



CT Score and Prognosis of Vaccinated and Unvaccinated Patients in COVID 19 Pneumonia

**Bayrakçi Onur ^{a*}, Onay Mehmet ^b, Altay Çetin Murat ^b,
Bayrakçi Sinem ^c and Binboğa Ali Burak ^b**

^a Thoracic Surgery Department, Ersin Arslan Training and Research Hospital, Turkey.

^b Radiology Department, Ersin Arslan Training and Research Hospital, Turkey.

^c Intensive Care Department, Ersin Arslan Training and Research Hospital, Turkey.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Covid-19 is infection has a wide range of clinical findings from asymptomatic, mild to severe pneumonia. Respiratory system is the first to be affected in Covid-19, and it has been reported that pathological findings appear before symptoms in CT. Vaccination is recommended against Covid 19 disease. Pulmonary involvement has been reported to be more common in the unvaccinated population.

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. Chi-Square Test was used for statistical analyzed.

Results: A total of 300 patients were reviewed. Male gender was 44.3% and female 55.7%. The 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 found. 18.6% of the patients were completed vaccinated, 10.6% incompleated-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 found. 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 related with vaccinated patients (mild). 8-17 CT score was related with unvaccinated (moderate). It was found that patients with a more than 18 CT score (severe lung involvement) had a longer hospital stay and a more often need for intensive care.

Conclusion: COVID 19 is found to be related with more severe lung damage in unvaccinated patients. In the vaccinated patients the lung damage was milder. A CT score of more than 18 was related with 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) [1]. Covid-19 is infection has a wide range of clinical findings from asymptomatic, mild to moderate illness to severe pneumonia, acute respiratory distress syndrome (ARDS) and sepsis. 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, 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]. Vaccination is recommended against Covid 19 disease. Pulmonary involvement has been reported to be more common in the unvaccinated population [5]. In our study, we aimed to investigate the relationship between CT score, clinical features and prognosis in vaccinated and unvaccinated patients.

2. MATERIALS 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. Scoring was done according to the percentage involvement rates of the lung lobes. Sum of lobar scores was categorized as mild moderate and severe [6]. 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 [Fig. 1] between 8-17 as moderate [Fig. 2], and 18 or more as severe [Fig. 3]. Thorax CT of all patients included in the study was examined and scored according to the percent involvement of the lobes. The sample size was determined 95% confidence interval and 90% power of test in this study. Chi-Square Test was used for statistical analyzed.

Table 1. CO-RADS classification

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

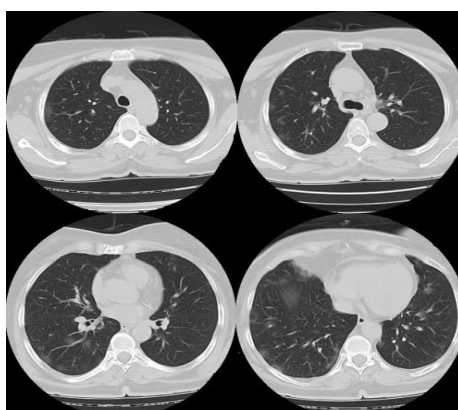


Fig. 1. Mild lung involvement image on CT

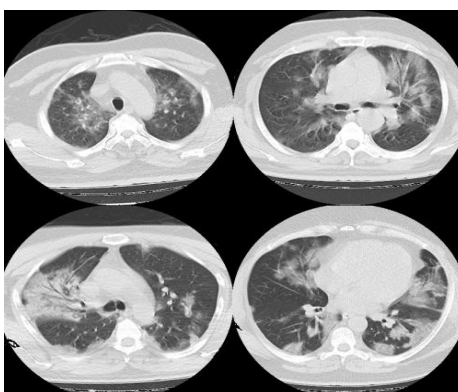


Fig. 2. Moderate lung involvement image on CT

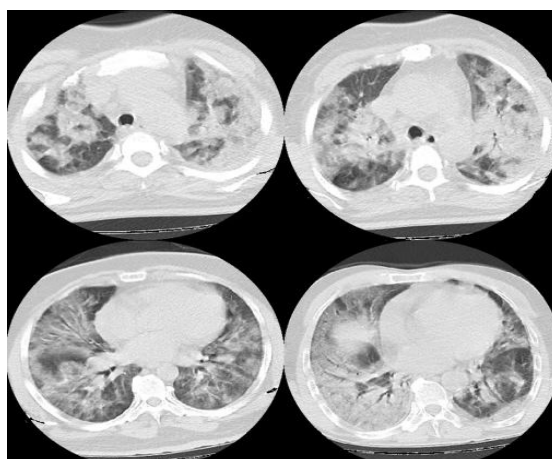


Fig. 3. Severe lung involvement image on CT

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

	N	Mean	SD	95% CI
Age	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
Gender				
Male	133	44,30%	0,497	± 0,08
Female	167	55,70%		

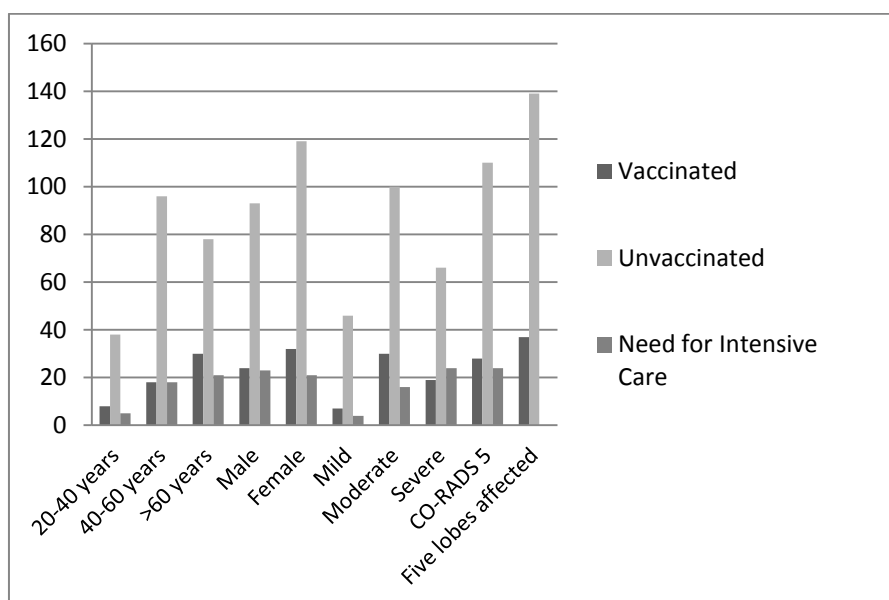


Fig. 4. Distribution of the relationship of the study with the variables according to the need for vaccination and intensive care

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 found 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 [Fig. 1], 49.3% moderate [Fig. 2], 24.6% severe [Fig. 3] lung involvement was found. 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 found (n:244 212 unvaccinated, 32 incompletely vaccinated patients). PCR test results were 9.2% negative and 90.8% positive. It was found that 17.6% needed intensive care. The average hospitalized stay was 9.2 days (median:8 range:1-38).

As a result of this study, it was determined that Covid-19 is more often in female gender and between the ages of 40-60. Although it was found 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 males needed intensive care more often than females. It was found that female gender did not prefer to be vaccinated ($p < 0.0001$). CT scores are 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 found that patients with a severe CT score (more than 18) had a longer hospital stay (> 15 days) and a more often need for intensive care ($p < 0.0001$). CORADS-5 classification, which expresses high probability typical Covid-19, was found to be statistically related 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 found to be associated with both unvaccinated patients and a long hospital stay [$p < 0.0001$, Table 4 and Fig. 4].

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

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 males than females [7]. In our study, it was more often 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 [8,9]. 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 [10,11]. Parenchymal reticulation and crazy pavement appearance are among the other radiological findings. These findings are generally observed to be related with clinical progression of the disease. All these findings, most frequently GGO, were observed. In our study, the lungs were evaluated anatomically and radiologically.

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 related 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 is found to be related with more severe lung damage in unvaccinated patients. In the vaccinated patients the lung damage was milder. A CT score of more than 18 was related with poor prognosis.

CONSENT

It is not applicable.

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.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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