



## Research Article

### Chest X-Ray Abnormalities In Covid-19: Review Of 150 Cases From Tertiary Care Hospitals of Lahore, Pakistan.

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#### Abstract

**Objective:** To analyze the most frequent radiographic abnormalities in COVID-19 patients.

**Methods:** In this multicenter retrospective study, chest X-ray films and reports of COVID-19 patients admitted between March 2020 and June 2020 in three tertiary care hospitals of Lahore were analyzed for abnormalities. Patients of age > 18 years with positive COVID -19 RT-PCR, who underwent X-ray chest at presentation were enrolled. The study included pregnant patients as well.

**Results:** Total 150 patients fulfilling inclusion criteria were enrolled. There was male predominance with mean age 50 years. Chest X-ray were abnormal in 127 (98%) patients. Predominant pattern of lung involvement was bilateral lesions in 121(95%), left lower zone 89(70%), right lower zone 85(67%), right mid zone 57(45%), left mid zone 50(39%), and diffuse involvement in 36 (28%). GGOs was the most common lung lesion found in 53 (42%), followed by GGOs and consolidation combined. Peripheral distribution was noted in 36(28%), peripheral and peri hilar combined 58(45%), random 27(21%) and perihilar in 6(5%). Peri bronchial cuffing was seen in 23(18 %), reticulation 20(16%), nodular lesions 8(6%) pneumomediastinum (1.5%) and minimal pleural effusion 1(0.7%).

Among 20 pregnant females, 15 (75%) had normal X- rays. All of abnormal CXR 5 (25%), had bilateral, mid and lower zone GGOs and consolidation. Distribution was random 3(60%), peripheral and perihilar combined 2(40%), patchy 1(20%) and confluent in 4(80%).

**Conclusion:** The most predominant radiological features of COVID-19 in our population were bilateral, lower zone, patchy, pure GGOs or combined GGOs and consolidation with peripheral and perihilar distribution.

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**Key Words:** COVID-19, GGOS, Chest X-ray, Consolidation

## Introduction

A local outbreak of severe lower respiratory tract illness leading to pneumonia and respiratory failure first detected in Wuhan, China, in December 2019 was named as COVID-19. The disease is caused by a novel strain of corona virus, now identified as SARS-CoV-2<sup>1</sup>. By March 2020 WHO officially declared it a global pandemic as the disease alarmingly spread to 110 countries<sup>2</sup>. Due to COVID-19 pandemic, 552,500 people have lost their lives so far. The wide spectrum of symptomatology ranging from asymptomatic carrier to bilateral pneumonia leading to respiratory failure and multi organ dysfunction keeps surprising the clinicians<sup>3,4</sup>.

The gold standard investigation for diagnosis of COVID-19 is RT-PCR mostly done on nasopharyngeal swab. Other possible samples to perform RT-PCR include throat swab, sputum and tracheal aspirates<sup>5</sup>. The test is reported to have sensitivity of <60% with many false negative results owing to multiple factors like low viral load, improper sampling, timing of sampling, or laboratory issues etc.<sup>6</sup>. Biochemical laboratory parameters like CRP, serum ferritin, LDH, D-dimers etc. are merely supportive and not diagnostic<sup>7</sup>.

Chest X-ray is a very frequently performed investigation in COVID-19 patients as majority presents with respiratory symptoms like cough or shortness of breath. Various characteristic radiological features have been observed in COVID-19 patients<sup>8</sup>. CT chest has been shown to be comparable to RT-PCR for diagnosis of COVID-19 due to its high sensitivity<sup>9,10</sup>. Regardless of high sensitivity CT chest can't be ordered frequently due to high cost, unavailability at many centers, infection control issues and need of decontamination of CT rooms. The American College of Radiology (ACR) recommends chest X-ray instead of CT in COVID-19 patients to minimize the risk of cross-infection especially in low resource settings<sup>11</sup>. Literature reveals variety of radiological patterns observed in COVID-19<sup>12</sup>. The aim of our study was to analyze radiological manifestations of COVID in our population to improve understanding and diagnosis of this novel illness. In presence of symptoms suggestive of COVID-19, negative RT-PCR and unavailability of CT chest, better understanding of typical X-ray manifestations along with biochemical profile may aid diagnosis.

## Methods

This was a multicenter retrospective study conducted in three leading tertiary care hospitals of Lahore including Lahore General Hospital, Fatima Memorial Hospital and Sir Ganga Ram Hospital after approval by institutional review board. Requirement to obtain written consent was waived by IRB.

Irrespective of sex, RT-PCR positive COVID-19 patients of age >18 years, admitted in Corona ward, HDU or ICU, who underwent chest X-ray between March 2020 and June 2020 were retrospectively enrolled in this study. Patients from corona center for pregnant women were also included to see any specific pattern of CXR abnormalities in pregnant females. Patients with negative COVID-19 RT PCR were not included in the study.

Chest X-ray films with reports were obtained from the patient record ensuring confidentiality and anonymity. X-rays were reviewed again by a senior radiologist to confirm findings. Each X-ray was analyzed for unilateral or bilateral disease, frequency of zones involved, nature & distribution of lesions and any other abnormal finding present. These findings were recorded in a predesigned proforma.

Data was analyzed by SPSS version 24. Quantitative variables like age was expressed as mean  $\pm$  standard deviation (SD) and median with inter-quartile range. Qualitative variables like sex, type of lesion, lung zone involved etc were expressed as frequency and percentages.

## Results:

During the study period, radiological data of 150 patients fulfilling the inclusion criteria was analyzed. Out of which 130 patients, were enrolled from Corona wards, HDUs, ICUs and OPDs of two tertiary care hospitals including Lahore General Hospital and Fatima memorial Hospital Lahore. Twenty patients were enrolled from obstetric COVID-19 ward of Sir Ganga Ram Hospital Lahore, the dedicated COVID hospital for pregnant women. The data of pregnant women was analyzed separately to analyze predominant lung lesions in pregnant COVID-19 positive women.

Among 130 non-pregnant patients 48 (37%) were females and 82 (63%) were males, with mean age of 50 years (ranging between 19 to 81 years). Majority

patients were from HDU 49(38%) and ICU 42(32%), followed by corona ward 29 (22%) and OPD10(8%). (Table 1)

**Table 1: Patient's Profile**

Characteristics	n = (130)	n (%)
<b>Sex</b>		
Male		82 (63)
Female		48 (37)
<b>Age</b>		
Mean		50 years
Range		19-81 years
<b>Location</b>		
HDU		49 (38)
ICU		42 (32)
Ward		29 (22)
OPD		10 (8)

**Table 2: Radiological findings of COVID -19 on Chest X-ray PA View**

Characteristics (n=130)	n (%)
Normal CXR	3 (2)
Abnormal CXR	127(98)
<b>INVOLVEMENT OF LUNG</b>	
Unilateral disease	6 (5)
Bilateral disease	121(95)
<b>LUNG ZONES</b>	
Left Lower	89 (70)
Left Mid	50 (39)
Left Upper	6 (5)
Right Lower	85 (67)
Right Mid	57 (45)
Right upper	12 (9)
Diffuse/All zones	36 (28)
<b>TYPE OF LESIONS</b>	
Pure GGOs	53 (42)
GGOs & Consolidation Combined	44 (35)
Pure Consolidation	30 (24)
Peri bronchial cuffing	23(18)
Reticulation	20 (16)
Nodularity	8 (6)
<b>DISTRIBUTION OF LESIONS</b>	
Peripheral	36 (28)
Peripheral +Perihilar	58 (45)
Peri hilar	6 (5)
Random	27 (21)
Patchy	67 (53)
Confluent	37 (29)
<b>OTHER FINDINGS</b>	
Pneumo mediastinum	2 (1)
Calcified granulomas	3(2)
Pleural effusion	1(0.7)

Normal X-rays were found in only 3 (2 %) whereas 127 (98%) had abnormal chest X-rays. (Table 2) Both lungs were involved in 121 (95%) CXR while in remaining 6 (5%) unilateral lung involvement was seen. Most commonly affected zone was left lower zone 89(70%) followed by right lower zone 85(67%) whereas 36 (28%) patients had diffuse involvement of both lungs affecting all 6 zones. Left upper zone was least affected. Ground glass opacification (GG-Os) was the most common lung lesion found in 53 (42%) followed by GGOs consolidation combined in 44(35%) and pure consolidation in 30 (24%). In 67(53%) cases, these lesions were patchy while 37 (29%) had confluent shadows. Regarding distribution of lung pathologies, 36(28%) had peripheral distribution, 6(5%) perihilar, 58 (45%) showed peripheral and peri hilar combined while 27 (21%) had random distribution. Peri bronchial cuffing was seen in 23(18 %) and reticulation in 20(16%). Nodular lesions were seen only in 8(6%) cases. Two patients (1.5%) had pneumomediastinum while minimal pleural effusion was found in only one patient (0.7%). (Table 2)

Among 20 pregnant females 5 (25%) had abnormal CXR. All 5(100%) patients had bilateral mid and lower zone involvement with combined GGOs and consolidation. Distribution was random in 3(60%), peripheral and perihilar combined 2(40%), patchy 1(20%) and confluent in 4(80%). (Table 3)

**Table 3: Findings in Pregnant Patients**

Characteristics (n=20)	n (%)
Normal CXR	15(75)
Abnormal CXR	5 (25)
<b>INVOLVEMENT OF LUNG</b>	
Unilateral disease	0 (0)
Bilateral disease	5 (100)
<b>LUNG ZONES</b>	
Right & Left Lower	5 (100)
Right & Left Mid	5(100)
Right & Left Upper zone	0 (0)
<b>TYPE OF LESIONS</b>	
Pure GGOs	0 (0)
GGOs & Consolidation Combined	5 (100)
Pure Consolidation	0 (0)
<b>DISTRIBUTION OF LESIONS</b>	
Peripheral	0 (0)
Peripheral +Perihilar	3(60)
Peri hilar	0 (0)
Random	2 (40)
Patchy	1 (20)
Confluent	4 (80)

**Discussion:**

The COVID-19 pandemic is quite a jolt to the world. The variable spectrum of disease ranging from an unnoticed carrier state to respiratory failure and multi-organ failure, has perplexed the health professionals.

RT-PCR is the gold standard for diagnosis of Covid-19. But considering the low sensitivity of the test and its limited availability at various centers, radiological presentation along with typical symptoms could have pivotal role in diagnosis. In highly suspected cases with negative PCR, characteristic findings on CT chest or X-ray chest can narrow down the differential diagnosis<sup>13</sup>. National Health commission of China has recommended use of clinical and CT findings to treat such patients<sup>14</sup>. Cost effectiveness, wide-spread availability and reduced infection control issues of X-rays compared to CT chest point towards the importance of analyzing and reporting any peculiar radiological features of COVID which may support the diagnosis in resource constrained areas<sup>15</sup>.

In our study only 3(2%) cases had normal chest X-rays while rest had lung lesions. A plausible explanation for this is that our study was done in tertiary care corona facilities catering mostly patients with moderate to severe COVID admitted in ICU and HDU. In our patients, GGOs 53(42%) were most common finding followed by GGOs and consolidation combined lesions (44(35%). Pure consolidation was seen only in 30(24%) cases and distribution of lesions was predominantly patchy, peripheral and peri hilar combined with bilateral and lower zone predominance. Our findings are consistent with most of the international studies except few which are mainly from china and have documented consolidation as a major finding.

Sergio et al reviewed 240 CXR and reported distribution of lesions in lower zones bilaterally. They observed GGOs was most common while pure consolidations comparatively less common type of lesions. These findings were in accordance with our results. Lesions were predominantly peripheral which differs from our findings and reticulations in 62% cases which were just 20% in our cases<sup>16</sup>. Shi H et al.in China and Duranni M et al. from Pakistan described GGOs as predominant feature with more or less same pattern of distribution as ours<sup>17,18</sup>. In

another study done in Korean population by Yoon SH et al. patchy GGOs /GGOs and consolidation combined were predominant than pure consolidative lesions and overall CXR involvement was 33%<sup>19</sup>. In Italy by Cozi D et al. revealed reticulo-nodular opacities in 66.6% cases which are much more than our observation in local population. GGOs remained the most frequent (62.8%) and consolidation in 57% cases<sup>20</sup>.

We had two cases of pneumo-mediastinum without pneumothorax which is rare finding in COVID-19. Only few cases have been described in literature<sup>21,22</sup>. Pleural effusion and lymphadenopathy remained less common finding throughout the world<sup>23</sup>.

The main limitation of our study was inability to get CT chest to further classify findings and rely on use of portable CXR in most cases. In addition, we could not correlate the findings with the duration and course of disease.

Among pregnant patients in our study, majority had normal X-rays 15(75%) which is different from the literature. A plausible reason for this is that majority of women were asymptomatic or had mild disease as data was collected in early stage of outbreak. The public health policy was to hospitalize and isolate all COVID-19 women regardless to severity of symptom to restrict disease transmission<sup>24</sup>. Abnormal X-ray findings were consistent with other researchers showing bilateral mid and lower zone GGOs as predominant lesions variably mixed with consolidation, mostly patchy and peripheral<sup>25,26</sup>. We saw confluent lesions predominantly with perihilar and peripheral combined distribution. The CXR finding of pregnant women were observed to be similar to findings in non-pregnant patients.

In conclusion the main radiological features of COVID-19 in our population were bilateral, lower zone, patchy, pure GGOs or combined GGOs and consolidation with peripheral and perihilar distribution. In a resource constrained country like Pakistan, ordering CT in every patient during pandemic is impossible, thus pointing to combination of CXR with clinical and biochemical profile as a useful alternative diagnostic tool.

**Ethical Approval:** Given

**Conflict of Interest:** The authors declare no conflict of interest

**Funding Source:** None

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