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HRCT chest: A valuable tool to differentiate other pneumonias from covid-19 pneumonia

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ABSTRACT

Objectives: To assess how COVID-19 pneumonia differs from other pneumonias in terms of the chest computed tomography features.

Materials and Methods: In this study we included 170 clinically diagnosed cases pneumonia referred to department of radio diagnosis subjected to HRCT thorax which include out patients and in patients out of which 127 patients tested RT-PCR positive for Covid 19 pneumonia for a total duration of 1 year. (March 2020 to March 2021). The parenchymal abnormalities including Ground glass opacities (GGO), ground glass opacities with interlobular septal thickening (crazy paving), GGO with consolidation, consolidation, pulmonary nodules, tree in bud appearances, bronchiolar wall thickening, interlobular septal thickening , halo sign, reverse halo sign, cavitation and pleural effusion and were observed and categorized along with determination of pattern of distribution on chest CT.

Results: 127 patients who tested positive for COVID 19 and 43 patients with other pneumonia (such as community-acquired pneumonia) were visited, and CT scans were analysed to determine the presence and distribution of the disease pattern.

Patients with COVID 19 pneumonia primarily have peripheral-based lesions (90%), whereas patients with other pneumonias primarily have mixed patterns (70%)—a difference that is statistically different (p 0.05). Statistics show that COVID 19 had higher bilateral involvement than other pneumonia ($p<0.05$).

Conclusion: In COVID-19 pneumonia, GGOs, GGOs with interlobular septal thickening (crazy paving), and GGOs with consolidation with peripheral and basal predominance in bilateral lung parenchyma are the most common imaging patterns and findings. These findings will help us distinguish COVID-19 pneumonia from other causes of pneumonia. There is less evidence of tree in bud, pure consolidation, cavitation, and bronchiolar wall thickening.

1. Introduction

In December 2019, the corona virus (COVID 19) outbreak started in Wuhan, China. This respiratory tract-borne virus led to pneumonia, which differed from previous pneumonias in certain ways. Numerous other nations experienced a rapid outbreak of Corona virus. The World Health Organization (WHO) declared this outbreak as pandemic on January 30, 2020.[1] The WHO officially recorded 44 888 869 confirmed cases and 1178 475 confirmed deaths, according to the Weekly Operational Update on COVID-19. It was challenging to distinguish COVID-19 from general pneumonia due to the predominant clinical characteristics of fever, exhaustion, dry cough, and expiratory dyspnea.[2] Reverse transcriptase is the test used to confirm the diagnosis.[3] The diagnosis is difficult since there are so many

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false negatives. The patients who initially exhibit COVID-19 clinical symptoms but are RT-PCR negative and exhibit typical COVID-19 pneumonia radiologic characteristics on the initial CT scan were confirmed positive by doing a repeat swab test while under isolated monitoring.[4]

The Ground glass opacity with interlobar and lobular septal thickening, air bronchogram sign, consolidation and fibrosis in later stages were some of the reported characteristic. These are mostly distributed in the periphery.[5]

The three unique patterns of lobar or alveolar consolidation, peribronchial nodules, and Groundglass opacities mostly unilateral (GGO), often known as bronciectasis, have been identified as the three CT presentations of general or community acquired pneumonia.[6]

A few pulmonary indications, such as the bulging fissure sign, which is caused by expansive lobar consolidation and helps distinguish COVID pneumonia from other types of general pneumonia, can aid. Lung abscesses caused by Staphylococcus aureus pneumonia can cause an air-fluid level sign.

The halo sign, which appears on a CT scan as a peripheral rim of ground-glass opacity surrounding a pulmonary nodule or mass, strongly suggests angioinvasive Aspergillus infection, but it can also occur in mucormycosis and infections with Candida, Pseudomonas, herpes simplex virus, and cytomegalovirus.[7]

Therefore, a chest CT scan is essential for screening, initial diagnosis and differentiating it from other pneumonia.

1.1. Image acquisition

According to regional protocols, standard acquisition parameters were used. With Toshiba's third generation helical CT scanner, 119 patients were scanned in total. Following were the scanning parameters: 120 kVp, 150 mA, 512x 512 reconstruction matrix, 1.5 mm slice thickness, and high spatial resolution algorithm.[8]

1.2. Image interpretation

On a chest CT, the parenchymal anomalies were seen, classified, and the pattern of distribution was determined. Ground glass opacities (GGO), GGO with interlobular septal thickening (crazy paving), GGO with consolidation, consolidation, pulmonary nodules, tree-in-bud appearances, bronchiolar wall thickening, inter and intra lobular septal thickening. Cavitation were among the parenchymal abnormalities that were examined.

1.3. Statistical analysis

Statistical analysis was done using SPSS software. Statistical significance was defined as a p value less than 0.05. Both quantitative and qualitative data was analyzed.

2. Results

220 patients had pneumonia from COVID 19 and other reasons, according to the diagnosis (like community acquired). Following the exclusion of pregnant women and people with a history of lung disease, 127 patients with a positive COVID 19 status and 43 people who had other pneumonia (such as community-acquired pneumonia) were seen, and CT scans were examined to determine the presence and distribution of the disease pattern.

All CT-positive patients with COVIID 19 and other pneumonias have the distribution of lesions seen in Table 1 for those patients. Patients with COVID 19 pneumonia primarily have peripheral lesions (90%), whereas patients with other pneumonias primarily have mixed patterns of involvement (70%) (Table 1). The difference was statistically significant ($p<0.05$).

Table 1: COVID 19 pneumonia distribution pattern and that of other pneumonias on CT

Characteristics	COVID 19 pneumonia (N-127)	Other Pneumonia (N-43)
Central	3(2%)	6(14%)
Peripheral	115(90%)	7(16%)
Mixed	9(7%)	30(70%)

Chi square =71.39, p <0.001.

According to Table 2, COVID 19 has higher bilateral involvement than other pneumonia ($p<0.05$).

Table 2:

Characteristics	COVID 19 pneumonia (N-127)	Other Pneumonia (N-43)
Unilateral	17(13%)	20(46%)
Bilateral	110(86%)	23(53%)

Chi square = 20.7, p <0.001

3. Discussion

The CT findings from respiratory infections frequently overlap with those from other pneumonias and present with a variety of different findings. Both involve the bilateral lung and exhibit varying degrees of involvement in each of the five lobes.

The pattern of involvement is where there are the biggest differences. In which the distribution of the COVID 19 pneumonia is primarily bilateral, peripheral, and basal lobar. While the location of the other pneumonias varies depending on how the infection spreads (it can have unilateral, bilateral, central, peripheral, or mixed patterns of involvement).[9]

Other pneumonias include bacterial and viral pneumonias, the latter of which tend to display diffuse

Table 3: The CT characteristic features listed as follows:

CT findings	COVID 19 group	Other pneumonia group
GGO	45(35%)	4(9%)
GGO with interlobular septal thickening (crazy paving)	32(25%)	6(14%)
GGO with consolidation	23(18%)	22(51%)
Consolidation	26(20%)	30(70%)
Pulmonary Nodules	2(1%)	9(21%)
Tree in bud appearances	4(3%)	16(37%)
Bronchiolar wall thickening	6(4%)	12(28%)
Pure Interlobular septal thickening	13(10%)	15(35%)
Halo sign	1(0.7%)	3(7%)
Reverse halo sign	6(4%)	1(2%)
Cavitation	0	7(16%)
Pleural effusion	2(1%)	29(67%)

central and peripheral involvement and involve a whole lobe in the case of bacterial pneumonia (lobar pneumonia).[10]

Ground glass opacities, interlobular septal thickening, GGO coupled with consolidation are major characteristic pattern in COVID group. These are observed because of the interstitial pathogenic involvement with fluid, cells and ultimately fibrosis.[11] The presence of bronchiolar wall thickening, pure consolidation, and rounded opacities is uncommon in patients with COVID 19 pneumonia.

When compared to other bacterial and viral pneumonia, pure consolidations with an air bronchogram, pleural effusion, pulmonary nodules, a tree in bud appearance due to endo-bronchial disease dissemination, thickening of the bronchiolar wall, cavitations, and the halo sign are the common CT findings in other pneumonia. Only a few of these also display pure GGOs. Only 20% of patients with COVID-19 had pure consolidations, compared to 70% of patients with other pneumonias.[12,13]

Even though these data lack some specificity, we can nevertheless utilise them collectively to distinguish pneumonias caused by COVID 19 from pneumonias caused by other conditions.[14–16]

4. Conclusion

Ground glass opacities (GGO), GGOs with interlobular septal thickening with peripheral and basal predominance in bilateral lung parenchyma are the most common imaging patterns and findings in COVID 19 pneumonia, However evidence of tree in bud, pure consolidation, cavitation, pleural effusion and bronchiolar wall thickening noted in other pneumonia.

5. Source of Funding

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6. Conflict of Interest

None.

References

1. Zu ZY, Jiang MD, Xu PP. Coronavirus Disease 2019 (COVID-19): A Perspective from China. *Radiology*. 2020;296(2):E15–25.
2. Nambu A, Ozawa K, Kobayashi N, Tago M. Imaging of community-acquired pneumonia: roles of imaging examinations, imaging diagnosis of specific pathogens and discrimination from noninfectious diseases. *World J Radiol*. 2014;6(10):779–93.
3. Xie X, Zhong Z, Zhao W, Zheng C, Wang F, Liu J, et al. Chest CT for Typical Coronavirus Disease 2019 (COVID-19) Pneumonia: Relationship to Negative RT-PCR Testing. *Radiology*. 2020;296(2):E41–5.
4. Fang Y, Zhang H, Xie J. Sensitivity of Chest CT for COVID-19: Comparison to RT-PCR. *Radiology*. 2020;296(2):E115–7.
5. Bernheim A, Mei X, Huang M, Yang Y, Fayad ZA, Zhang N, et al. Chest CT findings in coronavirus disease-19 (COVID-19): relationship to duration of infection. *Radiology*. 2020;29(3):200463. doi:10.1148/radiol.2020200463.
6. Zhao W, Zhong Z, Xie X, Yu Q, Liu J. Relation Between Chest CT Findings and Clinical Conditions of Coronavirus Disease (COVID-19) Pneumonia: A Multicenter Study. *AJR Am J Roentgenol*. 2020;214(5):1072–7.
7. Walker CM, Abbott GF, Greene RE, Shepard JA, Vummidi D, Digumarthy SR, et al. Imaging pulmonary infection: classic signs and patterns. *AJR Am J Roentgeno*. 2014;202(3):479–92.
8. Dai H, Zhang X, Xia J, Zhang T, Shang Y, Huang R, et al. High-resolution Chest CT Features and Clinical Characteristics of Patients Infected with COVID-19 in Jiangsu, China. *Int J Infect Dis*. 2020;95:106–12. doi:10.1016/j.ijid.2020.04.003.
9. Lei J, Li J, Li X, Qi X. CT Imaging of the 2019 Novel Coronavirus (2019-nCoV) Pneumonia. *Radiology*. 2020;295(1):18. doi:10.1148/radiol.202020023.
10. Koo HJ, Lim S, Choe J, Choi SH, Sung H, Do KH, et al. Radiographic and CT features of viral pneumonia. *Radiographics*. 2018;38(3):719–39.
11. Pan Y, Guan H, Zhou S, Wang Y, Li Q, Zhu T, et al. Initial CT findings and temporal changes in patients with the novel coronavirus pneumonia (2019-nCoV): a study of 63 patients in Wuhan, China. *Eur Radiol*. 2020;30(6):3306–9.
12. Li X, Zeng W, Li X, Chen H, Shi L, Li X, et al. CT imaging changes of corona virus disease 2019 (COVID-19): a multi-center study in Southwest China. *J Transl Med*. 2020;18(1):154. doi:10.1186/s12967-020-02324.
13. Liu M, Zeng W, Wen Y, Zheng Y, Lv F, Xiao K, et al. COVID-19 pneumonia: CT findings of 122 patients and differentiation from influenza pneumonia. *Eur Radiol*. 2020;30(10):5463–9.
14. Shi H, Han X, Zheng C. Evolution of CT Manifestations in a Patient Recovered from 2019 Novel Coronavirus (2019-nCoV) Pneumonia in Wuhan, China. *Radiology*. 2020;295(1):20. doi:10.1148/radiol.2020200269.
15. Li K, Wu J, Wu F, Guo D, Chen L, Fang Z, et al. The Clinical and Chest CT Features Associated With Severe and Critical COVID-19 Pneumonia. *Invest Radiol*. 2020;55(6):327–31.
16. Wu J, Wu X, Zeng W, Guo D, Fang Z, Chen L, et al. Chest CT Findings in Patients With Coronavirus Disease 2019 and Its Relationship With Clinical Features. *Invest Radiol*. 2020;55(5):257–61.

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