Original Research Article

Assessing role of chest radiography in management of COVID- 19 pneumonia

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Abstract

Aim: Role of chest radiography in management of COVID- 19 pneumonia.**Materials & Methods:**Forty- six patients who tested rtPCR positive for SARS COV2 of both genders were included. Chest X-rays were obtained. The progression, regression of abnormalities, number of days to reach progression, number of days to regression either from initial X-ray or after peak of progression was also recorded.**Results:**Maximum cases were seen in age group 50-60 years (males- 8, females- 7) followed by 40-50 years (males- 7, females- 5), >60 years (males- 5, females- 4), 30-40 years (males- 4, females- 3) and 20-30 years (male- 1, females- 3). Normal X- ray were observed in 13 (28.2%) patients, abnormal x- ray in 33 (71.8%), x-ray showing only peripheral opacities in 16 (34.7%), x-ray showing both central and peripheral opacities in 30 (65.3%), x-ray showing haziness (GGO) in 14 (30.4%), x-ray showing consolidation in 32 (69.2%). Left lung involvement was seen in 7 (15.2%), right lung involvement in 11 (24%) and bilateral lung involvement in 28 (60.8%) patients. Total HRCT was done in 25 (54.3%), out of which abnormal HRCT was seen in 40 (86.9%), abnormal X-ray abnormal HRCT in 32 (80%) and normal x-ray abnormal HRCT in 8 (20%). A significant difference as observed (P< 0.05) **Conclusion:**Chest X-ray is an important diagnostic aid in the detection and management of Covid-19 pnuemonia.

Keywords: Chest X-ray, Pneumonia, Lung, CT scan

Introduction

The world is engrossed by a pandemic caused by SARS COV -2 virus which results in a lower respiratory tract viral pneumonia termed as Covid-19 pneumonia[1]. The clinical symptoms of the disease are nonspecific presenting with influenza-like illness (ILI) with fever >38 degrees C, cough associated with malaise, generalised myalgia, headache and breathlessness[2].However, patients with severe acute respiratory infection (SARI) are advised hospitalisation as per WHO recommendation. Real-time polymerase chain reaction (RT-PCR) is the standard accepted test in the diagnosis of COVID-19 to detect the nucleic acid of the virus[3].

The chest X-ray is usually the initial and often only investigation required in the evaluation of diseases of the chest. Not all patients with SARS COV -2 virus infection develop pneumonia. No fixed definition of covid-19 pneumonia exists[4].Like other pneumonias, covid-19 pneumonia causes the density of the lungs to increase. This may be seen as whiteness in the lungs on radiography which, depending on the severity of the pneumonia, obscures the lung markings that are normally seen; however, this may be delayed in appearing or absent[5].

When lung markings are partially obscured by the increased whiteness, a ground glass pattern (ground glass opacity) occurs[6]. This can be subtle and might need confirmation with a radiologist. Peripheral, coarse, horizontal white lines, bands, or reticular changes which can be described, as linear opacities may also be seen in association with ground glass opacity. When lung markings are completely lost due to the whiteness, it is known as consolidation which is usually seen in severe disease.[7]Considering this, the present study aimed at assessing the role of chest radiography in management of COVID- 19 pneumonia.

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Methodology

Forty- six patients who tested rtPCR positive for SARS COV2 of both genders were included in this study. Consent for the study was obtained from them or their relatives. Ethical approval was also obtained beforehand.All patients' particulars were entered in case history performa. Chest X-rays were obtained from the concerned hospital. The initial radiograph was assessed as negative or positive, if positive the type of abnormality, its location, distribution, any other features such as cavitation, mediastinaladenopathy, pleural effusion was recorded. CT findings if performed at time of initial X-ray, whether positive or negative was also noted.

Patients who had more than one X-ray were followed up. The progression, regression of abnormalities, number of days to reach progression, number of days to regression either from initial X-ray or after peak of progression was also recorded. Complications such as ARDS, barotrauma, type of barotrauma, ventilator-associated pneumonia were recorded. Results of the present study after recording all relevant data were subjected for statistical inferences using chi- square test. The level of significance was significant if p value is below 0.05 and highly significant if it is less than 0.01.

Results

Table 1:Age and gender distribution

Age groups (years)	Male	Female	Total
20-30	2	1	3
30-40	4	3	7
40-50	7	5	12
50-60	8	7	15
>60	5	4	9
Total	26	20	46

Maximum cases were seen in age group 50-60 years (males- 8, females- 7) followed by 40-50 years (males- 7, females- 5), >60 years (males- 5, females- 4), 30-40 years (males- 4, females- 3) and 20-30 years (male- 1, females- 3) (Table 1).

Table 2:Patients characteristics

Characteristics	Number	Percentage	P value
Normal X- ray	13	28.2%	<0.05
Abnormal X- ray	33	71.8%	
X-ray showing only peripheral opacities	16	34.7%	<0.05
X-ray showing both central and peripheral opacities	30	65.3%	
X-ray showing haziness (GGO)	14	30.4%	<0.05
X-ray showing consolidation	32	69.2%	
Left lung involvement	7	15.2%	<0.05
Right lung involvement	11	24%	
Bilateral lung involvement	28	60.8%	
Total HRCT	25	54.3%	
Abnormal HRCT	40	86.9%	<0.05
Abnormal X-ray abnormal HRCT	32	80%	
Normal X-ray abnormal HRCT	8	20%	

Normal X- ray were observed in 13 (28.2%) patients, abnormal x-ray in 33 (71.8%), x-ray showing only peripheral opacities in 16 (34.7%), x-ray showing both central and peripheral opacities in 30 (65.3%), x-ray showing haziness (GGO) in 14 (30.4%), x-ray showing consolidation in 32 (69.2%). Left lung involvement was seen in 7 (15.2%), right lung involvement in 11 (24%) and bilateral lung involvement in 28 (60.8%) patients. Total HRCT was done in 25 (54.3%), out of which abnormal HRCT was seen in 40 (86.9%), abnormal X-ray abnormal HRCT in 32 (80%) and normal x-ray abnormal HRCT in 8 (20%). A significant difference as observed (P< 0.05) (Table 2).

Table 3:Outcome of treatment

Findings	Number	Percentage	P value
Patients showing progression on serial X-ray	12	26%	
Upper half involvement	15	32.6%	<0.05
Lower half involvement	31	67.4%	
Mean days of progression	6.2		<0.05
Mean days of regression	10.3		
Patients showing regression	12	26%	
Patients developed ALI	6	13%	>0.05
Patients progressed to ALI	4	8.6%	
Patients regressed from ALI	2	4.3%	
Patients developed barotrauma	3	6.5%	
Invasive ventilation patients	2	4.3%	<0.05
Non- invasive ventilation patients	1	2.1%	

We found that 12 (26%) patients showed progression on serial X-ray, 15 (32.6%) showed upper half involvement, 31 (67.4%) showed lower half involvement. Mean days of progression was 6.2 days, mean days of regression was 10.3 days, 12 (26%) patients showed regression. 6 (13%) patients developed ALI, 4 (8.6%) progressed to ALI and 2 (4.3%) patients regressed from ALI. 3 (6.5%) patients developed barotrauma, 2 (4.3%) were invasive ventilation patients and 1 (2.1%) were non- invasive ventilation patients. A significant difference as observed (P< 0.05) (Table 3).

Discussion

SARS COV-2 has a particular affinity for ACE-2 receptors. These are in abundance in type 2 alveolar cells. After gaining entry into the type 2 receptor cells there is diffuse alveolar damage resulting in exudation into the alveolar spaces[8].This appears on chest radiographs x-rays as a diffuse haziness obscuring vascular markings, akin to the well documented ground-glass densities seen on CT scans[9]. Initial chest radiography may be normal but patients may later develop clinical or radiological signs of covid-19 pneumonia—ie, early radiographs may be negative. With further progression in alveolar cell apoptosis the exudation may result in denser opacities on the X-ray appearing as consolidations[10].These consolidations do not incite sympathetic effusions or internal cavitation as may occur with bacterial pneumonias. Occasionally reticular opacities may be seen on the X-ray as linear bands due to septal/alveolar thickening due to inflammation. The distribution of abnormalities is usually in the lung bases as well as in the periphery[11].The present study aimed at assessing the role of chest radiography in management of COVID- 19 pneumonia.It was found

that maximum cases in our study were seen in age group 50-60 years (males- 8, females- 7) followed by 40-50 years (males- 7, females- 5), >60 years (males- 5, females- 4), 30-40 years (males- 4, females- 3) and 20-30 years (male- 1, females- 3). A quantitative meta-analysis covering 2847 patients in China and Australia, and a multinational descriptive analysis of 39 case report articles summarising 127 patients, found that covid-19 pneumonia changes are mostly bilateral on chest radiographs (72.9%, 95% confidence interval 58.6 to 87.1) and have ground glass opacity in 68.5% of cases (95% CI 51.8 to 85.2); however, these data are pooled so it is not possible to link the radiographic findings to the duration of disease or severity[12].In this study 13 (28.2%) patients had normal x- ray, 33 (71.8%) had abnormal x- ray, 16 (34.7%) showed peripheral opacities on x-ray only, 30 (65.3%) x-ray showed both central and peripheral opacities in, x-ray showing haziness (GGO) in 14(30.4%), x-ray showing consolidation in 32 (69.2%). Left lung involvement was seen in 7 (15.2%), right lung involvement in 11 (24%) and bilateral lung involvement in 28 (60.8%) patients. Total HRCT was done in 25 (54.3%), out of which abnormal HRCT was seen in 40 (86.9%), abnormal X-ray abnormal HRCT in 32 (80%) and normal x-ray abnormal HRCT in 8 (20%). Kohli et al[13] analysed the patterns of radiological findings on chest radiograph (CXR) for suspected and confirmed COVID-19 patients on initial presentation to the emergency medical services (EMS) on admission and to assess the progression and resolution. In this study, 756 RT-PCR confirmed COVID-19 patients were included in our study who had initial CXR. 510 (67.46%) of our patients with positive initial RT-PCR showed abnormal baseline CXR. The abnormal findings were described as haziness akin to ground glass opacities (GGO) on CT,peripheral opacities, patchy parenchymal opacities and consolidation. Peripheral opacities and lower zone distribution were the commonest pattern of CXR abnormalities with bilateral involvement. The severity of findings on serial CXR and radiographic regression was studied along with follow-up to assess response to treatment. Forty-six patients showed features of acute lung injury (ALI). Complications and new CXR findings were reported for patients who were given ventilator support.In present study, 12 (26%) patients showed progression on serial x-ray, 15 (32.6%) showed upper half involvement, 31 (67.4%) showed lower half involvement. Mean days of progression was 6.2 days, mean days of regression was 10.3 days, 12 (26%) patients showed regression. 6 (13%) patients developed ALI, 4 (8.6%) progressed to ALI and 2 (4.3%) patients regressed from ALI. 3 (6.5%) patients developed barotrauma, 2 (4.3%) were invasive ventilation patients and 1 (2.1%) were non- invasive ventilation patients. A retrospective case series of 64 patients hospitalised with covid-19 infection in Hong Kong found that chest radiograph changes are often peripheral (41%) and lower zone (50%) in distribution; these findings are supported by a pictorial review from the US describing common manifestations and patterns of lung abnormality seen on portable chest radiography in covid-19 patients[14].The British Society of Thoracic Imaging (BSTI) suggests that all seriously ill patients (oxygen saturation <94%) initially have a chest radiograph and that those who do not meet those criteria should have a chest radiograph if “clinically required” [15].

Conclusion

Chest X-ray is an important diagnostic aid in the detection and management of Covid-19 pneumonia. Portable chest X-ray can be used to monitor the progression, regression of lung changes in COVID- 19 positive patients.

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