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Role of CT scan in assessing post-acute COVID sequalae-a

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***Abstract*---**A variety of chest imaging findings have been described in patients with COVID-19. Use of imaging could be useful for the diagnosis of patients with suspected COVID-19 and in patients diagnosed with COVID-19, to inform management. Our study aimed at assessing the significance of CT scan usage in determining the lung injury in patients as post-acute COVID sequalae having COVID 19 after a 3 month follow up and to study the various findings in post-acute COVID sequalae through CT scan.

***Keywords*---**COVID19, chest CT, GGO, fibrosis, consolidation, lung segments.

Introduction

A cluster of pneumonia cases in Wuhan, China was first reported to the World Health Organization (WHO) China Country office on December 31, 2019.1 Soon thereafter, a novel coronavirus was identified as the causative agent.2-4 This virus was named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and the associated disease was named coronavirus disease 2019 (COVID-2019). Since December 2019, COVID-2019 has rapidly spread from Wuhan to other

parts of China and throughout the world. On January 30, 2020, WHO declared the outbreak a Public Health Emergency of International Concern and on March 11, 2020, WHO characterized the outbreak as a pandemic. A variety of chest imaging findings have been described in patients with COVID-19[1] Use of imaging could be useful for the diagnosis of patients with suspected COVID-19 and in patients diagnosed with COVID-19, to inform management. Twenty-three studies addressed the diagnostic accuracy of imaging in symptomatic patients suspected of having COVID-19 or SARS-CoV-2 infection (KQ 2). Of these, 19 studies evaluated chest CT, three studies evaluated CXR, and one study evaluated LUS. Seven studies were cohort studies, seven were case-control studies, and nine were case series. No study reported health outcomes associated with use of imaging. Three studies reported the association between imaging findings and health outcomes; all of these evaluated use of chest CT. No study reported the diagnostic accuracy of imaging for pulmonary thromboembolism in patients with COVID-19 (KQ 6)[1]. Two studies reported the prevalence of pulmonary thromboembolism on imaging in patients with COVID-19. One Chinese language study was translated into English. Six studies were published as pre-peer review articles. Our study aimed at studying the post-acute COVID sequalae through a follow up method by using CT scan as a tool in 3-month period.

Aim and objectives
To assess the significance of CT scan usage in determining the lung injury in patients as post-acute COVID sequalae having COVID 19 after a 3 month follow upto study the various findings in post-acute COVID sequalae through CT scan.

Method

After getting approval from the institutional ethical committee of Vinayaka missions hospital Salem, and a written informed consent was obtained from all study participants. A total of 54 patients who admitted in Vinayaka missions hospital from august 2021 to September 2021 who met inclusion criteria were prospectively enrolled for a 3-month follow-up chest CT evaluation. Patients with a diagnosis of COVID-19 that was confirmed by using reverse transcription polymerase chain reaction analysis and who had undergone chest CT were included in the study.

Patients died during the follow up interval and who did not give consent were excluded from this study, Severity of COVID 19 was defined using WHO's guidelines for adults in COVID 19 pneumonia was used.
All patients underwent 3-month follow-up unenhanced chest CT scans. Chest CT acquisitions were obtained with the patients in a supine position during end-inspiration and without contrast medium injection. Chest CT was performed with a 128-section CT scanner (Revolution EVO, GE Medical Systems). The following technical parameters were used: tube voltage, 120 kV; tube current modulation, 100–250 mAs; spiral pitch factor, 0.98; and collimation width, 0.625. Reconstructions were made by using a convolution kernel Bone Plus algorithm at a section thickness of 1.25 mm. [2]

The following CT findings were recorded: GGOs, GGO pattern, GGO location, multilobe involvement, total lobar involvement, bilateral distribution, posterior involvement by consolidations or GGOs, consolidation, interlobular septal thickening, fibrosis-like changes (reticular pattern and/or honeycombing) , bronchiectasis, air bronchogram, bronchial wall thickening, pulmonary nodules surrounded by GGOs, halo sign or reversed halo sign, pleural and pericardial effusion, lymphadenopathy (defined as a lymph node with a short axis >10 mm), enlargement of subsegmental arteries and veins (<3 mm), and pulmonary trunk diameter (<31 mm).

The presence of Honey comb appearance, sub pleural bands,GGOs, consolidation, and fibrosis-like changes were semi quantitatively analyzed in consensus by the same two radiologists mentioned above, who used the LSS (ranging from 0–40 points), which has previously been used in the literature to quantify COVID-19 pneumonia lung impairment (3). Ten segments for each lung were considered; each segment was evaluated and received 0–2 points on the basis of the area involved, with a score of 0 indicating normal parenchyma, a score of 1 indicating less than 50% segmental involvement, and a score of 2 indicating up to 50% segmental involvement. The final LSS was obtained from the sum of all lung segments; furthermore, individual segmental scores were added together to generate a total score with which to perform the statistical analysis.

Statistical analysis was performed by using SPSS (version 21). *P* values less than 0.05 were considered as statistically significant. Continuous data expressed in mean ± standard deviation. Categorical variables were described as counts and percentages; a comparison of the qualitative CT findings was performed by using the x^2 test.

Results

Age in years	N=54 Frequency %
20 -30	12(22.22%)
31-40	7(12.96)
41-50	17(31.48)
51-60	10(18.51)
61-70	4(7.40)
71-80	4(7.40)

A total of 54 patients were taken in our study. Around 31.48% were in the age group of 41 to 50.22.22% of the study participants were in the age group of 20 to 30.18.51% were in the age group of 51 to 60 years.7.4% in both 61to 70 as well as in 71 to 80 years.12.96% were in the age group of 31 to 40 years. The mean age of the study participant is 42.32+-2.44 years

Gender	N=54 Frequency
Male	36 (66.66)
Female	18(33.34)

Among the study participants 2/3 of the participants were males which accounts for 66.66%1/3 were females which accounted for 33.33%

Severity	N=54 frequency
Mild	21(38.88)
Moderate	22(40.74)
Severe	11(20.37)

Based on the severity of the cases 40.74% belonged to moderate type. Whereas 38.88%of the study participants belonged to mild category and only 20.37% belonged to severe category.

CT findings	N=54 Frequency
Honey comb appearance	5(9.25)
Subpleural bands	10(18.51)
Ground glass opacities	25(46.29)
Interstitial involvement	7(12.96)
Abnormal bronchial dilatation	4(7.40)
Air	3((5.55)

In CT findings 46.29% of the cases presented with ground glass opacity.18.51% presented with subpleural bands,12.96% presented with interstitial involvement,9.25% presented with honey comb appearance,7.4% had bronchial dilatation.

Right Lung segments	Before 3 months	After 3 months	P value
Anterior	0.63±0.450	0.11±0.22	<0.05
Apical	0.45±0.12	0.14±0.44	<0.05
Posterior	0.54±0.15	0.17±0.38	<0.05
Medial	0.62±0.27	0.13±0.29	<0.05
Lateral	0.34±0.29	0.19±0.49	<0.05
Superior	0.66±0.34	0.10±0.54	<0.05
Anterior basal	0.31±0.12	0.11±0.61	<0.05
Posterior basal	0.45±0.51	0.16±0.48	<0.05
Medial basal	0.52±0.242	0.17±0.64	<0.05
Lateral basal	0.58±0.16	0.12±0.51	<0.05

Left Lung segments	Before 3 months	After 3 months	P value
Anterior	0.83±0.42	0.13±0.32	<0.05
Apical	0.75±0.22	0.18±0.34	<0.05
Posterior	0.74±0.25	0.14±0.38	<0.05

Superior	0.67±0.17	0.12±0.26	<0.05
Superior Lingular	0.84±0.22	0.13±0.39	<0.05
Inferior Lingular	0.66±0.14	0.17±0.44	<0.05
Anterior basal	0.51±0.12	0.18±0.41	<0.05
Posterior basal	0.65±0.11	0.15±0.58	<0.05
Medial basal	0.72±0.62	0.18±0.44	<0.05
Lateral basal	0.78±0.36	0.10±0.41	<0.05

3-month CT showed an excellent follow up in predicting the GGOs and other abnormal changes with a sensitivity of 80% and a specificity of 83% with an AUC of 0.82.

Discussion

In our study role of CT scan was assessed and studied for acute Post COVID sequalae. Similar type of study was done by[12]Caruso et al where the follow up was done for a period of 6 months. On considering the population dynamics of Indian scenario the post COVID sequalae was assessed over a 3-monthperiod. In our study the sensitivity and specificity were 80%and 83% respectively. In the study done by Caruso et al the sensitivity and specificity weremore. It may be due to the bigger sample size as compared to our study. The segmental analysis of the lungs also showed a similar result as with the Caruso et al study where the comparison between baseline and 3 month follow up showed a decrease and there is a statistically significant association between the baseline and follow up values on the lobar analysis of both lungs. A study done by[13] Han et al also studied with a 6 month follow up it showed 1/3 of patients had fibrotic changes. Similar results were obtained in our study. A study done by Solomon et al CT abnormalities varies initially and after particular time period. Severity of lung involvement was also one of the factors. Similar results were also obtained in our study.

Conclusion

CT scan diagnosed effectively the post-acute COVID sequalae in mild, moderate and severe cases. However, in our study the participants are small. This prospective study may be used as base to study the long term COVID sequalae.

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