Original Article

The Effect of Deep Respiration and Prone Position on Common Respiratory Symptoms in Patients with COVID-19: A Randomized Clinical Trial

Abstract

Background: COVID-19 causes many respiratory problems**.** The most common clinical manifestation is acute respiratory failure. Respiratory rehabilitation is an important part of treatment, but little is known about it. This study was carried out to determine the effect of deep respiration and prone position on common respiratory symptoms in patients with COVID-19. **Materials and Methods:** In this clinical trial that was conducted in a hospital in Yasuj city, Iran, in 2021, 96 patients with COVID-19 were selected using a non-random convenience sampling method and were randomly assigned to three groups of deep respiration, prone position, and deep respiration and prone position. Data were collected using the Borg Rating of Perceived Exertion scale, the Visual Analog Scale, pulse oximetry, and a researcher-made checklist of patients' respiratory rates. The interventions were performed for 1 week (2–8 hours daily) based on patient tolerance. Data were collected before and immediately after the intervention. **Results:** There was no statistically significant difference ($p > 0.05$) among the three groups in terms of mean score of shortness of breath, intensity of symptoms, oxygen saturation of blood, and respiration rate before the interventions; however, significant differences were observed after the interventions ($p < 0.05$) in the three groups. **Conclusions:** Deep respiration with prone position could improve respiratory symptoms in patients with COVID-19 more than deep respiration or prone position alone. Respiratory exercise should be considered as a part of nursing cares and patients with respiratory symptoms should receive education in this regard.

Keywords: *Prone position, Respiration, respiratory, Signs and symptoms, COVID-19*

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Introduction

The global prevalence of SARS-nCoV-2 and its high rate of transmission and mortality led to the declaration of COVID-19 as a global pandemic by the World Health Organization.[1] According to general statistics, the mortality rate of COVID-19 is 3%.[2] Symptoms of the disease in the early stages include pneumonia, fever, pain, diarrhea, and smelling and tasting dysfunction.[2,3] Shortness of Breath (SOB), being a complex symptom, is defined as the mental experience of breathing distress consisting of distinct emotions that differ in terms of severity. SOB increases in patients with more severe symptoms.[4] In COVID-19, some people may experience only mild symptoms, while others may develop pneumonia that is not normally dangerous. Others may suffer severe lung damage and respiratory distress. According to studies, what is most prevalent in people with severe infection is Acute Respiratory Distress Syndrome (ARDS).[5] The treatment of respiratory distress syndrome involves using mechanical ventilation to increase the absorption of oxygen into the blood.[6] Prone position is a known method for treating severe hypoxemia in patients with ARDS.[7] Rapid and shallow respiration helps to reduce respiratory sinus arrhythmia maneuvers and changes in heart rate.[8]

In a study by Weiss *et al*.,[9] COVID-19 patients showed improved oxygenation in prone position. Moreover, Gleissman *et al*.[10] found that prone position could primarily improve PaO_2:FiO_2 in patients with PaO_2:FiO_2 < 120 mm Hg before treatment in three sessions. Both studies suggested further studies on this issue. According to the results of a study

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by Alwan and Abd Mohsen, chest breathing exercises and deep breathing exercise increase oxygen saturation values in patients with COVID-19.[11] In addition, Yokogawa *et al*.[12] found that non-specific breathing pattern had a greater effect on ventilation efficiency in women compared to diaphragmatic breathing pattern. The mentioned studies have suggested that more studies should be done to confirm their results.

Given the high number of patients with COVID-19, which is associated with severe acute distress syndrome, and it being the biggest global health challenge with many political, economic, legal, social, and cultural consequences, undertaking studies like the present one is highly recommended. It should be noted that non-pharmacological methods including deep breathing and prone positioning are low-risk and cost-effective, and there have been no studies on the role of these methods in the recovery of COVID-19 patients; therefore, the present study was conducted to determine the effect of deep respiration and prone position on common respiratory signs and symptoms in patients with COVID-19. SOB, respiratory rate, SpO_2, and intensity of signs and symptoms were examined.

Materials and Methods

This randomized clinical trial (IRCT 20210423051056N1) was conducted on all patients with COVID-19 admitted to clinical wards of Shahid Jalil Hospital of Yasuj City, Iran, from March to September 2021. A total of 96 patients with COVID-19 were selected through a non-random convenience sampling method. They were assigned to one of the three groups of deep respiration (n = 32), prone position (n = 32), and deep respiration with prone position (n = 32) via block randomization. The block randomization process was conducted using permuted blocks of size 3 to assign patients at a ratio of 1:1:1 to each of the three groups [Figure 1]. Inclusion criteria were having COVID-19, 18–85 years of age, ability to communicate and answer the questions, willingness to participate in the study, providing an informed written consent form, full awareness of patients, non-intubation, and blood oxygen saturation of ≤93%. The exclusion criteria were adverse changes in vital signs (heart rate, respiration, and blood pressure) and no intervention for more than 1 day.

The sample size was computed utilizing the statistical formula and considering $\alpha = 0.05$, $1\text{-}\alpha = 95$, $z_{1-\frac{\alpha}{2}} = 1.96$, $\beta = 0.2$, $1\text{-}\beta = 0.8$, $z_{1-\beta} = 0.85$, mean and standard deviation of SOB as 5.1 (1.1) based on a similar study,[13] and the maximum effect size of 0.8. Considering 20% dropout, the sample size was calculated to be 32 individuals in each group (96 in total for three groups).

In addition to a demographic characteristics form, the Borg Rating of Perceived Exertion (RPE) scale was used to assess SOB, Visual Analog Scale (VAS) to assess the intensity of respiratory symptoms, pulse oximetry to measure the oxygen saturation of arterial blood (SpO_2), and a researcher-made checklist of patients' respiratory rates to collect data. The number of breaths was measured using the checklist, and the blood oxygen saturation was determined through exertion and breathlessness during physical activity. The RPE scale is a type of visual rating scale that was developed to measure SOB and consists of a horizontal or vertical line with numbers or attributes along its axis.[14] In this scale, each number (0–10) is a description of respiratory status, with a score of 0 indicating no SOB and a score of 10 indicating the maximum SOB.[13] Daneshmandi *et al*.[14] reported the reliability of this scale as 0.84.

The VAS is a standard tool that was developed by Hayes and Patterson. The scale consists of a line 100 mm long and a label at both ends. The subject places a mark on the scale line to indicate the level of discomfort in different parts of the body. Then, according to the distance of the mark placed by the subject, from the left-hand side, the intensity of discomfort is numerically recorded between 0 and 100 mm or 0–10 cm. The advantages of VAS include easy management, sensitivity, and response to statistical analysis (strong parametric statistics).[15] The validity and reliability of the Persian version of this standard scale have been confirmed.[16]

The interventions were performed for 1 week (2–8 hours daily) based on patient tolerance on two shifts of morning and evening by the first author of this article. All precautionary measures, such as the use of masks, glasses, and gowns, were carried out according to the instructions of the Ministry of Health and Medicine of Iran for the care of patients with COVID-19. In the deep respiration, the intervention was orally taught, and then, the patient was asked to perform the inhalation and exhalation in a ratio of 4–6, that is, inhalation through the nose and counting 1 to 4, and exhalation through the mouth and counting 1 to 6. This was performed face to face, and patients counted to maintain the inhalation-exhalation ratio. A written guide was also provided to patients. The training lasted 10 minutes and included the following: 1) immobilizing the tongue; 2) breathing slowly, deeply, and regularly (deep and slow inhale, exhale, rest); and 3) not speaking during the procedure. The skill of the samples in performing the exercises was evaluated by the researcher, and after the training, the patient was asked to practice the task to achieve sufficient skill.

In the prone position group, the patients lay in the prone position for 30 minutes and before changing their position, their respiratory symptoms were measured and recorded. The patient then lay on his stomach or back for 30 minutes and the respiratory symptoms (blood oxygen saturation and breath) were measured again at 15 and 30 minutes. For

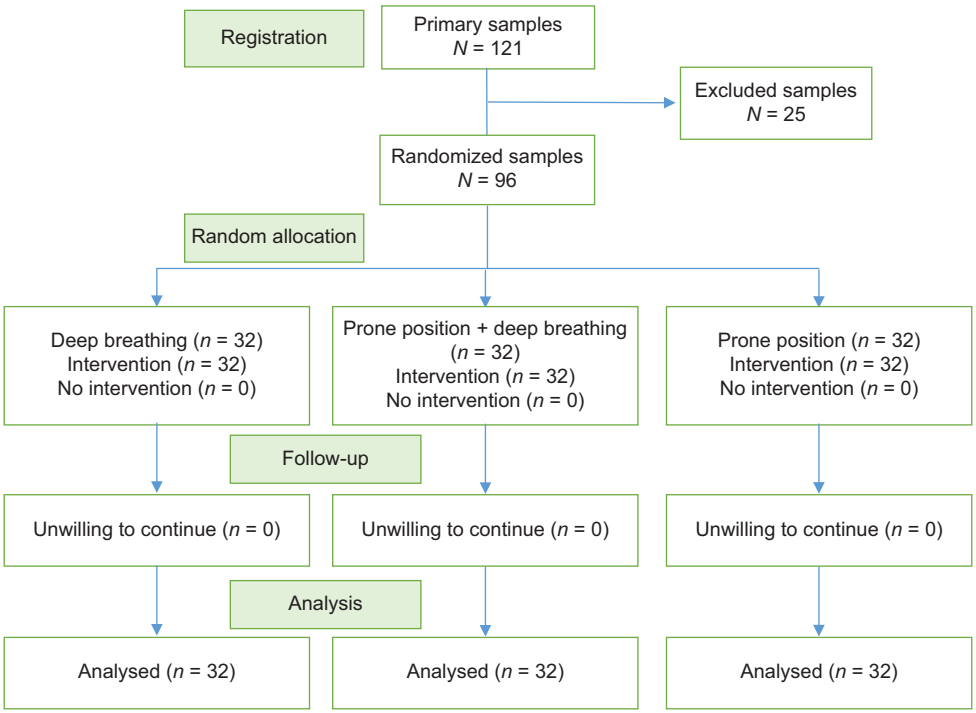

Figure 1: CONSORT flowchart of the study

more accuracy, respiratory symptoms were measured three times, at 15-second intervals each time, and the mean was recorded as the final value.

In the deep respiration with the prone position group, a combination of the interventions of the two previous groups was performed. Data were collected before (2 hours prior to starting the intervention on day 1) and after the intervention (2 hours post completing the intervention on day 7). The collected data were analyzed in SPSS software (version 21; IBM Corp., Armonk, NY, USA) using descriptive and inferential statistics. The results of outcome variables were reported using parametric tests, including one-way ANOVA and paired-samples *t*-test for between and within-group comparisons, respectively. The distribution of the data was normal. The data collector and data analyzer were blind to the participants of the three groups.

Ethical considerations

This study has been approved by the Research Ethics Committee of the Vice Chancellor for Research and Technology of Yasuj University of Medical Sciences, Iran (Ethics code: 024.1400.IR.YUMS.REC). Before the intervention, written consent was obtained from the participants, and the aim of the study was fully explained to them. Emphasis was placed on the confidentiality of patient information, fully voluntary participation in the study, and free withdrawal at any stage of the study.

Results

The present study was completed by 96 patients with COVID-19; 57 patients (59.375%) and 39 patients (40.625%) were women and men, respectively. The mean age of the participants was 57.124 (18.941) years. No statistically significant differences were observed in terms of demographic characteristics among the three groups [Table 1].

Based on the results of one-way ANOVA, there was no statistically significant difference in the mean score of SOB, intensity of respiratory symptoms, oxygen saturation of blood (SpO_2), and respiration rate among the three groups before the interventions ($p > 0.05$); however, the mean score of SOB, intensity of respiratory symptoms, SpO_2, and respiration rate showed a statistically significant difference among the three groups after the intervention ($p < 0.05$) [Table 2].

Within-group comparison of the mean score of SOB, intensity of respiratory symptoms, SpO_2, and respiration rate in the three groups was performed separately in each group. Based on the results of the paired-samples *t*-test, the mean score of SOB, intensity of respiratory symptoms, SpO_2, and respiration after the intervention were significantly different ($p > 0.05$) from before the interventions [Table 2].

Based on the results of post-hoc analysis using the Scheffe test for paired comparison, there was a statistically significant difference in the mean score of SOB, intensity of respiratory symptoms, SpO_2, and respiration rate between the group of deep respiration with prone position and the groups of deep respiration and prone position alone after the interventions ($p < 0.05$). In other words, deep respiration with prone position had improved patients' symptoms more than deep respiration or prone position

Table 1: Demographic characteristics of the three groups

Variable	Group	Deep respiration	Prone position	Deep respiration with prone position	*p*
Age Mean (SD)		60.34 (20.06)	52.21 (16.28)	51.81 (19.85)	0.191*
Gender *n* (%)	Male	13 (41)	17 (53)	9 (28)	0.126**
	Female	19 (59)	15 (47)	23 (72)	
Occupation *n* (%)	Unemployed	5 (16)	3 (9)	6 (18)	0.427**
	Housewife	14 (44)	14 (44)	17 (53)	
	Other	13 (40)	15 (47)	9 (29)	
Education *n* (%)	Illiterate	18 (56)	12 (37)	17 (53)	0.369**
	High school	5 (16)	7 (22)	4 (13)	
	Post diploma	9 (28)	13 (41)	11 (34)	
Marital status *n* (%)	Single	4 (12)	1 (3)	4 (12)	0.332**
	Married	28 (88)	31 (97)	28 (88)	

*One-way ANOVA, **Chi-square test

Table 2: Between and within-group comparison for mean scores of respiratory symptoms

Groups and Variables	Mean (SD)			Between-group comparison*
	Deep respiration	Prone position	Deep respiration with prone position	
Shortness of breath (SOB)				
Before	3.75 (1.96)	3.56 (1.5)	4.28 (2.24)	(f_2=1.194, p=0.308)
After	1.71 (0.93)	1.45 (0.72)	0.45 (0.21)	(f_2=23.325, p=0.001)
Within-group comparison**	(t_{31}=−8.296, p=0.001)	(t_{31}=−11.862, p=0.001)	(t_{31}=−12.351, p=0.001)	
Intensity of symptoms				
Before	4.53 (1.88)	4.12 (1.43)	5.03 (2.03)	(f_2=2.028, p=0.137
After	1.81 (0.98)	1.53 (0.67)	0.7 (0.3)	(f_2=15.644, p=0.001)
Within group comparison		0.001	0.001	
Oxygen saturation of blood (SpO_2)				
Before	84.65 (9.86)	87.34 (5.17)	85 (6.43)	(f_2=1.24, p=0.294)
After	89.37 (6.24)	91.87 (3.66)	93.62 (4.33)	(f_2=6.148, p=0.003)
Within group comparison	(t_{31}=−5.801, p=0.001)	(t_{31}=−12.63, p=0.001)	(t_{31}=−18.420, p=0.001)	
Respiration rate				
Before	30.65 (4.02)	30.46 (5.33)	32.78 (6.75)	(f_2=1.745, p=0.179)
After	23.75 (2.91)	23.78 (3.42)	21.59 (3.74)	(f_2=4.410, p=0.015)
Within group comparison	(t_{31}=15.353, p=0.001)	(t_{31}=13.515, p=0.001)	(t_{31}=15.969, p=0.001)	

*One-way ANOVA; **Paired-samples *t*-test

alone. However, there was no significant difference between the deep respiration group and the prone position group [Table 3].

Discussion

The present study was conducted to determine the effect of deep respiration with prone position on common respiratory symptoms in patients with COVID-19. The result of the study showed that deep respiration and prone position either alone or together had been useful in improving respiratory symptoms in patients with COVID-19; however, deep respiration with prone position improved respiratory symptoms in patients with COVID-19 more than deep respiration or prone position alone. Despite methodological differences such as intervention duration, time, and sample size, the results of this study were consistent with similar studies.[17,18] Few studies have investigated the effect of combined deep respiration and prone position on the common respiratory symptoms of patients with COVID-19.

Based on the results of the present study, the deep respiration intervention increased the mean score of common respiratory symptoms in patients with COVID-19 immediately after the intervention, which is consistent with the results of the study by Öner Cengiz *et al*.[18] Malik and Tassadaq also showed that deep breathing exercises are very important in improving pulmonary complications in patients with second-degree inhalation burns.[19] The results of a study by Serafim *et al*.[20] also showed that deep breathing reduces anxiety in patients with bipolar disorder. Breathing exercises, especially deep breathing, are used to increase health and reduce anxiety, which is suggested as a relaxing technique and can help a person achieve better health. Deep breathing relaxation as a treatment can be used to reduce heart rate, blood pressure, oxygen

Table 3: *Post-hoc* analysis for paired comparison of mean difference of respiratory symptoms

Variables	Group (I) - group (J)	Mean difference	*p**
Shortness of breath (SOB)	Deep respiration with prone position – deep respiration	1.26	0.001
	Deep respiration with prone position – prone position	1	0.001
	Deep respiration – prone position	0.26	0.401
Intensity of symptoms	Deep respiration with prone position – deep respiration	1.11	0.001
	Deep respiration with prone position – prone position	0.82	0.001
	Deep respiration – prone position	0.28	0.398
Oxygen saturation of blood (SpO_2)	Deep respiration with prone position – deep respiration	4.25	0.030
	Deep respiration with prone position – prone position	1.2	0.300
	Deep respiration – prone position	2.50	0.100
Respiration rate	Deep respiration with prone position – deep respiration	2.15	0.040
	Deep respiration with prone position – prone position	2.18	0.030
	Deep respiration – prone position	0.03	0.900

**Post-hoc* analysis using the Scheffe test

consumption, and stress hormone levels.[20] These findings are consistent with the results of our study.

Furthermore, according to the results of the present study, prone position increased the mean score of common respiratory symptoms in patients with COVID-19, which is consistent with the results of the study by Langer *et al*.[21] Prone position is a suitable method to improve oxygenation in ARDS and can reduce mortality. Therefore, it is highly recommended for SARS-CoV-2 patients.[22] Lu *et al*.[23] showed that mechanical ventilation in prone position is more useful than supine position in improving the blood gas status of patients with moderate to severe ARDS, reducing the burden on the right heart and promoting the recovery of patients. However, Padrão *et al*.[24] showed that prone position while awake did not reduce the chance of intubation in patients, which is not consistent with the results of the present study. This difference may be due to the type of study; although the two studies are similar in the nature of the disease and the measurement of oxygen, due to the retrospective nature of the study, the researchers of this study may not have been able to access data such as arterial blood gas analysis and oxygen saturation level before and after the prone positioning session. In addition, due to the retrospective nature of the intervention, it was not possible to randomize the participants' data, and no specific protocol was used for the intervention; thus, perhaps all patients were not placed in the prone position for a certain and equal period of time.

Based on the results of this study, the combination of deep respiration and prone position increased the mean total of common respiratory symptoms in patients with COVID-19, which is consistent with the results of the study by Westerdahl *et al*.[25] Based on the results, both deep respiration and prone position had a significant effect on respiratory symptoms, but their combination had a double effect, emphasizing the strengthening effect of these two interventions simultaneously. The reason for this effect, on the one hand, is the improvement of oxygen supply due to the improvement of ventilation, and on the other hand, activation of the parasympathetic nervous system, resulting in a reduction in the number of breaths.

The present study had limitations, such as early discharge of patients by a specialist physician due to a lack of hospital beds. Moreover, the researchers faced problems such as difficulty in assessing the patients for eligibility and the risk of disease transmission. These problems resulted in a delay in the selection of the representative sample, and finally, the prolongation of sampling time. Another limitation was that the data were collected self-reportedly.

Finally, further studies are suggested to investigate the effect of combined deep respiration and prone position on the radiological symptoms of the lungs of patients with COVID-19 and on the long-term pulmonary complications of patients with COVID-19.

Conclusion

According to the results of this study, the combined intervention of deep respiration and prone position could improve common respiratory symptoms in patients with COVID-19. Improving common respiratory symptoms in these patients reduces their difficulty in breathing and the stress caused by the disease. Therefore, it is suggested that members of the health team consider the implementation of these non-pharmacological therapeutic interventions in the treatment plan of patients with COVID-19. Respiratory exercises are a part of nursing duties and should be taught to patients with respiratory problems. These exercises are simple and without any side effects, and thus, patients can easily perform them in the hospital or at home to manage their symptoms.

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Conflicts of interest

Nothing to declare.

References

1. Mahase E. China coronavirus: WHO declares international emergency as death toll exceeds 200. BMJ 2020;368:m408.
2. Khafaie MA, Rahim F. Cross-country comparison of case fatality rates of COVID-19/SARS-COV-2. Osong Public Health Res Perspect 2020;11:74-80.
3. Wang W, Tang J, Wei F. Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in Wuhan, China. J Med Virol 2020;92:441-7.
4. Ora J, Liguori C, Puxeddu E, Coppola A, Matino M, Pierantozzi M, *et al*. Dyspnea perception and neurological symptoms in non-severe COVID-19 patients. Neurol Sci 2020;41:2671-4.
5. Kim ES, Chin BS, Kang CK, Kim NJ, Kang YM, Choi J-P, *et al*. Clinical course and outcomes of patients with severe acute respiratory syndrome coronavirus 2 infection: A preliminary report of the first 28 patients from the Korean cohort study on COVID-19. J Korean Med Sci 2020;35:e142.
6. Jannat Alipoor Z, Fotokian Z. COVID-19 and the elderly with chronic diseases: Narrative review. Journal Mil Med 2020;22:632-40.
7. Kallet RH. A comprehensive review of prone position in ARDS. Respir Care 2015;60:1660-87.
8. Reis MS, Arena R, Archiza B, de Toledo CF, Catai AM, Borghi-Silva A. Deep breathing heart rate variability is associated with inspiratory muscle weakness in chronic heart failure. Physiother Res Int. 2014;19:16-24.
9. Weiss TT, Cerda F, Scott JB, Kaur R, Sungurlu S, Mirza SH, *et al*. prone positioning for patients intubated for severe acute respiratory distress syndrome (ARDS) secondary to COVID-19: A retrospective observational cohort study. Br J Anaesth 2021;126:48-55.
10. Gleissman H, Forsgren A, Andersson E, Lindqvist E, Lipka Falck A, Cronhjort M, *et al*. Prone positioning in mechanically ventilated patients with severe acute respiratory distress syndrome and coronavirus disease 2019. Acta Anaesthesiol Scand 2021;65:360-3.
11. Alwan MK, Abd Mohsen RI. The effect of deep breathing exercise on oxygen saturation of patients with COVID-19. Mosul J Nurs 2022;10:51-5.
12. Yokogawa M, Kurebayashi T, Ichimura T, Nishino M, Miaki H, Nakagawa T. Comparison of two instructions for deep breathing exercise: Non-specific and diaphragmatic breathing. J Phys Ther Sci 2018;30:614-8.
13. Heidari M, Fayazi S, Borsi H, Moradbeigi K, Akbari Nassaji N. Effect of a self-management program based on 5A model on dyspnea and fatigue severity among patients with chronic obstructive pulmonary disease: A randomized clinical trial. J Hayat 2015;20:89-99.
14. Daneshmandi H, Choobineh AR, Rajaee-Fard A-R. Validation of Borg's RPE 6-20 scale in male industrial workers of Shiraz city based on heart rate. Jundishapur Sci Med J 2012;11:1-10.
15. Yeung AWK, Wong NSM. The historical roots of visual analog scale in psychology as revealed by reference publication year spectroscopy. Front Hum Neurosci 2019;13:86.
16. Rezvani Amin M, Siratinayer M, Ebadi A, Moradian T. Correlation between visual analogue scale and short form of McGill questionnaire in patients with chronic low back pain. Qom Univ Med Sci J 2012;6:31-4.
17. Ashra F, Chen R, Kang XL, Chiang KJ, Pien LC, Jen HJ, *et al*. Effectiveness of prone position in acute respiratory distress syndrome and moderating factors of obesity class and treatment durations for COVID-19 patients: A meta-analysis. Intensive Crit Care Nurs 2022;72:103257.
18. Öner Cengiz H, Ayhan M, Güner R. Effect of deep breathing exercise with Triflo on dyspnoea, anxiety and quality of life in patients receiving covid-19 treatment: A randomized controlled trial. J Clin Nurs 2022;31:3439-53.
19. Malik SS, Tassadaq N. Effectiveness of deep breathing exercises and incentive spirometry on arterial blood gases in second degree inhalation burn patients. J Coll Physicians Surg Pak 2019;29:954-7.
20. Serafim SD, da Ponte FDR, Lima FM, Martins DS, Rosa AR, Kunz M. Effects of deep breathing in patients with bipolar disorder. Perspect Psychiatr Care 2019;55:119-25.
21. Langer T, Brioni M, Guzzardella A, Carlesso E, Cabrini L, Castelli G, *et al*. Prone position in intubated, mechanically ventilated patients with COVID-19: A multi-centric study of more than 1000 patients. Crit Care 2021;25:1-11.
22. Carsetti A, Paciarini AD, Marini B, Pantanetti S, Adrario E, Donati A. Prolonged prone position ventilation for SARS-CoV-2 patients is feasible and effective. Crit Care 2020;24:1-3.
23. Lu H, Zhang P, Liu X, Jin L, Zhu H. Effect of prone position ventilation on right heart function in patients with acute respiratory distress syndrome. Clin Respir J 2021;15:1229-38.
24. Padrão EM, Valente FS, Besen BA, Rahhal H, Mesquita PS, de Alencar JC, *et al*. Awake prone positioning in COVID-19 hypoxemic respiratory failure: Exploratory findings in a single-center retrospective cohort study. Acad Emerg Med 2020;27:1249-59.
25. Westerdahl E, Wittrin A, Kånåhols M, Gunnarsson M, Nilsagård Y. Deep breathing exercises with positive expiratory pressure in patients with multiple sclerosis–A randomized controlled trial. Clin Respir J 2016;10:698-706.