Clinical and Experimental Health Sciences

Original Article / *Özgün Araştırma*

Effects of Different Position Changes on Hemodynamic Parameters and Dyspnea Severity in Patients with Dyspnea

Dispnesi Olan Hastalarda Farklı Pozisyon Değişiminin Hemodinamik Parametreler Ve Dispne Şiddeti Üzerine Etkisi

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ABSTRACT

Objective: This study was planned to determine the effects of different position changes on hemodynamic parameters and dyspnea severity in patients with dyspnea.

Methods: This was a quasi-experimental study, using a one-group, pre-test and post-test design. From March-December, 2015, 58 pulmonary service patients who had been hospitalized due to dyspnea and various respiratory diseases were assessed for dyspnea severity, oxygen saturation (SpO_2), systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR) and respiratory rate (RR).

Results: According to repeated measures variance analysis of patients in the prone and orthopnea position, there was no statistically significant difference between the measurement of dyspnea severity, O_2 saturation, SBP, DBP, and RR. However, the HR of patients increased in the prone position and dyspnea severity was shown to be reduced in the orthopnea position.

Conclusion: Comparing all the positions given to the patients, it was found that towards the 15th minutes, the orthopnea position had a positive effect on patients' mean dyspnea severity, SBP and O_2 saturation but a significant difference was observed only on the mean dyspnea severity.

Keywords: Change position, perception of dyspnea, hemodynamic parameters, prone position, orthopnea position

ÖZ

Amaç: Dispnesi olan hastalarda pozisyon değişiminin yaşamsal bulgular, oksijen saturasyonu ve dispne şiddeti üzerine etkisini belirlemek amaçlanmıştır.

Matreryal Metot: Bu araştırma ön test ve son test tasarımı kullanılan yarı deneysel bir çalışmadır. Mart-Aralık 2015 tarihleri arasında göğüs hastalıkları servisinde dispne ve çeşitli solunum hastalıkları nedeniyle yatarak tedavi gören 58 hastanın dispne şiddeti, oksijen saturasyonu (SpO_2), sistolik kan basıncı, diyastolik kan basıncı, kalp hızı ve solunum hızı değerlendirilmiştir.

Bulgular: Tekrarlayan varyans analizi sonuçlarına göre hastaların prone ve ortopne pozisyonunda dispne şiddeti, O_2 saturasyonu, sistolik kan basıncı, diyastolik kan basıncı ve solunum hızı istatistiksel olarak anlamlı farklılık göstermemiştir. Fakat hastaların kalp hızı prone pozisyonunda artış göstermiş ve dispne şiddeti ise ortopne pozisyonunda azalmıştır.

Sonuç: Hastalara verilen tüm pozisyonlar karşılaştırıldığında, ortopne pozisyonunun 15. dakikasında hastaların ortalama dispne şiddeti, sistolik kan basıncı ve O_2 satürasyonunda pozitif bir etki olduğu fakat sadece ortalama dispne şiddetinde anlamlı bir fark olduğu saptanmıştır.

Anahtar Kelimeler: Pozisyon değişimi, dispne algısı, hemodinamik parametreler, prone pozisyonu, ortopne pozisyonu

INTRODUCTION

Dyspnea is described by patients as "breathlessness, shortage of breath, inability to breathe" (1). To ease breathing in dyspnea patients, a frequently used nursing activity is position changing (2). Position changing is an intervention of independent nursing care. In many reports, authors show that suitable position changing affected oxygenation of blood increased gas stimulation, prevent decubitus ulcers and reduce urinary stasis (3). There are many studies showing that suitable position changing affects oxygenation of the blood and increases gas exchange in patients with cardiac or respiratory system problems (4, 5, 6, 7, 8, 9, 10). Proper positioning may promote oxygenation in a less traumatic, less invasive and less expensive manner than high-tech treatment such as intubation (11).

Early mobilization of patients in critical care was included in guidelines which were revised in 2015 by the German Society of Anesthesiology and Intensive Care Medicine. According to this guide, unsuitable positions can cause harm to the patient. Flat supine position should only be used in cases of urgent medical or nursing procedures and to have the head raised at an angle of 20-45° in patients with mechanical ventilation

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(12). Proper position should be determined according to the health condition of the patient. For example, trendelenburg position was linked to adverse effects on pulmonary function and intracranial pressure (13), however, it is appropriately used to reduce the risk of air embolism during subclavian vein central catheter placement (14).

In the literature there are many studies on the effects of the prone position on ARDS patients. As a result of many studies of prone positioning in ARDS, turning patients into the prone position is accepted as a reliable and beneficial procedure (7,10,16).Prone position, patient lie on their abdomens with the head turned to one side; the hips are not flexed. Perfusion is greater in the dorsal aspects of the lungs, no matter what the patient's position. Computed tomographic scanning revealed that lung damage and edema in ARDS were greatest in the dorsal areas. Prone positioning shifts fluid from the dorsal aspects, allowing undamaged alveoli in the dorsal areas to be recruited and filled with oxygenated air, thereby improving ventilation (15).

Few studies were found on the effect of orthopnea positioning on hemodynamic parameters. Orthopnea position is a seated position with the arms supported on pillows or the arm rest of a chair, and the patient leans forward over the bedside table or chair back. Orthopnea position causes organs in the abdominal cavity to fall away from the diaphragm with gravity. Giving more room for lungs to expand within the chest cavity, and allowing people to take in more air with each breath (17). Orthopnoea position eases respiration and circulation in patients with heart and lung dysfunctions. In one study, the orthopnoea position gave the best subjective easing of shortness of breath in chronic obstructive pulmonary disease (COPD) patients (8). A study conducted with patients with advanced breathing problems showed that the position which gave the best subjective easing of shortness of breath was the orthopnea position (4).

Taking account of the above-mentioned studies, it can be seen that the effects of various positions have been examined in different patient groups on physiological findings and hemodynamic parameters. However, few studies were found examining the effect of the orthopnea and prone positions on severity of dyspnea and hemodynamic parameters. For this reason, the aims of the study were to determine the effects of different position changes on hemodynamic parameters and dyspnea severity in patients with chronic respiratory diseases and dyspnea.

The research questions of this study are;

1. Does the prone position applied to patients with dyspnea affect the hemodynamic parameters and dyspnea severity of patients?
2. Does the orthopnea position applied to patients with dyspnea affect the hemodynamic parameters and dyspnea severity of patients?

Methods

Study Design

This research was a quasi-experimental study, using a one-group, pre-test and post-test design.

Sample

The study was conducted between March 20 and December 20, 2015 in the chest diseases service of a public hospital in Turkey.

Adult patients (over 18 years of age) with dyspnea due to acute or chronic diseases (asthma, COPD, pulmonary embolism, tuberculosis, lung cancer) were recruited into the study. Potential participants were identified by talking to the service doctor about whether the patients would be able to tolerate the change of position. Seventy seven patients who had complaints of dyspnea and who satisfied inclusion criteria were enrolled; however, 14 patients declined and 5 were unable to tolerate position changes, and were excluded from analysis, leaving 58 patients (Figure 1)."

Criteria for inclusion in the study were: hospitalized, dyspnea complaint, able to speak Turkish and being conscious.

Criteria for exclusion in the study were: receiving treatment in the outpatient unit and having any health problem hindering position change (deep vein thrombosis, any fracture and burnt, etc.).

A power analysis was performed for repeated-measures analysis of variance to determine the sample size, based on an assumption of an alpha level or type I error rate of 0.05. The prespecified level of statistical power for calculating the sample size was 96%, the expected difference in dyspnea severity was set at f = 0.30 and minimum sample size was calculated as 50. Post analysis, a sample size of 58 patients created a power of 0.98 (18).

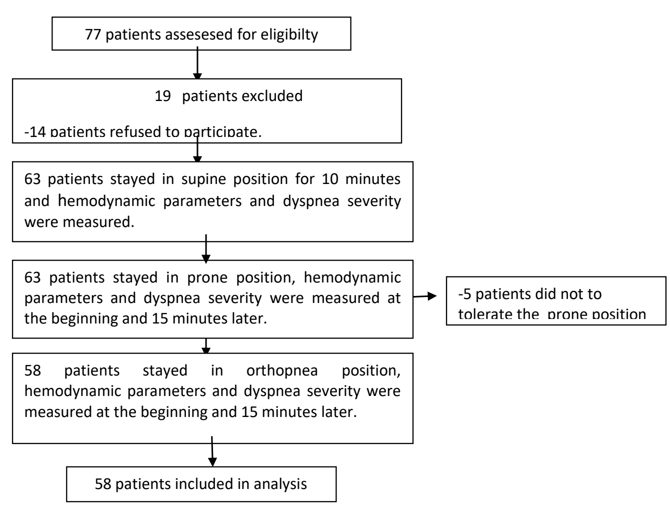

Figure 1: Flow Diagram

Data collection

In the collection of data, a Patient Identification Form and a form of hemodynamic parameters and dyspnea severity data were used. The forms were completed with the help of the researchers in face-to-face interviews with the patients in question-and-answer format. The Patient Identification Form was prepared by the researchers in accordance with the literature (1, 2, 3,19), taking account of similar studies which assessed patients receiving treatment for dyspnea, and included 13 questions on socio-demographic characteristics and information on the illness, such as age, gender, medical diagnosis, time since diagnosis, other chronic illnesses, the use of a bronchio-dilator or cortisone, alcohol consumption and smoking, height, weight, body mass index (BMI), weight loss and dyspnea severity. Patients' identifying data and data on the diagnosis of their illness were obtained from the patient monitoring forms of the chest diseases service. Other information was obtained from the patients themselves.

The form of hemodynamic parameters and dyspnea severity data was a form devised by the researchers, and included measurement data such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), respiratory rate (RR), oxygen saturation (spO_2) and dyspnea severity before and 15 minutes after position change.

Visual Analog Scale (VAS) has been established in many studies as a reliable scale which can be used to assess the dyspnea severity (20, 21). Güneş et al. (2012), in a study on COPD patients, compared the effectiveness of different scales in measuring the dyspnea severity, and found VAS to be a suitable scale for assessing the dyspnea severity (1). It is a scale in which a 100-mm vertical or horizontal line is marked with a pen: the 0 mm point indicates no dyspnea and the 100 mm point indicates the most severe dyspnea possible. The patient marks the severity of breathing difficulty at that moment on the scale according to these two criteria. Scoring is performed by measuring the point indicated with the help of a ruler (19, 21).

Intervention

Patients were assessed according to the inclusion criteria in the position in which they were found, and a pilot study was conducted with five patients. The primary objective of the pilot study was to determine the duration of the positions and the tolerance of patients to positions. Secondary purpose was to determine whether patients understand the questionnaires and to change the points that they did not understand. In the course of the pilot study it was found that five patients were unable to tolerate 30 minutes in the prone and orthopnea positions, and that the dyspnea symptoms of some patients worsened. Therefore, the time in each position was limited to 15 minutes. These five patients were not included in the sampling. The researchers have visited the chest diseases department at every noon and evening meal, and performed all interventions and measurements.

Patients were monitored for signs of an increase in pain between positions, breathing difficulty or inability to tolerate a position, and the study was brought to an end as soon as the findings were established. Patients were placed in turn in supine, prone and orthopnea positions.

The study was performed in three stages. During the three stages, all patients who fitted the study criteria were placed in a supine position on their own beds, and after they had rested in this position for five minutes, measurements of vital signs (HR, SBP/DBP and RR), SPO_2 and dyspnea severity were taken and recorded on the patient identification form. After that, the patients were placed in a prone position and the measurements of vital signs, SPO_2 and dyspnea severity were repeated. Patients were kept in the prone position for 15 minutes, and at the end of 15 minutes measurements were repeated. Later, patients were placed in the orthopnea position, and after that the same measurements were taken. Patients were kept in the orthopnea position for 15 minutes, and at the end of 15 minutes measurements were repeated. At the end of the study, the intervention was concluded by leaving the patient lying in a comfortable position. Measurements of patients' blood pressure and HR were taken with a digital instrument (Omron Healthcare Inc, Hoofddorp, Netherlands), RR was counted with a chronometer, and SpO_2 was measured from the patient by means of a pulse oximeter device (Beurer GmbH, Söflinger, Germany) attached to the fingertip. The pulse oximeter remains on the finger for 5-10 seconds for each measurement and gives a visual readout. This result was recorded.

Ethical Considerations

The research was approved by the University Ethics Committee (Approval Date: 10.15.2015, Approval No: 85.252.386-11). The study conformed to the principles outlines in the Helsinki Declaration. Written permission was obtained from the institutions where the study was to be carried out. Informed consent was obtained orally and in writing from the patients taking part in the study. The information included the purpose and procedures of the study, the voluntary nature of their participation and the option to withdraw at any time.

Statistical analysis

The data were evaluated via Statistical Package for the Social Sciences version 21.0 (SPSS Inc.; Chicago IL, USA). The Kolmogorov-Smirnov test was used because of the unit numbers during the investigation of the normal distribution of variables. As a result of this analysis, the variables was not show normal distribution. Descriptive statistics were used to describe the socio-demographic and disease characteristics of the sample (number, percentage, mean, standard deviations). In examining the distribution of the means of the patients' hemodynamic parameters, SPO_2 and dyspnea severity in supine, prone and orthopnea positions according to the times of intervention, variance analysis was used for the repeated measurements. In evaluation of data, the level of significance was set at $P < 0{\cdot}05$.

Results

The study was completed with 58 patients. Socio-demographic and illness status, and characteristics of patient's data are provided in Table 1. Mean age of patients was 65.79±9.36 (min: 44, max: 84) years, 62.1% were in the 65-84 age group, and 81% were male. Of patients, 55.2% were hospitalized with a diagnosis of asthma or bronchitis. Overall, 69% of participants did not have other chronic illnesses; 86.2% used a bronchodilator, and 93.1% used cortisone within one hour of the position intervention. By smoking status, 77.6% of patients were not currently smoking, though 50% had previously smoked. Patients' mean body mass index was 24.78±5.3 (min: 13.8, max:38.7).

Table 1. The Distribution of Demographic and Disease Characteristics of Patients

Characteristics (n=58)	Number	%
Ages		
44-64	22	37.9
65-84	36	62.1
The mean age 65.79±9.36 (min:44, max:84)		
Gender		
Female	11	19.0
Male	47	81.0
Medical Diagnosis		
Lung Cancer	2	3.4
Chronic Obstructive Pulmonary Disease	22	37.9
Asthma, bronchitis	32	55.2
Pulmonary embolism	1	1.7
Tuberculosis	1	1.7
Diagnosis length		
Less than 1 year	11	19.0
1-5 years	15	25.9
6-10 years	16	27.9
11-15 years	5	8.6
16 years and over	11	19.0
Do you have a chronic illness?		
Yes	18	31.0
No	40	69.0
Bronchodilator using		
Yes	50	86.2
No	8	13.8
Steroid using in the past 1 hour before position		
Yes	4	6.9
No	54	93.1
Smoking (now)		
Yes	13	22.4
No	45	77.6
Smoking (previously)		
Yes	29	50.0
No	29	50.0
Smoking length (n=29)		
6-10 years	1	3.4
20 years and over	28	96.6
Do you use alcohol?		
Yes	7	12.1
No	51	87.9
Body mass index		
Underweight	9	15.5
Normal	21	36.2
Overweight	18	31.0
Obese	10	17.2
The mean body mass index 24.78±5.33 (min: 13.8, max:38.7)		
Have you lost weight in the past 1 year		
Yes	11	19.0
No	47	81.0

Patients' hemodynamic parameters and dyspnea severity in all positions were shown in figure 2, table 2 and table 3. A statistically significant difference by time was found in the results of the repeated measures variances analysis between the mean values of patients' dyspnea severity (p= 0.003) and HR (p= 0.027) in supine position, at the beginning of the prone position (prone position's 0.minute), 15th minutes of the prone position, at the beginning of the orthopnea position (orthopnea position's 0.minute) and 15th of the orthopnea position. However, no statistically significant difference by time was found between the mean values of patients' SBP, DBP, RR and SpO_2 in the all-time (Figure 2). It was observed that patients' mean values of dyspnea severity were highest in measurements taken in the supine position and lowest in measurements performed after 15 minutes of the orthopnea position (supine: 47.06±19.35/orthopnea: 40.08±23.17). Also it was observed that patients' mean values of HR were highest in measurements taken in the supine position and lowest in measurements performed after 15 minutes of the orthopnea position (supine: 85.82±12.30/orthopnea: 88.27±11.40).

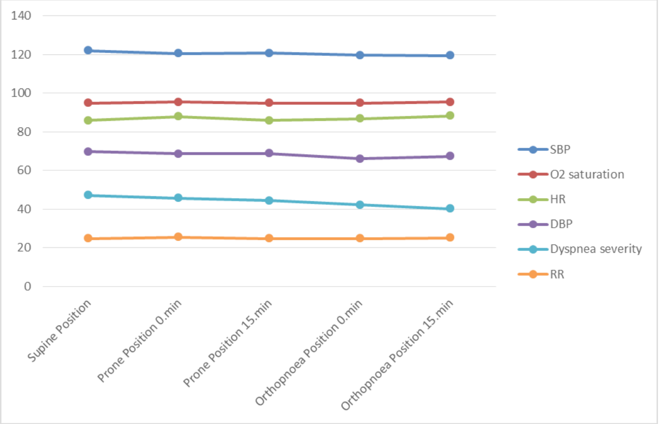

Figure 2: Variations in Patients' Dyspnea Severity and Hemodynamic Parameters According to Position Changing

Table 2. Dyspne Severity and Hemodynamic Parameters Values of Patients in Prone Position

Outcome measures	Before prone position [1]	0. minute[2]	15. minute[3]	F, p values[a]
	X±sd	X±sd	X±sd	
Dyspnea severity	47.06±19.35	45.60±20.52	44.31±22.17	F=2.590 p= .100
SBP	122.15±16.01	120.68±16.40	120.84±16.70	F= 0.550 p= .543
DBP	69.68±10.27	68.65±10.09	68.77±10.80	F=0.446 p= .641
HR	85.82±12.30	87.81±11.35	87.50±12.50	F=3.733 p= .027* 1<2[b]
RR	24.74±5.25	25.44±5.03	25.41±4.42	F= 0.861 p = .426
O_2 saturation	94.81±5.11	95.36±3.92	94.36±7.07	F= 0.970 p= .365

1: Supine position; 2: Prone position's 0.minute; 3: Prone position's 15.minute
SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR: heart rate; RR: Respiratory rate; *p <0.05
a: Repeated Measures Variances Test; b:Bonferroni test

Table 3. Dyspne Severity and Hemodynamic Parameters Values of Patients in Orthopnoea Position

Outcome measures	Before prone position [1]	0. minute[2]	15. minute[3]	F, p values[a]
	X±sd	X±sd	X±sd	
Dyspnea severity	44.31±22.17	42.24±22.55	40.08±23.17	F=6.915 p= 0.003* 1>3[b]
SBP	120.84±16.70	119.65±15.17	119.51±14.63	F= 0.629 p= .508
DBP	68.77±10.80	66.10±7.87	67.39±8.51	F=2.841 p= .063
HR	87.50±12.50	86.84±12.59	88.27±11.40	F=2.341 p= .101
RR	25.41±4.42	24.70±4.36	25.03±3.77	F= 1.425 p= .245
O_2 saturation	94.36±7.07	94.93±5.30	95.51±4.09	F= 1.529 p= .224

1: Prone position's 15. minute; 2: Orthopnoea position's 0.minute; 3: Orthopnoea position's 15.minute
SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR: heart rate; RR: Respiratory rate; *p<0.05
a: Repeated Measures Variances Test; b:Bonferroni test

Discussion

It is known that, COPD patients are encouraged to use support positions unsystematically to reduce the dyspnea. These positions are sitting up straight on the bed, stretching out forwards on pillows on a table beside the bed, sitting with the hands or elbows leaning on the knees, sitting leaning back, standing with the arms against a support such as the wall, standing with the back against a support, and being supported by leaning against a chair or other fixed object (22). In a study with patients experiencing dyspnea, it was found that the patients generally preferred the seated leaning forward position (4). Examining the literature it is seen that there have been many studies on the effect of prone position (5,7,9,10), the supine position (3,6,9,23,24), semi-fowler (6), and right and left lateral positions (3,23,24), but there have been few on the orthopnea position (4,8,24,25).

In this study, we evaluated the effects of supine, prone and orthopnea positions on hemodynamic parameters, O_2 saturation and dyspnea severity. The prone position had no effect by time over mean hemodynamic parameters and dyspnea severity except for an increase in HR that may not have been clinically meaningful, as the change was 2 beats per minute. Further, switching from prone to an orthopnea position had no effect on patients' hemodynamic parameters but it decreased dyspnea severity.

It was observed that mean systolic/diastolic blood pressure and dyspnea severity of patients' were highest in the supine position and lowest after 15 minutes of the orthopnea position. Orthopnea position allows maximum expansion of the chest (17), so the decreasing in the dyspnea severity is expected. The results of previous studies on dyspnea support our results. It was determined in one research conducted with COPD patients that in the orthopnea position patients' degree of congestion was less, their lungs were ventilated and their feeling of dyspnea was reduced (25). It was found in a study by O'Neill and McCarthy that the seated leaning-forward position was the optimum posture for the patients to generate maximum inspiratory pressures and to obtain greatest subjective relief of dyspnea (4). In another study, it was seen that the seated leaning forward position was preferred by COPD patients to ease dyspnea (8). This easing may be related to increased efficiency of the diaphragm because of the improved length-tension state helping to increase pulmonary function. However, the effects of a forward-leaning position on inspiratory muscle activity remain unclear. There is no consensus with respect to the muscle activity of the inspiratory accessory muscles in the forward-leaning position. Dyspnea is accepted as a subjective finding, and in aged patients there may be differences in the perception of dyspnea (26). According to many studies, the VAS scale is a suitable scale for determining the severity of dyspnea (19, 21). However, it is thought that the advanced age of the patients in the present study (65.79±9.36 years) may have affected the patients' assessment of their dyspnea.

Examining patients' HR and RR, it was observed that mean HR were lowest in the supine position and highest after 15 minutes of the orthopnea position. Results obtained from studies conducted with different patient groups differed from the results of our study. In a study, Sabeti et al. (2012), no significant difference was found in HR, so the averages of HR were equal in all positions (3). At the same time, it was determined in another study that patients' heart and RR were highest in the orthopnea position and lowest in the high right lateral position (24). In this study, patients' mean RR were lowest at the beginning of the orthopnea position, and highest after 15 minutes of the orthopnea position. In different body positions, changes of diaphragm movement due to pressure from abdominal viscera is expected to be effective on respiratory (27). In a study, Sabeti et al. (2012), RR was significantly higher in the left lateral position than other positions (3).

The results of this study show that patients' mean O_2 saturation was determined to be lowest after 15 minutes of the prone position and highest in measurements performed after 15 minutes of the orthopnea position. It was found in a study conducted with heart patients that the patients' mean O_2 saturation was higher in the orthopnea position and lower in the supine position (24). In a study conducted with healthy old people patients' O_2 saturation was measured first in the fowler position and then in the supine position, and it was found that their O_2 saturation was better in the fowler position (6). In two separate studies it was determined that O_2 saturation was higher in the prone position than in the supine position (23,28). Thus, the findings in the literature support the findings of our study. However, in a study conducted with patients who had undergone coronary bypass surgery, it was found that O_2 saturation was higher in the supine position (3). When patients are turned from a supine position to a prone position, the secretions in the lower lung move under the influence of gravity towards the open regions of the lung. Thus, the alveoli which were closed in the supine position open, and this helps the heterogeneous structure of the lung in ARDS to change, and to attain a more homogeneous structure (29). In this way it has been established in many studies that oxygenation is generally better with patients in the prone position (7,9,10,15). It was found in another study that the prone position improved SpO_2 and decreased respiratory distress as compared to the supine position in neonates with respiratory distress. Oxygen saturation was increased by about 7% (30).

There are also a few studies in the literature showing that position change does not affect hemodynamic parameters. In the conclusion of a study examining the effect on hemodynamic measurements of placing patients in different positions after heart surgery, no statistically significant differences were found (19). It is thought that the different results may arise from the different patient groups and from differences in methodology.

Limitations

The present study has several limitations to discuss. The findings from this study cannot be generalized as it was conducted only in selected areas at a single institution. Also, because the study was conducted with patients with a complaint of dyspnea arising from different diseases, the sample was not sufficiently homogeneous. Patients should be categorized according to the causes of dyspnea, because the etiology of dyspnea will affect the response to position change. It is recommended in the literature that patients should be rested for 5-15 minutes after position change in order for hemodynamic parameters not to be affected. However, in the present study dyspnea severity and hemodynamic parameters were assessed in the 0th and 15th minutes after position changing without resting the patients. This may have affected the results.

Conclusion

As a conclusion of the study, it was determined that when patients were placed in the orthopnea and the prone positions it did not affect their systolic and DBP or their RR. However, the HR of patients placed in the prone position showed a significant increase and dyspnea severity was significantly reduced in the orthopnea position. When all positions were compared, a positive effect was seen in patients' mean dyspnea severity, SBP and O_2 saturation towards the 15^{th} minute of the orthopnea position, but a significant difference was observed only on the mean dyspnea severity. In line with these findings, it would be useful to evaluate the subjective finding of dyspnea with valid and reliable measurements in clinical practice, and to plan interventions for patients with dyspnea. There are very few studies which show an effect of position change on the severity or perception of dyspnea or on hemodynamic parameters. In order to improve and standardize the quality of nursing care, it is necessary to rely on evidence-based practice. In this regard, randomized controlled studies are recommended to determine the duration and frequency of the best position, comparing the prone and orthopnea positions with other positions in patients with a complaint of dyspnea because of similar illnesses.

Ethics Committee Approval: The research was approved by the University Ethics Committee (Approval Date: 10.15.2015, Approval No: 85.252.386-11).

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