

## Innovative Modified CORAD Grading system of HRCT Chest in relation to clinical management and its severity Assessment of COVID19 Patients and its contacts

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### Abstract

**Background:** Novel corona virus is currently the causing a worldwide pandemic. Imaging modalities like X-ray and CT Chest are the first and foremost earliest imaging presentation during Corona virus infection. Presently all over the world using CORAD Grading system which neither gives information regarding clinical severity nor disease progression in the management and treatment of patients. **Material and methods:** Retrospective observational study was done among 130 suspected Covid patients with contact history and RT-PCR positive patients with their HRCT imaging findings. We further categorized clinically with new grading system as Mild, moderate, severe, recovering according to our grading system and treated accordingly. **Results:** Based on our new modified CORAD grading system of HRCT chest, we categorized 130 patients to 7 categories based on clinical and imaging scenario. Out of them 5 showing typical HRCT Findings but RT PCR Negative another 5 RT PCR Positive but HRCT normal. Those two categories are excluded from the study. Remaining patients are categorized based on HRCT lung findings to mild (HRCT Grading I, II-55 patients), moderate (HRCT Grading III, IV-35 patients), severe (HRCT Grading V, VI-20 patients), recovering (HRCT Grading VIII-10 patients) phases and treated accordingly. **Conclusion:** The Proposed New Innovative Modified COVID Grading system would improve imaging and understanding of COVID disease pathophysiology and its distribution and treatment accordingly. Thus, facilitating the diagnosis and management of COVID-19 patients as compared with previous system.

**Key Words:** CORAD Grading system, HRCT, COVID19.

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### Introduction

Novel corona virus is currently the causing a worldwide pandemic. Imaging modalities like X-ray and CT Chest are the first and foremost earliest imaging presentation during Corona virus infection. Presently all over the world using CORAD Grading system which neither gives information regarding clinical severity nor disease progression in the management and treatment of patients. The role of imaging in COVID infections are currently being debated in the medical community, and we introduced innovative Modified Innovative CORAD Grading System. Purpose HRCT Chest is first and foremost sensitive diagnostic indicator for Corona virus infected patients. Covid patients are most notable for showing bilateral and peripheral ground glass and consolidated opacities with bronchiectasis, fibrosis, occasional effusions and are marked by an absence of concomitant pulmonary nodules, cavitation, adenopathy.

Each and every patient in different phase of disease progression. As presently using CORAD grading system is limited as its neither give interpretation regarding progression nor severity by which clinicians unable decides for further management. We composed a comprehensive study for description of the imaging findings based on progression of disease and severity in involvement in lungs termed as a new novel modified grading system for Corad CT findings in COVID-19. [1] Present era of 2021 almost all counties are suffering with Covid19, and detection of RTPCR/Rapid antigen tests can't give extent of lung involvement. [2] As many Covid positive cases presenting varying degree of presentations. Few of them no signs and symptoms at all but majority showing HRCT Findings. [3] Present CORAD grading system not explaining the disease course in relation to HRCT Findings, which causes so much confusion among clinicians while treating the patients. [4] Even CT Severity index (25/25) Score not explaining the score values between ground glass opacities to patchy opacity and complicated fibrotic changes involving the lungs. Its giving misnomer interpretation for early to resolving opacities. Hence, we developed a modified HRCT grading system for COVID to arrange the patients categories according to their severity for the betterment of treatment. [5]

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Present grading system of HRCT Modified CORAD Grading system of helps the clinicians for better understanding the grade and severity, pathophysiological course of disease. [6] This helps the clinician better to evaluate patient and treat accordingly.

**Material and methods**

Retrospective observational study was done for a period of 6 months in 2020 evaluated HRCT under GE, Philips machine with 16,32 slice CT. Clinical scenarios of 120 Covid positive patients in two tertiary hospitals and analyzed with HRCT findings.

**Inclusion Criteria:** 1. Patients positive history and contact history of COVID 19.

2. Age group ranges from 20-50years.

3. Normal healthy individuals before attaining/admitted in hospital.

**Exclusion criteria:** 1. Any associated comorbidities.

2. Children and new born kids.

3. Extremely sick/ ventilated patients.

Study was retrograde observational study in 150 patients with cough, cold with exaggeration dyspnea and K/c/o covid positive or any contact history. Out of them 30 were associated with other comorbidities like hypertension/diabetes/malignancy/trauma, are excluded from study. HRCT done for those patients as a routine protocol and are analyzed.

**Table 1: Present CORAD Grading System**

CO-RADS*		
Level of suspicion COVID-19 infection		
		CT findings
CO-RADS 1	No	normal or non-infectious abnormalities
CO-RADS 2	Low	abnormalities consistent with infections other than COVID-19
CO-RADS 3	Indeterminate	unclear whether COVID-19 is present
CO-RADS 4	High	abnormalities suspicious for COVID-19
CO-RADS 5	Very high	typical COVID-19
CO-RADS 6	PCR +	

**Result**

Based on our new modified CORAD grading system of HRCT chest, we categorized 130 patients to 7 categories based on clinical and imaging scenario. Out of them 5 showing typical HRCT Findings but RT PCR Negative another 5 RT PCR Positive but HRCT normal.

Those two categories are excluded from the study. Remaining patients are categorized based on HRCT lung findings to mild (HRCT Grading I, II-55 patients), moderate (HRCT Grading III, IV-35 patients), severe (HRCT Grading V, VI-20patients), recovering (HRCT Grading VIII-10 patients) phases and treated accordingly.

**Table 2: Correlation between pathophysiology and HRCT Interpretation grading system**

Grading	Pathophysiology	HRCT Interpretation	Bilateral lungs	Any Single lung
I-A	Early phase 0-4 days	Minimal subplural hazyness/GGO (Ground glass opacity)	<2 lobes <2cm	<2 lobes <2cm
I-B	Early phase 0-4 days	Minimal subplural hazyness/GGO	>2 lobes <2cm	>2 lobes <2cm
II	Progressive phase 5-8 days	Ground glass opacities	<2 lobes 2-5cm	<2 lobes 2-5 cm
III	Progressive phase 5-8 days	Crazy Paving	Any lobe >5cm size	any lobe/ >5cm size
IV	Peak stage- A 5-13 days	Consolidation	<2 lobes, any size	<2 lobes, Any size
V	Peak stage -B 5-13 days	-	Entire of any lung (>2 lobes)	Entire of any lung (>2 lobes)
VI	complications >14 days	associated complication/effusion/bronchiectasis etc	Any	Any
VII	Resolving phase	any above with decreased findings	Any	Any

**Table 3: Clinical and HRCT Chest grading system Correlation**

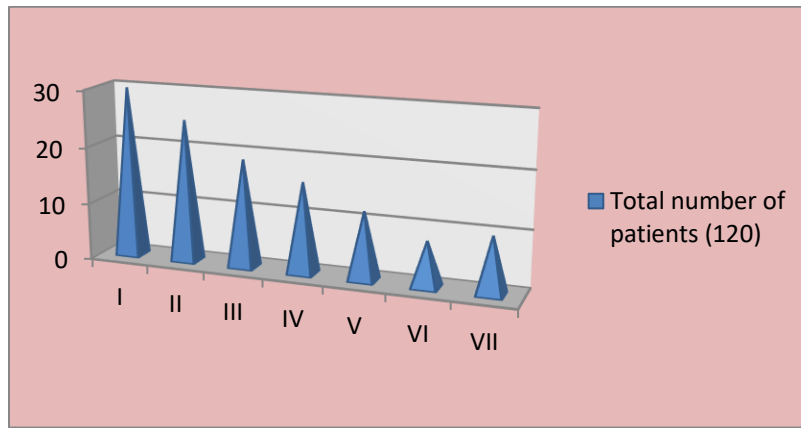
Radiological CT Grading system	Clinical severity
Grade I, II	Mild
Grade III, IV	Moderate
Grade V, VI	Severe
Grade VII	Resolving

**Table 4: Percentage of Patients in Relation to HRCT Grading System**

CT Grading system	Total number of patients (120)	Percentage
I	30 (20+10)	25 %
II	25	20.8%
III	19	15.8%
IV	16	13.3%
V	12	10.0%
VI	8	6.6%
VII	10	8.5%

**Table 5: Percentage Study of HRCT Chest Grading and in Correlation with Clinical Severity**

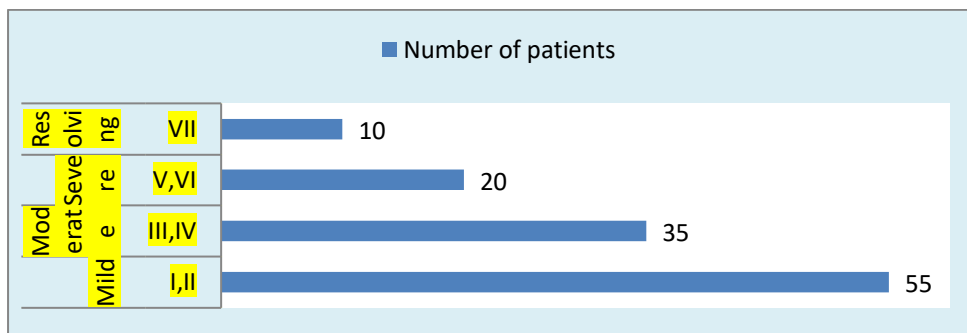
Clinical grading	HRCT GRADINGS	Number of patients (120)	Percentage
Mild	I,II	55	45.8%
Moderate	III,IV	35	29.3%
Severe	V,VI	20	16.6%
Resolving	VII	10	8.3%



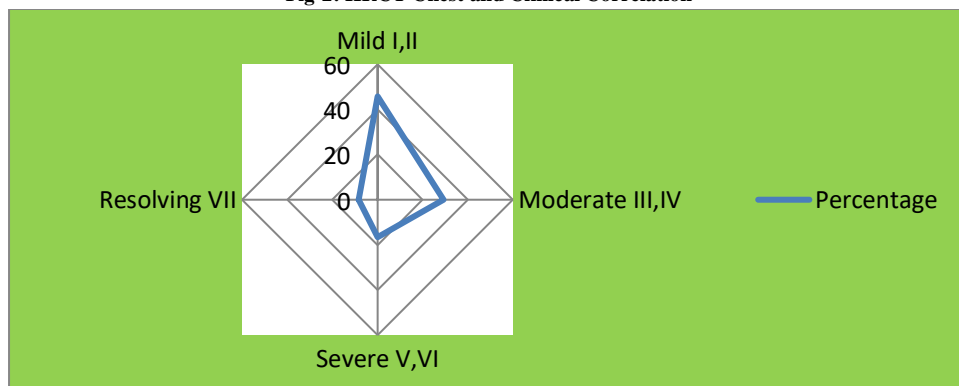
**Fig- 1: Distribution of Cases According to Modified HRCT Grading System**

Among 120 patients those 55 patients are grade I, II are categorized as presenting with mild symptoms/no significant symptoms noted. We categorized its as mild severity, 35 patients with HRCT grading III, IV as present with cough and cold, mild fever. No significant physical comorbidities noted and we categorized as moderate severity 20 patients grade V, VI severe form CORAD infection.

Mild cases are presented with minimal symptoms or no symptoms at all. Moderate cases came with complaints cough and cold and few of them admitted in the hospital. Severe cases are admitted in hospital needs urgent medical emergency and follow up.



**Fig-2: HRCT Chest and Clinical Correlation**



**Fig-3: Categorised HRCT findings of those patients into Modified CORAD Grading system**

**Discussion**

As present CORAD scoring system shows HRCT was done on 120 patients we categorized as :

**Grade IA/B** Includes 30 patients showing HRCT findings minimal sub plural haziness /GGO less than 2cm less t (ground glass opacity), out of which 20 patients are categorized as A less than (involving <2 lobes), 10 are categorized as B (involving >2 lobes). Pathophysiologically became early phase from 0 to 4 days. [7,8]

**Grade II** includes 25 patients with HRCT findings subplural haziness /GGO measuring 2-5 cm involving any of lungs or both lungs. Pathophysiologically phase from 5 to 8 days as progressive phases. Pathophysiologically phases 5<sup>th</sup> day to 8<sup>th</sup> days. [9,10]

**Grade III** includes 19 patients showing HRCT findings subplural haziness /GGO/Crazy paving >5 cm involving any of the lung or both lungs. Pathophysiologically phases 5<sup>th</sup> day to -8<sup>th</sup> days. [11]

**Grade IV** includes 16 patients showing HRCT findings of grade III with consolidative changes involving both or unilateral lung involving less than 2 lobes. Pathophysiologically phases started from 5<sup>th</sup> day to -13<sup>th</sup> days.

**Grade V** includes 12 patients showing HRCT finding as same with grade IV with more than 2 lobes unilaterally or bilaterally. Pathophysiologically phases started from 5<sup>th</sup> day to -13<sup>th</sup> days.

**Grade VI** includes 10 patients showing HRCT finding as grade V with associated complications like fibrosis/bronchiectasis/effusion etc. Pathophysiologically phases started from more than 14 days.

**Grade VII** Includes 10 patients showing HRCT any of the above with decreased findings as recovering phase. [12,13]

**Conclusion**

Our present modified CORAD grading system helps clinicians understanding better understanding the disease severity, pattern management protocol. But our study limited for only patients with RT-PCR positive patients, and its contacts history to evaluate the clinical grading for better evaluation. Our study is not extend for non COVID Cases, not included ICU patients, associated with other comorbid conditions. As compared with old CORAD grading system our new system clearly explained the phase and progression of disease and its guides the clinicians for follow up.

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