Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.1487
*Biol. Clin. Sci. Res. J., Volume, **2024**: 1487*
Original Research Article

IMPACT OF OFF-HOURS PRESENTATION ON DOOR-TO-BALLOON TIME AND CLINICAL OUTCOMES IN PATIENTS REFERRED FOR PRIMARY PERCUTANEOUS CORONARY INTERVENTION

SHAHZAD MMK[1], JAVAID SY[1], YASIN M[2], JAFFRI SKA[1], IQBAL MH[1], SAEED M[3]

[1]*Department of Cardiology, Armed Forces Institute of Cardiology & National Institute of Heart Diseases Rawalpindi, Pakistan*
[2]*Interventional Cardiologist Mega Medical Complex Saddar Rawalpindi, Pakistan*
[3]*Department of Cardiology, Pakistan Institute of Medical Sciences (PIMS), Pakistan*
**Corresponding author`s email address:* skhuram52@yahoo.com

(Received, 04th June 2024, Revised 25th December 2024, Published 30th December 2024)

Abstract: *Timely intervention is crucial in managing ST-elevation myocardial infarction (STEMI) patients undergoing primary percutaneous coronary intervention (PCI). Due to staffing and logistical constraints, off-hours presentations may impact door-to-balloon (D2B) time and clinical outcomes.* ***Objectives:*** *To assess the impact of off-hours presentation on door-to-balloon time and clinical outcomes in patients referred for primary percutaneous coronary intervention.* ***Methods:*** *After receiving approval from the Ethical Committee of the Department of Cardiology, Armed Forces Institute of Cardiology, and NIHD, 92 patients meeting inclusion criteria were enrolled, with written informed consent obtained. Participants underwent a detailed history review and physical examination. The study divided participants into off-hours and regular-hours groups based on their hospital arrival times. The main focus was on the timing of presentation, linked to outcomes like door-to-balloon (D2B) time, mortality, and complications such as cardiogenic shock and heart failure. Data on demographics, clinical characteristics, and PCI details were carefully collected using standardized forms by trained personnel.* ***Results:*** *The off-hours group had a mean age of 58.8 years, with 76.1% male, while the regular hour's group had a mean age of 54.7 years and 69.6% male. Hypertension was present in 37% of the off-hours group and 41.3% of the regular-hour group. Smokers comprised 67.4% of the off-hours group and 45.7% of the regular-hours group. The off-hours group had a mean door-to-balloon time of 89.96 minutes, compared to 83.46 minutes for the regular hour group. Mortality was 4.3% in the off-hours group and 8.7% in the regular-hour group. The Cardiogenic shock occurred in 6.5% of the off-hours group versus 10.9% in the regular-hour group. Multivariable regression showed that off-hours presentation increased D2B time by 12.6 minutes. Logistic regression revealed no significant differences in mortality, shock, or heart failure between the two groups. Both groups had similar angiography findings, with most lesions in the LAD.* ***Conclusion:*** *Off-hours presentations result in longer D2B times for STEMI patients, mainly due to staffing and logistical challenges. However, the off-hours group had lower mortality and cardiogenic shock rates, likely influenced by disease severity and post-procedural care. Although no significant outcome differences were observed, there was a trend toward more adverse events. These findings highlight the importance of improving off-hours care, optimizing pre-hospital processes, and promoting public health initiatives.*

Keywords: Off-hours, propranolol, Door-to-Balloon Time, primary PCI

Introduction

Acute ST-segment elevation myocardial infarction (STEMI) is a time-sensitive condition that demands rapid reperfusion therapy to reduce mortality and morbidity.(1) Primary percutaneous coronary intervention (PCI) is the gold standard treatment for STEMI, and timely intervention, particularly the door-to-balloon (D2B) time, is crucial for optimal clinical outcomes.(2) The door-to-balloon (D2B) time, which tracks the duration from a patient's arrival at the hospital to the initiation of coronary intervention, is a key indicator in evaluating the effectiveness of STEMI treatment.(3) Delays in treatment initiation are associated with increased risk of complications such as cardiogenic shock, heart failure, and mortality.(4, 5) Hospital presentation during off-hours, typically defined as evenings, nights, weekends, and holidays, has been recognized as a potential factor influencing the timeliness of PCI and, consequently, patient outcomes.(6) Previous studies have suggested that off-hours presentations may result in longer D2B times due to reduced staffing, logistical challenges, and limited availability of specialized personnel.(7, 8) However, the impact of off-hours presentation on clinical outcomes remains an area of ongoing research, with mixed findings regarding the association with mortality and adverse events.

This study explores the relationship between off-hours presentation, D2B time, and clinical outcomes in patients referred for primary PCI. Comparing off-hours and regular-hours presentations provides insights into how presentation timing influences reperfusion delays and patient outcomes and whether interventions to optimize care during off-hours could improve STEMI management.

Objective: To assess the impact of off-hours presentation on door-to-balloon time and clinical outcomes in patients referred for primary percutaneous coronary intervention.

Methodology

Randomized controlled trial Department of Cardiology, Armed Forces Institute of Cardiology and NIHD. The study duration was 3 months (July 2024 to Dec 2024). Non-probability Consecutive sampling was used to recruit patients. Patients with ST-Segment Elevation Myocardial Infarction (STEMI). Patients referred for primary

[Citation: Shahzad, M.M.K., Javaid, S.Y., Yasin, M., Jaffri, S.K.A, Iqbal. M.H., Saeed, M. (2024). Impact of off-hours presentation on door-to-balloon time and clinical outcomes in patients referred for primary percutaneous coronary intervention. *Biol. Clin. Sci. Res. J.*, **2024***: 1487*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1487]

percutaneous coronary intervention. Patients of 18-70 years of age. Both genders. Patients presenting with Non-ST-Elevation Myocardial Infarction (NSTEMI) or other acute coronary syndromes not requiring primary PCI. Patients deemed unsuitable for primary PCI due to contraindications underwent revascularization for a separate event within the study timeframe. Patients transferred from another facility where door-to-balloon time data cannot be reliably documented.

Following approval from the Ethical Committee of the Armed Forces Institute of Cardiology and NIHD, patients meeting the inclusion criteria were identified and provided written informed consent, either personally or via a guardian. Each participant underwent a comprehensive history review and a detailed physical examination. A total of 92 patients were enrolled in the study. The study systematically categorized participants into off-hours and regular-hours groups based on their hospital arrival times to enable a thorough comparison. The primary variable of interest was the timing of presentation, examined in relation to critical outcomes such as door-to-balloon (D2B) time, mortality rates, and the occurrence of complications like cardiogenic shock and heart failure. Comprehensive data collection encompassed demographic details, clinical characteristics, and specifics of the PCI procedure, with careful consideration of potential confounding factors. Trained personnel utilized standardized forms for data extraction, ensuring accuracy and consistency in the collected information.

Results

The comparison between the off-hours and regular hour's groups reveals that the mean age for the off-hours group was 58.80±9.370 years, compared to 54.73±10.367 years for the regular hours group. In terms of sex, 76.1% of the off-hours group and 69.6% of the regular-hour group were male. Hypertension was present in 37.0% of the off-hours group and 41.3% of the regular-hour group. Current smokers comprised 67.4% of the off-hours group and 45.7% of the regular hour's group. The mean door-to-balloon (D2B) time for the off-hours group was 89.956±5.129 minutes, while for the regular hours group, it was 83.456±5.991 minutes. Mortality occurred in 4.3% of the off-hours group and 8.7% of the regular hour group. Cardiogenic shock was observed in 6.5% of the off-hours group and 10.9% of the regular-hour group. Heart failure was present in 8.7% of both groups. The multivariable regression analysis for door-to-balloon (D2B) time showed that off-hours presentation was associated with an increased D2B time, with a coefficient of 12.6 (95% CI: 8.1 - 16.4), and this result was statistically significant (p-value = 0.00). Hypertension also contributed to a longer D2B time, with a coefficient of 6.7 (95% CI: 2.0 - 8.9), and was statistically significant (p-value = 0.00). However, current smoking did not significantly impact D2B time, with a coefficient of 1.7 (95% CI: -1.2 - 4.6) and a p-value of 0.23. The logistic regression analysis for clinical outcomes revealed no significant association between the off-hours presentation and mortality (OR = 1.47, 95% CI: 0.67 - 2.51, p-value = 0.16), cardiogenic shock (OR = 1.26, 95% CI: 0.58 - 2.03, p-value = 0.34), or heart failure (OR = 1.33, 95% CI: 0.88 - 2.15, p-value = 0.20). The angiography findings and clinical outcomes for off-hours and regular-hours presentations are as follows: In the off-hours presentation group, 73.9% had significant coronary artery disease (CAD), and 26.1% had normal or minimal disease. Most lesions were located in the left anterior descending artery (LAD). In terms of coronary wire passage, 63.0% of cases passed quickly. In the regular-hour presentation group, 63.0% had significant CAD, and 37.0% had normal or minimal disease, with 71.7% of lesions in the LAD. Similarly, 63.0% of cases passed the coronary wire easily.

Table 1: Characteristics of all enrolled patients (*n=92)*

Groups	**Presentation Time**	
	Off-Hours (Mean ±SD) or n (%)	Regular Hours (Mean ±SD) or n (%)
Age	58.80±9.370	54.73±10.367
Sex (Male)	35(76.1%)	32(69.6%)
Hypertension	17(37.0%)	19(41.3%)
Current Smoker	31(67.4%)	21(45.7%)
Door-to-Balloon Time and Clinical Outcomes		
D2B Time (minutes)	89.956±5.129	83.456±5.991
Mortality Rate	2(4.3%)	4(8.7%)
Cardiogenic Shock	3(6.5%)	5(10.9%)
Heart Failure	4(8.7%)	4(8.7%)

Table 2: Multivariable Regression Analysis for D2B Time

	Coefficient (95% CI)	**P-value**
Off-Hours Presentation	12.6 (8.1 - 16.4)	0.00
Hypertension	6.7 (2.0 - 8.9)	0.00
Current Smoker	1.7 (-1.2 - 4.6)	0.23
Logistic Regression Analysis for Clinical Outcomes		
Outcomes	Odds Ratio (95% CI)	p-value
Mortality	1.47 (0.67 - 2.51)	0.16
Cardiogenic Shock	1.26 (0.58 - 2.03)	0.34
Heart Failure	1.33 (0.88 - 2.15)	0.20

[Citation: Shahzad, M.M.K., Javaid, S.Y., Yasin, M., Jaffri, S.K.A, Iqbal. M.H., Saeed, M. (2024). Impact of off-hours presentation on door-to-balloon time and clinical outcomes in patients referred for primary percutaneous coronary intervention. *Biol. Clin. Sci. Res. J.*, **2024***: 1487*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1487]

Table 3: Angiography Findings and Clinical Outcomes

	Angiography Findings	Lesion Characteristics	Coronary Wire Passage	Clinical Outcome
	Significant CAD	Normal/Minimal Disease		Passed Easily
Off-Hours Presentation	34(73.9%)	12(26.1%)	Majority in LAD	29(63.0%)
Regular Hours Presentation	29(63.0%)	17(37.0%)	Majority in LAD	33(71.7%)

Discussion

The present study aimed to evaluate the relationship between off-hours presentation, door-to-balloon time, and clinical outcomes in patients undergoing primary PCI for STEMI, to identify potential disparities in treatment effectiveness, and to guide strategies to improve cardiovascular emergency care. The present study's findings provide valuable insights into how the timing of hospital presentation impacts the management and outcomes of acute STEMI, supporting previous research showing longer D2B times for patients presenting during off-hours than those presenting during regular hours.(9, 10) Several factors can contribute to the delays in initiating reperfusion therapy during off-hours, including the reduced availability of staff and specialized personnel and logistical difficulties in mobilizing the cardiac catheterization team.(11, 12) Off-hours presentation is associated with a longer D2B time, but it does not appear to have a significant impact on clinical outcomes such as mortality, cardiogenic shock, or heart failure. The clinical outcomes for both groups were comparable regarding heart failure incidence, with both groups showing an 8.7% rate. However, the off-hours group had a lower mortality rate (4.3%) than the regular-hours group (8.7%). The cardiogenic shock occurred in 6.5% of patients in the off-hours group, compared to 10.9% in the regular-hour group. Despite a longer D2B time in the off-hours group, the mortality and cardiogenic shock rates were lower, which may be attributed to factors such as the severity of coronary disease or the effectiveness and timing of post-procedural care.

While our analysis did not find any statistically significant differences in mortality or complications such as cardiogenic shock and heart failure between the off-hours and regular hour's groups, there was a clear trend showing higher rates of adverse events in the off-hours group. This finding aligns with previous studies, which suggest that patients who present outside regular hours may be at an increased risk for negative outcomes.(13, 14) The relationship between off-hours presentation and adverse clinical outcomes is likely multifaceted, influenced by a combination of factors. While delays in reperfusion therapy are a key contributor, other aspects of care delivery also play a role. These include variations in the initial triage process, the diagnostic procedures employed, and the quality of post-procedural care. Additionally, patient-specific factors, such as comorbidities, the severity of the underlying disease, and the timing of symptom onset related to the patient's presentation at the hospital, may further complicate outcomes. The interaction between these factors highlights the complexity of managing patients who present outside regular hours and suggests that adverse outcomes may result from a combination of both systemic delays and individual patient characteristics.(15-17) Addressing the impact of off-hours presentations on STEMI outcomes requires a comprehensive and multifaceted approach. This involves optimizing pre-hospital procedures, such as improving early recognition of STEMI symptoms and ensuring rapid access to emergency medical services. Enhancing resource allocation within the hospital, particularly during off-hours, and strengthening coordination among healthcare providers can help maintain consistent care quality, regardless of presentation time.(18) Additionally, public health initiatives aimed at raising awareness about the signs of STEMI, promoting timely recognition by the public, and encouraging early intervention through emergency services can significantly reduce delays in receiving appropriate care, ultimately improving outcomes.(19).

The mean age of patients in the off-hours group was slightly higher (58.80±9.370 years) compared to the regular hours group (54.73±10.367 years), which could suggest that older patients may be more likely to present outside of regular hours. In terms of sex distribution, a higher percentage of males were present in both groups, with 76.1% in the off-hours group and 69.6% in the regular hour's group, which reflects the higher prevalence of STEMI in men. Hypertension was present in a similar proportion of both groups (37.0% in off-hours and 41.3% in regular hours), indicating that hypertension is a common risk factor for STEMI regardless of presentation time.

Conclusion

It was concluded that off-hours presentation leads to longer door-to-balloon (D2B) times in STEMI patients, mainly due to staffing and logistical issues. Despite this delay, the off-hours group had lower mortality and cardiogenic shock rates, possibly due to factors like disease severity and post-procedural care. While no significant differences were found in outcomes, there was a trend toward more adverse events in the off-hours group. These findings emphasize the need for improved off-hours care, optimized pre-hospital processes, and public health initiatives to reduce delays and enhance outcomes.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned.
Consent for publication
Approved
Funding
Not applicable

[Citation: Shahzad, M.M.K., Javaid, S.Y., Yasin, M., Jaffri, S.K.A, Iqbal. M.H., Saeed, M. (2024). Impact of off-hours presentation on door-to-balloon time and clinical outcomes in patients referred for primary percutaneous coronary intervention. *Biol. Clin. Sci. Res. J.*, **2024***: 1487*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1487]

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

MALIK MUHAMMAD KHURAM SHAHZAD
Coordination of collaborative efforts.
Study Design, Review of Literature.
SYED YASSER JAVAID (Consultant)
Conception of Study, Development of Research Methodology Design, Study Design, manuscript Review, and final approval of manuscript. Conception of Study,
MUHAMMAD YASIN
Manuscript revisions, critical input.
Coordination of collaborative efforts.
SYED KHAWAR ABBAS JAFFRI (Fellow Interventional cardiologist)
Data entry and data analysis, as well as drafting the article.
MUHAMMAD HASNAIN IQBAL
Data acquisition and analysis.
Manuscript drafting.
MUNIBA SAEED
Data acquisition and analysis.
Coordination of collaborative efforts.

References

1. Martin L, Murphy M, Scanlon A, Naismith C, Clark D, Farouque O. Timely treatment for acute myocardial infarction and health outcomes: an integrative literature review. Australian Critical Care. 2014;27(3):111-8.
2. Khan N, Jan MW, Ullah R. The Influence of Presentation Timing and Door to Balloon Timing on the Clinical Outcomes in Primary Percutaneous Coronary Intervention: Influence of Presentation Timing and Door to Balloon Timing. Pakistan Journal of Health Sciences. 2023:181-6.
3. Butt TS, Bashtawi E, Bououn B, Wagley B, Albarrak B, Sergani HE, et al. Door-to-balloon time in treating ST-segment elevation myocardial infarction in a tertiary care center in Saudi Arabia. Annals of Saudi medicine. 2020;40(4):281-9.
4. Miedema MD, Newell MC, Duval S, Garberich RF, Handran CB, Larson DM, et al. Causes of delay and associated mortality in patients transferred with ST-segment–elevation myocardial infarction. Circulation. 2011;124(15):1636-44.
5. Bugiardini R, Ricci B, Cenko E, Vasiljevic Z, Kedev S, Davidovic G, et al. Delayed care and mortality among women and men with myocardial infarction. Journal of the American Heart Association. 2017;6(8):e005968.
6. Tang L, Chen P-F, Hu X-Q, Shen X-Q, Zhao Y-S, Fang Z-F, et al. Effect of Chinese national holidays and weekends versus weekday admission on clinical outcomes in patients with STEMI undergoing primary PCI. Journal of geriatric cardiology: JGC. 2017;14(10):604.
7. Kushner FG, Hand M, Smith Jr SC, King III SB, Anderson JL, Antman EM, et al. 2009 focused updates: ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction (updating the 2004 guideline and 2007 focused update) and ACC/AHA/SCAI guidelines on percutaneous coronary intervention (updating the 2005 guideline and 2007 focused update) a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2009;120(22):2271-306.
8. Basit A, Ishaque M, Aslam M, Waris A. Presenting Off-Hours, Door-to-Balloon Time, and Clinical Results in Patients Primary Percutaneous Coronary Intervention. Journal of Health and Rehabilitation Research. 2024;4(1):1463-8.
9. Genç Ö, Yıldırım A, Kurt İH, Kılıçkap M, Erol MK, Kayıkçıoğlu M, et al. Relationship Between Work Mode, Time of Admission, and Mortality in St-Segment Elevation Myocardial Infarction: Results From the TURKMI Registry. Angiology. 2023;74(6):553-62.
10. Bajaj S, Parikh R, Gupta N, Aldehneh A, Rosenberg M, Hamdan A, et al. "Code STEMI" protocol helps in achieving reduced door-to-balloon times in patients presenting with acute ST-segment elevation myocardial infarction during off-hours. The Journal of Emergency Medicine. 2012;42(3):260-6.
11. Lattuca B, Kerneis M, Saib A, Nguyen LS, Payot L, Barthelemy O, et al. On-versus off-hours presentation and mortality of ST-segment elevation myocardial infarction patients treated with primary percutaneous coronary intervention. Cardiovascular Interventions. 2019;12(22):2260-8.
12. Kandola D. Access to cardiac catheterization services in a rural-urban setting in northern British Columbia: Examining the impact of time-delay to PCI on patient outcomes and whether the sickest go the quickest: University of Northern British Columbia; 2014.
13. Sorita A, Ahmed A, Starr SR, Thompson KM, Reed DA, Prokop L, et al. Off-hour presentation and outcomes in patients with acute myocardial infarction: systematic review and meta-analysis. Bmj. 2014;348.
14. Ono Y, Ishida T, Iwasaki Y, Kawakami Y, Inokuchi R, Tase C, et al. The off-hour effect on trauma patients requiring subspecialty intervention at a community hospital in Japan: a retrospective cohort study. Scandinavian journal of trauma, resuscitation, and emergency medicine. 2015;23:1-12.
15. Shavadia JS, Chen AY, Fanaroff AC, de Lemos JA, Kontos MC, Wang TY. Intensive care utilization in stable patients with ST-segment elevation myocardial infarction treated with rapid reperfusion. JACC: Cardiovascular Interventions. 2019;12(8):709-17.
16. Barbato E, Gallinoro E, Abdel-Wahab M, Andreini D, Carrié D, Di Mario C, et al. Management strategies for heavily calcified coronary stenoses: an EAPCI clinical consensus statement in collaboration with the EURO4C-PCR group. European Heart Journal. 2023;44(41):4340-56.
17. Hammad TA, Parikh M, Tashtish N, Lowry CM, Gorbey D, Forouzandeh F, et al. Impact of COVID-19 pandemic on ST-elevation myocardial infarction in a non-COVID-19 epicenter. Catheterization and Cardiovascular Interventions. 2021;97(2):208-14.
18. Furmento J, CANDIELLOMTSAC A, Máscolo P, Lamelas P, Chapman I, Sigal A, et al. Optimization of Door-to-Balloon Time Implementing a Process Improvement Program. Results after 5 Years. Revista Argentina de Cardiología. 2023;91(2):218-22.
19. Alrawashdeh A, Nehme Z, Williams B, Smith K, Stephenson M, Bernard S, et al. Factors influencing patient decision delay in activation of emergency medical services for suspected ST-elevation myocardial infarction. European Journal of Cardiovascular Nursing. 2021;20(3):243-51.

[Citation: Shahzad, M.M.K., Javaid, S.Y., Yasin, M., Jaffri, S.K.A, Iqbal. M.H., Saeed, M. (2024). Impact of off-hours presentation on door-to-balloon time and clinical outcomes in patients referred for primary percutaneous coronary intervention. *Biol. Clin. Sci. Res. J.*, **2024***: 1487.* doi: https://doi.org/10.54112/bcsrj.v2024i1.1487]