

HRCT findings of COVID-19: Analysis of patients attending Sukhkarta advanced CT scan centre, Dhule, Maharashtra

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Abstract

Background: In humans, coronaviruses are among the spectrum of viruses that cause the common cold as well as more severe respiratory diseases—specifically, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). The most typical clinical presentation of COVID-19 is an acute febrile respiratory infection with dry cough, dyspnea, fatigue and myalgia. **Methodology:** The present study was a retrospective analytic study. The study was conducted in Sukhkarta Advanced CT scan centre, Dhule, Maharashtra. Total 424 patients reported to Sukhkarta Advanced CT scan centre from 01/08/2020 to 30/09/2020 were enrolled as study participants. All patients underwent HRCT with GE optima 660, 128 slice CT scanner. All CT images were reviewed independently by two experienced radiologists. **Result:** Involvement of right lower lobe was observed in 293 (69.10%) patients followed by 268 (63.20%) cases with involvement of left lower lobe and 124 (29.25%) showed no changes in both the lungs. Crazy paving was seen in 230 (54.25%) of study participants and 280 (66.04%) shows presence of vascular thickening. 161 (37.97%) participants shows sub-pleural bands on HRCT. CT severity score was mild in 204 (48.11%) study participants, moderate in 60 (14.15%) study participants and severe in 36 (8.49%) study participants. **Conclusion:** High-Resolution computed tomography (HRCT) can help prompt diagnosis, guide clinical decision making, and monitor disease progression, playing a crucial role in the early prevention and control of COVID-19.

Key words: HRCT, Novel Corona virus Disease (COVID-19), CT severity score.

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INTRODUCTION

On December 31, 2019, aggregate cases of an apparently new respiratory syndrome were reported in the city of Wuhan, China by Chinese national health authorities to the World Health Organization (WHO). In humans, coronaviruses are among the spectrum of viruses that cause

the common cold as well as more severe respiratory diseases—specifically, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS)¹. The most typical clinical presentation of COVID-19 is an acute febrile respiratory infection with dry cough, dyspnea, fatigue and myalgia. Approximately 15–20% of patients have severe disease and the mortality is around 2–3%.^{2–4} The method of reference is laboratory testing of nasopharyngeal aspirates for identification of SARS-CoV-2 by reverse transcriptase-polymerase chain reaction (RT-PCR). However, it takes several hours to obtain the results, and the sensitivity of the test is only 60 to 70%, depending on the quality of the sample and the rate of viral replication in the upper respiratory tract.^{5,6} High-Resolution computed tomography (HRCT) has rapidly emerged as a rapid and effective diagnostic tool, given the often quite characteristic presentation of COVID-19 pneumonia.^{7,8} The accurate diagnosis of viral pneumonia based on chest

CT may indicate isolation and plays an important role in the management of patients with suspected SARSCoV-2 infection, especially when there are very less scientifically proven therapies for the treatment of COVID-19.

MATERIAL AND METHODS

The present study was a retrospective analytic study. The study was conducted in Sukhkarta Advanced CT scan centre, Dhule, Maharashtra. Total 424 patients reported to Sukhkarta Advanced CT scan centre from 01/08/2020 to 30/09/2020 were enrolled as study participants.

All patients underwent HRCT with GE optima 660, 128 slice CT scanner. All CT images were reviewed independently by two experienced radiologists.

For each patient, the chest CT scan was evaluated for the following characteristics: (a) location of lesions with regards to involvement of one lung (right, left) or both the lungs. (b) Presence of crazy paving and presence of ground-glass opacities; (b) presence of consolidation; (c) presence of nodules (d) presence of a pleural effusion (e) presence of thoracic lymphadenopathy (defined as lymph node size of >10 mm in short-axis dimension) f) Presence of subpleural bands g) Vascular thickening h) Presence of fibrotic scarring.

Images were also evaluated for presence of associated airway, vascular, pleural and mediastinal abnormalities. Each of the five lung lobes was assessed for degree of involvement, which was classified as no involvement corresponded to a lobe score of 0, score of 1 to 5 % infected lobe, score of 2 to 5-25 % infected lobe, score of 3 to 25-50% infected lobe, score of 4 to 50-75% infected lobe and score of 5 to > 75% infected lobe. Score calculation was done based on each lobe involvement, each lobe had maximum score 5 and so all lobes had maximum score of 25. All CT images were reviewed independently by two experienced radiologists. CT score between 1-8 was considered as mild, score between 9-15 was considered moderate and score >15 was considered as severe. Written informed consent was waived from patients.

Data was entered on the computer using the “Microsoft Office Excel Software” program (2010) for windows.

RESULT

Table 1: Age-wise distribution of study participants

Age Group	Number	Percentage
≤20	6	1.42
21-30	39	9.20
31-40	58	13.68
41-50	90	21.23
51-60	118	27.83
61-70	86	20.28
>70	27	6.37
Grand Total	424	100

Above table shows age-wise distribution of the study participants. It was observed that out of 424 study participants 118 (27.83%) were in the age group of 51-60 years followed by 90 (21.23%) participants in the age group of 41-50 and 86 (20.28%) participants in 61-70 years of age group. 58 (13.68%) participants belongs to 31-40 years of age group, 39 (9.20%) in the age group of 21-30 years, 27 (6.37%) participants were > 70 years and only 6 (1.42%) in the age group of ≤ 20 years.

Table 2: Gender-wise distribution of study participants

Gender	Number	Percentage
Male	309	72.88
Female	115	27.12
Grand Total	424	100

Above table shows gender-wise distribution of study participants. Out of 424 study participants 309 (72.88%) were male and 115 (27.12%) were females.

Table 3: Distribution of study participants according to involvement of lung

Part of lung involved	Number of cases	Percentage
Right upper lobe	223	52.59
Right middle lobe	247	58.25
Right lower lobe	293	69.10
Left upper lobe	201	47.40
Left lower lobe	268	63.20
No changes in both lungs	124	29.25

Above table shows distribution of study participants as per involvement of part of lung. Out of 424 study participants 293 (69.10%) showed involvement of right lower lobe followed by 268 (63.20%) cases with involvement of left lower lobe, 201 (47.40%) cases with involvement of left upper lobe, 223 (52.59%) with involvement of right upper lobe, 247 (58.25%) cases with involvement of right middle lobe and 124 (29.25%) showed no changes in both the lungs.

Table 4: Distribution of study participants according to presence of nodules

Nodules in lung	Number of patients	Percentage
Absent	372	87.74
Present	52	12.26
Grand Total	424	100

It was observed that nodules were absent in 372 (87.74%) study participants and observed in only 52 (12.26%) study participants.

Table 5: Distribution of study participants according to presence of consolidation

Presence of consolidation	Number of patients	Percentage
Absent	398	93.87
Present	26	6.13
Grand Total	424	100

It was observed that consolidation was absent in 398 (93.87%) study participants and was observed in 26 (6.13%) of study participants.

Table 6: Distribution of study participants according to crazy paving

Crazy Paving	Number of participants	Percentage
Absent	194	45.75
Present	230	54.25
Grand Total	424	100

It was observed that crazy paving was absent in 194 (45.75%) study participants and it was seen in 230 (54.25%) of study participants.

Table 7: Distribution of study participants according to site of sub-pleural bands

Sub-pleural bands	Number of participants	Percentage
Present	161	37.97
Absent	263	62.03
Grand Total	424	100

It was observed that 161 (37.97%) participants shows sub-pleural bands on HRCT while sub-pleural bands was absent in 263 (62.03%) study participants.

Table 8: Distribution of study participants according to presence of vascular thickening

Presence of vascular thickening	Number	Percentage
Absent	144	33.96
Present	280	66.04
Grand Total	424	100

It was observed that out of 424 study participants 280 (66.04%) shows presence of vascular thickening and it was not observed in 144 (33.96%) of the study participants.

Table 9: Distribution of study participants according to presence of lymphadenopathy

lymphadenopathy	Number of participants	Percentage
Present	84	19.81
Absent	340	80.19
Grand Total	424	100

It was observed that enlargement of lymph nodes was seen in 84 (19.81%) of the study participants.

Table 10: Distribution of study participants according to presence pleural effusion

Pleural effusion	Count of pleural effusion	Percentage
Present	26	6.13
Absent	398	93.87
Grand Total	424	100

It was observed that out of 424 study participants pleural effusion was observed in 26 (6.13%) study participants.

Table 11: Distribution of study participants according to presence Emphysema

Presence of bullous or emphysema	Number	Percentage
Absent	411	96.93
Present	13	3.07
Grand Total	424	100

It was observed that out of 424 participants 13 (3.07%) participants shows presence of emphysema.

Table 12: Distribution of study participants according to presence of fibrotic scarring

Fibrotic Scarring	No. of patients	Percentage
Absent	357	84.20
Present	67	15.80
Grand Total	424	100

It was observed that fibrotic scarring was seen in 67 (15.80%) of the study participants.

Table 13: Distribution of study participants according to CT severity score

CT severity score	Number of patients	Percentage
Mild (1-8)	204	48.11
Moderate (9-15)	60	14.15
Severe (>15)	36	8.49
Normal HRCT	124	29.25
Total	424	100

It was observed that out of 424 patients 300 patients had CT severity score more than 1. Based on CT severity score patients were classified with mild, moderate and severe CT severity score. CT severity score was mild in 204 (48.11%) study participants, moderate in 60 (14.15%) study participants and severe in 36 (8.49%) study participants.

DISCUSSION

Retrospective analytical study was conducted in 424 suspected COVID 19 cases underwent HRCT scan in Sukhkarta Advanced CT scan centre, Dhule, Maharashtra. In the present study, out of 424 study participants 118 (27.83%) were in the age group of 51-60 years followed by 90 (21.23%) participants in the age group of 41-50 and 86 (20.28%) participants in 61-70 years of age group. 58 (13.68%) participants belongs to 31-40 years of age group, 39 (9.20%) in the age group of 21-30 years, 27 (6.37%) participants were > 70 years and only 6 (1.42%) in the age group of ≤ 20 years. Study conducted by the Marco Francone *et al.*⁹ observed that 22.3% of the patients were in the age group of 26-50 years, 50% belongs to 51-75 years age group and 27.7% above the 75 years of age. Out of 424 study participants 309 (72.88%) were male and 115 (27.12%) were females. Study conducted by the Youssriah Yahia Sabri *et al.*¹⁰ observed that the 68 (30.9%) females and 152 (69.1 %) males participated in their study. Study conducted by the Songlin Song *et al.*¹¹ revealed 119 (56.40%) males and 92 (43.60%) females participated in the study. Study conducted by the Jie Zhang *et al.*¹² observed that 60 (55.5%) males and 48 (44.45%) females were participated in the study. Out of 424 study participants 293 (69.10%) showed involvement of right lower lobe followed by 268 (63.20%) cases with involvement of left lower lobe, 201 (47.40%) cases with

involvement of left upper lobe, 223 (52.59%) with involvement of right upper lobe, 247 (58.25%) cases with involvement of right middle lobe and 124 (29.25%) showed no changes in both the lungs. Study conducted by the Marco Francone *et al.*⁹ observed that right upper lobe involvement was seen in 107 (82.3%) cases, middle lobe involvement was seen in 102 (78.4%), right lower lobe involvement was seen in 122 (93.8%), left upper lobe was seen in 113 (86.9%) and left lower lobe involvement was seen in 123 (94.6%) cases. Study conducted by the Youssriah Yahia Sabri *et al.*¹⁰ observed that the Multilobar affection was noted in 186/220 (84.54%) cases and lower lobes affection was noted in 179/220 (81.36%) cases. Study conducted by the Arshed Hussain Parry *et al.*¹³ observed that right upper lobe involvement in 88.2% cases, right middle lobe in 58.8% cases, right lower lobe in 76.5% cases, left upper lobe in 82.4% cases and left lower lobe in 76.5% cases. Study conducted by the Michael Chung *et al.*¹⁴ observed that right upper lobe involvement seen in 14 (67%) cases, right middle lobe in 12 (57%) cases, right lower lobe in 16 (76%) cases, left upper lobe in 14 (67%) cases and left lower lobe in 14 (67%) cases. It was observed that nodules were absent in 372 (87.74%) study participants and observed in only 52 (12.26%) study participants. Study conducted by the Yan Li *et al.*¹⁵ observed that the CT showed that 11 (21.6%) patients had discrete pulmonary nodules. Study conducted by the Adam Bernheim *et al.*¹⁶ observed that nodules were not observed in any case participated in the study. It was observed that consolidation was absent in 398 (93.87%) study participants and was observed in 26 (6.13%) of study participants. Study conducted by the Youssriah Yahia Sabri *et al.*¹⁰ observed that the Consolidation was encountered in 140/220 cases (66.7%). Study conducted by the Jie Zhang *et al.*¹² observed that consolidation was seen in 1 (1.2%) of the study participant. Study conducted by the Marco Francone *et al.*⁹ observed consolidation in 20% cases. It was observed that crazy paving was absent in 194 (45.75%) study participants and it was seen in 230 (54.25%) of study participants. Similar findings were observed in study conducted by the Soon Ho Yoon *et al.*¹⁷ revealed Crazy-paving appearance in 4 (10%) cases. Study conducted by the Youssriah Yahia Sabri *et al.*¹⁰ observed that crazy paving pattern was encountered in 82/220 cases (37.27%). Study conducted by the Yan Li *et al.*¹⁵ observed that the interlobular septal thickening appearing in a crazy-paving pattern in 36 (70.6%) patients. It was observed that 161 (37.97%) participants shows sub-pleural bands on HRCT while sub-pleural bands was absent in 263 (62.03%) study participants. Study conducted by the Youssriah Yahia Sabri *et al.*² observed that Subpleural bands and fibrous stripes were seen in 33

(40.24%) cases. Study conducted by the Marco Francone *et al.*¹⁵ observed sub-pleural lines in 21.5% of cases.

It was observed that out of 424 study participants 280 (66.04%) shows presence of vascular thickening and it was not observed in 144 (33.96%) of the study participants. Similar findings were seen in study conducted by the Youssriah Yahia Sabri *et al.*¹⁰ observed that Vascular thickening in all patients (100%) either within a lesion or in its vicinity. Study conducted by the Wei Gong *et al.*¹¹ observed that 92 cases (34.07%) showed bronchial vascular bundle thickening. Study conducted by the Yan Li *et al.*⁹ observed that the vascular enlargement in 42 (82.4%) patients. It was observed that enlargement of lymph nodes was seen in 84 (19.81%) of the study participants. Similar findings were observed in the study conducted by the Wei Gong *et al.*¹¹ revealed that 8 patients (2.96%) had mediastinal or bilateral hilar lymphadenopathy. Study conducted by the Yan Li *et al.*¹ revealed that the no patients had mediastinal lymphadenopathy. Study conducted by the Marco Francone *et al.*¹⁵ observed enlarged lymph nodes in 6.2% cases. It was observed that out of 424 study participants pleural effusion was observed in 26 (6.13%) study participants. Study conducted by the Youssriah Yahia Sabri *et al.*¹⁰ observed that 13 patients (4.81%) had bilateral pleural effusion. Study conducted by the Wei Gong *et al.*¹⁸ observed that Pleural effusion was seen in 13/220 (6%) cases. Study conducted by the Yan Li *et al.*¹⁵ observed that the only 1 (2.0%) patient showed pleural effusion. Study conducted by the JieZhangetal¹² revealed that pleural effusion was not seen in any participants. Study conducted by the Marco Francone *et al.*⁹ observed pleural effusion in 13% cases. It was observed that out of 424 participants 13 (3.07%) participants shows presence of emphysema. Study conducted by the Arshed Hussain Parry *et al.*¹³ observed that emphysema was seen in 3 (2.5%) of cases. Study conducted by the Michael Chung *et al.*¹⁴ observed that pulmonary emphysema was not seen any cases participated in the study. Fibrotic scarring was seen in 67 (15.80%) of the study participants. It was observed that CT score was mild (1-8) in 204 (48.11%) study participants, moderate (9-15) in 60 (14.15%) study participants and severe (>15) in 36 (8.49%) study participants. Study conducted by the Sudhir Bhandari *et al.*¹⁹ observed that CT severity index <15 was observed in 90% cases and CT severity index ≥15 was observed in 10% cases.

CONCLUSION

Use of HRCT for the diagnosis of viral pneumonia allows patients with suspected SARS-CoV-2 infection to be isolated and treated in time for recovery, thus optimizing patient management. Typical CT features of COVID-19

pneumonia include presence of ground glass opacities, crazy paving appearance, sub pleural bands, and presence of vascular thickening. Thin-slice chest CT can help prompt diagnosis, guide clinical decision making, and monitor disease progression, playing a crucial role in the early prevention and control of COVID-19.

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