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IMPACT OF DOOR-TO-BALLOON TIME ON OUTCOMES IN STEMI PATIENTS UNDERGOING PRIMARY PCI

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Abstract

Objective: *"To assess the impact of Door-to-Balloon Time on Outcomes in STEMI Patients Undergoing Primary PCI"*

Study Design: *Prospective observational study*

Place and period of study: *This research was conducted at department of Cardiology, Armed Forces Institute of Cardiology, Rawalpindi from March 2024 till August 2024*

Methodology: *After meeting selection criteria 246 patients of primary PCI were enrolled. Door-to-Balloon time was recorded. The primary outcome of this study was in-hospital mortality, with door-to-balloon time as the independent variable. Data were recorded in Proforma analyzed in SPSS version 23.*

Results: *The mean age was 49.20±15.82 years. Among the participants, 172 (69.9%) were male and 74 (30.1%) were female. The average door-to-balloon time was 81.13±23.50 minutes. Outcome comparison across door-to-balloon time categories revealed that in-hospital mortality occurred in 4 (6.6%) patients with door-to-balloon time <60 minutes, 13 (14.4%) cases with 60–90 minutes, and 20 (21.1%) patients with >90 minutes (p = 0.046). Similarly, MACE was observed in 11 (18%) cases with door-to-balloon time <60 minutes, 18 (20.0%) patients with 60–90 minutes, and 34 (35.8%) patients with >90 minutes (p = 0.014).*

Conclusion: *Door-to-balloon time significantly influences mortality in cases undergoing primary PCI, underscoring the need for the earliest possible intervention.*

INTRODUCTION

Because primary percutaneous coronary intervention (PCI) may restore epicardial artery flow, it is the gold standard for treating the cases with ST-segment elevation myocardial infarction (STEMI) [1].Since STEMI is still one of the world's top causes of cardiovascular disease-related deaths, prompt management is crucial to enhancing case outcomes. If primary percutaneous coronary intervention (PCI) is carried out within the suggested Door-to-Balloon (D2B) timeframe of less than 90 minutes, it is the gold standard for revascularization in acute STEMI. Negative consequences, such as increased mortality rates and worse myocardial healing, are frequently associated with failure to meet this time limit [2, 3].

The cornerstone of modern STEMI care is prompt reperfusion treatment, which is usually accomplished via primary percutaneous coronary intervention (PCI) [4, 5]. The interval between the patient's hospital admission and the beginning of balloon inflation in the affected coronary artery is known as the door-to-balloon (DTB) period, is a crucial element affecting how well PCI works. [5]. The timely administration of primary percutaneous coronary intervention (PCI) for ST-segment elevation myocardial infarction (STEMI) has a significant influence on patient outcomes. However, because it may have an impact on patient prognosis and treatment efficiency, There is still serious concern about how door-to-balloon (D2B) time and clinical results are affected by off-hours presentations (nights, weekends, and holidays) [6].

Given its critical function in saving the ischemic myocardium and lowering death rates, significant efforts have been made in recent decades to minimize DTB duration. The significance of meeting DTB timeframes within predetermined benchmarks—typically 90 minutes or fewer after the cases arrival at the catheterization laboratory (Cath lab)—has been underlined by guidelines and quality improvement programs. However, a number of systemic, clinical, and logistical variables make prompt reperfusion difficult to achieve[7, 8].

Numerous studies have established that shorter D2B times are associated with improved survival rates and myocardial recovery. For instance, a reduction in D2B time to under 120 minutes has been shown to lower 30-day and 1-year mortality [9]. Similarly, studies in Pakistan have demonstrated that prolonged D2B times correlate with worse outcomes, particularly when combined with extended symptom-to-door times [10].

Coronary artery diseases pose a significant threat to public health.A higher incidence of CAD risk factors, such as inadequate diet, inactivity, and restricted access to preventative care, may be associated with poverty. Thus, the purpose of this study was to assess the impact of Door-to-Balloon Time on the results of STEMI patients receiving primary PCI.

METHODOLOGY

After approval from ethical review committee (ERC letter number with date), this prospective observational study was conducted at the department of Cardiology, Armed Forces Institute of Cardiology, Rawalpindi March 2024 till August 2024. The calculated sample size of the stud was 139 taking the door to door balloon proportion of mortality between 60-90 minutes as 10% [3]. The margin of error for this calculation of sample size was 5% and confidence interval was 95%. Patients were recruited who fulfilled following criteria by using non-probability, consecutive sampling.

Inclusion criteria: The inclusion criteria for the study are as follows: Participants must be aged 18 years or older and have been diagnosed with STEMI. Additionally, they should have undergone primary percutaneous coronary intervention (PCI) within 12 hours of symptom onset.

Exclusion criteria: The exclusion criteria for the study include patients who required thrombolysis due to logistical or clinical reasons, as this could confound the analysis of door-to-balloon (D2B) time. Additionally, patients with a history of prior myocardial infarction are excluded, as pre-existing cardiac damage could influence the outcomes. Patients with severe renal or hepatic dysfunction, contrast allergies, or other contraindications to PCI are also excluded. These criteria were established to ensure a homogeneous study population, minimizing confounding variables that could affect the assessment of D2B time on clinical outcomes.

Informed consent and demographic detail was taken. In this study door to door balloon was defined as time

in minutes between a patient's arrival at the hospital and the first balloon inflation or device deployment as documented in the patient's medical record [11]. The procedural success was defined as successful restoration of coronary artery patency with no significant complications during PCI. The primary outcome of this study was In-hospital mortality and the independent variable was door to balloon time. Data were measured and recorded by trained personnel who were blinded to the study's objectives in order to minimize bias in data collection. All the data was collected on pre-designed Proforma.

All the collected data was entered and analyzed on SPSS version 23. All the quantitative data was presented in the form of mean±SD and all the qualitative data was presented in the form of frequency and percentages.

RESULTS:

A total of 246 patients were enrolled in this study. The mean age was 49.20 ± 15.82 years, and the average door-to-balloon time was 81.13 ± 23.50 minutes. Among the participants, 172 (69.9%) were male and 74 (30.1%) were female. The study findings showed that 85 (34.6%) patients were smokers, 100 (40.7%) were diabetic, and 74 (30.1%) were hypertensive. In terms of outcomes, MACE occurred in 20 (8.1%) patients. **Table 1**

This study found that in-hospital mortality occurred in 37 (15.04%) patients. **Fig 1**

Comparison of outcomes across door-to-balloon time categories showed that in-hospital mortality occurred in 4 (6.6%) cases with D2B <60 minutes, 13 (14.4%) with 60–90 minutes, and 20 (21.1%) with >90 minutes, shows a statistically significant difference (p = 0.046). Similarly, MACE occurred in 11 (18%) patients with D2B <60 minutes, 18 (20.0%) with 60–90 minutes, and 34 (35.8%) with >90 minutes, also showing a statistically significant distinction (p = 0.014). **Table 2**

Table-I: Demographic and clinical details of enrolled patients (n = 246)

Parameters		Output
Age (Years)		49.20 ± 15.82
Gender	Male	172 (69.9%)
	Female	74 (30.1%)
Smoking		85 (34.6%)
Hypertension		148 (60.2%)
Diabetes		100 (40.7%)
Hyperlipidemia		74 (30.1%)
MACE		20 (8.1%)
Door to Balloon Time		81.13 ± 23.50
Door to Balloon Time (minutes)	<60	61 (24.8%)
	60-90	90 (36.6%)
	>90	95 (38.6%)

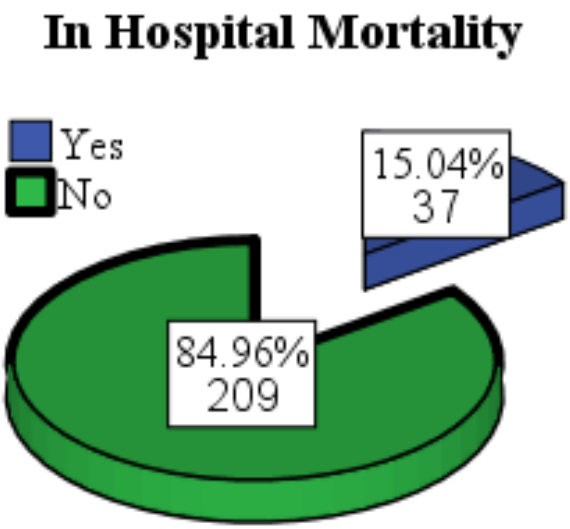

Figure-1: In-hospital mortality observed (n = 246)

Table-II: Association of outcome (in-hospital mortality & MACE) with increased door to balloon time (n = 246)

In Hospital Mortality		**Yes**	**No**	**p-value**
Door to Balloon Time (Minutes)	<60	4 (6.6%)	57 (93.4%)	0.046
	60-90	13 (14.4%)	77 (85.6%)	
	>90	20 (21.1%)	75 (78.9%)	
MACE		**Yes**	**No**	
Door to Balloon Time (Minutes)	<60	11 (18.0%)	50 (82.0%)	0.014
	60-90	18 (20.0%)	72 (80.0%)	
	>90	34 (35.8%)	61 (64.2%)	

DISCUSSION:

Door-to-balloon time, which is now recorded by several clinical registries, has emerged as the primary focus of all cardiac care facilities and quality improvement programs. Door to balloon time is a crucial technique for treating myocardial infarction and is a key component of cardiovascular disease treatment. The time it takes to move someone from the door to the balloon is more closely linked to mortality, according to research, than the period between the balloon operation and the onset of symptoms; therefore, every person should try to reduce this time [12-14].

In this study Outcome comparison across door-to-balloon time categories revealed that in-hospital mortality occurred in 4 (6.6%) cases with door-to-balloon time <60 minutes, 13 (14.4%) patients with 60–90 minutes, and 20 (21.1%) patients with >90 minutes (p = 0.046). Similarly, MACE was observed in 11 (18%) cases with door-to-balloon time <60 minutes, 18 (20.0%) patients with 60–90 minutes, and 34 (35.8%) patients with >90 minutes (p = 0.014). Below is a discussion of a few of the studies and their findings.

Waheed Ur Rehman et al showed that the total in-hospital death rate, including the 1.12% (14) procedure mortality rate, was 3.82% (48). Most patients fall within the 60-minute range. Patients with

longer door-to-balloon periods (> 90 minutes = 4.8%, 60-89 minutes = 2.85%, 90-120 minutes = 15.27% p < 0.001) exhibited greater mortality rates within the door-to-balloon time groups[15].

One study by Ibrar Hussain et al resulted found 35% of patients in the group had D2B times longer than 60 minutes, whereas 65% of patients had D2B durations less than 60 minutes. In-hospital mortality was considerably lower in the ≤60-minute group (2%) than in the >60-minute group (12%) (p=0.0001). Additionally, the ≤60-minute group had a lower MACE incidence (4%) than the >60-minute group (20%) (p=0.0002). The ≤60-minute group had a 98% overall survival rate, while the >60-minute group had an 85% rate (p=0.0003) [3].

One study [16] resulted in a mean age of 58 years and a 73% male preponderance in the research. The three most prevalent risk factors were diabetes (39%), smoking (38%), and hypertension (33%). The Left Anterior Descending (LAD) was the most often blocked artery (63%). Door-to-balloon delays were common; the median duration was 169 minutes. These delays were often caused by social issues and budgetary constraints. While 22.6% of patients were advised to have a bypass after PCI of the infarct-related artery (IRA), the majority of patients (77.4%) simply had PCI. The primary reason of the 24.2% fatality rate in the delayed treatment group was complications[16].

Lack of cardiac catheterization facilities and qualified interventional cardiologists hinder timely PCI administration for MI patients. Comparatively, between 53.8 and 71.53% of South Africans reside 60 or 120 minutes away from a PCI facility, respectively [17]. S Akber et al shown that limiting D2B periods to less than 90 minutes considerably increases survival and lowers MACE in STEMI patients after initial PCI. These results highlight how crucial it is to streamline treatment processes in order to reduce delays and improve patient outcomes in STEMI[18].

Although direct assessments of D2B times in Pakistan are limited, emerging data from the region align with global trends. For example, Mansoor et al. (2023) in a multi-center study conducted at the National Institute of Cardiovascular Diseases (NICVD) in Karachi reported an average D2B time of 81.3 minutes, which was associated with a 5.6% MACE rate at 30 days. These findings contribute valuable benchmarks that can be used to optimize cardiac care in Pakistan, underlining the importance of minimizing delays in STEMI treatment [19].

When treating myocardial infarction, the door-to-balloon time—the interval between a patient's admission and percutaneous coronary intervention—is essential. It is advised to aim for less than 90 minutes because shorter durations are linked to better results [16]. The absence of emergency medical personnel and well equipped cardiac care facilities is one of Pakistan's biggest challenges in meeting the door-to-balloon time. Emergency medical personnel drastically cut down on door-to-balloon Prehospital ECGs are an excellent method of identifying, triage, and manage STEMI patients early on, saving them valuable time [20].

CONCLUSION:

On the basis of this study we may conclude that door-to-balloon time has a significant impact on mortality and MACE in undergoing of cases in primary percutaneous coronary intervention. It is recommended that treatment should be initiated at the earliest possible time.

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