ISSN No:-2456-2165

Clinico-Radiological Profile in Covid – 19 Patients

Mohit Bhardwaj, Ayush Pandey, Sonali Saini, DPS Sudan, Prem Kumar Singhal, Adil Jokhi
Department of Pulmonary Medicine, SGT Medical College, Hospital & Research Institute, Gurugram-122505, India

Abstract:- The coronavirus-2 positive cases were enrolled retrospectively and specific data were collected on CT and imaging features. On admission, 45 patients out of 50, were symptomatic and 5 were asymptomatic. On admission, abnormalities in CT images were detected in 24 patients. The typical findings of chest CT images were ground glass opacities with bilateral, multifocal, patchy peridermal lessions. Fever was the most common complaint present in 74% patients. Based on COVID-19 severity illness grading, the patients were grouped as asymptomatic, mild, moderate, severe or critical.

Keywords:- *RT-PCR; CT Imaging; Classification.*

I. INTRODUCTION

The coronavirus disease-2019 was first reported from Wuhan, China. The rapid spread of the infection in different parts of the world resulted in an epidemic (1). World Health Organisation (WHO) declared the disease as an international public health emergency. The causal organism of the disease is a corona virus named as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The virus is now referred to as 2019-nCoV (2).

Corona viruses belong to family Coronaviridae and are grouped under the category of non-segmented positive sense RNA viruses (3). Although most human corona virus infections are mild in nature but some viruses like Middle East Respiratory Syndrome corona virus (MERS-CoV) are considered virulent (4-9). The transmission of virus in human takes place either through droplets or contact with fomites which is one of the major routes of the virus spread. The virus causes mild infection in many patients but may also cause serious illness leading to hospitalization and even death in elderly patients or those with comorbid conditions (10).

In India, the first COVID-19 positive patient was diagnosed in Kerala on January 30, 2020. In Haryana, the first COVID-19 positive case was diagnosed in on March 4, 2020 and subsequently the first positive case in Gurugram was reported on March 16, 2020 (11).

The clinical symptoms of COVID-19 disease begins from mild to moderate fever, dry cough associated with shortness of breath, sore throat, anosmia and loss of taste sensation with generalized weakness, later involvement of gastrointestinal symptoms were reported in few positive cases which included acute abdominal pain, nausea, vomiting and diarrhea (12-14). Depending on the exposure to viral load and immunity of individual, the symptoms varies from mild fever with malaise to breathlessness with chest pain, high grade fever which is refractory to paracetamol medication. Infection by the virus ranges from asymptomatic to severe life-threatening course or eventually death.

The severity of illness of COVID-19 patients varies from asymptomatic, to mild, moderate, severe and critical.

1. **Asymptomatic infection**- Absence of clinical sign and symptom of disease and normal chest x-ray or CT scan associated with positive test for SARS-CoV-2.
2. **Mild infection**- Upper airway symptoms include fever, fatigue, myalgia, cough, sore throat, sneezing, and running nose. Some cases may not have fever and others may show gastrointestinal (GIT) symptoms (e.g., nausea, vomiting, abdominal pain and diarrhea).
3. **Moderate infection**- Clinical signs of pneumonia with persistent fever, initially dry cough, which becomes productive, may have wheezing or crackles on pulmonary auscultation but show no respiratory distress. Some individual may not have any symptom or clinical sign but CT scan reveal typical pulmonary lesion.
4. **Severe infection**- Initial respiratory symptoms may be associated with gastrointestinal complaints (GIS) such as diarrhea. The clinical deterioration usually occurs in a week with development of dyspnea and hypoxemia (blood oxygen saturation <94%).
5. **Critical infection**- There is fast deterioration of patients leading to deterio to acute respiratory distress syndrome or respiratory failure. These may be present with shock, encephalopathy, myocardial injury or heart failure. In some critical pateints coagulopathy, acute kidney injury and multiple organ dysfunction have also been observed.

The diagnostic criteria of COVID-19 is inclusive of history of exposure, clinical features and RT-PCR from specimens obtained by oro-pharyngeal or nasopharyngeal swab, assisted with work-up of ultrasound (US), digital Chest X-Ray (CXR) and (CT).

II. METHODS

Present study was conducted on the patients admitted in the SGT Medical College, Hospital and Research Institute, Gurugram, Haryana. It is a retrospective observational case series of demographic features and clinic radiological manifestations in patients suffering from COVID-19. A total of 50 COVID-19 positive patients were admitted in the hospital between May 2020 to September 2020 during the outbreak of COVID-19 disease.

Upon arrival, the suspected patients were isolated and admitted in isolation ward. The isolation facility was established according to the standardized checklist published by the Ministry of Health and Family Welfare

ISSN No:-2456-2165

(MoHFW). All the health-care workers deputed for taking care of the infected patients were given comprehensive training about the contro practices and procedures. All patients were treated by standardized protocol issued by government authorities from time to time. All the patients were advised to contact a physician for any complication or to have a follow up checkup at regular intervals.

The nasopharyngeal and oropharyngeal swabs were tested in the Mycobacteriology lab (NABL certified) of SGT Medical College, Hospital and Research Institute, Gurugram, Haryana for detection of COVID-19 using quantitative RT-PCR for confirmation.

The medical records of patients were analyzed in the Department of Pulmonary Medicine of SGT Medical College, Hospital and Research Institute Gurugram, Haryana. The clinical, laboratory and radiological characteristics data were obtained from medical records and history given by the patients. All data were reviewed by the team.

The recorded information included medical history, exposure history, underlying co-morbidities, symptoms, signs, and laboratory findings such as chest X-ray and CT scan.

III. RESULTS

In the present study, a total of 50 patents, all from Gurugram district of Haryana State, were incuded. The average age of patients was 44 years (ranged 12-86 years). There was a male preponderance (76%). Out of 50 patients 4 were health care workers exposed from the SGT hospital, remaining 46 patients were non-health care workers.

The common symptoms experienced by the patients varied from fever, cough, sore throat, shortness of breath, to generalized weakness. Five patients (10%) were found to be asymptomatic. Of the remaining 45 symptomatic patients (90%), fever was the most common complaint recorded in 37 patients (74%). Nineteen patients (38%) suffered with cough, sixteen patients (32%) with shortness of breath, seven patients (14%) with sore throat while six patients (12%) were having complaint of weakness.

Seven patients (14%) of total 50 had co-morbidities. Diabetes was the most common co- morbidity present in 5 patients followed by hypertension in 2 patients. The total leucocyte count on admission were normal (4000 – 11000/cmm) in 40 (80%) out of 50 patients and leukocytosis was seen in 8 (16%) patients while leucopenia was found in 2 (4%) patients. Out of 50 patients, three (6%) showed increased lymphocyte/neutrophil ratio. Eight (16%) patients showed high ESR and CRP, and D-dimer level and IL-6 on admission were found to be raised in 8 (16%) patients. In all patients the serum creatinine was normal but blood urea was raised in 2 (4%) patients. SGOT and SGPT were higher in 17 (34%) patients. Chest X-ray was found to be normal in 26 patients (52%). 20 (40%) patients showed abnormality in the form of infiltrates and haziness in mid and lower zones of lung parenchyma [Fig. 1]. Pleural effusion was present in only one patient (2%).

At the time of admission, abnormalities in chest CT images were detected in 24 (48%) patients. Of the 20 patients, the typical findings of chest CT images were ground glass opacities with bilateral, multifocal, patchy peripheral lesions. The lower lobes were affected more than the upper lobes [Fig. 2]. Bilateral ground glass opacities involving multiple segments were also noted. Pure consolidation picture in lung fields were present in 2 (4%) patients.

Mixed pattern showing ground glass opacities with consolidation were present in 2 (4%) patients. One patient (2%) had pleural effusion tracing into fissures.

All 50 COVID-19 positive patients became asymptomatic and were discharged from the hospital after RT-PCR report. All discharged patients were advised home quarantine for 7 days as per latest guidelines issued on 8th May, 2020 earlier it was 14 days. (guidelines issued on 21st April, 2020)

IV. DISCUSSION

The COVID-19 infection spreads through human-to-human contact via respiratory route (15, 16). The clinical manifestations of the disease range from mild symptoms to severe illness and sometimes leading to death. It has been seen that the infected individual shows no sign and symptoms of the disease.

An analysis of chest CT revealed that 2 (4%) asymptomatic cases were having abnormalilities in the lungs. Similar findings have also been reported in asymptomatic cases that sowed a positive CT. Inui et al. (17) observed that in Diamond Princess Cruise Ship case, 56% of asymptomatic COVID-19 cases were found to be with abnormal lungs. They made a comparison of total CT score (determined visually as the percentage of total lung involvement) and reported a significantly lower CT score in asymptomatic cases as compared to the symptomatic cases (p-value < 0.05). The consolidations were more common in symptomatic cases (41%) as compared to asymptomatic cases (17%), whereas GGOs (ground glass opacities) predominated in asymptomatic cases (83% vs 59%).

Bandivali et al. (18) reported pulmonary parenchymal abnormalities in 59% (100/170) of asymptomatic or minimally symptomatic patients. Similarly several such cases of asymptomatic COVID-19 patients with pulmonary findings have been reported (19). The converse has also been observed where symptomatic cases can have a negative CT (17, 20).

The distribution and type of pulmonary opacities in asymptomatic cases may resemble the CT findings in symptomatic cases (20-23). However, asymptomatic and mildly symptomatic cases have a lower percentage of lung involvement with low CT severity score. It has been

reported that the percentage of the total lung involvement signifying the disease burden determines the severity of the disease and the final clinical outcome (23-24).

The percentage of lung opacification is a surrogate of clinical outcome in COVID-19 pneumonia with a higher percentage of lung involvement suggesting an adverse outcome (23), a feature also reported by Tabatabaei et al. (24)

Yu et al. (26) reported that age, presence of co-morbidities, low lymphocyte count, presence of consolidations, crazy paving pattern, larger size of pulmonary opacities and pleural effusion were associated with severe illness. Older age has been found to be an important risk factor for severe disease and adverse outcome (21, 23-25). Yang et al. (26) reported that asymptomatic patients were younger (median age of 37 years) as compared to symptomatic patients (56 years) ($p < .001$). They had a higher CD4 +T lymphocyte count and showed a faster lung recovery on CT scans (9 vs 15 days) ($p = .003$) (25).

Although CT has helped us in understanding the disease but the repeat CTs are not recommended in recovering patients. However, a repeat examination may be indicated in cases with suspected complications (e.g., super infection, pulmonary embolism) (26). According to American College of Radiology guidelines, CT should be reserved for hospitalized, symptomatic patients with specific clinical indications like deteriorating respiratory status (27, 28).

Present study included 50 COVID-19 affected patients with the median age being 46 years. These patients were around one decade younger than that reported by Wang et al. (15) (56.0 years), Chen et al. [9] (55.5 years) and three years younger than Huang et al. [29] (49.0 years). In our study most of the patients infected with COVID-19 were male (76%). Amost a similar observation was made by Chen et al. (9) which showed 73.10% male predominance. On the other hand, a study conducted by Wang et al. (15) reported (54.3%) males.

Out of 50 patients, 8% were asymptomatic. In symptomatic patients, in 74% pateints fever was the most common symptom followed by cough (38%), and shortness of breath (32%). Our observations are similar to that reported by Wang et al. (15) and Huang et al. (29).

Of all the pateints, two patients (4%) showed lymphocytopenia which is very low when compared with the study of Zhang et al. (30) (75.4%). In our study one patient had lymphocytopenia with thrombocytopenia (2%).

HRCT chest of patients demonstrated bilateral, multifocal, patchy peripheral lesions. Bilateral ground glass opacities involving multiple segments were also noted. These findings were similar with Guan et al. (10) and Young et al. (31).

The mean duration of conversion of the infection showed no relation with the symptoms of patients and history of exposure.

V. CONCLUSION

Based on COVID-19 severity illness grading, out of total 50 enrolled patients, 5 (10%) patients were asymptomatic, 21 (42%) patients had mild infection, and 24 (48%) patients had moderate infection. Of 50 patients, 24 (48%) patients showed abnormal chest x-ray and CT chest findings.

The various lung opacities observed on CT chest in COVID-19 patients were ground glass opacity (GGO), GGO with crazy paving pattern, pure consolidation, mixed pattern (GGO with consolidation), segmental vessel enlargement, sub pleural linear/curvilinear lines, bronchial wall thickening, bronchial dilatation, air bronchogram sign, and air bubble sign nodules, reticulations, and halo sign.

In our study, 20 (40%) patients, showed ground glass opacities which are bilateral, multifocal, patchy peripheral lesions. The lower lobes were found to be affected more as compared to upper lobes. Bilateral ground glass opacities involving multiple segments were also noted. Pure consolidation picture in lung fields were present in 2 (4%) patients. One patient (2%) had pleural effusion extending into fissures. Mixed pattern showing ground glass opacities with consolidation were present in 2 (4%) patients. One patient (2%) had pleural effusion extending into fissures and two (4%) patients were asymptomatic. But CT chest examination revealed typical pulmonary lesions.

Seven patients (14%) of the total 50 showed co-morbidities. The most common co-morbidity was diabetes that was recorded in 5 patients. Hypertension was found in two patients. The total leucocyte count of patients on admission were normal (4000 – 11000/cmm) in 40 (80%) patients and leukocytosis was seen in 8 (16%) patients and leucopenia was seen in 2 (4%) patients. Out of 50, Three patients (6%) showed increased lymphocyte/neutrophil ratio. ESR and CRP were high in 8 (16%) patients, and D-dimer level and IL-6 on admission were also found to be raised in 8 (16%) patients. Serum creatinine was normal in all the patients but blood urea was raised in 2 (4%) patients. SGOT and SGPT were raised in 17 (34%) patients.

In our study, the mean age of participants was 44. There was a male preponderance (76%). Out of 50 patients, 4 health care workers exposed from SGT hospital, remaining 46 patients were non-health care workers.

The abnormal lung findings on CT were observed in asymptomatic cases with COVID-19 pneumonia. Clinically, some patients recovered without developing symptoms whereas some showed mild symptoms. In some other cases the condition of others deteriorated considerably. In such cases imaging follow-up may reveal partial or complete progression or there may not be any change.

ISSN No:-2456-2165

The conditions which were commonly associated with clinic radiological progression include older age, higher lymphocyte count, higher D dimer and presence of co-morbidities.

The containment of spread of disease is the most important determinant of the final morbidity due to COVID-19 pandemic. In India, there is need to follow-up pattern of disease spread involving clinical presentation in the larger population. In order to prevent widespread transmission within the communities, a close monitoring and large-scale control strategies are urgently needed.

TABLE I. DEMOGRAPHIC, CLINICAL FEATURES OF COVID-19 PATIENTS

Age Group:

Criteria	Male	Female
0-19 years	0 (0%)	3 (6%)
20-39 years	11 (22%)	2 (4%)
40-59 years	25 (50%)	4 (8%)
>60 years	3 (6%)	2 (4%)
Total	39 (78%)	11 (22%)

Asymptomatic	Symptomatic
05	45

Health Care Workers (HCW)	Non-Health Care Workers (NHCW)
04	46

Subsequent Symptoms:

Symptoms	Male	Female
Fever	27 (54%)	10 (20%)
Cough	15 (30%)	04 (8%)
Sore throat	05 (10%)	02 (4%)
Shortness of breath	11 (22%)	05 (10%)
Generalized weakness	03 (6%)	03 (6%)
Loose stools	01 (2%)	01 (2%)

Co morbid Illness:

	Male	Female
Diabetes	03 (6%)	02 (4%)
Hypertension	01 (2%)	01 (2%)

Death:

Male	Female
0	0

Types of Lung opacities on Chest CT:

Lung opacity	Number of patients (%)
Ground glass opacity	20 (40%)
Pure consolidation	2 (4%)
Mixed pattern	2 (4%)

Severity of illness of COVID-19 patients:

Asymptomatic	5
Mild	21
Moderate	24
Severe	0
Critical	0

CECT THORAX OF COVID19 PATIENTS

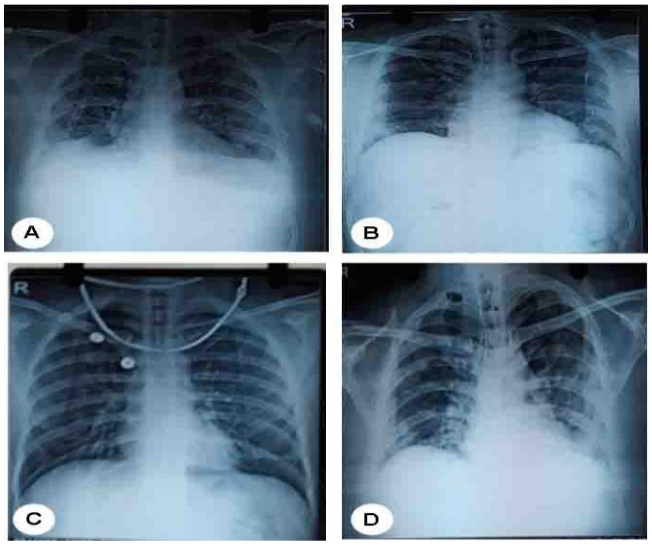

FIGURE 1: CHEST X-RAY OF STUDY PATIENTS SHOWING BILATERAL LUNG OPACITIES

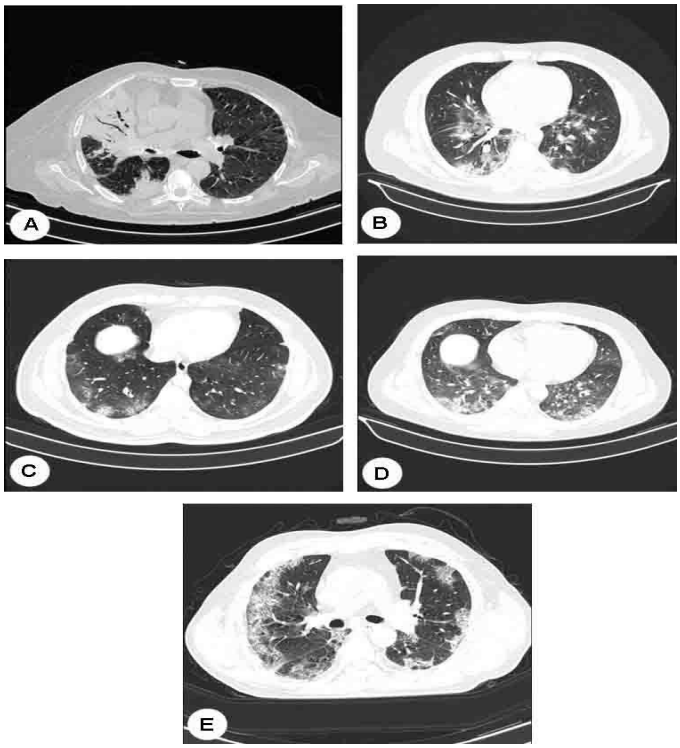

Figure. 2. A. Areas of consolidation in right lung field. **B.** Diffuse ground glass opacities in bilateral lower lobes. **C.** Multifocal ground glass opacities in bilateral lower lobes in peripheral and subpleural region. **D.** Diffuse areas of ground glass opacities in bilateral lower lobes in peripheral region. E. Diffuse area of ground glass opacities in bilateral lung fields.

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