Research Article

ROLE OF CT IN EVALUATION OF COVID PATIENTS: OUR EXPERIENCE IN A TERTIARY CARE COVID HOSPITAL

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A R T I C L E   I N F O

A B S T R A C T

Introduction: COVID-19 being a global pandemic of the era is emerging with highest transmission rates and fatality in most cases, disease affection and rapid progression remains as an unidentified factor leading to highest number of mortality. Through this study we will try to observe and conclude the disease manifestation with the help of imaging modality that is CT scan of randomly selected people.

Materials and method: The study was done in the department of Radio diagnosis, Medical College Kolkata .50 COVID positive patients were selected from EKO diagnostic centre who had been referred from the isolation ward and fever clinic of MEDICAL COLLEGE KOLKATA, for CT scan after their initial evaluations and RTPCR testing done. CT Machine of EKO diagnostic centre was used for the imaging.

Result: we observed highest percentage of people were of adult age group. Children were having a mild grade of disease, and males were affected more in number than females. Among CT features bilaterality, GGO, consolidation, crazy paving etc were the most common findings.

Conclusion: Though CT is not used as a first line diagnosing modality but its definitely a very important tool for assessing disease severity progression and also prognosis.

INTRODUCTION

COVID-19 (Coronavirus disease 2019) an infectious disease caused by Coronavirus 2 (SARS-CoV-2), a strain of coronavirus. The first case was seen in Wuhan, China, in December 2019. Thereafter a sudden global spreading noted with more than 1.5 million deaths and 78 million cases confirmed. The outbreak was officially recognized as a pandemic by the World Health Organization (WHO) on 11 March 2020. This is the 7th known corona virus to infect man.[1]

Definitive diagnosis of COVID-19 requires a positive RT-PCR test. However imaging plays a major role in predicting the disease progression and severity though not used as a diagnostic modality and hence helps in clinical management through various CT findings and severity scorings.

REVIEW OF LITERATURE

Background Chest CT is used in the diagnosis of coronavirus disease 2019 (COVID-19) and is an important complement to reverse-transcription polymerase chain reaction (RT-PCR) tests. Chest CT may be considered as a primary tool for the current COVID-19 detection in epidemic areas.[2]

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Children infected with COVID-19 can present with normal or atypical findings (nodular opacities/unilateral involvement) in chest imaging more frequently than adult patients. Therefore, more caution should be taken to avoid misdiagnosis or missed diagnosis in infected children. Besides, clinical and laboratory findings need to be considered more decision-making for paediatric patients with normal or atypical chest CT scan but high suspicion of COVID-19.[3]

However, false negative multiple polymerase chain reaction (RT-PCR) results can be diagnostically challenging. In a study conducted in Italy (March to May 2020), three patients with history of fever and different clinical signs underwent chest computed tomography (CT) scans that showed lung alterations typical of COVID-19 with multiple negative RT-PCR tests Two of the three patients showed residual pneumonia on CT after the onset of the first clinical signs. One patient presented with diarrhoea without respiratory symptoms. These cases suggest that in the COVID-19 pandemic period, to provide an earlier specific treatment a chest CT scan can be useful in those presenting with a fever or a history of fever associated with persistent mild respiratory symptoms or with abdominal complaints despite repeated negative RT-PCR results.[4]

The hallmarks of COVID-19 infection on imaging were bilateral and peripheral ground-glass and consolidative

pulmonary opacities, linear opacities, "crazy-paving" pattern and the "reverse halo" sign.[5]

The current novel coronavirus disease 2019 (COVID-19) pandemic is revealing profound differences between men and women in disease outcomes worldwide. In the United States, there has been inconsistent reporting and analyses of male–female differences in COVID-19 cases, hospitalizations, and deaths. We seek to raise awareness about the male-biased severe outcomes from COVID-19, highlighting the mechanistic differences including in the expression and activity of angiotensin-converting enzyme 2 (ACE2) as well as in antiviral immunity.[6]

Retrospective study, chest CTs of 121 symptomatic patients infected with coronavirus disease-19 (COVID-19) from four centers in China from January 18, 2020 to February 2, 2020 were reviewed for common CT findings in relationship to the time between symptom onset and the initial CT scan (i.e. early, 0-2 days (36 patients), intermediate 3-5 days (33 patients), late 6-12 days (25 patients)). The hallmarks of COVID-19 infection on imaging were bilateral and peripheral ground-glass and consolidative pulmonary opacities.[7]

MATERIALS AND METHODS

The study was conducted in Medical college Kolkata, A Tertiary covid care hospital in patients coming with typical symptoms of COVID-19 to fever clinic and patients from isolation ward, referred to EKO diagnostic centre for CT scan evaluation and disease severity assessment.

Inclusion Criteria

1. Patients of all age groups.
2. With typical symptoms of the disease like fever, shortness of breath, dry cough, anosmia or loss of taste sensations.
3. Patient who are RTPCR/RAT positive with symptoms.

Exclusion Criteria

1. Unstable patients
2. Asymptomatic patients.
3. Pregnant patients.
4. Patients in whom CT was a contraindication.

This study was carried out from October 2020 to December 2020 (2 months period) including a total of 50 patients who underwent CT scans in EKO diagnostic centre with symptoms of COVID-19.50 consecutive patients were selected for the study irrespective of age and sex. All the patients were positive for the disease. Patient preparation done followed by positioning and breath holding whenever necessary.

EKO GE 16 slice CT machine was used and Scanning parameters as follows: 120 kv,100-250 m As collimation of 5 mm pitch of 1-1.5 matrix size- 512 x 512.no contrast was administered. CT scans of NONCOVID patients were done from 9 am to 3 pm.

Afterwards from 3pm till 9 pm there was provision for CT SCAN of COVID positive patients. After that sanitisation of CT scan room was done with hypochlorite solution followed by fumigation.

Cases are increasingly reported in which the assay yielded a positive result only after multiple negative results in patients with typical clinical and imaging signs of COVID-19. Also,

RT-PCR takes hours, or even days, before the results are available, hence before using RTPCR results keeping in mind about patient isolation and treatment and Increasingly, situations arise in which RT-PCR tests are scarce and can not be used for every patient, we can use imaging as an initial assessment mode to categorise patients according to lung involvement as CO-RADS provides a level of suspicion for pulmonary involvement of COVID-19 based on the features seen at unenhanced chest CT. The level of suspicion increases from very low (CO-RADS category 1) to very high (CO-RADS category 5).Two additional categories encode a technically insufficient examination (CO-RADS category 0) and RT-PCR–proven severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection at the time of examination (CO-RADS category 6).[8]

In our study all patients come under CORADS-6 as we have taken all the proven positive cases for our study.

Table 1: Overview of CO-RADS Categories and the Corresponding Level of Suspicion for Pulmonary Involvement in COVID-19

CO-RADS Category	Level of Suspicion for Pulmonary Involvement of COVID-19	Summary
0	Not interpretable	Scan technically insufficient for assigning a score
1	Very low	Normal or noninfectious
2	Low	Typical for other infection but not COVID-19
3	Equivocal/unsure	Features compatible with COVID-19 but also other diseases
4	High	Suspicious for COVID-19
5	Very high	Typical for COVID-19
6	Proven	RT-PCR positive for SARS-CoV-2

Note.—CO-RADS = COVID-19 Reporting and Data System, COVID-19 = coronavirus disease 2019, RT-PCR = reverse transcription-polymerase chain reaction, SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.

Imaging findings were looked for presence of typical CT features like-
Ground-glass opacities (GGO): bilateral, sub pleural, peripheral
Crazy paving appearance (GGOs and inter-/intra-lobular septal thickening)
Air space consolidation.
Bronchovascular thickening.
Traction bronchiectasisetc.
Subpleural bands.

For assessing the disease severity CT SEVERITY SCORING was used In all cases, a semi-quantitative CT severity scoring proposed by Pan *et al*[9] was calculated per each of the 5 lobes considering the extent of anatomic involvement, as follows:

1. no involvement.
2. < 5% involvement.
3. 5–25% involvement.
4. 26–50% involvement.
5. 51–75% involvement.
6. > 75% involvement.

The resulting global CT score was the sum of each individual lobar score (0 to 25). Then to grade the imaging analysis results according to score obtained.

Analysis

| GRADE	SCORE
MILD	< 8
MODERATE	9 -15
SEVERE	>15

Ethical consideration

The study was conducted after getting approval from Institutional Ethics Committee and other authority. Informed consent was taken from all participants.

RESULTS

There was a total of 50 patients of which 28 were male and 22 female. Age group taken as 0-13 years (paediatric age group) having 6 patients,14-60 years age group having 30 patients and more than 60 years having 14 patients. There were more no of infected people in the age group of 14-60 years 30 patients(60%) followed by 14 patients of age > 60 years (28%) and only 6 of paediatric population (12%).There was not much discrepancy in the gender distribution of disease still male were 56% and female 44%.
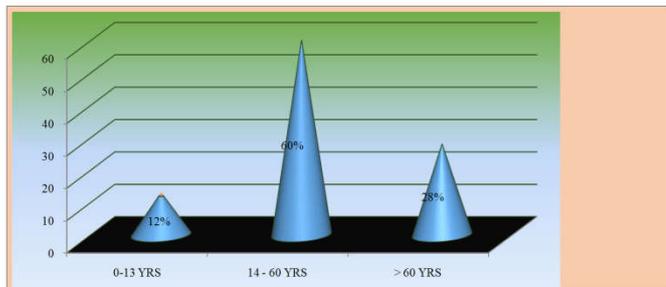

Distribution of patients according to age
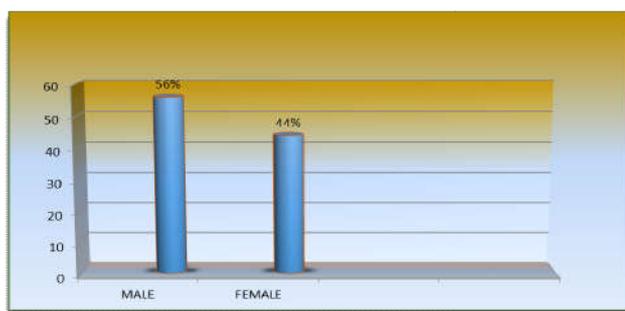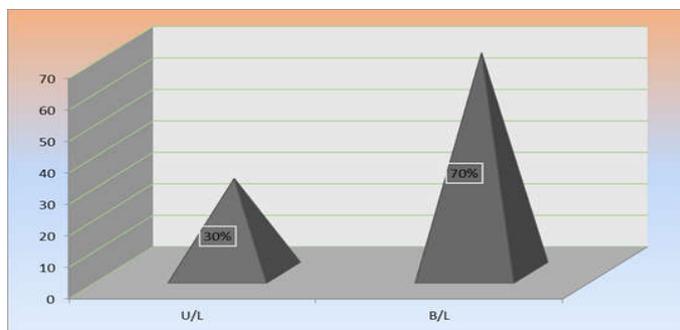

Distribution according to gender

CT Findings Were Studied As Below

The disease was almost peripheral in distribution in all the cases. The typical findings as studied are ground-glass opacities (GGO) which was present in 48 patients out of 50 (96%) being the most common finding almost in every patient, crazy paving (CP) appearance (GGOs and inter/ intra lobular septa thickening) was there in 25 patients (50%), air space consolidation (CON) in 32 patients(64%), branchovascular thickening (BVT) in 38 (76%) patients and 1 (2%) paediatric patient was having reverse halo sign(RH). Out of 50 patients 10 patients were having pleural effusion (20%) and 5 patients were having mediastinal lymphadenopathy (LN) (10%), these findings were nonspecific for the disease.
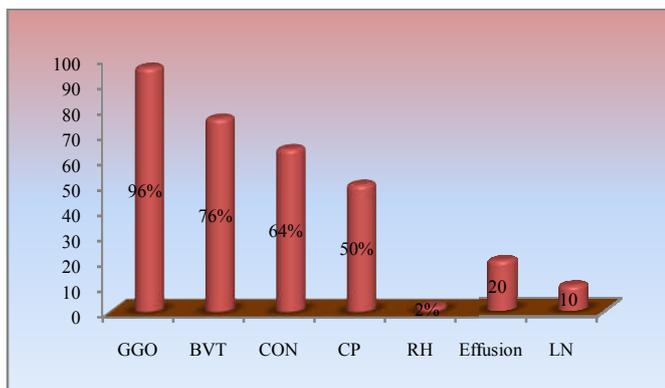

Disease Distribution among Patients

Among all patient at the time of initial evaluation 35 patients were having B/L affection of the lung that is bilateral lower lobe was seen involved that is 70% and 15 patients were having U/L involvement (30%) most commonly right lower lobe was involved hence it can be observed here in this study bilaterality is the most common feature of involvement and right lower lobe is commonly involved in U/L disease.

According To Involvement of Lung (U/L / B/L)

CT Severity Scoring

| Age group	Mild (Total=24)	Moderaten (TOTAL=19)	Severe (TOTAL=7)
0-13 YRS(N=6)	4	1	1
14-60 YRS(N=30)	16	12	2
>60 YRS(N=14)	4	6	4
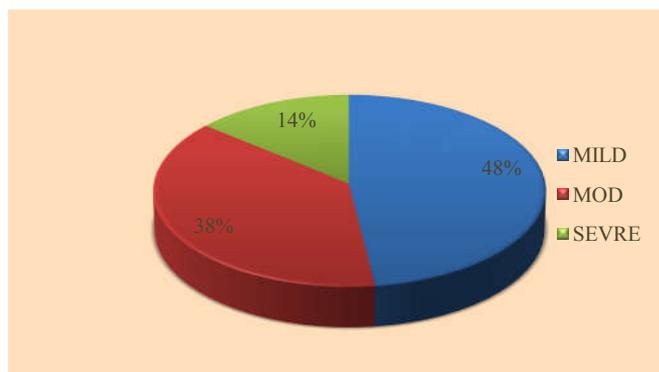
Percentage Distribution of Grades

According to CT severity assessment in this study group there were total of 24 patients in the MILD category that is 48% among them 13 were male (54%) and 11 female (45%) and 19 patients (38%) moderate grade among them 10 were male (52%) and 9 were female (47%) and only 7 (14%) of severe disease category having 5 male (71%) and 2 female (28%). Hence we can see male were more in number compared to female in each category proving males are more prone to the disease compared to females. According to age distribution we can conclude here there were more percentage of people in the severe grade that is 66% in the age group of 14-60 years followed by 28% in the older age groups (>60 years) and least in the paediatric age group that is 16%.Hence we can say here paediatric population are having the least chances of having severe disease. In the mild disease variety 66% was in paediatric age group followed by 53% in age group of 14-60 years and 28% of age > 60 years indicating paediatric patients are having maximum percentage of patients under mild category and least people of >60 years in mild category thus we can observe here older age group people if contract the disease will progress to either moderate or severe grade compared to patients of paediatric age group who will be maximally in the mild grade with least chances of progression

to moderate or severe disease. under moderate category 6 out of 14 patients were under age group of >60 years (42%) and 12 0ut of 30 people were in the age group of 14-60 years (40%) and 1 patient out of 6 from paediatric group (16 %) ,showing least percentage of people in the paediatric group in moderate category and highest in the older age group.

Imaging Findings
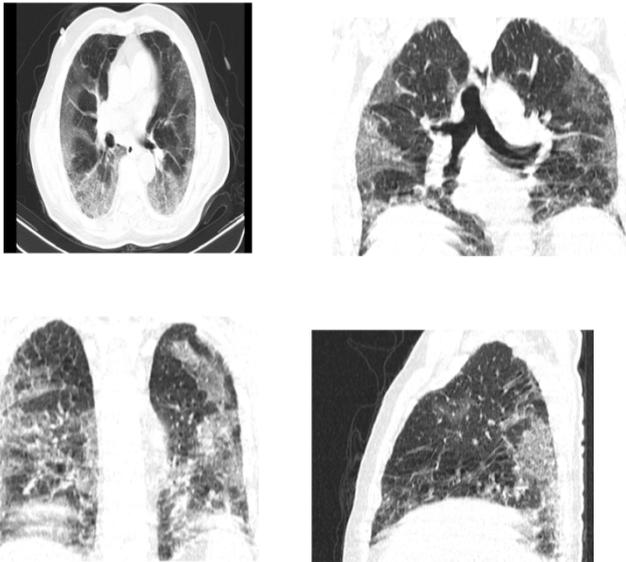
The above CT images of a patient showing multiple peripherally distributed ground glass opacities, septal thickening and consolidation involving the bilateral lung field.

Imaging Findings
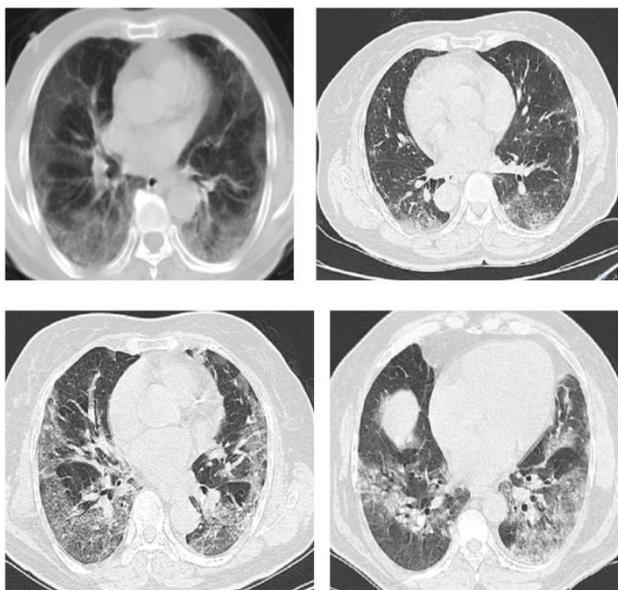
B/L involvement of lung with peripheral consolidation, GGO and septal thickening

DISCUSSIONS

In my study there was more percentage of adult population than children that is only 12% concluding children's are less commonly affected than adults which supports the data reported from the Chinese Centres for Diseases Control and Prevention indicated that among the 44,672 confirmed cases of COVID-19 as of February 11, 2020, 416 (0.9%) were aged 0–10 years and 549 (1.2%) aged 10–19 years.[10] in this study highest percentage of children were seen having mild disease and least percentage having moderate disease supporting a met

analysis of 195 studies of which 33 were selected, and 14 (371 patients) of them were included in the meta-analysis. Then, 19 case reports (25 patients) were summarized separately. The meta-analysis revealed that 17.4% of children had asymptomatic infection. The prevalence of severe or critical illness was almost 0% (95% CI = 0–1.0). Ground-glass opacity was observed in the CT scan of 53.9% (95% CI = 38.4–68.7) of children diagnosed with pneumonia, Children are at a lower risk of developing COVID-19 and have a milder disease than adults.[11]

In our study there were 56% male and 44% female indicating male are more susceptible than female for developing the disease and also severity was more in male than female supporting a study by Jian-Min Jinet. All Older age and a high number of comorbidities were associated with higher severity and mortality in patients with both COVID-19 and SARS. Age was comparable between men and women in all data sets. In the case series, however, men's cases tended to be more serious than women's. In the public data set, the number of men who died from COVID-19 is 2.4 times that of women. In SARS patients, the gender role in mortality was also observed. The percentage of males were higher in the deceased group than in the survived group.[12]

According to a study by N. David Yanez, Noel S. Weiss, Jacques-André Romand Over the six-week period of data, there were 178,568 COVID-19 deaths from a total population of approximately 2.4 billion people. Age and sex were associated with COVID-19 mortality. Compared with individuals ages 54 years or younger, indicating that the mortality rate of COVID-19 was 8.1 times higher (95%CI = 7.7, 8.5) among those 55 to 64 years, and more than 62 times higher (IRR = 62.1; 95%CI = 59.7, 64.7) among those ages 65 or older. Mortality rates from COVID-19 were 77% higher in men than in women (IRR = 1.77, 95%CI = 1.74, 1.79)[13], this agrees with our present study that is least percentage of patients in the study of Older age group having mild disease and more were of moderate disease concluding older age group patients were having highest burden for developing moderate and severe disease and hence mortality compared to younger patients.

If we discuss about the disease affection the disease was mostly seen to be B/L, right lower lobe in U/L affection of disease, GGO, bronchovascular thickening, Consolidation and crazy paving etc being the typical CT features studied in most patients which supports the study done by Cuiping Bao *et al* A total of 13 studies met inclusion criteria. The pooled positive rate of the CT imaging was 89.76% and 90.35% when only including thin-section chest CT. Typical CT signs were ground glass opacities (83.31%), ground glass opacities with mixed consolidation (58.42%), adjacent pleura thickening (52.46%), interlobular septal thickening (48.46%), and air bronchograms (46.46%). Other CT signs included crazy paving pattern

lymphadenopathy (3.38%). The most anatomic distributions were bilateral lung infection (78.2%) and peripheral distribution (76.95%). The incidences were highest in the right lower lobe (87.21%), left lower lobe (81.41%), and bilateral lower lobes (65.22%). The right upper lobe (65.22%), middle lobe (54.95%), and left upper lobe (69.43%) were also commonly involved. The incidence of bilateral upper lobes was 60.87%.[14]

CONCLUSIONS

In conclusion we can say we can almost make a complete disease assessment using imaging that is CT evaluation of disease extent severity assessment and progression hence help in better management of risks or morbidity associated with it. So every patient having positive test must undergo a CT scan for accurate assessment of the disease severity and progression. Even though test is negative but patient is having typical clinical symptoms must undergo a CT scan to rule out the disease.

Though x ray is used as a primary screening modality in every covid patient as it is widely available, cheaper and faster, CT is always the gold standard due to higher sensitivity and specificity.

Limitations

CT evaluation couldn't be done in pregnant patients who were COVID positive and others in whom CT was a contraindication.

Many patients denied undergoing the test.

There was difficulty in doing CT in Unstable patients with oxygen support.

Long term Follow up CT evaluation for monitoring the sequelae and further consequences couldn't be done in this study.

Further research with larger number of patient is needed for correlation of CT findings and disease manifestation.

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