Original Article

A Prospective Study of 200 Patients Admitted in a Tertiary ICU with Severe Acute Respiratory Infection to Develop a Pretest Probability Score of COVID 19 Infection, COV-SARI Score

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Background : COVID-19 infection is the worst and biggest pandemic the world is facing.The biggest challenge is to identify the infection at the earliest and isolate these patients at the earliest. Availability of reverse transcriptase polymerase chain reaction (RT-PCR) is very limited especially in developing countries and sometimes it takes lot of time to get the results.This study was aimed to detect suspected COVID-19 infection by Clinico-Radiological Co-relation till the nasopharyngeal swab test results are available.

Material and Method : We conducted a prospective study of 200 patients who came consecutively to the intensive care unit (ICU) with severe acute respiratory infection (SARI) at Zydus Hospital Ahmedabad. We collected clinical data as per the protocol and subjected all of them to High resolution chest tomogram (HRCT Thorax). We devised a Pretest probability score, COV-SARI score to determine the positive predictability of COVID 19 infection.

Results : Based on the prevalence of symptoms, history and COVID-19-reporting and data system (CO-RADS) score a simplified score of 17 was devised. Based on the statistical analysis of the data a cutoff score of <9 or >9 was determined. Patient with COV-SARI Score$\geq$9 has sensitivity 89.4% and positive predictive value 73.07% and Negative predictive value 90.62% and specificity 75.6%.

Conclusion : This score can be a very good screening tool and quarantine these patientstill the results of RT-PCR is available.

[*J Indian Med Assoc* 2020; **118(12):** 54-7]

COVID-19 infection started in December 2019 from Wuhan in China and took the world by storm as a pandemic by mid-March 2020. By the time of this writing more than 238million cases have been confirmed worldwide and more than 800,000 deaths have been reported. More than 250 countries are affected by this deadly infection irrespective of their geography, economy and medical facilities. India saw its first case in January 2020 but increasing numbers started in middle of March. By now India has reported

Editor's Comment :
- Considering the seriousness and pandemicity of the COVID 19 infection, the need of the hour is to have a simple clinical score to predict probability of COVID 19 infection.
- This simple score can easily predict the probability of COVID 19 infection, along with HRCT thorax till the results of RTPCR are available with good sensitivity and specificity.

more than 3million cases with around 59500 deaths.

On January 30th, 2020 the World Health Organization (WHO) declared the outbreak a Public Health Emergency of International Concern and on March 11th, 2020, declared it a pandemic[1].

The gold standard for COVID-19 diagnosis relies on Severe acute respiratory syndrome Coronavirus-2 (SARS-CoV-2) RNA detection by reverse transcription polymerase chain reaction (RT-PCR) through nasal and oropharyngeal swabs (sensitivity of the RT-PCR ranges between 56 to 83%)[2].

Many centres in the world including India did not have many labs to do the swab test.Swab tests are also dependent on the quality of swab collection,

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transport medium and the test kits. Besides this, in many small centres, the test results take about 36-48 hours for the results to be available. Hence a quick handy tool would be very useful to suspect COVID-19 infection and in immediately isolating the patients for further treatment.

This study was aimed to detect suspected COVID-19 infection by Clinico-Radiological Co-relation till the nasopharyngeal swab test results are available.

We started collecting data prospectively from 17th May2020 onwards for 200 patients who came to Emergency Department with Severe Acute Respiratory Infection (SARI) to devise a Pre-testpredictability Score-COV-SARI Score by clinical and radiological correlation.

AIM

A Prospective study of 200 patients presenting with Severe Acute Respiratory Infection (SARI) in Zydus Hospital ICU to devise a Clinico-Radiological scoring system to predict the probability of COVID-19 infection (COV-SARI SCORE).

MATERIAL AND METHODS

A prospective study was designed to include all those patients who were admitted to Zydus Hospital Isolation Intensive care unit (ICU) with Severe Acute Respiratory Infection (SARI) above the age 18 years.

Zydus Hospital is a 500 beddedtertiary care Multi-speciality hospital situated in Ahmedabad, Gujarat, India.

200 consecutive patients were studied from the period from 17th May 2020 to 12th July 2020.

Inclusion criteria :

All the patients coming to Zydus Hospital Isolation ICU with Severe Acute Respiratory Infection (SARI) above the age 18 years.

Exclusion criteria :

1. Patients with interstitial lung disease or any pre-existing structural lung disease

2. Pregnant patients

A detailed demographic data with clinical history as per the protocol were collected. All the patients were subjected to HRCT thorax and CO-RADS scoring was done.

Following scoring system was adopted as per our clinical judgement (Table 1).

All these patients were subjected to RT-PCR testingfor COVID-19 by taking a swabeither and/or from throat, nasopharynx, endotracheal tubes or Broncho-alveolar lavage (BAL). If the RT-PCR was negative, it was repeated after 24 hours in cases where the clinical suspicion was strong and the COV-SARI Score was ≥9.

Table 1 — COV-SARI Scoring System		
		Point
History of COVID Positive Contact		1
Previous hospitalization in last 4 weeks		1
Co-Morbidities	None	0
	1	1
	≥2	2
Symptoms		
	Fever >100°F	2
	Cough	2
	Breathlessness	2
	GI Symptoms	1
	CNS / or Others	1
CT CO-RADS SCORE		1-5 (maximum -5)
TOTAL		17

Data Collection :

For all the eligible patients, demographic data (age, sex, residence), history of contact with COVID-19 patients, travel to and from COVID-19 affected countries, past medical history and co-morbid conditions like diabetes, hypertension, malignancy, chronic kidney disease etc. were recorded. Presenting symptoms as per the chart and HRCT thorax findings with CO-RADS scoring were recorded.

In March 2020, Dutch Association of Radiology prepared a CT scoring system (Table 2).

Typical findings of HRCT chest in COVID-19:[3]

1. Multifocal ground glass opacities (GGO)
2. Peripheral and basal distributions
3. Unsharp demarcation
4. Vascular thickening
5. Crazy paving
6. Ground glass and consolidation (Reverse halo)
7. Spider web

Based on above features all the CT scans were reported by a single senior radiologist who was blinded to the clinical details.

Table 2 — CORADS classification- level of suspicious of COVID- 19 infection		
CO-RADS1	No	CT findings normal or noninfectious abnormality
CO-RADS 2	Low	Abnormality consistent with infection other than COVID-19
CO-RADS 3	Intermediate	Unclear whether COVID-19 present
CO-RADS 4	High	Abnormality suspicious of COVID-19
CO-RADS 5	Very High	Typical COVID-19 infection
CO-RADS 6	RT-PCR positive	
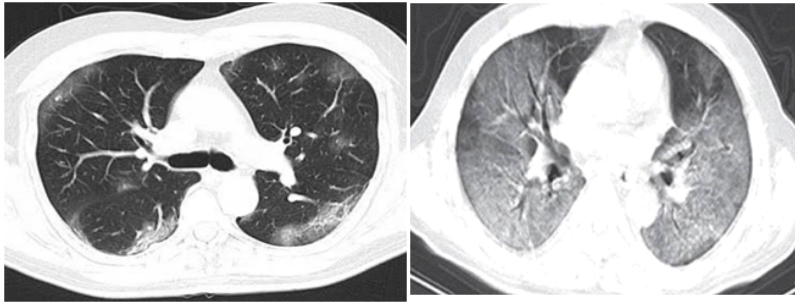
Classical radiological features of COVID-19 pneumonia

Statistical analysis :

Two hundred patients were classified into COVID-19 positive and COVID-19 negative groups according to RT-PCR test results. 85 patients were COVID-19 positive and 115 patients were COVID-19 negative. Data is entered in MS Excel spreadsheet. Qualitative data is expressed by using descriptive statistics as percentage, Chi square test is applied to check statistical association in cross tabulation that made comparison between two qualitative data. P value less than 0.05 is considered as statistically significant.

Ethics committee approval :

As this was an observational study and did not require any intervention, Institutional no objection certificate was obtained with a waiver of patient consent. However, complete confidentiality of the patient information was maintained at all times.

Results :

In a period of 57 days, we screened all the 200 patients who were admitted to ICU Isolation.Out of 200 patients, 85 patients were RT-PCR positive and 115 patients were RT PCR negative.Out of these 85 patients, COVID 19 contact history was positive only in 7 (8.2%) patients, while it was not seen in 78 (91.7%) patients.

Majority of the patients had respiratory symptoms 69/85 i.e. 80%. Fever was seen in 63/85 (74.12%). Coughwas seen in 41/85 (48.24%). Breathlessness seen in 69/85 (81.18%). 23.5% (20/85) had Gastrointestinal (GI) symptom, 8.2% (7/85) had CNS symptoms and 56% had other symptoms like extreme weakness, change / loss of taste / loss of smell etc (Fig 1).

In our study no patient who had CO-RADS 1 score was found to be RT-PCR positive. CO-RADS 2 score in 6/85 (7%). CO-RADS 3 score seen in 2/85 (2.35%). CO-RADS 4 score seen in 8/85 (9.81%). CO-RADS 5 score wasseen in 69/85 (81.18%) patients (Fig 2).

40/85 (47%) patients had history of previous hospitalization in last 1 month while 45/85 (53%) did not have history of hospitalization.15/85 (17.6%) patient

had no co-existing co-morbidities while 25/85 (29.4%) had one co-morbidity and 45/85 (53%) had 2 or more than 2 co-morbidities (Tables 3&4).

DISCUSSION

This study was designed to quickly and accurately screen the patients of SARI. As many centres in India at the time of this study did not have facility to do RT-PCR and the test needed particular expertise in collecting the specimen. In remote areas the sample had to be transferred to another centre and it use to take 24-36 hours for the results to be available.

As this score involved clinical history and symptoms with CT scan scoring, within a couple of hours the score was ready.

As this study, ≥ 9 score has sensitivity 89.4% and specificity of 75.6% with a positive predictive value of 73.0% and negative predictive value of 90.62%. This is a good screening tool in a centre where RT-PCR facilities are not easily available.

In our score, heavy weightage is given to CO-RAD scoring because ours is a tertiary care centre and mainly a referral centre, hence patients normally report after 5-7 days of illness and hence most of these COVID-19positive patients showed CORAD Score ³4.

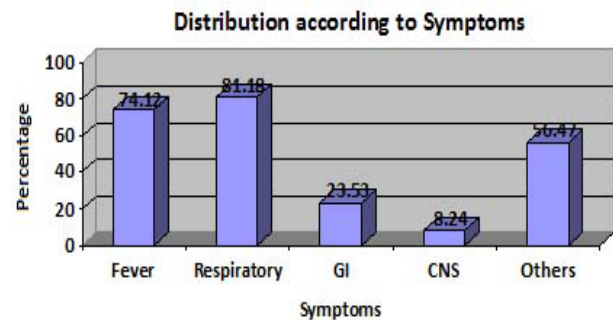Use of CTchest alone as a primary screening tool
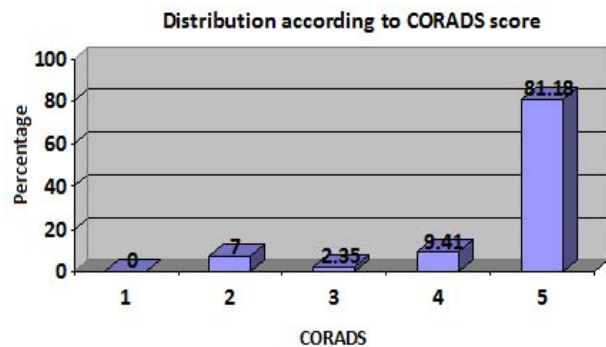

Fig 1 — Distribution of patients according to symptoms

Fig 2 — Distribution of patients according to CT CO-RADS score

Table 3 — Characteristic of patients					
		COVID-19 RT-PCR Positive(n)	COVID-19 RT-PCR Negative(n)	Total	P Value
Age	≥55 Years	64	77	141	0.2012
Sex	Male	53	74	127	0.772056
History of Exposure	Present	7	0	7	
Symptoms	Fever	63	43	106	<0.00001
	Cough	41	21	62	<0.00001
	Breathlessness	69	56	125	<0.00001
	GI Symptoms	20	49	69	0.005017
	CNS Symptoms	7	38	45	0.000033
	Others	48	48	96	
CT Co-rads Score	1-3	8	99	107	<0.00001
	4-5	77	16	93	<0.00001
H/O Previous Hospitalization in Last 4 Weeks	Yes	40	44	84	0.212692
Co-morbidity	None	15	19	34	0.834106
	1	25	33	58	0.912147
	≥2	45	63	108	0.796179
Cut-off Score	≥9	76	28	104	<0.00001
P value <0.05 is statistically significant					

Table 4 — Sensitivity and specificity calculated according to various cut-off score				
Cut-off Score	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
8	96.47%	53.91%	60.74%	95.38%
9	89.41%	75.65%	73.07%	90.62%
10	80.0%	87.83%	82.93%	85.59%
11	75.29%	93.04%	88.88%	83.59%

must be discouraged as in mild disease orin early disease CT is likely to be negative. CT can be a good modality in patients with worsening respiratory status. However, it improves pre-test probability in more severe cases[4].

This is aneasy to calculate score hence easy to implement even at the junior level and is easily reproducible.

We hope that this score is used as a screening tool in areas where RT-PCR is not easily available. Places where RT-PCR is available, this scoring system can help in isolating the suspected patients till the report become available.

Our study and this score has certain limitations. If patient comes early in the course (less than 5 days) of illness, the score may not pick up all cases. Sample size is small and there is no focus on lab investigations including the lab studies like lymphopenia, thrombocytopenia, raised C- reactive protein (CRP) etc. Including the lab results in study could have been a good idea[5].

CO-RADS scoring has a limitation that it becomes positive only after 5-6 days, hence if patient presents early in course of illness the score can still be negative.

Our centre has a very busy Nephrology unit and many of chronic kidney disease (CKD) patients who came with acute severe volume overload had high COV-SARI Score, as these patients had high CO-RADS scoring and hence COV-SARI Score falsely was very high.

Besides these two groups, this score is a very good and simple clinico-radiological screening tool to predict possibility of SARI due to COVID- 19 infection.

Summary :

To conclude this simple bedside score combined with radiological scoring can be a very simple and effective and above all a quick screening tool for the patients who present with SARI till the swab results are available.

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