ISSN 2515-8260 Volume 09, Issue 02, 2022

Study of X-Ray findings of COVID 19 from Assam medical college and hospital, Dibrugarh, Assam

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Abstract

Background: The COVID-19 pandemic has led to an unprecedented surge in hospitalised patients with viral pneumonia. Chest X-Ray (CXR) is one of the important, non-invasive methods and used as a preliminary investigation to detect different pulmonary abnormalities. Present study was aimed to study X-ray findings of COVID 19 from Assam medical college and hospital, Dibrugarh. Assam.
Material and Methods: Present study was single-center, prospective, observational study, conducted in patients 18-65 years age, who were confirmed cases of COVID 19 by RT PCR or RAT testing.
Results: In present study, 220 patients satisfying study criteria were evaluated. Chest X ray abnormalities were noted in 48.18% cases initially, while in 2.73% cases, initial normal CXRs later became abnormal. 5.91% CXRs had unilateral abnormalities while 42.27% CXRs had bilateral abnormalities. Symmetrical abnormal findings was noted in 21.82% as compared to asymmetrical abnormal findings in 20.45% cases. CXRs lesion distribution was peripheral location (35.91%), central location (5.91%) & combined peripheral and central location (6.36%). Localization of abnormalities in CXRs was in Lower, Middle & upper zone in 32.73%, 10.45% & 5% respectively. Common specific radiographic abnormalities were Ground glass opacities (GGOs) (42.73%), Consolidation (23.64%), Nodularity (0.91%), Reticular opacity (5.91%) & Pleural effusion (9.55%), Severity score in present study was mild, moderate & severe in 33.18%, 11.82% & 3.18% cases respectively.
Conclusion: Chest X-ray is a valuable tool in better management of patients during the COVID-19 pandemic. Despite its lower sensitivity compared with CT scans, its inherent advantages such as reasonable cost, broad range of use, and rapid speed make it indispensable.

Keywords: Chest X-ray, COVID-19, pandemic, radiology

Introduction

The COVID-19 pandemic has led to an unprecedented surge in hospitalised patients with viral pneumonia. Real-time reverse transcription polymerase reaction (RT-PCR) of viral

ISSN 2515-8260 Volume 09, Issue 02, 2022

nucleic acid has limited reliability due to a high number of false negative results; a correlation of clinical features with the findings on a chest radiograph (CXR) would be more definite for a confirmatory diagnosis of COVID-19.

Pulmonary abnormalities caused by COVID-19 can be monitored on a chest radiograph [2]. Chest X-Ray (CXR) is one of the important, non-invasive methods and used as a preliminary investigation to detect different pulmonary abnormalities. It can act as an alternative screening modality for the detection of COVID-19 [3].

CXR findings in COVID-19 patients are usually most evident about 10-12 days after onset of symptoms. The density of the lungs increased in cases of pneumonia which is seen as whiteness in the lung on radiography. Covid-19 pneumonia also causes similar manifestation. This increase in the density depending on the severity of the pneumonia [1].

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 [4]. According to Baj *et al*. [5] the course of COVID-19 and the classification of its severity can be determined by imaging and evaluating each stage on chest radiographs. Present study was aimed to study X-ray findings of COVID 19 from Assam medical college and hospital, Dibrugarh. Assam.

Material and Methods

Present study was single-center, prospective, observational study, conducted in department of radio-diagnosis, at Assam medical college and hospital, Dibrugarh. Assam, India. Study duration was of 1 year (July 2020 to June 2021). Study was approved by institutional ethical committee.

Patients 18-65 years age, who were confirmed cases of COVID 19 by RT PCR or RAT testing, underwent chest X-ray, analyzed by expert radiologist for presence of X-Ray findings. Patients with co-morbidities which were likely to interfere with interpretation of Chest X Ray Findings such as those having COPD, tuberculosis or interstitial lung disease etc., patients with SpO_2 < 94% or severe symptomatic COVID 19 were excluded. The demographic details such as age, gender, symptoms such as fever, sore throat, cough and bodyache, clinical features, were also recorded in a proforma. The patients were divided into asymptomatic and mildly symptomatic cases.

The chest X-Ray PA view was analyzed for presence of and type of abnormalities. All CXRs were performed as digital radiographs following hospital protocols with the same portable X-ray unit (Medilux systems portable 100 ma X-ray machine) in an isolation ward or in an ICU. CXRs were acquired in anteroposterior (AP) projection for bed-ridden patients and in the posteroanterior (PA) projection for the rest of the patients; follow-up CXRs were performed similarly.

According to the Fleischer Society glossary of terms, radiological features were identified as ground-glass opacities (GGO), consolidation, reticular-nodular opacities, and pulmonary nodules [6]. Moreover, specific patterns of lung involvement were characterized as perihilar predominance or peripheral predominance, unilateral or bilateral lung involvement, and lower zone, upper zone or no zonal preference. Other associated pulmonary pathologies such as pleural effusion, cardiomegaly and pneumothorax were also recorded.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Statistical analysis was done using descriptive statistics.

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Results

In present study, 220 patients satisfying study criteria were evaluated. Majority of patients were from 19-40 years age group (51.36%), followed by 41-60 years age group (35.45%) & > 60 years age group (13.18%). Majority were male (53.18%) as compared to female (42.27%), Mean duration at presentation from onset of symptoms was 4.2±2.1 days. Common comorbid conditions were hypertension (17.73%), diabetes mellitus (13.18%), chronic kidney disease (3.64%), coronary artery disease (6.36%), chronic obstructive pulmonary disease (5.00%) & malignancy (0.91%).

Table 1: General characteristics

Characteristic	No. of Patients	Percentage
Age group (years)		
19-40	131	51.36%
41-60	55	35.45%
> 60	29	13.18%
Gender		
Male	117	53.18%
Female	93	42.27%
Mean duration at presentation from onset of symptoms	4.2 ± 2.1 days	
Comorbid conditions		
Hypertension	39	17.73%
Diabetes mellitus	29	13.18%
Chronic kidney disease	8	3.64%
Coronary artery disease	14	6.36%
Chronic obstructive pulmonary disease	11	5.00%
Malignancy	2	0.91%

Chest X ray abnormalities were noted in 48.18% cases initially, while in 2.73% cases, initial normal CXRs later became abnormal. 5.91% CXRs had unilateral abnormalities while 42.27% CXRs had bilateral abnormalities. Symmetrical abnormal findings was noted in 21.82% as compared to asymmetrical abnormal findings in 20.45% cases. CXRs lesion distribution was peripheral location (35.91%), central location (5.91%) & combined peripheral and central location (6.36%). Localization of abnormalities in CXRs was in Lower, Middle & upper zone in 32.73%, 10.45% & 5% respectively.

Common specific radiographic abnormalities were Ground glass opacities (GGOs) (42.73%), Consolidation (23.64%), Nodularity (0.91%), Reticular opacity (5.91%) & Pleural effusion (9.55%), Severity score in present study was mild, moderate & severe in 33.18%, 11.82% & 3.18% cases respectively.

Table 2: Characteristics of Chest X-rays in COVID-19 patients

Chest X ray abnormalities	No. of Patients	Percentage
Findings		
a) Patients with normal CXRs	108	49.09%
b) Patients with abnormal CXRs	106	48.18%
c) Patients with normal CXRs-later became abnormal	6	2.73%

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Distribution of abnormalities		
• CXRs with unilateral abnormalities.	13	5.91%
• CXRs with bilateral abnormalities.	93	42.27%
• CXRs with symmetrical abnormal findings.	48	21.82%
• CXRs with asymmetrical abnormal findings.	45	20.45%
• CXRs findings having peripheral location.	79	35.91%
• CXRs findings having central location.	13	5.91%
• CXRs findings having combined peripheral and central location.	14	6.36%
Localization of abnormalities in CXRs.		
a) Lower Zone	72	32.73%
b) Middle Zone	23	10.45%
c) Upper Zone	11	5.00%
Prevalence of specific radiographic abnormalities		
• Ground glass opacities (GGOs).	94	42.73%
• Consolidation.	52	23.64%
• Nodularity.	2	0.91%
• Reticular opacity.	13	5.91%
• Pleural effusion.	21	9.55%
Severity score		
a) Abnormal X-rays, mild (<25%).	73	33.18%
b) Abnormal X-rays, moderate (25-50%).	26	11.82%
c) Abnormal X-rays, severe (>75%).	7	3.18%

Discussion

A person with comorbid conditions has increased susceptibility to infection by SARS-CoV-2. Several studies have shown that regarding confirmed COVID-19, people with comorbidities, such as the elderly, have a higher risk of experiencing severe and fatal symptoms than those without comorbidities. The most common comorbidities recorded among patients with COVID-19 are hypertension, diabetes mellitus, heart disease, and chronic obstructive pulmonary disease [6, 7].

With the aid of high-performance computers, it is now possible to quickly extract countless quantitative features from medical imaging such as digital radiographs, ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET) [8].

Chest X-Ray (CXR) is one of the important, non-invasive clinical adjuncts that play an essential role in the preliminary investigation of different pulmonary abnormalities.

The radiological findings of COVID 19 on chest X-ray were [1]

- Ground glass opacity (When lung markings are partially obscured by the increased whiteness).
- Peripheral, coarse, horizontal white lines, bands, or reticular changes which can be described, as linear opacities.
- Consolidation (When lung markings are completely lost due to the whiteness).
- Rarely-nodular lung lesion, pleural effusion and pneumothorax.

Vancheri evaluated X-ray findings to reveal GGO as the most common lesion in the intermediate/late phase of SARS-CoV-2 infection. The most common early lesions were

ISSN 2515-8260 Volume 09, Issue 02, 2022

reticular alteration and consolidation increased over time. Most frequently, the lesions were identified bilaterally and peripherally, in the middle and lower lobes. Septal thickening, bronchiectasis, pleural thickening, and subpleural involvement are some of the less common findings and usually occur during the course of the disease [9]. Gradual resolution of opacity consolidation and a decrease in the number of lesions usually occurs after 2 weeks and is associated with a favorable clinical response [10].

Sahu AK *et al*., [11] noted that, 157 patients (72%) were symptomatic and 61 (28%) were asymptomatic. 104 CXRs (48%) were abnormal (97 in symptomatic (62%) and four in asymptomatic (6%)). 74 patients (47%) in the symptomatic group had known comorbidities and of these, 62 (84%) had abnormal CXR. 97 CXRs (93%) had bilateral findings and 87 CXRs (84%) had peripherally predominant abnormalities. The lower zone was the most common area of involvement (73%). Ground glass opacity (GGO) was the most common finding (94%-98 CXRs). Mild disease was seen in 56 (54%). Similar findings were noted in present study.

Avinash P Mural *et al*., [12] noted that there were 45 (56.25%) males and 35 (43.75%) females with a M:F ratio of 1:0.77. 39 (48.75%) patients were symptomatic whereas remaining 41 (51.25%) patients were asymptomatic. Common chest X Ray findings were bilateral peripheral consolidation sparing perihilar region (Reverse batwing pattern) which was seen in 25 (31.25%) patients. The other common abnormalities seen on X-ray were Multifocal bilateral consolidation (22.50%), Multifocal lower lobe predominance consolidation (17.50%) and Multifocal unilateral consolidation (17.50%). Similar findings were noted in present study.

Rabab Yasin [13] studied 350 patients proven with positive COVID-19 disease; 220 patients (62.9%) had abnormal baseline CXR and 130 patients (37.1%) had normal baseline CXR. During follow-up chest X-ray studies, 48 patients (13.7%) of the normal baseline CXR showed CXR abnormalities. In abnormal chest X-ray, consolidation opacities were the most common finding seen in 218 patients (81.3%), followed by reticular interstitial thickening seen in 107 patients (39.9%) and GGO seen in 87 patients (32.5%). Pulmonary nodules were found 25 patients (9.3%) and pleural effusion was seen in 20 patients (7.5%). Most of the patients showed bilateral lung affection (181 patients, 67.5%) with peripheral distribution (156 patients, 58.2%) and lower zone affection (196 patients, 73.1%). The total severity score was estimated in the baseline and follow-up CXR and it was ranged from 0 to 8. The outcome of COVID-19 disease was significantly related to the age, sex, and TSS of the patients. Male patients showed significantly higher mortality rate as compared to the female patients (P value 0.025). Also, the mortality rate was higher in patients older than 40 years especially with higher TSS.

Among 120 COVID-19 patients, Satyanand S *et al*., [14] noted that 74 (61.67%) and 46 (38.33%) were males and females, respectively; 64 patients (53.33%) had ground-glass opacities (GGO), 55 (45.83%) had consolidation and 38 (31.67%) had reticular-nodular opacities, with lower zone distribution (50%) and peripheral distribution (41.67%). Baseline chest X-ray showed a sensitivity of 63.3% in diagnosing typical findings of SARS-CoV-2 pneumonia. &e maximum RALE score was 2.13 ± 1.9 in hospitalized patients and 0.57 ± 0.77 in discharged patients (p value <0.0001). Spearman's rank correlation coefficient between maximum RALE score and clinical outcome parameters was as follows: age, 0.721 (p value <0.00001); >10 days of hospital stay, 0.5478 (p value <0.05); ≤10 days of hospital stay, 0.5384 (p value <0.0001); discharged patients, 0.5433 (p value <0.0001) and death, 0.6182 (p value 0.0568). Study findings suggested that the RALE score can quantify the extent of COVID-19 and can predict the prognosis of patients.

Rao V *et al*., [15] studied 460 RT-PCR positive hospitalized patients CXRs in various stages of disease involvement were retrospectively analyzed. There were 248 males (53.92%) and 212 females (46.08%) in the cohort, with a mean age of 50.1 years (range 12-89 years). The

commonly observed alterations included lung consolidations, ground glass opacities and reticular-nodular opacities. Bilateral involvement was more common compared to unilateral involvement. Of the 460 CXRs analyzed, the model reported 445 CXRs as COVID-19 with an accuracy of 96.73%.

Worsening of radiographic changes are generally concordant with clinical imaging. The peak CXR changes have been reported between day 10 to 12(from infection onset). While some studies have shown that radiological and virological recovery parallel each other [16], discordant timelines have been demonstrated by others [17].

Artificial Intelligence (AI) with image processing could be an efficient and accurate technique to differentiate this normal and affected chest X-ray images with good accuracy. It has the potential to improve the speed of COVID-19 case identification and reduce its spread particularly in resource-constraint environments where expert radiologist and high-end medical equipment are not available for early diagnosis and management of patients [18].

Conclusion

Chest X-ray is a valuable tool in better management of patients during the COVID-19 pandemic. Despite its lower sensitivity compared with CT scans, its inherent advantages such as reasonable cost, broad range of use, and rapid speed make it indispensable.

Conflict of Interest: None to declare.

Source of funding: Nil.

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