International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

IJMRP

Original Research Article.

Demographic Profile, Management Issues and Outcomes in Patients Presenting with STEMI During COVID-19 Pandemic in a Tertiary Care Centre in Delhi

Rajeev Bharadwaj[1*], Ranjit Kumar Nath[2], Neeraj Pandit[3], Subhro Sekhar Chakraborty[1], Ashok Thakur[1], Vinod Kumar[1], Ajay Pratap Singh[1]

[1]Senior Resident, [2]Professor & Head, [3]Professor,
Department of Cardiology, ABVIMS & Dr. RML Hospital, New Delhi, India.

ABSTRACT

Introduction: Primary percutaneous transluminal coronary angioplasty (PTCA) is becoming the main management strategy of ST-elevated myocardial infarction (STEMI) in the urban areas as compared to the rural areas in India. The aim of this study was to find out the changing patterns of STEMI management in a tertiary care centre in India with around 90-100 cases of STEMI undergoing primary PTCA per month before Covid-19 pandemic in India, with a mortality of around 2-3% before COVID. It is a comparative analysis for a period of 3 months before and 3 months after the nationwide lockdown on 22nd March 2020 for Covid-19 pandemic.

Methods: 321 patients with acute STEMI presented during this period, 257 patients in the 3 months prior to 22nd March 2020 (Pre Covid-19 period) as compared to 64 patients in the subsequent 3 months after nation-wide lockdown, were included in this observational study to look for differences in demographic profile, management challenges and outcome differences due to the pandemic.

Results: There was a 75% reduction in patients presenting with STEMI during the Covid-19 pandemic as compared to the pre Covid-19 period. Door-to-needle time was also longer than 30 minutes in 45.4% cases. Only 62.5% cases underwent PTCA for STEMI in the Covid-19 period as compared to 93.4% cases before Covid-19. Mean hospital stay during Covid-19 was 4.6 ± 3.1 days compared to 2 ± 0.4 days beforehand for STEMI management which was statistically significant ($p < 0.005$). Mortality was 6.3% during Covid-19 period compared to 2.3% pre Covid-19 period due to cardiogenic causes.

Conclusion: Late presentation to hospital remains a critical factor in management of STEMI patients in India during covid 19. Overlapping of symptoms of STEMI with Covid-19 symptoms, needing further evaluation before ACS management strategy, and prolonged door-to-needle time were among the prominent reasons for lower performance of primary PTCA and higher mortality and hospital stay during covid 19.

Keywords: STEMI, Covid-19, Primary PTCA, Thrombolysis.

***Correspondence to:**

Dr. Rajeev Bharadwaj,
Senior Resident,
Department of Cardiology,
ABVIMS & Dr. RML Hospital, New Delhi, India.

Article History:

Received: 12-06-2020, **Revised:** 05-07-2020, **Accepted:** 28-07-2020

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2020.6.4.030	

INTRODUCTION

India being a developing country with the 2nd largest population in the world has among the highest number of Coronary artery disease patients in the world. STEMI being one of the most dreaded manifestations of the disease is contributing to the morbidity and mortality associated with CAD. It has been projected that between 1990 and 2020, there will be 117% and 105% rise in mortality from CAD in men and women respectively in India.[1] Primary percutaneous coronary intervention (PPCI) is the most effective therapy for STEMI and achieves rapid and more consistent reperfusion with low complication rate when compared to thrombolysis.[2] Thrombolytic therapy is equally effective for management of acute STEMI, when instituted at the earliest in reducing mortality and morbidity. All available evidence has shown that thrombolytic therapy is underutilized in patients with STEMI, because of hesitancy in prescribing a fibrinolytic agent.[3] This high mortality remains unexplained but may be attributable in part to the clustering of modifiable and non-modifiable cardiovascular risk factors. Covid-19 is a viral pneumonia caused by SARS CoV 2 that may result in severe systemic inflammation and ARDS, and both conditions have profound effects on the heart.

On 30 January 2020, the WHO declared the outbreak of SARS-CoV-2 a Public Health Emergency of International Concern.[4]

India declared its first nationwide lockdown for one day on 22nd March 2020, followed by a full lockdown for 2 months, 2 days later.[5] Due to the logistical issues including transport and time delays secondary to diagnostic uncertainty of STEMI with associated Covid-19 symptoms, direct transport of the patient to the Cathlab may not be prudent for PPCI. Furthermore, additional time is being taken to establish an STEMI diagnosis (echocardiography to assess for wall motion), and/or for Covid-19 status assessment and potential treatment (e.g., respiratory support). Thus, during the Covid-19 pandemic, there may be limitations of doing prompt PPCI with longer door-to-balloon times while doing primary PCI effecting outcomes.[6]

In addition, the following challenges were being faced by our institution. First, our's being a referral centre for PTCA in STEMI from nearby states, sealing of interstate borders during lockdown impacted the flow of STEMI patients. Secondly, due to lack of clear directives for management of covid 19 to the private sector from government, they were not accepting majority of STEMI patients with covid 19 symptoms resulting in late presentations after visiting multiple hospitals and out of window period.

Thirdly, our's being a single cathlab without facility for negative ventilation or other protective measures, taking every STEMI patient directly to cathlab was not feasible to prevent exposure of patient-to-patient and health care workers.

Fourth, patients who had presented with covid-19 like symptoms and STEMI, Chest x-ray requires a minimum of 1 hr and the test available for ruling out the diagnosis of Covid-19 (rt-PCR) takes more than 24 hrs to give the results, which nullifies the benefit of primary PTCA in such cases, even if they had presented within the window period.

Fifth, having limited PPE stock in this nationwide pandemic, procedures had to be rationed each day so that the limited manpower available is not unduly stretched due to inadvertent exposure.

Clinical trials have provided clinicians with many evidence-based interventions and medications while observational studies have revealed differences and shortcomings in management practices among countries as well as within different regions of the same country.[7,8]

So, in this pandemic situation this observational study was done to evaluate the changing pattern of STEMI management in a tertiary care centre in India.

METHODS

This observational study was carried out at a tertiary care centre in New Delhi, India from December 2019 till June 2020. Patients presenting with symptoms of acute myocardial infarction and ECG diagnosis of acute STEMI 3 months before 22nd March 2020 till 3 months after the nationwide lockdown were included. All patients presenting with chest pain within the preceding 72 hrs who fulfilled ECG criteria for acute STEMI were included in the study. A diagnosis of STEMI was made by an emergency physician and confirmed by a cardiology resident or cardiologist before admission. Troponin level was not checked in all cases but was done in doubtful cases.

Assessment with history, physical examination, and ECG was performed for every patient presenting with chest pain using a predesigned proforma, and those patients fulfilling the criteria for STEMI were included in the present study. Patients provided written informed consent prior to management. Pre Covid-19 patients were incorporated on the basis of data available in the hospital records and telephonic conversations.

Following hospital discharge, patients were allowed to be followed up at their usual clinics and telephonic conversations with the cardiologist whenever needed. An echocardiogram was performed to assess left ventricular function and to assess regional wall-motion abnormalities at discharge, besides it was also done in cases who were suspected to have mechanical complications before taking for PPCI.

All the principles outlined in the Helsinki declaration for ethical conduct were followed at each step of data collection and analysis with full informed written consent from each participant of the study. Our study also being purely an observational study, with no additional data collection, on top of, which is normally collected from a patient during management of STEMI.

The study observed the differences in demographic profiles, diagnostic and management challenges, and difference in outcomes of patients in the pre Covid-19 versus Covid-19 period.

Statistical analysis was performed with, SPSS statistical package, version 25.0 (SPSS, Chicago, IL, USA). Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. p value of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

RESULTS

Total 321 patients with confirmed STEMI presented to the emergency during the study period of six months with 257 before 22nd March 2020 (precovid group) and 64 after 22nd March till 22nd June 2020 (covid group), for three months in each group. Precovid group consisted of 57 (22.2%) females and 200 (77.8%) males and the mean age was 55.1 (±12.2) years. The majority of patients (28.6%) belonged to the age group of 41–50 years, and a further 11% were from the above 70 years age group. In the covid group, 18 (28.1%) were females and 46 (71.9%) were males with a mean age of 55.9 (±10.8) years.

Predominant risk factors being hypertension (39.7%) and smoking (30.3%) in the precovid group as compared to hypertension (50%) and diabetes (39.1%) in the later group. Chest pain was the dominant presenting complaint in 245 (95.3%) patients followed by sweating (40%) in the precovid group and chest pain in 52 (81.2%) patients followed by breathlessness in 39 (60.9%) patients and 40(62.5%) patients had fever in the last 1 wk in the covid group. Other risk factors, co-morbidities and demographic profiles are given in Table 1.

Clinical profile of patients presenting in the precovid group shows 154 (59.9%) patients presented in killip class I with majority 195 (75.9%) patients with AWMI. 238 (92.6%) patients in sinus rhythm with a mean heart rate of 110 (±20) with a mean hospital stay of 2 (±0.4) days.

In the covid group 32 (50%) patients, and 21 (32.8%) patients presented in killip class I and II respectively. 37 (57.8%) patients with AWMI and 27 (41.2%) patients with IWMI. 61 (95.3%) patients presented in sinus rhythm, mean heart rate was 84 (±18) and mean hospital stay of 4.6 (±3.1) days (Table 2).

In the precovid group 134 (52.1%) patients presented between 361 and 720 minutes (7-12hours) and 98 (38.1%) patients

presenting within 360 minutes (6hours), of the 206 patients undergoing PTCA in the precovid group 104 (50.5%) patients had a door-to-balloon time between 61 to 90 minutes. Only 4 patients underwent thrombolysis in the precovid group. In the covid group 30 (47%) patients presented out of the window period of 720 minutes (12 hours). Of the 15 patients in this group 6 (40%) patients had a door-to-balloon time of more than 90 minutes. Of the 22 patients thrombolysed 10 patients had a door-to-needle time of more than 30 minutes (45.4%). The delay in the covid group for both thrombolysis and PTCA was due to various issues as mentioned earlier (Table 3).

In the precovid group, 240 (93%) patients presenting with STEMI underwent PTCA while thrombolysis was done in 4 (1.6%) patients, 13 (5%) patients had recanalised culprit vessel and were put on medical management with anticoagulant, DAPT and statin.

In the covid group 40 (62.5%) patients underwent PTCA and 22 (34.4%) patients underwent thrombolysis. Either streptokinase and tenecteplase were used depending on availability.

Of the 8 (3.1%) patients who died in the precovid group, 6 (2.3%) died due to persistent cardiogenic shock, 3 of them presented with cardiogenic shock, 2 cases who died of non-cardiogenic causes had chronic kidney disease and sepsis respectively. Arrhythmia was noted in 6 (2.3%) cases consisted of sustained VT and atrial fibrillation. The mean LVEF at discharge was 38.9% (±5.2%). In the covid group 5(7.8%) patients died, 4 of them due to cardiogenic shock and 1 due to resistant hyperkalemia in the background of chronic kidney disease. 4 (6.2%) patients had arrhythmia in the form of AIVR and VT. The mean LVEF at discharge was 34.6% (± 4.8%). There were no cases of stroke or mechanical complications in either of the groups (Table 4).

Table 1: General and demographic profile of patients presenting with STEMI.

		Precovid period n=257 (%)	Covid period n=64 (%)
Age	**≤30**	6 (2.3)	1 (1.6)
	31-40	26 (10.1)	5 (7.8)
	41-50	73 (28.4)	17 (26.6)
	51-60	71 (27.6)	20 (31.3)
	61-70	54 (21.0)	17 (26.6)
	>70	27 (10.5)	4 (6.25)
Gender	**Male**	200 (77.8)	46 (71.9)
	Female	57 (22.2)	18 (28.1)
Risk factors	**Smoking**	78 (30.3)	15 (23.4)
	Hypertension	102 (39.7)	32 (50.0)
	Hyperlipidemia	65 (25.3)	13 (20.3)
	Diabetes	62 (24.1)	25 (39.1)
	Obesity	39 (15.2)	6 (9.4)
	Family H/O IHD	26 (10.1)	5 (7.8)
Symptoms	**Chest pain**	245 (95.3)	52 (81.2)
	Sweating	103 (40.0)	32 (50.0)
	Breathlessness	65 (25.3)	39 (60.9)
	Palpitation	26 (10.1)	6 (9.4)
	Nausea/Vomiting	26 (10.1)	6 (9.4)
	Fever in last 7 days	26 (10.1)	40(62.5)
	Giddiness	21 (8.17)	6 (9.4)

Table 2: Clinical profile of patients presenting with ST-elevated myocardial infarction.

		Precovid period n=257(%)	Covid period n=64(%)
Killip class	**I**	154(59.9)	19(29.7)
	II	72(28)	12(18.7)
	III	25(9.7)	22(34.4)
	IV	6(2.3)	11(17.2)
MI	**AWMI**	195(75.9)	37(57.8)
	IWMI	60(23.3)	27(42.2)
miscellaneous	**New onset LBBB**	1(0.4)	0
	Posterior MI	1(0.4)	0
Cardiogenic shock		6(2.3)	11(17.2)
Rhythm	**Sinus**	238(92.6)	61(95.3)
	CHB	15(5.8)	3(4.7)
	Junctional/high grade av block	4(1.6)	0
Heart rate (mean ± SD)		110±20	84±18
Blood pressure	**Systolic (mean ± SD)**	124±25	122±20
	Diastolic (mean ± SD)	80±22	82±24
Temporary pacemaker		19(7.4)	3(4.7)
IABP		4(1.6)	4(6.2)
Mechanical ventilation		8(3.1)	4(6.2)
Hospital stay (mean ± SD) days		2±0.4	4.6±3.1

Table 3: Timing variables

	Time in minutes	Precovid period n=257(%)	Covid period n=64(%)
Window period	**≤ 360**	98(38.1)	14(21.8)
	361-720	134(52.1)	20(31.2)
	>720	25(9.7)	30(47)
PTCA within 12 hrs		N=206	N=15
Door-to-balloon time	**≤60**	99(48)	2(13.3)
	61-90	104(50.5)	7(46.7)
	>90	3(1.5)	6(40)
Thrombolysis within 12hrs		N=4	N=22
Door-to-needle time	**≤10**	1(25)	6(27.3)
	11-30	1(25)	6(27.3)
	>30	2(50)	10(45.4)

Table 4: Complications among STEMI patients

		Precovid period n=257(%)	Covid period n=64(%)
Death	**Cardiogenic**	6(2.3)	4(6.3)
	Non cardiogenic	2(0.7)	1(1.5)
Arrhythmia		6(2.3)	4(6.2)
Bleeding		3(1.1)	2(3.1)
Acute kidney injury		12(4.6)	4(6.2)
LVEF % (mean ± SD)		38.9±5.2	34.6±4.8

DISCUSSION

Most of the STEMI diagnosis was achieved both by clinical and ECG criteria. Troponin levels were obtained in a minority of patients, more in the covid period after 22nd March because of the variability of presentation with breathlessness, prior history of fever and out of window period presentations.

Cardiovascular disease (CVD) is the number one cause of death in India and accounted for approximately 21% of deaths in the year 2010, with 10% of all deaths occurring due to CAD. Estimate of age-standardized CVD death rate is 272 per 100,000 in Indian population as per the global burden of disease study by WHO, which is higher than the global average of 235 per 100,000 population.[9] Ours is a tertiary care centre with 24 hours working catheterization laboratory with PTCA capability for management of STEMI. After start of the Covid-19 pandemic in India the below mentioned differences in the 3 months period prior and after 22nd March 2020 (first pan india lockdown day) has been observed in this study. The prevalence of diabetes (39%) in the covid group was more than the precovid group (24%) but are comparable to the data from regional and global studies.[10,11] The prevalence of hypertension, dyslipidemia, and preexisting coronary heart disease (Table 1) among STEMI patients were similar in other studies. Mohanan et al. reported the prevalence of hypertension and previous IHD among patients in Kerala, India, presenting with ACS to be 48% and 14%[11]; the Access study investigators reported higher prevalence of 65% and 26%, respectively[10]. There was higher prevalence of Diabetes, hypertension and obesity in the patients presenting with STEMI in the covid period.

Chest pain (95%) and sweating (40%) being the predominant presenting symptoms in the precovid group with breathlessness (61%) being the second most common after chest pain (81%) in patients during the covid period. The prevalence of fever in the previous 7 days was 62.5% in the covid period as compared to 10.1% in the precovid period. This history of fever and breathlessness was the major concern for taking up patients directly for PPCI as the Cathlab does not have the negative pressure air conditioning facility, needed to reduce transmission and they required Covid-19 exclusion before admission as covid mimicking stemi is well documented in literature.[12]

In the present study acute anterior wall MI was the most common STEMI in 75.9% patients in the precovid group and 57.8% patients in the covid group, (23.3%) and (41.2%) patients had inferior wall MI in the two groups. Majority (87.9%) were in killip class I and II in the precovid group in stark contrast to among (51.6%) in the covid period who presented in killip III and IV. The higher incidence of cardiogenic shock (17.2%) in the covid period may be due to late presentation due to the reasons enumerated before. Misiriya KJ et al and Hanania G et al in their studies observed that most common MI was anterior wall MI in 43% and 39% respectively and Killip class of I and II was seen in 85% and 78% of subjects.[13,14] Out of window period presentation for reperfusion therapy was present in (9.7%) cases in the precovid group as compared to (47%) in patients presenting during covid period, the reason were referral from other hospitals and due transport delay and other logistical issues related to lockdown and diagnosis of covid 19. Mohanan et al. recently reported time from ACS symptom onset to ER presentation of over 6 hours in India[11].

Here we would like to emphasize that chest x-ray alone is a poor screening test to triage covid 19 infection without rt PCR, as the following 38yr old post-partum female from a hotspot area presented with chest pain, ecg suggestive of awmi (Fig 1.a) with cxr demonstrating bilateral interstitial infiltrates typical of covid 19 (Fig 1.b) but was negative for covid 19 by rt PCR twice within a span of 5 days. Her coronary angiogram showed proximal LAD 100% occluded which was successfully opened with a drug eluting stent at PPCI. Majority (93.4%) cases underwent PCI in the precovid period, whereas only (62.5%) cases underwent PTCA±S in the covid period, rest underwent thrombolysis and medical management.

Meta-analysis has shown primary PCI to be superior to thrombolysis in the treatment of STEMI and to benefit long term survival and reduce strokes, recurrent ischemia, and reinfarction.[15]
The door to balloon time was less than 90 minutes in (98.5%) cases in the precovid period as compared to (60%) in the covid period. Only 4 patients underwent thrombolysis in the precovid period as compared to 22 patients in covid period. Door to needle time being less than equal to 30 mins in(50%) and (54.6%) cases in both groups.
Door to needle time was more than 30mins in 45.4% of cases in the covid period. Another reason for delay in addition to those mentioned earlier may be the longer time in donning and doffing of the ppe kit.
Mohanan et al. reported that less than one-third of patients undergoing thrombolysis had door-to-needle times of more than 30 min in India.[11]
Guidelines recommend a door to needle time of less than 30 minutes and both ACC and ESC propose a door-to-balloon time of 90 min or PCI related delay of 60 min as standard as beyond which the benefit of PPCI over fibrinolysis is lost.[16,17] This was achieved in nearly 75.3% of the patients in a study by subban V et al. 46% of the patients in that study had door-to balloon time of less than 60 min[18].
The outcomes of ACS patients in the developing countries of Latin America, the Middle East, and Africa reported that 39% of STEMI patients did not receive thrombolysis or PCI[10], It was a multinational survey, which included 11,731 patients, the overall rates for angiography were 58% and for PCI it was 35%.
All the patients of STEMI had received aspirin, clopidogrel/ticagrelor/prasugrel, and a statin on presentation to our department, some of them who were referred had also taken an incomplete loading dose. Aspirin was the medication most likely to be withheld, mostly for reasons of epigastric pain or presumed gastrointestinal hemorrhage. An ACEI or ARB along with a beta blocker was started after admission and continued in majority of patients at discharge.
Only 2 patients in the covid period were positive for covid 19 who presented with STEMI, both were thrombolysed and they showed recanalised vessels after angiography and were discharged on medical management without complications.
29 (11.3%) patients had complications in the precovid group versus 14 (21.9%) in the covid group, the majority of which were from cardiac causes. No patient developed major bleeding requiring blood transfusion in either groups. No patients had stroke or mechanical complications in either of the 2 groups. Discharge mean LVEF in the precovid group was 38.9% (SD 5.2%) versus 34.6% (SD 4.8%) in the covid group which was statistically significant (p value <0.05). The low mean values in either groups may be due to fallacies of early LVEF estimation post reperfusion (stunned myocardium). The lower LVEF in the covid group may be due to higher percentage of patients presenting out of window period and a higher door to balloon time in these patients undergoing PTCA. In hospital mortality due to cardiogenic cause was 2.3% in the precovid group vs 6.3% in the covid group. Mohanan et al. reported an in-hospital mortality of 4.3–8.6% among various cardiac registries globally.[11]
Finally, there was a reduction of 75% of patients presenting with STEMI during covid period as compared to the precovid period, which is significanty higher than found in studies from the united states and Ireland which were 38% and 36% respectively.[19,20] This can be explained by the fact that considerable no. of the patients which come to our centre are from neighbouring states of Haryana and uttar Pradesh, the borders of which were sealed during lock down as well as the general fear among patients, due to rising cases of covid 19 in Delhi.
Regionally, in India 7.5–12% of patients presenting with ACS undergo primary PCI and 20% undergo angiography[11,21]. In comparison, western countries report rates of 56.3% for angiography, 40.4% for percutaneous intervention, and 3.4% for coronary artery bypass grafting for patients presenting with acute STEMI.[22,23] Hence, we have established a standard STEMI management protocol according to global standards in our hospital which needs further streamlined approach in these covid19 pandemic as we learn more about the disease.

LIMITATIONS

Limitations of this study were its it was a single-center observational study with a relatively short duration (6 months), and that it included only patients in the acute-care setting, which may have led to underestimation of the event rates, since patients who were dead on admission would not have been included in our analysis. Analytical or interventional study design would have helped in identifying independent risk factors, efficacy of treatment for STEMI.

CONCLUSION

Delhi being in the fore front of the covid19 pandemic with its standard STEMI protocols in the tertiary care hospitals, needs further refinement. Robust clinical, diagnostic and treatment protocols focusing on coronary interventions should be incorporated to alleviate the logistical and transport delays plaguing STEMI management during Covid 19 to reverse the trend in favour of coronary interventions.

REFERENCES

1. World Health Organization. World Health Statistics Annual. Geneva, Switzerland: World Health Organization; 1998.
2. Keeley EC, Boura JA, Grines CL. Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomised trials.Lancet. 2003;361:13e20.
3. Antman EM, Braunwald E. ST segment elevation mycocardial infarction. In: Zipes, Libby, Bonow, Braunwald eds. Braunwalds Heart disease a text book of cardiovascular medicine. 7th ed. Philadelphia: Elsevier Saunders; 2005:1141-1142.
4. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV) 30 January 2020, WHO, Statement, Geneva, Switzerland.
5. Indian Prime Minister Narendra Modi Announces Total Lockdown of 1.3 Billion People for 21 Days, https://time.com/5808348/india-coronavirus-lockdown/ accessed july 20/2020
6. Management of Acute Myocardial Infarction During the COVID-19 Pandemic. J Am Coll Cardiol 2020; Apr 20:[Epub ahead of print].
7. Eagle KA, Goodman SG, Avezum A, Budaj A, Sullivan CM, Lopez-Sendon J, et al. Practice variation and missed opportunities

for reperfusion in ST-segment-elevation myocardial infarction: findings from the Global Registry of Acute Coronary Events (GRACE) Lancet. 2002;359(9304):373–7. doi: 10.1016/S0140-6736(02)07595-5.
8. Fox KA, Goodman SG, Anderson FA, Jr, Granger CB, Moscucci M, Flather MD, et al. From guidelines to clinical practice: the impact of hospital and geographical characteristics on temporal trends in the management of acute coronary syndromes. The Global Registry of Acute Coronary Events (GRACE) Eur Heart J. 2003;24(15):1414–24. doi: 10.1016/S0195-668X(03)00315-4.
9. WHO, WHO Fact sheet No 310, updated June 2011. 2011.
10. Investigators A Management of acute coronary syndromes in developing countries: acute coronary events-a multinational survey of current management strategies. Am Heart J. 2011;162(5):852–9. doi: 10.1016/j.ahj.2011.07.029.
11. Mohanan PP, Mathew R, Harikrishnan S, Krishnan MN, Zachariah G, Joseph J, et al. Presentation, management, and outcomes of 25 748 acute coronary syndrome admissions in Kerala, India: results from the Kerala ACS Registry. Eur Heart J. 2013;34(2):121–9. doi: 10.1093/eurheartj/ehs219.
12. Stefanini GG, Montorfano M, Trabattoni D, et al. ST-elevation myocardial infarction in patients with COVID-19: clinical and angiographic outcomes. Circulation. 2020; Epub ahead of print.
13. Misiriya KJ, Sudhayakumar N, Khadar SA, George R, Jayaprakasht VL, Pappachan JM. The clinical spectrum of acute coronary syndromes: experience from a major centre in Kerala. J Assoc Physicians India. 2009 May; 57:377-83.
14. Hanania G, Cambou JP, Guéret P, Vaur L, Blanchard D, Lablanche JM, et al. The USIC 2000 investigators: management and in-hospital outcome of patients with acute myocardial infarction admitted to intensive care units at the turn of the century: results from the French nationwide USIC 2000 registry. Heart. 2004;90:1404-10.
15. Keeley EC, Boura JA, Grines CL. Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomised trials. Lancet. 2003;361(9351):13–20. doi: 10.1016/S0140-6736(03)12113-7.
16. Rathore SS, Curtis JP, Chen J, et al. Association of door-to balloon time and mortality in patients admitted to hospital with ST elevation myocardial infarction: national cohort study. BMJ. 2009;338:b1807.
17. McNamara RL, Wang Y, Herrin J, et al. Effect of door-toballoon time on mortality in patients with ST-segment elevation myocardial infarction. J Am Coll Cardiol. 2006;47:2180e2186.
18. Subban V, Lakshmanan A, Victor SM, et al. Outcome of primary PCI - an Indian tertiary care center experience. Indian Heart J. 2014;66(1):25-30. doi:10.1016/j.ihj.2013.12.036
19. Garcia S., Albaghdadi M.S., Meraj P.M. Reduction in ST-Segment Elevation Cardiac Catheterization Laboratory Activations in the United States during COVID-19 Pandemic. J. Am. Coll. Cardiol. 2020 doi: 10.1016/j.jacc.2020.04.011.
20. Coughlan, John Joseph et al. "COVID-19 and STEMI: A snapshot analysis of presentation patterns during a pandemic." International Journal of Cardiology. Heart & Vasculature, 100546. 26 May. 2020, doi:10.1016/j.ijcha.2020.100546
21. Xavier D, Pais P, Devereaux PJ, Xie C, Prabhakaran D, Reddy KS, et al. Treatment and outcomes of acute coronary syndromes in India (CREATE): a prospective analysis of registry data. Lancet. 2008;371(9622):1435–42. doi: 10.1016/S0140-6736(08)60623-6.
22. Hasdai D, Behar S, Wallentin L, Danchin N, Gitt AK, Boersma E, et al. A prospective survey of the characteristics, treatments and outcomes of patients with acute coronary syndromes in Europe and the Mediterranean basin; the Euro Heart Survey of Acute Coronary Syndromes (Euro Heart Survey ACS) Eur Heart J. 2002;23(15):1190–201. doi: 10.1053/euhj.2002.3193.
23. Fox KA, Goodman SG, Klein W, Brieger D, Steg PG, Dabbous O, et al. Management of acute coronary syndromes. Variations in practice and outcome; findings from the Global Registry of Acute Coronary Events (GRACE) Eur Heart J. 2002;23(15):1177–89. doi: 10.1053/euhj.2001.3081.

Source of Support: Nil. **Conflict of Interest:** None Declared.

Cite this article as: Rajeev Bharadwaj, Ranjit Kumar Nath, Neeraj Pandit, Subhro Sekhar Chakraborty, Ashok Thakur, Vinod Kumar, Ajay Pratap Singh. Demographic Profile, Management Issues and Outcomes in Patients Presenting with STEMI During COVID-19 Pandemic in a Tertiary Care Centre in Delhi. Int J Med Res Prof. 2020 July; 6(4): 126-31. DOI:10.21276/ijmrp.2020.6.4.030