

STUDY OF CT SEVERITY INDEX IN COVID-19 PATIENTS IN TERTIARY CARE HOSPITAL OF MAHARASHTRA

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Abstract

Background: Covid-19 is an infection that has widely and rapidly spread all over the world and become a pandemic with significantly impacts upon the socio-political milieu and health care system. CT scan has high sensitivity in patients infected by covid-19 when other test like nasal pharyngeal swabs may be insensitive hence CT severity index has potential impact on clinical decision making for covid-19. **Materials and Methods:** 50 patients aged between 18 to 50 years admitted at covid-19 ward were studied with CT chest scan images 120kvp automatic tube current modulation (30-70 mAS) pitch 0.99 – 1.22 mm slice thickness 10 mm, FoV=350 mmx 350 mm. All images were reconstructed with a slice interval of 0.625 to 1.250 mm opacity, (GGO), consolidation GGO with consolidation, linear opacities, and crazy paving halo sign reverse halo sign. **Result:** CT chest findings had 4 (8%) has 1 lobe affected, 6 (12%) had 2 lobes affected, 5 (10%) had 3 lobes affected, 3 (6%) had 4 lobes affected, 1 (2%) had 5 lobes affected. 4 (8%) had GGO with consolidation, 14 (28%) had GGO, 1 (2%) had consolidation. Frequency of lobe, 6 (12%) had right middle lobe, 14 (28%) had right lower lobe, 3 (6%) had left upper lobe, 4 (8%) left lingual lobe, 15 (30%) had left lower lobe. The distribution of opacification and pattern had rounded shape, 2 (4%) had linear opacity, 4 (8%) crazy paving pattern, 1 (2%) reverse halo sign, 4 (8%) halo sign, 13 (26%) had peripheral distribution. CT severity score was 4 (8%) severe, 32 (64%) moderate, 14 (28%) mild. **Conclusion:** CT scan study has significant role in management of severity and possible outcome of covid-19. CT severity scores can be positively correlated with inflammatory laboratory markers.

INTRODUCTION

A non-contrasts high resolution CT chest imaging plays a pivotal and essential role in the early detection of disease particularly in patients with false negative RF PCR results. Severe acute respiratory syndrome corona virus 2 (SARS COV-2) or corona virus disease 2019 (covid-19) was firstly described in a series of 41 individuals presenting with undetermined forms of “pneumonia” in Wuhan, China during December -2019.^[1,2] Since its first observation, SARS-COV-2 infection outbreak has transformed into an unprecedented worldwide health care emergency which recently reached the necessary epidemiological criteria to be declared pandemic by world Health organisation.^[3,4] CT has reported high sensitivity in patients infected by SARS-COV-2 the reason why it is largely used to help patient management. A high incidence of bilateral ground glass opacities has been reported in cohort studies of covid-19, apart from consolidation, ground-gland opacities with consolidations.^[5] Linear opacities, crazy paving halo signs, reversed halo

signs were observed in CT scan studies which were potential impact on clinical diagnose for covid-19.^[6] There was, a growing evidence that, sensitivity of combined nasal and pharyngeal swabs might be insufficient for clinical diagnose hence it was imperative to use CT scan techniques for confirmation of covid-19 and nasal pharyngeal swab study were additional findings or primary findings. Hence attempt was made to evaluate CT study severity Index so that present study can be a guide lines for clinician to treat such patients efficiently.^[7,8]

MATERIALS AND METHODS

50 (fifty) adult patients admitted at covid-19 ward of Medicine department of JIIU'S IIMS and Research hospital warudi Jalna (district) Maharashtra-431202 were studied.

Inclusive Criteria

The patients RT-PCR positive 18 to 50 years of age were selected for study.

Exclusion Criteria

Patients below 18 years and RT-PCR negative immune compromised patients were excluded from study.

Method

Every admitted patient with covid-19 was studied with CT imaging because it is more reliable, feasible and rapid method to diagnose and assess covid-19.

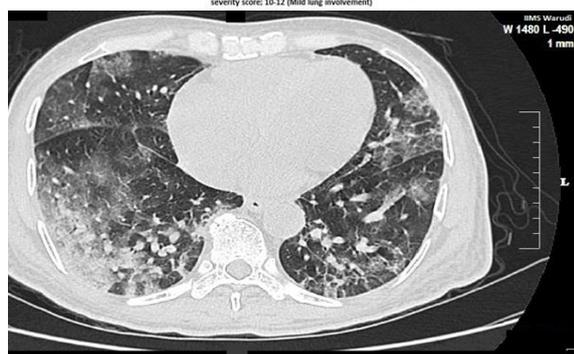
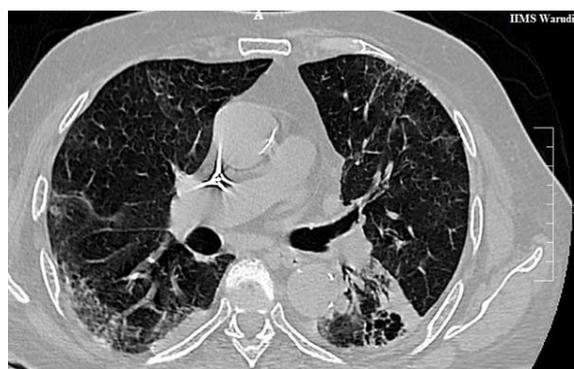
All CT chest scans images were obtained with one CT system (optima 660 GE) patients were scanned in supine position during breath holding. The main imaging parameters were tube voltage, 120 kvp, automatic tube current modulation (30-70 mAS) pitch=0.99-1.22 mm, matrix=512x512, slice thickness = 10 mm, FoC = 350 mm x 350mm. All images were then reconstructed with a slice interval of 0.625 to 1.250 mm.

Analyses of CT images were carried out. The main features of CT images were described as the following patterns

- (1) Ground glass opacity,
- (2) Consolidation,
- (3) Ground glass opacity with consolidation,
- (4) Other signs included (Linear opacities crazy paving halo and reverse halo sign) CT severity score, percentage of lung involvement degrees included mild moderate and severe) were noted.

Duration of study March-2021 to September-2021

Statistical analysis: CT severity score index findings. Areas of involvement CT chest findings were classified with percentage. The statistical analysis was carried out in SPSS software. The ratio of the male and female were 2:1.



RESULTS

[Table 1] Study of CT severity score Index in chest

- 0 (zero score guide, 0 No involvement, 1 <50% lung involvement, > 50% lung involvement severe

CT severity score severe > 19.5 > 50% lung involvement

Mild < 13 - < 30% lung involvement

Moderate 13-19.5 30-50% lung involvement

[Table 2]

- **Study of CT chest findings:** 4 (8%) had lobe was affected, 6 (12%) had 2 lobes affected, 5 (10%) had 3 lobes affected, 3 (6%) had 4 lobes affected, 1 (2%) had 5 lobes affected.
- **Opacities:** 4 (8%) had GGO with consolidation, 14 (28%) had GGO only, 1 (2%) had consolidation.
- **Frequency of lobes involvement:** 4 (8%) right upper lobe, 6 (12%) right middle lobe, 14 (28%) right lower lobe, 3 (6%) left upper lobe, 4 (8%) left lingual lobe, 15 (30%) left lower lobe.
- **Opacification distribution and pattern:** 6 (12%) rounded shape, 2 (4%) linear opacity, 4 (8%) crazy pave pattern, 1 (2%) reverse halo pattern, 4 (8%) Halo sign, 13 (26%) peripheral distribution.

[Table 3] CT severity scores 4 (8%) were severe, 32 (64%) moderate, 14 (28%) were mild.

Table 1: CT severity score Index

| Right lung segments | Score | Left lung segments | Score |
|----------------------|-------|----------------------|-------|
| Upper lobe Apex | 0 | Upper lobe Apex | 0 |
| Upper lobe Anterior | 0 | Upper lobe Anterior | 0 |
| Upper lobe Posterior | 0 | Upper lobe Posterior | 0 |
| Middle lobe | 0 | Superior lingual | 0 |
| Central Middle lobe | 0 | Inferior lingual | 0 |
| Lower lobe superior | 0 | Lower lobe superior | 0 |
| Anterior – Basal | 0 | Anterior – Basal | 0 |
| Posterior – Basal | 0 | Posterior – Basal | 0 |
| Medial – Basal | 0 | Medial – Basal | 0 |
| Lateral – Basal | 0 | Lateral – Basal | 0 |
| Right Lung total | 0 | Left lung total | 0 |

TCT severity score – 0/40 (0% Lung involvement).

Total 20 Lung region each side taken in consideration

Score guide:

| Area of involvement | Score |
|---------------------|-------|
| No involvement | 0 |
| < 50% involvement | 1 |
| > 50% involvement | 2 |

CT severity score:

Severe - 19.5 > 50% Lung involvement
 Moderate - 13-19.5 30-50% Lung involvement
 Mild - < 13 < 30% lung involvement

Table 2: Study of CT chest findings

| Observation | No. of Patients: 50 |
|--|---------------------|
| a) No. of lobes affected | |
| 1 | 4 (8%) |
| 2 | 6 (12%) |
| 3 | 5 (10%) |
| 4 | 3 (6%) |
| 5 | 1 (2%) |
| 6 | 0 |
| b) Opacities | |
| 1 Grand-glass opacities with consolidation | 4 (8%) |
| 2 Ground-glass opacity (990) | 14 (28%) |
| 3 Consolidation | 1 (2%) |
| c) Frequency of lobe involvement | |
| 1 Right upper lobe | 4 (8%) |
| 2 Right Middle lobe | 6 (12%) |
| 3 Right lower lobe | 14 (28%) |
| 4 Left upper lobe | 3 (6%) |
| 5 Left lingual lobe | 4 (8%) |
| 6 Left lower lobe | 15 (30%) |
| d) Opacification distribution and pattern | |
| 1 Rounded Shape | 6 (12%) |
| 2 Linear opacity | 2 (4%) |
| 3 Crazy paving pattern | 4 (8%) |
| 4 Reverse halo sign | 4 (8%) |
| 5 Peripheral distribution | 13 (26%) |

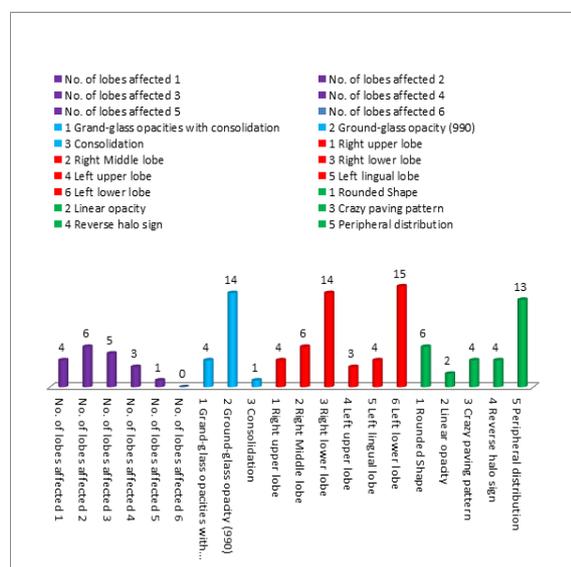


Figure 1: Study of CT chest findings

Table 3: Study of sever scores in covid-19

| Severe < 19.5 | Moderate 13-19.5 | Mild < 13 |
|---------------|------------------|-----------|
| 4 (8%) | 32 (64%) | 14 (28%) |

- Severe > 50% lung involvement
- moderate 30-50 % long involvement
- Mild < 30% Lung involvement

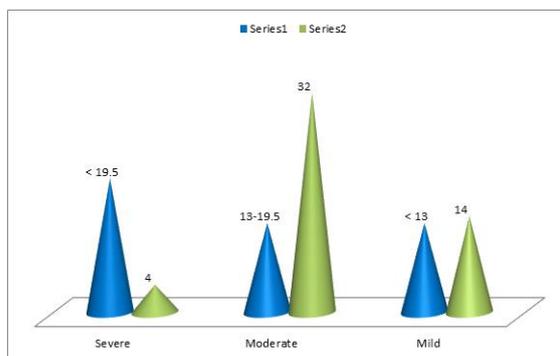


Figure 2: Study of sever scores in covid-19

DISCUSSION

The WHO advised the use of chest imaging as part of diagnostic work up of covid-19 disease whenever RT-PCR testing is not available, in case of delayed test results or when there is a clinical suspicion of covid-19 with initial negative RT-PCR testing.

Present study of CT severity index in covid-19 patients of Maharashtra Population. CT chest findings were 4 (8%) had 1 lobe affected, 6 (12%) had 2 lobes were affected, 5 (10%) had 3 lobes were affected, 3 (6%) had 4 lobes, 1 (2%) had 5 lobes were affected. (In opacities study – 4 (8%) had GGO with consolidation 14 (28%) had only GGO, 1 (2%) had consolidation (c) In frequency of lobes involvement study – 4 (8%) had right upper lobe, 6 (12%) had right middle lobe, 14 (28%) had right lower lobe, 3 (6%) had left upper lobe, 4 (8%) had left lingual lobe, 15 (30%) had left lower lobe (d) Distribution of opacification and pattern – 6 (12%) rounded shape, 2 (4%) had linear opacity, 4 (8%) had crazy paving pattern, 1 (2%) reverse halo sign, 4 (8%) had halo sign, 13 (26%) had peripheral distribution [Table 2]. The severity scores in covid-19 was 4 (8%) had severe, 32 (64%) had moderate, 14 (28%) had mild severity Index [Table 3] (Images- 1, 2, and 3). These findings are more or less in agreement with previous studies.^[9,10,11,12]

Covid-19 manifests with non-specific respiratory symptoms of variable severity ranging from mild to life threatening which may demand advanced respiratory, assistance artificial of covid-19. Diagnosis by identification of viral RNA was in reverse transcriptase (PCR). In many places laboratory testing (RT-PCR) was not available or results are delayed but CT scan study was earliest tool or technique for clinical diagnose for severity of covid-19.^[13,14]

Presence of bilateral GGO with or without consolidation areas were with a predominant peripheral, lower lobes and posterior anatomic distribution.^[15]

The prevalence of GGOs observed in early phases of the disease represent the imaging correlate of the acute phase diffuse alveolar damage with air space oedema bronchiolar fibrin and interstitial thickening.^[16] Late disease progresses with activation of humeral and cellular immunity

mediated by virus specific B and T cells causing an intense production of pro-inflammatory cytokines that may trigger an un-controlled auto immune reaction.^[17] These findings confirm the higher prevalence of crazy-paving pattern and consolidation areas with alveolar oedema, bacterial super-infection and interstitial inflammatory changes.^[18,19] Such changes were commonly observed in Hypertensive, type-II diabetic, cardiovascular, cancer, obese, COPD, tuberculosis and elderly patients and rarely in healthy adults.^[20] CT scoring was also compared with independent risk factors associated with ARDS and fatal outcome.

CONCLUSION

CT scans can have a pivotal role in assisting physicians in the management plan and work as an indicator for disease severity and possible outcome. CT severity score positively correlated with inflammatory lab markers, length of hospital stay and oxygen requirement in patients with covid-19 infections, but this demands further study to clarify the value of chest CT for prognostication in covid-19 disease because in patients with lesser immunity like type-II DM, HTN, lung cancer, COPD, ARDS, obese and elderly patients had very poor or bad prognosis.

Limitation of Study

Owing to tertiary location of study institution, small number of patients and lack of latest techniques we have limited results.

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