001
Systolic blood pressure	114.90 ± 6.35	145.31 ± 14.75	138.32 ± 10.26	p < 0.001
Diastolic blood pressure	76.20 ± 6.35	96.88 ± 14.24	94.55 ± 10.72	p < 0.001

Table 3. Shows the complete blood count (CBC) profile in different groups.

Parameter	Control Group (Mean ± SD)	Non-Diabetic AMI (Mean ± SD)	Diabetic AMI (Mean ± SD)	P-Value
Hemoglobin (gm%)	13.40 ± 0.83	11.69 ± 0.92	10.95 ± 1.13	p < 0.001
RBC Count (Millions/cumm)	5.01 ± 0.41	4.75 ± 0.44	4.71 ± 0.38	p < 0.001
WBC Count (Thousand/cumm)	7.07 ± 1.18	9.97 ± 1.27	10.38 ± 1.79	p < 0.001
Platelet Count (Lacs/cumm)	2.85 ± 0.31	2.56 ± 0.35	2.46 ± 0.55	p < 0.001

Table 4. Shows biochemical and inflammatory parameters.

Parameter	Control Group (Mean ± SD)	Non-Diabetic AMI (Mean ± SD)	Diabetic AMI (Mean ± SD)	P-Value
RBG (mg/dL)	100.05 ± 11.56	117.36 ± 6.89	185.62 ± 58.06	$p < 0.001$
FBG (mg/dL)	87.01 ± 8.75	104.56 ± 6.04	173.04 ± 33.88	$p < 0.001$
HbA1c (%)	4.98 ± 0.32	5.27 ± 0.21	7.39 ± 1.40	$p < 0.001$
hs-CRP (mg/L)	1.34 ± 0.36	11.71 ± 2.64	13.69 ± 3.63	$p < 0.001$

Table 5. Illustrates cardiac marker levels (CK-MB and GPBB) at different time points.

Time Point (Hours)	CK-MB (IU/L) in Non-Diabetic AMI (Mean ± SD)	CK-MB (IU/L) in Diabetic AMI (Mean ± SD)	GPBB (ng/mL) in Non-Diabetic AMI (Mean ± SD)	GPBB (ng/mL) in Diabetic AMI (Mean ± SD)
1st Hour	15.77 ± 4.47	15.99 ± 3.98	40.92 ± 15.92	48.42 ± 18.72
2nd Hour	20.99 ± 4.26	20.09 ± 3.51	48.88 ± 16.24	58.07 ± 21.77
3rd Hour	24.22 ± 3.65	23.37 ± 3.09	74.96 ± 23.67	85.39 ± 24.35

Table 6. Shows sensitivity, specificity, PPV, NPV, and AUC for GPBB and CK-MB.

Cardiac Marker	Time Point	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	AUC	P-Value
CK-MB	6th Hour	81.25	64	59	84	0.933	$p < 0.001$
GPBB	2nd Hour	97	96	93.94	98	1.00	$p < 0.001$

DISCUSSION

The findings of this study emphasize the potential of glycogen phosphorylase BB (GPBB) as a superior early biomarker for the diagnosis of acute myocardial infarction (AMI), particularly within the first two hours following symptom onset. Unlike CK-MB, which peaks later in the diagnostic process (around 6 hours), GPBB shows significantly higher sensitivity and specificity in the early phase of AMI, providing a valuable diagnostic advantage. At the 2-hour time point, GPBB demonstrated 97% sensitivity and 96% specificity, compared to CK-MB's 81.25% sensitivity and 64% specificity at the 6th hour. This earlier peak suggests that GPBB could play a critical role in prompt diagnosis, enabling more timely interventions and improving patient outcomes [7].

The study also showed that individuals with AMI had notable changes in inflammatory markers like hs-CRP, IL-6, and TNF-α. These markers are integral to the inflammatory processes associated with myocardial injury and have been previously linked to adverse outcomes in cardiovascular events. The elevated levels of these markers in both diabetic and non-diabetic AMI patients underscore their potential value in assessing the severity and progression of AMI. Their presence further validates the hypothesis that inflammation plays a key role in the pathophysiology of AMI and suggests they could serve as adjunctive markers for clinical diagnosis [8–10].

Furthermore, the complete blood count (CBC) profile provided additional insights into the hematologic response to AMI. Significant changes in WBC count, hemoglobin levels, and platelet counts were observed, reflecting the systemic inflammatory response triggered by myocardial damage. These findings align with previous literature, which indicates that such hematologic alterations are common in AMI patients and may provide complementary diagnostic information.

In conclusion, the results of this study support the early use of GPBB for AMI diagnosis, particularly in high-risk groups like diabetic patients. The combination of GPBB with inflammatory markers and CBC parameters could enhance diagnostic accuracy, offering a more holistic approach to managing AMI in clinical settings.

CONCLUSIONS

The findings suggest that GPBB could be an effective diagnostic tool for early detection of AMI, especially in the first few hours, outperforming CK-MB. Furthermore, the elevated levels of inflammatory markers and significant changes in CBC parameters underscore their potential role in understanding the inflammatory processes associated with AMI and their utility in clinical practice.

Funding

This research received no external funding.

Acknowledgments

None.

Conflicts of Interest

The authors declare no conflict of interest.

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