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Comparison of the Prone Position-related Characteristics of Intubated COVID-19 Patients with and without Facial Pressure Injuries

Ayda Kebapçı, Berrin Bulut Çepni

Department of Nursing, Koç University School of Nursing, Istanbul, Türkiye

Abstract

Background: In Coronavirus 2019 (COVID-19) patients, the risk of a facial pressure injury increases due to the prolonged prone position.

Aim: To compare the prone position-related characteristics of intubated COVID-19 patients with and without facial pressure injuries.

Methods: This cross-sectional, retrospective, and case–control study included 49 COVID-19 patients who were intubated and in the prone position in the adult intensive care unit of Koç University Hospital between March 01, 2020, and March 15, 2021. Retrospective data of the patients were obtained using the Patient Information Form. While evaluating the demographic and clinical data, descriptive statistical methods (frequency, percentage, mean, and standard deviation) were used. Furthermore, for the comparison of the prone position-related features (day of onset, frequency, and total duration) between patients with and without facial pressure injuries, the Mann–Whitney U test was used.

Results: It was determined that 52.1% of the intubated patients required a prone position, and 73.4% developed facial pressure injuries after prone positioning. Pressure injury developed on the 7th day of the prone position and on the chin (29%), left cheek (20.5%), nose (17.9%), and right cheek (16.7%), respectively. The prone duration was statistically significantly higher in patients with facial pressure injuries than those without ($P < .01$).

Conclusions: Pressure injuries occur with a high incidence in intubated COVID-19 patients in the prone position. Importance should be given to maintaining the treatment and care approaches with the multidisciplinary team for patients who still require prolonged prone positioning despite the development of pressure injuries in the facial area. Focusing primarily on preventing pressure injuries in the face area with frequent skin preparations and more frequent head position changes in the early period may contribute to prevention. In addition, there is a need for different and more preventive-oriented measures and specific protocols specific to COVID-19 patients in prolonged prone positions.

Keywords: COVID-19, facial, intensive care, pressure injury, prone position

Introduction

In the global coronavirus 2019 (COVID-19) pandemic, treatment and care strategies for managing hypoxemic respiratory failure in the intensive care unit (ICU) have been critical. Prone positioning is widely used in the ICU in patients with severe acute respiratory distress syndrome (ARDS).[1] In patients, early and long-term prone position increases gas exchange, oxygenation, and ventilation/perfusion (V/Q) ratio by reducing alveolar distension and collapse.[2] In a systematic review and meta-analysis study, it has been determined that the prone position for 12 h or more reduces mortality in patients with moderate and severe ARDS.[3] In another study, it was determined that the prone position for a long time reduced mortality in patients with severe ARDS and PaO2/FiO2<150.[4] In non-intubated ARDS patients, it has been determined that the prone position is beneficial and prevents intubation by increasing the oxygenation of the patients.[5,6] In the "Sepsis Survival Campaign 2019 in COVID-Associated Critical Patients" guideline published by the European Intensive Care Association and the American Intensive Care Association; It is recommended to apply a prone position for 12–16 h in moderate and severe COVID-19, especially in intubated patients with PaO2/FiO2<150.[7]

In the literature, there are studies on the incidence of pressure injury development in intensive care patients in the supine position. In COVID-19 patients, the risk of pressure

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Corresponding author: Ayda Kebapçı
E-mail: akebapci@ku.edu.tr

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injury development increases due to the preference for a prone position for longer than 12 h.[8] Pressure injuries occur in soft tissues over bony prominences exposed to pressure from body weight and medical devices. Especially in intubated patients, pressure injuries develop in the facial area, such as the forehead, chin, cheek, and ear.[9] In previous studies, it has been reported that the rate of pressure injury in the prone position is 56.9% in patients with severe ARDS, which is much higher than in the supine position.[10] In another study, it was found that the prone position was associated with developing edema and pressure injuries in the ARDS patient group, especially in the face area.[8] During the COVID-19 pandemic, there has been an increase in the number of pressure injuries in the facial area with the prolonged (>12 h) prone position given to COVID-19 patients in the ICU.

Pressure injuries cause deterioration in patients' quality of life in ICUs, a significant increase in the length of stay, mortality, and morbidity rates, and an increase in the burden of caregivers and the cost of care.[11,12] The exact incidence of skin damage associated with COVID-19 is unknown.[13] In addition, there is no study in the literature on the incidence of pressure injuries developing in the facial area in intubated patients who need prone positions for a long time due to COVID-19. A pressure injury, which is one of the most important indicators of the quality of nursing care, can be prevented by nursing interventions, but it still continues to be a problem in COVID-19 patients who are in a long-term prone position.[14]

Therefore, this study aimed to compare the prone position-related characteristics of intubated COVID-19 patients with and without facial pressure injuries. In addition, it was aimed to draw attention to the development of pressure injuries in the increased facial region in COVID-19 patients and to contribute to the development of preventive care strategies for pressure injuries development related to the prone position.

Research Hypotheses

- H1. The frequency of prone positioning is higher in intubated COVID-19 patients who develop pressure injuries on the facial area.
- H2. The daily prone position time given in intubated COVID-19 patients who develop pressure injuries on the facial area is longer.
- H3. Total prone position time is longer in intubated COVID-19 patients who develop pressure injuries in the facial area.

Materials and Methods

Design and Setting

This case–control and retrospective study was conducted to compare the characteristics of the prone position in COVID-19 patients who were intubated, prone, and those with and without pressure injuries in the facial area.

Participants

Adult COVID-19 patients hospitalized in the Adult ICU of Koç University Hospital between March 2020 and March 2021 were included in the study. The population of the study consisted of a total of 157 patients hospitalized in the ICU between these dates. In the study, the sample size was calculated as 15 people for each group, considering a 10% difference between the two groups with the G-Power 3.0.10 program, with 80% power and a 5% acceptable error. The research sample consisted of 49 patients over 18 who were intubated and given the prone position (pressure injury developed, n=36; pressure injury did not develop, n=13), and the data of all patients were obtained. The remaining 108 patients were not included in the study since they were not intubated and were in a prone position.

Data Collection

Data were obtained retrospectively from the electronic patient record system by the researcher. The patient records of all patients who met the sampling criteria, from admission to the ICU until discharge from the ICU, were examined.

In the hospital where the research was conducted, the electronic patient record system is used, and the nurses record the demographic characteristics of the patients, their daily clinical notes, and evaluations (duration of the prone and supine positioning, information about the position change, etc.) into this system. The "Pressure Wound Evaluation and Follow-up Form," in which intensive care nurses provide detailed daily evaluations and interventions for patients during their stay in the ICU, was accessed from the electronic patient record system. In this form, nurses recorded the location, stage, dimensions (width, height, depth), amount of exudate, if any, type of exudate, and the state of the surrounding tissue of the pressure injury. In addition, although there is no prone position protocol, there is a protocol that includes pressure injury prevention, diagnosis and staging, and stage-specific interventions.

Prevention, diagnosis, staging of pressure injury, and implementation of interventions appropriate to the stage are performed in a standard way in line with this protocol. If pressure injury develops in patients, the wound care nurse in the institution is informed, and the patient's pressure injury is evaluated and staged under the leadership of the wound care nurse. Then, the interventions suitable for the stage are determined according to the pressure injury protocol. After the first evaluation with the wound care nurse, the patient's pressure injury and intensive care nurses continue to evaluate the wound daily. The wound care nurse continues to evaluate and follow up twice a week, more frequently if necessary. In line with all these approaches, it is aimed to provide standardization for pressure injury prevention, diagnosis, staging, and the implementation of stage-specific interventions in all patients and to achieve the highest reliability between nurses' evaluations and interventions. In the ICU, while the patients were in the prone position, appropriate wound dressings were used on the pressure areas of the face and body parts for prevention, and support surfaces were used to distribute the pressure by the pressure injury protocol. The protocol was also used in COVID-19 patients included in the study.

In the staging of pressure ulcers, the European Pressure Ulcer Advisory Panel and the National Pressure Ulcer Advisory Panel Pressure Ulcers Classification System, adopted by the institution and nurses, stage the pressure injury of the patients accordingly (Stage I, stage II, stage III, stage IV, unstageable stage, and suspected deep tissue injury). All nurses working in the ICU were included in the orientation training before starting to work in the institution and received formal training on pressure injury prevention, diagnosis, staging, and planning and implementation of appropriate interventions.

Data Collection Tools

Data on the demographic and clinical characteristics of the patients were collected using the Patient Information Form.

Patient Information Form: The form created by the researchers to collect the demographic and clinical characteristics of the patients. In addition, clinical data included the presence of pressure injury on the face, the location and stage of the pressure injury and the day of the development, the day the prone position was started during the stay in the ICU, the total time of the prone position (hours), the average daily prone time (hours/day), the total number (frequency) of the prone position, the total length of stay in the ICU (days).

Statistical Analysis

The data were analyzed using the Statistical Package for the Social Sciences for Windows 26.0 program (IBM Corp.; Armonk, NY, USA). Data on demographic and clinical characteristics of patients were evaluated using descriptive statistical methods (number, percentage, mean, standard deviation, median). The Mann-Whitney U test was used to compare the data on the total time (hours) and the total number (frequency) of the prone position, the day of initiation of the prone position during hospitalization in the ICU between patients with and without pressure injury, since the data did not show a normal distribution. Significance was evaluated at the $P < .05$ level.

Ethical Considerations

Ethics committee permission was obtained from the Ethics Committee of Koç University, and institutional permission was obtained from the institution (Approval Number: 2021.365.IRB1.155, Date: 24.09.2021). Written consent was obtained from the patients who participated in this study.

Results

A total of 49 COVID-19 patients hospitalized in the ICU and placed in intubated and prone positions were included in the study.

The findings regarding the demographic characteristics of the patients were examined. It was determined that there was no significant difference between the patients with and without pressure injury in terms of demographic characteristics, the majority of the patients were male, and the mean age was 66 ($P > 0.05$) (Table 1). Considering the clinical characteristics of the patients, it was determined that the patients were placed in the prone position on the 4th day of their admission to the ICU, and they were in the prone position a median of 3 (1–18) times during their stay in the ICU. The median duration of the prone position was 18 hours for each positioning cycle (Table 2).

It was determined that pressure injury developed in the facial region in 73.4% (n=36) of the patients. The most common areas of pressure injuries are the chin (29%), the left cheek (20.5%), the nose (17.9%), the right cheek (16.7%), the forehead (6.5%), the lip (5.1%), and ears (3.9%). The most common stages were suspected deep tissue damage (20.5%), unstageable stage (20.5%), and stage II (19.3%), respectively (Table 3). Finally, it was determined that the prone time and the frequency of prone time in patients with pressure injury were significantly different from those without pressure injury ($P < .01$). However, there was no statistically significant difference between the groups in terms of the day of starting the prone position after admission to the ICU and the mean daily prone time ($P > .01$) (Table 4).

Discussion

Although serious facial pressure injuries are among the contraindications for a prone position, it is stated that COVID-19 patients need a prone position for long periods to increase oxygenation and gas exchange.[7,8,15,16] In the literature, many studies on preventing pressure injuries in intensive care patients have mainly focused on supine pressure injuries.[17-20] However, there has been a significant increase in the number of COVID-19 patients who were intubated and hospitalized in the prone position for a long time during the COVID-19 pandemic.[15,21]

Lucchini et al[9] (2020) found that 14% of ARDS patients hospitalized in the ICU developed pressure injuries due to a prone position, mainly on the chin and cheeks. Shearer et al[15] (2021) determined that 47.6% of COVID-19 patients who were intubated and given a prone position developed pressure injuries on the face, and the most common areas were the cheeks (84%) and ears (50%), respectively. In this study, similar to previous studies, it was determined that 71.4% of the patients developed pressure injuries on the 8th day after prone positioning, most commonly in the chin, cheeks, nose, and forehead regions. It is stated that a prolonged prone position provides better oxygenation and increases survival in patients with hypercapnia, hypoxemia, and low lung capacity who are critical secondary to COVID-19 infection and do not respond adequately to mechanical ventilation support.[22]

A study stated that the total hours per prone position cycle in COVID-19 patients averaged 16 h/day, and their oxygenation increased and benefited from the extended prone position exceeding 16 h a day.[23] Lucchini et al[9] (2020) found that ARDS patients need an average of 2 prone positions during their stay in the ICU, and each prone position takes an average of 9 h. Girard et al[10] (2014) stated that patients in the prone position developed pressure injuries on the 7th day of their admission to the ICU. The pressure injury development rate was higher in the prone position than in the supine position. In this study, it was determined that the duration of prone position and the frequency of positions given during the time they were hospitalized in the ICU in patients with pressure injury (82.75 h/5 times) were higher compared to those who did not (35 h/day). A meta-analysis study specified that the longer prone position for patients with ARDS provided greater oxygenation.[24] The results in this study, in parallel with previous studies, showed that the prone position is needed for a long time to improve the oxygenation and ventilation of ARDS patients in the ICU, and this requirement is an important risk factor for the development of pressure injuries in the face area in COVID-19 patients.[9] Kim and Mullins (2016) determined that patients with ARDS who were not given any support and care before the prone position developed necrotic scars and multiple deep tissue damage in the future.[8] Furthermore, it was found that pressure injuries did not develop in the facial area, especially in patients who placed silicone-based thin foam dressings between pressure-inducing tools such as endotracheal tubes.

In the patients included in this study, to prevent pressure injuries, the moisture balance of the skin was ensured using a moisturizer on the face area of the patient's barrier cream or spray was used on

Table 1. Comparison of demographic characteristics of patients with and without pressure injuries

	Patients (n=49)		
	Patients with a pressure injury (n=36)	Patients without pressure injury (n=13)	
	n (%)	n (%)	*P**-value
Gender			
Men	29 (80.5)	12 (92.3)	0.321
Women	7 (19.5)	1 (7.7)	
Comorbid diseases			
Hypertension			
No	25 (69.4)	9 (69.2)	0.986
Yes	11 (30.6)	4 (30.8)	
Diabetes Mellitus			
No	26 (72.2)	11 (84.6)	0.374
Yes	10 (27.8)	2 (15.4)	
Hyperlipidemia			
No	34 (94.4)	13 (100)	0.382
Yes	2 (5.6)	0 (0)	
Chronic obstructive pulmonary disease			
No	34 (94.4)	10 (76.9)	0.076
Yes	2 (5.6)	3 (23.1)	
Obesity			
No	35 (97.2)	13 (100)	0.542
Yes	1 (2.8)	0 (0)	
Other (Arrhythmia, CAD, HF, CRF, CA***)			
No	29 (80.5)	11 (84.6)	0.760
Yes	7 (19.5)	2 (15.4)	
Smoking			
No	19 (52.7)	3 (23.1)	0.657
Yes	17 (47.3)	10 (76.9)	
Survival after discharge from the intensive care unit			
No	23 (63.8)	8 (61.5)	0.882
Yes	13 (36.2)	5 (38.5)	
	Patients with a pressure injury (n=36)	**Patients without pressure injury (n=13)**	**t****	***P*-value**
	Mean (SD)	**Mean (SD)**	−.123	0.491
Age	66.94 (12.40)	66.46 (11.2)		

*$P < .01$, **t: Independent group t-test, *** CAD: Coronary artery disease, HF: Heart failure, CKD: Chronic renal failure, CA: Cancer.

the pressure areas, appropriate wound dressings were placed on the pressure areas for prevention (hydrocolloid, foam dressing, etc.) and sponge support. Although the head of patients was supported with specific wound care products, long-term prone position and medical devices such as endotracheal tube cause greater vertical forces on the face, possibly further contributing to the development of edema and pressure injuries in the face area.[25,26]

The development of pressure injuries in ARDS patients can be affected by age, hemodynamic instability, infection, organ failure,

Table 2. Clinical characteristics of the patients

	Patients (n=49)		
	Median (Mean)	SD±	Min-Max
The day the prone position started	4.00 (4.33)	2.12	1–13
Frequency of prone positioning (times)	3.00 (4.82)	3.59	1–18
Average prone time (hours/day)	18.00 (18.50)	2.78	13–25
Total prone time (hours)	52.00 (86.88)	12.37	18–301
The total length of stay in the intensive care unit (days)	12.00 (22.12)	13.76	3–77
	n		%
Presence of pressure sores in the facial area	No	13	26.6
	Yes	36	73.4

SD: Standard deviation

Table 3. Characteristics of patients with a pressure injury

	Patients (n=36)*	
	Median	Min-Max
The day the pressure sore develops (after admission to the intensive care unit)	11.29	0.5–47
Stage of pressure injury	**Sayı**	**%**
Stage I	2	2.6
Stage II	15	19.3
Stage III	4	5.1
Unstageable Stage	16	20.5
Deep Tissue Damage	41	52.5
Location of Pressure Injury**		
Ear	3	3.9
Chin	23	29.4
Right Cheek	13	16.7
Left Cheek	16	20.5
Nose	14	17.9
Forehead	5	6.5
Lips	4	5.1

*Includes data on patients with pressure injuries, **Includes data on one or more pressure injuries developing in the facial regions of patients during their stay in the intensive care unit.

Table 4. Comparison of prone position data of patients with and without pressure injuries

	Patients with a pressure injury (n=36)		Patients without pressure injury (n=13)			
	Median	Min-Max	Median	Min-Max	Z	*P**
The day the prone position is given	2.80	0–13	3.40	0.5–13	–1.00	0.317
Frequency of prone positioning (times)	5.00	1–18	2.00	1–10	–2.905	**0.004**
Average daily prone time (hours)	18.00	13–25	18.50	13.5–25	–1.156	0.248
Total prone time (hours)	82.75	18–301	35.00	18–219	–2.978	**0.003**

Z: Mann-Whitney U test, *$P < .01$

length of stay in the ICU, sedative agents used in intubated patients, immobilization, and nutritional status other than the prolonged prone position[10] and poor blood circulation in small vascular structures associated with COVID-19. It is stated that the circulatory insufficiency that develops, especially in the facial area, causes an increase in the risk of pressure injury development in patients.[27,28]

For this reason, it is important to plan the multidisciplinary treatment and care of patients with COVID-19 intubated and hospitalized in the ICU and consider the risk factors other than the prone position. However, it is important to be aware of potential complications such as pressure injuries due to a prone position since rehabilitating patients discharged from the ICU is important.[29] Thus, considering that the prevention of pressure injuries is more cost-effective than its treatment,[30] the additional financial burden on the health system will be avoided when the incidence of pressure injuries in the facial region due to prolonged prone position in COVID-19 patients is reduced.[31-34]

Limitations

Since the intensive care physicians in the ICU made the prone position decision, the physicians selected the patients who could tolerate the prone position. They thought that the position would increase patients' oxygenation. For this reason, patients who applied for prone positions in line with the physicians' decisions were included in the study. Finally, another study limitation is that other risk factors for pressure injury (friction, moisture, etc.) should have been evaluated.

Conclusion

This study found that most intubated COVID-19 patients hospitalized in the ICU developed pressure injuries in the facial region, especially in the chin, cheeks, forehead, and nose. When the long prone position is an inevitable treatment approach in COVID-19 patients in the ICU, the patient should be evaluated by a multidisciplinary team in terms of all risk factors, considering the increased risk of pressure injury development in these patients. Regular and more frequent skin evaluation of the facial area by the intensive care or wound care nurse, starting to use appropriate skin care and supportive products earlier, giving importance to more protective approaches, and changing the position of the head at more frequent intervals may contribute to the prevention of pressure injuries. There is a need for future studies in which a specific protocol that will minimize the risk of pressure injury development in this patient group or all risk factors are examined.

Ethics Committee Approval: Ethics committee permission was obtained from the Ethics Committee of Koç University, and institutional permission was obtained from the institution (Approval Number: 2021.365.IRB1.155, Date: 24.09.2021).

Informed Consent: Written consent was obtained from the patients who participated in this study.

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