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RESEARCH ARTICLE

A STUDY OF CORRELATION BETWEEN CHEST HRCT SCORE WITH CT VALUES OF RT-PCR TESTING FOR COVID-19 INFECTION

Sana Pathan¹, Dr. Swati Bhise², Dr. Nitin Dhokane³, Dr. Sunanda Zodpey⁴ and Dr. Jawahar Rathod⁵

1. Research Assistant, State Level-Viral Research and Diagnostic Laboratory (VRDL), Department of Microbiology, Government Medical College, Nagpur-440003, Maharashtra, India.
2. Associate Professor, Department of Microbiology, Government Medical College, Nagpur-440003, Maharashtra, India.
3. Associate Professor, Department of Physiology, Government Medical College, Sindhudurg.
4. Professor and Head, Department of Microbiology, Government Medical College, Nagpur.
5. Professor, International Radiology, Government Medical College and Trauma Care Centre, Nagpur.

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Abstract

Objectives: To compare the performance of chest CT and Real-Time Reverse Transcription-Polymerase Chain Reaction (RT-PCR) in the initial diagnostic assessment of the coronavirus disease in COVID-19 patients during pandemic.

Methods & Results: In this study we have included 209 clinically suspected cases of COVID-19 from Government Medical College, Nagpur who undergone both HRCT chest and RT-PCR. In our study, 3.35% of patients who were RT-PCR positive did not have any findings on CT chest, and total positivity by RT-PCR was 100%. Of the patients, 51.67% showed mild HRCT score, 41.19% showed moderate HRCT score, and 4.78% showed severe HRCT score. An inverse relation between CT value of RT-PCR and chest HRCT score was detected ($p < 0.01$).

Discussion: The viral load in patients with less severe COVID-19 does not necessarily indicate the need for hospitalization or treatment. Both RT-PCR and Chest CT scan should be used in combination, but chest CT should be used judiciously.

Conclusion: Combining RT-PCR with chest CT scans can provide valuable insights into the severity of COVID-19, and thus, the two should be used together for accurate diagnosis.

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Introduction:-

The Coronaviridae family is home to various viruses that can trigger severe respiratory illnesses, such as Severe Acute Respiratory Syndrome (SARS) and Middle East respiratory Syndrome (MERS)[1]. The emergence of coronavirus disease 2019 (COVID-19) can be traced back to December 2019, when a new strain of coronavirus was discovered in Wuhan, Hubei province, China[2,3]. This virus was later identified as SARS-CoV-2, which is responsible for causing COVID-19 and can cause acute respiratory distress syndrome (ARDS), bilateral pneumonia, and pulmonary failure, which can ultimately lead to mortality[4]. In the absence of a specific treatment for COVID-19, identifying and quarantining infected individuals early is crucial to curbing the spread of the disease[5]. Real-

Corresponding Author:- Sana Pathan

Address:- Research Assistant, State Level-Viral Research and Diagnostic Laboratory (VRDL), Department of Microbiology, Government Medical College, Nagpur-440003, Maharashtra, India.

time reverse transcription polymerase chain reaction (RT-PCR) is the most dependable diagnostic method for COVID-19 but the sensitivity of this approach is limited[6,7].Consequently, chest Computed Tomography (CT) has become a prevalent approach to evaluating the lung function of COVID-19 patients without invasive procedures[8]. The aim of this study was to compare the diagnostic outcomes of chest CT scans and RT-PCR for the detection of COVID-19.

Material &Methods:-

During the period of August 2020 to November 2020, a retrospective study was conducted at the Government Medical College & Hospital on 209 suspected patients (Male-116, Female-93) who underwent both chest HRCT and RT-PCR assay for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. The study included patients of different age groups and both genders who were admitted to the COVID-19 wards and was approved by the institutional review board of the Government Medical College in Nagpur. Informed consent was waived for this study [9].

RT-PCR assay was used for laboratory confirmation of SARS-CoV-2. RNA was extracted from clinical samples using the Genes2Me spin column RNA extraction kit, and RT-PCR assay was performed using a target RDRP gene, E gene, and N gene according to the Genes2Me Viral detect II multiplex real-time PCR kit[10]. Thermal cycling was performed on a BioRad CFX96 Real Time system[11]. Patients were excluded when the time between the chest CT and the RT-PCR assay was longer than 7 days. The CT value of the target gene (RDRP gene, E gene, and N gene) less than or equal to 37 was considered positive, indicating the presence of SARS-CoV-2 in the tested sample. The result of the sample testing was related to the process of sample collection, transfer, storage, and processing, and any mistakes may lead to inaccurate results.

All the suspected patients underwent thin-slice multislice spiral CT scan in a supine position. In HRCT siemens 128 slice machines, the total severity score of chest HRCT ranged 0(no involvement)-25(maximum involvement)[12]. Patients were instructed to hold their breath if clinically possible. The procedure was performed taking all measures into account to prevent contamination of patients and personnel, which included cleaning procedures and use of protective equipment by patients and personnel. The chest CT scans are read using a standardizing reporting scheme using the items reported as typical or atypical for COVID-19. Since the PCR results were available after 12-24 hrs, both readers were unaware of the PCR test results.

Results:-

Of the 108 patients with mild HRCT scores, 52.89% exhibited medium range RTPCR CT values, 37.50% had low CT values, and 76.66% had high CT values. Among patients with moderate HRCT scores, 55.35% had low RT-PCR CT values and 38.01% had medium values. Patients with severe HRCT scores demonstrated low (7.14%) and medium (4.96%) RT-PCR CT values. In this study, we observed that 3.33% of RT-PCR-positive patients did not display any findings on CT chest (HRCT score of zero), with the overall positivity rate for RT-PCR being 100%. Additionally, 51.67% of patients had mild HRCT scores (<7), while 40.19% had moderate HRCT scores (7-17) and 4.78% had severe HRCT scores.

Table 1:-Correlation of severity CT Score and Viral load in covid 19 patients.

CT SEVERITY	NO. OF PATIENTS n(%)	OVERALL VIRAL LOAD			p-value
		LOW (30-39.99) n(%)	MEDIUM (20-29.99) n(%)	HIGH (<20) n(%)	
NORMAL (0)	7(3.33)	0	5(4.13)	2(6.66)	CHI2=18.46 D.F.=6 p=0.005,HS
MILD (<7)	108(51.67)	21(37.50)	64(52.89)	23(76.66)	
MODERATE (7-17)	84(40.19)	31(55.35)	46(38.01)	5(16.66)	
SEVERE (>17)	10(4.78)	4(7.14)	6(4.96)	0	

Discussion:-

In this retrospective study, we aimed to investigate the correlation between the RT-PCR CT values and chest HRCT scores of COVID-19 patients. The findings of the study showed that the CT values were inversely proportional to the HRCT scores. RT-PCR testing has become a crucial tool in determining the hospitalization and isolation of individual patients with COVID-19. However, this study highlights the limitations of RT-PCR testing in controlling

disease epidemics. RT-PCR tests have insufficient sensitivity, insufficient stability, and a relatively long processing time, which can be detrimental to controlling disease outbreaks. The results of RT-PCR tests can be affected by several external factors, including sampling operations, specimen source, timing, and performance detection kits, so caution must be exercised when interpreting their results.

The limitations of RT-PCR testing have prompted the use of chest HRCT scans as an essential tool for assessing lung conditions in COVID-19 patients. Chest CT scans are a conventional, non-invasive imaging modality with high accuracy and speed. The imaging characteristics of chest CT scans can help determine the prognosis of progressive lesions on HRCT. Chest CT scans shows higher sensitivity than RT-PCR in detecting COVID-19, especially in patients with negative RT-PCR results but with typical chest CT findings.

However, the use of chest CT scans in COVID-19 patients has its limitations, as highlighted in the study[13]. One limitation is the potential risks of chest CT scans in pregnant women, including radiation exposure and potential harm to the foetus[14]. Another limitation is the high transmission rate of SARS-CoV-2, which requires CT machines to be sterilized after each use, resulting in delays in reporting on potentially life-threatening conditions[15].

In summary, the study adds to the growing body of literature supporting the use of chest CT scans in assessing lung conditions in COVID-19 patients. However, caution must be exercised when interpreting the results, and the potential risks and limitations of chest CT scans should be considered. This study also emphasizes the need for a multimodal approach to diagnosing and managing COVID-19 patients, using both RT-PCR testing and chest HRCT scans, in order to provide accurate and timely diagnoses and improve patient outcomes.

Conclusion:-

RT-PCR testing for COVID-19 can be performed in community-level testing centres and is the gold standard for diagnosis. Chest CT scans can provide valuable information on the severity of the disease and should be used in combination with RT-PCR for accurate diagnosis. Additional studies involving larger cohorts are necessary to validate the findings of this study and to determine the clinical significance of chest CT scans in managing COVID-19.

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