IMAGING FINDINGS ON CHEST X-RAY IN PATIENTS WITH COVID-19

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Abstract

Purpose: To describe the most common manifestations and patterns of parenchymal abnormalities in patients with confirmed corona virus disease.

Methods: Chest X -ray is the first imaging method to diagnose COVID 19 corona virus infection because it is cheap, readily available and can easily be cleaned. Portable radiography units are preferred. We retrospectively reviewed the chest x-rays in hospitalized patients for COVID-19. Radiologists can recognize and identify pulmonary involvement, airspace opacities, consolidation, ground-glass opacity, pulmonary lesion distribution, lobe predomination and unlike parenchymal abnormalities.

Results: The main symptom in our patients was fever. The most frequent findings on X-ray were airspace opacities, whether described as consolidation or ground glass opacity. The distribution was most often bilateral, peripheral and lower zone predominant. No patient presented cavitations.

Conclusion: Chest X- ray is effective, fast and useful tool to diagnose COVID 19 and it is a first line diagnostic imaging tool.

Keywords: COVID-19, corona virus infection, chest X-ray, pneumonia, ground glass opacity.

Introduction

A novel corona virus, newly named corona virus disease 2019 (COVID-19) by the World Health Organisation (WHO), is responsible for the recent pneumonia outbreak that started in December 2019 in Wuhan City, China [1]. Although the majority of cases were reported to be related to the Human Seafood Market, the source of the virus is still unclear. All over the world COVID19-cases have been reported. The COVID 19 has been confirmed to spread from person to person and mainly transmitted through respiratory secretions or direct contact [2]. Early detection, isolation and effective treatment are crucial to block the spread of COVID-19, which has declared an emergency by the WHO Emergency Committee [2].

X-ray images play a major role in detecting pneumonia and first diagnostic mood for the suspected cases. If the patient has the epidemiological history, clinical features and viral pneumonia features, he/she should be considered probably positive, despite negative or even second PCR [3]. The presence of viral pneumonia is one of the most important diagnostic criteria for the suspected cases [3]. Meanwhile, isolation needs to be applied to reduce the risk of transmission [3].

Rapid progression is one of the main characteristics of COVID-19. COVID-19 usually presents with fever, cough and shortness of breath. Abdominal and other symptoms are possible. The disease can be asymptomatic. We do not know the number of infected people in our country and all people have not been tested for the virus; consequently we do not know the actual mortality rate in the country. Illness severity can vary from mild (no symptoms, mild coughing and fever), severe (dyspnea, hypoxia or more than 50% lung involvement) and critical (respiratory failure, shock and multiple organ failure).

Chest radiography, especially bed-side, is recommended for monitoring the very severe and critical cases [3]. Pathological changes in the lung tissue with COVID-19 patients have not yet been studied. The pathogenesis of viral infections in the same family may be similar. Previous studies of corona viruses may be helpful in understanding the various CT findings in COVID-19 patients based on similar pathological changes. In SARS patients, pathological changes include injury to pulmonary epithelial cells, hyaline membrane formation on the inner wall of the alveoli and a large number of tissue cells and mass thrombi formed by proliferative fibrous tissue that block the small airway [4]. The minimal personal protective equipment (PPE) includes face masks, face shields, gloves and long-sleeved gown. The procedure for dressing and undressing has a specific order. The removal of the PPE is done in reverse order [4]. The chest radiograph (CXR) is insensitive early in the disease. Chest films can be useful in the following of the disease.

The chest radiographs of patients infected by the Novel corona virus demonstrate characteristic pneumonia-like patterns that can help in the diagnosis. The chest imaging findings are non specific

and most commonly show atypical or organising pneumonia, often with a bilateral, peripheral and bi-basal predominant distribution [5].

Imaging Departments policies on personal protective equipment (PPE) for patient with COVID -19 are strongly advised in these current times [6].

Materials and methods

All patients with a history of infectious pneumonia with a clinical suspicion of COVID diagnosed on X-ray images from April 2020 to June 2020 at Institute of Radiology were included in this study. The inclusion criteria were PCR tests confirming the viral origin of pneumonia.

The exclusion criteria were laboratory findings in favor of bacterial origin, normal lung parenchyma on chest CT, presence of non-infectious lung parenchyma on chest CT and presence of non-infectious lung parenchyma lesions on chest X-ray (pneumothorax, lung cancer, pulmonary oedema).

Pulmonary X-ray was performed on digital and conventional X-ray machines.

All lesions were evaluated for the following characteristics: location (right, left, bilateral lungs), distribution (peripheral, central or diffuse), air bronchogram, pleural effusion, number of lesions (1, 2 and more), ground glass opacity.

The main symptom of patients was fever and secondary symptoms included cough, expectoration, and myalgia.

Our study patients had clinical symptoms for more than 7 days. All patients underwent pulmonary X- ray and had laboratory examinations for C-reactive protein (CPR). Also, if a chest X-ray or chest CT suggests COVID-19 viral testing is the only specific method for diagnosis.

Results

Twenty-six patients (96.3%) with COVID-19 pneumonia had moderate x-ray manifestations and 1 (3.7%) had severe ones.

Among the imaging characteristics we found air bronchogram in 3 (11.1%), and pleural effusion in 0 patients. We retrospectively analyzed X ray images of 27 patients at the Institute of Radiology with COVID-19 pneumonia, 18 (66.66%) males and 9 (33.33%) females. The patients'age ranged between 34 and 69 years.

CT imaging was performed in 7 patients.

The most frequent radiographic findings were airspace opacities, whether described as consolidation or less commonly ground glass opacity (GGO).
Our study showed the following imaging characteristics of COVID-19 pneumonia.

The most common location was the bilateral lungs (100%)(Fig1-4) and the most common distribution was diffuse.(Fig. 3 and Fig. 4)

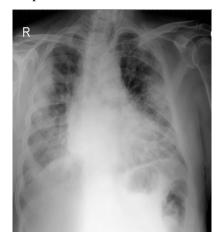No pleural effusion was associated with COVID -19 pneumonia in our study.
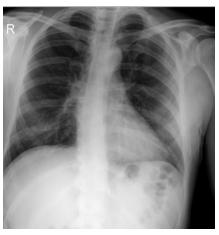

Fig. 1. Bilateral peripheral opacities

Fig. 2. Reticular pattern on the right lower zone
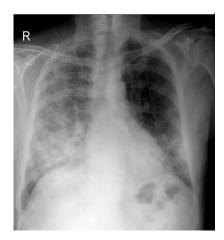
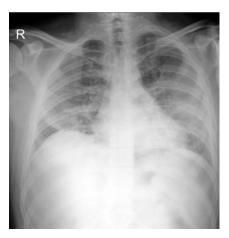**Fig. 3.** Billateral consolidation consolidation

Fig. 4. Diffuse distribution of billateral

Discussion

COVID-19 is a novel disease and we can analyze retrospectively only the existing information. Our study has several limitations. Firstly, this is a retrospective study with a limited number of patients.

Secondly, all patients did not have chest CT and we did not compare findings on CT because chest CT was supplementary performed in some of them.

X-ray findings in COVID-19 pneumonia were extremely similar to common types of viral pneumonia. The primary objective of our study was to present pulmonary X-ray findings of patients with COVID-19 pneumonia. Air bronchogram is not specific to COVID-19, but it helps distinguish the virus from other bacterial pneumonia [4]. Follow-up X-ray or CT examinations are necessary in a short period of time and those with highly suspicious clinical and radiological manifestations should have multiple nucleic aid tests.

The lung abnormalities tended to be predominantly distributed in bilateral lungs. Our results correspond with those in the literature [1].

The sensitivity of chest radiographs for pneumonia are relatively low and it is difficult to use chest radiographs to distinguish COVID-19 from common pneumonia during the cold season and pneumonia caused by other corona viruses [5].

Our study was done in the period April – 15th of June, when the temperature was not low and the seasonal flue was not typical for that period. In our study the positive rate of detecting the pulmonary parenchyma abnormalities on X-ray was 100%. Further research is needed to observe differences in CT manifestations. Finally, there was no histopathological evidence from diseased patients. In conclusion, our study showed that plan X-ray of chest was effective in detecting pulmonary abnormalities in the natural course of COVID -19. Interestingly, pleural effusion was rare. We did not find any pleural effusion in the group of 32 patients, which correspond with published data [5].

Chest radiography is not sensitive for the detection of ground glass opacities, which are the main imaging features of COVID - 19 pneumonia [4, 7]. Chest radiography is the first-line imaging modality of choice used for patients with suspected COVID-19 infection. It is readily available and the equipment can easily be cleaned. For ease of decontamination, the case of portable Radiography Units is preferred [8].

Conclusion

Chest X-ray is the first imaging method to diagnose COVID-19 corona virus infection. It is a cheap method and can be used in all patients.

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