

## Identification of Common and Severe Covid 19: The Value of Ct Texture Analysis and Correlation with Clinical Characteristics

**Dr. Ayesha Kamran<sup>1\*</sup>, Dr. Kanwal Sharif<sup>2</sup>, Dr. Adnan Khalil<sup>3</sup>**

<sup>1</sup>Assistant professor Radiology at DHQ Sargodha

<sup>2</sup>Assistant Professor Anatomy at Azra Naheed Medical College Lahore

<sup>3</sup>Consultant Radiologist at DHQ Rajan pur

### ABSTRACT

**Introduction:** Coronavirus pandemic is spreading tremendously all over the world. The need of the hour is to devise a diagnostic tool that is appropriate, efficient, time saving as well as cost effective for the diagnosis of disease.

**Aim:** The present study assesses the role of CT in early diagnosis of coronavirus disease .

**Methodology:** This retrospective study was conducted at DHQ teaching hospital of Sargodha. It included suspected patients of coronavirus visiting the hospital from 6th March 2020 to 23<sup>rd</sup> September 2020. The demographic and clinical features of the patients were noted. The RT-PCR and CT findings were recorded and compared. The statistical analysis of collected data was conducted on SPSS.

**Results:** The results showed that there is an agreement between the results of RT-PCR and CT. However, few discrepancies were also evident.

**Conclusion:** It can be concluded that CT scan is an adequate technique for efficient and timely diagnosis of coronavirus disease.

### Keywords

Coronavirus; pandemic; CT, RT-PCR.

### Introduction

In 2019, a serious respiratory disease was detected in many individuals of Wuhan, China. In January 2020, the issue was found affiliated with a novel coronavirus. The issue prevailed enormously turning into outbreak in no time [1]. By February 2020, WHO declared the condition as a Public health Emergency of International Concern due to its wide spread to other countries [2]. In March, the circumstances turned out to be a pandemic. Consequently, strict quarantine rules, precautionary instructions and lockdowns begin to be applied in order to overcome the infection[3].

The patients with symptoms of COVID-19 are subjected towards clinical diagnosis. This includes detection of viral nucleic acid through nasal swabs, throat swabs, respiratory tract secretions and sputum. The most widely method of identifying viral nucleic acid is through reverse transcription polymerase chain reaction (RT-PCR) [4]. Despite the high specificity of RT-PCR, the low sensitivity of the diagnostic tool is major obstacle in its accuracy. Its sensitivity ranges from 45% to 70%, which indicates high chances of occurrence of false negative cases. Such circumstances result from low viral load or limitations imparted by sample collection[5].

As a substitute of PCR, diagnostic imaging can be used for diagnosing and assessing severity of disease. Previous research works have extensively worked on various aspects of Chest computed tomography (CT) imaging with relevance to COVID-19 [6]. The present study aims to evaluate role of chest CT in diagnosing COVID-19. Such an approach will be useful in exploring the role of CT in patient management of Pakistani population.

## **Methodology**

### **Patient population**

The present study included patients visiting DHQ Teaching Hospital, Sargodha from 6th March 2020 to 23<sup>rd</sup> September 2020 with suspicion of COVID-19. The Hospital comprises of separate reserved pathway for assessment of coronavirus patients. At first step, the body temperature and travel history of the patients were recorded. Moreover, the patient was asked about any contact with individuals suffering from coronavirus infection before the appearance of disease symptoms.

At persistence of suspicion, the patients were admitted in isolation room where they were tested for coronavirus through nasopharyngeal swab sample. The RT-PCR assays were conducted to verify diagnosis. Moreover, arterial blood gas (ABG) examination, blood test and imaging evaluation through CT were also conducted. In the present study, 352 individuals, presented with clinical suspicion of COVID-19, were retrospectively assessed

### **Imaging technique**

The CT examination was conducted in CT scanning room at Radiology Department. The individuals were laid in supine position with arms raised. They were asked to hold breath during the procedure. The CT scan Toshiba (Asteion/ VR) single slice was used.

### **Imaging interpretation**

The chest CT scans were evaluated by four radiologists individually. They were unaware to final diagnosis and results of RT-PCR. In present study, nine major CT findings were included such as consolidation, bronchial wall thickening, ground-glass opacities (GGOs), interlobular septal thickening, mixed GGO and consolidation, nodules with GGOs, air bronchogram, pleural effusion and mediastinal lymph node enlargement.

The CT was classified as negative CT, inconsistent CT, possible CT and typical CT. Such classification was helpful in addressing patients carefully towards intensive care unit.

### **Statistical analysis**

The SPSS v.17 was used for statistical analysis of collected data. At first, Cohen's kappa was utilized for nominal variables including 0 for no sign detection and 1 for sign detection. Thus, this method was used to compare radiological diagnosis and results of RT-PCR. At second step, the distribution of each CT finding in patients was assessed through chi square test.

## Results

The demographic and clinical attributed of participants are shown in the Table 1. According to which, majority of patients were male (n=257; 73.01%), with age range of 31 to 40 years (n=68; 19.31%). Fever was found to be the most prevalent symptom (n=117; 33.23%). Only 59 (16.76%) patients had travel history and 110 (31.25%) had interaction with coronavirus positive patients before onset of symptoms. Some patients were shifted or referred from other hospitals (n=7; 1.98%). Majority of patients had no co-morbidities (n=156; 44.31%), whereas, Obstructive chronic bronchopulmonary disease was found to be the most prevalent co-morbidity (n=46; 13.06%). The mean age of the patients was found to be  $53.28 \pm 5.82$  years. The mean stay time for patients in hospital was found out to be  $7.93 \pm 3.38$  days.

**Table 1.** Demographics and clinical features of patients

<b>Gender</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
Male	257	73.01
Female	95	26.98
<b>Age</b>		
1-10	10	2.84
11-20	17	4.82
21-30	64	18.18
31-40	68	19.31
41-50	66	18.75
51-60	56	15.90
61-70	43	12.21
71-80	19	5.39
81-90	8	2.27
91-100	1	0.28
<b>Symptoms</b>		
Fever	117	33.23
Cough	50	14.20
Sore throat	4	1.13
Chills	1	0.28
Myalgia	3	0.85
Dyspnea	1	0.28
Headache	5	1.42
Diarrhea	3	0.85
Vomiting	8	2.27
Breathing difficulty	57	16.19
Irritability	1	0.28
Backache	1	0.28
Asymptomatic	101	28.69
<b>Travel history</b>		
Yes	59	16.76
No	293	83.23

<b>Contact history with corona positive patients</b>		
Yes	110	31.25
No	242	68.75
<b>Shifted/referred from other medical centre</b>		
Yes	7	1.98
No	345	98.01
<b>Co-morbidities</b>		
Cancer	15	4.26
Diabetes	26	7.38
Hypertension	21	5.96
Dyslipidemia	33	9.37
Obstructive chronic bronchopulmonary disease	46	13.06
Cardiovascular disease	32	9.09
Cerebrovascular disease	12	3.40
Heart failure	11	3.12
Absent	156	44.31

In present study, the findings of CT were compared with that of RT-PCR. Thus, on the basis of RT-PCR results, patients were classified as positive and negative. Among 352 patients, 139 patients were positive, whereas, 213 were negative. The mean age for corona positive patients was higher ( $60 \pm 10$  years) than corona negative patients ( $52 \pm 7$  years). The time for onset of symptoms to hospital admission varied from 1 to 14 days.

**Table 2:** Inter rater reliability

<b>Index</b>	<b>Kappa</b>	<b>t</b>	<b>p</b>	<b>Intervals</b>
Ground-glass opacity (GGO)	.563	9.273	0.000000	Moderate
Consolidation	.635	9.131	0.000000	Moderate
Mixed GGO and Consolidation	.532	9.473	0.000000	Moderate
Single/multiple nodules with halo sign	.746	11.373	0.000000	Substantial
Peripheral distribution	.154	3.483	0.000000	Slight
Centrolobular distribution	.164	4.134	0.000000	Slight
Both peripheral and centrolobular distribution	.323	5.533	0.000001	Fair
Upper lung	.322	5.134	0.000000	Fair
Lower lung	.645	9.333	0.000000	Moderate
Both upper lung and lower lung	.561	9.182	0.000000	Moderate
Unilateral	.923	14.744	0.000000	Almost perfect
Bilateral	.121	3.183	0.000000	Slight
Focal	.341	10.373	0.000000	Moderate
Multifocal	.358	10.283	0.000000	Moderate
Diffuse	.364	9.733	0.000000	Moderate
Interlobular septal thickening	.384	9.373	0.000000	Moderate
Bronchial wall thickening	.718	12.374	0.000001	Substantial
Air bronchogram	.311	9.374	0.000000	Moderate
Lymph nodes	.422	10.383	0.000000	Moderate

Pleural effusion	.713	13.374	0.000000	Substantial
COVID Positive according to CT findings	.927	14.585	0.000000	Almost perfect

The Table 2 shows inter rate reliability analyzation. It is evident that all indexes are significant with  $p < 0.001$ . Thus, coders were found to be at good agreement. The findings show that substantial agreement was found between CT readings and RT-PCR ( $p < 0.000001$ ). However, discrepancies were present in 21 cases, which were CT positive but RT-PCR negative. On the other hand, 13 cases were CT negative and RT-PCR positive.

The Table 3 shows radiological index for patients. It is evident that findings such as bronchial wall thickening, air bronchogram, multifocal or diffuse abnormalities localized in lungs, mixed GGO and consolidation pattern, peripheral and bilateral distribution had greater frequency in positive patients.

**Table 3:** Distribution of radiological indexes

Index	$\chi^2$	p	Cramer's V	Direction
Ground-glass opacity (GGO)	5.384	.073723	.273	NA
Consolidation	4.248	.038311	.182	NA
Mixed GGO and Consolidation	82.487	.000000	.495	P
Single/multiple nodules with halo sign	11.384	.000837	.284	N
Peripheral distribution	113.485	.000000	.524	P
Centrolobular distribution	3.585	.003827	.172	NA
Both peripheral and centrolobular distribution	4.284	.002724	.182	NA
Upper lung	73.297	.000383	.495	P
Lower lung	5.384	.027342	.173	NA
Both upper lung and lower lung	92.487	.000000	.694	P
Unilateral	115.387	.000027	.583	P
Bilateral	50.397	.000021	.682	P
Focal	10.398	.000003	.294	N
Multifocal	60.297	.000283	.524	P
Diffuse	92.847	.000847	.683	P
Interlobular septal thickening	3.485	.038283	.028	NA
Bronchial wall thickening	5.387	.002834	.533	NA
Air bronchogram	82.047	.000018	.582	P
Lymph nodes	94.484	.000037	.681	P
Pleural effusion	82.497	.000022	.495	P
COVID Positive according to CT findings	97.397	.000344	.583	P

### Discussion

The tremendous spread of coronavirus from China has posed health care system with difficulty to cope up with the situation in various countries[7]. Same is true for Pakistan, where corona positive patients are increasing each day [8]. The present study assessed the role of CT in early and effective detection of COVID-19.

The data collected from coronavirus suspected patients were retrospectively assessed and compared with the results of RT-PCR[9]. Although, RT-PCR is widely used for diagnosis of coronavirus, its low sensitivity and negative predictive value are constant drawbacks, which is not reliable in estimating disease severity [10]. In such circumstances, CT is regarded as a potential substitute with high sensitivity and specificity. It is highly accurate in assessing disease severity [11]. It helps in early detection of disease which helps in proper management of patient avoiding further spread of the disease [1].

The findings of present study shows that substantial agreement exist between RT-PCR and CT results ( $p < 0.0000001$ ). In patients showing RT-PCR and CT positive results manifestations such as mixed GGO, consolidation pattern, bronchial wall thickening, air bronchogram, multifocal and diffuse abnormalities in lungs, and septal thickening were highly prevalent. This is in accordance with previous research work of Gaia et al [12]).

### Conclusion

It can be concluded that CT is a useful technique of early diagnosis of COVID-19 patients. It needs to be manifested at larger scale as it is helpful in proper and timely management of the disease.

### References

- [1] Rubin, G., Ryerson, C., & Haramati, L. (2020). The role of chest imaging in patient management during the COVID-19 pandemic: a multinational consensus statement from the Fleischner society. *Radiology*.
- [2] Yang, X., Yu, Y., & Xu, J. (2020). Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *Lancet Respirat Med*.
- [3] Lu, H., Stratton, C., & Tang, Y.-W. (2020). Outbreak of pneumonia of unknown etiology in Wuhan, China: the mystery and the miracle. *J Med Virol*, 92, 401–402.
- [4] Kanne, J., Little, B., & Chung, J. (2020). Essentials for Radiologists on COVID-19: an Update-Radiology Scientific Expert Panel. *Radiology*.
- [5] Zhu, N., Zhang, D., & Wang, W. (2020). A Novel Coronavirus from Patients with Pneumonia in China, 2019. *New England J of Med*, 382, 727–733.
- [6] Shi, H., Han, X., & Jiang, N. (2020). Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. *Lancet Infectious Diseases*, 20, 425–434.
- [7] Wu, F., Zhao, S., & Yu, B. (2020). A new coronavirus associated with human respiratory disease in China. *Nature*, 579, 265–269.
- [8] Liu, K.-C., Xu, P., & Lv, W.-F. (2020). CT manifestations of coronavirus disease-2019: a retrospective analysis of 73 cases by disease severity. *Eur J Radiol*, 126(108941).
- [9] Guan, C., Lv, Z., & Yan, S. (2020). Imaging features of coronavirus disease 2019 (COVID-19): evaluation on thin-section CT. *Acad Radiol*.

- [10] Zhao, W., Zhong, Z., & Xie, X. (2020). Relation between chest ct findings and clinical conditions of coronavirus disease (COVID-19) pneumonia: a multicenter study. *Am J Roentgenol*.
- [11] Hosseiny, M., Kooraki, S., & Gholamrezanezhad, A. (2020). Radiology Perspective of Coronavirus Disease 2019 (COVID-19): lessons from severe acute respiratory syndrome and middle east respiratory syndrome. *Am J Roentgenol*.
- [12] Gaia, C., Chiara, C. M., Silvia, L., Chiara, A., Luisa, C. M., Giulia, B. S., Cristina, V. (2020). Chest CT for early detection and management of coronavirus disease (COVID19): a report of 314 patients admitted to Emergency Department with suspected pneumonia. *La radiologia medica*, 125, 931–942.