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Radiological findings from 200 patients with COVID-19 pneumonia- A descriptive study

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Abstract
Background: The pathogen responsible for the respiratory illness was a novel strain of the family Corona viradae, which is similar to two previous epidemics, namely Middle Eastern Respiratory Syndrome (MERS) and severe acute respiratory syndrome (SARS). The present study was conducted to assess radiological findings in COVID- 19 patients.
Materials and Methods: 200 COVID- 19 patients were enrolled. Based on the time interval between onset of symptoms and the CT scan, 4 groups of 50 patients were created. Group 1 (subclinical cases, in which CT scans were done before onset of symptoms); group 2 (CT scans done ≤1 week after symptom onset); group 3 (CT scans done >1 to 2 weeks after symptom onset); and group 4 (CT scans done >2 weeks to 3 weeks after symptom onset). All patients underwent CT scans.
Results: Group I had 30 males and 20 females, group II had 22 males and 28 females, group III had 25 males and 25 females and group IV had 24 males and 26 females. Common clinical features were cough seen in 76%, 48% and 31%, dyspnoea in 62%, 72% and 45%, chest tightness in 80%, 55% and 25%, diarrhoea in 34%, 25% and 6%, vomiting in 54%, 15% and 14% and fever in 95%, 82% and 30% in group II, III and IV respectively. The difference was significant ($P< 0.05$). The mean lung segments involved were 3.4 in group I, 10.2 in group II, 13.1 in group III and 12.7 in group IV. Pattern involved was Bilateral seen in 40%, 25%, 2% and 5%, peripheral in 20%, 20%, 25% and 5%, ill- defined in 25%, 15%, 28% and 30% and ground-glass opacification in 15%, 30%, 45% and 60% respectively. The difference was significant ($P< 0.05$).
Conclusion: Most common radiological feature found in COVID- 19 affected patients was ground-glass opacification.

Keywords: COVID- 19, MERS, opacification

Introduction

During 2020, the COVID-19/SARS-CoV2 (COVID-19), sometimes referred to as the "coronavirus," has been the cause of a major viral respiratory infection global pandemic [1]. At the time of this publication, the US Centers for Disease Control and Prevention (CDC) had listed the following symptoms associated with COVID-19 infections: fever, chills, cough, shortness of breath, fatigue, body aches, headache, new onset of loss of taste or smell, sore throat, congestion, runny nose, nausea/vomiting, and diarrhea [2].

Patients with moderate or severe symptoms should generally be hospitalized. Moderate COVID-19 infection has been defined as having dyspnea (i.e., shortness of breath) but having a blood oxygen saturation level of <94% on room air. Severe COVID-19 infection have been defined as someone with marked tachypnea with need of invasive/ non-invasive ventillation, hypoxemia (SPO2 <90% on room air), and lung infiltrates. Unfortunately, there has yet to be any validated treatments for COVID-19 at the time of this publication [3].

Patients who are hospitalized generally need to be frequently monitored and provided supportive respiratory therapy. Until there is an approved COVID-19 treatment, individuals are advised to continue to self-isolate, wash their hands frequently, and wear the appropriate personal protective equipment (PPE) when around those infected with COVID-19. The radiological changes in the lungs of people with COVID-19 pneumonia have not been fully characterised. CT is important in the diagnosis and treatment of lung diseases [4]. Imaging features of COVID-19 pneumonia are diverse, ranging from normal appearance to diffuse changes in the lungs. In addition, different radiological patterns are observed at different times throughout the disease course.

Because the time between onset of symptoms and the development of acute respiratory distress syndrome (ARDS) was as short as 9 days among the initial patients with COVID-19 pneumonia, early recognition of the disease is essential for the management of these patients [5]. The present study was conducted to assess radiological findings in COVID- 19 patients.

Materials and Methods

The present study comprised of 200 COVID- 19 patients. All were informed and their written consent was obtained.

Demographic data such as name, age, gender etc. was recorded. All cases were confirmed by real-time RT-PCR analysis of throat swab specimens. Based on the time interval between onset of symptoms and the CT scan. 4 groups of 50 patients were created based on duration of symptoms. Group 1 (subclinical cases, in which CT scans were done before onset of symptoms); group 2 (CT scans done ≤1 week after symptom onset); group 3 (CT scans done >1 to 2 weeks after symptom onset); and group 4 (CT scans done >2 weeks to 3 weeks after symptom onset).

All patients underwent CT scans were obtained with patients in the supine position, using one of the following scanners SOMATOM Definition AS+ with following parameters were used: detector collimation widths 64 × 0·6 mm, 128 × 0·6 mm, 64 × 0·6 mm, and 64 × 0·6 mm; and tube voltage 120 kV. Scans were read by experienced radiologists. Results were clubbed and analysed using appropriate statistical test with p value less than 0.05 as significant.

Results

Table 1: Distribution of patients

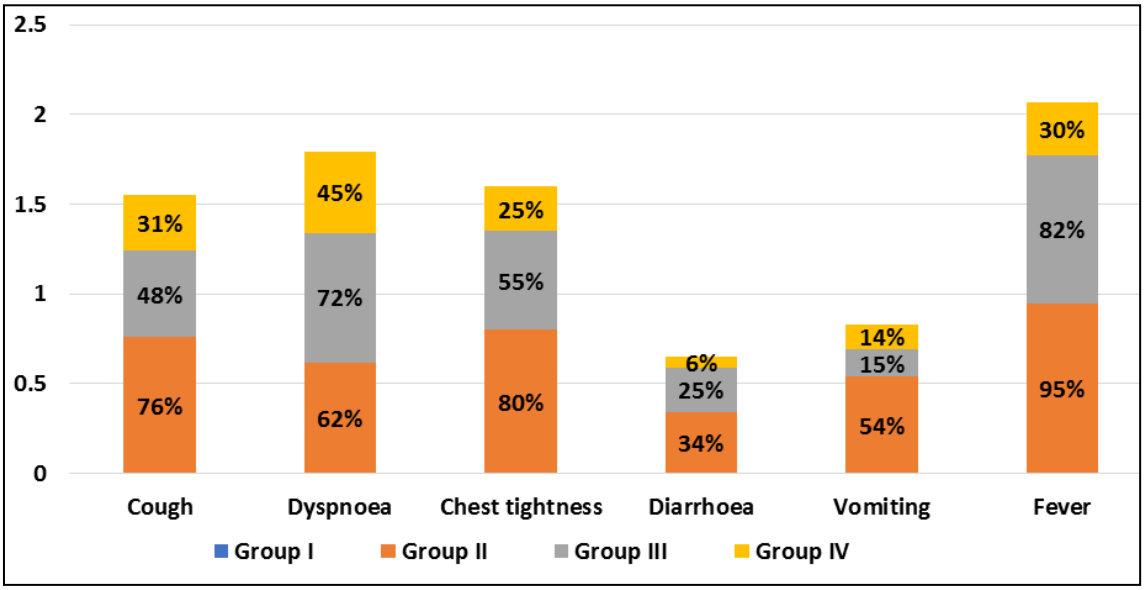
Groups	Group I	Group II	Group III	Group IV
CT scan	Before symptoms onset	≤1 week	>1 to 2 weeks after symptom	>2 weeks to 3 weeks
M:F	30:20	22:28	25:25	24:26

Table I shows that group I had 30 males and 20 females, group II had 22 males and 28 females, group III had 25 males and 25 females and group IV had 24 males and 26 females.

Table 2: Clinical features

Features	Group I	Group II	Group III	Group IV	P value
Cough	0	76%	48%	31%	0.02
Dyspnoea	0	62%	72%	45%	0.01
Chest tightness	0	80%	55%	25%	0.04
Diarrhoea	0	34%	25%	6%	0.03
Vomiting	0	54%	15%	14%	0.01
Fever	0	95%	82%	30%	0.05

Table II, graph I shows that common clinical features were cough seen in 76%, 48% and 31%, dyspnoea in 62%, 72% and 45%, chest tightness in 80%, 55% and 25%, diarrhoea in 34%, 25% and 6%, vomiting in 54%, 15% and 14% and fever in 95%, 82% and 30% in group II, III and IV respectively. The difference was significant (P< 0.05).



Graph 1: Clinical features

Table 2: Radiological findings

Variables	Parameters	Group I	Group II	Group III	Group IV	P value
Mean lung segments		3.4	10.2	13.1	12.7	0.01
Pattern	Bilateral	40%	25%	2%	5%	0.05
	Peripheral	20%	20%	25%	5%	
	Il defined	25%	15%	28%	30%	
	Ground-glass opacification	15%	30%	45%	60%	

Table II shows that mean lung segments involved were 3.4 in group I, 10.2 in group II, 13.1 in group III and 12.7 in group IV. Pattern involved was Bilateral seen in 40%, 25%, 2% and 5%, peripheral in 20%, 20%, 25% and 5%, ill-defined in 25%, 15%, 28% and 30% and ground-glass opacification in 15%, 30%, 45% and 60% respectively. The difference was significant ($P< 0.05$).

Discussion

The coronavirus related pandemic is one of the deadliest known epidemics in recent times. These numbers are increasing exponentially and, with no definitive treatment or available vaccine in sight, creating havoc for the health and financial systems of the world. The earliest reported cases were in Wuhan, the capital city of Hubei province in China. These cases were treated as pneumonia of an unknown origin. As the disease spread, China alarmed the World Health Organization (WHO) of the presence in Wuhan of several cases of an unusual type of pneumonia [6]. Researchers discovered that the pathogen responsible for the respiratory illness was a novel strain of the family Corona viradae, which is similar to two previous epidemics, namely Middle Eastern Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) [7]. This new illness was named SARS-CoV-2 by the International Committee on Taxonomy of Viruses (ICTV) on February 11, 2020. The WHO officially labelled the disease caused by SARS-CoV-2 as COVID-19 in the International Classification of Diseases (ICD) [8].

The radiological perspective used for disease assessment and follow-up is very helpful. It provides a direct insight into the pathophysiology of the disease process. As the coronavirus related respiratory illness presents clinically as pneumonia, predominant imaging findings are that of an atypical or organizing pneumonia [9]. Although chest X-rays are less sensitive than CT scans, the former may be used as a first-line approach because of their availability and ease of decontamination. Chest X-ray findings may be normal earlier in the clinical course and tend to peak 10-12 days after the onset of clinical symptoms [10]. The present study was conducted to assess radiological findings in COVID- 19 patients.

In present study group I had 30 males and 20 females, group II had 22 males and 28 females, group III had 25 males and 25 females and group IV had 24 males and 26 females. We found that mean lung segments involved were 3.4 in group I, 10.2 in group II, 13.1 in group III and 12.7 in group IV. Pattern involved was Bilateral seen in 40%, 25%, 2% and 5%, peripheral in 20%, 20%, 25% and 5%, ill- defined in 25%, 15%, 28% and 30% and ground-glass opacification in 15%, 30%, 45% and 60% respectively. Shi *et al.* [11] described the CT findings across different time points throughout the disease course. Findings 81 patients admitted to hospital between Dec 20, 2019, and Jan 23, 2020, were retrospectively enrolled. The cohort included 42 (52%) men and 39 (48%) women, and the mean age was 49·5 years (SD 11·0). The mean number of involved lung segments was 10·5 (SD 6·4) overall, 2·8 (3·3) in group 1, 11·1 (5·4) in group 2, 13·0 (5·7) in group 3, and 12·1 (5·9) in group 4. The predominant pattern of abnormality observed was bilateral (64 [79%] patients), peripheral (44 [54%]), ill-defined (66 [81%]), and ground-glass opacification (53 [65%]), mainly involving the right lower lobes (225 [27%] of 849 affected segments). In group 1 (n=15), the predominant pattern was unilateral (nine [60%]) and multifocal (eight [53%]) ground-glass opacities (14 [93%]). Lesions quickly evolved to bilateral (19 [90%]), diffuse (11 [52%]) ground-glass opacity predominance (17 [81%]) in group 2 (n=21). Thereafter, the prevalence of ground-glass opacities continued to decrease (17 [57%] of 30 patients in group 3, and five [33%] of 15 in group 4), and consolidation and mixed patterns became more frequent (12 [40%] in group 3, eight [53%] in group 4).

We found that common clinical features were cough seen in 76%, 48% and 31%, dyspnoea in 62%, 72% and 45%, chest tightness in 80%, 55% and 25%, diarrhoea in 34%, 25% and 6%, vomiting in 54%, 15% and 14% and fever in 95%, 82% and 30% in group II, III and IV respectively. Rousan *et al.* [12] included a total of 88 patients (50 (56.8%) females and 38 (43.2%) males) were admitted to the hospital with confirmed COVID-19. Their age ranged from 3 to 80 years (35.2 ± 18.2 years). 48/88 (45%) were symptomatic, only 13/88 (45.5%) showed abnormal chest x-ray findings. A total of 190 chest x-rays were obtained for the 88 patients with a total of 59/190 (31%) abnormal chest x-rays. The most common finding on chest x-rays was peripheral ground glass opacities (GGO) affecting the lower lobes. In the course of illness, the GGO progressed into consolidations peaking around 6–11 days (GGO 70%, consolidations 30%). The consolidations regressed into GGO towards the later phase of the illness at 12–17 days (GGO 80%, consolidations 10%). There was increase in the frequency of normal chest x-rays from 9% at days 6–11 up to 33% after 18 days indicating a healing phase. The majority (12/13, 92.3%) of patients with abnormal chest x-rays were symptomatic ($P = 0.005$).

Conclusion

The most common radiological feature found in COVID- 19 affected patients was ground-glass opacification, which is more evident in a patient having progressive symptoms beyond one week.

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