Clinical, Biochemical, and Radiological Features Associated with COVID-19 Pneumonia

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AH SAA conceived idea, SAA drafted the study, AH HS collected data, HS SAA did statistical analysis and interpretation of data, SAA AH critical review manuscript All approved final version to be published

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

Abstract

Background: COVID-19 is an acute respiratory illness that has been declared a global pandemic by the WHO on March 11, 2020. The culprit behind this pandemic is a SARS-CoV2 strain belonging to the family of coronaviruses. The pathogens included in this family are not unfamiliar to mankind as they have given rise to previous outbreaks in the form of MERS-CoV in 2012, and SARS-CoV1 in 2003.

Objectives: This study was conducted with the aim to study the characteristics of COVID positive patients.

Methodology: A retrospective study comprising of 52 patients was conducted at Ziauddin University Hospital, a tertiary care center located in Karachi, Pakistan. All patients belonged to Southeast Asian ethnicity. All patients included in this study were confirmed cases of SARS-CoV-2 pneumonia, tested positive on reverse transcriptase polymerase chain reaction of nasopharyngeal or oropharyngeal swab, at the time of admission. Patients exhibiting symptoms of COVID-19, but NOT proven positive on RT-PCR were excluded from the study. Data was collected using EMR, and analyzed using SPSS v. 23.3.

Results: A total of 52 patients were observed in this study from 04-29-2020 to 06-28-2020. Mean age was found to be 55.15. Majority of the cases belonged to ages between 50 to 70 years (34 patients,65.4%). Only one patient was a 5-year-old male, with pre-existing liver abscess.

Conclusion: In summary, the most common clinical features of SARS-CoV-2 pneumonia can be classified in a triad of fever, cough and myalgia, while the accessory symptoms include, but are not limited to, diarrhea and headache. On presentation of any of the aforementioned traits, patients should immediately contact health care facilities to inquire about COVID-19 testing and follow proper measures of social distancing.

Hypertensive and diabetic populations were found to be more susceptible to SARS-CoV-2. Therefore, maintaining a good check of glycemic control and keeping a controlled BP is the preferable aim in such patients with COVID-19.

Lastly, extremely high values of D-dimer may be used as a predictor of mortality or severity of pneumonia caused by SARS-CoV-2. In-patient laboratory tests should include testing for patient's D-dimer levels.

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Introduction

COVID-19 is an acute respiratory illness that has been declared a global pandemic by the WHO on March 11, 2020.[1] The culprit behind this pandemic is a SARS-CoV-2 strain belonging to the family of coronaviruses. The pathogens included in this family are not unfamiliar to mankind as they have given rise to previous outbreaks in the form of MERS-CoV in 2012, and SARS-CoV-1 in 2003.[2-3]

The first few cases of this outbreak emerged in Wuhan, Hubei Province, China, and have now escalated to a number of total 24.2 million cases with

at least 827,032 deaths reported globally, as of August 26, 2020. The US alone accounts for 5.8 million cases of COVID-19.

SARS-CoV-2 is believed to be of zoonotic origin, considering bats and pangolins as possible candidates for its reservoir.[4-6]

According to the recent studies, the mode of transmission of COVID-19 is determined to be mainly through respiratory droplets and through close contact of the virus with mucosal surfaces (direct or indirect). Feco-oral transmission has not been completely excluded and is under further investigation, as viral shedding was found in fecal specimens of some infected patients.[7-9] The target receptor for gaining entry in host cells is recognized as ACE2 receptor, to which the viral surface protein, Spike, attaches.[3,10]

Reverse transcription polymerase chain reaction(RT-PCR) tests are the mainstay of diagnosis of COVID-19 (8) and the role of chest CT is proven valuable for patient follow-up and management during the course of infection.[11]

This extensive spread of COVID-19 involves as many as 213 countries with the highest number of deaths, counting 179,000, in the US. The mortality rate according to the 'situation report' published by the WHO, in March 2020, is estimated to be around 3.4%.

Methodology

A retrospective study comprising of 52 patients was conducted at Ziauddin University Hospital, a tertiary care center located in Karachi, Pakistan. All patients belonged to Southeast Asian ethnicity. All patients included in this study were confirmed cases of SARS-CoV-2 pneumonia, tested positive on reverse transcriptase polymerase chain reaction of nasopharyngeal or oropharyngeal swab, at the time of admission. Patients exhibiting symptoms of COVID-19, but NOT proven positive on RT-PCR were excluded from the study. Data was collected using EMR, and analyzed using SPSS v. 23.3.

Results

A total of 52 patients were observed in this study from 04-29-2020 to 06-28-2020. Mean age was found to be 55.15. Majority of the cases belonged to ages

Table 1. Clinical characteristics and co-morbidities associated with COVID-19 cases reported at the time of admission

Characteristics	Frequency (%)	
Age, years	55.15 (mean age)	
Gender Male Female	 43 (82.7%) 9 (17.3%)	
Risk and Factors Comorbidities	Yes	No
Smoking	3 (5.8%)	49 (94.2%)
Diabetes Mellitus	29 (55.8%)	23 (44.2%)
CKD	3 (5.8%)	49 (94.2%)
Asthma	4 (7.7%)	48 (92.3%)
HTN	40 (76.9%)	12 (23.1%)
CVA	1(1.9%)	51 (98.1%)
Dyslipidemia	17 (32.7%)	35 (67.3%)
IHD	18 (34.6%)	34 (65.4%)
COPD	1 (1.9%)	51 (98.1%)
Symptoms	**Present**	**Absent**
Temperature >98.6 F	52 (98.1%)	1 (1.9%)
Cough	49 (94.2%)	3 (5.8%)
SOB	47 (90.4%)	5 (9.6%)
Fatigue or muscular soreness	48 (92.3%)	4 (7.7%)
Chest Tightness	27 (51.9%)	25 (48.1)
Diarrhea	6 (11.5%)	46 (88.5%)
Headache	23 (44.2%)	29 (55.8%)

Table 2. Biochemical Characteristics of COVID-19 Patients

Characteristics	Frequency	Reference ranges
CBC		
RBC, x10(12)/L		(3.75-5)
<3.71	7 (13.5%)	
3.75-5	31 (69.6%)	
>5	14 (26.9%)	
Hb <12	24 (46.2)	(12-16)
Hct <34%	16 (30.8%)	(34.5-45.0)
MCV<82	20 (38.5%)	(82-100)
MCH<28	30 (57.7%)	(28-35)
MCHC<31	7 (13.5%)	(31-36.5)
WBC, 10^9/L		
<4.8	6 (11.5%)	(4.8-10.8)
>10.8	31 (59.6%)	
Lymphocytes <20%	38 (73.1%)	(20-40%)
Platelets, 10^9/L		(150-440)
<150	7 (13.5%)	
Alanine aminotransferase, U/L >40	18 (34.6%)	(10-40)
Aspartate aminotransferase, U/L>40	19 (36.5%)	(10-40)
Sodium, mmol/L <135 >145	 9 (17.3%) 6 (11.5%)	(135-145)
Potassium, mmo/L >5 <3.5	 9 (17.3%) 3 (5.8%)	(3.5-5)
Chloride, mmol/L >105 <95	 11 (21.2%) 4 (7.7%)	(95-100)
Calcium, mg/dL<8.5	17 (32.7%)	(8.5-10.5)
Bicarbonate, Meq/L <22 >28	 28 (53.8%) 8 (15.4%)	(22-28)
Troponin I, ng/mL>0.04	30 (57.7%)	(less than 0.04)
CRP, mg/L>15	44 (84.6%)	(less than 10)
Lactate dehydrogenase, U/L>245	41 (78.8%)	
Ferritin, ng/mL>400	38 (73.1%)	(12-300)

Data is expressed in mean, frequency and percentages.

Table 3. Radiological features of SARS-CoV2 pneumonia on CXR

	Frequency(%)	
Zone involved		
Upper zone only	7.69	
Lower zone only	25.0	
Both zones	67.3	
Unilateral involvement	9.6	
Bilateral involvement	90.3	
	Present	**Absent**
Airspace opacities	47 (90.4%)	5 (9.6%)
Ground glass opacities(GCO)	29 (55.8%)	23 (44.2%)
Interlobular septal thickening	12 (23.1%)	40 (76.9%)
Pavement appearance	2 (3.8%)	50 (96.2%)
Consolidation	33 (63.5%)	19 (36.5%)
Pleural effusion	1 (1.9%)	51 (98.1%)
Pulmonary edema	20 (38.5%)	32 (61.5%)
Bronchovascular thickening	21 (40.4%)	31 (59.6%)
Peripheral distribution	36 (69.2%)	16 (30.8%)
tractional bronchiectasis	1 (1.9%)	51 (98.1%)

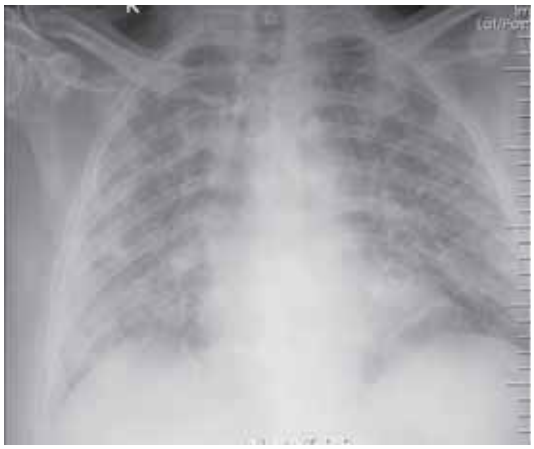

Fig. 1 CXR of a 49-year-old patient, positive for COVID-19
Fluffy air space opacification with air bronchogram seen in both lungs, mid and lower zones, along the peripheral aspect, representing extensive pulmonary infection. Both costophrenic angles are clear.

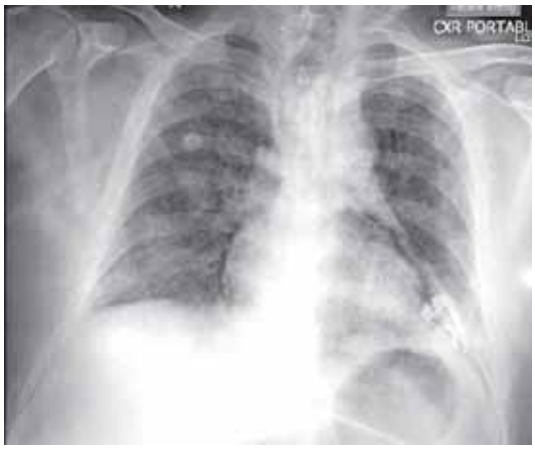

Fig 2. CXR AP of a 60-year-old male patient, positive for COVID-19.
Air space opacification seen in both lung fields predominantly at lung peripheries, more so on the Left side.
Both costophrenic angles are clear.

between 50 to 70 years (34 patients, 65.4%). Only one patient was a 5-year-old male, with pre-existing liver abscess.

Male gender was found to be predominantly effected with a total of 43(82.7%) males and 9(17.3%) females included in our population.

Table.1 shows the risk factors, co-morbidities and clinical presentation of the disease reported in these patients at the time of admission.

Biochemical studies of the patients are summed up in Table 2.

All cases received Chest X-rays to assess the radiological aspect of pneumonia caused by SARS-CoV-2. Findings are summarized in Table 3.

Outcomes at the end of the study, comprised of two categories of patients: those who were discharged (37 cases, 71.2%), and those who died(15 cases, 28.8%). Majority of the deaths were confined to the age groups between 50-70 years, accounting for a total of 86.6%

Table 4. Outcomes according to Age Group

Age Groups	Discharged Patients	Death
0-9	1/1	0
10-19	0	0
20-29	1/1	0
30-39	5/6	1/6
40-49	6/6	0
50-59	7/15	8/15
60-69	11/16	5/16
70-79	4/5	1/5
80-89	2/2	0

deaths. 100% discharge outcome was seen in 6 patients belonging to ages between 40-49 years (Table 4).

Discussion

To our knowledge this is one of the few comprehensive studies in Pakistan exploring a substantial amount of data pertinent to COVID-19. Information collected during the study includes demographics, admission and discharge details, risk factors, comorbidities, vitals, medical and surgical history, drug history, in-patient medications, complete blood count, acute phase reactants, urine analysis, blood cultures, ABGs, LFTs, UCEs, ECG and CXR findings.

Clinical characteristics of SARS-COV2 Pneumonia

The presenting symptoms reported at the time of admission were consistent with the emerging data on the disease revealed by the studies conducted in Wuhan[18] and according to the WHO guidelines on symptoms of COVID-19.

All patients reported with at least 2/3 symptoms from the triad of fever, cough and myalgia. Fever being the most predominant sign (98.1%), followed by cough (94.2%) and fatigue (92.3%). Headache was obvious in 23 (44.2%) of the patients. Few patients reported with gastrointestinal symptoms manifesting as diarrhea (11.5%).

Radiological Features of SARS-COV-2 Pneumonia

To our disadvantage, radiological modality was limited to chest X-ray only. CT scan was performed for a few severe cases. Most predominant radiological feature on CXR was presence of airspace opacities (90.4%) with a peripheral distribution (69.2%), followed by consolidation (63.5%) and ground glass opacities (55.8%). Rare findings of pleural effusion and tractional bronchiectasis were found in one patient only (a 30 year old male).

At the time of discharge, patient CXR lagged behind in terms of improvement. Post COVID-19 pulmonary fibrosis takes 4 to 6 weeks to resolve.

Outcomes of Subgroups of Patients According to Co-Morbidities

The leading comorbidity among our patients was found to be of HTN, reported in 40 patients followed by Diabetes mellitus coexisting in 28 of those patients. Isolated DM was found in 1 patient only.

As for HTN:

- 12.5% were found to have unaccompanied HTN
- 12.5% reported with either dyslipidemia or IHD or both
- 20% with coexisting Diabetes Mellitus only
- 35% with coexisting Diabetes Mellitus with either Dyslipidemia or IHD
- 17.5% had HTN along with DM, Dyslipidemia a s well as IHD.

Out of these hypertensive patients 32.5% died, 12.5% showed no improvement and 2.5% resulted in a worsened outcome.

Diabetes is in the race of leading morbidities of the world's population and numerous work has been done to elucidate its parameters. One such aspect is the association of diabetic patients with a higher susceptibility to certain infections, including pneumonia.[12,15] The mortality rate of COVID-19 in diabetic patients is found to be four times higher.

An increased expression of ACE2 receptors in diabetic patients can be linked to an increase risk of COVID-19 complications and higher mortality rates in such patients.[13] Furthermore, the presence of hyperglycemia and diabetic complications may pose a threat to worsen the severity of COVID-19. [17]

In our study 34.48% of the diabetic patients died, and 13.7% showed no improvement. All diabetics who passed away had Mean Blood Sugar levels above 150 mg/dl and an HBA1c of >9mmol/L, except for 3 patients with HbA1c <7 to 7 mmol/L.

Outcomes According to D-Dimer Values

Numerous amount of work has been done to explicate the association between high D-dimer values and an increase in mortality rate in patients with SARS-CoV-2 pneumonia.[19]

While more than three quarters of our population reported to have D-dimer values above 250, these levels still did not appear to have a striking connection to a higher mortality rate among our patients.

Despite the *high levels of D-dimer, a large number patients were discharged at the end of the study (82.35%), in comparison to the patients who died (14.7%).

Whereas, *extremely high levels of D-dimers were notably linked to an increased number of deaths (66.67%) and a fewer discharged patients (33.33%).

(*high D-dimer levels indicated levels between 250-15000 ng/ml FEU, extremely high D-dimer levels signify levels above 15000 ng/ml FEU. Highest level reported was 129950 ng/ml FEU).

Troponin I

Raised Troponin I levels, above 0.04 ng/ml, were found in 30 patients. 50% of this group subsequently needed investigation either for acute coronary syndrome or thromboembolism. ECG findings depict sinus tachycardia in 34.6% and supraventricular tachycardia in 5.76% of the total cases.

limitations

The primary limitations to this research were a small sample size and a short duration of study. Although a sample size of 52 patients is adequate to study the most commonly presenting features and associations in various aspects of COVID-19, a larger sample size lowers any heterogeneity and is suitable for running various statistical tests with precision.

Conclusion

In summary, the most common clinical features of SARS-CoV-2 pneumonia can be classified in a triad of fever, cough and myalgia, while the accessory symptoms include, but are not limited to, diarrhea and headache. On presentation of any of the aforementioned traits, patients should immediately contact health care facilities to inquire about COVID-19 testing and follow proper measures of social distancing.

Hypertensive and diabetic populations were found to be more susceptible to SARS-CoV-2. Therefore, maintaining a good check of glycemic control and keeping a controlled BP is the preferable aim in such patients with COVID-19.

Lastly, extremely high values of D-dimer may be used as a predictor of mortality or severity of pneumonia caused by SARS-CoV-2. In-patient laboratory tests should include testing for patient's D-dimer levels.

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