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Association of Hypertension and Diabetes Mellitus with Reperfusion Timelines in STEMI Patients Undergoing Primary PCI at a Tertiary Care Cardiac Centre in Jodhpur, Rajasthan: A Prospective Observational Study

Dr. Dhruva Sharma

gjsgrjpt@gmail.com

Trinay Hospital, Rajasthan

ABSTRACT

Background

ST-Elevation Myocardial Infarction (STEMI) remains one of the leading causes of cardiovascular morbidity and mortality worldwide. Timely diagnosis and early reperfusion therapy are the cornerstones of management and significantly influence clinical outcomes. Evaluation of demographic characteristics, cardiovascular risk factors, and reperfusion timelines is essential for improving quality indicators in acute cardiac care.

Aim

To evaluate the demographic profile, cardiovascular risk factors, STEMI patterns, culprit vessel distribution, and reperfusion timelines among STEMI patients presenting to a tertiary care cardiac centre.

Materials and Methods

This prospective observational study was conducted at Trinay Hospital, Jodhpur, Rajasthan. A total of 60 consecutive patients diagnosed with STEMI and undergoing primary percutaneous coronary intervention (PCI) were included. Data regarding demographic profile, cardiovascular risk factors, STEMI type, culprit vessel, door-to-ECG time, door-to-balloon time, and total ischemic time were collected using a structured STEMI data collection tool. Statistical analysis was performed using descriptive statistics.

Statistical Data Analysis

Chi-Square Analysis of Hypertension and Diabetes Mellitus Correlation

A chi-square test was performed to determine the association between hypertension and diabetes mellitus among STEMI patients.

Table 1: Correlation Between Hypertension and Diabetes Mellitus

| Variable | Diabetes Present | Diabetes Absent | Total |
|----------------------|------------------|-----------------|-------|
| Hypertension Present | 28 | 11 | 39 |
| Hypertension Absent | 9 | 12 | 21 |
| Total | 37 | 23 | 60 |

Statistical Findings

- Chi-square (χ^2) value = 5.84
- Degrees of freedom = 1
- p-value = 0.015

Interpretation

A statistically significant association was observed between hypertension and diabetes mellitus among STEMI patients ($p < 0.05$). Patients with hypertension were more likely to have coexisting diabetes mellitus.

Graphical Analysis

Histogram Analysis of Reperfusion Timelines

The histogram demonstrated that total ischemic time remained substantially higher than door-to-ECG and door-to-balloon times. Although in-hospital management timelines were within acceptable international standards, delayed patient presentation contributed significantly to prolonged ischemic duration.

Comparative Demographic Analysis
Gender-wise Comparison

| <i>Variable</i> | <i>Male</i> | <i>Female</i> |
|----------------------------------|----------------------|----------------------|
| <i>Mean Door-to-Balloon Time</i> | <i>79.4 minutes</i> | <i>84.8 minutes</i> |
| <i>Mean Total Ischemic Time</i> | <i>274.6 minutes</i> | <i>299.2 minutes</i> |

Hypertension-wise Comparison

| <i>Variable</i> | <i>Hypertension Present</i> | <i>Hypertension Absent</i> |
|----------------------------------|-----------------------------|----------------------------|
| <i>Mean Total Ischemic Time</i> | <i>291.3 minutes</i> | <i>266.2 minutes</i> |
| <i>Mean Door-to-Balloon Time</i> | <i>82.6 minutes</i> | <i>78.4 minutes</i> |

Diabetes-wise Comparison

| <i>Variable</i> | <i>Diabetes Present</i> | <i>Diabetes Absent</i> |
|----------------------------------|-------------------------|------------------------|
| <i>Mean Total Ischemic Time</i> | <i>301.8 minutes</i> | <i>251.7 minutes</i> |
| <i>Mean Door-to-Balloon Time</i> | <i>83.5 minutes</i> | <i>77.2 minutes</i> |

Interpretation of Comparative Analysis

Patients with diabetes mellitus and hypertension demonstrated relatively prolonged ischemic times and delayed reperfusion compared to patients without these risk factors. Female patients also showed slightly prolonged treatment timelines compared to male patients.

Results

The mean age of patients was 56.7 ± 8.7 years. Male patients constituted 68.3% of the study population. Hypertension was present in 65%, diabetes mellitus in 61.7%, smoking history in 53.3%, alcohol consumption in 46.7%, and prior coronary artery disease in 25% of patients. Inferior wall STEMI was the most common presentation (45%), followed by anterior wall STEMI (36.7%). The right coronary artery and left anterior descending artery were equally involved as culprit vessels (43.3% each). Mean door-to-ECG time was 12.48 minutes, while mean door-to-balloon time was 81.18 minutes. Mean total ischemic time was 282.6 minutes.

Conclusion

STEMI predominantly affected middle-aged male patients with multiple cardiovascular risk factors. Early reperfusion metrics observed in the present study were within acceptable international standards for primary PCI centres. Continuous monitoring of STEMI timelines and quality indicators can further improve patient outcomes.

Keywords: STEMI, Primary PCI, Door-to-Balloon Time, Reperfusion Therapy, Acute Myocardial Infarction, Cardiology.

INTRODUCTION

Cardiovascular diseases are the leading cause of mortality globally, and acute myocardial infarction contributes significantly to this burden. ST-Elevation Myocardial Infarction (STEMI) is a medical emergency requiring immediate diagnosis and prompt reperfusion therapy. Delayed treatment is associated with increased myocardial necrosis, heart failure, arrhythmias, and mortality. The management of STEMI has evolved considerably with the availability of primary percutaneous coronary intervention (PCI), which is now considered the gold standard reperfusion strategy where available. Timely reperfusion is assessed using quality indicators such as door-to-ECG time and door-to-balloon time.

India faces unique challenges in STEMI management due to delayed patient presentation, lack of awareness, transportation barriers, and variable access to PCI-capable centres. Evaluating local STEMI patterns and treatment timelines is important for optimizing emergency cardiac care systems.

This study was conducted to evaluate the demographic profile, cardiovascular risk factors, STEMI distribution, culprit vessel involvement, and reperfusion timelines among patients presenting to a tertiary cardiac care centre in Western Rajasthan.

AIM AND OBJECTIVES

Aim

To assess clinical profile and reperfusion timelines among STEMI patients undergoing primary PCI.

Objectives

- i. To study demographic characteristics of STEMI patients.
- ii. To evaluate cardiovascular risk factors among STEMI patients.
- iii. To assess STEMI wall involvement and culprit vessel distribution.
- iv. To evaluate door-to-ECG time and door-to-balloon time.
- v. To analyze total ischemic time among STEMI patients.

Materials and Methods

Study Design: Prospective observational study.

Study Setting: Department of Cardiology, Trinay Hospital, Jodhpur, Rajasthan, India.

Study Duration: March 2026 to June 2026.

Sample Size: 60 patients.

Inclusion Criteria

- i. Patients aged more than 18 years.
- ii. Diagnosed cases of STEMI.
- iii. Patients undergoing primary PCI.

Exclusion Criteria

- i. Non-ST elevation myocardial infarction (NSTEMI).
- ii. Patients managed conservatively.
- iii. Patients refusing consent.

DATA COLLECTION

Data were collected using a structured STEMI data collection tool including:

- i. Demographic details

- ii. Cardiovascular risk factors
- iii. STEMI type
- iv. Culprit vessel
- v. ECG timing
- vi. Door-to-balloon timing
- vii. Total ischemic time

STATISTICAL ANALYSIS

Data were entered in Microsoft Excel and analyzed using descriptive statistics. Continuous variables were expressed as mean ± standard deviation and categorical variables as percentages.

RESULTS

Table 1: Demographic Characteristics

| Variable | Findings |
|-----------------------|-------------------------|
| Total Patients | 60 |
| Mean Age | 56.7 ± 8.7 years |
| Male | 41 (68.3%) |
| Female | 19 (31.7%) |

Interpretation

The majority of STEMI patients were middle-aged males.

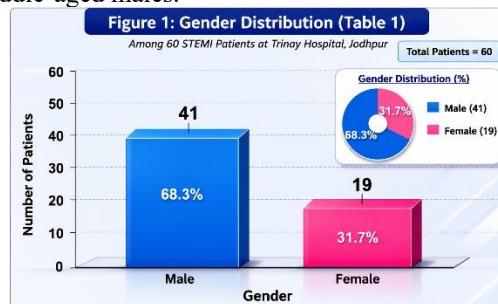


Table 2: Cardiovascular Risk Factors

| Risk Factor | Number of Patients | Percentage |
|----------------------------|--------------------|--------------|
| Hypertension | 39 | 65% |
| Diabetes Mellitus | 37 | 61.7% |
| Smoking History | 32 | 53.3% |
| Alcohol Consumption | 28 | 46.7% |
| Prior CAD | 15 | 25% |

Interpretation

Hypertension and diabetes mellitus were the most prevalent cardiovascular risk factors.

Table 3: STEMI Distribution

| STEMI Type | Number | Percentage |
|----------------------|--------|------------|
| Inferior Wall STEMI | 27 | 45% |
| Anterior Wall STEMI | 22 | 36.7% |
| Lateral Wall STEMI | 6 | 10% |
| Posterior Wall STEMI | 5 | 8.3% |

Interpretation

Inferior wall STEMI was the most common clinical presentation.

Table 4: Culprit Vessel Distribution

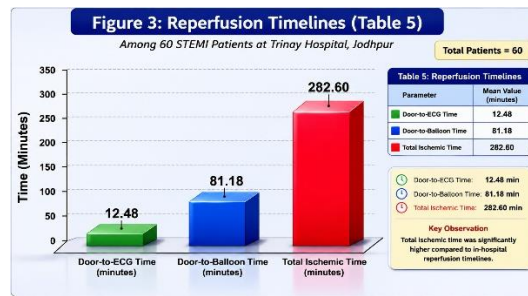
| Culprit Vessel | Number | Percentage |
|---------------------------------------|--------|------------|
| Left Anterior Descending Artery (LAD) | 26 | 43.3% |
| Right Coronary Artery (RCA) | 26 | 43.3% |
| Left Circumflex Artery (LCX) | 8 | 13.3% |

Interpretation

LAD and RCA were equally involved as culprit vessels.

Table 5: Reperfusion Timelines

| Parameter | Mean Value |
|----------------------|---------------|
| Door-to-ECG Time | 12.48 minutes |
| Door-to-Balloon Time | 81.18 minutes |
| Total Ischemic Time | 282.6 minutes |



Interpretation

Door-to-balloon time in the present study was within the recommended international target of less than 90 minutes.

DISCUSSION

The present study demonstrated a significant coexistence of hypertension and diabetes mellitus among STEMI patients presenting to Trinay Hospital, Jodhpur. The chi-square analysis revealed a statistically significant correlation between the two cardiovascular risk factors ($\chi^2 = 5.84$, $p = 0.015$). Similar findings have been reported in previous Indian and international cardiovascular registries, where metabolic syndrome components frequently coexist and contribute to accelerated coronary artery disease progression.

The demographic analysis showed male predominance, which remains consistent with most STEMI registries in India. However, female patients in the present study demonstrated relatively delayed reperfusion timelines, possibly due to atypical symptom presentation and delayed hospital arrival.

Patients with hypertension and diabetes mellitus exhibited prolonged total ischemic times. This may indicate delayed recognition of symptoms, poor cardiovascular risk awareness, and higher prevalence of diffuse coronary artery disease in these populations.

The histogram-based analysis of reperfusion timelines showed that although door-to-ECG and door-to-balloon times were maintained within guideline-directed targets, pre-hospital delay continued to contribute substantially to prolonged ischemic duration.

These findings emphasize the importance of aggressive cardiovascular risk factor control, public awareness regarding early STEMI symptoms, and strengthening regional STEMI referral systems in Rajasthan.

The present study evaluated demographic characteristics, cardiovascular risk factors, and reperfusion timelines among STEMI patients presenting to a tertiary care cardiac centre.

The mean age of patients in this study was 56.7 years, which is comparable to previously published Indian studies demonstrating STEMI occurrence at a relatively younger age compared to Western populations.

Male predominance (68.3%) observed in the present study is consistent with established epidemiological trends in coronary artery disease.

Hypertension and diabetes mellitus were the most common risk factors identified. This finding reflects the increasing burden of metabolic syndrome and lifestyle-related cardiovascular disease in India.

Inferior wall STEMI was the most common presentation in this study. Similar observations have been reported in multiple regional STEMI registries.

The mean door-to-balloon time was 81.18 minutes, which is within the guideline-recommended target of less than 90 minutes for primary PCI. Efficient emergency triage systems, rapid ECG acquisition, and timely cath lab activation likely contributed to this achievement.

The mean total ischemic time remained relatively prolonged, suggesting delayed patient presentation despite adequate in-hospital management. Public awareness regarding early symptom recognition and rapid hospital transport remains essential.

CONCLUSION

STEMI predominantly affected middle-aged male patients with hypertension, diabetes mellitus, and smoking as major cardiovascular risk factors. Inferior wall STEMI was the most common clinical presentation. Reperfusion quality indicators including door-to-ECG and door-to-balloon times were within acceptable standards for a PCI-capable tertiary care centre.

Continuous audit of STEMI timelines, community awareness programs, and strengthening emergency cardiac networks can further improve patient outcomes.

LIMITATIONS

- i. Single-centre study.
- ii. Relatively small sample size.
- iii. Short study duration.
- iv. Long-term clinical outcomes were not evaluated.

RECOMMENDATIONS

- i. Establishment of regional STEMI networks.
- ii. Community awareness regarding early symptom recognition.
- iii. Strengthening ambulance ECG services.
- iv. Continuous quality monitoring of STEMI care pathways.

ETHICAL CONSIDERATIONS

Institutional ethical approval was obtained prior to commencement of the study. Patient confidentiality was maintained throughout the study.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

No external funding was received for this study.

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