

COMPARISON OF HOSPITALIZATION RATES AND CLINICAL OUTCOMES FOR ST ELEVATION MYOCARDIAL INFARCTIONS BEFORE AND AFTER COVID-19 PANDEMIC

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ABSTRACT

Objective: To evaluate and compare the impact of COVID-19 pandemic on admission rates and mortality in patients presenting with ST elevation myocardial infarction (STEMI) to a tertiary care cardiac setup in Pakistan.

Study Design: Comparative cross-sectional study

Place and Duration of Study: Armed Forces Institute of Cardiology/National Institute of Heart Disease (AFIC/NIHD) Rawalpindi, from Apr to May 2020.

Methodology: All ST elevation myocardial infarction patients presenting to our hospital for two months (April, May) during COVID-19 pandemic were studied. Similar patients were also analyzed from pre-COVID era for an equivalent period. Parameters compared include total number of ST elevation myocardial infarction patients, age, gender, door to balloon (DTB) time, MI type (anterior versus non-anterior) and prognosis in terms of mortality. Categorical variables are presented as absolute numbers and percentages and compared by chi-square test. Odds ratio was determined to study the impact of COVID-19 pandemic on ST elevation myocardial infarction mortality. SPSS-23 was used for all the analysis.

Results: We observed a significant 43% reduction in the total numbers of ST elevation myocardial infarction admissions compared to equivalent time before pandemic. There was a decrease in patients >75 years of age (4.1%, p -value 0.007), decrease in female patients (21.7%, p -value 0.001), mild improvement in door to balloon (1.3%, p -value 0.4), increase in anterior MI (1.2%, p -value 0.7). The ST elevation myocardial infarction case fatality rate during the pandemic increased from 4-7.1% (Odds ratio 1.81, confidence interval 1.01 to 3.24, p -value 0.04).

Conclusion: Although ST elevation myocardial infarction admissions decreased after COVID-19 but there was a paradoxical increase in mortality. Late presentation to hospital due to contagion fear, various lockdown measures, unavailability of public transport, economic instability may be some of the contributing factors, in addition to the COVID-19 infection itself, that need to be studied further.

Keywords: COVID-19, ST elevation myocardial infarction.

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INTRODUCTION

More than 287 thousand COVID-19 cases with around 6000 deaths have been reported in Pakistan since 26 February 2020 when first case was reported here¹. At present Pakistan is seeing a gradual decline in the number of new cases as well as new deaths but we have seen a peak in June 2020. Respiratory illness is commonest in COVID infection but cardiovascular complications like acute myocardial infarction, arrhythmias, myocarditis and heart failures have been reported in a large number of patients². Due to lock down measures, social containment to combat the contagion, reorganization of the healthcare systems, some changes in the pattern of admission as well as clinical outcomes have been reported for ailments other than COVID-19³⁻⁴. The objective of this study was to determine impact of COVID-19 on admission rates and mortality in patients presenting with ST elevation myocar-

dial infarction (STEMI) to our cardiac center.

METHODOLOGY

This comparative cross-sectional study was carried out at Armed Forces Institute of Cardiology, Rawalpindi, from April to May 2020. All the patients presenting with STEMI were studied after approval of hospital ethics committee. The patients were followed up until discharge. A written informed consent was obtained. All STEMI patients underwent PPCI as per American Heart Association (AHA) and society for cardiovascular angiography and interventions (SCAI) when it could be provided in a timely fashion, with an expert team outfitted with personal protective equipment (PPE). Similar data was collected retrospectively from hospital records for two months of 2019 for comparison. Acute STEMI was defined as per fourth universal definition of myocardial infarction. Variables like age, gender, door to balloon (DTB) time and MI type (anterior versus non-anterior) were studied. Categorical variables are presented as absolute numbers and

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percentages and compared by chi-square test. Odds ratio was determined to study the impact of COVID-19 pandemic on STEMI mortality. SPSS-23 was used for all the analysis.

RESULTS

A total of 340 patients were admitted with the diagnosis of STEMI during two months of COVID-19 pandemic as compared to an equivalent period before COVID-19 with a 43% reduction in total cases. Comparison of various clinical parameters like age, sex, DTB and MI type between pre and post COVID-19 period is shown in the table-I. Mild improvement in number of patients with DTB of <90 minutes for Primary percutaneous coronary intervention (PCI) and more patients with anterior wall MI was reported but not statistically significant.

The STEMI case fatality rate during the pandemic increased from 4-7.1% (Odds ratio 1.81, confidence interval 1.01-3.24, *p*-value 0.04). Among STEMI patients 15 (4.4%) patients were SARS-CoV-2 positive. Mortality rate among COVID-19 positive patients was enormously higher (60%) as compared to COVID-19 negative patients (7.1%) in this study group.

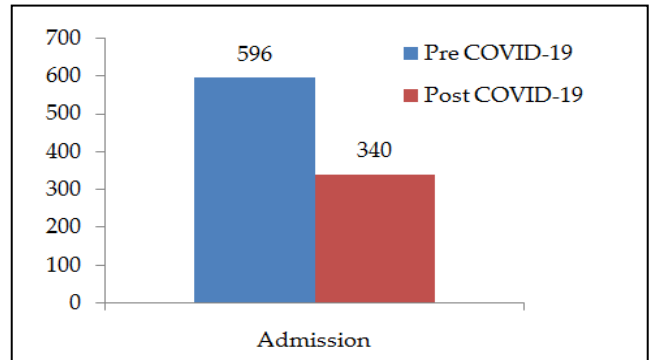


Figure-1: Comparison of Admissions with STEMI before and after COVID-19.

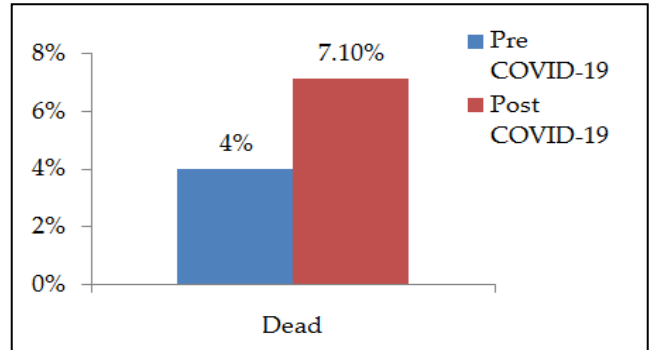


Figure-2: Comparison of mortality with STEMI before and after COVID-19.

Table-I: Change in number of admissions with STEMI and other parameters pre and post COVID-19.

Parameter	Category	Pre-COVID-19 STEMI	Post-COVID-19 STEMI	Change (%)	<i>p</i> -value
Total Admission		596	340	43	
Age	<75 Years	556 (93.3%)	331 (97.4%)	4.1	0.007
	>75 Years	40 (6.7%)	9 (2.6%)		
Sex	Male	416 (69.8%)	311 (91.5%)	21.7	0.000
	Females	180 (30.2%)	29 (8.5%)		
DTB	<90 Minutes	553 (92.8%)	320 (94.1%)	1.3	0.4
	>90 Minutes	43 (7.2%)	20 (5.9%)		
MI Type	Anterior Wall MI	396 (66.4%)	230 (67.65%)	1.2	0.7
	Non-Anterior Wall MI	200 (33.56%)	110 (32.35%)		

Table-II: Comparison of Pre and post COVID-19 STEMI mortality.

		Pre-COVID-19 STEMI	Post-COVID-19 STEMI	Odds Ratio	95% Confidence Interval	<i>p</i> -value
Outcome	Recovered	572 (96%)	316 (92.9%)	1.81	1.01-3.24	0.04
	Dead	24 (4%)	24 (7.1%)			

DISCUSSION

COVID-19 infection commonly affects cardiovascular system⁵⁻⁶. Several observational studies have shown that COVID-19 infection can mimic ST-elevation myocardial infarction (STEMI)², and is associated with more severe disease and worse prognosis⁷. But there has been a paradoxical decrease in number of STEMI cases presented to cardiac centers worldwide⁸⁻¹⁰. A recent study from Pakistan has shown STEMI patients

reporting to ED (Emergency Department) declined by 37.84%, number of patients undergoing PPCI declined enormously by 66.43%. STEMI mortality was not specifically analyzed in this study but total number of ED mortality decreased¹¹. Indolfi *et al*, published a multi-center study from Italy showing a 26.5% reduction in STEMI admissions during pandemic but the STEMI case fatality rate increased to 13.7% from 4.1% in 2019. The pandemic has also resulted in significant delays

in door to balloon time due to lockdowns, and the time from first medical contact to coronary revascularization was increased by 31.5%¹². The Minneapolis Heart Institute Foundation data from nine large US STEMI centers during the COVID-19 pandemic has shown a 38% reduction in US cardiac catheterization laboratory STEMI activations¹³. In another study from Spain revealed a 57% decline in diagnostic coronary angiograms, a 48% decline in PCI, a 81% decline in structural procedures, and a 40% decline in the use of PCI for STEMI¹⁴. In addition to the published literature, a decrease in the STEMI echoing among cardiologists on various social media platforms¹⁵⁻¹⁶.

The reasons behind a decrease in STEMI presentations were beyond the scope of this study but various plausible theories are possible. It is also important to determine whether there is true reduction in myocardial infarction incidence or less patients are reporting during this pandemic. Some of the factors which have been proposed to argue in favor of true reduction in acute coronary syndrome cases include reduction in pollution due to lockdown, no annoyance of heavy traffic to the workplace, less physical strain, more family time and relaxation^{7,17}. It is also postulated that there is less smoking as well as alcohol consumption and better medication compliance leading to adequate control of hypertension and diabetes mellites. But at the same time, increase in case fatality rate might be indicative of the fact that relatively stable patient with ACS could have died without seeking medical advice due to present pandemic and only unstable and complicated patients reported to cardiac units, resulting higher than usual mortality¹². Stay-at-home mandates and fear of contracting the virus in the hospital setting may have discouraged access to emergency medical services³. Furthermore, the relocation of health-care resources to a huge number of patients with COVID-19 might have contributed to deferred treatment of less urgent cases of STEMI¹⁸.

CONCLUSION

Lesser patients with STEMI were admitted to hospitals during COVID-19 pandemic but case fatality paradoxically increased. Further studies are required to determine whether there is a genuine reduction in the STEMI incidence or lockdown measures, fear of contagion at hospitals and relocations of resources to COVID-19 patients have falsely caused reduction in STEMI reporting.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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