

Abstract

Prompt reperfusion via primary percutaneous coronary intervention (PCI) is essential in the treatment of ST-segment elevation myocardial infarction (STEMI). This study evaluates the relationship between door-to-balloon (D2B) time and in-hospital patient outcomes. A retrospective analysis of de-identified patient records was conducted, dividing patients into two groups: D2B ≤ 60 minutes and > 60 minutes. Outcomes assessed included length of stay, post-procedure ejection fraction (EF), discharge status, and need for coronary artery bypass grafting (CABG). Patients with D2B ≤ 60 minutes demonstrated significantly higher ejection fractions (43% vs. 34.5%, p = 0.046). While length of stay was shorter in this group (4 vs. 5 days), the difference was not statistically significant (p = 0.586). Additional trends suggested improved overall outcomes with shorter D2B times. These findings support the importance of minimizing D2B time to improve cardiac function and reinforce the role of rapid intervention in optimizing STEMI patient outcomes.

Introduction & Summary

What is a Heart Attack?

In humans, the coronary arteries run along the outside of the heart, supplying oxygen-rich blood to the cardiac muscle (myocardium). Due to lifestyle factors, genetics, and aging, the inner layer of coronary arteries collects plaque (atherosclerosis) [1], preventing the flow of blood to the myocardium. When these plaque deposits grow too large, the flow of blood in the coronary arteries is blocked, and the myocardium is starved of oxygen, resulting in a heart attack (myocardial infarction).

STEMI vs NSTEMI

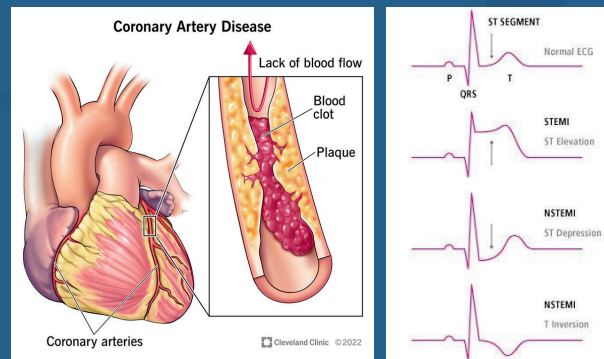
There are two types of myocardial infarction: Non-ST-segment elevation myocardial infarction (NSTEMI), ST-segment elevation myocardial infarction (STEMI). NSTEMI typically occurs when a coronary artery is greatly narrowed by plaque but not quite 100% blocked, while STEMI typically occurs when there is a 100% blockage. Both types of myocardial infarction are emergencies, but STEMI is more severe and must be reversed immediately to prevent cardiac death [2].

Heart Attack Reversal

Myocardial infarction is treated via percutaneous coronary intervention (PCI). When treating a STEMI patient, this procedure is referred to as primary PCI. During PCIs, interventional cardiologists use catheters to access the coronary arteries, compress plaque against the arterial wall or break plaque deposits to increase blood flow, and potentially place stents to prevent future blockages [3].

D2B Alliance

The American College of Cardiology (ACC), created the Door to Balloon (D2B) Alliance in 2006 to improve health outcomes for patients experiencing STEMI by mandating that the time between arrival at an emergency room and the first balloon to 90 minutes or less for all primary PCIs [4]. This standard was backed by the research available during its implementation that suggested that primary PCI times under 90 minutes resulted in reduced mortality compared to longer times [5]. Recently, researchers have begun speculating that reducing the standard for D2B times to less than 60 minutes will result in better patient health outcomes.



Methodology

This quantitative investigation consisted of data collected on de-identified STEMI patients who underwent primary PCI procedures in the Memorial Hermann Southwest Hospital Cath Lab between January to March of 2026. The variables collected were door-to-balloon time, length of stay, post-procedure ejection fraction (EF), discharge status, and need for coronary artery bypass grafting (CABG). Upon collection, all cases with D2B times longer than 90 minutes were discarded, and the remaining data were divided into two groups based on D2B time (≤ 60 minutes and >60 minutes) for comparison. After grouping, the variables were compared between the groups to determine if there were significant differences in patient health outcomes.

Results

Figure 1: Length of Stay in Days of Patients with D2B Times ≤ 60 minutes and >60 minutes

	≤ 60 minutes (Group 1)	>60 minutes (Group 2)
Number of Values in the Dataset	10	5
Average Length of Stay	4	5
Standard Deviation of Length of Stay	2.49	2.97

Welch's Independent t-test:
t-statistic = -0.575, t-critical = 2.160, p-value = 0.586

Figure 2: Post-PCI Ejection Fraction of Patients with D2B Times ≤ 60 minutes and >60 minutes

	≤ 60 minutes (Group 1)	>60 minutes (Group 2)
Number of Values in the Dataset	10	5
Average Ejection Fraction	43	34.5
Standard Deviation of Ejection Fraction	8.96	5.70

Welch's Independent t-test:
t-statistic = 2.230, t-critical = 2.160, p-value = 0.046

Figure 3: Discharge Location of Patients with D2B Times ≤ 60 minutes and >60 minutes

	≤ 60 minutes (Group 1)	>60 minutes (Group 2)
Home	9	5
Mortality	1	0

Figure 4: Plans to Perform CABG of Patients with D2B Times ≤ 60 minutes and >60 minutes

	≤ 60 minutes (Group 1)	>60 minutes (Group 2)
Yes	0	3
Maybe	1	1
No	9	1

Findings

Patients with D2B times ≤60 minutes demonstrated a shorter average hospital stay (4 vs. 5 days), although this difference was not statistically significant (Figure 1). However, these patients had a significantly higher average post-procedure ejection fraction (43% vs. 34.5%, p = 0.046), indicating improved cardiac function (Figure 2). Discharge outcomes were similar across both groups, with nearly all patients returning home and one mortality in the ≤60-minute group considered an outlier (Figure 3). Additionally, patients with longer D2B times showed a slightly higher incidence of planned or potential CABG, suggesting more severe disease (Figure 4). Overall, the findings support the hypothesis that shorter D2B times are associated with improved patient health outcomes.

Discussion

This study successfully followed the proposed methodology by using de-identified Cath Lab data to compare patient outcomes based on D2B time. The data were organized and analyzed as planned, allowing for clear comparisons between groups. However, the small sample size limits the reliability and generalizability of the findings. While some trends and a significant difference in ejection fraction were observed, larger studies are needed to confirm these results. Additionally, although shorter D2B times appear beneficial, more research is necessary to determine whether current standards should be further reduced. Patient outcomes are influenced by many factors, and in this study, individuals had widely varying health backgrounds. These differences likely impacted results, potentially more than D2B time itself. Future research should include larger sample sizes and better control for patient history to more accurately isolate the effect of D2B time on clinical outcomes.

References

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