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ABOUT COVER

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ORIGINAL ARTICLE

Retrospective Study

Effect of vaccination status on CORADS and computed tomography severity score in hospitalized COVID-19 patients: A retrospective study

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Abstract

BACKGROUND

The coronavirus disease 2019 (COVID-19) pandemic is continuing. The disease most commonly affects the lungs. Since the beginning of the pandemic thorax computed tomography (CT) has been an indispensable imaging method for diagnosis and follow-up. The disease is tried to be controlled with vaccines. Vaccination reduces the possibility of a severe course of the disease.

AIM

The aim of this study is to investigate whether the vaccination status of patients hospitalized due to COVID-19 has an effect on the CT severity score (CT-SS) and CORADS score obtained during hospitalization.

METHODS

The files of patients hospitalized between April 1, 2021 and April 1, 2022 due to COVID-19 were retrospectively reviewed. A total of 224 patients who were older than 18 years of age, whose vaccination status was accessible, whose severe acute respiratory syndrome coronavirus 2 polymerase chain reaction result was positive, and who had a Thorax CT scan during hospitalization were included in the study.

RESULTS
Among the patients included in the study, 52.2% were female and the mean age was 61.85 years. The patients applied to the hospital on the average 7th day of their complaints. While 63 patients were unvaccinated (Group 1), 20 were vaccinated with a single dose of CoronaVac (Group 2), 24 with a single dose of BioNTech (Group 3), 38 with 2 doses of CoronaVac (Group 4), 40 with 2 doses of BioNTech (Group 5), and 39 with 3 doses of vaccine (2 doses of CoronaVac followed by a single dose of BioNTech, Group 6). CT-SS ranged from 5 to 23, with a mean of 12.17.

RESULTS
CT-SS mean of the groups were determined as 14.17, 13.35, 11.58, 10.87, 11.28, 10.85, respectively. Accordingly, as a result of the comparisons between the groups, the CT-SS levels of the unvaccinated patients found to be significantly higher than the other groups. As the vaccination rates increased, the rate of typical COVID-19 findings on CT was found to be significantly lower.

CONCLUSION
Increased vaccination rates in COVID-19 patients reduce the probability of typical COVID-19 symptoms in the lungs. It also reduces the risk of severe disease and decreases CT Severity Scores. This may lead to a loss of importance of Thorax CT in the diagnosis of COVID-19 pneumonia as the end of the pandemic approaches.

Key Words: COVID-19; CORADS; Computed tomography severity score; Thorax computed tomography; SARS-CoV-2; Vaccination

Core Tip: This is a retrospective study to evaluate the effect of vaccination status on CORADS and computed tomography (CT) severity score in hospitalized coronavirus disease 2019 (COVID-19) patients. Accordingly, as a result of the comparisons between the groups, the CT severity score levels of the unvaccinated patients were significantly higher than the other groups. As the vaccination rates increased, the rate of typical COVID-19 findings on CT was found to be significantly lower.

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INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic still continues, although the number of cases has decreased[1]. The disease most commonly affects the lungs, and since the beginning of the pandemic, thorax computed tomography (CT) has been an indispensable imaging method for diagnosis and follow-up[2]. The disease is tried to be controlled with the introduction of vaccines and the increase in vaccination rates. Vaccination reduces the probability of severe course of the disease and the CORADS score, which is an indicator of lung involvement[3-6].

CoronaVac vaccine (Sinovac Life Sciences, Beijing, China), which is an inactive vaccine, has been started to use from the elderly population and healthcare workers in our country as of January 2021[7]. As of April 2021, the BNT-162b2 (BioNTech/Pfizer) vaccine, which is an mRNA vaccine, has begun to be used[8]. Reminder doses are also applied as the pandemic continues.

The aim of this study was to investigate whether the vaccination status of patients hospitalized due to COVID-19 had any effect on the CT severity score (CT-SS) and CORADS scoring assessed during hospitalization.

MATERIALS AND METHODS

Study design

This study was planned as a retrospective, cross-sectional study and was conducted with the approval of Erzincan Binali Yildirim University Clinical Research Ethics Committee (Date: 27.10.2022 / Decision No: 04/16).

The files of patients admitted to the COVID-19 inpatient clinic between April 1, 2021 and April 1, 2022 were retrospectively reviewed.

Inclusion criteria: (1) Being over 18 years of age; (2) Having a positive polymerase chain reaction (PCR) test for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and receiving inpatient treatment in one of the COVID-19 inpatient clinics; (3) Having a Thorax CT scan on the seventh day of complaints during hospitalization; (4) Having access to COVID-19 vaccination information during hospitalization; (5) Among the patients for whom vaccination information was available, it was defined as 14 days or more from the last vaccine dose for patients who received 2 or more vaccines, and 14 days or more from the date of vaccination for patients who received a single dose of vaccine.

Accordingly, 224 patients out of a total of 2000 patients were included in the study. In our study, patients who met the inclusion criteria were divided into 6 groups: Unvaccinated (Group 1), single dose CoronaVac vaccine (Group 2), single dose BioNTech vaccine (Group 3), 2 doses CoronaVac vaccine (Group 4), 2 doses BioNTech vaccine (Group 5) and 2 doses CoronaVac + 1 dose BioNTech vaccine (Group 6). Patients were evaluated according to the severity of involvement in thorax CT and whether there is typical involvement or not. At the same time, it was investigated whether the acute phase parameters of the patients were affected by the vaccination status.

Laboratory tests

The SARS-CoV-2 PCR test was studied with DS CORONEX COVID-19 Multiplex Real Time qPCR (DS Nano and Biotechnology). The hemogram test of the patients was performed using the Sysmex XN-1000 Hematology System (Sysmex Corporation, Kobe, Japan); and biochemical tests were studied with AU 5800 (Beckman Coulter, California, United States) and coagulation tests with Ceveron® alpha (Diapharma Group, Ohio, United States).

Thorax CT

All patients had a CT scan without intravenous contrast material on the day they were admitted to the hospital (Siemens SOMATOM Sensation 16, Forchheim, Germany). All patients were scanned in the supine position using an adult CT protocol; reconstruction images of the 1.5 mm lung window were obtained using tube voltage = 130kV, effective mAs = 70, slice thickness = 5 mm, collimation = 16 × 1.2, pitch = 0.8. In children, reconstruction images of the lung window of 1.5 mm were obtained with protocol tube voltage = 110kV, effective mAs = 60, slice thickness = 8 mm, collimation = 16 × 1.2, pitch = 0.8 (14 years and younger). CT-SS and CORADS score were evaluated by 3 independent experienced radiologists.

CT severity score

The result of the CT examination on admission to hospital was used to define the CT severity value. CT severity of the patients was defined for each lung segment, and the sum of the severity value of each lobe was used to arrive at a final severity score. CT severity scores were calculated using the method described by Pan *et al*[9] (Table 1). The mean value of two measurements was recorded as the final value.

CORADS score

The CORADS system was used to determine the probability of disease based on the severity of lung involvement in CT examinations performed during hospitalization. CORADS 0 indicates that the examination is not of sufficient quality to be evaluated. CORADS 1 indicates either a normal thorax scan or the presence of a non-infectious disease. CORADS 2 identifies findings that are unusual for COVID-19 but are common in other infectious diseases such as bronchitis and bronchopneumonia. CORADS 3 describes findings that could be related to COVID 19 as well as other viral pneumonias or non-infectious diseases. CORADS 4 identifies findings that are typical for COVID 19 but may also be relevant for other viral pneumonias. Its difference from CORADS 5 is its atypical involvement. CORADS 5 category implies a very high level of suspicion for pulmonary involvement by COVID-19. Patients who are positive according to the reverse transcription-PCR test result are defined as CORADS 6[10].

Statistical analysis

NCSS (Number Cruncher Statistical System) 2020 (Kaysville, Utah, United States) program was used for statistical analysis. Descriptive statistical methods (mean, standard deviation, median, frequency, percentage, minimum, maximum) were used while evaluating the study data. The suitability of the quantitative data to the normal distribution was tested by the Shapiro-Wilk test and graphical analyses.

Oneway ANOVA test was used for the comparison of normally distributed quantitative variables between groups, and Bonferroni test was used for post hoc evaluations. The Kruskal-Wallis test was used for the comparison of quantitative variables that did not show normal distribution, and the Dunn-Bonferroni test was used for post hoc evaluations.

Pearson Chi-Square test was used to compare qualitative data. Statistical significance was accepted as $P < 0.05$.

RESULTS

The study was conducted in a university hospital from the eastern of Turkey between April 1, 2021 and April 1, 2022, with a total of 224 cases, of which 52.2% (n = 117) were female and 47.8% (n = 107) were male. The ages of the cases ranged from 22 to 97, and the mean age was 61.85±15.36 years.

A statistically significant difference was found between the age distributions of the groups ($P < 0.001$); when the significances are analyzed; the mean age of those who were not vaccinated was found to be significantly lower than the single dose CoronaVac, two doses CoronaVac, two doses BioNTech and three doses vaccine groups ($P = 0.021$; $P = 0.001$; $P = 0.011$; $P = 0.001$; $P < 0.05$, respectively).

Table 1 Computed tomography severity scoring

CT severity score	Extent of lesions for each lung lobe, %
0	0
1	< 5
2	5-25
3	26-50
4	51-75
5	> 75

CT: Computed tomography.

The mean age of those who received a single dose of CoronaVac was higher than those who received a single dose of BioNTech ($P = 0.049$), and significantly lower than the two-dose CoronaVac and three-dose vaccine groups ($P = 0.002$; $P = 0.001$; $P < 0.01$, respectively).

The mean age of those who received a single dose of BioNTech was also found to be significantly lower than the two-dose CoronaVac and three-dose vaccine groups ($P = 0.001$; $P = 0.001$; $P < 0.01$, respectively).

The ages of those who received two doses of CoronaVac were also significantly higher than those who received two doses of BioNTech ($P = 0.001$; $P < 0.01$). The age of those who received two doses of BioNTech was also significantly lower than the group that received three doses of vaccine ($P = 0.001$; $P < 0.01$).

No statistically significant difference was found between the distribution of the groups according to gender ($P > 0.05$) (Table 2).

A statistically significant difference was found between the CT severity scores according to the groups ($P < 0.01$). When it was analyzed from which groups the significance originated, no significant difference was found between the severity scores of those who were not vaccinated and those who received a single dose of CoronaVac and a single dose of BioNTech ($P > 0.05$). The severity score was significantly higher than those who received two doses of CoronaVac, two doses of BioNTech, and three doses of vaccination ($P < 0.05$) (Table 3, Figure 1).

A statistically significant difference was found between the distribution of the groups according to the CORADS classification according to their typicality ($P = 0.001$; $P < 0.01$). When the significances were analyzed, the typical incidence rate in those who were not vaccinated and those who received a single dose of CoronaVac vaccine was significantly higher than in all other groups. Typical rates of those who received a single dose of BioNTech and those who received two doses of CoronaVac vaccine were also found to be higher than those who received two doses of BioNTech and three doses of vaccine (Table 4).

A statistically significant difference was found between the C-reactive protein (CRP) levels of the groups ($P < 0.01$). When it was analyzed from which groups the significance originated, CRP levels of those who received a single dose of BioNTech vaccine were found to be statistically significantly lower than those who received two doses of CoronaVac, two doses of BioNTech, and three doses of vaccine ($P = 0.012$; $P = 0.014$; $P = 0.008$; $P < 0.05$). No significant difference was found between the CRP levels of the other groups ($P > 0.05$) (Table 5, Figure 2).

A statistically significant difference was found between the lactate dehydrogenase (LDH) levels of the groups ($P < 0.01$). When it was analyzed from which groups the significance originated, LDH levels of those who received three doses of vaccine, two doses of CoronaVac vaccine, one dose of BioNTech, and those who were not vaccinated were statistically significantly lower ($P = 0.010$; $P = 0.038$; $P = 0.001$; $P < 0.05$). The LDH levels of those who received two doses of BioNTech were significantly lower than those who were not vaccinated ($P = 0.040$; $P < 0.05$). No significant difference was found between the LDH levels of the other groups ($P > 0.05$) (Table 5, Figure 3).

There was no statistically significant difference between the lymphocyte levels of the groups ($P > 0.05$) (Table 5).

A statistically significant difference was found between the procalcitonin levels of the groups ($P < 0.01$). It was analyzed from which groups the significance originated, the procalcitonin levels of those who received a single dose of BioNTech were found to be statistically significantly lower than those who received a single dose of CoronaVac vaccine, two doses of CoronaVac and two doses of BioNTech ($P = 0.001$; $P = 0.001$; $P = 0.042$; $P = 0.037$; $P <0.05$). No significant difference was found between the Procalcitonin levels of the other groups ($P > 0.05$) (Table 5, Figure 4).

There was no statistically significant difference between D-Dimer levels according to the groups ($P > 0.05$) (Table 5).

DISCUSSION

In our country, COVID-19 vaccination was started with the CoronaVac vaccine, which is an inactive vaccine. The vaccine was first started to be administered to healthcare workers and elderly individuals, and vaccination continued from older individuals to younger individuals gradually. While the pandemic was continuing, the BNT-162b2 (BioNTech) vaccine, which is an mRNA vaccine, has also been started to be used in our country[7,8]. This explains why the average age of those who received two doses of CoronaVac and three doses of vaccine in our study was higher.

Table 2 Evaluations of the groups by age and gender

	n	Age	Gender	
		mean ± SD	Male	Female
[1]Unvaccinated	63	50.95 ± 13.54	27 (42.9)	36 (57.1)
[2]Single dose CoronaVac	20	60.75 ± 8.82	9 (45.0)	11 (55.0)
[3]Single dose BioNTech	24	50.1 ± 11.015	7 (29.2)	17 (70.8)
[4]Two doses CoronaVac	38	73.55 ± 9.34	21 (55.3)	17 (44.4)
[5]Two doses BioNTech	40	59.13 ± 13.88	24 (60)	16 (40)
[6]Three doses	39	74.23 ± 10.29	19 (48.7)	20 (51.3)
Total	224	61.09 ± 15.36	107 (47.8)	117 (52.0)
P value		0.001[a,c]	0.204[b]	
Post hoc		1 < 2, 4, 5, 6; 2 > 3; 2 < 4, 6; 3 < 4, 6; 4 > 5; 5 < 6	-	

[a]Oneway Anova test.
[b]Pearson chi-square test.
[c]$P < 0.01$.

Table 3 Evaluation of computed tomography severity scores of the groups

Group	*n*	CT severity scores				*P* value
		Mean	SD	Median	Min-Max	
[1]Unvaccinated	63	14.17	4.56	15	5-23	0.002[b]
[2]Single dose CoronaVac	20	13.35	4.12	13.5	5-21	
[3]Single dose BioNTech	24	11.58	5.29	11.5	5-20	1 > 4; $P = 0.015$[a]
[4]Two doses CoronaVac	38	10.87	4.42	10.5	5-19	1 > 5; $P = 0.021$[a]
[5]Two doses BioNTech	40	11.28	5.25	12.0	5-21	1 > 6; $P = 0.045$[a]
[6]Three doses	39	10.85	5.01	9	5-22	
Total	224	12.17	4.950	12	5-23	

Kruskal Wallis test & post hoc Dunn test.
[a]$P < 0.05$.
[b]$P < 0.01$. CT: Computed tomography.

Thorax CT has been used since the beginning of the pandemic to diagnose COVID-19 suspected patients, especially those with negative SARS-CoV-2 PCR tests. With the CORADS scoring system, patients are evaluated for COVID-19 with Thorax CT. At the same time, Thorax CT is used for disease severity scoring[11,12]. The pandemic is tried to be controlled with the introduction of COVID-19 vaccines. In the study of Haas *et al*[13], it was shown that 2 doses of BioNTech vaccine reduced the risk of severe disease and death. Hu *et al*[14] also found that 2 doses of inactive vaccine were highly effective against the Delta variant and reduced the risk of severe disease. In the study of Sagiraju *et al*., it was shown that full dose vaccination reduces the risk of severe disease and mortality, regardless of the vaccine type[15]. In the study of Mahajan *et al*[16], where they evaluated vaccinated and unvaccinated patients with a positive SARS-CoV-2 PCR test, they found that the CT-SS of vaccinated people was mild-moderate, while unvaccinated individuals were moderate-severe. Again, in the studies conducted by Russo *et al*[4], Ravindra *et al*[5], Fatima *et al*[6], and Yavuz *et al*[17], when the CT SS of vaccinated and unvaccinated patients were compared, it was shown that vaccinated patients had milder pulmonary involvement. In our study, it was shown that unvaccinated individuals had moderate-severe lung involvement, and patients who received two doses of CoronaVac or two doses of BioNTech or three doses of vaccine had moderate lung involvement. Also, it was shown that incomplete vaccination was not effective in reducing CT SS. This finding supports the literature. At the same time, it is an indication that incomplete vaccination will not have any effect on severe disease.

In our study, unlike other studies, the group that had a reminder dose with mRNA vaccine after 2 inactivated vaccines was also evaluated. Accordingly, the CT SS of the patients who received 3 doses of vaccine was found to be lower than those who received 2 doses of vaccine, although it was not statistically significant. This is an evidence of the necessity of reminder doses.

Table 4 Evaluation of groups according to CORADS classification

Group	*n*	CORADS		*P* value
		Typical	Not typical	
[1]Unvaccinated	63	57 (90.5)	6 (9.5)	0.001[a]
[2]Single dose CoronaVac	20	18 (90)	2 (10.3)	
[3]Single dose BioNTech	24	14 (58.3)	10 (41.7)	
[4]Two doses CoronaVac	38	26 (68.4)	12 (31.6)	
[5]Two doses BioNTech	40	15 (37.5)	25 (62.5)	
[6]Three doses	39	17 (43.6)	22 (56.4)	
Total	224	147 (65.6)	77 (34.4)	

[a]*P* < 0.01. Pearson chi-square test.

Table 5 Distribution of Acute Phase Variables by Groups

		[1]Unvaccinated	[2]Single dose CoronoVac	[3]Single dose BioNTech	[4]Two doses CoronaVac	[5]Two doses BioNTech	[6]Three doses	*P* value[c]	Post Hoc
CRP	mean ± SD	52.95 ± 40.49	49.75 ± 31.26	34.0 ± 32.3	66.58 ± 52.75	84.35 ± 72.99	81 ± 62.88	0.006[a]	3 < 4, 5, 6
	Median (Min-Max)	46 (3-173)	39.5 (12-124)	22 (2-106)	59 (4-204)	66 (2-341)	54 (2-286)		
LDH	mean ± SD	359.17 ± 164.41	315.2 ± 58.2	331.83 ± 116.61	401.5 ± 305.74	294.05 ± 89.57	276.36 ± 94.2	0.001[a]	6 < 5, 3, 1; 5 < 1
	Median (Min-Max)	359 (164-1213)	311 (195-461)	328 (207-692)	368 (156-1943)	290 (152-640)	273 (131-538)		
Lymphocyte count	mean ± SD	1335.4 ± 512.04	1396.5 ± 470.93	1502.92 ± 724.42	1637.11 ± 1896.86	1628.75 ± 86.02	1477.95 ± 867.82	0.660	
	Median (Min-Max)	1290 (390-2790)	1375 (510-2050)	1340 (420-3450)	1200 (340-12360)	1575 (550-5200)	1320 (260-4640)		
Procalcitonin	mean ± SD	0.52 ± 0.94	0.28 ± 0.29	0.13 ± 0.13	0.77 ± 2.39	0.25 ± 0.2	0.27 ± 0.31	0.001[a]	3 < 1, 2, 4, 5
	Median (Min-Max)	0.3 (0.1-6)	0.3 (0.1-1.3)	0.1 (0.1-0.7)	0.2 (0.1-15)	0.1 (0.1-0.7)	0.1 (0.1-1.2)		
D-DIMER	mean ± SD	1041.08 ± 1559.79	955.95 ± 1156.16	1396.71 ± 1608.97	1561.63 ± 2118.83	1462.2 ± 2934.47	1388.41 ± 1922.45	0.106	
	Median (Min-Max)	596 (24-11805)	549.5 (133-4661)	714.5 (140-6193)	942.5 (251-13077)	622 (166-17459)	820 (194-9440)		

[a]*P* < 0.01.
[c]Kruskal Wallis test & post hoc Dunn test.

Since the beginning of the pandemic, Thorax CT has had an important place in the diagnosis of suspected COVID-19 patients, especially those with negative PCR tests. Patients with negative SARS-CoV-2 PCR test were not included in our study, and patients were admitted to the hospital on the 7th day of their symptoms on average. When the CORADS scores of the diagnosed cases were evaluated, it was found that the typical appearance was significantly less as the number of vaccinations increased. This suggests that while the pandemic continues, the role of CT in the diagnosis of COVID-19 may remain in the background.

In a study evaluating the effectiveness of the CoronaVac vaccine and hospitalizing 292 patients diagnosed with COVID-19, no significant difference was found between the acute phase reactants of vaccinated and unvaccinated patients[17]. In another study conducted in Poland, no significant difference was found between acute phase reactants [18]. In our study, different acute phase reactants (CRP and procalcitonin) responses were observed depending on the number and type of vaccination, and it was thought that it could not be interpreted clearly since only the acute phase reactants of the patients at the time of admission to the hospital were examined. Otherwise, LDH level is associated with the prognosis of the disease[19]. In our study, the higher LDH levels of unvaccinated or incompletely vaccinated patients showed that vaccination would reduce the probability of a severe course of the disease but, only the measurements of the

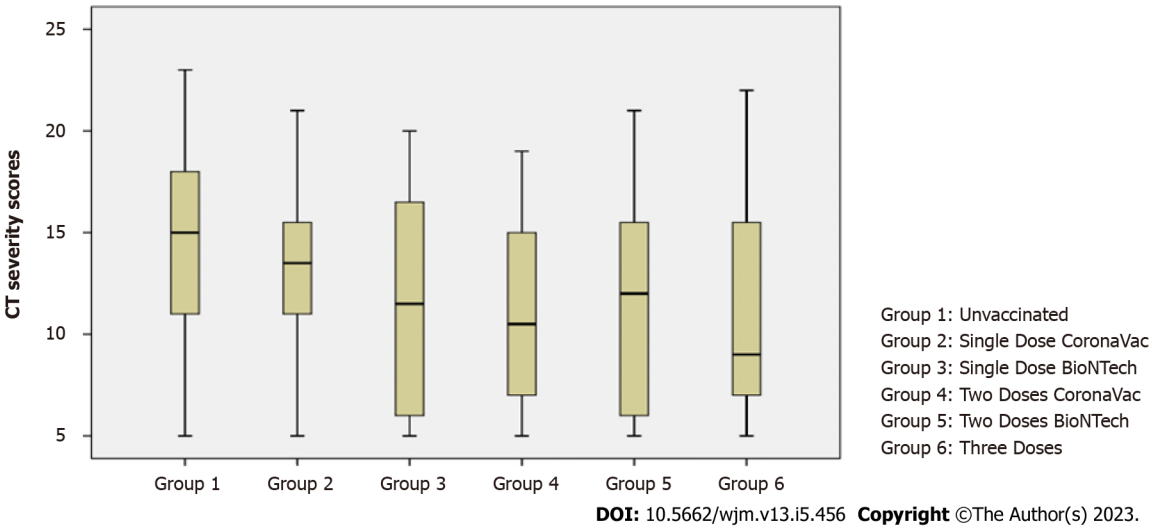

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Figure 1 Distribution of computed tomography severity scores of the groups. CT: Computed tomography.

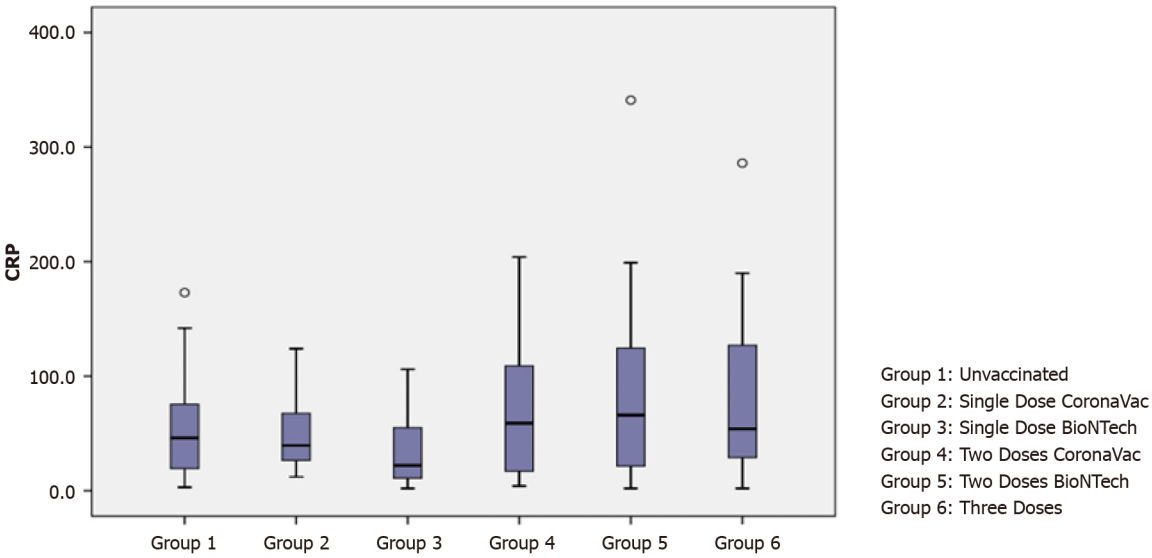

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Figure 2 Distribution of C-reactive protein levels of the groups. CRP: C-reactive protein.

patients at the time of admission to the hospital were evaluated in our study.

Strength of the study

The strength of our study is that, unlike other studies, we evaluated the group that received a booster dose with mRNA vaccine after 2 doses of inactive vaccine.

Limitations of the study

The acute phase reactants in the follow-up of the patients were not evaluated. This is one of the limitations of the study. Again, not evaluating the comorbid diseases and mortality rates of the patients are other limitations of our study.

CONCLUSION

In conclusion, our study showed that being vaccinated, regardless of the type of vaccine, leads to a decrease in CT severity scores. Again, our study suggests that with the effect of vaccination, we may no longer see the CT images that we are accustomed to seeing in COVID-19 patients, and CT may remain in the background in diagnosis.

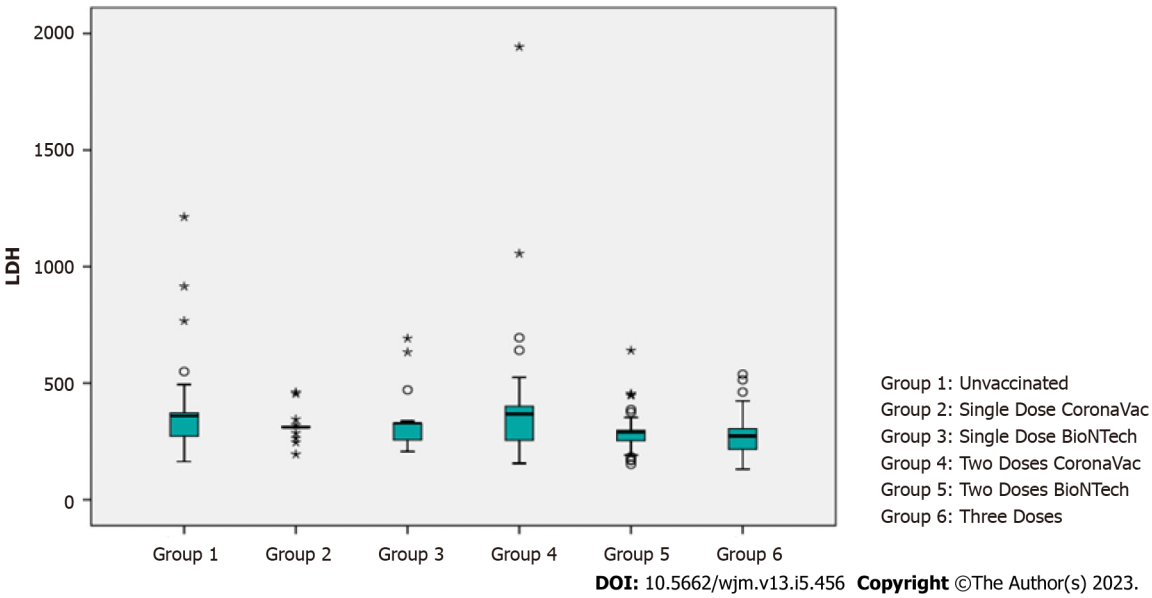

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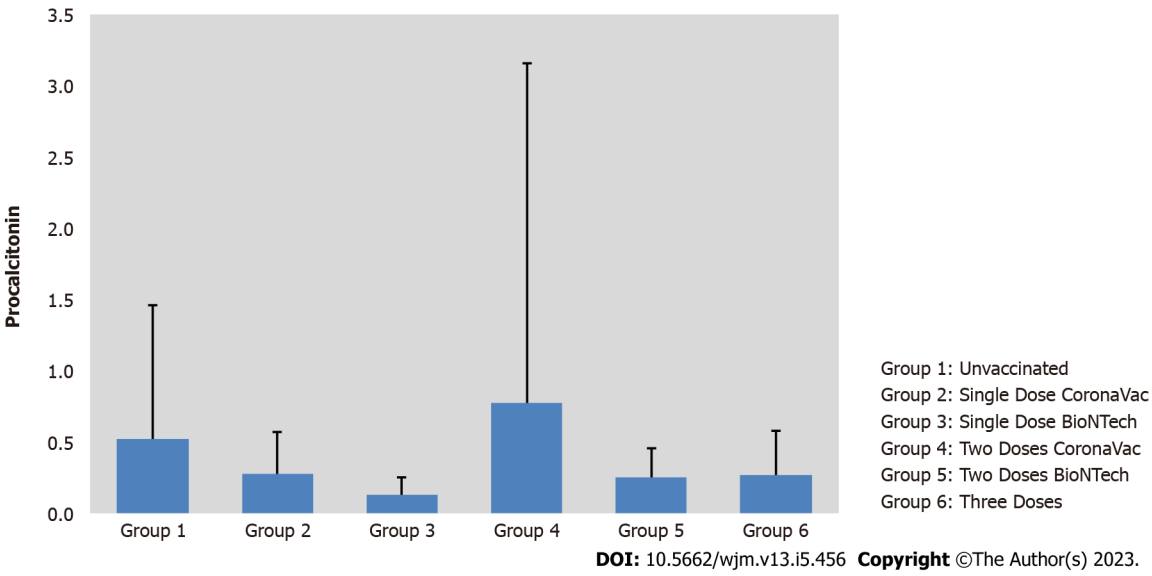
Figure 3 Distribution of lactate dehydrogenase levels of the groups. LDH: Lactate dehydrogenase.



DOI: 10.5662/wjm.v13.i5.456

Figure 4 Distribution of procalcitonin levels of the groups.

ARTICLE HIGHLIGHTS

Research background

The coronavirus disease 2019 (COVID-19) pandemic is still continuing. Vaccination has an important place in preventing the disease and vaccination reduces the possibility of a severe course of the disease.

Research motivation

It is important to investigate whether vaccination has any effect on the computed tomography (CT) severity score (CT-SS) and CORADS score of COVID-19 patients.

Research objectives

We aim to investigate whether the vaccination status of inpatient treatment for COVID-19 has any effect on the CT-SS and CORADS score taken during hospitalization.

Research methods

This single-center retrospective study was conducted between April 1, 2021 and April 1, 2022 with a total of 224 patients older than 18 years of age, whose vaccination status was accessible, who had positive severe acute respiratory syndrome

coronavirus 2 polymerase chain reaction results, and who had a thorax CT taken during hospitalization.

Research results

Among the patients included in the study, 52.2% were female and the mean age was 61.85 years. The patients applied to the hospital on the average 7th day of their complaints. While 63 patients were unvaccinated (Group 1), 20 were vaccinated with a single dose of CoronaVac (Group 2), 24 with a single dose of BioNTech (Group 3), 38 with 2 doses of CoronaVac (Group 4), 40 with 2 doses of BioNTech (Group 5), and 39 with 3 doses of vaccine (2 doses of CoronaVac followed by a single dose of BioNTech, Group 6). CT-SS ranged from 5 to 23, with a mean of 12.17. CT-SS mean of the groups were determined as 14.17, 13.35, 11.58, 10.87, 11.28, 10.85, respectively. Accordingly, as a result of the comparisons between the groups, the CT-SS levels of the unvaccinated patients found to be significantly higher than the other groups. As the vaccination rates increased, the rate of typical COVID-19 findings on CT was found to be significantly lower.

Research conclusions

The increase in vaccination rates in COVID-19 patients reduces the CT Severity Score and the CORADS score.

Research perspectives

It is important that COVID-19 vaccinations continue. With the effect of vaccination, the possibility of severe course of the disease will decrease. There will be a need for studies in which more patient data are analyzed and data obtained from patients with different vaccines are evaluated.

FOOTNOTES

Author contributions: Binay UD designed and performed the research and wrote the manuscript; Karavas E designed the research and supervised the report; Karakeçili F designed the research and contributed to the analysis; Barkay O, Aydin S, Senbil DC provided clinical advice; Barkay O, Aydin S, Senbil DC supervised the report. All authors have read and approved the final manuscript.

Institutional review board statement: This study was reviewed and approved by the Erzincan Binali Yildirim University Ethics Committee (Approval No: 04/16).

Informed consent statement: Since it is a retrospective study, patient consent was not obtained.

Conflict-of-interest statement: All the authors declare that they have no conflict of interest.

Data sharing statement: Data will be shared upon request.

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