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High CORADS is it Risk Factor for Acute Coronary Syndrome?

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ABSTRACT

Background: COVID-19 Reporting and Data System (CO-RADS) is another initiative for standardization, published in mid-March of 2020, which differs from the RSNA's approach as it is based in previous efforts such as Lung-RADS, PI-RADS, and BI-RADS, which grades the findings on how likely the diagnosis of COVID-19 is. Also, the attention of the clinician to acute coronary syndromes (ACS) in a patient with a background of SARS-CoV-2 infection, in addition to classic risk factors, should be aimed at assessing the mechanisms involved in the development of Type 2 myocardial infarction (MI) as well as the presence of vasospasm. **Aim and Objectives:** To determine the risk of cardiac insults in patients with high CORADS detected in C.T chest. **Subjects and Methods:** This study was conducted on 100 patients diagnosed with acute coronary syndrome referred to Tanta University Hospitals, Cardiovascular Department within 6 months starting from November 2021. **Result:** Our results, positive respiratory symptoms and CO-RADS were significantly associated with the incidence of STEMI and NSTEMI. So, the risk of cardiac insults increases in patients with high CORADS detected in C.T chest. **Conclusion:** We conclude that positive respiratory symptoms and CO-RADS were significantly associated with the incidence of acute coronary syndrome (ACS). So, the risk of cardiac insults increases in patients with high CORADS detected in C.T chest.

Keywords: CO-RADS; Covid-19; acute coronary syndrome (ACS); acute myocardial infarction (AMI).

1. Introduction

Coronavirus-2019 (COVID-19) outbreak is currently the most discussed public health issue, caused by the highly infectious severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). COVID-19 was declared a pandemic by the World Health Organization in early March 2020 and it was characterized by an exponential rise in contagions worldwide, with continuously increasing number of victims (CSSE, 2020).

The development of myocardial injury is not uncommon among patients with COVID-19 and correlates with disease severity.

COVID-AMI has been defined as the elevation of high-sensitivity cardiac troponin (hs-cTn) above the 99th percentile of its upper limit of normal or evidence of new electrocardiographic (ECG) or echocardiographic abnormalities (Kang *et al.,* 2020).

In fact, the presence of increased levels of hs-cTn was found to be an independent predictor of disease severity and mortality rate in COVID-19 (Zheng *et al.,* 2020) even after adjustment for baseline characteristics and medical comorbidities, also showing an association with the need for intensive care unit (ICU) admittance (Li *et al.,* 2020).

We used CO-RADS scoring as an indicator for susceptibility of COVID-19 infection and its relation to acute coronary syndrome.

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Aim of The Work

The aim of this work is to determine the risk of cardiac insults in patients with high CORADS detected in C.T chest.

2. Patients and Methods

Technical design

Study type and region: This prospective cross-sectional clinical study was conducted at Cardiovascular Department, Tanta University Hospitals.

Study population: This study was conducted on 100 patients diagnosed with acute coronary syndrome referred to Tanta University Hospitals, Cardiovascular Department within 6 months starting from November 2021.

Inclusion criteria: Age between 20:71 years old. Both males and females were involved. Both patients diabetic and not diabetic were involved. Patients with negative cardiac history to coronary heart disease. Patients with CT-chest showing CO-RADS (1, 2, 3, 4, 5). Both patients smoker and non-smoker. Both patients hypertensive and not hypertensive.

Exclusion criteria: Age under 20 and over 71 years old were excluded. Patients with positive cardiac history to coronary heart disease. Declined informed consent.

Operational design:

The eligible subjects included in this study were subjected to the following: Informed consent was obtained from each participant after full explanation of benefits and risks of the study.

History taking: Personal history: age, sex, residence, occupation. The existence of classical cardiovascular risk factors, such as age, gender, diabetes mellitus (DM), hypertension (HT), dyslipidemia, family history of premature CAD and smoking were determined Thus, patient who had a fasting plasma glucose concentration >125 mg/dL at two separate measurements, or used anti-diabetic medication such as insulin or oral hypoglycemic agents considered as diabetic patient. Patients were considered as hypertensive if their mean systolic blood pressure was >140 mmHg or mean diastolic pressure was>90 mmHg or they were taking antihypertensive drug. Hypercholesterolemia was defined as cholesterol level>200 mg/dL and TG level >150 mg/dL or patients who were advised to use cholesterol / triglyceride- lowering drugs by their physician.

Clinical examination: All participants subjected to complete physical examination including assessment of the general condition and vital signs as blood pressure and heart rate. Blood pressure was measured twice at the right brachial artery in sitting position. Chest pain analysis for site, character, onset, duration and site of referred pain. Body weight and height were measured without shoes and in light clothing during physical examination. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m2). Local examination of the heart: heart sounds, additional sounds as S3 or S4 and cardiac murmurs.

ECG: Standard 12 lead ECG to detect ST-segment elevation or depression (including J-point elevation in multiple leads), T-wave tenting or inversion, and pathologic Q waves.

Laboratory measurements:

Cardiac enzymes: Analysis of enzyme concentrations (CK-MB, Troponin) at admission, 6 hours later after admission as marker of myocardial necrosis.

Routine laboratory investigations: In all patients, antecubital venous blood samples for the laboratory analysis were drawn into tri potassium EDTA based anticoagulated tubes. Random blood glucose routine measurement at admission. Hemoglobin, platelet, white blood cell (WBC) counts, neutrophil, lymphocyte, glucose, high sensitivity C-reactive protein (CRP), lipid profile, and all routine biochemical tests will be performed on an auto analyzer (Roche Diagnostic Modular Systems, Tokyo, Japan).

All patients were managed according to European society of Cardiology (ESC) guidelines (2017) (5).

CT chest: Standard low-dose unenhanced or contrast-enhanced chest CT was performed using a 128-slice multidetector CT (iCT 128, Philips, Eindhoven) at 100 kVp (contrast-enhanced) or 120 kVp (unenhanced) and a dose right index of 8 with dose modulation. Contrast-enhanced chest CT was requested mainly when pulmonary embolism was considered a relevant differential diagnosis.

CO-RADS score: CT images were interpreted according to CO-RADS classification without knowing the clinical features, laboratory findings**.** Each CT chest imaging was evaluated in terms of the following characteristics: distribution of lesion, including dorsal, ventral or both dorsal and ventral lung involvement, pulmonary lobe distribution (right upper lobe (RUL), right middle lobe (RML), right lower lobe (RLL), left upper lobe (LUL), and left lower lobe (LLL)) and the whole lung; distribution of lesion including along with the peripheral area of the lung, distribution along with peribronchovascular (central) area of the lung; presence of ground glass opacity (GGO), consolidation, vascular thickening, crazy paving sign, air bronchogram, halo, reversed halo, septal thickening, pleural thickening, subpleural band, architectural distortion, vacuolization, bronchial wall thickening, centrilobular nodules; other negative findings as follows: lymphadenopathy, pleural effusion, pericardial effusion. Also, we used CT involvement score (CT-IS) for assessing chest CT images of COVID-19 patients. Each of the 5 lung lobes was assessed for degree of involvement, such as below 5% involvement equivalent to a lobe score of 1, 5–25% involvement to a lobe score of 2, 26–49% involvement to a lobe score of 3, 50–75% involvement to a lobe score of 4, and above 75% involvement to a lobe score of 5. A whole lung CT-IS total CT-IS" was met by aggregating 5 lobe scores (range of scores, 1–25).

CO- RADS*		
	Level of suspicion COVID-19 infection	**CT findings**
CO- RADS 1	No	Normal or non-infectious abnormalities
CO- RADS 2	Low	Abnormalities consistent with infections other than COVID-19
CO- RADS 3	Indeterminate	Unclear whether COVID-19 is present
CO- RADS 4	High	Abnormalities suspicious for COVID-19
CO- RADS 5	Very high	Typical COVID-19

Time schedule of the study:

Topic	Period
Preparatory phase	One month
Design of examination sheet	Two months
Review of literature	Three months
Collection, organization, entering of data and statistical analysis	Four months

Administrative and Ethical Design: Informed written consent was obtained from the patients, the aim of the study and its full procedures explained to them and full affirmation it will not affect their medical service if they refuse to participate in the study, any patient has the right to refuse to complete the interview at any time with no consequences an approval was obtained from the research ethical committee in Ethics Committee of Faculty of Medicine, Tanta University. Any risk for the subjects who shared in this study during the course of the study was cleared to participants and the ethical committee on time. There were adequate provisions to maintain privacy of participants and confidentiality of the data are as follows: We put a code number for every participant with the name and address kept in a special file. We hide the patient's name when we use the study. We used the results of the study only in a scientific manner and not to use it in any other aims.

Statistical Analysis

All data were collected, tabulated and statistically analyzed using SPSS 24.0 for windows (SPSS Inc., Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test (χ2) and Fisher exact was used to calculate difference between qualitative variables as indicated. Quantitative data were expressed as mean ± SD (Standard deviation) for parametric and median and range for non-parametric data. Independent T test and Mann Whitney test were used to calculate difference between quantitative variables in two groups for parametric and non-parametric variables respectively. Receiver operating characteristic (ROC) curve was constructed to permit selection of threshold values for test results and comparison of different testing strategies. Areas under ROC curves and their standard errors were determined using the method of Cantor, and compared using the normal distribution, with correction for correlation of observations derived from the same cases. Value of area under a ROC curve (AUC) indicates: 0.90 – 1 = excellent, 0.80-0.90 = good, 0.70-0.80 = fair; 0.60-0.70 = poor; and 0.50-0.6 = fail. The optimal cutoff point was established at point of maximum accuracy. All statistical comparisons were two tailed with significance Level of P-value ≤ 0.05 indicates significant, p <0.001 indicates highly significant difference while, P> 0.05 indicates non-significant difference.

3. Results

In this study, we aimed to determine the risk of cardiac insults in patients with high CORADS detected in C.T chest.

A total of 100 patients with acute coronary syndrome (72 males and 28 females) were recruited in our study with ages ranged between 32 and 71 years and a median age of 58.5 years (IQR between 47.25 and 66.25 years) (Table 1). In terms of risk factors distribution, out of 100 acute coronary syndrome patients, 39% were diabetic, 59% were hypertensive, 51% were smokers and 63% had dyslipidemia. On the other hand, no patient had history of previous acute coronary syndrome.

Table 1: Baseline characteristics of the studied patients

		Study participants (n=100)
Age (years)	**Median**	58.5
	IQR	47.25 - 66.25
	Min – Max	32 – 71
Sex	**Male**	72 (72%)
	Female	28 (28%)
Risk factors	**DM**	39 (39%)
	HTN	59 (59%)
	Smoking	51 (51%)
	Dyslipidaemia	63 (63%)
	Previous acute coronary syndrome	0 (0%)

Data are presented as frequency (%) unless otherwise mentioned, DM: Diabetes mellitus, HTN: Hypertension

Laboratory and clinical investigations as the studied patients had a median RBS of 182 mg/dL with IQR from 144 to 216.25 mg/dL and a median MAP of 97 mmHg with IQR from 83 to 107 mmHg. The majority of our patients (73%) suffered from respiratory symptoms (Table 2).

Table 2: Laboratory and clinical examination of the studied patients

		Study participants (n=100)
RBS at admission (mg/dL)	**Median**	182
	IQR	144.25 - 216.25
MAP (mmHg)	**Median**	97
	IQR	83 – 107
Respiratory symptoms		73 (73%)

Data are presented as frequency (%) unless otherwise mentioned, RBS: Random blood sugar, MAP: Mean arterial pressure

Moreover, our CT chest scan results detected that 14% of the studied patients had CO-RADS 1, 8% had CO-RADS 2, CO-RADS 3 was the most prevalent grade in approximately half patients (46%), 21% had CO-RADS 4 and 11% had CO-RADS 5. In terms of ACS type, 74 of the 100 studied patients had STEMI, 12 patients had non-STEMI and 14 had unstable angina. Out of the 74 STEMI patients, 56.76% had anterior STEMI, 35.14% had inferior, 12.16% had posterior and 10.81% had lateral STEMI (Table 3).

Table 3: CT chest scan results of the studied patients

		Study participants (n=100)
CO-RADS	CO-RADS 1	14 (14%)
	CO-RADS 2	8 (8%)
	CO-RADS 3	46 (46%)
	CO-RADS 4	21 (21%)
	CO-RADS 5	11 (11%)
Type of Acute coronary syndrome		
STEMI (n=74)	Anterior	42 (56.76%)
	Posterior	9 (12.16%)
	Inferior	26 (35.14%)
	Lateral	8 (10.81%)
NSTEMI		12 (12%)
Unstable angina		14 (14%)

Data are presented as frequency (%), CO-RADS: COVID-19 Reporting and Data System, STEMI: ST Elevation Myocardial Infarction, NSTEMI: Non-ST-elevation myocardial infarction

We found no statistically significant relation between the type of ACS and age, sex distribution or risk factors (DM, HTN, smoking and dyslipidemia). On the other hand, there was a statistically significant relation between type of ACS and the prevalence of respiratory symptoms (P= 0.003) as patients with STEMI had significantly higher prevalence rate of respiratory symptoms compared to those with unstable angina (P= 0.001) (Table 4).

Table 4: Relation between type of ACS and baseline characteristics among the studied patients (n=100)

		STEMI (n=74)	NSTEMI (b=12)	Unstable angina (n=14)	P value
Age (years)	**Median**	57	61	56.5	0.288
	IQR	45 - 70	60 – 66.5	43.75 – 66.5	
	Min – Max	32 - 71	53 – 67	36 - 70	
Sex	**Male**	20 (27%)	5 (41.7%)	3 (21.4%)	0.502
	Female	54 (73%)	7 (58.3%)	11 (78.6%)	
Risk factors	**DM**	27 (36.5%)	6 (50%)	6 (42.9%)	0.644
	HTN	43 (58.1%)	7 (58.3%)	9 (64.3%)	0.91
	Smoking	42 (56.8%)	3 (25%)	6 (42.9%)	0.1
	Dyslipidemia	47 (63.5%)	7 (58.3%)	9 (64.3%)	0.937
Respiratory symptoms		60 (81.1%)	8 (66.7%)	5 (35.7%)	**0.003***
Pairwise comparison		P1=0.266	**P2=0.001***	P3=0.238	

Data are presented as frequency (%) unless otherwise mentioned, P1: Comparison between STEMI and NSTEMI groups, P2: Comparison between STEMI and unstable angina groups, P3: Comparison between NSTEMI and unstable angina groups, *: Statistically significant as P value<0.05

The simple logistic regression analysis revealed that positive respiratory symptoms and CO-RADS were significantly associated with the incidence of STEMI. Patients with respiratory symptoms had higher odds of experiencing STEMI compared to those with no symptoms (OR: 4.29, 95% CI: from 1.634 to 11.239, P= 0.003). As compared to patients diagnosed with CO-RADS 1, those with CO-RADS 3 (OR: 3.78, 95%CI: from 1.086 to 13.139, P= 0.037), CO-RADS 4 (OR: 8, 95%CI: from 1.588 to 40.3, P= 0.012) and CO-RADS 5 (OR: 13.33, 95%CI: from 1.321 to 134.62, P= 0.028) had significantly higher odds of having STEMI (Table 6).

Table 5: Relation between type of ACS and CO-RADS grades among the studied patients

	STEMI (n=74)	NSTEMI (b=12)	Unstable angina (n=14)	P value
CO-RADS 1	6 (8.1%)	5 (41.7%)	3 (21.4%)	
CO-RADS 2	6 (8.1%)	0 (0%)	2 (14.3%)	
CO-RADS 3	34 (45.9%)	5 (41.7%)	7 (50%)	0.06
CO-RADS 4	18 (24.3%)	1 (8.3%)	2 (14.3%)	
CO-RADS 5	10 (13.5%)	1 (8.3%)	0 (0%)	

Data are presented as frequency (%)

Table 6: Univariate logistic regression of factors associated with the incidence of STEMI

	OR	95%CI	P value
Age	0.978	0.937 to 1.019	0.295
Sex			
Male		Ref	
Female	1.2	0.451 to 3.192	0.715
Positive risk factors and symptoms			
DM	0.67	0.271 to 1.656	0.386
HTN	0.867	0.347 to 2.165	0.76
Smoking	2.48	0.979 to 6.282	0.056
Dyslipidemia	1.09	0.433 to 2.733	0.858
Respiratory symptoms	4.29	1.634 to 11.239	**0.003***
CO-RADS			
CO-RADS 1		Ref	
CO-RADS 2	4	0.587 to 27.249	0.157
CO-RADS 3	3.78	1.086 to 13.139	**0.037***
CO-RADS 4	8	1.588 to 40.3	**0.012***
CO-RADS 5	13.33	1.321 to 134.62	**0.028***

OR: Odds ratio, CI: Confidence interval, *: Statistically significant as P value<0.05

Furthermore, the simple logistic regression analysis revealed that CO-RADS were significantly associated with the incidence of NSTEMI as patients diagnosed with CO-RADS 3 (OR: 0.22, 95%CI: from 0.052 to 0.921, P= 0.038) and CO-RADS 4 (OR: 0.09, 95%CI: from 0.009 to 0.886, P= 0.039) had significantly lower odds of experiencing NSTEMI when compared to those with CO-RADS 1 (Table 7).

Table 7: Univariate logistic regression of factors associated with the incidence of NSTEMI

	OR	95%CI	P value
Age	**1.07**	0.995 to 1.146	0.068
Sex			
Male		Ref	
Female	0.495	0.143 to 1.716	0.268
Positive risk factors and symptoms			
DM	1.67	0.496 to 5.595	0.408
HTN	0.97	0.285 to 3.296	0.96
Smoking	0.278	0.07 to 1.096	0.067
Dyslipidemia	0.8	0.235 to 2.729	0.722
Respiratory symptoms	0.708	0.195 to 2.574	0.6
CO-RADS			
CO-RADS 1		Ref	
CO-RADS 2	---	---	---
CO-RADS 3	0.22	0.052 to 0.921	**0.038***
CO-RADS 4	0.09	0.009 to 0.886	**0.039**
CO-RADS 5	0.18	0.017 to 1.847	0.149

OR: Odds ratio, CI: Confidence interval, *: Statistically significant as P value<0.05, ---: No estimates are reported due to shortage of events leading to imprecise estimates with confidence interval ranging to infinity

The simple logistic regression analysis showed that positive respiratory symptoms were significantly associated with the incidence of unstable angina as patients with respiratory symptoms had lower odds of experiencing unstable angina when compared to those with no symptoms (OR: 0.15, 95%CI: from 0.044 to 0.493, P= 0.002) (Table 8).

Table 8: Univariate logistic regression of factors associated with the incidence of unstable angina

	OR	95% CI	P value
Age	0.99	0.94 to 1.039	0.649
Sex			
Male		Ref	
Female	1.503	0.386 to 5.848	0.557
Positive risk factors and symptoms			
DM	1.2	0.384 to 3.783	0.75
HTN	1.3	0.401 to 4.193	0.665
Smoking	0.68	0.219 to 2.137	0.513
Dyslipidaemia	1.07	0.329 to 3.462	0.914
Respiratory symptoms	0.15	0.044 to 0.493	**0.002***
CO-RADS			
CO-RADS 1		Ref	
CO-RADS 2	1.22	0.158 to 9.467	0.848
CO-RADS 3	0.66	0.146 to 2.976	0.587
CO-RADS 4	0.39	0.056 to 2.678	0.335
CO-RADS 5	---	---	---

OR: Odds ratio, CI: Confidence interval, *: Statistically significant as P value<0.05, ---: No estimates are reported due to shortage of events leading to imprecise estimates with confidence interval ranging to infinity

4. Discussion

Definitive diagnosis of COVID-19 is usually made using a reverse transcriptase-polymerase chain reaction (RT-PCR) assay, which performs accurately in a laboratory setting. However, reported sensitivities in clinical practice range between 42% and 83% depending on symptom duration, viral load, and test sample quality. Cases are increasingly reported in which the assay yielded a positive result only after multiple negative ones in patients with typical clinical and imaging signs of COVID-19. Also, RT-PCR takes hours, or even days, before the results are available, putting strain on the holding units where patients are kept before being sent to a normal or COVID-19 ward (Amer *et al.,* 2021).

In this light, the role of chest computed tomography (CT) in COVID-19 is constantly evolving with modest scientific evidence but substantial differences in opinion on when and how the technique should be used for clinical workup or treatment decisions. The 7th Chinese Novel Coronavirus Pneumonia Diagnosis and Treatment Plan incorporates CT imaging into the criteria that clinically define COVID-19. The Fleischner Society, in their recent statement, however, sees a role for imaging in various scenarios, with imaging, and in particular, CT scanning, as a major tool if symptoms worsen or in an environment that is resource-constrained for RT-PCR (Lal and Choudhary, 2020).

A COVID-19 infection, which primarily affects the lungs, has a wide clinical spectrum, from asymptomatic infection to mild upper respiratory illness, severe viral pneumonia, respiratory failure, shock and, in some cases, death (Khot and Nadkar, 2020).

The COVID-19 pandemic has had a serious impact on our understanding of the traditional course of ACS. However, the course and outcomes of ACS in coronavirus infections remain unclear. It is assumed that it is possible to develop both acute myocardial infarction (AMI) type 1 or 2, and myocardial infarction with non-obstructive coronary arteries (MINOCA). It is important to be able to recognize ACS concealers, especially atypical ones, in order to provide adequate treatment and avoid additional risks or even harm (for example, fibrinolysis in the case of myocarditis or stress cardiomyopathy which will expose patients to the risk of bleeding or possible invasive coronary angiography for unresolved ST elevation, which would be inappropriate) (Khot and Nadkar, 2020).

Although primarily affecting the respiratory tract, the clinical course of COVID-19 may be complicated by several systemic and potentially life-threatening conditions, with a reported in-hospital mortality rate ranging from 9% to 15%. Cardiovascular involvement is frequently reported in COVID-19 and may impact on patient clinical outcome and mortality risk (Bansal, 2020).

Acute coronary syndrome (ACS) has been reported in a substantial proportion of patients with COVID-19. Although the underlying pathogenesis remains unclear, several potential mechanisms have been hypothesized, including direct viral cellular damage, systemic inflammatory response with cytokine-mediated injury, microvascular thrombosis, endothelial dysfunction, and oxygen supply/demand imbalance due to the severe hypoxic state. Moreover, as described in other infective diseases, COVID-19 may promote atherosclerotic plaque instability and thrombus formation and precipitate type 1 myocardial infarction (MI) (Bansal, 2020).

In this study, we aimed to determine the risk of cardiac insults in patients with high CORADS detected in C.T chest.

A total of 100 patients with acute coronary syndrome (72 males and 28 females) were recruited in our study with ages ranged between 32 and 71 years and a median age of 58.5 years (IQR between 47.25 and 66.25 years). In terms of risk factors distribution, out of 100 acute coronary syndrome patients, 39% were diabetic, 59% were hypertensive, 51% were smokers and 63% had dyslipidemia. On the other hand, no patient had history of previous acute coronary syndrome.

Laboratory and clinical investigations as the studied patients had a median RBS of 182 mg/dL with IQR from 144 to 216.25 mg/dL and a median MAP of 97 mmHg with IQR from 83 to 107 mmHg. The majority of our patients (73%) suffered from respiratory symptoms.

Moreover, our CT chest scan results detected that 14% of the studied patients had CO-RADS 1, 8% had CO-RADS 2, CO-RADS 3 was the most prevalent grade in approximately half patients (46%), 21% had CO-RADS 4 and 11% had CO-RADS 5. In terms of ACS type, 74 of the 100 studied patients had STEMI, 12 patients had non-STEMI and 14 had unstable angina. Out of the 74 STEMI patients, 56.76% had anterior STEMI, 35.14% had inferior, 12.16% had posterior and 10.81% had lateral STEMI.

We found no statistically significant relation between the type of ACS and age, sex distribution or risk factors (DM, HTN, smoking and dyslipidemia). On the other hand, there was a statistically significant relation between type of ACS and the prevalence of respiratory symptoms as patients with STEMI had significantly higher prevalence rate of respiratory symptoms compared to those with unstable angina. The simple logistic regression analysis revealed that positive respiratory symptoms and CO-RADS were significantly associated with the incidence of STEMI. Patients with respiratory symptoms had higher odds of experiencing STEMI compared to those with no symptoms.

As compared to patients diagnosed with CO-RADS 1, those with CO-RADS 3, CO-RADS 4 and CO-RADS 5 had significantly higher odds of having STEMI.

Furthermore, the simple logistic regression analysis revealed that CO-RADS were significantly associated with the incidence of NSTEMI as patients diagnosed with CO-RADS 3 and CO-RADS 4 had significantly lower odds of experiencing NSTEMI when compared to those with CO-RADS 1.

The simple logistic regression analysis showed that positive respiratory symptoms were significantly associated with the incidence of unstable angina as patients with respiratory symptoms had lower odds of experiencing unstable angina when compared to those with no symptoms.

In the study of Rashid *et al.* (2021) patients in the COVID-19 ACS group were older compared with the non-COVID-19 ACS group (72.8 years vs 67.0 years), and a greater proportion were from Black, Asian and Ethnic minority origin (20.2% vs 12.8%), and they had a lower body mass index (26.9 vs 28.2) and more likely to be hospitalized with NSTEMI (67.0% vs 62.0%). The COVID-19 ACS group also exhibited an increased incidence of in-hospital cardiac arrest (6.3% vs 3.0%), higher troponin levels and were more likely to have presented in pulmonary oedema (9.0% vs 3.4%) or cardiogenic shock (9.6% vs 3.9%). They had a higher prevalence of heart failure (23.7% vs 13.4%), cerebrovascular disease (15.7% vs 8.0%), insulin-treated diabetes (13.6% vs 7.5%) and hypertension (69.4% vs 58.3%).

A total of 223 ACS patients (mean age 64.2 ± 13.3 years, 82.5% male) were included in the analysis, including 52 patients negative for COVID-19 in the COVID-19 group and 171 patients in the pre-COVID- 19 group. Of these, 71.1% (37/52) of ACS patients in 2020 were transferred via a regional non-PCI-capable facility, at a higher rate than that in 2019 (61.4%, 105/171). And the population in each month in 2020 was decreased compared with that in 2019.

The baseline characteristics of the 223 AMI:There were no significant differences relating to age, gender, BMI, blood pressure, history of smoking, prevalence of hypertension (HT), diabetes mellitus (DM), congestive cardiac failure, atrial fibrillation, previous MI, previous PCI, cerebrovascular disease or peripheral vascular disease between the two groups (Table 1). There were more patients transferred with ACS in the COVID-19 group than that in the pre-COVID group ($p = 0.04$) (Zuo *et al.,* 2022).

15 studies with a total of 379 patients were included in the final analysis. Mean age of patients was 62.82 ± 36.01, with a male predominance (72%, n = 274). Hypertension, dyslipidemia and diabetes

mellitus were the most common cardiovascular risk factors among these patients, with a pooled proportion of 72%, 59% and 40% respectively. Dyspnea (61%, n = 131) was the most frequent presenting symptom, followed by chest pain (60%, n = 101) and fever (56%, n = 104). 62% of the patients had obstructive CAD during coronary angiography. The primary reperfusion method used in the majority of cases was percutaneous coronary intervention (64%, n = 124). Mortality, which is the primary outcome in our study, was relatively high, with a rate of 34% across studies (Daoulah *et al.,* 2021).

A total of 78 patients were included in this review, a majority of whom were men, with a median age of 65 years. Patients carried a high comorbidity load; most (43, 55%) had at least 4 comorbidities. The most common comorbidities were dyslipidemia (72, 92%), hypertension (57, 73%), smoking (41, 53%), and diabetes mellitus (21, 27%). During hospitalization, 34 patients (44%) had mild pneumonia, 2 (3%) had severe pneumonia, 8 (10%) developed acute respiratory distress syndrome, 5 (6%) developed septic shock, and a total of 14 (18%) required mechanical ventilation. Median pain to reperfusion time was

12.6 hours. 19 (24%) patients were treated with primary PCI and 59 (76%) were treated with fibrinolytic therapy as the initial reperfusion strategy. A total of 13 patients (17%) required cardiac resuscitation, 7 (9%) re-infarcted during their hospitalization, and 9 (12%) died (Hamadeh *et al.,* 2020).

There was absolute agreement in assigned CORADS category in 573 of 840 (68.2%) observations. A discrepancy by one CORADS category was seen in 235 of 840 (28.0%) observations, and of these pairs, CORADS categories 4 and 5 and CORADS categories 1 and 2 occurred in 128 of 840 (15.2%) observations. A difference of two CORADS categories was found in 31 (3.7%) observations, and a difference of three categories was found in one (0.1%) observation. The resulting 5 × 5 table is given in Appendix E3 (online). The Fleiss κ value of all observers on CORADS was 0.47 (95% CI: 0.45, 0.49). The κ values and 95% CIs for the individual categories were as follows: CO-RADS 1, 0.58 (95% CI: 0.54, 0.62); CORADS 2, 0.36 (95% CI: 0.32, 0.40); CORADS 3, 0.31 (95% CI: 0.28, 0.35); CORADS 4, 0.20 (95% CI: 0.17, 0.24); CORADS 5, 0.68 (95% CI: 0.65, 0.72). The κ value for each observer is provided in Table 4. Agreements of individual observers with the median of the remaining observers were either substantial (n = 4) or moderate (n = 4) (Prokop *et al.,* 2020).

In contrast to our study, The Gulf RACE study recruited 6704 consecutive patients presenting with ACS. Of these patients, 4085 had N- STEMI and 2619 had STEMI, with mean age of 56 years. Compared with patients with STEMI, patients presenting with N-STEMI were more often female, elder, diabetic, hypertensive, dyslipidemic, and obese and more likely to have prior history of CAD and coronary revascularization. STEMI patients were more often smokers and less likely to be taking aspirin prior to the index admission when compared with NSTEMI patients. So, they showed that smokers were younger and less likely to be diabetic, hypertensive, and dyslipidemic compared with nonsmokers. Most of the cardiovascular risk factors' patients apart from smoking were more prevalent among women compared with men (El‐Menyar *et al.,* 2011).

Cardiac injury has been shown to be quite common in COVID-19, with up to 40% of hospitalized patients presenting elevated cardiac biomarkers including troponin and brain natriuretic peptides (Stefanini *et al.,* 2020).

Metkus *et al.* (2021) compared intubated patients with COVID- -19 with a historical ARDS cohort, showing that myocardial injury in severe COVID-19 was related to baseline comorbidities and multiorgan failure but was not an independent predictor of mortality at multivariable regression analysis. Most importantly, COVID-19-related ARDS was associated with a lower risk of myocardial injury compared with non- COVID-19-related ARDS.

Conclusion

We conclude that positive respiratory symptoms and high CO-RADS were significantly associated with the incidence of acute coronary syndrome. So, the risk of cardiac insults increases in patients with high CORADS detected in C.T chest.

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