

Comparative study of COVID 19 positive and COVID 19 negative STEMI (ST elevation myocardial infarction) during covid pandemic

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Abstract

Background: Since COVID-19 is also associated with hypercoagulation and thrombosis, multiple early reports and questions were raised about the likely increased risk of acute myocardial infarction (AMI) developing in patients with risk factors. Present study was aimed to compare the outcome of COVID 19 positive and COVID 19 negative STEMI (ST elevation myocardial infarction) during covid pandemic. **Material and Methods:** Present study was single-center, prospective, observational study, conducted in patients presenting with symptoms of acute myocardial infarction and ECG diagnosis of acute STEMI (ST elevation myocardial infarction), RTPCR was done on admission, patients were shifted to COVID ICU if report was positive. **Results:** In this present study 154 patients were studied. Majority of them were from the 51-60 years age group. Out of the all-risk factors, IHD (p-value=0.049) and OLD PVD (p-value=0.024) in covid (+) are significantly more than covid (-) patients. Single PTCA and multivessel PTCA are slightly more in Covid (-) patients as compared to covid (+) patients. There was no significant difference in complications of Covid positive and Covid negative STEMI as treated promptly with pharmacoinvasive treatment i.e., thrombolysis on admission then planned PTCA. Covid (+) patients needed more inotropes than covid (-) group. Use of BIPAP ventilation was more in covid positive patients. In covid (-), there are 34 (27 %) cardiogenic shock patients and in covid (+) there are 9 (33%) cardiogenic shock patients. Significantly more deaths in Covid positive cardiogenic shock patients. Significantly more angioplasty done in Covid negative group. One year follow up Mortality was 2.3% and 7.4% in Covid negative and positive groups respectively. 1.5 year follow up Mortality was 3.7% and 4.7% in Covid positive and negative groups respectively Conclusion: Covid positive patients needed more inotropes, more Thrombotic lesions, more use of BIPAP ventilation, more deaths in covid positive cardiogenic shock patients as compared to covid negative cardiogenic shock patients.

Keywords: COVID 19 positive, STEMI (ST elevation myocardial infarction), RTPCR, thrombolysis

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Introduction

The typical clinical spectrum of COVID-19 includes fever, cough, myalgia, dyspnea, with frequent progression to pneumonia, which in one third of the cases eventually leads to acute respiratory distress syndrome (ARDS), of which another third warrant critical care.¹ Although the respiratory tract is the most involved organ system in this disease, other organs and particularly the heart are also affected with a negative impact on outcome.² Furthermore, pre-existing cardiovascular disease (CVD) can affect severity and mortality of these patients. Although SARS-CoV-2 infects people of all age groups, elderly people with underlying cardiovascular diseases and those with conventional cardiovascular risk factors including male sex, diabetes, obesity and hypertension are particularly vulnerable with high morbidity and mortality.^{3,4}

Since COVID-19 is also associated with hypercoagulation and thrombosis, multiple early reports and questions were raised about the likely increased risk of acute myocardial infarction (AMI) developing in patients with risk factors.⁵ Present study was aimed to compare outcome of COVID 19 positive and COVID 19 negative STEMI (ST elevation myocardial infarction) during covid pandemic.

Material and Methods

Present study was a single-center, prospective, observational study, conducted in the department of the coronary care unit, cardiology department, at Ruby Hall Clinic, Pune, Maharashtra, India. Study duration was 10 months (March 2020 to December 2020). Study was approved by the institutional ethical committee.

Inclusion criteria

- Patients presenting with symptoms of acute myocardial infarction and ECG diagnosis of acute STEMI (ST elevation myocardial infarction).

Exclusion Criteria

- Evolved myocardial infarction, myocarditis, cardiomyopathy, NSTEMI, unstable angina. Patients thrombolysed outside Ruby Hall Clinic.
- . Patient demographic details, clinical history, physical examination, and ECG findings were noted in a predesigned proforma. On admission, for every patient presenting with chest pain, diagnosis of STEMI was made by an emergency physician and confirmed by a cardiology resident or cardiologist before admission. Those patients fulfilling the criteria for STEMI were included in the present study.

For all patients, RT PCR was done on admission with all covid precautions & the patient was treated in an isolation ICU. After the RT PCR report, patients were shifted to COVID ICU if the report was positive. All patients were treated as per standard operating protocol of our institute.

Following hospital discharge, patients were allowed to be followed up at their usual clinics, cardiologists 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 bedside in all cases on admission

Statistical Analysis

Data was collected in a predesigned Performa and later tabulated in a Microsoft excel sheet. Results on categorical data were shown as n (% of cases) and the data on continuous measurements will be presented on Mean \pm Standard Deviation. Statistical analysis done using IBM SPSS Statistics 20 Windows (SPSS Inc., Chicago, USA). Two proportion z test and chi-square test was applied to compare the random samples of two populations. $P < 0.05$

will be considered statistically significant. And different charts and graphs like bar graph, pie charts were drawn using excel.

Results

In this present study 154 patients were studied. Majority of them were from the 51-60 years age group. There is no significant difference between female and male of covid (+) and covid (-) of STEMI patients. Out of the all-risk factors, IHD (p-value=0.049) and OLD PVD (p-value=0.024) in covid (+) are significantly more than covid (-) patients. More patients had STEMI with a previous history of IHD and PVD in Covid positive group.

Table 1: General characteristics

Characteristics	Covid (-) (n=127)	Covid (+) (n=27)	P-value
Age (in years)			
20-30	2 (1.57%)	1 (3.7%)	
31-40	9 (7.0%)	3 (11.11%)	
41-50	24 (18.89%)	6 (22.22%)	
51-60	55 (43.30%)	9 (33.33%)	
61-70	27 (21.25%)	4 (14.81%)	
71-80	10 (7.87%)	2 (7.40%)	
81>	0	2 (7.40%)	
Total	127	27	
Gender			
Female	23 (18.1%)	4 (14.8%)	0.682
Male	104 (81.9%)	23 (85.2%)	
Risk Factor			
DM	56 (44%)	10 (37%)	0.503
HTN	63 (50%)	11 (41%)	0.395
IHD	9 (7%)	5 (19%)	0.049
OLD PTCA	10 (8%)	4 (15%)	0.254
OLD CABG	1 (0.78%)	0 (0%)	0.603
OLD CVA	2 (2%)	2 (7%)	0.159
COPD	1 (1%)	1 (4%)	0.250
OLD PVD	0 (0%)	1 (4%)	0.024
CKD	1 (0.78%)	0 (0%)	0.603
HT & DM	43 (34%)	6 (22%)	0.226

Points scored

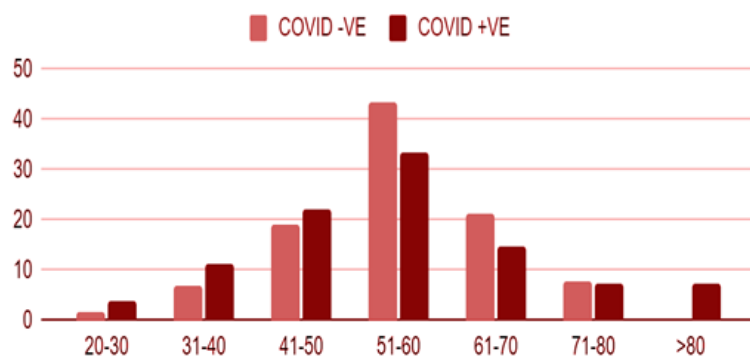


Figure 1: Age distribution

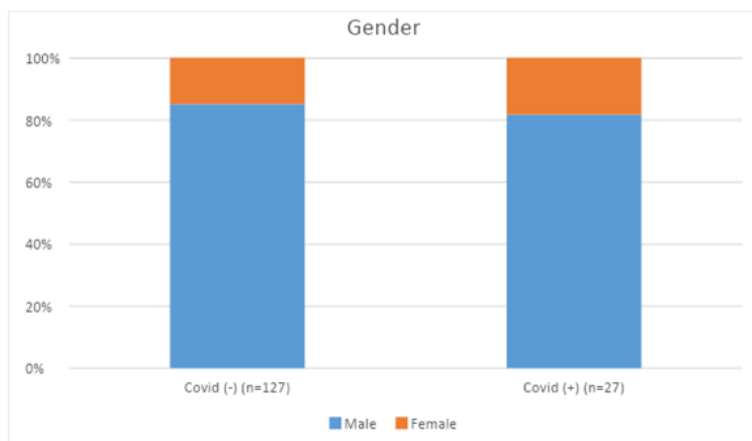


Figure 2: Gender distribution

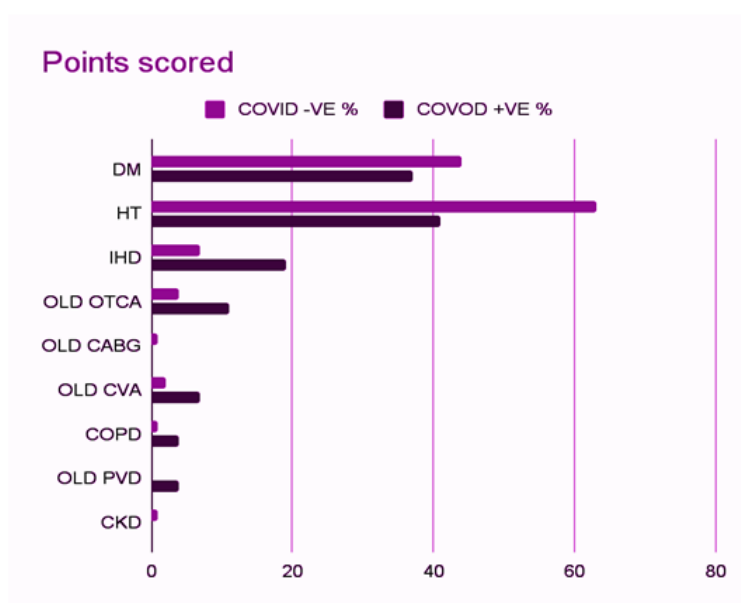


Figure 3: Risk factors

Most of the patients presented with classical symptom triad i.e., chest pain, breathlessness, sweating, but breathlessness, fever and other symptoms were significantly more in Covid positive patients than Covid negative patients. There was no significant difference between STEMI patients of covid (+) and covid (-) cases in symptoms of chest pain, sweating, back pain, cough, left shoulder pain. But the fever (p-value=0.012) and other symptoms (p-value=0.028) significantly more in covid (+) cases than covid (-) cases.

Table 2: Symptoms

Symptoms	COVID (-)	COVID (+)	P-value
Chest pain	124(97.6%)	26(96.3%)	0.535
Breathlessness	73(57.5%)	20(74.1%)	0.101
Sweating	66(52.0%)	11(40.7%)	0.298
Back pain	15(11.8%)	3(11.1%)	0.881
Fever	6(4.7%)	5(18.5%)	0.012
Left shoulder pain	9(7.1%)	1(3.7%)	0.562
Other	26(20.5%)	10(37.0%)	0.028

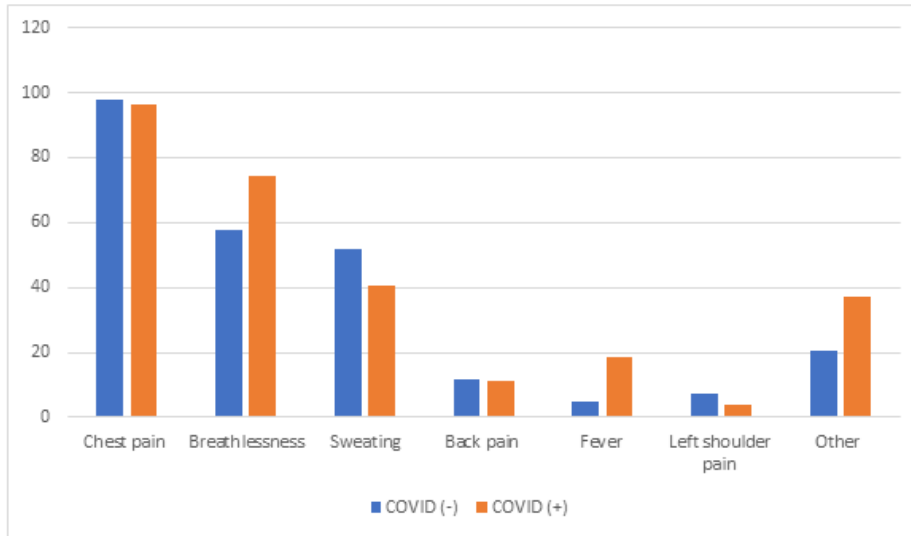


Figure 4: Symptoms

Table 3: Symptom duration.

Symptoms duration (hours)	COVID (-) (n=127)	COVID(+) (n=27)
0--1	28(10%)	1(2%)
1--4	43(15%)	6(9%)
4--8	68(24%)	11(17%)
8--12	14(5%)	2(3%)
12--24	47(17%)	14(22%)
24--48	46(16%)	20(31%)
48>	37(13%)	11(17%)

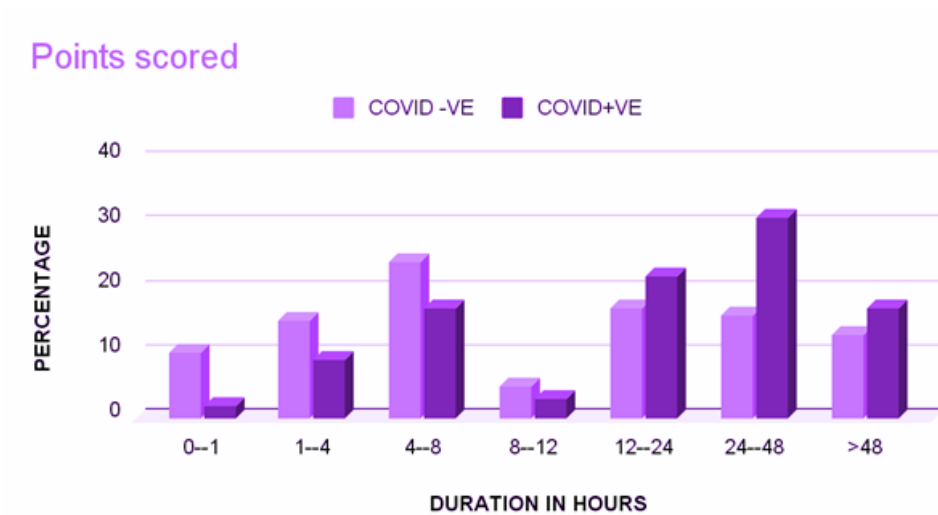
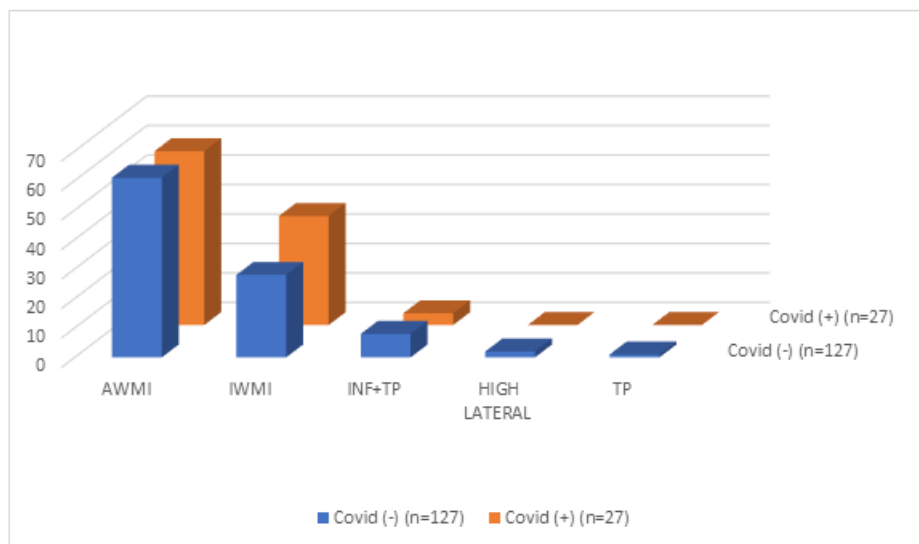


Figure 4 Duration in Hours

In the present study, the site of myocardial infarction does not significantly differ in covid (+) and covid (-ve) patients.

Table 4: Site of myocardial infarction

Site of myocardial infarction	Covid (-) (n=127)	Covid (+) (n=27)	P-value
AWMI	78(61%)	16(59%)	0.834
IWMI	35(28%)	10(37%)	0.327
INF+TP	10(8%)	1(4%)	0.447
HIGH LATERAL	3(2%)	0(0%)	0.418
TP	1(1%)	0(0%)	0.646

**Figure 5: Site of myocardial infarction**

In this study, there was no significant difference in use of thrombolytic drugs in covid (-) and covid (+) patients. In the present study, there was a significant difference between single and multivessel in covid (+) and covid (-) patients. Single PTCA and multivessel PTCA are slightly more in Covid (-) patients as compared to covid (+) patients. Door to needle time is the same in Covid positive and negative STEMI (41, 38 min respectively). Number of single and multivessel PTCA is more in Covid negative patients.

Table 4: Early management

Thrombolytic drug	Covid (-) (n=127)	Covid (+) (n=27)	P-value
TNK	21(17%)	6(22%)	0.478
STK	57(45%)	11(41%)	0.697
RETEPLASE	6(5%)	3(11%)	0.201
Coronary angiography report			
LAD	77 (60.2%)	3 (10%)	
RCA	50 (39.1%)	5 (16.7%)	
LCX	31 (24.2%)	1 (3.3%)	
LEFT MAIN	11 (8.6%)	2(6.7%)	
Multivessel disease	64(50.4%)	7 (25.9%)	
PTCA			
Single	67 (52.75%)	6(22.22%)	0.042
Multivessel	26(20.47%)	2(7.4%)	0.043
Left Main	8(6.29%)	2 (7.4%)	0.834
CABG			

CABG	6(5%)	1(4%)	0.818
ADV	5(4%)	2(7%)	0.430

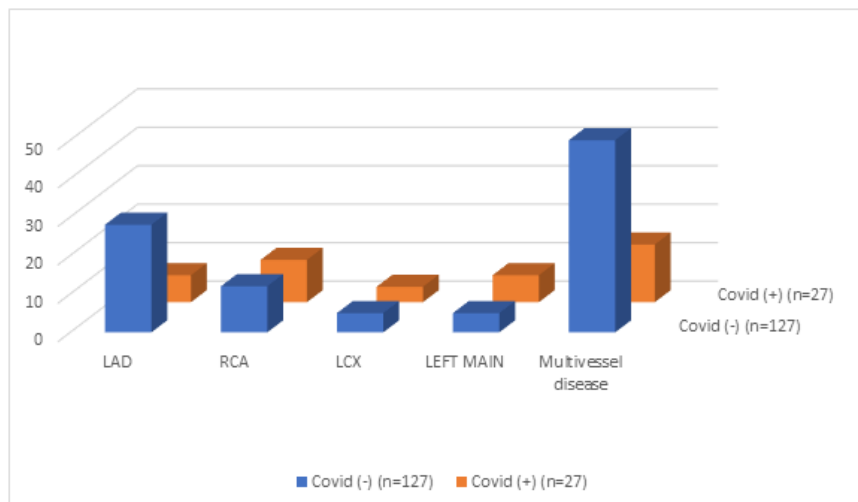


Figure 6: Coronary angiography report

There was no significant difference in complications of Covid positive and Covid negative STEMI as treated promptly with pharmacoinvasive treatment i.e., thrombolysis on admission then planned PTCA.

Table 5: Complications

Complications	Covid (-) (n=127)	Covid (+) (n=27)	P-value
Cardiogenic shock	34(27%)	9(33%)	0.529
Heart failure	52(41%)	14(52%)	0.294
VT	21(17%)	8(30%)	0.121
VF	4(3%)	0(0%)	0.363
CHB	5(4%)	1(4%)	---
Mechanical Complications	11(7%)	4(15%)	0.175
MR			
VSD	1(2%)	0(0%)	0.459

In the present study, covid (+) patients needed more inotropes than covid (-) group. Use of GPIIb3a inhibitors, is more in Covid (-) patients as compared with covid (+) patients (p-value =0.032). Use of BIPAP ventilation was more in covid positive patients. More deaths in covid (+) patients than in covid (-) patients. About ventilated patients' outcome - more patients were treated with BIPAP in Covid positive group. Significantly more ventilated patients discharged in Covid negative group than Covid positive group. Significantly more deaths in Covid positive patients than Covid negative patients.

Table 6: Complication management

Inotropes	Covid (-) (n=34)	Covid (+) (n=9)	P-value
Single	17(50%)	2(22%)	0.136
Multiple	17(50%)	7(78%)	0.0445
IABP	7(21%)	1(11%)	0.516
GP2b/IIIa inhibitors			
TIROFIBAN	40(31%)	3(11%)	0.032

EPTIDAY	1(0.78%)	0(0%)	0.646
ventilation			
BIPAP	6(30%)	5(41.66%)	0.011
INVASIVE	13(65%)	5(41.66%)	0.223
HFNO2	1(5%)	1(10%)	0.719
OUTCOME OF VENTILATED PATIENTS			
DISCHARGE	15(83%)	6(55%)	0.321
DEATH	4(22%)	5(45%)	

Out of 27 covid positive patients 8 received Remdesivir and MPS (Methylprednisolone). Five (62.5%) of them died, and three (37.5%) were discharged. Out of 27 Covid positive patients, 9 were on Aspirin and Atorvastatin, all discharged. One patient on antiretroviral treatment, discharged.

Majority of covid (-) patients were discharged in 2-4 days. Majority of covid (+) patients were discharged in 6-8,8-10 and >10 days. In covid (-) there are 34(27%) cardiogenic shock patients and in covid (+) there are 9(33%) cardiogenic shock patients. More deaths in covid (+) positive patients as compared with covid (-) patients. In covid (-), cardiogenic shock patients most of the patients get discharged. In covid (+), cardiogenic shock patients are more deaths observed. Significantly more Covid negative patients of cardiogenic shock got discharged. Significantly more deaths in Covid positive cardiogenic shock patients.

Table 7: Outcome

OUTCOME	Covid (-) (n=127)	Covid +(n=27)	P-value
DISCHARGE	119(93.7%)	22(81.5%)	0.039
DAMA	4(3.1%)	0(0%)	0.352
DEATH	4(3.1%)	5(18.5%)	0.002
TOTAL	127	27	

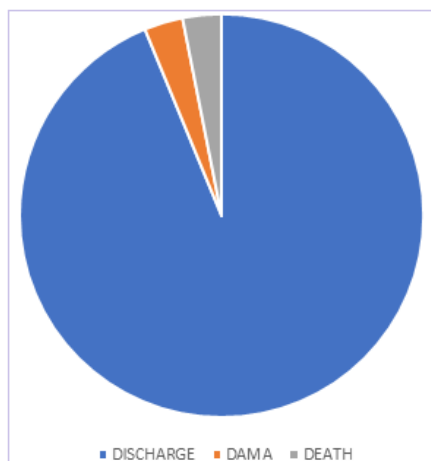


Figure 7- Covid (-) OUTCOME

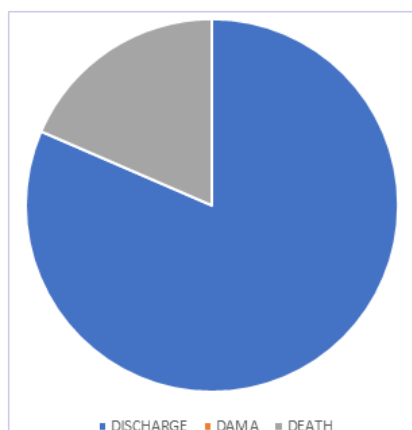


Figure 8: Covid (+) OUTCOME

Significantly more angioplasty done in Covid negative group. Significantly more Thrombotic lesions in Covid positive patients. LAD is the most involved artery in Covid negative group. 4 Covid negative patients had cardiac arrest in the emergency room and were revived, treated, and discharged.

Table 8: Angioplasty

	Covid (-) patients	Covid (+) patients	P-value
Total Angioplasty	90(71%)	10(37%)	<0.001
Thrombotic lesion	56(62%)	10(100%)	0.017
Atherosclerotic lesion /Plaque	59(66%)	4(40%)	0.112
TIMI III flow	68(76%)	9(90%)	0.303
TIMI II flow	3(3.3%)	1(10%)	0.308
Recanalized	12(13%)	0(0%)	0.219
Muscle Bridge	2(2%)	0(0%)	0.631
Not willing for PTCA	5(6%)	0(0%)	0.447
ADV CABG	16(18%)	2(20%)	0.865
Angioplasty Done	90(100%)	10(100%)	<0.001

One year follow up Mortality was 2.3% and 7.4% in Covid negative and positive groups respectively. 1.5 year follow up Mortality was 3.7% and 4.7% in Covid negative and positive groups respectively.

Table 9: Follow-up (Telephonic)

	1 Year		1.5 years	
	Covid (-)	Covid (+)	Covid (-)	Covid (+)
Regular follow-up	100	19	77	20
Irregular treatment	3	2	3	2
Chest pain	5	0	3	0
CAG	3	0	1	0
Medical treatment	2	0	2	0
PTCA	1	0	0	0
Death	3	2	0	2
CABG	0	1	6	1
Wrong number/ Not reachable/Switched off	17	3	29	4

In present study, 12 patients in COVID negative group had TROP I levels >30000. 2 patients required inotropic support & mechanical ventilation. 11 were discharged while 1 patient took DAMA. All patients were on regular follow up till 1 year. One death was noted at 1.5 year follow up.

Table 10: Details of 12 patients in COVID negative group (TROP I levels >30000)

No	1	2	3	4	5	6	7	8	9	10	11	12
Age	57	41	54	66	56	62	75	69	65	37	56	53
Sex	M	M	M	F	M	M	M	M	F	M	M	M
Symptoms	>48 HRS	4 HRS	12 HRS	12 HRS	>48 HRS	>48 HRS	>48 HRS	12 HRS	18 HRS	12 HRS	6 HRS	>12 HRS
Fever	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Stay (days)	18	4	5	6	12	4	4	4	7	5	4	30
Risk Factors	HT	DM			DM	DM		HT	Hypothyroid	DM HT	DM, HT	
MI	INF+TP	INF	AW	AW	INF+TP	AW	AW	IW	AW	AW	IW	IW
Thrombolysis	N	STK	N	STK	N	TNK	N	STK	STK	N	STK	N
Lesion	RCA, LAD, LCX	RCA			LAD LCX RCA	LAD	LAD RCA	LCX	LAD	LAD	LAD RCA	LT MAI N+T VD
PAMI	RCA	N	LAD	N	N	N	N	N	N	N	N	N
WBC	15500	19800	20000	21700	12800	21500		6600	21700		16000	13700
Lymphocyte	9	4.8	43	4	14	3.5		15	4.3		11.8	20
CRP-HS	17		1.5	2.7	21.21				2.7			
TROP I	123600	71,140	>30,000	99650	>30000	>30000	50150	>30000	99650	>30000	>30000	>30000
Ferritin					328							
LDH	312		1850	1138				522	1138			
LVF	30%	50%	35%	25%	20%	35%	40%	40%	25%		40%	30%
Shock	Y	N	Y	Y	Y	Y	N	N	N	N	N	Y
Inotropes	NA, ADR, VASO	N	NA	NA	NA	N	N	N	N	N	N	NA, ADR
IABP	Y	N	N	N	N	N	N	N	N	N	N	Y
LVF	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VT	Y	N	N	Y	2:1 AV bloc	N	N	N	Y	N	N	Y

					k							
MR	Y	N	N	Y	N	N	N	N	Y	N	N	Y
Ventilation	invasive	N	BIPAP	N	N	N	N	N	N	N	N	invasive
PTCA	RCA	RCA	LAD	LAD	N	LAD	LAD RCA	N, medical treatment	LAD	LAD	not willing	
CABG												Y
THROMBUS	RCA total thrombotic occlusion LAD,L CX - CTO	RCA						RE ANA LISE D	LAD 70% THR OM BUS	85% LAD THR OM BUS	95% ,RCA THR OM BUS	
STENT	4X48	3.5X 18 3.5X 21				4.0X 18			2.5X 15,3 .0X3 0	3.5X 18		
OUTCOME	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DIS	DA MA	DIS
1 YR F.U.	On Reg Treat ment	Reg F.U.	Reg F u		On Trea tme nt	Reg F.U		Reg F.U.	Reg F.U.	On Trea tme nt		Reg. F.U
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Discussion

Acute ST segment elevation myocardial infarction (STEMI), is associated with high mortality if not treated in time even with modern medicine.⁶ Timely reperfusion therapy is critical for STEMI patients because a short ischemia time is associated with better clinical outcomes and lower acute and long-term mortality.⁷

The pandemic has also severely affected several health care systems and cardiovascular departments in several areas, which may cause a delay and hesitancy for patients with symptoms of AMI to seek appropriate care.⁸

In a similar study by Jena KK et al.,⁹ with 300 patients admitted with STEMI, 11.66% were COVID-19 positive. Atherosclerotic cardiovascular risk factors were much lower in COVID-19-positive STEMI patients when compared to non-COVID STEMI patients. Mean oxygen saturation at time of presentation in COVID-19 positive and negative patients was 85.1% and 97.5%, respectively (P < 0.001). COVID-19 group had significantly higher noncardiac complications than non-COVID patients (P < 0.001). The average duration of hospital stay in

COVID-19 STEMI was 13.6 days, whereas in non-COVID group was 6.8 days ($P < 0.001$). Higher mortality was found in the COVID-19 positive group (14.28%) when compared to non-COVID STEMI (7.9%; $P < 0.001$). Similar findings were noted in the present study.

Nomesh K et al.,¹⁰ studied 33 articles covering 37 patients, among which 30 (81.1%) were male, and 7 (18.9%) were females, mean age was 52.8 ± 15.6 years. Several comorbidities such as hypertension (16 cases, 43.2%), diabetes (14 cases, 37.8%), smoking (8 cases, 21.6%), obesity (3 cases, 8.1%), morbid obesity (1 case, 2.7%), and elevated lipid levels (4 cases, 10.8%) were also identified. The most common symptom of AMI was chest tightness (22 cases, 59.5%), while the most common symptoms for COVID-19 were dyspnea (25 cases, 67.6%) and fever (22 cases, 59.5%). The mortality rate was 35.1%. Given the high mortality rate, physicians are encouraged to properly check for signs of cardiac dysfunction and possible AMI while treating COVID-19 positive patients with several comorbidities or previous history of AMI.

In a meta-analysis on cardiovascular disease in COVID-19, Momtazmanesh S et al.,¹¹ noted that acute cardiac injury occurred in more than 25% of cases, mortality was 20 times higher, and admission to intensive care unit increased by 13.5 times. Hypertension was the most common pre-existing comorbidity with a frequency of 29.2%, followed by diabetes mellitus (13.5%). The deceased group of patients had higher cardiac and inflammatory biomarkers, with statistically significant standardized mean differences, compared with survivors.

Troponins may be elevated for a number of reasons in the context of infection (severe sepsis and myocarditis being two of the reasons).¹² In present study 12 patients had high levels of Troponin I. Covid 19 positives are at risk of STEMI, particularly in the first week of illness and it can be the first clinical manifestation in them even in the absence of conventional coronary artery disease risk factors. The primary percutaneous coronary intervention (PPCI) should be the standard of care for STEMI in covid-19 confirmed or probable patients at PCI capable hospitals.¹³

Pharmacoinvasive approach for STEMI care is the preferred solution in the COVID era. It is the most effective and practical approach to reduce STEMI inflicted morbidity and mortality with enormous limitations in the era of COVID. However, PPCI is the most promising gold standard approach for STEMI care. Selective PPCI may be recommended in large anterior wall MI, cardiogenic shock, hemodynamically unstable patients in the setting of malignant arrhythmias and when there are contraindications to thrombolytic therapy.¹⁴

Conclusion

Covid positive patients needed more inotropes, more Thrombotic lesions, more use of BIPAP ventilation, more deaths in cardiogenic shock patients as compared to covid negative patients. One year follow up Mortality was 2.3% and 7.4% in Covid negative and positive groups respectively.

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