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Effect of COVID 19 Infection on ST Elevation Myocardial Infarction (STEMI) Patients Managed by Primary PCI

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ABSTRACT

A life-threatening cardiovascular-emergency called ST elevation myocardial infarction (STEMI) necessitates immediate intervention for reperfusion. COVID-19 has a negative effect on STEMI patients. The purpose of this work was to contrast individuals who had STEMI and concomitant COVID-19 infection with patients who had STEMI without COVID-19 infection, and both managed by primary percutaneous coronary intervention(PPCI). **Methods:** This prospective, cohort work was performed on 50 patients with clinical criteria of patients presented by STEMI within 24 hours of symptoms onset with and without concomitant COVID 19 infections managed by PPCI. Participants were split into two equal groups: group A: participants presented by STEMI and concomitant COVID-19 infection diagnosed by polymerase chain reaction and chest computerized tomography c. group B: patients presented by STEMI without COVID 19 infection. Results: No significant variation was discovered among COVID-19 group and non-COVID-19 group as regard major adverse cardiovascular events (MACE). It was found from the multivariate logistic regression analysis of data that COVID-19 infection significantly delayed time to reperfusion (door to balloon time) and this was associated with worse prognosis and increased rate of MACE. positive C-reactive protein also was significant from multivariate data analysis and this was associated with poor prognosis of STEMI patients. **Conclusions:** COVID-19 pandemic had a direct effect on the prognosis of individuals with STEMI due to delay from symptoms onset to first medical contact(FMC) and delay in door-to-balloon time.

Keywords: COVID 19, Prognosis, ST myocardial infarction, primary PCI

1. Introduction

A life-threatening cardiovascular-emergency called ST elevation myocardial infarction (STEMI) necessitates immediate intervention for reperfusion (Roger, 2007).

The most effective STEMI therapy for STEMI is reperfusion of the infarct-related coronary artery via percutaneous coronary intervention (PCI), which minimizes myocardial damage, maintains ventricular function, and lowers morbidity and death (Morishima *et al.,* 2000 and Sim *et al.,* 2016).

The American Heart Association (AHA) and the European Society of Cardiology (ESC) recommendations demonstrated the benefits of primary PCI (PPCI) against the employing of thrombolytic treatment in handling cases of STEMI (Jollis *et al.,* 2007 and O'Gara *et al.,* 2013). Despite these guidelines, new data from the US National Cardiovascular Data Registry revealed that just 51% of individuals with STEMI transferred for primary PCI were able to meet the required first door-to-balloon time of fewer than 120 minutes (Larson *et al.,* 2016).

Owing to the delay between the beginning of symptoms and the first medical contact (FMC) and the delay from the door-to-balloon (time to reperfusion), the correlation of COVID-19 infection with STEMI worsens the prognosis of those affected (Lacour *et al.,* 2021).

The primary processes involved in COVID-19 pathophysiology are prothrombotic triggering of the coagulation cascade, cytokine-mediated systemic inflammatory responses, and hypoxic injury caused by an imbalance in oxygen availability and demand. As a result, COVID-19 infection raises

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the risk of hazardous thrombotic issues like acute coronary syndrome (ACS), pulmonary embolism (PE) and venous thromboembolism (VTE) (Oylumlu *et al.,* 2020 and Bogdan *et al.,* 2021).

The prevalence of numerous thrombotic culprit lesions, the thrombus grade, and the procedural success rate of PPCI operations were all greater among individuals suffering from STEMI alongside COVID-19 infection (Oylumlu *et al.,* 2020) .

PPCI for those suffering from STEMI with COVID-19 infection is a highly hazardous technique that poses a risk of infection to both hospitalized individuals as well as healthcare personnel. On the contrary, PPCI may be delayed and the patient's prognosis could be impacted as a result of screenings and infection control procedures (Xiang *et al.,* 2020).

Medical personnel must determine an equilibrium between delivering rapid revascularization for STEMI individuals as well as putting infection prevention protocols in place to stop COVID-19 from spreading across healthcare workers and vulnerable patients with cardiac conditions throughout the COVID-19 pandemic (Sjauw *et al.,* 2006).

The COVID-19 outbreak poses a significant threat to Egypt's healthcare system. old citizens and those with heart disease have a greater risk of mortality (Shaheen *et al.,* 2020).

The purpose of this research was to examine the impact of COVID-19 infection on individuals who had PPCI for STEMI.

2. Patients and Methods

This prospective, cohort observational work was performed on 50 individuals with age ranged 29-82 presented by STEMI within 24 hours of symptoms onset with and without concomitant COVID 19 infections treated by primary PCI.

The work was done following permission from the Ethics Committee cardiovascular medicine department at Tanta university hospitals from January 2022 to January 2023. The patient or the patient's family members provided their explicit written approval.

Exclusion criteria were individuals who suffers acute coronary syndrome other than STEMI, individuals with missed myocardial infarction who are not eligible for primary PCI, patients with severe acute respiratory distress syndrome, patients on mechanical ventilator and patients with multiorgan failure.

Participants had been allocated into 2 equal groups: (grouping was done based on concomitant COVID-19 infection): group A: patients presented by STEMI and concomitant COVID-19 infection diagnosed by PCR and chest computerized tomography (CT) c. group B: patients presented by STEMI without COVID 19 infection.

Each participant had been exposed to: comprehensive taking of history, comprehensive clinical assessment (vital signs and general examination), laboratory tests, non-contrast CT scan of the chest, reperfusion and Echocardiography (assess left ventricular (LV) systolic function using Simpson's method, Qualitative assessment Segmental wall motionabnormalities and global wall motion).

2.1. Resting 12 leads Electrocardiogram (ECG)

In accordance with ESC recommendations from 2017, a standard 12-lead ECG was taken within ten minutes of the FMC for each individual upon admitting to the hospital. This included chest leads from V1 to V6 as well as the limb leads I, II, and III. In order to identify right ventricular infraction or posterior wall infarction, certain individuals had right pericardial leads (V3R, V4R, V5R, and V6R) and posterior chest leads (V7 to V9) (Ibánez *et al.,* 2017).

2.2. Preparation before primary PCI

A loading dose of dual anti platelet (Aspirin 300mg chewable) plus P2Y12 inhibitor (Ticagrelor 180 mg or Clopidogrel 600mg), plus IV unfractionated heparin (UFH) or low molecular weight heparin (LMWH) were used before the procedure. Glycoprotein IIb IIIa inhibitor (Tirofiban) was used during the procedure in selected cases according to its indication (Bhatt, 2015).

2.3. The arterial access

2.3.1. Femoral approach

In a region 3 to 4 cm in diameter, 3 to 4 cm beneath the inguinal ligament, a local anesthesia is injected. To ensure proper vascular compression when the sheaths are removed, the planned puncture location should be overlying bone. Via the skin and a tunnel, an 18-gauge needle is inserted into the femoral artery's lumen. A Teflon-coated guiding wire is inserted into the pierced vessel's lumen when pulsatile blood has started to flow freely throughout the needle. The wire is cleaned to eliminate blood and thrombi while being kept securely in place when the needle is withdrawn. The wire is subsequently eliminated by advancing a sheath into the vascular lumen over it and via a side arm port. Catheters are inserted via the side-arm port and progressed through the sheath to the heart, allowing for ongoing pressure monitoring and infusion (Bhatt, 2015).

2.3.2. Radial approach

Was done in selected patients with normal Allen's test and no previous history of abnormal anatomy, generally the choice of the arterial access was up to the operators to decide. The optimal entrance point is about 2 cm proximally from the radial styloid. The operator may choose to employ a single-wall anterior puncture with a micro-puncture needle or a double-wall through-and-through technique with an Angiocath (Valgimigli *et al.,* 2015 and Jolly *et al.,* 2009).

2.4. Imaging

2.4.1. Left coronary imaging:

A contrast injection in the left coronary cusp is a reasonable first step to define the ostium of the left main (LM) coronary artery, an antero-posterior (AP) view or a shallow right anterior oblique (RAO) caudal view may be useful to evaluate middle and distal LM coronary artery stenosis. A shallow left anterior oblique (LAO) or LAO cranial view is usually best to visualize osteal LM stenosis. Adequate visualization of the left coronary system commonly requires five or more views: The LAO view, the RAO view, the AP cranial view, the AP caudal view, the spider view (Bhatt, 2015).

2.4.2. Right coronary imaging (RCA):

The RCA should be approached in the 30-degree LAO projection. The Judkin Right 4 (JR4) is advanced to the aortic valve level and is slowly withdrawn approximately 2 cm while clockwise rotation is applied to rotate the catheter anteriorly to the right sinus of Valsalva then the catheter should sit in the RCA ostium (Bhatt, 2015). [14]Usually, two or three views of the RCA are obtained: The LAO view is useful to evaluate the proximal and mid-RCA, the AP view with 30-degree cranial angulation is often the best for evaluating the RCA bifurcation, ostia of the patent ductus arteriosus (PDA) and posterolateral branches and a shallow RAO view is useful to show the entire PDA(Bhatt, 2015) .

Thrombolysis in Myocardial Infarction (TIMI) blood flow grade is used to assess the success of reperfusion: TIMI flow grade classified reperfusion as either successful (TIMI 3) or abnormal (TIMI 0-1-2) (Bhatt, 2015).

2.5. High-dose intra venous (IV) tirofiban: If a bailout indicator was found, 25 µg /kg for 3 minutes, followed by 0. 15 mg/kg/min for a maximum of 24 hours were administered:

- A heavy thrombus load inside the afflicted vessel.
- Acute vessels closure brought on by coronary dissection or thrombus.
- No reflow following stent placement.

2.6. In hospital follow up

The incidence of major adverse cardiovascular events (MACE) (defined as recurrent acute myocardial infarction (AMI), repeat coronary revascularization of the target lesion due to in-stent thrombosis, heart failure and in hospital death due to cardiac cause, and bleeding complication) and Acute thrombosis of stents is described as (the complete or partial blockage of any stent(s) inserted during percutaneous coronary intervention (pPCI) during a 24-hour period after the index operation on an angiography) were recorded (Généreux *et al.,* 2014) .

Bleeding complication was defined according to the TIMI bleeding classification (TIMI Study Group, 1985). TIMI Patients with cerebral hemorrhaging a haemoglobin level ≥5 g/dl, or a hematocrit ≥ 15% are considered to have significant bleeding., orany overt clinical signs of hemorrhage [18]. Minor bleeding is identified as bleeding not affectingthe patient hemodynamics and correlated with a < 3 g/dL reduce in hemoglobin level or <9% reduce in haematocrit such as (hematuria, epistaxis, bleeding per gum, bleeding at intravenous access sites) (Mehran *et al.,* 2011).[19]

2.7. Statistical analysis

SPSS v26 (IBM Inc., Chicago, IL, USA) was used for the statistical analysis. Unpaired Student's t-test was used for comparing quantitative data among both groups. Quantitative parameters were provided as mean and standard deviation (SD). When applicable, qualitative parameters were examined utilizing the Chi-square or Fisher's exact test and given as frequencies and percentages (%). A two-tailed P value < 0.05 was considered statistically significant.

3. Results

a substantial variation was existed among the two groups in age (P value = 0. 036), Hypertension (HTN) (P value =0. 047), Smoking (P value =0. 010), Dyslipidemia (P value =0. 047) and door to balloon time (P value <0. 001). (Table 1)

Table 1: Comparison between the two studied groups according to the demographic data, co-morbidity, symptoms duration, door to balloon time and vital sings

		Group A (n = 25)	Group B(n = 25)	p
Sex	**Male**	19 (76. 0%)	19 (76. 0%)	1. 000
	Female	6 (24. 0%)	6 (24. 0%)	
Age (years)		48. 52 ± 13. 02	56. 04 ± 11. 66	0. 036*
Diabetes		6 (24. 0%)	6 (24. 0%)	1. 000
HTN		3 (12. 0%)	9 (36. 0%)	0. 047*
Smoking		10 (40. 0%)	19 (76. 0%)	0. 010*
Family history		2 (8. 0%)	7 (28. 0%)	FEp=0. 138
Dyslipidemia		3 (12. 0%)	9 (36. 0%)	0. 047*
Symptoms duration (hr.)		7. 64 ± 6. 04	6. 30 ± 5. 17	0. 470
Door to balloon (minutes)		108. 0 ± 28. 72	60. 60 ± 25. 79	<0. 001*
Systolic Blood pressure (mmHg)		124. 0 ± 21. 79	120. 0 ± 22. 55	0. 534
Diastolic blood pressure (mmHg)		77. 20 ± 12. 42	74. 40 ± 12. 61	0. 326
Pulse (bpm)		88. 60 ± 21. 58	83. 0 ± 14. 58	0. 288
Random blood sugar (mg/dl)		195. 2 ± 97. 37	178. 3 ± 71. 27	0. 705

Data are presented as Mean ± SD and numbers of (%), *: Statistically significant at p ≤ 0. 05, HTN: Hypertension

No statistically substantial variation was existed among both groups regarding STEMI location (Table 2).

Table 2: Comparison between the two studied groups according to STEMI location

		Group A (n = 25)	Group B (n = 25)	MCp
STEMI location	**Anterior**	18 (72. 0%)	16 (64. 0%)	0. 729
	Inferior	6 (24. 0%)	6 (24. 0%)	
	Lateral	1 (4. 0%)	3 (12. 0%)	

Data are presented as numbers of (%), STEMI: ST elevation myocardial infarction.

A statistically substantial variation was existed among both groups as regard C-reactive protein (CRP), serum ferritin, CORAD class, Hb concentration and white blood cells (P value =<0. 001). no statistically substantial variation was existed among both groups as regard creatinine level and platelets (Table 3).

Table 3: Comparison between the two studied groups according to laboratory test

		Group A (n = 25)	Group B (n = 25)	p
CRP	Positive	20 (80. 0%)	7 (28. 0%)	<0. 001*
	Negative	5 (20. 0%)	18 (72. 0%)	
Serum ferritin	Normal	7 (28. 0%)	20 (80. 0%)	<0. 001*
	High	18 (72. 0%)	5 (20. 0%)	
CORAD class	≤3	7 (28. 0%)	25 (100. 0%)	<0. 001*
	>3	18 (72. 0%)	0 (0. 0%)	
Creatinine(mg/dl)		1. 21 ± 0. 33	1. 21 ± 0. 46	0. 566
Hb (gm/dl)		11. 20 ± 1. 28	14. 52 ± 0. 97	<0. 001*
White blood cells (number/mm^6)		13. 0 ± 4. 10	8. 99 ± 2. 36	<0. 001*
Platelets (number/mm^6)		234. 1 ± 58. 85	232. 4 ± 68. 67	0. 926

Data are presented as Mean ± SD and numbers of (%), *: Statistically significant at p ≤ 0. 05, CRP: c-reactive protein, CORAD: COVID-19 Reporting and Data and Hb: hemoglobin

A statistically substantial variation was existed among both groups as regard angiographic lesion, IV tirofiban. no statistically substantial variation was existed among both groups as regard final TIMI, contrast induced nephropathy, major bleeding, congestive heart failure (CHF) and re-infarction. None of the study population had ischemic stroke or mortality during hospital stay (Table 4).

Table 4: Comparison between the two studied groups according to angiographic lesion, final TIMI flow, IV tirofiban and hospital outcome

		Group A (n = 25)	Group B (n = 25)	P
Angiographic lesion	Non thrombotic	4 (16. 0%)	17 (68. 0%)	<0. 001*
	Thrombotic	21 (84. 0%)	8 (32. 0%)	
Final TIMI Flow	TIMI 0:2	3 (12. 0%)	2 (8. 0%)	^{FE}p= 1. 000
	TIMI 3	22 (80. 0%)	23 (92. 0%)	
IV Tirofiban		21 (84. 0%)	9 (36. 0%)	0. 001*
Hospital Outcome	**CIN**	1 (4. 0%)	1 (4. 0%)	^{FE}p=1. 000
	Death	0 (0. 0%)	0 (0. 0%)	–
	Stroke	0 (0. 0%)	0 (0. 0%)	–
	Reinfarction	1 (4. 0%)	0 (0. 0%)	^{FE}p=1. 000
	CHF	6 (24. 0%)	4 (16. 0%)	0. 480
	Major bleeding	2 (8. 0%)	1 (4. 0%)	^{FE}p=1. 000

Data are presented as numbers of (%), TIMI: thrombolysis in myocardial Infarction, FE: Fisher Exact, CHF: Congestive heart failure, CIN: Contrast induced nephropathy, *: Statistically significant at p ≤ 0. 05

It was found from the univariate logistic regression analysis of the data that COVID-19 infection significantly delayed time to reperfusion (door to balloon time). Aging and smoking, positivity CRP, high ferritin and thrombotic coronary lesion were significant as regard patient's prognosis. Thrombotic coronary lesions significantly increased the need of IV and intracoronary tirofiban. In multivariate analysis, positive CRP was also significant, and this was associated with poor prognosis and increased rate of MACE (Table 5).

Table 5: Univariate and multivariate logistic regression analysis for the parameters affecting STEMI patients withCOVID-19 infection [group A]

	Univariate		#Multivariate	
	P	**OR(LL–UL95% C. I)**	**p**	**OR (LL–UL95% C. I)**
Female	1. 000	1. 000 (0. 273 – 3. 662)		
Age (/years)	0. 045*	0. 950 (0. 904 – 0. 999)	0. 249	0. 948 (0. 865 – 1. 038)
Presence of Diabetes	1. 000	1. 000 (0. 273 – 3. 662)		
Presence of Hypertension	0. 057	0. 242 (0. 056 – 1. 040)		
Smoker	0. 012*	0. 211 (0. 062 – 0. 711)	0. 051	0. 051 (0. 003 – 1. 007)
Presence of Family history	0. 082	0. 224 (0. 041 – 1. 210)		
Symptoms duration (hr.)	0. 397	1. 045 (0. 944 – 1. 157)		
Systolic Blood pressure (mmHg)	0. 518	1. 009 (0. 983 – 1. 035)		
Diastolic blood pressure (mmHg)	0. 425	1. 019 (0. 973 – 1. 066)		
Pulse (bpm)	0. 286	1. 018 (0. 986 – 1. 051)		
Random blood sugar (mg/dl)	0. 479	1. 002 (0. 996 – 1. 009)		
		STEMI location		
Presence of Anterior	0. 545	1. 446 (0. 438 – 4. 781)		
Presence of Inferior	1. 000	1. 000 (0. 273 – 3. 662)		
Presence of Lateral	0. 320	0. 306 (0. 030 – 3. 159)		
Hemoglobin (gm/dl)	0. 001*	0. 129 (0. 039 – 0. 433)		
White blood cells (number/mm^6)	0. 001*	1. 444 (1. 153 – 1. 808)		
Platelets (number/mm^6)	0. 924	1. 000 (0. 992 – 1. 009)		
Positivity of CRP	0. 001*	10. 286 (2. 768 – 38. 215)	0. 039*	17. 874 (1. 154 – 276. 810)
Serum ferritin [High]	0. 001*	10. 286 (2. 768 – 38. 215)		
Creatinine (mg/dl)	0. 986	1. 013 (0. 248 – 4. 131)		
Angiographic lesion [Thrombotic]	0. 001*	11. 156 (2. 864 – 43. 464)	0. 462	2. 312 (0. 248 – 21. 576)
Final TIMI Flow [TIMI 3]	0. 639	0. 638 (0. 097 – 4. 188)		
Presence of IV Tirofiban	0. 001*	9. 333 (2. 431 – 35. 839)		
Contrast induced nephropathy	1. 000	1. 000 (0. 059 – 16. 928)		
In hospital CHF	0. 482	1. 658 (0. 405 – 6. 785)		
In hospital Major bleeding	0. 559	2. 087 (0. 177 – 24. 615)		
Door to balloon (minutes)	<0. 001*	1. 060 (1. 028 – 1. 092)	0. 003*	1. 078 (1. 026 – 1. 133)

STEMI: ST elevation myocardial infarction, CRP: C- reactive protein, TIMI: Thrombolysis in Myocardial Infarction, OR: Odd`s ratio C. I: Confidence interval, LL: Lower limit, UL: Upper limit, CHF: Congestive heart failure IV: intravenous. All variables with p<0. 05 was included in the multivariate, *: Statistically significant at p ≤ 0. 05

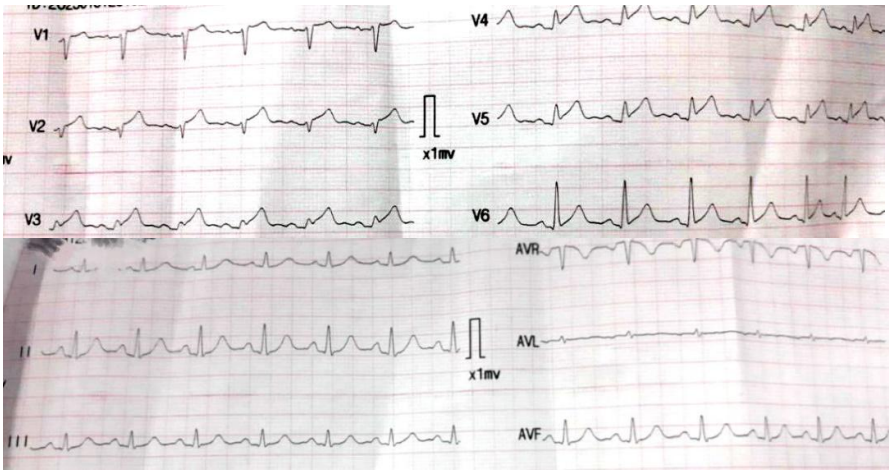
Case 1

Male patient aged 50 years old, not known to be diabetic or hypertensive patient, not known to be smoker, not known to be cardiac before, negative family and drug history .

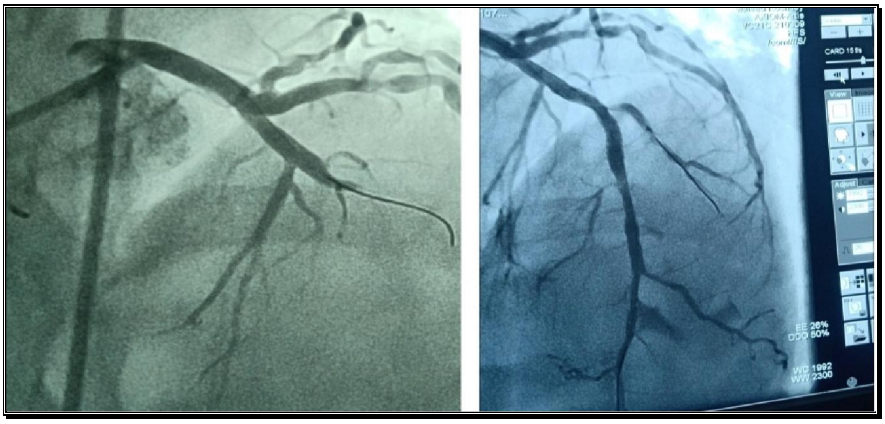
He presented to cardiology department, Tanta university hospital complaining of typical angina pain and sweating lasting approximately 6 hours before presentation .

- Vital signs: B/P 140/70 mmHg, heart rate 85 bpm.
- Respiratory rate: 14, Killip class: I.
- ECG: sinus rhythm with ST segment elevation from V1 to V5 leads, with ST depression in inferior leads.

He initially received 4 tablets of chewable acetyl salicylic acid 75 mg (300mg), 600 mg Clopidogrel,8o mg atorvastatin and He also received 5000 IU of UFH intravenously. Laboratory investigations were within normal except for positive PCR for COVID 19, positive CRP (56) and CT chest showing CORADS IV. Then patient entered the catheterization laboratory under strict infection control measures after approximately 45 minutes where coronary angiography was performed through a femoral approach. The coronary angiography revealed that the left anterior descending artery (LAD) has proximal total thrombotic occlusion with TIMI 0 flow, while Left circumflex artery (LCX) and RCA showed also significant stenosis. The left main was engaged using a guiding catheter and guide wire used to cross the lesion of the LAD. Predilatation was done with multiple balloon inflation and there was high thrombotic burden with TIMI I flow so, intracoronary tirofiban was used then a diethylstilbestrol (DES) was deployed to LAD with final TIMI III flow. Then patient admitted for 48 HR received IV tirofiban and started ambulation with no exertional chest pain. He was discharged from critical care unit (CCU) after 2 days on anti-ischemic and anti-failure medications. (Figure 1)



A



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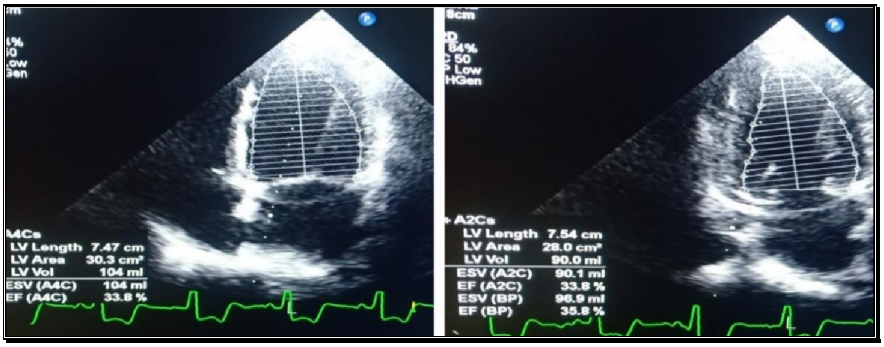


C

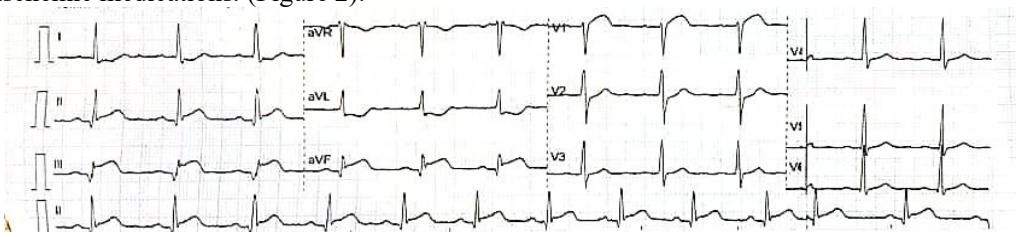
Fig. 1: Male patient aged 50 years old: (A) ECG showed ST elevation in anterior chest leads, (B) Showed TIMI 0 flow in LAD with wiring of distal LAD (left of figure19), then TIMI III flow of LAD after deployment of DES and use of bail-out tirofiban (right of figure19) and (C) Showed measurement of LV systolic function by using Simpsons method

Case 2

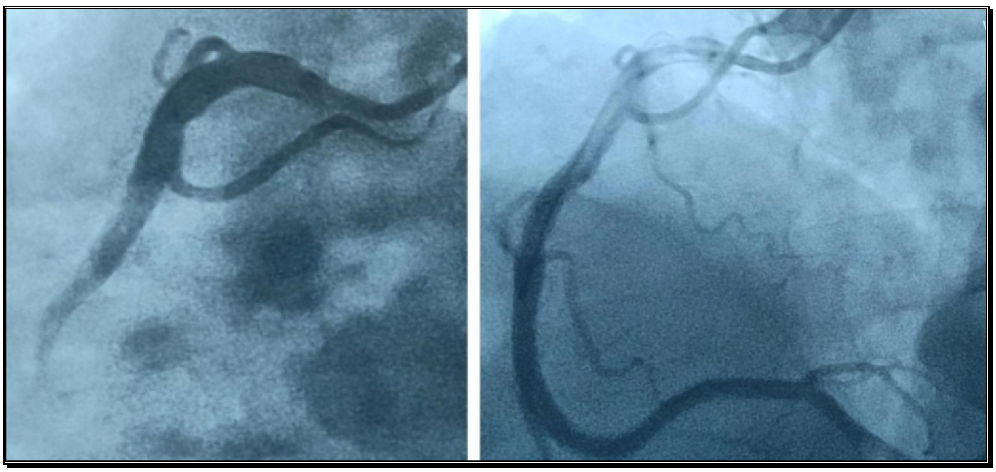
Female patient aged 50 years old, not known to be diabetic or hypertensive patient, known to be dyslipidemia, not known to be cardiac before, negative family history. She presented to cardiology department, Tanta university hospital complaining of typical angina pain for 4 hours.

- Vital signs: B/P 110/70 mmHg, heart rate 70 bpm
- Respiratory rate: 16, Killip class: I
- ECG: sinus rhythm with ST segment elevation in lead II, III and AVF, with ST depression in I, AVL leads.

She initially received 4 tablets of chewable acetyl salicylic acid 75 mg (300mg), 180 mg ticagrelor,8o mg atorvastatin and she also received 5000 IU of UFH intravenously. Laboratory investigations were within normal. Then patient entered the catheterization laboratory under strict infection control measures after approximately 60 minutes where coronary angiography was performed through a femoral approach. The coronary angiography revealed that the RCA has midsegment total thrombotic occlusion with TIMI 0 flow, while LAD and LCX showed no substantial stenosis. The RCA was engaged using a guiding-catheter and a guide wire used to cross the lesion of the RCA. PTCA was done with compliant balloon inflation then a DES was deployed to RCA with final TIMI III flow. She was admitted in CCU for 48 hr for follow up then discharged after 2 days on anti-ischemic medications. (Figure 2).



A



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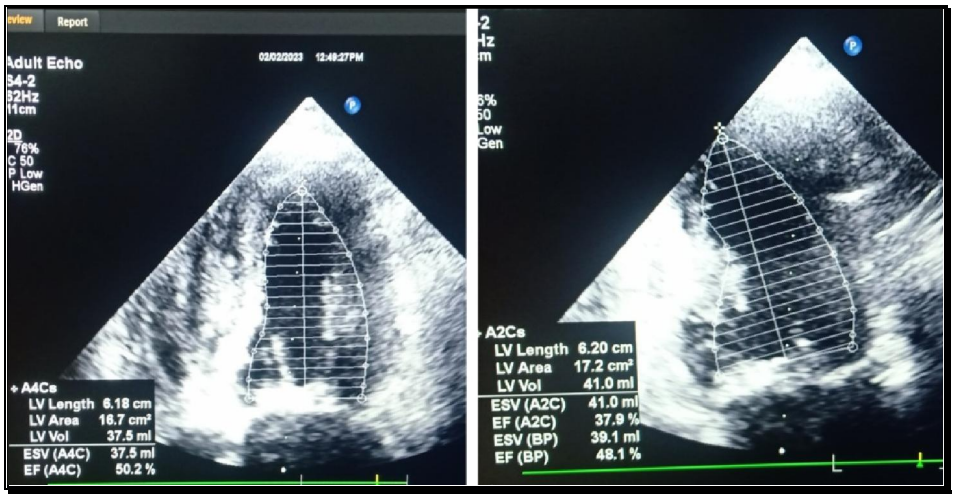

C

Fig. 2: Female patient aged 50 years old: (A) ECG showed ST elevation in inferior leads, (B) showed TIMI 0 flow in RCA (left of figure22), then TIMI III flow of RCA after deployment of DES (right of figure22) and (C) showed measurement of LV systolic function by using simpsons method

4. Discussion

The main findings in our study showed that in group A, 6 patients were diabetics (24%), and in group B, 6 patients also were diabetics (24. 0%), this work was in line with research performed by Hamadeh *et al.* (2020) who studied Characteristics and Outcomes of individuals Presented With COVID-19 and STEMI in 78 patients, via a multicentre retrospective study, in which 21 patients of total 78 patients (26 %) had diabetes.

In research performed by Camarero *et al.* (2021) who studied the relationship between covid-19 and ACS incidence via Observational multicentre cohort work of 3. 108 COVID-19 individuals. 10 individuals with STEMI while had been hospitalized due to COVID 19 only 10 % of STEMI patients and positive COVID-19 infection had diabetes.

According to our findings, in group A, 10 patients were smokers (40%), while in group B, 19 patients were active smokers (76%) . this work was in line with research performed by Bonnet *et al.* (2021) who found that 40. 5 % of the STEMI population were active smokers.

In this study dyslipidemia was discovered in 12 % of group A and 36 % of group B. A statistical substantial variation was existed among both groups (P value =0. 047).

This came in contrast to a study conducted by De Luca *et al.* (2020) who showed no **s**ubstantial variation among between COVID group and non-COVID group as both had 40. 3 % of the study population known to have dyslipidemia.

In this study the mean duration of symptoms in group A was 7. 64 ± 6. 04 hours. In group B, it was 6. 30 ± 5. 17 hours. this work was in line with a research performed by Dharma *et al.* (2016) who found that the STEMI patients presented after 2:6 HR from onset of the symptoms represented(51.4 %), patients presented after 6:12 HR represented (40 %), patients presented less than 2 HR represented (2. 9 %) and patients presented by more than 12 HR represented (5. 7 %).

In this study the mean door-to-balloon time of individuals in group A, was 108. 0 ± 28. 72. In group B, it was 60. 60 ± 25. 79, A statistically substantial variation was existed among both groups (P value <0. 001). this work was in line with research performed by Dharma *et al.* (2016) in which mean door-to-balloon time was 104 minutes.

In the current work, 34 (68%) of the study participants suffered anterior STEMI, 12 (24%) individuals experienced inferior STEMI and 4 (8%) individuals experienced lateral STEMI.

this work was in contrast with research performed by Stefaniniin *et al.* (2020) who reported that most of instances experienced inferior STEMI (39.2%), patients with anterior STEMI represented (14. 2 %), patients with lateral STEMI represented (3.5%), patients with new onset LBBB represented (10. 7 %) and patients with multiple infarct locations (32. 14 %).

Our findings showed that**, i**n group A, a substantial rise in CRP and ferritin levels comparted to group B (P value =<0. 001). In a work performed by Chen *et al.* (2020) who found that CRP was positive in 85 % of the study population and this was correlated with worsen prognosis of STEMI.

Regarding CORAD class, our study showed that in group A, 18 patients had CORAD class>3 (72. 0 %) and 7 patients had CORAD class ≤3(28. 0 %). In group B, 25 patients had CORAD class ≤3(100. 0 %) and no patients had CORAD class >3(0 %), a statistically substantial variation was existed among both groups (P value =<0. 001).

The present study revealed that, in group A,21 individuals had thrombotic coronary lesion (84%), in group B, 8 patients had thrombotic coronary lesion (32 %) (P = < 0. 001). this work was in line with research performed by Stefanini *et al.* (2020) in which 60 % of the study population in the COVID-19 group had thrombotic coronary artery occlusion.

Our results showed that in group A, 22 individuals experienced TIMI III flow (88%), and 3 individuals experienced TIMI 0:2 (12%). In group B:23 individuals experienced TIMI III flow (92 %), and 2 individuals experienced TIMI 0:2(8 %). no statistically substantial variation was existed among both groups (P =1. 000).

In group A, 21 patients needed IV tirofiban (84%), and 4patients didn't need IV tirofiban (16 %). In group B:9 patients needed IV tirofiban (36 %), and 16patients didn't need IV tirofiban (64 %). A statistically substantial variation was existed among both groups (P = 0. 001).

this work was in line with research performed by Dharma *et al.* (2016) in which 87 % of the study population had final TIMI III flow in coronary angiography.

In a work performed by De Luca *et al.* (2009) revealed that 34 % of the COVID group needed iv tirofiban while only 22. 9 % of non- COVID group needed iv tirofiban.

Our results showed that re-infarction, CHF, major and minor bleeding were insignificantly different between groups.

In a work performed by De Luca *et al.* (2004) revealed that 8. 1 % of the COVID group suffered from acute in stent thrombosis while 1. 6 % of non-COVID group suffered from acute in stent thrombosis, 14 % of the study population of COVID group in this study suffered from heart failure manifestations while 33% of non-COVID group suffered from heart failure manifestations, 3. 3 % of the COVID group had major bleeding while 3. 6 % of non-COVID group had major bleeding and none in that study had CIN, minor bleeding or stroke.

It was found from the univariate logistic regression analysis of the data that COVID-19 infection significantly delayed time to reperfusion (door to balloon time). (p value <0. 001).

this work was in line with research performed by Dharma *et al.,* (2016) in which mean door-to-balloon time of individuals with STEMI were significantly delayed during COVID-19 pandemic as the meantime delay was 104 minutes.

Also, it was found that aging and smoking significantly affected STEMI patient's prognosis especially rate of complications (MACE). (p value for age 0,045, p value for smoking 0. 012).

this work was in line with research performed by Rashid *et al.* (2021) in which patients in the COVID-19 ACS group were elder and had worse prognosis contrasted to the non-COVID-19 ACS group.

Positivity of CRP and high ferritin titre also were significant as regard patient's prognosis as patients with positive CRP and high ferritin titre were associated with worse prognosis. (p value for CRP 0,001, p value for ferritin0. 001).

this work was in line with research performed by Chen *et al.* (2020) who studied clinical and epidemiological features of 99 instances of 2019 novel coron-avirus pneumonia in Wuhan, China it was found that CRP was positive in 85 % of the study population and this was correlated with worsen prognosis.

Also, it was found that thrombotic coronary lesion significantly affected most of the study participants in group A. (p value 0. 001)

Thrombotic coronary lesions significantly increased the need of IV and intracoronary tirofiban. (p value 0. 001).

This work was in line with research performed by Stefanini *et al.* (2020) in which 60 % of the study population had thrombotic coronary artery occlusion and needed iv tirofiban.

It was found from the multivariate logistic regression analysis of data that COVID-19 infection significantly delayed time to reperfusion (door to balloon time), and this was associated with worse prognosis and increased rate of MACE. (p value 0. 003)

This work was in line with research performed by Dharma *et al.* (2016) in which mean door-to-balloon time of individuals with STEMI was substantially delayed throughout COVID-19 pandemic as the meantime delay was 104 minutes (79. 50–149. 25 minutes) and this was associated with worse prognosis and increased rate of MACE.

Positive CRP also was significant from multivariate data analysis and this was associated with poor prognosis of STEMI patients. (p value 0. 039). this work was in line with research performed by Chen *et al.* (2020) who found that CRP was positive in 85 % of the study population and this was associated with worse prognosis.

Limitations: The research's possible drawbacks included the study population's limited size, which was caused by short study duration and a single-center experience. Further drawbacks were the short period assigned for follow-up the patients (in hospital stay) that prevented the display of mortality, re-infarction, and re-hospitalization outcomes. The decision to give tirofiban during coronary angiography was operator dependent and did not depend on any pre-specified criteria, and because of the significant perceived danger of bleeding problems, some individuals with a greater baseline bleeding risk might not have gotten the bailout tirofiban.

5. Conclusions

COVID-19 pandemic had a direct effect on the prognosis of STEMI patients due to delay from symptoms onset to first medical contact (FMC) and delay in door to balloon time. COVID-19 has prothrombotic effect and induce endothelial injury so most of the culprit lesions were thrombotic with increased the need to use IV and intracoronary tirofiban, in spite of high thromotic burden most of the

study population had final TIMI III flow. Therefore, throughout the COVID-19 pandemic, primary angioplasty should continue to be the standard of therapy for STEMI, and it ought to be carried out with a number of precautionary measures and in the safest accomplishing possible.

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