Comparison Of Short-Term Clinical Outcomes in Patients Undergoing Primary Percutaneous Angioplasty for Acute ST Elevation Myocardial Infraction During Regular & Non-Regular Working Hours

Dr. Muhammad Ibaad Siddiqui *, Dr. Gianchand*, Dr Faizan Wallam*, Dr Shahzaib Memon*, Tahir Hussain, Junaid Ahmed*****

*****National Institute of Cardiovascular Disease Karachi-Pakistan
****** Hamdard Institute of Management Sciences Karachi-Pakistan
******* Quaid E Azam College of Nursing and Allied Health Sciences Karachi-Pakistan

Abstract-
The majority of patients with Acute Myocardial Infarction (AMI) are treated at centers with primary Percutaneous coronary intervention (PCI) facilities open all the time, however, the level of care varies on weekdays (regular hours) and on days off, holidays, and nighttime (off-hours). Comparing the therapeutic outcomes of individuals receiving primary coronary intervention (PCI) for acute myocardial infarction with ST elevation (STEMI) at a higher-level cardiac center at non-regular and regular work hours was the major goal of the study. A total of 666 participants were recruited and split evenly into groups according to regular time (unexposed) and non-regular time (exposed). Time from door to balloon was noted. In order to track the mortality rate in hospitals, individuals were monitored during the time they were hospitalized. A door-to-balloon time analysis was made between the exposed and unexposed groups. It was determined whether exposure as well as mortality in hospitals were related. A P-value of less than 0.05 was considered statistically significant. According to the statistics, the research included a total of 19.06 % female patients (Group B) and 73.3 percent male patients (Group A). In contrast, there were 26.7 percent female participants and 80.9 percent male patients in Group B. In group B, 68.5 percent of patients had high blood pressure, 64.6 percent had diabetes mellitus, 5.5 percent were smoking, 0% had CAD family history, and zero percent had obesity. In group A, 48.6 percent of patients had high blood pressure, 45.3 percent had diabetes mellitus, 22.3 % were smoking, and 4.5 percent had a CAD family history. Of the patients in group A, 24.9 percent had SVD, 34 percent had 2VD, and 41.2 percent had 3VD. In contrast, group B included 42.5 percent of patients with SVD, 3.6 percent with 2VD, and 18.9 percent with 3VD. The most prevalent disease location in both groups A (62.3 percent) and B (44.1 percent) was the left anterior descending Also, the study discovered no connection between study groups and in-hospital mortality that was noteworthy. Patients with STEMI receiving primary PCI who presented outside of normal working hours did not significantly affect the death rate in the hospital or door-to-balloon time

Keywords: Total Hours of Duty, Acute STEMI, Primary Percutaneous Coronary Intervention (PCI), and Outcomes

I. INTRODUCTION

Concerns have been raised regarding the potential impact of hospitalization times on the prognosis for individuals receiving primary percutaneous coronary intervention (PCI) for ST-segment elevation myocardial infarction (STEMI). This worry has been linked to the hospital's inconsistent treatment of patients with STEMI between normal working hours and off-hours (Dharma et al., 2018). Relative to normal working hours, individuals with coronary artery disease (STEMI) who received primary PCI at off-peak hours had an increased short-term mortality rate (in-hospital or Thirty days). However, because only short-term outcomes were taken into account, the research had little therapeutic impact (Dharma et al., 2018), and there are very few long-term follow-up investigations (Nan et al., 2020). Different researchers examined the relationship among the one and two year longevity rates of individuals with STEMI who received primary PCI during normal working hours and after hours and revealed the two-year rate of mortality. According to Cucinotta and Vanelli (2020), cardiovascular disease (CVD) is the primary cause of mortality globally, contributing to 17.3 million fatalities in 2008, or nearly thirty percent of the total fatalities globally. Acute coronary syndrome, more commonly known as ACS, and coronary artery disease (CAD) cause more than seven million fatalities annually. There are over fifty countries in the region of Asia-Pacific, seven of which are in the top ten most populous in the entire globe. With over 4.2 billion individuals living in the region—roughly sixty percent of the global population—the region's economic output is estimated to be worth 18 trillion USD and is expanding at a rate of about six percent annually. Numerous investigations have revealed a diurnal variance in acute coronary syndrome outcomes (Scholz et al., 201). The causes of these observations, meanwhile, have not yet been thoroughly studied. Furthermore, it is unclear whether incident events and fatalities are equally affected by potential patient behaviours, methods of therapy, or the combination of subgroups like people with diabetes as well as additional factors, and if there is an additional relationship between deaths and individuals who have had coronary heart disease in the past. There is a paucity of information regarding variations in the course of treatment (weekly) myocardial infarction (MI) according to the aforementioned criteria. When contrasted with everyday admissions, the "weekend effect" refers

to the negative impact that weekend admissions have on medical results (such as in-hospital fatality) (Ibanez et al., 2017). Weekends may see a decrease in accessibility to services and staffing levels even while the effect of disease and demands on health care is probably constant. There's no guarantee that this will be made up for by better treatment on later workdays. Increased in-hospital mortality was observed for weekend admissions for individuals with serious health issues, including ruptured aneurysms of the abdomen, acute throat inflammation, and pulmonary edema, as well as for twenty-three of the most prevalent causes of mortality in 100, according to one of the initial studies on the weekend impact (Brunetti et al., 2017; Jnr, 2020).
Although, the present research is aimed to evaluate and compare the medical outcomes of patients having percutaneous coronary intervention (PCI) for acute ST-elevation myocardial infarction (STEMI) during off-hours (weekends) with the patients having surgeries and other procedure during the normal/regular hours in the hospital (weekdays).

II. MATERIAL AND METHODS

The research was carried out at the National Institute of Cardiovascular Diseases (NICVD), Karachi, in the Adult Cardiology Department. The projected number of participants for each group was determined by taking into account the death rate statistics for on-hours and off-hours, which were 1.3 percent and 6.8 percent, respectively, as well as the test power of ninety percent and 99 percent respectively. The sample size was determined using the World Health Organization's sample size calculator. The study employed non-probability consecutive sampling. The CPSP gave their clearance before the study could begin. The NICVD Ethical Review Committee gave their approval. Individuals who met the inclusion criteria and presented with STEMI in the adult cardiac department of NICVD, Karachi, were enrolled in the research. Prior to enrollment, every participant was allowed to verbally give their informed consent to participate in the study, after which the lead investigator discussed the purpose of the research, advantages, and risks. According to the operational definition, the necessary number of connective patients who were admitted during regular (unexposed group) and non-regular (exposed group) hours were enrolled. According to the operational criteria, the patient's age (years), weight (kilogramme), height (centimetres), BMI (kg/m2), obesity, gender, smoking, diabetes mellitus, high blood pressure, and family history of CAD were all noted along with other clinical and demographic data. In accordance with the operational descriptions, the door-to-balloon time (in minutes) was documented, individuals were monitored for up to seven days throughout their time in the hospital, and mortality in the hospital was noted. By closely adhering to the inclusion criteria and stratification, confounding variables and discrimination were closely monitored. Patient data was kept private and only those with permission could access it. SPSS was utilized for data analysis.

III. RESULTS

According to the demographic table below, the results indicated that there were 83.9% male participants in Group A and 19.06 percent female patients in Group B, with 73.3 percent male and 26.7 percent female patients in Group B.
In group B, 68.5 percent of patients had high blood pressure, 64.6 percent had diabetes mellitus, 5.5 percent had smoking, 0% had a CAD family history, and 0% had obesity. In group A, 48.6 percent of patients had hypertension, 45.3 percent had diabetes mellitus, 22.3 percent had smoking, and 4.5 percent had CAD family history. Additional results are included in the table below. The most prevalent type of myocardial infarctions in groups A and B were anterior wall (45.6 percent) and inferior wall (44.1 percent), respectively. The table below displays the frequency distribution in detail. Group B had 42.5 percent of patients with SVD, 3.6 percent with 2VD, and 18.9 percent with 3VD, whereas group A had 24.9 percent of patients with SVD, 34 percent with 2VD, and 41.2 percent with 3VD. The most prevalent disease location in both groups A (62.3 percent) and B (44.1 percent) was LAD. The tables below provide detailed frequency distributions of the number of infected vessels and the disease's location, respectively.

Age (years)				
Gender			Frequency	Percent
Male	Valid	25-40	44	8.2
		41-50	76	14.1
		51-60	193	35.8
		61-70	124	23.0
		71-80	102	18.9
		Total	539	100.0
Female	Valid	25-40	6	4.7
		41-50	21	16.5
		51-60	51	40.2
		61-70	25	19.7
		71-80	24	18.9
		Total	127	100.0
BMI (kg/m2)				
Gender			Frequency	Percent
Male	Valid	20-25	95	17.6
		26-30	221	41.0
		31-35	223	41.4
		Total	539	100.0
Female	Valid	20-25	19	15.0
		26-30	53	41.7
		31-35	55	43.3
		Total	127	100.0
HTN				
Gender			Frequency	Percent
Male	Valid	no	277	51.4

		yes	262	48.6
		Total	539	100.0
Female	Valid	no	40	31.5
		yes	87	68.5
		Total	127	100.0
DM				
Gender			Frequency	Percent
Male	Valid	no	295	54.7
		yes	244	45.3
		Total	539	100.0
Female	Valid	no	45	35.4
		yes	82	64.6
		Total	127	100.0
SMK				
Gender			Frequency	Percent
Male	Valid	no	419	77.7
		yes	120	22.3
		Total	539	100.0
Female	Valid	no	120	94.5
		yes	7	5.5
		Total	127	100.0
Fam Hist CAD				
Gender			Frequency	Percent
Male	Valid	no	515	95.5
		yes	24	4.5
		Total	539	100.0
Female	Valid	no	127	100.0
Obesity				
Gender			Frequency	Percent
Male	Valid	no	530	98.3
		yes	9	1.7
		Total	539	100.0
Female	Valid	no	127	100.0
Type of Myocardial Infarctions				
Gender			Frequency	Percent
Male	Valid	Anterior Wall	246	45.6
		Anterior Wall; Lateral Wall	82	15.2
		Anterior Wall; Septal Wall	8	1.5
		Inferior Wall	162	30.1
		Inferior Wall; Lateral Wall	9	1.7
		Inferior Wall; Posterior Wall	25	4.6
		Posterior Wall	7	1.3
		Total	539	100.0
Female	Valid	Anterior Wall	34	26.8
		Anterior Wall; Lateral Wall	22	17.3
		Inferior Wall	56	44.1
		Inferior Wall; Posterior Wall	8	6.3
		Lateral Wall	7	5.5
		Total	127	100.0
Number of diseased vessels				
Gender			Frequency	Percent
Male	Valid	2VD	183	34.0
		3VD	222	41.2
		SVD	134	24.9
		Total	539	100.0
Female	Valid	2VD	24	18.9
		3VD	54	42.5
		SVD	49	38.6
		Total	127	100.0
Localization of disease				
Gender			Frequency	Percent
Male	Valid	LAD	336	62.3
		LCX	58	10.8

		RCA	145	26.9
		Total	539	100.0
Female	Valid	LAD	56	44.1
		LCX	14	11.0
		RCA	57	44.9
		Total	127	100.0
Door to Balloon (DTB) Time (min)				
Gender			Frequency	Percent
Male	Valid	25-100	33	6.1
		101-200	51	9.5
		201-300	152	28.2
		301-400	101	18.7
		501-600	100	18.6
		601-650	102	18.9
		Total	539	100.0
Female	Valid	25-100	14	11.0
		101-200	15	11.8
		201-300	35	27.6
		301-400	20	15.7
		501-600	25	19.7
		601-650	18	14.2
		Total	127	100.0
In-hospital Mortality				
Gender			Frequency	Percent
Male	Valid	no	468	86.8
		yes	71	13.2
		Total	539	100.0
Female	Valid	no	120	94.5
		yes	7	5.5
		Total	127	100.0

Table 1: Demographics of the Participants

IV. DISCUSSION

In the current investigation, the door-to-balloon times for patients who were not exposed to radiation were 114.24 ± 85.88 and 125.56 ± 100.17, respectively. Less than 90 percent of STEMI patients received the percutaneous coronary intervention (PCI) in a 90-minute period, and their door-to-balloon delays were greater during days off from work. In group A, the death rate was 12.6 percent, while in group B, it was 10.8 percent. Regardless of the average door-to-balloon duration reaching 180 min, a study found that a roughly 30-min delay in door-to-balloon time is related to a twenty to thirty percent relative rise in in-hospital fatality for STEMI patients (Vidal-Alaball et al., 2015). Thus, assuming a linear relationship between door-to-balloon duration and mortality, the 15-minute rise in door to balloon time seen during off-peak hours could result in a ten to fifteen percent increase in death. It was in line with the van Dongen et al. (2019) point estimation of a twelve percent increase in risks of fatality for STEMI, which proposed that longer door-to-balloon times could be a contributing factor in the mortality rise during off-peak hours. According to Duman et al. (2020), after adjusting for ischemia treatment duration, the mortality differences ceased to be significant. Increased mortality during off-hours might be partially explained by a reduced rate of immediate percutaneous coronary intervention for patients with STEMI (Jin et al., 2020). Disparities in the periods it took to open balloons and the frequency of percutaneous coronary interventions were probably related to the availability of heart specialists, cardiovascular catheterization support from lab workers, or both. There wasn't always a 24-hour on-site cardiac service available. Numerous institutions must gather cardiac specialists and on-call personnel during off-peak hours in order to set up the cardiovascular catheterization lab. This was aptly demonstrated by Mahmud et al. (2020), who found that almost all of the rises in door-to-balloon duration in off-hours could be explained by the longer time between getting an ECG and reaching the cath lab.

The mortality rate in hospitals in the current study was 10.8 percent for exposed groups and 12.6 percent for unexposed groups. In the United States of America, Ohira and Iso (2013) found that there was a noteworthy weekend impact on 30-day in-hospital mortality rates of acute myocardial infarction, with 9.6 percent vs 11 percent for fatalities on weekdays vs. weekends (when adjusted odds ratio = 1.15, 95% confidence interval (CI): 1.03 to 1.26, P = 0.007). This finding was supported by a study conducted by Morrow et al. (2000). Comparing 2-day mortality in hospitals to 30-day hospital mortality, Sorita et al. (2015) found a larger weekend effect for myocardial infarction (MI), with 5.8 percent vs. 7.2 percent for deaths on weekdays vs. the weekends (adjusted risk ratio = 1.23, 95% confidence interval (CI): 1.08 to 1.38, P = 0.001). Previous research suggests that fewer invasive operations take place on weekends, which could account for the myocardial infarction at weekends effect. Emergency invasive techniques like catheterization, percutaneous coronary interventions, and bypass grafting of the coronary arteries are frequently necessary for the therapy of acute myocardial infarction, especially in cases where the myocardium is ST elevated (Jneid et al., 2008; Sugumaran and Poornima, 2012).

Moreover, it was noted that the time off rise in death persisted to be significant in the death rates that were controlled. These findings revealed that certain variables that emerge after hospital presentation were linked to higher mortality during off-peak hours, even though residual confounding from the different case mix can't be ruled out. A considerably larger variation in mortality among regular and off-hours hours in particularly recent decades was observed in a meta-regression conducted by Banerjee et al. (2012). Theories included the following: either an unjust increase in the implementation of evidence-based therapies during regular working hours as opposed to off-hours, or a rise in working shifts or transfers for off-hour coverage; yet, this might have been a coincidence and was undoubtedly subject to ecological bias. On the other hand, Sorita et al. (2015) report that there was not a substantial shift in the door to balloon time variance between normal-hour and off-hour presentations as time passed. The disparity between door-to-balloon durations and mortality rates could indicate that variables beyond door-to-balloon times influence the mortality variation among regular and off-peak hours. It could also be the result of high variability. When compared to long-term patterns that indicate declines in the door-to-balloon timeframes and the overall rate of mortality (Lattuca et al., 2019), these findings highlight the chance to enhance the standard of care given during off-peak hours.

	In-Hospital Mortality					
Diabetes Mellitus	**Yes**			**No**		
	Unexposed	**Exposed**	**TOTAL**	**Unexposed**		**TOTAL**
	13(10.5)	27(28.4)	**40**	21(8.04)	6(3.5)	**27**
	110(89.4)	68(71.5)	**178**	240(91.9)	165(96.4)	**405**
	123	**95**	**218**	**261**	**171**	**448**
Hypertension	**Yes**			**No**		
	Unexposed	**Exposed**	**TOTAL**	**Unexposed**	**Exposed**	**TOTAL**
	33 (24.8)	45 (22.5)	**78**	39 (26.1)	50 (27.1)	**89**
	100 (85.1)	155 (77.5)	**255**	110 (73.8)	134 (7.06)	**244**
	133	**200**	**333**	**149**	**184**	**333**
Smoking	**Yes**			**No**		
	Unexposed	**Exposed**	**TOTAL**	**Unexposed**	**Exposed**	
	5 (7.7)	0 (0)	**5**	35 (13.1)	36 (13.3)	**71**
	60 (92.3)	62 (100)	**122**	233 (86.9)	235 (86.7)	**468**
	65	**62**	**127**	**268**	**271**	**539**
CAD Family History	**Yes**			**No**		
	Unexposed	**Exposed**	**TOTAL**	**Unexposed**	**Exposed**	**TOTAL**
	2 (13.3)	1 (11.1)	**3**	19 (5.8)	36 (11.1)	**54**
	13 (86.6)	8 (88.8)	**24**	305 (94.1)	288 (88.9)	**593**
	15	**9**	**18**	**324**	**324**	**648**
Obesity	**Yes**			**No**		
	Unexposed	**Exposed**	**TOTAL**	**Unexposed**	**Exposed**	**TOTAL**
	0 (0)	0 (0)	**0**	33 (10.2)	42 (12.5)	**76**
	2 (0)	7 (100)	**9**	288 (89.7)	294 (87.5)	**582**
	2	**7**	**9**	**321**	**336**	**657**

V. CONCLUSION

The results of the study have shown that there was not a statistically significant difference in the door to balloon time among the patient's regular (unexposed) and nun-regular (exposed). That is also the study also demonstrated that there was a negligible association between the mortality of patients during exposed and exposed groups. However, the STEMI patients undergoing primary percutaneous coronary intervention operations were admitted during non-regular Hospital hours and had little effect on the mortality prognosis. Although the present research has included a number of constraints such as the study was conducted on a small number of groups as well as in a particular research area the results cannot be generalized on the overall population so it is suggested to conduct future studies in different areas as well as in large number of population groups to make the results of study generalizable.

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Authors

First Author – Dr Muhammad Ibaad Siddiqui
Post fellow Interventional Cardiology
National Institute of Cardiovascular Diseases (NICVD)

Second Author – Gianchand
Assistant Professor
Adult interventional cardiologist
National Institute of Cardiovascular Diseases (NICVD)

Third Author – Faizan Wallam
Clinical Fellow Adult Cardiology
National Institute of Cardiovascular Diseases (NICVD)

Fourth Author –Dr. Shahzaib Memon
Post fellow interventional cardiology
National Institute of Cardiovascular Diseases (NICVD)

Fifth Author – Tahir Hussain
PhD Scholar Hamdard Institute of Management Sciences
Karachi Pakistan

Sixth Author –Junaid Ahmed
Senior Instructor
Quaid E Azam College of Nursing and Allied Health Sciences
Karachi-Pakistan

Correspondence Author Tahir Hussain
PhD Scholar Hamdard Institute of Management Sciences
Karachi Pakistan