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A Retrospective Analysis of Door-to-Balloon Time and Its Determinants in STEMI Patients

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Door-to-ballon time directly impacts the prognosis of STEMI patients, reducing door-to-balloon time **(**Time taken from the patient's arrival at the hospital to catheter guidewire crosses the culprit lesion in the cath lab**)** and early reperfusion is essential in STEMI treatment. Hence, our study aims to determine the factors that prolong door-to-balloon time.
Study Design: This is a retrospective study.
Place and Duration of Study: Department of Cardiology, Aster Ramesh Hospitals, Vijayawada, India. It was done retrospectively on patients who visited the hospital between January and May 2024.
Methodology: The study included patients arriving at the emergency department diagnosed with STEMI and underwent angioplasty. the study employed a pre-designed data collection form covering demographic data, past medical history, the time when the patient entered the emergency department (ed), the first ECG time, door-to-balloon time, and why the door-to-balloon time was delayed.
Results: a total of 170 patient's data was collected, of these, 75% were male and 25% were female. The mean door-to-balloon time (D-to-B) was 2 hours, 29 minutes. subjects were divided into group I (DTBT ≤90 min, n=90), group II (DTBT 91-120 min, n=40), group III (DTBT 121-180 min, n=22), and group IV (DTBT >180 min, n=18). among the patients whose DTB > 90 min, 31% of the delays were due to difficulty in assimilating and understanding the severity of the disease, 30% wanted to take a second opinion, 29% were delayed due to financial issues, and 10% were having problems with hemodynamic abnormalities that prevent rapid management in the cath lab (e.g., an active source of sepsis).
Conclusion: for patients, a DTB time of 90 minutes can be attained with efficient hospital strategies. difficulty in assimilating and understanding the severity of the disease is the primary cause of the DTB time delay in this study. Socioeconomic and cultural barriers adversely affect the door to balloon time in diverse countries like India. public awareness campaigns nationwide about common medical emergencies and their solutions may favourably improve treatment in the golden hour.

Keywords: Angioplasty; door-to-balloon time; factors affecting DBT; ST-elevation myocardial infarction.

ABBREVIATIONS

D-to-B : Door to Ballon Time
ECG : Electrocardiogram
AMI : (Acute Myocardial Infarction)
NSTEMI : Non-ST Segment Elevation Acute Myocardial Infarction (NSTEMI)
STEMI : ST- Segment Elevation Myocardial Infarction (STEMI)
PCI : Percutaneous Coronary Intervention
ACC/AHA : American College of Cardiology and American Heart Association
CAD : (Coronary Artery Disease)
MI : Myocardial Infarction
PPCI : (Primary Percutaneous Coronary Intervention)
TIMI : Thrombolysis in Myocardial Infarction
CCU : Coronary Care Unit
FMC : First Medical Contact

1. INTRODUCTION

The prevalence of cardiovascular disease in India has reached epidemic proportions. the probability of ischemic heart disease is four times higher in urban Indians than in Americans. India has a higher burden of CAD, especially in the younger population than the West, resulting in a decreased valuable life span. previous studies showed that 50% of males affected by ischemic heart disease are under the age of 50, and 25% occur in men under the age of 40 [1] the CREATE registry has made clear crucial aspects of ST-elevation MI (STEMI) management. STEMI is more common (60.6%) and more deadly (8.6%) in the Indian population than in developed

countries. these statistics call for stringent and effective STEMI treatment protocols [2].

Despite significant progress in medical technology in recent years, acute coronary syndrome (ACS) continues to pose a challenge for healthcare professionals. it is of two types: non-st segment elevation acute myocardial infarction (NSTEMI) and st-segment elevation myocardial infarction (STEMI). prompt reperfusion therapy can achieve and sustain normal blood perfusion in myocardial tissue, lower the risk of heart failure, and minimize the size of infarcts. [3–4] Additionally, in patients with new-onset left bundle branch block and STEMI that occurred within 12 hours of continuous ST-segment elevation, it can inhibit left-ventricular remodeling and prevent infarct expansion [5-6].

Percutaneous Coronary Intervention (PCI) has thus emerged as a significant and successful reperfusion treatment in STEMI patients. The door-to-balloon (d-to-b) time directly correlated with the prognosis of STEMI patients following their initial PCI. As a result, the D-to-B time reduction and the ratio of increase in early reperfusion are the most important requirements for STEMI patient treatments. [7–8] The time between a patient entering the hospital and the first balloon dilatation (angioplasty) is called door-to-balloon time. according to aha/acc treatment guidelines, DBT should be within 90 minutes in STEMi patients [9] the present study aims to determine the factors that prolong door-to-balloon time.

2. MATERIALS AND METHODS

2.1 Study Design and Duration

This retrospective study includes patients arriving at the emergency department diagnosed with STEMI and undergoing angioplasty between January and May 2024. This study was approved by the Institutional Ethics Committee (ECRH 042024).

2.2 Study Site and Sample Size

The study was conducted at a tertiary cardiac hospital in a tier II town in Vijayawada, south India. A total of 170 patient's data was collected.

2.3 Study Tools

A pre-designed data collection form was made for this research. Patient records were systematically reviewed to extract data such as demographic information including their admission details, past medical history, the time when the patient entered the Emergency Department (ED), the first ECG time, door-to-balloon time, and why the door-to-balloon time was delayed.

2.4 Statistical Analysis

The data collection process involved using a pre-designed data collection form and the subsequent recording of responses in spreadsheet format. A thorough error check was conducted to ensure data accuracy. The data was subject to descriptive analysis using cross-tabulation in IBM SPSS Statistics, Version 29.

3. RESULTS AND DISCUSSION

3.1 Results

During the study period, 170 patient data were collected. Among them, 75 % were male participants, and 25% were female participants, with a mean age of 57.4 years. Subjects were divided into group I (DTBT ≤90 min, n=90), group II (DTBT 91-120 min, n=40), group III (DTBT 121-180 min, n=22), and group IV (DTBT >180 min, n=18). At the time of admission, 29.4% of patients had type 2 diabetes mellitus, and 23.5% of patients had hypertension**.** Before being admitted to the hospital, 7% of patients did not know they had high blood pressure, and 6% did not know they had diabetes (Table 1, Table 2).

The mean time to ECG is 3 minutes and 24 seconds (SD 0.0007). The average D-to-B time was 2 hours 29 minutes. Among the D-to-B >90 min group, 31% of the delays were due to difficulty in assimilating and understanding the

Table 1. Baseline demographic and clinical characteristics of the study group

Characteristic	Number (%)
Age (mean) years +SD	57.4±11.6
Male	127 (75)
Female	43 (25)
Hypertension	52 (30.5)
Diabetes mellitus	60 (35.2)
Expired Patients	5 (2.9)

Table 2. Door–to–balloon time in males and females

S.NO	Parameters	Group I	Group II	Group III	Group IV
1.	Males	70	29	14	14
2.	Females	20	11	8	4

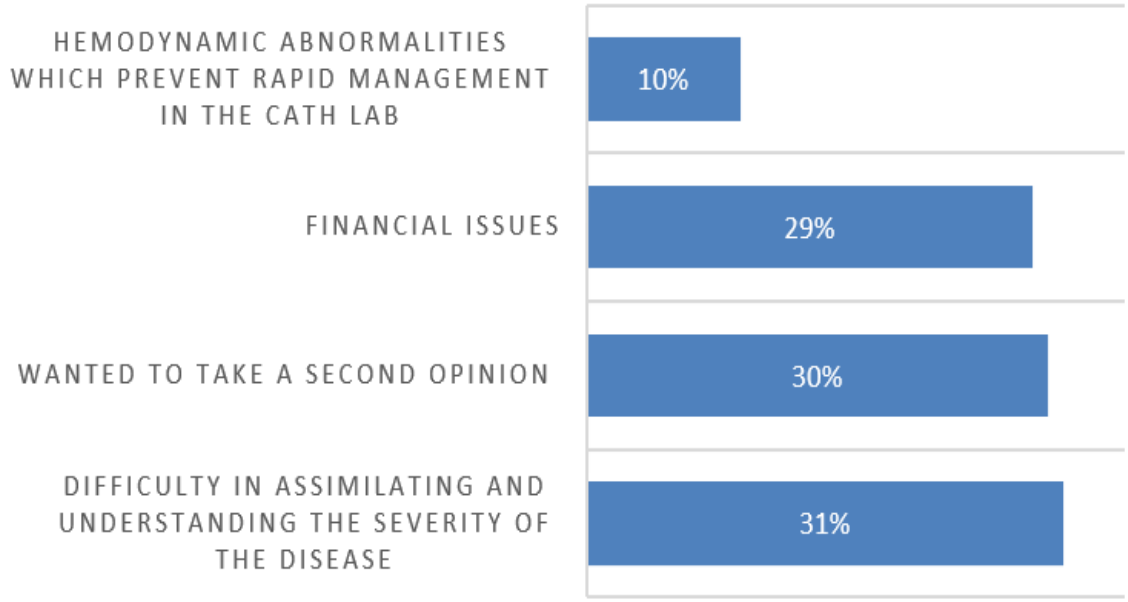

Fig. 1. Reasons for delay in DTB time

severity of the disease, 30% wanted to take a second opinion, and 29% delayed due to D-to-B financial issues. Ten percent had hemodynamic abnormalities, preventing rapid management in the Cath lab (e.g., an active source of sepsis) (Fig. 1).

4. DISCUSSION

Numerous studies have shown that the probability of death in acute MI decreases with less DTB time [10,11]. To minimize DTB time as much as possible, integrated teamwork, realistic goals, and committed compliance are needed [12]. Multiple randomized clinical trials suggested thrombolysis and primary PCI as treatments for STEMI [13,14]. Data from twenty-three randomized trial results show that those who underwent PPCI have less chance of getting nonfatal re-infarction, heart attack, and short-duration mortality than thrombolysis cases in STEMI patients [15]. Studies have shown the importance of shorter door-to-balloon (DTB) times in the management of STEMI [10,16].

Though the American College of Cardiology/American Heart Association (ACC/AHA) criteria concerning managing STEMI patients suggest door-to-balloon intervals of 90 minutes or less [17], barely a minority of patients are currently treated within this time frame, and this pattern has not changed recently. There is widespread agreement that shorter First Medical Contact (FMC) and door-to-ballon times result in a better prognosis, as shown by Menees et al. Door-to-balloon time of 55 minutes is associated with higher survival, the findings provide indirect evidence of the impact of the quality enhancement intervention on survival. In a multivariate Cox model, older age, lower TIMI flow at the end of PPCI, and an ejection fraction of 45% were also identified as predictive of death [18].

Recent research indicates that an increasing number of elderly patients, particularly women with various comorbidities, and a longer pre-hospital stay may counteract the advantages of early reperfusion [19,20].

A Korean patient sample with a median of 2 hours from the beginning of myocardial ischemia symptoms to the hospital door showed a significant improvement in survival at 1 year when the door-to-balloon time shortened [21]. Furthermore, even after three years, less than 90-minute D2B time was associated with a higher survival rate in anterior wall STEMI [11].

The findings suggest that, as there aren't many unavoidable scenarios, the DBT of a 90-minute goal can be achieved. In the present study, Subjects were divided into group I (DTBT ≤90 min, n=90), group II (DTBT 91-120 min, n=40), group III (DTBT 121-180 min, n=22), and group IV (DTBT >180 min, n=18). In our study, 60% of patients achieved door-to-ballon time within the suggested time frame.

The main cause for increasing DTB time was a delay in obtaining patient consent and financial reasons reported by Suma M. Victor et al. In our study, difficulty in assimilating and understanding the severity of the disease (31%) was the primary contributor to the increased D-to-B time.

In our study among the DTB > 90-minute group, 31% of the delays were due to difficulty assimilating and understanding the severity of the disease, 30% wanted to take a second opinion, and 29% were delayed due to financial issues.

The Centres for Medicare & Medicaid Services (CMS) conducted a study from 2005 to 2010, which included patients from nine hundred hospitals this study results showed that the DBT time in America decreased from 96 to 64 minutes [22]. The average DTB time was 2 hours, and 29 minutes in the present study.

5. CONCLUSION

For Patients, a DTB time of 90 minutes can be attained with efficient hospital strategies. difficulty in assimilating and understanding the severity of the disease is the primary cause of the DTB time delay in this study. Socio-economic and cultural barriers adversely affect the door to balloon time in diverse countries like India. Public awareness campaigns nationwide about common medical emergencies and their solutions may favourably improve treatment in the golden hour.

6. LIMITATIONS

The limitation of the present study is the small sample size, we are planning to conduct a larger study based on this study and launch a public campaign to increase awareness in seeking timely reperfusion therapy in acute coronary syndrome.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

We hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

CONSENT

It is not applicable.

ETHICAL APPROVAL

This study was approved by the Institutional Ethics Committee (ECRH042024).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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