

## Original Research Article

# CT score and prognosis of vaccinated and unvaccinated patients in Covid 19 pneumonia

### ABSTRACT

**Background:**SARS-CoV-2 virus, which emerged in December 2019 in Wuhan, China, was defined as a Covid-19 pandemic by the WHO.The PCR test is the most common diagnosis test.CT is the common used because it sometimes detects pathological findings in the lung before symptoms.

**Aims:**In the study, we aimed to investigate the relationship between CT score and prognosis in vaccinated and unvaccinated patients.

**Study Design:**CT score and clinical findings in hospitalized patients due to Covid-19 were analyzed retrospectively.

**Place and Duration of Study:**Ersin Arslan Training and Research Hospital Covid Wards between July 1, 2021, and September 30, 2021.

**Methodology:**300 vaccinated or unvaccinated patients(133 male,167 female) with or without a medical history hospitalized in hospital wards were included in the study.CT and clinical findings of the patients were evaluated.CT score was calculated according to lung lobes involvement rates.

**Results:**Male gender was 44.3% and female 55.7%.Average age was 57 years (median:57 range:21-96).According to the CT scores;18.6% mild, 49.3% moderate, 24.6% severe lung involvement was detected.18.6% of the patients were completed vaccinated, 10.6% incompleted-vaccinated, and 70.8% unvaccinated.Pulmonary involvement was mild in 84%, moderate in 16% of the vaccinated patients.In unvaccinated and incompletely-vaccinated; 27% severe, 69% moderate and 4% mild were detected.It was determined that 17.6% of patients needed intensive-care.The mean hospitalized stay was 9.2 days(median:8 range:1-38). 7 or less CT scores was associated with vaccinated patients(mild). 8-17 CT score was associated with unvaccinated(moderate).It was determined that patients with a more than 18 CT score(severe lung involvement) had a longer hospital stay and a higher need for intensive care.

**Conclusion:**Covid 19 found to be associated with more severe lung damage in unvaccinated patients.Even if the vaccinated got the disease, the lung damage was milder.A CT score of more than 18 was associated with intensive care unit admissions and longer hospital stays and poor prognosis.

**Keywords:** Covid-19, lungs, pneumonia, radiological, vaccinated

### 1.INTRODUCTION

SARS-CoV-2 virus, which emerged in December 2019 in Wuhan, China, was defined as a Covid-19 pandemic by the World Health Organization (WHO). Covid-19 infection has a wide range of clinical findings from asymptomatic, mild to moderate illness to severe pneumonia, acute respiratory distress syndrome (ARDS) and sepsis [1]. Reverse transcription polymerase chain reaction (RT-PCR) test is most commonly used for diagnosis. Respiratory system is the first to be affected in Covid-19,

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and it has been reported that pathological findings appear before symptoms in computerized tomography (CT) [2,3]. Therefore, CT is a significant radiological method for the diagnosis of Covid-19 infection in the initial evaluation and follow-up of the lungs [4]. In our study, we aimed to investigate the relationship between CT score, clinical features and prognosis in vaccinated and unvaccinated patients.

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## 2. MATERIAL AND METHODS

Patients hospitalized in Ersin Arslan Training and Research Hospital Covid Wards between July 1, 2021, and September 30, 2021, were retrospectively examined. All patients younger than 18 years of age who were not hospitalized and did not have a PCR test were excluded from the study. A total of 300 vaccinated and unvaccinated patients over the age of 18 who had PCR test results and were hospitalized in Covid wards were included in the study. Age, gender, vaccination and radiology data, PCR test results, intensive care needs and hospital stay of the patients included in the study were analyzed. Radiological data were based on CO-RADS (table 1), and computed tomography (CT) of the thorax was categorized (table 2) according to lobar involvements and the score and severity of the five lobes [5]. The sample size was determined as a minimum of 55 for 5% Type 1 error, 95% confidence interval and 90% power in this study. The obtained data were analyzed statistically with the McNemar's Chi-Square Test.

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**Table 1.CO-RADS Classification**

	Chance of COVID-19	CT Findings
<b>CO-RADS 1</b>	Highly unlikely	Normal or non-infectious abnormalities
<b>CO-RADS 2</b>	Unlikely	Abnormalities consistent with infections other than COVID-19
<b>CO-RADS 3</b>	Equivocal	Unclear whether COVID-19 is present
<b>CO-RADS 4</b>	Probable	Abnormalities suspicious for COVID-19
<b>CO-RADS 5</b>	Highly likely	Typical COVID-19
<b>CO-RADS 6</b>	PCR proven	

\*CO-RADS: COVID-19 Reporting and Data System

**Table 2.Lobar scores and overall severity of the five lobes**

Lobar Involvement	Lobar Score
5% or less	1
5%-25%	2
26%-49%	3
50%-75%	4
>75%	5
Total Score (numerical)	Severity (category)
7 or less	Mild
8-17	Moderate
18 or more	Severe

\* Saeed GA, Gaba W, Shah A, et al. Correlation between Chest CT Severity Scores and the Clinical Parameters of Adult Patients with COVID-19 Pneumonia. Hindawi Radiology Research and Practice 2021;1-7.

## 3. RESULTS AND DISCUSSION

A total of 300 vaccinated and unvaccinated patients over the age of 18 who were hospitalized in Covid 19 wards between 1 July 2021 and 30 September 2021 were

retrospectively analyzed. Male gender was 44.3%, female gender 55.7%, and the average age was 57 years (median:57 ranges:21-96, table 3). According to the Co-Rads classification; it was determined as 51% Co-Rads-5, 19.3% Co-Rads-4, 14.6% Co-Rads-3, 7.6% Co-Rads-2 and 7.5% Co-Rads-1. According to the CT scores (table 2); 18.6% mild (figure 1), 49.3% moderate (figure 2), 24.6% severe (figure 3) lung involvement was detected. 18.6% of the patients were completed vaccinated, 10.6% incompletely vaccinated, and 70.8% unvaccinated. Pulmonary involvement (CT score) was mild in 84% and moderate in 16% of the vaccinated patients (n:56). In unvaccinated and incompletely vaccinated patients; 27% severe, 69% moderate and 4% mild lung involvement were detected (n:244/212 unvaccinated, 32 incompletely vaccinated patients). PCR test results; 9.2% negative and 90.8% positive. It was determined that 17.6% needed intensive care. The mean hospitalized stay was 9.2 days (median:8 range:1-38).

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**Table 3. Distribution of the study population by age and gender**

	N	Mean	SD	95% CI
<b>Age</b>	300	56,6 (21-96)	16,12	± 1,82
20-40 years	51	17,00%	0,376	± 0,09
40-60 years	130	43,30%	0,496	± 0,08
>60 years	119	39,70%	0,491	± 0,08
<b>Gender</b>				
Male	133	44,30%	0,497	± 0,08
Female	167	55,70%		

As a result of this study, it was determined that Covid-19 is more common in female gender and between the ages of 40-60. Although it was determined that patients aged 40-60 years do not prefer to be vaccinated more and patients older than 60 years of age need more intensive care, this is not statistically significant ( $p < 0.290$  and  $p < 0.236$ ). It was determined that male needed intensive care more frequently than female. It was found that female did not prefer to be vaccinated ( $p < 0.0001$ ). According to CT scores; It is lower (7 or less) in vaccinated patients and is compatible with mild ( $p < 0.003$ ). Moderate CT score (8-17) was found to be statistically correlated with unvaccinated patients ( $p < 0.0001$ ). It was determined that patients with a severe CT score (more than 18) had a longer hospital stay (>15 days) and a higher need for intensive care ( $p < 0.0001$ ). CORADS-5 classification, which expresses high probability typical Covid-19, was found to be statistically associated with both unvaccinated patients and long hospital stays ( $p < 0.0001$ ). Regardless of the lung involvement rate in CT, if only the anatomical lobe involvement received as criteria; if five lobes of the lung affected, it was detected to be associated with both unvaccinated patients and a long hospital stay ( $p < 0.0001$ , table 4 and figure 1).

Comment [A5]: Not clearly written, rewrite it??

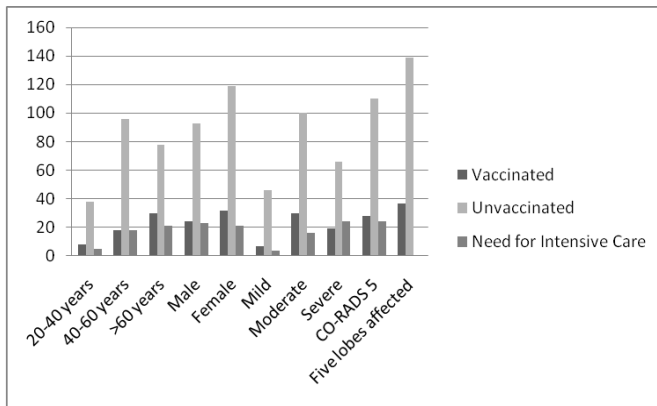
**Table 4. Statistical analysis data of the study according to the variables**

	Vac (n)	I.Vac. (n)	Unvac. (n)	Need for IC (n)	Hosp.>15 days (n)	p ODDS / CV
<b>Age</b>						
20-40 years	8	5	38	5	9	$p < 0,489$ 0,648 / 0,038
40-60 years	18	16	96	18	17	$p < 0,290$ 0,889 / 0,061
>60 years	30	11	78	21	22	$p < 0,236$ 1,365 / 0,068
<b>Gender</b>						
Male	24	16	93	23	29	$p < 0,251$ 0,769 / 0,066
Female	32	16	119	21	19	$p < 0,0001$

						1.129 / 0.028	
<b>CT score</b>	Mild	7	3	46	4	4	p<0,147
	Moderate	30	18	100	16	15	1.232 / 0.076
	Severe	19	11	66	24	29	p<0.0001
<b>CO-RADS 5</b>		28	15	110	24	31	0.744 / 0.067
<b>Five lobes affected</b>		37	23	139	32	33	p<0.0001
							1.063 / 0.012
							1.077 / 0,017
							p<0.0001
							1.421 / 0.056

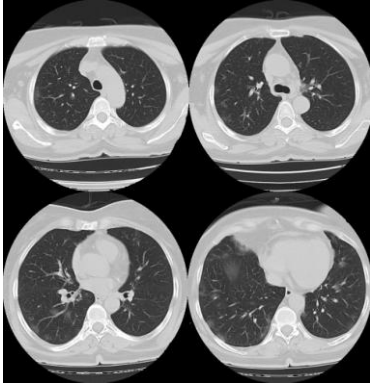
\*Vac: Complete Vaccinated, I.Vac: Incomplete vaccinated, Unvac: Unvaccinated  
 Need for IC: Need for Intensive Care, Hosp>15 days: Length of stay in hospital.  
 \*McNemar's Chi-Square Test was used for statistical analysis.

**Figure 1. Distribution of the relationship of the study with the variables according to the need for vaccination and intensive care**

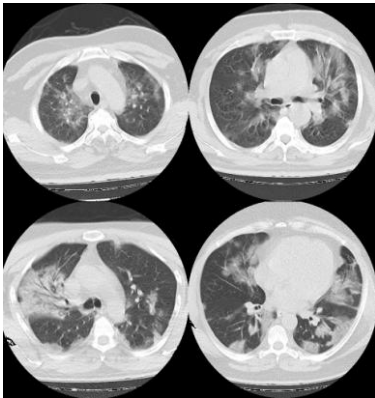


Covid-19, which most commonly affects the respiratory system, is a very serious disease that causes the death of tens of thousands of people. It has been reported that it is more common in male than female [6]. In our study, it was more common in female and over 60 years of age in patients in hospital wards. CO-RADS is the ability to distinguish between low and high probability of Covid-19. It is 71-99% reliable for possible Covid-19. [7,8]. In this study, no patient with negative PCR test in CO-RADS 3-4 and 5 was detected. According to the results of the PCR Test repeated twice, 9.2% of the patients were Covid negative and radiologically reported as CO-RADS 1 and 2. The most common finding on CT in Covid 19 pneumonia is ground glass opacity (GGO). It often shows peripheral or subpleural localization. With increasing size, a consolidation pattern, alveolar and interstitial exudation, patchy ground glass infiltration and signs of fibrosis are seen [9,10]. Parenchymal reticulation and crazy pavement appearance are among the other radiological findings. These findings are generally observed to be associated with clinical progression of the disease. All these findings, most frequently GGO, were observed in our study. In our study, the lungs were evaluated anatomically and radiologically. In the literature, there are publications about the lung lobe involvement rates and the CT score determined. In our study; CT score with radiological data, thorax CT was categorized according to lobar involvement and the score and severity of the five lobes [5]. According to this, lobar involvement is 1 point 5% or less, 2 points between 5%-25%, 3 points 26-49%, 4 points 50-75%, and 5 points if it is 75% or more. A total score was considered of 7 or less as mild,(figure 2) between 8-17 as moderate (figure 3), and 18 or more as severe (figure 4).

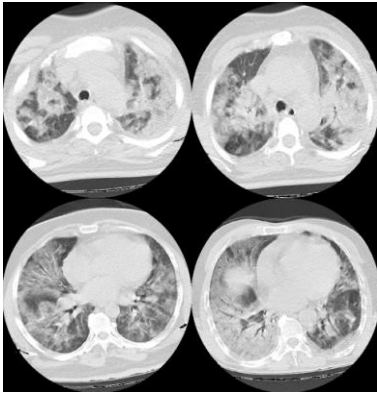
**Figure 2. Mild lung involvement image on CT**



**Figure 3. Moderate lung involvement image on CT**



**Figure 4. Severe lung involvement image on CT**



. In unvaccinated patients were more pulmonary involvement, longer hospital stay, higher CT score, and more need for intensive care. Prognostic factors act an important role in the course of the disease. Variables that reduce the length of hospital stay and the need for intensive care are good prognostic factors. In the study, it was determined that the severe CT score, the affected of five lobes of the lung and the CORADS-5 classification increased the length of hospital stay. Severe CT score was found to be associated with intensive care admission. CT score was lower in vaccinated patients compared to unvaccinated. For this reason, it has been understood that the vaccine reduces the damage caused by Covid-19 to the lungs. Because in unvaccinated patients, it was determined that five lobes of the lungs were affected and the lobe was involved at a higher rate.

#### 4. CONCLUSION

Covid 19 found to be associated with more severe lung damage in unvaccinated patients. Even if the vaccinated got the disease, the lung damage was milder. A CT score of more than 18 was associated with intensive care unit admissions and longer hospital stays and poor prognosis.

#### ETHICAL APPROVAL

Republic of Turkey Ministry of Health 2021-09-18T22\_38\_39 numbered and Gaziantep University Medical Ethics Committee 2021/322 numbered approval have been received.

#### REFERENCES

- 1.Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA. 2020;323(11):1061-1069.
- 2.Kim J.Y, Choe P.G, Oh Y, et al. The first case of 2019 novel coronavirus pneumonia imported into Korea from Wuhan China: implication for infection prevention and control measures. J Korean Med Sci. 2020 Feb 10;35(5):e61.
- 3.Pan Y, Guan H, Zhou S, et al. Initial CT findings and temporal changes in patients with the novel coronavirus pneumonia (2019-nCoV): a study of 63 patients in Wuhan, China. Eur Radiol 2020;30:3306-3309.

4. Ng M.Y, Lee E.Y.P, Yang J, et al. Imaging profile of the COVID-19 infection: radiologic findings and literature review. *Radiol Cardiothorac Imaging*, 2020;2(1):e200034.

5. Saeed GA, Gaba W, Shah A, et al. Correlation between Chest CT Severity Scores and the Clinical Parameters of Adult Patients with COVID-19 Pneumonia. *Hindawi Radiology Research and Practice* 2021;1-7.

6. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 2020; 395: 507–513

7. Prokop M, van Everdingen W, van Rees Vellinga T, et al. CO-RADS: A categorical CT assessment scheme for patients suspected of having COVID-19 definition and evaluation. *Radiology*. 2020;296:97-104.

8. Inui S, Kurokawa R, Nakai Y, et al. Comparison of chest CT grading systems in Coronavirus disease 2019 (COVID-19) pneumonia. *Radiol Cardiothorac Imaging*. 2020;2:e200492.

9. Bao C, Liu X, Zhang H, Li Y, Liu J. Coronavirus disease 2019 (COVID-19) CT findings: a systematic review and meta-analysis. *J Am Coll Radiol*. 2020:S1546-1440(20)30262-3.

10. Shi H, Han X, Zheng C (2020) Evolution of CT manifestations in a patient recovered from 2019 novel coronavirus (2019-nCoV) pneumonia in Wuhan, China. *Radiology*. 2020; 295:20.

**Comment [A6]:** Follow the author guidelines for reference?

UNDER PEER REVIEW