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Comparison of the clinical and radiological manifestations of male patients with COVID-19 from different ethnicities

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Abstract

Aim: The coronavirus disease 2019 (COVID-19) outbreak began in Wuhan, China, and quickly escalated into a significant pandemic threat. COVID-19 is associated with variable morbidity and mortality rates, which differ greatly from one country to another. This study aimed to investigate the clinical findings of SARS-CoV-2 infection in different ethnic groups, as well as to identify the radiological manifestations and various biomarkers for the assessment of COVID-19 patients.

Materials and Methods: The clinical data of 210 COVID-19 patients with respiratory disorders, who attended the chest clinic at Mouwasat Hospital, Jubail, in the Eastern area of the Kingdom of Saudi Arabia from April to May 2020, were thoroughly reviewed. The patients were divided into seven groups based on their ethnicities (Saudi, Egyptian, Nepali, Filipino, Pakistani, Bangladeshi and Indian). The differences in the clinical findings, laboratory data and radiological manifestations between these groups were statistically analysed.

Results: The study included 210 COVID-19 patients from seven ethnic groups (Saudi, Egyptian, Nepali, Filipino, Pakistani, Bangladeshi and Indian). Comorbidities were reported among 60.9% of patients, which were significantly higher among Filipinos at 73.3%. Dyspnoea was prevalent in the Saudi and Pakistani groups, while hypoxaemia was prevalent in the Indian group (40%). In terms of laboratory assessment, Bangladesh patients had the highest median of serum ferritin and lactate dehydrogenase (LDH) levels with a significant *P* value (<.001), while Saudi patients had the highest median of C-reactive protein (CRP) levels with a significant *P* value (<.001). According to computed tomography (CT) findings, structural destruction was the most common finding in bilateral parenchymal affection among 88.6% of patients. Filipinos and Bangladeshis had the highest morbidity rates.

Conclusion: There were great variations in clinical, radiological and even laboratory findings among different ethnic groups of COVID-19 patients.

1 | INTRODUCTION

The coronavirus disease 2019 (COVID-19) outbreak began in Wuhan, China, and quickly escalated into a significant pandemic threat. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the causative agent of this disease. Dissemination of COVID-19 infection is mainly via respiratory droplets, close contact or aerosols in closed surroundings. Moreover, infections may be spread through

contaminated surfaces.[1,2] Clinical manifestations of viral pneumonia are commonly correlated with COVID-19 disease. Fever, fatigue, dry cough and shortness of breath are the most common findings.[2] The World Health Organization (WHO) classifies COVID-19 severity into mild disease, moderate disease (pneumonia), severe disease (severe pneumonia) and critical disease.[3] Variable rates of mortality have been documented from one country to another, ranging from 0.4% to 3.4%.[4]

Nucleic acid detection-based techniques are a trustable tool for COVID-19 diagnosis. Chest computed tomography (CT) is a more sensitive but less specific method. However, it is considered one of the main methods used for diagnosis.[5] Regarding disease outcomes, 85% of patients have a good prognosis, while 15% have a poor prognosis as severe and critical cases with ARDS, coagulopathy, multiple organ dysfunction, etc.[6] Close monitoring of disease progression is crucial in the management of COVID-19. Laboratory biomarkers, including D-dimer (DD), lactate dehydrogenase (LDH), procalcitonin (PCT), C-reactive protein (CRP), total leucocytic count (TLC) and its differential count are essential parameters linked with COVID-19 progressions.[7] The current study aimed to characterise the different clinical and radiological findings of COVID-19 among different ethnic groups.

What's known

- COVID-19 has been a global healthcare concern since December 2019 after its detection in Wuhan.
- Clinical manifestations of viral pneumonia are commonly correlated with COVID-19 disease.
- The mortality rate of COVID-19 differs greatly from one country to another.

What's new

- Our findings showed great variations in clinical, radiological and even laboratory findings among different ethnic groups.
- This study describes the possible association between ethnicity and the COVID-19 disease.
- The current report is important for recognising disease behaviour in clinical and public health settings.

2 | MATERIALS AND METHODS

This cross-sectional study included 210 COVID-19 patients from 7 different groups: Saudi, Egyptian, Nepali, Filipino, Pakistani, Bangladeshi and Indian (30 patients from each group), who attended the chest clinic at Mouwasat Hospital, Jubail, in the Eastern area of the Kingdom of Saudi Arabia from April to May 2020.

2.1 | Inclusion criteria

Confirmed adult case of COVID-19 with chest symptoms of fever, cough, dyspnoea or atypical presentation.

2.2 | Exclusion criteria

Cases of interstitial lung diseases (ILDs), lung cancer, sarcoidosis, patients on radiation, pneumoconiosis and younger than 14 years.

2.3 | Methods

All patients were involved in our study according to demographic information, clinical presentation, history of contact with a positive infected case of COVID-19, past medical history, comorbidities and laboratory investigation in the form of complete blood count (CBC), CRP, LDH, ferritin and PCT. Radiological evaluation is in the form of a chest X-ray and a CT scan of the chest.

2.4 | Molecular diagnosis of COVID-19

Detection of SARS-CoV-2 viral RNA was carried out on nasopharyngeal samples.[8] Nasopharyngeal swabs were taken using nasopharyngeal rayon swabs (Cod. 26061 Rayon) according to WHO guidelines,[9] following the case definition published in the Saudi MOH protocol guidelines. Clinical samples manipulations were done in a Class IIA Biosafety Cabinet using BSL-2 precautions. RNA was extracted from the samples using the QIAamp Viral RNA Mini Kit (QIAGEN, Hilden, Germany, Cat. No. 52904) according to the manufacturer's instructions. The SARS-CoV-2/SARS-CoV Multiplex REAL-TIME PCR kit (DNA-Technology, Cat. No. R3-P436-23/9EU) was used for the detection using the respective controls, following the manufacturer's instructions, and loaded into a DTlite thermal cycler (DNA-Technology, Moscow, Russia). The kit amplifies three targets: one is generic to SARS-CoV-like coronaviruses (CoV-like); the other two are specific to SARS-CoV-2, for the E gene (CoV-2 E) and the N gene (CoV-2N). The DTmaster software for the DNA-Technology kit was used to automate the analysis.[10]

2.5 | Laboratory diagnosis

The samples for laboratory tests were collected on admission and during the hospital stay. Laboratory tests included total leukocyte and its differential cell count, in addition to CRP, ferritin, LDH, PCT and D-dimer levels. All tests were performed according to the manufacturer's instructions. Peripheral venous blood was collected for routine blood tests. A complete blood count (CBC) was measured using an automatic haematology analyser (Sysmex XS 500i, Japan). The biochemical parameters such as liver, renal function, ferritin and LDH were measured using the Cobas c 311 automated clinical chemistry analyser (Roche Diagnostics, Mannheim,

Germany). CRP was measured with specific protein analyser QR-100 (HEALES, Shenzhen, China). Serum PCT and D-dimer levels were measured using a Pathfast chemiluminescent immunoassay analyser (Mitsubishi/LSI, Tokyo, Japan). The STA-Compact coagulation analyser was used for detection of the coagulation tests (Diagnostica Stago, Saint-Denis, France).

2.6 | Radiological manifestations

Chest X-ray in two views was performed for all patients. In addition, multidetector CT scanners (Somatom Sensation 64, Siemens Healthineers) were used for all CT scan chest examinations. The presetting parameters for a thorax routine were identical to those advised by the manufacturer. In all cases, images were reconstructed using the conventional filtered back-projection method with a soft tissue kernel of B20 and a lung kernel of B60 with a 1 mm slice thickness. Coronal and sagittal multiplanar reconstructions were also available in all cases.

2.7 | Image analysis

According to Pan et al,[11] a semi-quantitative CT severity grading was derived for each of the 5 lobes, taking into account the extent of anatomic involvement: (0) indicates no involvement; (1) up to 5% involvement; (2) 5%-25% involvement; (3) 26%-50% involvement; (4) 51%-75% engagement and (5) more than 75% involvement.

2.8 | Statistical analysis

Statistical analysis was done using the SPSS software package (version 16.0 for Windows; SPSS Inc, Chicago, IL, USA). Data were presented using numbers and per cent for qualitative variables, while the mean, standard deviation (SD) or median and interquartile range (IQR) were for quantitative variables. Comparison of qualitative variables between groups was done using the chi-squared test and the Fisher's exact test. For comparing quantitative variables, Student and ANOVA tests were used. The Kruskal-Wallis and Mann-Whitney tests were used for non-normally distributed variables. A *P* value of .05 or less was considered to be statistically significant.

2.9 | Ethical statements

This study was performed in accordance with the ethical principles of the 1975 Declaration of Helsinki and approved by the Ethics Committee of the Mouwasat Hospital Jubail (MHJ-01). Written informed consent was obtained from each patient before clinical and laboratory investigations for the involvement of anonymous patients' data in scientific research for the current study.

TABLE 1 Basal characteristics and clinical features of COVID-19 cases

	N (=210)	%
Age		
Mean ± SD	41.99 ± 9.7	
Ethnicity		
Egyptian	30	14.3
Saudi	30	14.3
Indian	30	14.3
Bangladeshi	30	14.3
Pakistani	30	14.3
Filipino	30	14.3
Nepali	30	14.3
Duration of illness		
Mean ± SD	7.38 ± 3.48	
Comorbidity		
Any	98	46.7
Diabetes mellitus	30	14.3
Hypertension	30	14.3
Liver disease	68	32.4
Clinical findings		
Fever	102	48.6
Cough	136	64.8
Dyspnoea tightness/pain	108	51.4
Fatigue	14	6.7
Abdominal pain/diarrhoea	18	8.6
Sore throat	18	8.6
Investigation		
CRP, median (IQR) (mg/L)	18 (12-36)	—
D-dimer, median (IQR) (μg/mL)	0.61 (0.39-0.90)	—
LDH, median (IQR) (U/L)	349 (261.75-473)	—
Ferritin, median (IQR) (ng/mL)	700 (341-996)	—
Procalcitonin (ng/mL)	0.20 (0.047-0.47)	—
Lymphocytopenia	150	71.4
Hypoxaemia		
Yes	38	18.1
No	172	81.9
Rapid antibody test		
Positive	56	26.7
Negative	120	57.1
Not done	34	16.2

Abbreviations: CRP, C-reactive protein; IQR, interquartile range; LDH, lactate dehydrogenase; N, number of cases; SD, standard deviation.

3 | RESULTS

The specimens were collected from 210 COVID-19 patients. The study involved 7 different ethnic groups, with 30 patients in each group. The mean age of the studied groups was 41.99 ± 9.7 years.

TABLE 2 Clinical features of COVID-19 among different ethnicities

		Sore Throat		Fever		Chest tightness		Cough	
		N0	Yes	N0	Yes	N0	Yes	N0	Yes
Egyptian	N	24	6	22	8	14	16	14	16
	%	80.0%	20.0%	73.3%	26.7%	46.7%	53.3%	46.7%	53.3%
Saudi	N	28	2	10	20	20	10	6	24
	%	93.3%	6.7%	33.3%	66.7%	66.7%	33.3%	20.0%	80.0%
Indian	N	28	2	10	20	16	14	16	14
	%	93.3%	6.7%	33.3%	66.7%	53.3%	46.7%	53.3%	46.7%
Bangladeshi	N	28	2	20	10	8	22	10	20
	%	93.3%	6.7%	66.7%	33.3%	26.7%	73.3%	33.3%	66.7%
Pakistani	N	28	2	20	10	18	12	6	24
	%	93.3%	6.7%	66.7%	33.3%	60.0%	40.0%	20.0%	80.0%
Filipino	N	30	0	8	22	10	20	2	28
	%	100.0%	0.0%	26.7%	73.3%	33.3%	66.7%	6.7%	93.3%
Nepali	N	26	4	18	12	16	14	20	10
	%	86.7%	13.3%	60.0%	40.0%	53.3%	46.7%	66.7%	33.3%
P value		.161		<.001*		.023*		.001*	

*Refer to statistically significant difference.

Post hoc analysis revealed a statistically significant difference between Filipinos with Bangladeshis, Pakistanis, Nepalis and Egyptians with *p* values of .023, .007, .008 and .045 respectively. The average duration of the illness was 7 days. The majority of patients (64%) presented with a cough, while 6.7% of patients presented with fatigue (Table 1). Cough and fever in relation to patient ethnicity were highly statistically significant ($P = .001$ and $P < .001$, respectively) (Table 2). Sixty-eight patients (32.4%) had liver diseases, while 30 patients (14.3%) had diabetes and hypertension. On the other hand, 98 patients (46.7%) had other comorbid conditions. The rapid antibody test was done for 176 patients (84%). The test was positive for 56 patients (26.7%). Hypoxaemia was only shown in 18.1% of patients (Table 1). According to our findings, the percentage of morbidities among COVID-19 cases was statistically significant ($P = .009$) in relation to their ethnicity. The per cent of morbidities was highest among Filipino and Bangladeshi patients, 73.3% and 60% respectively. Nepalis had the lowest morbidity rate, at 26.7% (Table S2).

CRP, D-dimer, LDH, ferritin and PCT had average levels of 18 (12-36) mg/L, 0.61 (0.39-0.90) μg/mL, 349 (261.75-473) U/L, 700 (341-996) ng/ml and 0.20 (0.047-0.47) ng/ml, respectively, in the laboratory tests. Low lymphocyte count was recorded in 150 patients (71.4%). Apart from D-dimer (P value = .222), most of the laboratory test results showed statistical significance in relation to their ethnicity. The *P* values of CRP, D-dimer, ferritin, and LDH were <.001, while the procalcitonin *p* value was .004 among different groups (Table 3). Regarding the radiological findings, most of the patients (186; 88.6%) have bilateral lung affection, while 24 (11.4%) patients had unilateral lesions (Figures 1 and 2). Structural destruction was the most common finding (96, 45.7%), followed by ground-glass opacity (GGO) (78, 37.1%), atoll sign (20, 9.5%) and crazy paving (16, 7.6%) (Table 4).

4 | DISCUSSION

In December 2019, there was a worldwide outbreak of COVID-19, which began in the Chinese city of Wuhan and quickly spread throughout the world.[12] The current work reported the clinical and radiological characteristics of COVID-19 patients who attended the outpatient department (OPD) at the Mouwasat Jubail Hospital in the Kingdom of Saudi Arabia. This study was carried out between April and May 2020. The current report involved 300 patients who attended the OPD, and the majority of them complained of chest symptoms, so a respiratory triage score was performed, followed by a COVID-19 PCR swab. In addition, a chest X-ray, liver and kidney function tests, CRP and serum electrolytes were performed according to the Saudi protocol for COVID-19 management.[13] There were 210 COVID-19 cases with positive PCR results. Patients were classified according to their clinical findings into mild, moderate and severe (15%). Severe cases had hypoxia or more than 50% radiological infiltration in CT scan chest. We investigated the clinical, laboratory and radiological characteristics of 30 cases from each group (Saudi, Egyptian, Indian, Nepali, Bangladesh, Pakistani and Filipino).

The majority of patients had contact with positive cases. Both diabetes mellitus and hypertension were the main risk factors in 14.3% of the cases. About 32.4% of our patients were associated with elevated liver function tests, which matched the results of Huang and coworkers, who noticed increased levels of aspartate aminotransferase

among 25% of non-ICU patients.[13] In addition, many studies have highlighted the correlation of abnormal liver functions with severe COVID-19 disease.[14-18] In this report, COVID-19 was mainly studied in male patients. This could be attributed to the nature of the kingdom, in which the primary workers are male. This gender predominance is consistent with many previous reports.[7,13,19,20] Also, the reduced level of COVID-19 infection among female patients could be as a result of sex hormones and X chromosomes that contribute to innate and adaptive immunity.[21] The mean age of the patients was about 42 years. This is in accordance with previous reports, which more or less documented comparable age mean.[7,13,19] Regarding the duration of illness, patients presented to our chest clinic within 7.38 ± 3.48 days of the illness.

Fever and cough were the most dominant manifestations in COVID-19, while gastrointestinal upsets were less common, which suggests a variety of viral pathogenesis compared with SARS-CoV, MERS-CoV and seasonal influenza.[6,19,22] In our report, dry cough, dyspnoea and fever were the most remarkable findings, manifested in 64.8%, 51.4% and 48.6% of the studied cases, respectively. On the other hand, abdominal pain, diarrhoea and sore throat were found in 8.6% of patients, whereas fatigue was found in 6.7% of patients. The main symptoms among Egyptian patients were cough and dyspnoea, while only cough was the most remarkable finding among Saudi, Filipino and Pakistani patients. Fever was the main finding among Indian patients. Dyspnoea was mainly present among Bangladeshi and Nepali patients. Variable symptoms of COVID-19 disease were also reported by the Burke study, including cough (84%), fever (80%), myalgia (63%), chills (63%), fatigue (62%), headache (59%) and shortness of breath (57%).[23] Severe complications of COVID-19 and poor outcomes were significantly associated with high levels of inflammatory cytokines and proteins such as CRP, LDH, ferritin, PCT, D-dimer and erythrocyte sedimentation rate (ESR).[24,25] COVID-19 pathogenesis is mainly linked with dramatic inflammatory responses during lung involvement.[7] In our study, the highest levels of ferritin and LDH were observed among Bangladesh patients, while the highest CRP level was reported among Saudi patients. In addition, the most elevated levels of procalcitonin and D-dimer were mainly manifested among Nepalese patients. Indian patients have the highest levels of hypoxaemia.

Diagnosis with chest computed tomography (CT) is more intuitive and faster. Therefore, chest CT is one of the main methods used for screening and diagnosis of COVID-19.[5] Chest CT scans play an important role in the diagnosis and treatment of lung disease. Radiological terms referenced, such as ground-glass opacity (GGO), crazy-paving pattern and pulmonary consolidation, were based on the standard glossary for thoracic imaging reported by the Fleischner Society.[26] The chest X-ray may be considered insensitive in early COVID-19 infection.[27,28] However, most COVID-19 patients exhibited lung involvement in CT scan imaging patterns and radiological (X-ray) examinations, which makes them an essential method for diagnosis and evaluation of disease progression.[29] Typical chest CT scan findings of COVID-19 involve peripherally distributed multifocal ground-glass opacities (GGOs) with patchy consolidations and posterior part or lower lobe involvement predilection.[30] Increasing numbers of pulmonary lesions, extent and density of GGOs on CT scan show disease progression.[19,30]

TABLE 3 Comparison of the laboratory investigations among different ethnicities

	Egyptian	Saudi	Indian	Bangladeshi	Pakistani	Filipino	Nepali	*P* value
Ferritin median (IQR) (ng/mL)	400.0 (202-820)	261.0 (197-913)	850.0 (340-1140)	913.0 (600-1000)	650.0 (277-700)	848.0 (689.75-2000)	850.0 (560-1000)	<.001*
D-dimer median (IQR) (μg/mL)	0.42 (0.37-0.60)	0.54 (0.29-1.96)	0.59 (0.5-0.78)	0.70 (0.40-1.01)	0.70 (0.4-0.9)	0.70 (0.3-0.8)	0.80 (0.47-1.06)	.222
Lactate dehydrogenase median (IQR) (U/L)	270.0 (200-350)	248.0 (177-349)	345.0 (300-371)	500.0 (314-651)	461.0 (262-634)	358.0(302-456.5)	421.0 (287-651)	<.001*
Procalcitonin 0.5 median (IQR) (ng/mL)	0.235 (0.082-0.40)	0.079 (0.024-0.231)	0.30 (0.104-0.61)	0.20 (0.03-0.65)	0.04 (0.02-0.4)	0.20 (0.13-0.30)	0.309 (0.20-0.90)	.004*
C-reactive protein median (IQR) (mg/L)	16.0 (12-36)	261.0 (197-913)	18.0 (12-24)	24.0 (12-48)	24.(12-24)	24.0 (12-48)	42.0 (12-48)	<.001*

*Refer to statistically significant difference; (IQR): interquartile range.

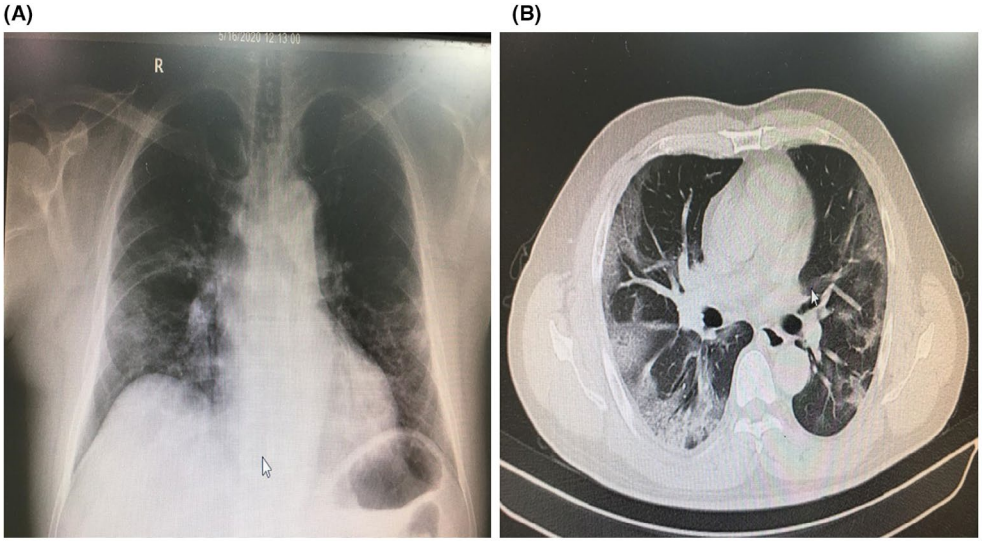

FIGURE 1 Chest radiograph of Filipino patient. A, Chest X-ray of male Filipino patient showed bilateral middle and lower zones heterogeneous opacities with preserved lung marking as well as several reticulation more on the right side; B, CT scan chest showed bilateral peripherally located patchy areas of ground-glass opacity with thickening of interlobular setae and intralobular septal thickening given the crazy paving pattern, areas of vascular dilation and minimal traction bronchiectasis are also seen

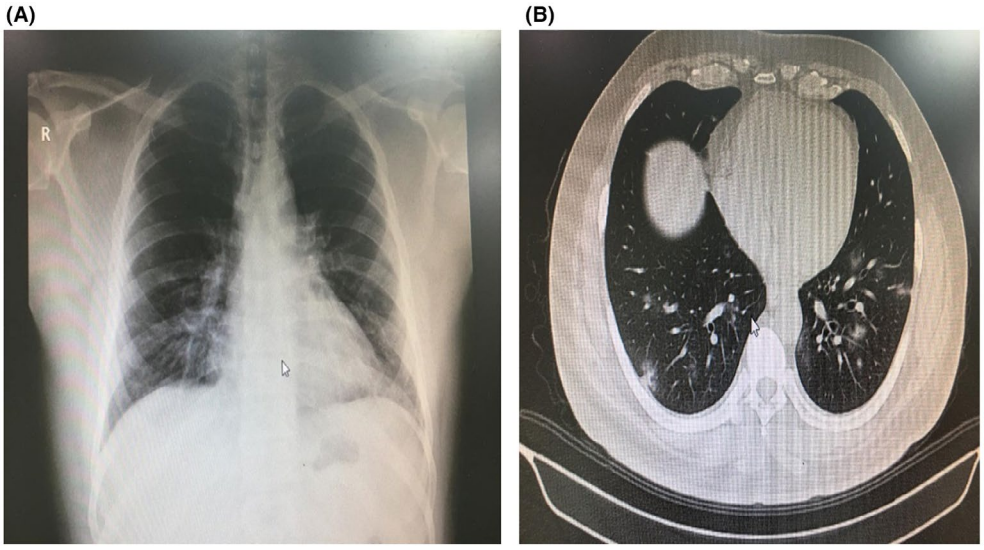

FIGURE 2 Chest radiograph of Pakistanis patient. A, Chest X-ray of Pakistanis patient showed right basal fine reticular changes; while B, CT scan chest showed bilateral lower lobes few small nodules GGO, minimal bronchiolar dilatation noted on the left side

In our study, chest radiography had little value in diagnosis in the early days of infection. The chest X-ray varied from normal findings to basal reticular infiltration, up to sporadic opacities on both sides. However, the chest CT findings were bilateral affection in about 88.6% of cases in the form of structural destruction in 45.7% of cases, ground-glass opacity in 37.1% of cases, atoll sign in 9.5% and crazy paving in 7.6% of cases. Our findings are consistent with those of an Egyptian report that included 220 patients and found that 76.36% had bilateral affection, while 23.64% had unilateral affection.[31] In our study, structural destruction was found to be the most common radiological feature, while ground glass was found to be the predominant feature among Saudi and Filipino groups. From our point of view, this differs according to the time of the patient's presentation.

5 | CONCLUSION

Understanding the association between ethnicity and COVID-19 is an essential priority in order to minimise morbidity and mortality. Our findings showed great variations in clinical, radiological and even laboratory findings among different ethnic groups. The current

TABLE 4 Radiological findings among different groups

	Ground-glass opacity (GGO)	Crazy paving	Structural destruction	Atoll sign
Egyptian	6 (20%)	0	20 (66.7%)	4 (13.3%)
Saudi	18 (60%)	4 (13.3%)	8 (26.7%)	0
Indian	10 (33.3%)	4 (13.3%)	14 (46.7%)	2 (6.7%)
Bangladeshi	8 (26.7%)	4 (13.3%)	16 (53.5%)	2 (6.7%)
Pakistani	10 (33.3%)	2 (6.7%)	16 (53.3%)	2 (6.7%)
Filipino	24 (80%)	2 (6.7%)	2 (6.7%)	2 (6.7%)
Nepali	2 (6.7%)	0	20 (66.7%)	8 (26.7%)
Total	78 (37.1%)	16 (7.6)	96 (45.7%)	20 (9.5%)

report is of clinical and public health significance to provide an overview of disease behaviour among different ethnicities. However, there are some limitations to the current work, involving low numbers of study subjects and the absence of the female gender for proper sex comparison. In addition, the current study did not cover all of the world's ethnicities.

DISCLOSURE

The authors declared no conflict of interest.

AUTHOR CONTRIBUTIONS

Conceptualisation, MAFK; OLN; SAA; EEM; RIA and MIA Methodology, OLN; SAA; EEM; RIA and MIA Writing—original draft preparation, MAFK; OLN; SAA; EEM; RIA and MIA Writing—review and editing, MAFK Statistical analysis and supervision RIA and MIA All authors have read and agreed to the published version of the manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in the supplementary material of this article.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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