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ORIGINAL ARTICLE

Radiological and Clinical Correlation of Chest X-Ray as a First Tool of Imaging in COVID-19 Patients

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ABSTRACT

Introduction: COVID-19 began to appear and spread from the city of Wuhan, China, in December 2019 around the world very quickly. **Objectives:** The main objective of the study is to find the radiological and clinical correlation of chest x-ray as a first tool of imaging in COVID-19 patients.

Material and methods: This retrospective study was conducted in Jinnah Hospital Lahore During 2021. The data was collected from 100 COVID-19 patients. All the patients are confirmed for COVID-19 through chest X-ray (CXR). The data include all the demographic and disease profile (CBC, LFT's, RFT's, CXR).

Results: The data was collected from 100 confirmed COVID-19 patients. There were 56 males and 44 females. The mean age was 34.56 ± 5.67 years. 46 patients were symptomatic and 54 patients were asymptomatic. Cough and fever were the most frequent symptoms. The most common co-morbidities among the patients were hypertension (15.9%) and diabetes (10.2%).

Conclusion: It is concluded that chest radiograph can be used as an adjunctive prognostic indicator, in addition to other clinical information and laboratory tests, in guiding further treatment and resource allocation.

Keywords: COVID-19, Patients, CXR, Health, Pneumonia

INTRODUCTION

COVID-19 began to appear and spread from the city of Wuhan, China, in December 2019 around the world very quickly. In March 2020, the World Health Organization declared it a global pandemic that caused the closure of airports, restricted internal and external movements, and paralyzed the global economy. By May 13, 2021, the total number of global cases reached about 161,596,640 people, and the number of active cases reached 17,782,865 people, while the number of deaths reached 3,352,620 people, and serious critical cases reached 104,362 people; the number is still increasing daily [1]. The virus spreads through saliva droplets or nasal swabs. The symptoms a person has are high fever, dry cough, headaches, muscle aches, tingling, sneezing, a sore throat, and respiratory diseases from mild to moderate [2]. In addition, 97% of people with COVID-19 suffer from mild symptoms, and 3% suffer from critical cases. However, the elderly and those with chronic diseases such as asthma, pneumonia, heart disease, and diabetes are likely to die from COVID-19 [3].

The gold standard diagnostic test for COVID-19 is the real-time reverse transcription-polymerase chain reaction- (RT-PCR-) based detection of the viral nucleic acids; however, RT-PCR has low sensitivity [4]. If RT-PCR is not available or if the results are negative in symptomaticCOVID-19 patients, chest imaging is considered a part of the screening procedure for suspected COVID-19 cases [5]. Radiological imaging complements clinical evaluation and laboratory parameters for managing COVID-19 patients [4]. Computed tomography (CT) is specific and more sensitive (95%) than chest X-ray (CXR) for diagnosing this disease, and CT was used in China during the peak of the first wave of the pandemic [5, 6]. The Fleischner Society stated that a CT scan is not suitable for screening or initial diagnosis of COVID-19 [7] because it requires time-consuming decontamination procedures to prevent the risk of cross-infection [8]. Therefore, CXR can be used instead of CT because of its extensive availability and easy and quick decontamination procedures. Few studies have compared the sensitivity of CXR and RT-PCR for detecting COVID-19 [9]; however, the association between CXR findings and clinical and laboratory findings has not been assessed adequately.

Chest x-ray was found to have limited value in the initial diagnosis of COVID-19 with a sensitivity of about 69% [10]. Patients with COVID-19 had typical radiological findings on chest imaging including multifocal and bilateral ground glass opacities and consolidations with peripheral and basal predominance. Septal thickening, bronchiectasis, pleural effusion, lymphadenopathy, and cavitation were less commonly seen [11].

Objectives: The main objective of the study is to find the radiological and clinical correlation of chest x-ray as a first tool of imaging in COVID-19 patients.

MATERIAL AND METHODS

This retrospective study was conducted in Jinnah Hospital Lahore During 2021. The data was collected from 100 COVID-19 patients. All the patients are confirmed for COVID-19 through chest X-ray (CXR). The data include all the demographic and disease profile (CBC, LFT's, RFT's, CXR). All the chest x-rays were acquired as a digital radiograph in the anteroposterior projection using portable x-ray units in the isolation wards following local protocols. A severity score was determined for each lung using the Radiographic Assessment of Lung Edema (RALE) score proposed by Warren et al. In the case of positive CXR findings, the predominant pattern of CXR findings was documented as follows: the presence and distribution of airspace opacities (consolidation, GGOs, and reticular and nodular opacities). Regarding the distribution of lesions on CXRs, we considered halfway between the lateral edge of the lung and the hilum to divide lesions into peripheral predominant, perihilar predominant, or diffuse (neither peripheral nor perihilar). The laterality of the lesions is mentioned as right, left, or bilateral lungs. The score is determined by the involvement of each lung in terms of consolidation or GGO, scored from 0 to 4.

Statistical analysis: The data was collected and analyzed by SPSS version 20.0. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The data was collected from 100 confirmed COVID-19 patients. There were 56 males and 44 females. The mean age was 34.56 ± 5.67 years. 46 patients were symptomatic and 54 patients were asymptomatic. Cough and fever were the most frequent symptoms. The most common co-morbidities among the patients were hypertension (15.9%) and diabetes (10.2%). The majority of the patients (96.6%) had a history of travel 21% to overseas. The mean time from initial positive RT-PCR to negative RT-PCR was 12 ± 3 days (range 7–19 days).

Table 02 shows the basic characteristics of CXR of 100 patients. These findings shows that there were 56 patients which have GGO, 7% patients have consolidation and 23% patients have mixed pattern of CXR.

Table 1: Patient demographics and clinical features

Criteria	Number of patients (%)
Age (years)	34.56 ± 5.67
Male	56 (56%)
Female	44 (44%)
History of travel	21 (21%)
Symptoms/signs at presentation	
Fever	31 (30%)
Cough	44 (44%)
Chest pain	11 (11%)
SOB	7 (6.9%)
Chills	16 (16%)
Arthralgia/myalgia/fatigue	14 (13%)
GI symptoms	18 (19%)
Headache	12 (11%)
Seizure	1 (2%)
Co-morbidities	
COPD	17 (16%)
Asthma	11 (10%)
Cardiovascular disease	40 (40%)
DM	28 (28%)
Immunocompromiseda	6 (7%)
Pregnancy	1 (2%)
Renal disease	6 (6%)
Death	16 (16%)

Table 2: Baseline chest X-ray CXR characteristics

Baseline chest X-ray feature	Number of cases	%
Pattern of X-ray		
Normal	14	14%
GGO	56	56%
Consolidation	7	7%
Mixed	23	23%
CoV-P category		
CoV-P1	48	48%
CoV-P2	52	52%
Lung involvement among CXRs with positive findings		
Unilateral	14	14%
Bilateral	86	86%

DISCUSSION

Patients with SARS-Cov-2 infection can experience a diverse range of clinical presentations, from no symptoms to acute respiratory distress syndrome (ARDS), septic shock, and/or multiple organ failure. SARS-Cov-2 virus is detectable in the respiratory tract 2–3 days before symptom onset, peaks at symptom onset, and declines over the following 7–8 days [10]. Difficulties in infection control of COVID-19 are in part ascribable to this viral shedding profile, contrasting to that of influenza virus that peaks after symptom onset. RT-PCR is currently the most reliable diagnostic tool for COVID-19. Specimens obtained from a nasopharyngeal or oropharyngeal swab are commonly used [11]. However, the false-negative rate of RT-PCR test is not negligible, estimated as 100% on the day of infection (day1) and 38% on the day of symptom onset (day 5), which decreases to 20% at 3 days after symptom onset (day 8) and increases again thereafter [12].

Our study demonstrated common patterns in the evolution of CXR findings with disease severity progression from GGO to predominantly consolidative and from lower zones involvement to diffuse [13]. A common pattern of consolidation was noted to start peripherally. The vertical distribution and peripheral areas of consolidation noted in our study are in keeping with previous reports. Recent literature shows promising utilization of artificial intelligence (AI)-driven tools in the screening and diagnosis of COVID-19 pneumonia. An example of the former application is Truncated Inception Net that is being proposed as a screening tool for COVID-19 outbreak using chest x-rays taking advantage of the AI-driven tools active-learning based on cross-population train/test models that utilize multitudinal and multimodal data [14]. An example of the diagnostic application is CV19-Net that was able to diagnose COVID-19 pneumonia and differentiate it from non-COVID-19 pneumonia using CXR with high sensitivity and specificity. An area of future research is to utilize this data set to design an AI based algorithm to predict clinical deterioration using radiographic images [15].

CONCLUSION

It is concluded that chest radiograph can be used as an adjunctive prognostic indicator, in addition to other clinical information and laboratory tests, in guiding further treatment and resource allocation.

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