ORIGINAL ARTICLE

Özgün Araştırma

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Geliş Tarihi : 27 May 2022
Received
Kabul Tarihi : 02 August 2022
Accepted
E Yayın Tarihi : 01 January 2024
Online published

Bu makalede yapılacak atıf
Cite this article as

Sanliturk D, Dortkardes N, Avsar FN. Evaluation of the Effect of Prone Position in Intubated and Non-intubated COVID-19 Patients
Akd Med J 2024;10(1): 70-77

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DOI: 10.53394/akd.1122190

Evaluation of the Effect of Prone Position in Intubated and Non-intubated COVID-19 Patients

Entübe ve Entübe Olmayan COVID-19 Hastalarında Prone Pozisyon Etkisinin Değerlendirilmesi

ABSTRACT

Objective:

This study was conducted to evaluate the effect of prone position (PP) applied to intubated, and non-intubated patients followed up with COVID-19 in the intensive care unit (ICU).

Material and Methods:

One hundred eight COVID-19 patients followed in a single ICU were included in the study. PP was applied to the patients 12 hours a day. The effect of PP on outcome parameters such as PaO2:FiO2 ratio, development of complications, length of hospital stay and mortality was evaluated.

Results:

Baseline PaO2:FiO2 ratio significantly increased after PP was applied to the intubated group on the 1st day, and the increase continued after the supine position ($p<0.01$). In the non-intubated group, the baseline PaO2:FiO2 ratio increased significantly on the 1st day, but the increase did not continue after the supine position ($p>0.05$). After the positioning on the 3rd day, when the intubated group was placed in the supine position after PP, there was an increase in the PaO2:-FiO2 ratio, and this increase was statistically significant ($p<0.001$); however, the increase in the non-intubated group was not statistically significant ($p>0.05$). There was a statistically significant difference between the two groups in terms of mortality ($p<0.001$); however, hospital stay was not statistically significant ($p>0.05$).

Conclusions:

PP improved oxygenation in the intubated group but was ineffective in reducing the length of hospital stay, complication, and mortality rates. Besides, in the non-intubated group, it is an effective method that improves oxygenation, delays intubation, and reduces complication development and mortality rates.

Key Words:

SARS-CoV-2, COVID-19, Prone position, Nursing, Intubation, Patient

ÖZ

Amaç:

Bu çalışma yoğun bakım ünitesinde (YBÜ) COVID-19 ile takip edilen entübe ve entübe olmayan hastalara uygulanan prone pozisyonunun (PP) etkisini değerlendirmek amacıyla gerçekleştirilmiştir.

Gereç ve Yöntemler:

Tek bir YBÜ'de takip edilen 108 COVID-19 hastası çalışmaya dahil edilmiştir. Hastalara PP uygulanmış ve PP'nin oksijenizasyon, komplikasyon gelişimi, hastanede yatış süresi ve mortalite gibi sonuç parametrelerine etkisi değerlendirilmiştir.

Bulgular:

Entübe gruba birinci gün uygulanan PP sonrası PaO2:FiO2 oranı başlangıç değerlerinden önemli ölçüde artmış ve artış supin sonrası da devam etmiştir ($p<0.01$). Etübe olmayan grupta ise birinci gün PaO2:FiO2 oranı başlangıç değerlerinden önemli ölçüde artmış ancak artış supin sonrası devam etmemiştir ($p>.05$). Uygulamanın üçüncü gününde pozisyonlama sonrası entübe grubun PP sonrası supin pozisyona alındığında PaO2:-FiO2 oranında artış olduğu ve bu artışın istatistiksel olarak anlamlı olduğu ($p<.001$); ancak entübe olmayan gruptaki artışın istatistiksel olarak anlamlı olmadığı belirlenmiştir ($p>.05$).

Sonuç:

PP'nin entübe grupta oksijenizasyonu düzelttiği ancak hastanede kalış süresi, komplikasyon ve mortalite oranlarını azaltmada etkili olmadığı; entübe olmayan grupta ise oksijenizasyonu düzelten, entübasyonu geciktiren, komplikasyon oluşumu ve mortalite oranlarını azaltan etkili bir yöntemdir.

Anahtar Kelimeler:

SARS-CoV-2, COVID-19, Yüzüstü pozisyon, Hemşirelik, Entübasyon, Hasta

INTRODUCTION

In late December 2019, a new coronavirus (SARS-CoV-2) that causes coronavirus disease 2019 (COVID-19) emerged in Wuhan, China (1,2). The virus triggers the inflammatory and oxidative process, causing the development of pneumonia, acute respiratory distress syndrome (ARDS), and lung failure (3). It is reported that the incidence of acute hypoxemic respiratory failure and ARDS in patients followed up with COVID-19 pneumonia varies between 17-29%, and the intensive care requirement of these patients is around 23-32% (4). Viral interstitial pneumonia and hypoxemic respiratory failure pose significant challenges in the care of these patients (5). Moreover, mortality rates in cases with ARDS range from 25% to 62% (6-10). The mortality rate in patients with ARDS (CARDS) developing due to COVID-19 climbs up to 74% (8).

In COVID-19, ventilation-perfusion imbalance develops due to pulmonary vasoregulation impaired by endothelial damage (inflammation) (11). Lung protective ventilation strategies are needed to provide oxygenation of the perfused regions of the lung and reduce ventilatory-induced lung injuries (VILI) (5,12). In the supine position, dependent areas of the lungs lack adequate ventilation associated with the weight of the ventral lungs, heart, and abdominal viscera (5). In the prone positioning (PP), the pressure of the heart and abdomen on the lungs is reduced, providing homogeneous distribution of oxygen throughout the alveoli, improving ventilation/perfusion (V/Q) ratios, and hypoxia (13,14). It was reported that PP delays intubation by increasing oxygenation in non-intubated patients while increasing oxygenation in intubated patients, reducing hospital stay, mortality rates and improving ventilation (13,15-17).

The literature review suggests that separate studies show that PP is effective in improving oxygenation and clinical outcomes in intubated and non-intubated patients with COVID-19, but studies comparing the two groups were not found. We designed this study to evaluate whether the prone position is more beneficial in correcting oxygen in non-intubated patients compared to intubated patients, how effective it is in preventing intubation in non-intubated patients, and whether there is a difference between the two groups in terms of length of hospital stay, death rates, and the development of complications.

This study was conducted to evaluate whether the effect of PP applied to intubated and non-intubated patients followed up with COVID-19 in an ICU differs between the two groups.

MATERIAL and METHODS

Study design and participants

The research was carried out with a pretest-posttest experimental design without a control group. The research was carried out by Sanlıurfa Mehmet Akif Inan Health Application and Research Center of the Health Sciences University between July and September 2021.

The research population consisted of 142 patients diagnosed with COVID-19 who were treated in the COVID-19 ICU of the hospital. The sample size was calculated based on data from previous studies (12,18). After the power analysis, it was determined that at least 41 patients should be included in the study with a margin of error of .05 and a confidence interval of 95%. It was decided to include 120 patients in the study, considering that there may be data loss during the study and to increase the power of the study. 8 patients were excluded from the study because PP was contraindicated (pregnancy and obesity), 16 patients could not tolerate PP (worsening in oxygenation and pain), and 10 patients could not communicate fully (who did not speak Turkish). The study was completed with 108 patients.

Those 18 years of age and older who were admitted to ICUs due to SARS-CoV-2 infection, who spoke Turkish, were included in the study. Those who cannot tolerate PP and those who do not speak Turkish, who have conditions such as extreme obesity, pregnancy, unstable spine, seizures, high intracranial pressure, and maxillofacial surgery, which are contraindicated for PP, were excluded from the study (5).

Intervention

Intubated patients receiving ICU treatment are divided into two groups: the intubation group and the non-intubated patients as the non-intubated group. PP was applied to both groups. Prone positioning was applied when the patients' arterial oxygen

pressure: fractional inspired oxygen (PaO2:FiO2) ratio was <150 mmHg (3,16,17). PP treatment was planned as a total of 12-16 hours of application, alternating the prone position for 4 hours and the supine position for 4 hours (5,19). PP was administered with other treatments and did not affect other treatments in any way. Conscious patients were told what PP is, and the positioning was applied until they felt comfortable. Those who could not tolerate PP initially were placed in the supine position for approximately 2 hours, and then the procedure was repeated. Patients who could not tolerate PP in any way were excluded from the study. Since the duration of the prone position is vital in improving oxygenation, it was emphasized that patients should tolerate this position as much as possible.

Measures

PaO2:FiO2 and arterial oxygen saturation (SpO2) values were determined before the patients were placed in the prone position, on the 1st day of prone positioning, 1 hour after the prone position, and one hour after they were placed back in the supine position, and one hour after the prone and supine positions on the 3rd day. Follow-up of the patients continued until they were discharged from the hospital. Follow-up included which patients died, length of stay in the ICU, extubated status of intubated patients, intubated status of non-intubated patients, oxygenation levels, fever, heart rate, total PP time, and development of complications (hospital infection, pressure ulcer). Besides, demographics of the patients such as age, gender, and comorbidities were also collected.

Ethical Approval of Research

Ethics approval was obtained from Non-interventional Clinical Research Ethics Committee of Tokat Gaziosmanpasa University (01.07.2021/12). Institutional permission were obtained Sanlıurfa Mehmet Akif Inan Health Application and Research Center of the Health Sciences University. Research was conducted in line with the Declaration of Helsinki and Good Clinical Practice. Informed consent was also obtained from the patients or their relatives after official approval. Permission was obtained for the measurement tools used in the study.

Data analysis

IBM SPSS Statistics 25.0 software (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp., USA) was used to assess the data. Numbers and percentages were used to present introductory information about patients. Distribution of data was analyzed with the Shapiro–Wilk normality test and graphical examinations. It was determined that the data was normally distributed. Paired sample t-test and ANOVA (single factor) in repeated measurements were used for comparisons between groups. The Tamhane's T2 test as a post hoc analysis method was employed to identify which group had a statistically significant difference from other groups. The sample size and effect size in the study were calculated with the Gpower v3.1.9.2 statistical analysis software. 0.05 was used as the significance level.

RESULTS

PP, which had perfect results in improving oxygenation in COVID-19 patients, was applied to a total of 108 patients, 92 of whom were intubated and 16 of which were non-intubated. The mean age of these patients was 64.72±16.80; 55.6% of them were male. There was no statistically significant difference between the two groups in terms of parameters other than respiratory support type and laboratory values (p>0.05). The characteristics of the patients are shown in Table I.

Table I: Demographic and clinical characteristics of the patients.

Characteristics	All patients (n=108)	Intubated (n=92)	Non-intubated (n=16)	p value*
	Mean±SD	Mean±SD	Mean±SD	
Age, y	64.72±16.80	66.26±16.81	55.87±14.70	.107
Gender, Male, n (%)	60 (55.6)	52 (56.5)	8 (50.0)	.738
Having a chronic disease, n (%)				
Diabetes	40 (37.0)	34 (37.0)	6 (37.5)	
Hypertension	22 (20.4)	20 (21.7)	2 (12.5)	
Renal failure	6 (5.6)	6 (6.5)	0	632
COPD-Asthma	14 (13.0)	10 (10.9)	4 (25.0)	
Heart failure	12 (11.1)	10 (10.9)	2 (12.5)	
No chronic disease	14 (13.0)	12 (13.0)	2 (12.5)	
Type of respiratory support				
Invasive mechanical ventilation	72 (66.7)	72 (78.3)	0	
Non-invasive mechanical ventilation	24 (22.2)	16 (17.4)	8 (50.0)	*p*<.001
High flow nasal cannula	12 (11.1)	4 (4.3)	8 (50.0)	
Vital signs				
Temperature, ◦C	37.32±0.77	37.36±0.80	37.11±0.58	409
Heart rate, m	111.64±21.94	123.54±21.04	100.75±25.31	129
Respiratory rate, m	39.44±6.84	39.73±6.64	37.75±8.17	453
Laboratory parameters				
D-dimer, ng/mL	3.92±3.45	4.92±4.49	0.86±0.53	<.001
Albumin	27.95±6.21	26.89±5.98	34.06±3.49	002
Arterial blood gases				
PaCO2 (mm Hg)	42.91±21.56	43.04±22.98	42.20±11.15	920
PaCO2 (mm Hg)	46.18±17.86	45.86±20.14	44.01±8.41	713
HCO3	21.96±6.53	21.62±6.62	23.91±6.00	366
pH	7.32±0.13	7.31±0.14	7.36±0.04	348
Base Excess	7.03±5.92	7.55±6.24	4.08±1.71	128
Vaccination status				
Single dose	36 (33.3)	26 (28.3)	10 (62.5)	.060
Double dose	0 (0.0)	0 (0.0)	0 (0.0)	
Unvaccinated	72 (66.7)	66 (71.7)	6 (37.5)	

Parameters are shown at baseline (the first day on ICU), *COPD* chronic obstructive pulmonary disease, *PaCO2*:partial pressure of carbon dioxide, *: Intubated and non-intubated groups were compared.

PP on the 1st day significantly increased the PaO2:FiO2 ratio from baseline in all patients (intubated and non-intubated), and the increase continued after supine (baseline 216.85±70.08 mm Hg, 1 h after PP 234.07±71.86 mm Hg, and 1 h after SP 241.11±77.79 mmHg p<0.01). PaO2:FiO2 increased in the same way in intubated patients, and this increase was statistically significant (p<0.01). In non-intubated patients, the PaO2:-FiO2 ratio increased significantly after PP compared to baseline, which was found to be statistically significant (baseline 225.00±47.80 mmHg, 1 h after PP 255.00±57.07, p=0.031). Post-hoc analysis to determine the source of difference revealed that the difference was between the pre-PP and 1 h after PP. After the non-intubated patients were placed in the supine position, the PaO2:FiO2 ratio decreased, and it was determined

that the change in the PaO2:FiO2 ratio of the patients was not statistically significant (p=0.081). It was indicated that the PaO2:FiO2 ratio increased when the patients who were intubated after positioning on the 3rd day were put back into the supine position after PP, and this increase was statistically significant (p<0.001). The PaO2:FiO2 ratio continued to increase after supine in non-intubated patients, which was not statistically significant (p>0.05). PP on the 1st day significantly increased SpO2 from baseline values in all patients, and the increase decreased after supine (baseline 77.42±6.89 mm Hg, 1 h after PP 85.55±5.24 mm Hg, and 1 h after SP 84.38±5.64 mmHg, p<0.01). Post-hoc analysis to determine the source of difference revealed that the difference was between the pre-PP and 1 h after PP. After positioning on the 3rd day, when all patients were re-positioned in the supine position after PP, it was determined that there was a slight decrease in SpO2 values, which was not statistically significant (p>0.05) (Table II, Figure 1,2).

Table II: Change in PaO2/FiO2 and SpO2 ratios on the 1st and 3rd days after the prone positioning

Prone characteristics	All patients (n=108)	Intubated (n=92)	Non-intubated (n=16)	p-value[c]
1st day PaO_2:FiO_2	Mean±SD	Mean±SD	Mean±SD	
Before prone	216.85±70.08	215.43±73.59	225.00±47.80	.641
1 h after prone	234.07±71.86	230.431±74.05	255.00±57.07	.377
1 h after supine	241.11±77.79	240.21±82.98	246.25±38.89	.842
p value[a]	F= 19. 592, p<.001	F= 12.566, p<.001	F=3.920, p=.081	
PostHoc	Pre/post1h, (p<.001)	Pre/post1h, (p<.001)		
3rd day PaO_2:FiO_2				
1 h after prone	249.81±78.31	246.95±82.88	266.25±43.73	525
1 h after supine	265.37±78.63	263.47±83.85	277.50±40.97	647
p value[b]	t=-5.313, p<.001	t=-5.109, p<.001	t=-1.515, p=.174	
1st day SpO2				
before prone	77.42±6.89	76.67±7.03	81.74±4.20	054
1 h after prone	85.55±5.24	85.00±5.32	88.75±3.53	061
1 h after supine	84.38±5.64	83.71±5.65	88.25±3.91	035
p-value	F=109.960, p<.001	F=96.959, p<.001	F=39.940, p<.001	
PostHoc	Pre/post1h, (p<.001)	Pre/post1h, (p<.001)	Pre/post1h, (p<.001)	
3rd day SpO2				
1 h after prone	88.03±5.49	87.50±5.56	91.12±4.05	085
1 h after supine	87.83±5.74	87.36±5.70	90.50±5.55	157
p value	t=.312, p=.757	t=0.193, p=.847	t=0.280, p=788	

[a]: ANOVA (single factor) in repeated measurements, [b]: Paired samples t-test, [c]: Intubated and non-intubated groups were compared.

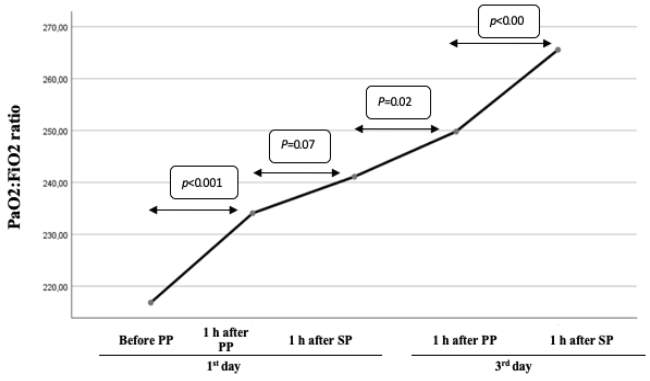

Figure 1. Graphic of patients' PaO2:FiO2 ratios over time on the 1st day and 3rd day: 1st day before prone positioning (PP), 1 h after PP, 1 h after supine positioning (SP), and 3rd day 1 h after PP and 1 h after SP. ANOVA (single factor) analysis was used in repeated measures to compare each time point. It was determined that the PaO2:FiO2 ratio increased with time, and the change in the PaO2:FiO2 ratio was statistically significant (p<0.001, p=0.028, p<0.001) at all times, except for the change in the 1 h after supine after PP on the 1st day (p=0.074).

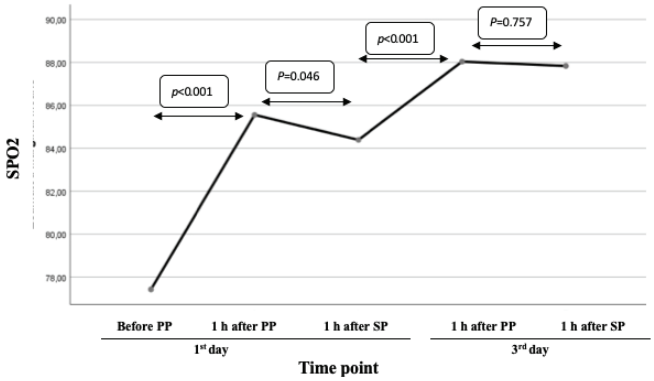

Figure 2. Graphic of patients' SpO2 values according to the 1st day and 3rd day: 1st day before prone positioning (PP), 1 h after PP, 1 h after supine positioning (SP), and 3rd day 1 h after PP and 1 h after SP. ANOVA (single factor) analysis was used in repeated measures to compare each time point. It was concluded that there was a significant increase in SpO2 values over time compared to the baseline after PP, a decrease in SpO2 values in supine after PP, and the changes in all times were statistically significant except for the change between PP and supine on the 3rd day (p=0.757) (p<0.001, p=0.046, p<0.001).

When the two groups were compared, it was found out that there was no statistically significant difference in terms of daily and total PP time, ICU, and hospital stay (p>0.05). It was determined that there was a statistically significant difference in terms of the development of complication (p<0.05). In the non-intubated group, 25% of the patients developed facial and edema in extremity, while 12.5% had corneal/conjunctival damage. In the intubated group, 31.5% of the patients developed edema in the face and extremities, and there was a statistically significant difference between the two groups in terms of the type of complication (p<0.05).

There was a statistically significant difference between the two groups in terms of discharge, mortality, and intubation rates (p<0.001). In the non-intubated group, it was indicated that 87.5% of the patients were discharged, 12.5% of them were intubated, and none of the patients died. 16.7% of the patients in the intubated group were initially extubated, and then they were included in the intubated patient group. It was found out that 80.4% of the patients died, 17.4% were intubated while initially extubated, and 2.2% were extubated while intubated (Table III).

Table III: Outcomes of the variables

Outcomes	All patients (n=108)	Intubated (n=92)	Non-intubated (n=16)	p value[a,b]
	Mean±SD	Mean±SD	Mean±SD	
PP time per day, h	9.57±1.86	9.52±1.89	9.87±1.80	626
Total time of PP, h	33.25±8.05	33.26±7.98	33.25±9.00	997
Complications, yes, n (%)	82 (75.9)	76 (82.6)	6 (37.5)	005
Corneal/conjunctival damage	18 (16.7)	18 (19.6)	2 (12.5)	
Facial/periorbital damage	8 (7.4)	8 (8.7)	0	
Edema of face and extremities	34 (31.5)	30 (32.6))	4 (25.0)	
Unplanned extubation	2 (1.9)	2 (2.2)	0	.010
Displacement of tube or catheter	4 (3.7)	4 (4.3)	0	
Hospital infection	12 (11.1)	12 (13.0)	0	
No complication	30 (27.8)	18 (19.6)	8 (75.0)	
Outcomes, n (%)				
Number of cured and discharged patients	14 (13.0)	0	14 (87.5)	
Being intubated while extubated	18 (16.7)	16 (17.4)	2 (12.5)	p<.001
Being extubated while intubated	2 (1.9)	2 (2.2)		
Mortality	74 (68.5)	74 (80.4)	0	
The total length of ICU, d	10.14±6.39	10.52±6,69	8.00±3.89	307
The total length of hospitalization, d	11.31±6.19	11.17±6.33	12.12±5.66	693

[a]: Intubated and non-intubated groups were compared. [b]: ANOVA (single factor) in repeated measurements.

DISCUSSION

This study, which evaluated the effectiveness of PP on the oxygenation of intubated and non-intubated patients with COVID-19 treated in the ICU, was completed with 54 (46 intubated and 8 non-intubated) patients. As a result of the study, it was concluded that PP was effective on oxygenation in both groups.

PP has long been known to improve oxygenation in mechanically ventilated patients with moderate to severe ARDS (20). Previous studies reported that PP was used in 76% of mechanical ventilation-dependent patients with COVID-19 and that PP was effective on oxygenation (17,21,22). In our study, the baseline PaO2:FiO2 ratio increased significantly in intubated patients, and the increase continued after supine. Similar to our findings, Parker et al. (2021) evaluated the effect of PP in intubated patients and reported that PP provided improvement in oxygenation (23). Mittermaier et al. (2020) also reported that PP improved oxygenation compared to the supine position in intubated patients with COVID-19 (17). Our study and other studies suggest that PP improves oxygenation.

Compared to the supine position, it is evident that PP has significant effects on oxygenation. Besides, the continuation of the improvement in oxygenation is another good progress. Our study determined that the improvement in the PaO2/FiO2 ratio continued even after the patients returned to the supine position. Similar to our study findings, it was reported that the improvement in oxygenation continued in some other studies (18,24).

PP is considered a low-cost, life-saving adjunctive intervention that does not require special equipment and can be applied with short training, increasing lung ventilation (12). Our study inferred that there was increasing in SpO2 values compared to before PP. However, the change on the 3rd day is not significant. Similar to the 1st-day findings of our study, Retucci et al. reported an improvement in SpO2 after PP in non-intubated patients (25). In the study of Winearls et al. with non-intubated patients with COVID-19, it was reported that pre-PP SpO2 increased after PP administration (18). It is thought that the possible reason for similar results is that PP increases oxygenation by increasing lung capacity.

The prone positioning provides homogeneous distribution of the air taken into the lungs by inspiration, balances ventilation and tissue perfusion, relieves pressure and tension on the lungs, and improves oxygenation (3). It is applied to patients with COVID-19 as it provides an improvement in hypoxia in non-intubated patients (Elharrar et al., 2020). In our study, the PaO2:FiO2 ratio on the 1st day increased from the baseline in non-intubated patients.On the 3rd day, there was no significant effect on the PaO2:FiO2 ratio in non-intubated patients. Similar to our study findings, studies with non-intubated patients reported that PP improves oxygenation parameters (24, 26-28).

Prone positioning is a life-saving intervention that improves oxygenation in mechanically ventilated patients with moderate-to-severe ARDS (29). However, pressure ulcers due to reasons such as patients with COVID-19 staying in the prone position for a long time, wrinkles on the bedspread, pressure applied to the skin of the devices attached to the patient's body, dislocation of the tubes, edema in the face and extremities, hypotension, bronchoraspiration, and unexpected complications such as extubation may develop (30). It is of paramount importance for ICU nurses to closely monitor patients for these complications during and throughout positioning (3, 30-32). In our study, edema in the face and extremities, hospital infection, corneal damage, and pressure ulcer developed most frequently in intubated patients. Other studies reported that frequent but minor complications developed after PP was applied to mechanically ventilated patients, and pressure ulcers and compressive neuropathies were known complications (12, 23). In our study, it was identified that non-intubated patients had facial and extremity edema and corneal damage. In the study of Winearls et al. with non-intubated patients with COVID-19, no complications were reported except for two patients who could not tolerate PP (18). According to our study findings, the possible reason for the fewer complications in the non-intubated group may be that the conscious patients can adjust their position in the prone position, contributing to the reduction in the development of complications. Our findings also suggest that ICU nurses should make sure that the patient's bed sheets are not wrinkled and that the tubes are in place, support the pressure areas, frequently check the areas of the body in contact with each other for redness, and the application of corneal protective interventions are effective measures in reducing the complications that may develop (30). There are studies on prone position and complication development in intubated patients. However, studies on prone position and complication development in the non-intubated group are limited.

Our study concluded that the improvement in oxygenation was significant and was similar to the findings of other studies. However, it was clearly seen that mortality was independent of oxygenation. The mortem of the majority (80%) of the patients in the intubated group is an indication of this. Unlike our study findings, Ferrando et al.'s study with mechanically ventilated patients found that the all-cause mortality rate was 32% (22). Douglas et al. also reported the mortality rate as 31% (12). It is estimated that the possible reason for the high mortality rate was the low rate of vaccination (71.7% of patients were unvaccinated). With respect to this, the province where the study was conducted is the city with the lowest vaccination rate in Turkey as of the study period (33).

Recently, the use of PP in awake, non-intubated patients with COVID-19 has been suggested to prevent intubation, reduce hospital stay, and potentially improve patient-focused outcomes (34,35). It is emphasized that PP is especially effective in improving oxygenation and reducing progression to intubation (24,26,28,34). In our study, it was determined that only two (12.5%) of the sixteen patients from the non-intubated group was intubated during the follow-up, the majority of them were discharged (87.5%), and the length of hospital stay was 8.00±3.89 in the ICU, a total of 12.12±5.66 days. In the study conducted by Winearls et al. with 24 non-intubated patients with COVID-19, it was reported that 4 patients died, 18 were discharged, and 2 were intubated (18). Differently, in a systematic review by Pavlov et al. in which they compared PP applied

to non-intubated patients with COVID-19 with patients receiving standard care, it was reported that PP was effective in increasing oxygenation but did not decrease the intubation rate (27%) (27). According to the study findings, it can be argued that PP reduces the intubation rate. It is considered that including PP in routine treatment protocols could effectively improve clinical outcomes and reduce costs, especially in non-intubated patients.

Limitations

The limitation of this study is that the study was conducted within a certain date range in terms of time / it was a cross-sectional and nonrandomized study without a control group. Furthermore, the fact that data were collected from a single health center was accepted as a limitation in generalizing the results.

CONCLUSION

The results showed that PP had a positive effect on oxygenation in the intubated group but was not effective in reducing the length of hospital stay, complication, and mortality rates. In the non-intubated group, it was found to be effective in improving oxygenation, delaying intubation, developing complications, and reducing mortality rates.

In this study, complications such as unplanned extubation in 2 patient and displacement of the tube and catheter in 4 patients were experienced. In order to increase patient safety, it is recommended that each department using this method should receive training on the method and that the application steps of the method should be distributed to the units in written form. Particularly, ICU nurses receiving special training on this method are considered a precaution to prevent sudden complications.

In managing COVID-19 in the ICU, the administration of PP and routine practice appears to have an additive effect in improving oxygenation. Consequently, at this time, when the global COVID-19 epidemic is becoming more and more deadly with new variants coming out constantly, the implementation of PP is considered an intervention that will help achieve success in the fight against the high mortality rate of COVID-19. This intervention is a cost-effective and effective method to improve oxygenation in intubated patients, improve oxygenation and reduce the incidence of intubation and mortality in non-intubated patients.

This study is a potential source of information from which nurses caring for patients with COVID-19 in the ICU can benefit. The study findings could be used during PP administration to both intubated and non-intubated COVID-19 patients. The study is valuable in terms of comparing both intubated and non-intubated patient groups. In the study, the effect of PP on oxygenation provided strong evidence as the PaO2:FiO2 ratio as well as SpO2 values were examined. Additionally, holistic patient evaluation needs to consider parameters such as complications during PP application, length of hospital stay, transition to intubation, and mortality.

It is recommended that PP delays intubation in non-intubated patients, and that complications experienced during its application are preventable, and that the method should be applied together with preventive interventions for these complications in future studies.

Ethics Committee Approval:

This research complies with all the relevant national regulations, institutional policies and is in accordance with the tenets of the Helsinki Declaration, and has been approved by the Non-interventional Clinical Research Ethics Committee of Tokat Gaziosmanpasa University (approval number: 01.07.2021/12).

Informed Consent:

All the participants' rights were protected and written informed consents were obtained before the procedures according to the Helsinki Declaration.

Author Contributions:

Concept – D.Ş., N.D.; Design - D.Ş., N.D.; Supervision - D.Ş., N.D., F.N.A.; Resources - D.Ş., N.D.; Materials - D.Ş., N.D.; Data Collection and/or Processing - D.Ş., N.D., F.N.A.; Analysis and/ or Interpretation - D.Ş.; Literature Search – D.Ş.; Writing Manuscript – D:Ş.; Critical Review - D.Ş., N.D., F.N.A.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure:

The authors declared that this study has received no financial support.

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