ORIGINAL ARTICLE

FACTORS LIMITING SAME-DAY DISCHARGE AFTER PRIMARY PERCUTANEOUS CORONARY INTERVENTION IN LOW-RISK PATIENTS

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Objectives: The objective of this study was to assess the factors associated with delay in discharge of low risk patients after primary percutaneous coronary intervention (PCI) at a tertiary care cardiac center.

Methodology: In this study we included consecutive patients undergone primary PCI categorized as low risk based on the Zwolle risk score (ZRS) with the score of ≤3. Patients were stratified into two groups same-day discharge (SDD) and late discharge (>24 hours).

Results: A total of 491 patients were include out of which 82.7% (406) were male and mean age of the study sample was 53.37±10.65 years. Of the total 87.6% (430) patients were discharged on the same-day by the treating physician. Delay in discharge was found to be associated with female gender (26.2% (16/61) vs. 16% (69/430); p=0.049), inferior wall myocardial infarction (59% (36/61) vs. 45.3% (195/430); p=0.045), femoral access for the procedure (67.2% (41/61) vs. 49.8% (430); p=0.011), culprit right coronary artery (47.5% (29/61) vs. 31.2% (134/430); p=0.011), and post-procedure complications (4.9% (3/61) vs. 0.5% (2/430); p=0.015).

Conclusion: A significant number of low risk patients did not get to discharge within same day of the procedure. Delay in discharge of low risk patients after primary PCI was observed to be associated with some of the patients and procedure related factors such as female gender, inferior wall myocardial infarction, femoral access for the procedure, culprit right coronary artery, and post-procedure complications.

Keywords: STEMI, primary PCI, same-day discharge, late discharge, factors

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INTRODUCTION

A rising number of percutaneous coronary intervention (PCI) besides increasing cost of healthcare has resulted in a considerable logistic and monetary restraints on overburdened healthcare systems, throughout the world.[1] There have been multiple initiatives taken to lessening healthcare expenses though maintaining medical efficiency and patient care. It is a routine practice to keep post PCI patients overnight to assess the risk of vascular access site complications and acute stent thrombosis.[1] PCI has always been viewed as short stay an inpatient procedure, requiring about 24 hours of observation. The clinical foundation for this approach can be traced back to the early days of PCI, when acute ischemia episodes caused by vascular access complications or abrupt artery closure were prevalent and often fatal. The incidence of acute ischemia episodes has been reduced to a greater extent thanks to the technological advancements i.e. systematic stent placement and developments in adjunctive medication.[2] In the case of ST-segment elevation myocardial infarction (STEMI), management included close observation and medication titration followed by urgent reperfusion.

The purpose of hospital observation is to keep track of individuals for complications associated to myocardial infarction (MI), i.e. cardiac failure, arrhythmias, and re-infarction or stent thrombosis.[3] Various patient related and diseases related factors such as success of timely reperfusion and severity of MI all play a role in risk categorization for sequelae after STEMI. The tendency has shifted towards the implementation of fast track treatment routes as hospital resources become scarcer.[4] Different researches, both observation and experimental in nature, have been have been conducted to demonstrate that same day or early discharge following PCI is not only possible but also secure.[5,6]

It is a common clinical practice for the individuals with stable coronary artery disease (CAD) managed with PCI to get discharge early or on the same day, but in very recent years this strategy has been gaining acceptance for the primary PCI patients as well. Same day discharge (SDD) has been proven secure in patients having PCI in multiple studies. The majority of expected adverse events or procedure related complications happen within 6 hours of PCI or within a day of PCI.[1,2,7-9] The key advantages of SDD following PCI include shorter length of hospital stay (LOS), better utilization of healthcare resources, and improved patient satisfaction.[2] Although, because of the concerns regarding medico-legal and patient safety, limited studies have been conducted to support and validate the SDD practice. The best time to discharge low risk STEMI patients after primary PCI is unknown and professional society guidelines are not very clear on this topic. The American College of Cardiology (ACC) provides no suggestions on best timing for discharge, however the European Society of Cardiology recommends early discharge for low risk STEMI patients within 48 to 72 hours (Class IIa).[10]

There is a rising interest in finding low risk sub-group of patients for whom an early discharge approach would be possible and secure. In order to identify patients with less prone to cardiovascular problems, several predictive models such as Cadillac and Zwolle have been proposed. Determination of low risk patient and decreasing LOS after primary PCI can lead to a substantial reduction in healthcare costs for a low resources system.[11] Therefore, aim of this study to assess the factors associated with delay in discharge of low risk patients after primary percutaneous coronary intervention (PCI) at a tertiary care cardiac center.

METHODOLOGY

This cross sectional study was conducted at the largest cardiac care center of Karachi, Pakistan. Study was conducted between August 2019 and July 2020 after approval of the ethical review committee of the institution (ERC-38/2019). Inclusion criteria of the study were consecutive patients of either gender, ≥ 18 years of age, diagnosed with STEMI and undergone primary PCI within recommended time window. All included patients were categorized as low risk based on the Zwolle risk score (ZRS). Patients in killip class II or higher, in cardiac arrest, with arrhythmias at presentation, with prior history of cardiac related intervention, or refused to participate in the study were excluded.

The Zwolle risk score (ZRS) was calculated based on demographic and clinical factors such as age of the patient, Killip class at presentation, anterior wall myocardial infarction (AWMI), time between onset of symptom to catheterization laboratory activation, number of diseased vessels, and initial thrombolysis in myocardial infarction (TIMI) flow grade as defined by De Luca G et al.[12] Criteria of low risk for the patients ZRS of less than or equal to three.

Data for the study were collected using a structured proforma consisted of variables needed for the calculation of ZRS and other patient related and procedure related factors such as co-morbid conditions, access for procedure, infarct related artery, post-procedure TIMI flow grade and complication such as contrast induced nephropathy, major bleeding (requiring transfusion), ventricular tachycardia, or dissection. Decision of SDD was made by the treating physician based on clinical assessment of the patients. Collected data were analyzed using IBM SPSS version 19. Patients were stratified into two groups based on timing of discharge after primary PCI as same-day discharge (SDD) or late discharge (> 24 hours of hospital stay). Continuous variables such as age and ZRS were expressed as mean ± standard deviation (SD) and independent sample t-test was performed to compare SDD and late discharge group. The total ischemic time (minutes) was expressed as median [IQR] and Mann-Whitney U test was conducted to compare SDD and late discharge group. Frequency and percentages were computed for the categorical response variables and Chi-square test was performed to assesses the association of variables with SDD and late discharge group while Fisher's exact test was applied in the cases where expected cell count were less than five. Statistical significance criteria was p-value ≤ 0.05.

RESULTS

A total of 491 low risk patients were include out of which 82.7% (406) were male and mean age of the study sample was 53.37 ± 10.65 years. Of the total 87.6% (430) patients were discharged on the same-day by the treating physician and discharge was delayed in remaining 12.4% (61) of the patients. The distribution of baseline demographic and clinical characteristics were found to be similar with no statistically significant differences between the same-day and late discharged group of patients except for the proportion of female gender and inferior wall MI (IWMI). In low risk patients, female gender (26.2% (16/61) vs. 16 (69/430); p=0.049) and IWMI (59% (36/61) vs. 45.3% (195/430); p=0.045) were found to be associated with late discharge after primary PCI (Table 1).

Distribution of angiographic and procedural characteristics of the low risk patients stratified by time of discharge after primary percutaneous are

presented in Table 2. Late discharge of low risk patients was found to be associated with femoral access for the procedure (67.2% (41/61) vs. 49.8% (430); p=0.011), culprit right coronary artery (47.5% (29/61) vs. 31.2% (134/430); p=0.011), and post procedure complications (4.9% (3/61) vs. 0.5% (2/430); p=0.015). Ventricular tachycardia, dissection, and CIN were the three complications observed in one patient each among the late discharged group of patients.

Table 1: Distribution of baseline demographic and clinical characteristics of the low risk patients stratified by time of discharge after primary percutaneous coronary intervention

Characteristics	Total	Discharge		P-value
		Same-day	Late	
Total	**491**	**430**	**61**	**-**
Gender				
Male	82.7% (406)	84% (361)	73.8% (45)	0.049*
Female	17.3% (85)	16% (69)	26.2% (16)	
Age (years)	53.37 ± 10.65	53.36 ± 10.52	53.46 ± 11.57	0.947
≤ 45 years	24% (118)	23.7% (102)	26.2% (16)	0.668
46 to 65 years	63.3% (311)	64.2% (276)	57.4% (35)	0.302
> 65 years	12.6% (62)	12.1% (52)	16.4% (10)	0.344
Zwolle risk score (ZRS)	1.77 ± 0.9	1.77 ± 0.91	1.82 ± 0.89	0.673
Total ischemic time (minutes)	259 [129 to 450]	252.5 [150 to 450]	280 [120 to 600]	0.816
Type of myocardial infarction				
Anterior	46.4% (228)	47.7% (205)	37.7% (23)	0.144
Inferior	47% (231)	45.3% (195)	59% (36)	0.045*
Posterior	4.5% (22)	4.7% (20)	3.3% (2)	0.628
Lateral	2% (10)	2.3% (10)	0% (0)	0.229
Risk factors				
Hypertension	50.3% (247)	49.3% (212)	57.4% (35)	0.238
Diabetes	38.9% (191)	37.9% (163)	45.9% (28)	0.231
Family history of CAD	5.1% (25)	4.9% (21)	6.6% (4)	0.578
Smoking	33.2% (163)	33.7% (145)	29.5% (18)	0.513
Obesity	4.7% (23)	4.9% (21)	3.3% (2)	0.579

*CAD=coronary artery diseases, *significant at 5%*

Table 2: Distribution of angiographic and procedural characteristics of the low risk patients stratified by time of discharge after primary percutaneous

Characteristics	Total	Discharge		P-value
		Same-day	Late	
Total	**491**	**430**	**61**	**-**
Access for the procedure				
Radial	48.1% (236)	50.2% (216)	32.8% (20)	0.011*
Femoral	51.9% (255)	49.8% (214)	67.2% (41)	
Number of vessels involved				
Single vessel disease	23.6% (116)	23.7% (102)	23% (14)	0.895
Two vessel disease	39.7% (195)	40% (172)	37.7% (23)	0.732
Three vessel disease	36.7% (180)	36.3% (156)	39.3% (24)	0.642
Culprit coronary artery				
Left main	1.6% (8)	1.9% (8)	0% (0)	0.283
LAD	51.1% (251)	52.6% (226)	41% (25)	0.091
Right coronary artery	33.2% (163)	31.2% (134)	47.5% (29)	0.011*
Circumflex	12.4% (61)	12.6% (54)	11.5% (7)	0.810
Ramus	1.2% (6)	1.4% (6)	0% (0)	0.353
Diagonal	0.4% (2)	0.5% (2)	0% (0)	0.594
Initial thrombolysis in myocardial infarction flow grade				
0	48.3% (237)	47.4% (204)	54.1% (33)	0.330
I	45% (221)	45.3% (195)	42.6% (26)	0.689
II	4.7% (23)	5.1% (22)	1.6% (1)	0.229
III	2% (10)	2.1% (9)	1.6% (1)	0.814
Final thrombolysis in myocardial infarction flow grade				
0	0.2% (1)	0.2% (1)	0% (0)	0.706
I	0% (0)	0% (0)	0% (0)	-
II	12.5% (60)	11.8% (50)	16.9% (10)	0.288
III	87.3% (420)	87.9% (371)	83.1% (49)	0.216
Post-procedure complication(s)				
Total	1% (5)	0.5% (2)	4.9% (3)	0.015*

Contrast-induced nephropathy	0.2% (1)	0% (0)	1.6% (1)	0.124
Major Bleeding	0.2% (1)	0.2% (1)	0% (0)	>0.999
Ventricular tachycardia	0.4% (2)	0.2% (1)	1.6% (1)	0.233
Dissection	0.2% (1)	0% (0)	1.6% (1)	0.124

*LAD=left anterior descending artery, *significant at 5%*

DISCUSSION

As the population of STEMI patients undergoing primary PCI rises, an insurmountable expense is looming. As a result, the factors that cause these patients LOS to be prolonged should be better understood. Patient related factors such as medical condition, angiographic findings, fears and anxieties of patient and attendant, hospital policies, physicians' reluctance, and post-procedure outcome and complications are some of key determinants. In-hospital observation for 2-10 days after primary PCI of STEMI patients is a routine clinical practice in order to examine the potential complications including heart failure, mortality, arrhythmias and re-infarction.[13] Prolonged LOS is viewed as a preventive approach to lessen the likelihood of these complications, as such complications can have catastrophic consequences. Due to the heterogeneity in the demographic and clinical composition of STEMI patients, recommendations regarding the ideal LOS has yet to be defined. Hence, the understanding of factors leads to prolongation of the hospital stay are of paramount importance. Therefore, in this study we sought to assess the factors associated with delay in discharge of low risk patients after primary PCI. We observed delayed in discharge in a significant, 12.4%, number of low risk patients which was found to be associated with some of the patients and procedure related factors such as female gender, IWMI, femoral access for the procedure, culprit right coronary artery, and post-procedure complications.

In the past studies various angiographic characteristics, in addition to clinical characteristics, were found to be helpful in distinguishing patients with low risk STEMI. Older individuals, women, and those with a history of hypertension, diabetes, or MI, high Killip class, zero initial TIMI flow grade, angiographic failure, culprit left anterior descending artery (LAD) lesion, multi-vessel disease, low left ventricular ejection fraction (LVEF), and occurrence of vascular complications were found to be associated with prolonged hospitalization.[13-15] A study by Khaled S et al.[16] reported that early discharged patients had low risk AMI features, such as a lower frequency of cardiovascular risk factors and comorbidities, and urgent revascularization using primary PCI within the target widow of door to balloon time (DBT).

When deciding early discharge after procedure, clinical features of the patients and risk assessment of immediate outcomes of AMI play a very crucial role. Early discharged patients showed lower Killip class, higher post MI LVEF, and lesser severity of coronary artery disease with lesser occurrence of left main and multi vessel disease.[17,18] Mirbolouk F et al.[19] concluded that optimal use of medical resources and facilities is the top priority in the present demanding situations. The major economic metrics for decreasing healthcare expenses are the length of stay and bed occupancy rate (BOR). Determining associated factors at the time of admission, including comorbidities, clinical characteristics, PCI failure, and post-procedure complication may also help to reduce excessive use of medical resources and optimize patients' remission. In another study by Schellings DA et al.[20] the major indicator of long-term hospitalization was heart failure at the time of hospital arrival. Additionally, older, female, with the history of previous MI, and TIMI flow 0 before PCI were also found to be associated with longer hospital stay.

Easy methods i.e. the Zwolle risk score (ZRS), PAMI II method, Cadillac risk along with other factors, might be used to identify individuals for early discharge following STEMI.[3,21] The application of proper risk classification for the triage of patients having STEMI is necessitated by the rapidly changing healthcare structure and desire for prompt, advanced cardiovascular treatment. A study by Ebinger JE et al.[22] described the implementation of a risk-guided triage and early discharge of STEMI patients result in reduction in cost while keeping acceptable patient outcomes. In this study ZRS was used retrospectively to 967 individuals who undergone primary PCI and risk-guided triage and discharge was found associated with optimal utilization of healthcare resources and lowering of expenses without impacting quality or patient outcomes. In a recent study by Shah JA et al.[21] reported moderate discriminating potential of ZRS for the safety assessment of same-day discharge after primary PCI. A more accurate and reliable risk assessment mode not only based on the clinical factors but also on diseases and procedure related factors is need of the hour for the implementation of SDD strategy to optimize the utilization of healthcare resources in systems with limited resources.

CONCLUSION

A significant number of low risk patients did not get to discharge within same day of the procedure. Delay in discharge of low risk patients after primary PCI was observed to be associated with some of the patients and procedure related factors such as female gender, IWMI, femoral access for the procedure, culprit right coronary artery, and post-procedure complications. Systematic categorization of low risk patients eligible for the same-day discharge has significant clinical and financial implications. Future attempts of developing a risk categorization model should also include patient as well as procedure related factors should be considered.

AUTHORS' CONTRIBUTION:

JAS, KAK, RK, GA and BAS: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. MH, MZ, UB, JAS and TS: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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