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The CT Chest Findings in Follow-up COVID-19 Patients: Review Article

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ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) may benefit from a chest CT scan for diagnosis, identification of sequelae, and prognosis. Ground-glass opacities, vascular enlargement, bilateral abnormalities, lower lobe involvement, and posterior inclination have all been found on chest CT in more than 70% of RT-PCR test–proven COVID-19 cases. In more than one-third of patients who survived severe coronavirus illness 2019 pneumonia, a six-month follow-up CT revealed fibrotic-like alterations in the lung. COVID-19 survivors exhibited continued improvement on chest CT following a year of follow-up after discharge. Residual lesions, on the other hand, could be seen and linked with lung volume metrics. Early diagnosis of post-COVID-19 pulmonary fibrosis cases may allow for the prevention or at least modification of this disabling consequence.

Objective: Highlight chest CT imaging for the symptomatic COVID-19 patient after three months and the radiologist should be aware of the pulmonary sequelae changes at imaging.

Methods: These databases were searched for articles published in English in 3 databases (PubMed – Google scholar-science direct) and Boolean operators (AND, OR, NOT) had been used such as (Chest CT AND COVID-19 Patients OR CT chest findings) and in peer-reviewed articles between February 2020 and December 2021. Documents in a language apart from English have been excluded as sources for interpretation were not found. Papers apart from main scientific studies had been excluded: documents unavailable as total written text, conversation, conference abstract papers, and dissertations.

Conclusion: Chest CT imaging plays an important role in diagnosis and follow-up patients in COVID-19 disease.

Keywords: CT Chest, COVID-19 Patients.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a highly contagious disease that causes severe respiratory distress syndrome. It was originally detected in Wuhan, China, in late 2019 and has since expanded worldwide. The World Health Organization designated the coronavirus pandemic of 2019 an international public health emergency on March 11, 2020 [(1)]. COVID-19 has a wide spectrum of symptoms, ranging from asymptomatic infection to fulminant respiratory failure. Patients with COVID-19 infection have a varied recovery rate. Although the majority will heal completely, others will suffer from sequelae long after they have recovered from the acute infection [(2)].

Long COVID is defined as persistent symptoms after 4 weeks, while post-COVID syndrome is defined as symptoms that continue longer than 12 weeks, according to British Medical Journal guidelines [(3)].

Imaging by CT plays a crucial role in the diagnosis of COVID-19 pneumonia. The CT findings vary depending on the stage of the disease and the severity of the condition. Peripheral and bilateral ground-glass opacities (GGOs) are the most common CT findings during the early stages of COVID-19 pneumonia, followed by consolidation that gradually disappears in survivors as the disease progresses [(4)].

The severity of the underlying infection, age, gender, and body mass index all influence the likelihood of developing long COVID or post-COVID syndrome.

The real-time polymerase chain reaction is the gold standard for verifying COVID-19 (RT-PCR). In the diagnosis, care, and follow-up of patients with COVID-19 pneumonia, radiologic imaging, particularly thin slice CT, plays a significant role. Chest CT can detect early stages of infection and allow patients to be isolated sooner the sensitivity of CT in the diagnosis of COVID-19 has been reported to be 60–98%, with a specificity of 25–56% [(5)].

In the current outbreak, computed tomography (CT) can be a valuable supplement to RT-PCR for detecting COVID-19 pneumonia, the extent of pneumonia involvement by CT findings can help to evaluate the severity of COVID-19 pneumonia [(5)].

CT findings:

At the initial stage, the most prevalent finding on chest CT in patients with COVID-19 pneumonia is ground-glass opacities (GGO), which is usually described as patchy, peripheral, bilateral, and subpleural [(6)].

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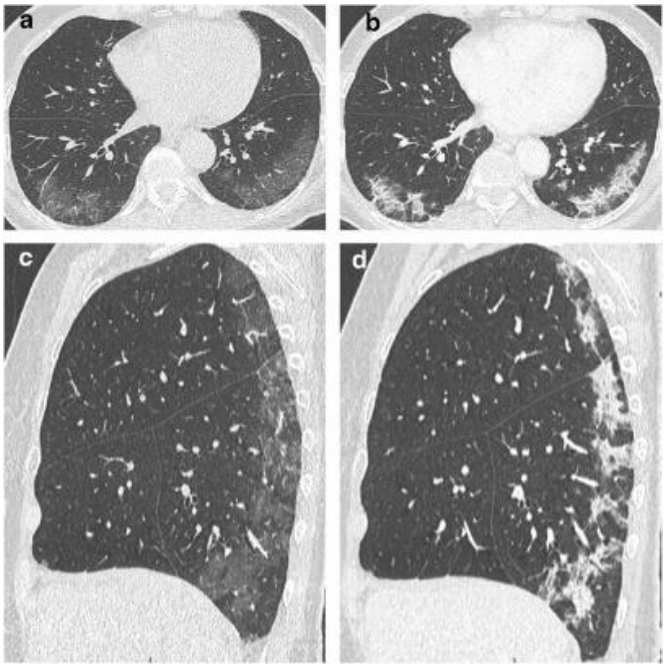

Figure (1): CT axial and sagittal scans display bilateral peripheral ground-glass opacities at the early stage of COVID-19 infection (A&C) progress to consolidation as the disease progress (B & D) [(4)].

In 17 to 91 percent of COVID-19 pneumonia patients discharged at 3 months, there are still CT abnormalities that most commonly occur in patients admitted to intensive care units with a severe degree of COVID-19 infection [(7)].

Low attenuation GGO remains the most common CT finding and is found in up to two-thirds or more of patients. Other CT findings include reticulation and interstitial thickening, as well as straight coagulation or band-like and perilobular opacity, probably partially consistent with organizing pneumonia [(3)].

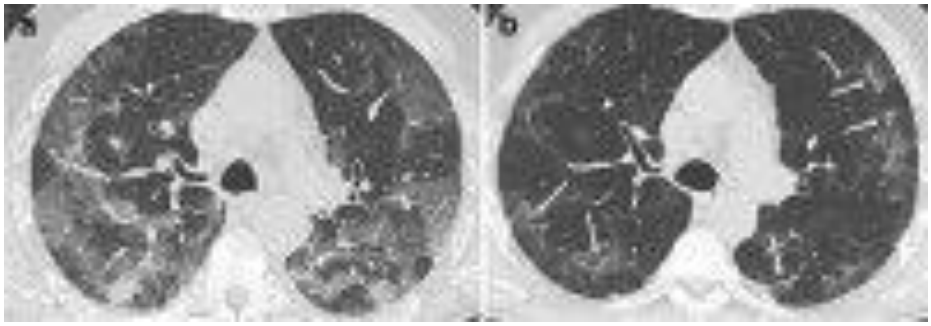

Figure (2): Axial CT pulmonary window display ground-glass opacity at baseline scans (a) then follow-up after 3moths demonstrates improvement of ground-glass opacities with the presence of linear consolidations parallel to the pleura (allows) [(3)].

In follow-up CT of severe infected cases after more than three months, CT findings of fibrotic-like changes such as reticular tissue associated with traction bronchiectasis were reported in 21-26% of patients [(8)].

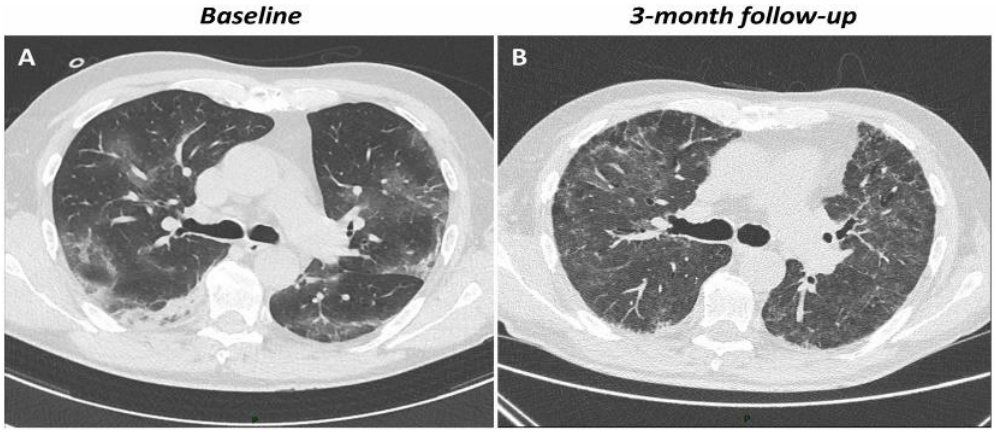

Figure (3): Axial CT scans at baseline show ground-glass opacities and at 3months follow-up traction bronchiectasis and reticular opacities are noticed [(8)].

Fibrotic-like changes are possible precursors to fibrosis, but there's a good chance they'll go away with time [(3)].

In symptomatic patients who were hospitalized and/or had a more severe clinical course of the disease, follow-up imaging should be examined, given the likelihood of persistent lung abnormalities. Three months following discharge from the hospital, these individuals should have a chest CT. Further investigations and repeated follow-up imaging after a further 3 months are recommended for patients with non-resolving chest CT abnormalities. Imaging results should always be compared to clinical findings and lung function testing[8].

With the paucity of data on long-term implications, it's uncertain whether the "so-called" traction bronchiectasis being reported is an irreparable condition or not [9].

At 6 months, honeycombing and traction bronchiectasis were found in 10% of patients.

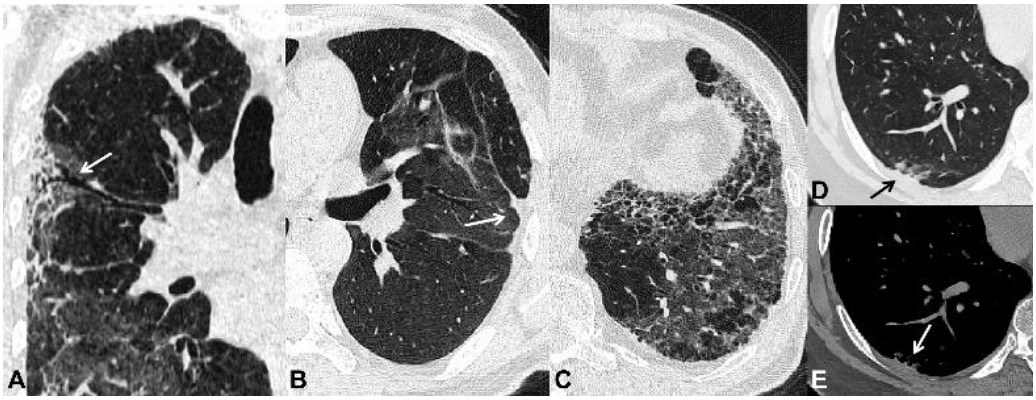

Figure (4): follow-up CT chest after 6months reveals traction bronchiectasis (A), a fibrotic band (b), honeycombing (c), and pleural thickening (D&E) [10].

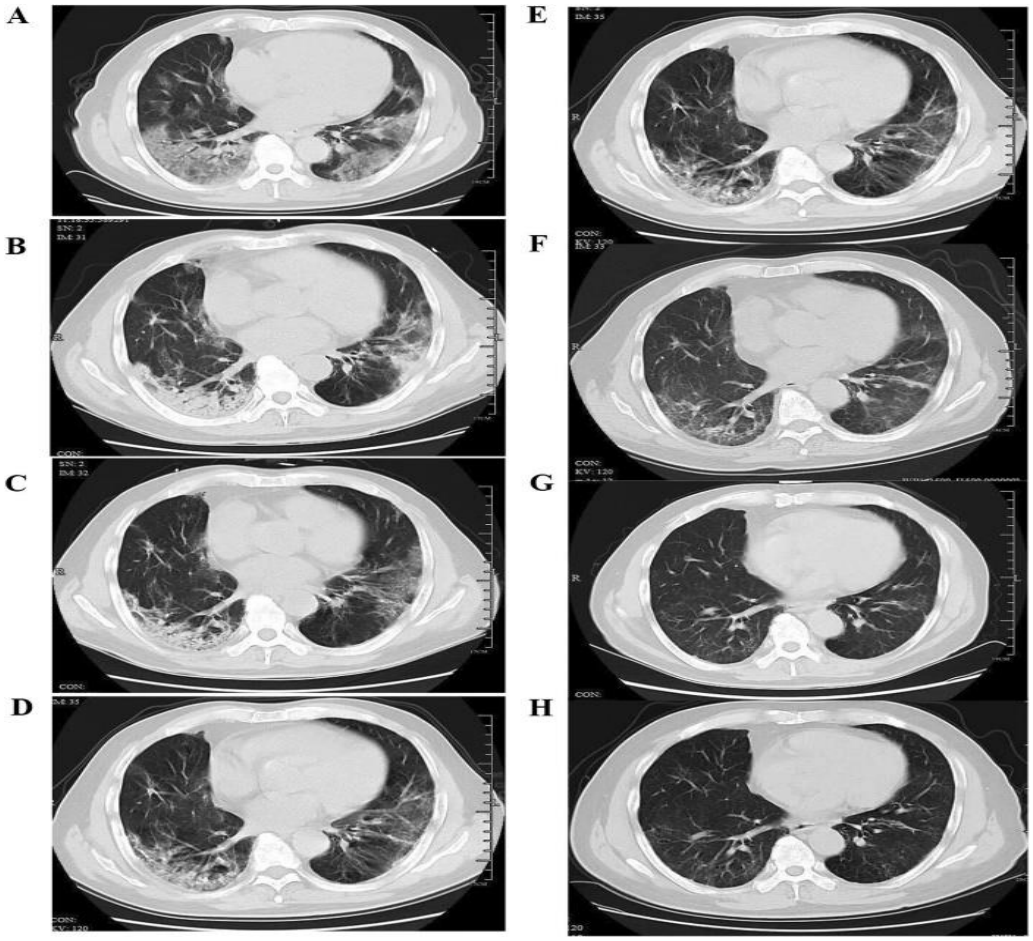

Figure (5): follow-up CT shows A-ground glass opacity at the first week, B- ground glass and consolidation opacities at two weeks, C-partially resolved ground glass and consolidation opacities at three weeks, D&E-development of linear opacities within the ground glass at one month, F-subpleural reticular opacities at three months, G-partially resolved the reticular opacities at six months and H- near-complete resolved reticular shadows at one-year follow-up [11].

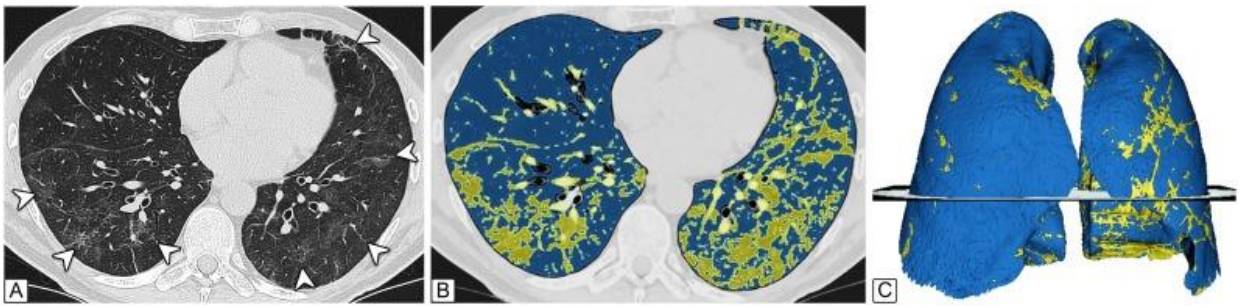

Figure (6): Axial CT (A) and 3D volumetric images after three months reveal the subpleural reticular shadows at A and the normally aerated lung (blue) at C and D[13].

COVID-19 patients' long-term outcomes can be predicted using CT severity rating, the CT severity score was calculated for each of the 5 lobes regarding the extent of pathologic involvement, as follows: 0, no involvement; 1, < 5% involvement; 2, 5–25% involvement; 3, 26–50% involvement; 4, 51–75% involvement; and 5, > 75% involvements. The resulting global CT score was the sum of each lobar score from 0 to 25[12].

Accuracy of CT chest in the diagnosis of COVID-19:

The reported sensitivity of CT in the diagnosis of COVID-19 is 60–98%, and the reported specificity is 25–56% [14, 15, 16]. The reported positive and negative predictive values are 92% and 42% respectively [15]. The low specificity and negative predictive values suggest that CT is unsuitable as a screening tool [17].

A meta-analysis performed by **Xu *et al.* [18],** involving 16 studies and 3186 patients, emphasized the high sensitivity (92%) and low specificity (25–33%) of CT in the diagnosis of COVID-19. The high sensitivity of CT led to the adoption of chest CT as a diagnostic criterion in the fifth edition of the Diagnosis and Treatment Program of 2019 New Coronavirus Pneumonia proposed by the National Health Commission of China[19]. Generally speaking, in the epidemic areas, the addition of CT as a diagnostic criterion will allow early diagnosis and effective control of the epidemic.

CONCLUSION

Chest CT imaging plays an important role in diagnosis and follow-up patients in COVID-19 disease.

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