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ORIGINAL ARTICLE

CHEST COMPUTED TOMOGRAPHIC IMAGING FINDINGS AND CLINICAL CRITERIA OF COVID-19 IN ZAGAZIG UNIVERSITY HOSPITALS, EGYPT.

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ABSTRACT

Background: COVID-19 pneumonia patients have variant prognosis and mortality. A great concern should be given to the clinical and imaging characteristics of those patients, As a result, the aim of current research was to identify clinical, laboratory, and chest computed tomography results in confirmed COVID -19 patients, as well as to compare severe patients to non-severe groups. **Methods**: In a retrospective cross-sectional analysis, 169 confirmed COVID-19 individuals were enrolled. Computerized medical reports and images were used. **Results:** The enrolled individuals were classified into asymptomatic: 2 patients (1.2%), mild: 33 patients (19.5%), moderate: 103 patients (60.9%) and severe: 31 patients (18.3%). Fever, cough, shortness of breath were significantly more frequent symptoms in severely infected COVID patients (p=0.001). Moreover, a highly significant decrease in SPO2(p=0.00), a remarkable increase in WBCs (p=0.002), and a significant increase in CRP and Ferritin were detected in that group (p=0.00). The chest "high resolution computed tomography findings were associated with multiple lesions in both lungs and more GGO with consolidation (p<0.05). Crazy pavement, septal thickening, and subpleural thickening were also significantly presented in severe COVID pneumonia rather than other groups (p<0.05). **Conclusion:** Occurrence of clinical factors including aging, cough, fever, dyspnea, comorbidities, hypoxemia, increased WBCs, increased CRP, and ferritin were more prevalent in severe COVID-19 pneumonia. GGO with consolidation and Septal thickening were independent predictors of COVID pneumonia severity findings in HRCT.The use of computed tomography in the diagnosis and assessment of illness severity is crucial.

Keywords: COVID-19, Chest high resolution computed tomography , Ground Glass Opacities (GGO).

INTRODUCTION

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2)-caused Corona Virus Disease 2019 (COVID-19) has been spreading over the world, posing a hazard to the global public health. COVID-19 infection produces a wide range of respiratory illnesses, from mild pneumonia to Acute Respiratory Distress Syndrome, which can be fatal (ARDS) **[1,2]**. To reduce the disease's consequences and mortality, it's vital to identify and treat severe and critical cases of COVID-19 at the earliest possible stage. Many research has been conducted to identify illness severity-related characteristics in clinical practice, and various clinical, laboratory, and imaging indicators have been identified as predictors of disease severity **[2,3]**. Owing to the feasibility of administration and quick diagnosis, a chest CT scan is a commonly utilized imaging tool for the earlier identification and monitoring of people affected by COVID-19. Typical CT characteristics of confirmed COVID-19 pneumonia cases have been proven to aid in determining the severity and scope of the infection **[4,5]**. Assessing chest CT characteristics across the spectrum of COVID-19 infection clinical presentation can assist in predicting prognosis and enhance clinical decision-making. Therefore, the aim of current work was to identify clinical, laboratory, and chest computed tomography (CT) findings in confirmed COVID -19 patients and to compare severe patients with other non-severe groups.

PATIENTS AND METHODS

This study was conducted in outpatient isolation clinics and Radiodiagnosis Departments at Zagazig University Hospitals during the period of June 2020 to September 2020. It was approved by the "Institutional Review Board of Zagazig University" (IRB-ZU). The current work was done according to the World Medical Association's Code of Ethics (Declaration of Helsinki) for human studies. All patients signed written informed consent forms.

PATIENTS

This retrospective cross-sectional study included (169) patients who were already diagnosed as COVID-19 cases. Their radiological laboratory and clinical data were collected from computerized medical reports and images. They were (40.2%) males and (59.8%) females, and the average age was (44.51±14.6) years.

Patients involved in this study were clinically suspected to be infected with COVID-19 as per Egyptian MOH criteria (version 1.4, May 2020) and confirmed by positive results on "real-time reverse transcriptase-polymerase-chain-reaction" (RT-PCR) assay of nasal and pharyngeal swab specimens. Patients with incomplete data were excluded.

METHODS

Patient's data were reviewed with recording history taking focusing on: fever, loss of smell and taste, sore throat, cough, drowsiness, shortness of breath, GIT symptoms, bonny aches, fatigue, headache, presence of comorbidities, and assessment of COVID-19 severity of infection. Laboratory investigations in the form of white blood cells, percent of lymphocytes, serum ferritin, CRP, D-dimer, Oxygen saturation were included.

The images of high-resolution chest computed tomography image were analyzed separately and blindly according to the following criteria: (1) distribution: peripheral, diffuse, or central; (2) lesion number: single lesion or multiple lesions either in one lobe or more than one lobe affecting one lung or both lungs; (3) lesion attenuation: existence of ground-glass opacities, mixed ground-glass opacities with consolidation, or consolidation; (4) number of lobes altered by ground-glass or consolidative opacities; (5) associated radiological findings: the existence of bronchiectasis, thoracic lymphadenopathy (defined as lymph node size of ≥ 10 mm in short-axis dimension), pleural effusion, crazy paving, bronchial wall thickening, air bronchogram, tree in bud, interlobular septal thickening and subpleural lines. Consolidation was described as opacification with obscuration of vessel and airway edges, while ground-glass opacification was characterized as hazy enhanced lung attenuation with preservation of bronchial and vascular borders **[6].**

According to the Egyptian Ministry of Health and Population's COVID-19 management guideline (2020), patients were further divided into asymptomatic, mild, moderate, and severe groups

STATISTICAL ANALYSIS

Quantitative Data were displayed as mean ± SD and analyzed by one-way analysis for variance (F test). Qualitative data was presented by number and percentage and analyzed by Chi-square test or Fisher exact test when appropriate. The correlation coefficient (r) was used to highlight the relationship between quantitative variables. A P-value of <0.05 is considered significant.

RESULTS

This study included 169 patients, their mean age (44.51±14.6) years, (59.8%) females and (40.2%) males, most of them (50.9%) were medical staff (Table 1).

They were further classified into Asymptomatic: 2 patients (1.2%), mild: 33 patients (19.5%), moderate: 103 patients (60.9%) and severe: 31patients (18.3%). In this study, severe COVID patients (with their mean age 59.6±18) were significantly older than those in moderate, mild, or asymptomatic groups of patients (p=0.001).

The results of the present study clarified that 62.1% of moderately infected patients were females while 58.1% of the severe group were males without reaching a significant difference (p=0.09). 87.1% of severely infected COVID patients were non-medical staff, while in moderate, mild, and asymptomatic groups of severity, the medical staff was presented with significant difference (p=0.00). Regarding the time of CT performance from the onset of symptoms, in the current study, mild cases underwent CT earlier than moderate and severe cases. As duration between symptoms onset and CT performance was 4.61±5.35 days in mild cases versus 4.91±2.95, 6.77±1.86 in moderate and severe cases, respectively.

Fever, which represented 89.3%, was the most predominant symptom, followed by cough (81.1%), shortness of breath (67.7%), bonny aches (57.4%), fatigue (56.2%), sore throat (46.7%), loss of taste (36.7%), headache (32.5%) and the least was GIT symptoms (31.4%).

Among the studied patients, the most frequent comorbidities were diabetes mellitus (7.7%) and hypertension (7.7%), followed by others (5.3%); renal or hepatic impairment, (4.7 %) were both hypertensive and diabetics, and (0.6%) suffered from cardiac diseases. It was clear that fever, cough, shortness of breath were remarkably more frequent symptoms in severely infected COVID patients; besides, they were significantly associated with comorbidities (p=0.001) (Table 2).

A highly considerable decrease in SPO2 (p=0.00) and a significant increase of WBCs were observed in severe COVID patients (p=0.002), while a remarkable increase in CRP and Ferritin was detected in those patients (p=0.00) (Table 3).

The current work revealed that peripheral distribution was significantly high in severe patients, followed by diffuse distribution and central distribution. Also, severe COVID pneumonia was associated with multiple lesions in both lungs (p<0.05). In moderate cases, GGO was the most common finding (55.3%) versus (16.1%) in severe cases; however, GGO with consolidation was most common in severe cases (54.8%). The frequently affected lobes in both moderate and severe groups were successively the lower right lobe, the lower left lobe, the middle right lobe, and less often the upper left lobe and the upper right lobe (Table 4). (Fig 1)

Associated radiological findings as bronchiectasis (41.9%), Crazy paving (61.2%), septal thickening (77.4%), and subpleural thickening (60%) were significantly presented in the severe group (p<0.05) (Table 5). (Fig 2,3)

Herein, the multivariate logistic regression for independent predictors of severity of COVID pneumonia showed that only GGO with consolidation and Septal thickening were independent predictors of COVID pneumonia severity in HRCT (p=0.02,0.001) respectively (Table 6).

Table1.Demographic characteristics of studied patients in relation to severity

			Severity				X^2	P
			Asymptomatic N=2	Mild N=33	Moderate N=103	Severe N=31		
Age	**Mean ± SD**		**31.5 ± 12.02**	**37.4 ±13.26**	**42.47±12.56**	**59.6±18**	**16.573**	**0.00***
Gender	**Female**	**101 (59.8%)**	**2 (100.0%)**	**22 (66.7%)**	**64 (62.1%)**	**13 (41.9%)**	**6.33**	**0.096**
	Male	**68 (40.2%)**	**0 (0.0%)**	**11 (33.3%)**	**39 (37.9%)**	**18 (58.1%)**		
Occupation	**Non Medical staff**	**83 (49.1%)**	**0 (0.0%)**	**7 (21.2%)**	**49 (47.6%)**	**27 (87.1%)**	**30.2**	**0.00***
	Medical staff	**86 (50.9%)**	**2 (100.0%)**	**26 (78.8%)**	**54 (52.4%)**	**4 (12.9%)**		
CT from onset of sympt.	**Mean ± SD**		**-**	**4.61±5.35**	**4.91±2.95**	**6.77±1.86**	**4.33**	**0.006***

Table 2. Frequencies of symptoms and comorbidities among severity groups

	N%	Mild 33 (100 %)	Moderate 103 (100 %)	Severe 31 (100 %)	X^2	P
Cough(N%)	**137(81.1)**	**22(66.7%)**	**85(82.5%)**	**30(96.8%)**	**18.14**	**0.00***
Fever(N%)	**151(89.3)**	**32 (97.0%)**	**89(86.4%)**	**30(96.8%)**	**21.52**	**0.00***
Loss of taste(N%)	**62(36.7)**	**12 (36.4%)**	**44(42.7%)**	**6(19.4%)**	**6.78**	**0.079**
Sore throat(N%)	**79(46.7)**	**16 (48.5%)**	**52(50.5%)**	**11(35.5%)**	**3.95**	**0.26**
Bone aches(N%)	**97(57.4)**	**17(51.5%)**	**62(60.2%)**	**18(58.1%)**	**3.49**	**0.32**
Fatigue(N%)	**95 (56.2)**	**18(54.5%)**	**60(58.3%)**	**17(54.8%)**	**2.81**	**0.42**
Shortness of breath(N%)	**113 (67.7)**	**10(30.3%)**	**72(69.9%)**	**31(100%)**	**45.3**	**0.00***
GIT disturbances (N%)	**53(31.4)**	**10(30.3%)**	**37(35.9%)**	**6(19.4%)**	**4.0**	**0.26**
Headache (N%)	**55(32.5)**	**11(33.3%)**	**33(32.0%)**	**11(35.5%)**	**1.1**	**0.77**
Comorbidities	**Distribution**					
HTN (N%)	**13(7.7%)**	**0(0.0%)**	**8(7.8%)**	**5(16.1%)**	**74.85**	**0.00**
DM(N%)	**13(7.7%)**	**2(6.1%)**	**5(4.9%)**	**6(19.4%)**		
HTN& DM (N%)	**8(4.7%)**	**2(6.1%)**	**3(2.9%)**	**3(9.7%)**		
Cardiac(N%)	**1(0.6%)**	**0(0.0%)**	**0(0.0%)**	**1(3.2%)**		
Other	**9(5.3%)**	**0(0.0%)**	**4(3.9%)**	**5(16.1 %)**		

Table 3. Relation of laboratory findings and severity of COVID infection.

	Mild(n=33) mean±SD	Moderate (n=103) mean±SD	Severe(n=31) mean±SD	X2	P
SPO2	**96.48±1.50**	**96.26±1.74**	**81.96±6.4**	**178.006**	**0.00****
WBCs	**7.25±2.31**	**7.84±3.32**	**11.35±5.29**	**5.236**	**0.002***
Lymphocytes	**1.67±0.71741**	**1.57±0.98**	**1.51±0.83**	**0.511**	**0.675**
Platelets	**248.12±74.41**	**243.25±70.07**	**207.81±82.26**	**1.914**	**0.129**
D dimer	**0.86±0.75**	**0.88±0.04**	**1.26±1.06**	**0.622**	**0.541**
CRP	**20.17±18.9**	**39.65±31.74**	**121.92±95.79**	**13.335**	**0.00****
Ferritin	**160.44±16.379**	**507.6±91.992**	**1198.71±71.687**	**15.36**	**0.00***

Table 4. HRCT findings and its distribution with Severity of COVID infection

HRCT Findings	Distribution		Moderate 103(100 %)	Severe 31(100 %)		
Lesion distribution	**Central**	**N %**	**2 (1.9%)**	**4 (12.9%)**	**8.41**	**0.003***
	Peripheral	**N %**	**86(83.4%)**	**31(100%)**	**4.63**	**0.03***
	Diffuse	**N %**	**25(24.2%)**	**24(77%)**	**29.3**	**0.00****
Lesion_no	**Single lesion**	**N %**	**14(13.5%)**	**0(0.0%)**	**10.01**	**0.01***
	Multiple lesions/one lobe	**N %**	**19(18.4%)**	**0(0.0%)**		
	Multiple lesions in more than one lobe/1 lung:	**N %**	**27(26.2%)**	**7(6.7%)**		
	Multiple lesions in inboth lungs	**N %**	**43(41.7%)**	**24(77.4%)**		
lesion_att	GGO	**N%**	**57(55.3%)**	**5(16.1%)**	**7.21**	**0.026***
	Consolidation	**N %**	**16(15.5%)**	**9(29%)**		
	GGO with consolidation	**N %**	**30(29.0%)**	**17(54.8%)**		
Lobe_no	Rt lower lobe	**N %**	**62(60.2%)**	**31(100%)**	**5.49**	**0.23**
	Lt lower lobe	**N %**	**58(56.3%)**	**31(100%)**		
	Rt middle lobe	**N %**	**28(27.2%)**	**27(87.1%)**		
	Lt upper lobe	**N %**	**25(24.3%)**	**25(80.6%)**		
	Rt upper lobe	**N %**	**19(18.4%)**	**22(70.9%)**		

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Table 5. Associated radiological findings and severity of COVID infection

		Moderate 103 (100 %)	Severe 31(100 %)	X^2	P
Bronchiectasis	**N%**	**23(22.3%)**	**13 (41.9%)**	**5.74**	**0.016***
LN	**N%**	**2(1.9%)**	**8(25.8%)**	**0.56**	**0.45**
Pleural eff	**N%**	**12(11.7%)**	**9(29%)**	**0.03**	**0.84**
Crazy pav	**N%**	**39(37.9%)**	**19(61.2%)**	**5.32**	**0.02***
Bronchial wall	**N%**	**28(27.2%)**	**20(64.5%)**	**2.44**	**0.11**
Air broncho	**N %**	**37(35.9%)**	**19(61.2%)**	**0.002**	**0.96**
Tree in bud	**N%**	**34(33.0%)**	**14(45.2%)**	**1.52**	**0.21**
Septal thick	**N %**	**57(55.3%)**	**24(77.4%)**	**19.4**	**0.00****
Subpleural line	**N%**	**40(38.8%)**	**19(60.0%)**	**4.82**	**0.022***

Table 6. Multivariate logistic regression for independent predictors of severity of COVID pneumonia

Factor	Wald	P	OR	CI 95%
Multiple lesion	1.58	0.415	2.088	(0.63-11.89)
GGO with consolidation	3.258	0.02*	3.52	(1.58-9.63)
Crazy pav	1.987	0.112	1.63	(0.82-13.25)
Septal thick	4.856	0.001**	4.88	(2.13-8.22)
Subpleural line	1.958	0.138	2.53	(0.98-22.3)

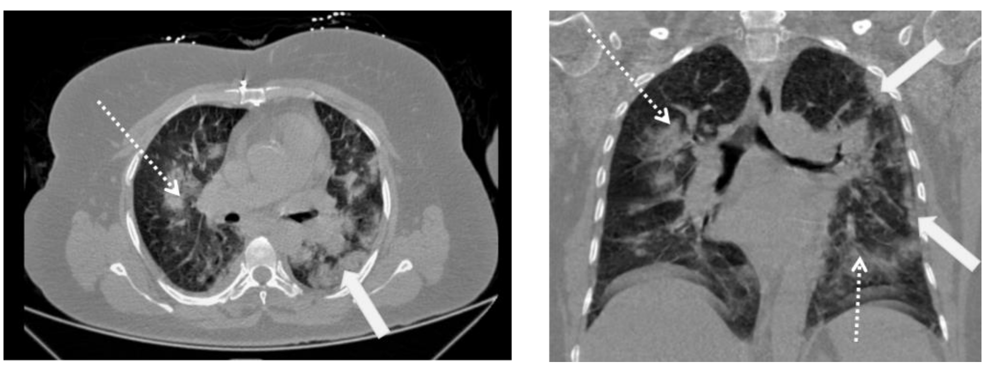

Figure 1: High resolution computed tomography shows bilateral multilobar areas of ground glass opacities mainly in the hilar region (**dashed thin white arrows**) and areas of consolidation mixed with GGO's are detected in the periphery and basal lung fields (**thick white arrow**).

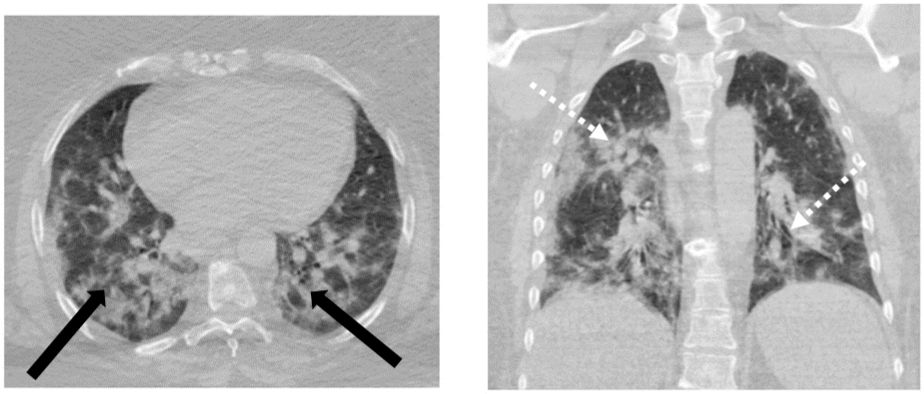

Figure 2: High resolution computed tomographic axial sections and coronal reconstruction images shows bilateral multilobar areas of bronchial wall thickening with cluster areas of ground glass opacities **(black thick arrows).** Peri-bronchial cuffing and interstitial septal thickening **(white thin dashed arrows).** There are areas of consolidation with air bronchogram in the basal and posterior lung aspects in both sides. There are areas of basal pleural thickening, however no pleural effusion. No lymphadenopathy.

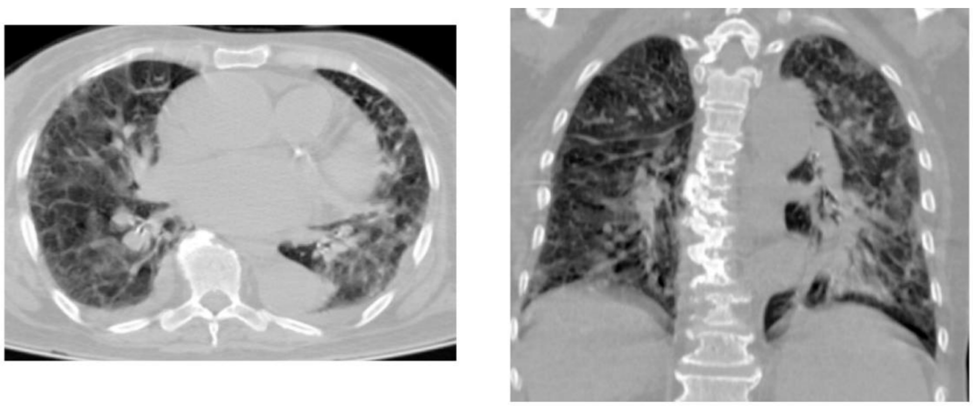

Figure 3: High resolution computed tomographic images ,axial sections and coronal reconstruction images shows bilateral multilobar areas of diffuse ground glass opacities with ill-defined pattern of distribution. Areas of consolidation are noted in the left lower lobe (**thick white arrow**). Both lungs show interstitial septal thickening with bronchial wall thickening. Bilateral minimal pleural effusion. No lymphadenopathy. Note: Tortuous descending aorta and anterior osteophytes of the spine (**white thin dashed arrows**).

DISCUSSION

Severe COVID-19 pneumonia patients had a poor prognosis and high mortality compared with the non-severe groups **[7,8]**. Studying the imaging and clinical characteristics of those patients can help in gaining a better knowledge of how severe/critical illnesses work, as well as in boosting clinical diagnosis and therapy.

Based on that, the present work was implemented to identify clinical, laboratory, and chest computed tomography (CT) findings in confirmed COVID -19 patients and comparing severe patients with other non-severe groups.

Two cases in the current investigation had positive "RT-PCR SARS-CoV-2" tests while being negative clinically and on chest HRCT imaging. The same result was observed by Kunwei et al.2020; their findings revealed six patients had no clinical and radiologic findings, implying that these instances were potential sources of infection and that more attention should be devoted to them **[9].**

Patients in the severe COVID group were found to be older than those in the asymptomatic, mild, or moderate COVID categories (Table 1). Serious diseases afflict elderly persons in poor health, which could be the result of reduced immune functions **[10]**. Without reaching a significant difference, 62.1% of moderately infected patients were females, whereas 58.1% of severely infected patients were males, demonstrating that sex was not a risk factor for illness severity **[11]**.

A recent meta-analysis concluded that infection, severe disease, ICU admission, and death are predominant among males **[12]**. Our results may be different due to the fact that a relatively larger proportion of medical personals included in this study were females.

In regards to occupation, 87.1% of severely infected COVID patients were non-medical, while medical staff was significantly presented in moderate, mild, and asymptomatic groups. These findings are in accordance with Sahu et al. meta-analysis **[13]**, which found that infected COVID-19 health care workers (HCW) made up a considerable fraction of all COVID-19 patients, but their severity and death were lower. These findings could be explained by HCWs' younger age and lower comorbidity prevalence when compared to non-HCWs **[14]**. This could also be attributable to HCWs' early access to health-care services, as well as their improved knowledge and understanding of the disease process.

In the current study, mild cases had CT earlier than moderate and severe cases in terms of time from the beginning of symptoms. It's possible that poor CT performance early is linked to high severity. According to Yun et al. **[15]**, the most severe lung damage in the majority of COVID-19 patients occurred around day 13 after the onset of symptoms. Periodic chest CT scans in COVID-19 patients are indicated (at least once every five days during the first 13–15 days) and may provide important information to guide clinical treatment.

Fever, cough, shortness of breath, and comorbidities were significantly more represented in severely infected COVID patients than in the moderate group (Table 2); the same results were reported by El-Shabrawy et al. **[16]**. The immune system of severe patients was significantly stimulated, as seen by their elevated temperature **[17]**.

According to Liu et al. **[18]**, diabetes had a 4.82 (95% CI: 1.55–16.64; P = 0.01) times higher risk of worsening illness severity than those without diabetes. At autopsy, it was discovered that the basement membrane of the lung is thicker in diabetic individuals, which may impact pulmonary diffusion function **[19]**. Furthermore, hypertension patients were more frequently associated with severe COVID-19 pneumonia; it is well recognized that ACE2 is an important regulator of heart activities, which could explain this finding **[20]**.

In this study, significantly low SPO2 and significantly high WBCs, CRP, and ferritin were observed in the severe group. Lymphocytes were decreasing with the severity of the disease but did not reach a significant difference (Table 3). Such a decrease in severe/critical patients implies that a high number of immune cells have been consumed and the immune activity has been suppressed, and it could be used as a measure of disease severity **[5]**. According to Chen et al. **[10]**, high WBC, C-reactive protein, and ferritin levels in the severe group were linked to a cytokine storm generated by viral invasion and combined with other infections. Other researchers concluded that older age, comorbidities impaired oxygenation, increased CRP, elevated D-dimer, and high serum ferritin level were all linked to severe illness or death **[21,22]**.

Regarding lesion distribution, the current work revealed that peripheral distribution is significantly high in severe patients followed by diffuse distribution, then central distribution. In addition, multiple lesions in both lungs were found to be more in severe patients (Table 4). This is in line with the findings of Yun et al. **[15]** and Hashemi-madani et al. **[23]**, who found that in severe instances of COVID-19, bilateral lung involvement is 3.44 times more probable than in the common type.

In moderate cases, GGO was the most common finding (55.3%) versus (16.1 %) in severe cases; however, GGO with consolidation was the most common in severe cases (54.8%). This is similar to Zhao et al. **[4]**, who concluded that mixed GGO and consolidation were associated with 64.3% of emergency cases; nevertheless, his results were nearly the same as in non-emergency cases. In accordance with the current results, Ragab et al. **[20]**, concluded that the ground glass opacities (GGOs) were more common in non-severe cases than in severe cases (77.6% Vs 22.4 %) also consolidation was greater in severe cases than in non-severe (51.1% Vs 48.9 %). Consolidated tissue is much more radio-opaque than typically aerated lung parenchyma, demonstrating that inflammatory exudation, hemorrhage, or pus have completely filled the alveoli. This usually signifies that the virus has spread across the respiratory epithelium, causing diffuse alveolar damage and necrotizing bronchitis **[5]**, which indicates the degree of lung involvement.

The current study showed that the most frequently affected lobes in both moderate and severe groups were the lower right lobe, followed by the lower left lobe, then middle right lobe, and less often the upper left lobe and the upper right lobe (Table 4). In terms of lobar involvement, although there was no discernible difference between severe and moderate individuals, our results were similar to that reported by Li et al. **5** and Kunwei et al. **[9]**, also Francone et al. **[24]**, found that the mean CT score in RLL was considerably higher than in ML (p<0.0001) and in RUL (p<0.0001). Furthermore, the mean CT score in the left lung was significantly greater in LLL than in LUL (p<0.0001).

Associated radiological findings as bronchiectasis (41.9%), Crazy paving (61.2%), septal thickening (77.4%), and subpleural thickening(60%) were significantly more present in the severe group (p<0.05) (Table 5).

Bronchiectasis was the most common COVID-19-related airway alteration **[25]**, accounting for 10–20 percent of cases **[26]**. This indicates that both bronchial obstruction and inflammatory distortion of the bronchial wall resulted in the breakdown of bronchial wall structures and lead to bronchiectasis **[6]**. A recent study indicated that individuals with severe/critical COVID-19 had a much higher percentage of bronchial wall thickening. Moreover, the presence of alveolar edema and inflammation of the interstitial tissues suggests Crazy paving **[26]**. This was the case in 5–36% of COVID-19 patients **[5]**. When GGOs and consolidations are present, it is thought to be an indication of progression or a peak stage **[27]**.

In the current study, 29% of severe cases had pleural effusion versus 11.7% in the moderate group, while 25.8% of severe patients had LN enlargement versus 1.9% in the moderate group. The existence of pleural effusion has been considered as a predictor of a poorer prognosis. In addition, LN enlargement has been identified as a risk indicator for COVID-19-patients with severe/critical pneumonia in a small percentage of cases (4–8%) **[5]**. According to some researchers, the presence of lymphadenopathies in conjunction with pleural effusion and small lung nodules showed bacterial superinfection **[28,29,30]**.

In contrary to our results, Ragab et al. **[20**] reported that crazy paving, septal lines, and lymphadenopathy were more presented in the non-severe cases (87.1%, 81.8 %, 61.1%, respectively).

Multivariate regression analysis of the most relevant radiological finding for severity among patients with COVID-19 revealed that GGO with consolidation (OR: 3.52; 95% CI: 1.58-9.63; $P = 0.02$) and septal thickening (OR: 4.88; 95% CI: (2.13-8.22); $P = 0.001$) are the most significant finding. Similarly, Xie et al. **[31]** had found that GGO with consolidation (OR: 31.084; 95% CI: 0.272–1033.61; $P = 0.018$) was a significant independent predictor of severity of COVID-19 patients. Additionally, Liu et al. **[32]** concluded that in severe COVID and critical group, the GGO, fibrosis, and pleural thickening or adhesion could be found in every follow-up CT and were the main persistent radiological signs in follow up CTs than those of moderate group.

LIMITATION

First, this study is a retrospective one that includes a small number of cases who had been diagnosed with SARS-CoV-2 infection. Second, because this was a cross-sectional study, we were unable to examine the dynamic CT changes at various stages. Using bigger, more diverse samples, we will study the chest CT features of COVID-19 differential phases in the future. Finally, the data from the two groups were not evenly distributed, and the severe/critical group's sample size was tiny. Additional research with more patients, particularly severe/critical patients, is needed.

CONCLUSION

To sum up, the occurrence of clinical factors; aging, cough, fever, dyspnea, comorbidities, hypoxemia, increased WBCs, and increased CRP and ferritin were more prevalent in severe COVID-19 pneumonia. GGO with consolidation and septal thickening were the most relevant radiological findings for severity in multivariate regression analysis. The use of computed tomography in the diagnosis and assessment of illness severity is crucial.

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