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Original Article

Evaluating the Use of Communication Board on Cortisol Level and Physiological Parameters in Mechanically Ventilated Patients

Anahita Divani[1], Arpi Manookian[1], Shima Haghani[2], Mohsen Meidani[3], Mojdeh Navidhamidi[1]

[1]Department of Medical-Surgical Nursing and Basic Sciences, School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, [2]Department of Biostatistics, Iran University of Medical Sciences, Tehran, Iran, [3]Department of Infectious Diseases and Tropical Medicine, Imam-Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran

Abstract

Background: Mechanically ventilated patients experience a high level of anxiety due to their therapeutic condition. Anxiety is one of the strongest emotions that patients under mechanical ventilation experience due to their inability to communicate with others. The aim of this study was to investigate the effect of using a communication board on these patients' by assessing serum cortisol level and vital signs. **Materials and Methods:** This randomized clinical trial study was conducted in 2020. This study included 60 ventilated patients, who had been randomly assigned into two intervention and control groups. After blood sampling and evaluation of cortisol and physiological parameters, patients in the control group received routine communication by nurses, whereas those in the intervention group received communication using a communication board. Subsequently, the serum cortisol level and physiological parameters were measured again. **Results:** No significant difference was observed between the two groups in terms of demographic characteristics. There was a significant difference in blood cortisol levels before and after in the intervention group ($t_{29} = 15.52$, $p < 0.001$). After the intervention, the intervention group's systolic blood pressure ($t_{58} = -3.78$, $p < 0.001$), diastolic blood pressure ($t_{58} = -3.79$, $p < 0.001$), and heart rate ($t_{58} = -2.09$, $p = 0.041$) were significantly lower than the control group. **Conclusions:** Communication through a communication board in mechanically ventilated patients leads to decreased cortisol levels and physiological parameters. It is recommended to do more studies about communication boards' content and use this tool for more prolonged periods.

Keywords: *Anxiety, communication, ventilation, nursing, vital signs*

Introduction

Mechanical ventilation, which is mainly used in intensive care units, is a vital technology that supports the lives of patients who are in the urgent and vital need of respiration and oxygen.[1] Although mechanical ventilation can save a person's life, and as an important therapeutic measure, it cannot be avoided for critically ill patients admitted to intensive care units, its use may have adverse psychological and physiological consequences for patients.[2]

Feeling anxious due to the inability to communicate with others is one of the strongest emotions these patients experience.[3] According to research, about 62% of mechanically ventilated patients report that they often experience despair, hopelessness, and anxiety while trying to communicate[4] because they cannot easily communicate their needs to them.[4] One of the essential communication barriers between nurses and patients under mechanical ventilation is the lack of effective communication methods.[5] Therefore, by identifying and creating appropriate and effective communication methods, these patients' anxiety can be significantly reduced.[6]

According to the North American Nursing Diagnosis Association (NANDA), anxiety is a vague feeling of fear and concern with a nonspecific and unknown origin associated with the autonomic system response.[7] When a person is in an anxious situation, the possible consequence is an increase in his/her blood catecholamines levels such as adrenaline and corticosteroids such as cortisol, secreted from the adrenal cortex glands and lead to a variety of physiological responses.[8] Following changes in blood cortisol levels, the body's physiological parameters including vital signs would also change. These changes are manifested by

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How to cite this article: Divani A, Manookian A, Haghani S, Meidani M, Navidhamidi M. Evaluating the use of communication board on cortisol level and physiological parameters in mechanically ventilated patients. Iran J Nurs Midwifery Res 2022;27:198-203.

Submitted: 31-Mar-2021. **Revised:** 26-Apr-2021. **Accepted:** 04-Oct-2021. **Published:** 23-May-2022.

Address for correspondence:
Dr. Mojdeh Navidhamidi, Nosrat st. Tohid sq. Tehran I, Iran.
E-mail: m-navid@tums.ac.ir

Access this article online

Website: www.ijnmrjournal.net

DOI: 10.4103/ijnmr.ijnmr_82_21

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increasing blood pressure, increasing heart rate, increasing respiration rate, altered heart rhythm, bone density reduction, increasing blood sugar, and delayed wound healing, cognitive impairment, and delirium.[9] Therefore, monitoring serum cortisol levels is a very reliable criterion for measuring anxiety levels.[10,11]

Communication is a crucial component between the nurse, patient, and health care provider. The primary purpose of communication between nurses and patients is to provide comfort and reduce stress and anxiety.[12] In intensive care units, due to impaired speech and communication, nurses have a significant role in meeting patients' needs and reducing their stress and anxiety.[13]

The American Speech-Language-Hearing Association (ASHA) defines Augmentative and Alternative Communication (AAC) as communication methods used in situations where verbal communication is not possible.[14] However, most of these devices are very expensive and fragile; in addition, the radio waves emitted from them can disrupt other medical devices.[15] Thus, more economical and cheaper tools such as a communication board can better communicate with patients under mechanical ventilation. The Communication Board (CB) is one of the best tools for identifying patients' needs. The CB contains letters, words, symbols, and shapes that can display activities, emotions, objects, and people to share their needs and requests with others by pointing to each of these items on the board.[16,17] Although AAC strategies can facilitate communication in mechanically ventilated patients, this strategy needs to ensure nurses' qualification and knowledge. Moreover, the ability of intensive care units to provide this device for each intubated patient should be considered[15] given that few studies have been done on the use of communication boards. El-Soussi *et al*.[16] evaluated the effectiveness of alternative communication methods in intubated Chronic Obstructive Pulmonary Disease (COPD) patients, and Kaur *et al*.[18] examined the effectiveness of communication board on anxiety and satisfaction among mechanically ventilated patients. However, these studies used written questionnaires and scales to assess the efficiency of this tool. The present study examined the effects of this tool on patients' anxiety with more objective and reliable indicators such as vital signs and serum cortisol level. This study hypothesizes that applying a communication board can affect vital signs and serum cortisol levels due to decreasing anxiety levels of mechanically ventilated patients.

Materials and Methods

This study is a randomized clinical trial study (IRCT20190914044768N1) conducted on mechanically ventilated patients in intensive care units of Imam Khomeini Hospital in Tehran, Iran in 2020. To determine the sample size at a confidence level of 95% and power of 80%, the minimum sample size in each group was calculated as 28 patients. By considering the loss of patients, the final sample size determined 30 people in each group.[19]

Convenience sampling was performed, as Sixty patients admitted to intensive care units with artificial airways (oral/nasal endotracheal tube and tracheostomy) were randomly divided into intervention and control groups. For this, the letter "A" was considered for the intervention group and the letter "B" for the control group. All the permutation combinations of the letters A, A, B, and B (six different combinations) were written down on six cards. The patient was then asked to select a card randomly. This operation was continued until the sample size reached the quorum to prevent bias in the study results and, in each time sampling in each intensive care unit, only one patient was examined. Inclusion criteria were as follows: being 18–60 years old; having an endotracheal tube or tracheostomy; being fully conscious; not using sedatives and hypnotics; having a minimum literacy; having the ability to speak and understand Persian language; having no hearing, vision, or cognitive problems; having no history of previous intubation or tracheostomy; not taking any medication that could affect cortisol levels or hemodynamic parameters; and having no disease affecting hemodynamic parameters. Exclusion criteria included the need for Cardiopulmonary Resuscitation (CPR) during the study, patient's death or loss of consciousness, withdrawal of the artificial airway for any reason, and the need for immediate patient's transfer to the operating room [Figure 1].

Demographic information of the samples, including age, sex, level of education, occupation, smoking and alcohol consumption, history of diseases, type of artificial airway,

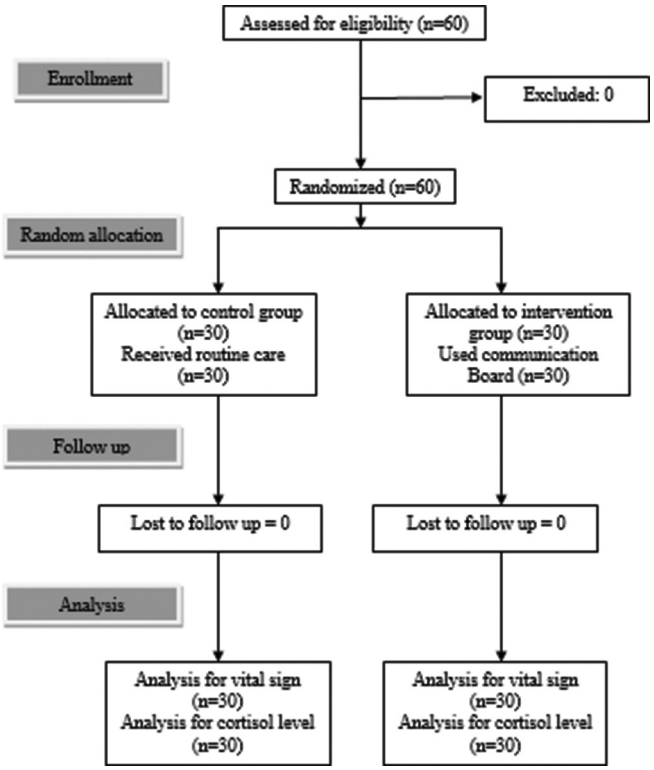

Figure 1: Study protocol and selection process

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history of artificial airway use, and number of intubation days, were collected by a demographic information questionnaire by using the medical files of the patients. A monitoring system recorded the patients' vital signs, and blood samples were collected for serum cortisol in two stages. The first blood sample was collected in the early morning before the intervention, and the second one was collected after the intervention (11–12 am).

A communication board consisting of three sections, namely the alphabet section, a section with simple pictures of patients' everyday needs with simple subtitled phrases, and a section for patients to write down their requests, was used.[16] At first, patients' vital signs, including heart rate and systolic/diastolic blood pressure, were monitored and recorded using a monitoring system. Blood samples (3 ml) were then collected by the researcher through the cephalic vein for measuring the cortisol level before the intervention. The blood samples were immediately transferred to a refrigerator (at 2°C–8°C) and then sent to a centrifugation laboratory in less than hour. Due to the long distance between the intensive care unit and the laboratory, a cold box was used to ensure a constant cold temperature for sample transportation.and assure a steady temperature (between +2 C and +8 C) for plasma. The cold box was used to prevent significant changes in the biochemistry contents of the blood samples and prevent haemolysis. In the intervention group, necessary explanations on how to use the communication board were given to the patients; then, a communication board was given to each patient to communicate his/her needs to the nurse and other members of the treatment team. In the control group, the nurse–patient communication method did not change and stayed the same as before the nurse asked a question repeatedly, and the patient answered non-verbally with body movements. After the intervention, both groups' vital signs were rechecked, and blood samples were collected from both groups for the second time. In the laboratory, blood samples were centrifuged at 4000 rpm, and serum samples were frozen at −77°C. Then, the serum cortisol level was measured by Enzyme-Linked Immunosorbent Assay (ELISA) method by using the Monobind kit made in the US; the normal range of serum cortisol levels was 5–25 μg/dl at morning and half of this values in the afternoon. All laboratory works were performed by a laboratory science expert who was not aware of the identity of the samples.

The data were analyzed using SPSS statistical software. (IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp). Descriptive statistics methods in relative and absolute frequency distribution tables were used to describe the data. The normality of the distribution of quantitative variables before and after the intervention in each group was confirmed using the Kolmogorov–Smirnov test. To test the hypotheses, inferential statistics, including independent *t* test, paired *t* test, Chi-square, and Fisher's exact test were used.

Ethical considerations

Permission to conduct the study was obtained from the Joint Organizational Ethics Committee of Nursing and Midwifery, and Rehabilitation Schools of Tehran University of Medical Sciences. Verbal and written informed consent were obtained from all participating patients. This research has been registered in Tehran University of Medical Sciences with the ethics code IR.TUMS.FNM.REC.1398.108.

Results

Sixty patients were randomly allocated to intervention and control groups. There was no attrition or withdrawal during the study. The mean (SD) age of samples in the control group was 45.70 (5.18) years, and in the experimental group, it was 43.70 (3.65) years. The statistical tests results showed no statistically significant difference between the two groups in terms of age, gender, marital status, education, job, and terms of disease history [Table 1]. Moreover, reviewing the patients' disease history showed no statistically significant difference between the two groups in terms of the type of artificial airway, duration of artificial airway use, and use of drugs affecting hemodynamic parameters and cortisol levels. Thus, the two groups were homogeneous in that regard.

Mean (SD) blood cortisol level before the intervention in the control group was 39.36 (3.77) μg/dl, and in the experimental group was 39.29 (3.69) μg/dl. The independent *t* test did not show a statistically significant difference between the two groups in terms of the mean blood cortisol level (t_{58}= -0.04, p = 0.919). After the intervention, the mean (SD) serum cortisol in the control group was 39.09 (3.81) μg/dl, and in the intervention group, it was 36.04 (4.21) μg/dl. After the intervention, the independent *t* test showed a statistically significant difference between the two groups in terms of the mean serum cortisol level. The mean serum cortisol level in the intervention group was significantly lower than that in the control group (t_{58}=-2.94, p = 0.005). The paired *t* test also showed no statistically significant difference in the serum cortisol level of the control group before and after the routine communication (t_{29} = 1.09, p = 0.295). However, in the intervention group, the serum cortisol level after the intervention was significantly lower than that before intervention (t_{29} = 15.52, p < 0.001) [Table 2].

The paired *t* test showed no statistically significant difference in the control group's vital signs before and after the routine communication. However, in the intervention group, systolic blood pressure (t_{29}=0.31, p = 0.11), diastolic blood pressure (t_{29} = 0.31, p = 0.757), mean arterial pressure (t_{29} = 1.09, p = 0.284), and heart rate (t_{29}=0.92, p = 0.365) after the intervention was significantly lower than those before. In contrast, the independent *t* test showed that after the intervention, systolic blood pressure (t_{29} = 43.50, p < 0.001), diastolic blood pressure (t_{29} = 6.33, p < 0.001), mean arterial pressure (t_{29} = 6.37, p < 0.001), and heart

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Table 1: Demographic characteristics of patients in the groups

Demographic characteristics *n*(%)		Control group *n*(%)	Intervention group *n*(%)	Tests and *p* value
Gender	Male	20 (66.60)	18 (60)	χ^2=0.28
	Female	10 (33.33)	12 (40)	df=1
	Total	30 (100)	30 (100)	*p*=0.592
Marital status	Single	1 (3.33)	2 (6.66)	
	Married	28 (93.33)	28 (93.33)	Fisher=1.34
	Other	1 (3.33)	0 (0)	*p*<0.999
	Total	30 (100)	30 (100)	
Age (Years)	Mean (SD)	45.5 (7.18)	43.3 (7.65)	*t* = −1.13
	Max–Min	56–19	57–23	df=58
				p=0.263
Job	Unemployed	3 (10)	2 (6.66)	
	Labor	3 (10)	6 (20)	
	Employed	3 (10)	4 (13.33)	Fisher=4.89
	Other	9 (30)	6 (20)	*p*=0.443
	Housewife	6 (20)	10 (33.33)	
	Retired	6 (20)	2 (6.660	
	Total	30 (100)	30 (100)	
Educational level	Under diploma	4 (13.33)	1 (3.33)	
	Bachelor	22 (73.33)	23 (76.66)	Fisher=2.09
				p=0.387
Disease condition	Hypertension	1 (3.33)	0 (0)	
	Cardiac disease	1 (3.33)	2 (6.66)	
	Mental disorder	0 (0)	1 (3.33)	
	other	15 (50)	19 (63.33)	Fisher=3.91
	Without disease	13 (43.33)	8 (26.66)	*p*=0.424
	Total	30 (100)	30 (100)	

Table 2: Numerical indices of serum cortisol in patients with artificial airways in the control and intervention groups before and after the intervention

Physiological anxiety Mean (SD)		Control group	Intervention group	t	df	*p* value
		Mean (SD)	Mean (SD)			
Cortisol (µg/dl)	Before Intervention	39.36 (3.77)	39.29 (3.69)	−0.03	58	0.91
	After Intervention	39.09 (3.81)	36.04 (4.21)	−2.94	58	0.005
Paired *t*-test		*t*=1.09 df=29	*t*=15.52 df=29			
		p=0.295	*p*<0.001			

rate (t_{29} = 6.57, $p < 0.001$) in the intervention group were significantly lower than those in the control group [Table 3].

Discussion

Communication plays the most important role between the nurses and patients.[20] However, a range of conditions may interfere with patient communication. One of these conditions is having an artificial airway and the use of mechanical ventilation.[21] One of the most important emotions that these patients experience is anxiety due to the inability to communicate with others.[22] Feeling anxious leads to elevated serum cortisol levels and changes in vital signs.[23] Therefore, establishing proper communication with mechanically ventilated patients and reducing their anxiety is an important issue. Thus, the aim of this study was to investigate the effect of using a communication board on these patients' physiological and anxiety indexes.

In the present study, the serum cortisol level of patients in the control and intervention groups was higher than normal at the beginning of the study. This finding indicates that mechanically ventilated patients are anxious. This finding is consistent with the study by Judith Ann Tate and Engsa Engström.[24,25] Patients who are mechanically ventilated using an artificial airway face many communication problems and barriers. The inability to communicate and express basic needs leads to fear, a sense of despair, and anxiety in these patients.[26] Complementary and alternative communication methods, such as a communication board, can greatly reduce anxiety and fear in these patients.[27]

In this study, after using a communication board and nurse training, patients' serum cortisol levels decreased significantly. There was also a statistically significant difference between the serum cortisol levels of patients who used communication

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Table 3: Numerical indices of vital signs in patients with artificial airways in the control and intervention groups before and after the intervention

Vital signs Mean (SD)		Intervention Mean (SD)	Control Mean (SD)	t	df	*p* value
Systolic blood pressure (mm HG*)	Before intervention	127.66 (9.85)	130.33 (9.80)	−1.05	58	0.298
	After intervention	119.46 (8.66)	128.90 (10.57)	−3.78	58	<0.001
	Paired *t*-test	*t*=43.5 df=29	*t*=1.62 df=29			
		p<0.001	*p*=0.114			
Diastolic blood pressure (mm HG)	Before intervention	82.86 (10.40)	88.40 (12.08)	−1.90	58	0.06
	After intervention	76.36 (10.75)	88.16 (13.18)	−3.79	58	<0.001
	Paired *t*-test	*t*=6.33 df=29	*t*=0.312 df=29			
		p<0.001	*p*=0.757			
Mean arterial pressure (mm HG)	Before intervention	97.80 (9.68)	102.37 (10.57)	−1.74	58	0.08
	After intervention	90.73 (9.59)	101.74 (11.71)	−3.98	58	<0.001
	Paired *t*-test	*t*=6.37 df=29	*t*=1.09 df=29			
		p<0.001	*p*=0.284			
Heart rate (Beats per minute)	Before intervention	90.13 (10.57)	90.26 (10.81)	−0.04	58	0.962
	After intervention	83.46 (11.06)	88.86 (9.93)	−2.09	58	0.041
	Paired *t*-test	*t*=6.57 df=29	*t*=0.92 df=29			
		p<0.001	*p*=0.365			

*Millimeter of mercury

boards compared to patients who communicated routinely. In contrast, after using the communication board, patients' hemodynamic parameters such as heart rate and systolic and diastolic blood pressure decreased significantly, which indicates that the use of the communication board leads to a decrease in anxiety in these patients. A study by Jamsahar *et al*.[19] investigated how patients are transferred from the cardiovascular surgery department to the normal ward and showed that non-pharmacological and educational interventions reduce anxiety and physiological indexes such as cortisol levels in these patients.

A quasi-experimental study by Hosseini *et al*.[28] showed that using a communication board in conscious patients under mechanical ventilation facilitates communication and reduces anxiety. The findings of this study are consistent with the results of the present study, but with the difference that our study was conducted on a sample size that was twice as big as the study by Hosseini *et al*.;[28] moreover, patients' anxiety was assessed with physiological indexes because when the patient cannot communicate properly, the probability of error and bias in completing the anxiety questionnaire will be higher. The study by Zaga *et al*.,[29] which was conducted to evaluate the effectiveness, self-efficacy, and safety of communication methods in mechanically ventilated patients in intensive care units, also confirmed that the effective communication method used by patients was safe and effective; thus, nurses should use it widely to improve communication with patients.[29]

Other studies, including those by El-Soussi *et al*.[16] and Kaur *et al*.,[18] have shown that using a communication board increases patient satisfaction and ultimately reduces mechanically ventilated patients' anxiety. All the aforementioned studies are consistent with the present study, with the difference that in the aforementioned studies, the level of anxiety was measured using questionnaires. However, in the present study, the anxiety level was examined by laboratory and hemodynamic indexes.

In a systematic review, Hoorn *et al*.[30] examined different communication methods in mechanically ventilated patients. One of these methods was using a communication board. They concluded that the use of a communication board was associated with increased satisfaction and reduced stress and anxiety in a large percentage of patients. The difference between this study and the mentioned studies was in the method of measuring anxiety, which examined serum cortisol levels and vital signs as indicators of anxiety. Inclusion of all types of artificial airways (endotracheal tube, nasotracheal tube, and tracheostomy) was also a distinguishing feature of this study. However, there were some limitations to the use of a communication board in their study, including the fact that some patients had certain requests that had not been represented on the board. To avoid such problems in the present study, we tried to examine all patient's needs and include them in the communication board as much as possible.

Conclusion

This study showed that using a communication board to communicate and meet mechanically ventilated patients' basic needs is practical and can effectively reduce the cortisol level and anxiety of these patients. Patients' opinions about the content and sentences included in communication boards are beneficial for the greater efficiency of this tool. Moreover, due to the time limit in using the communication board in this study, it is recommended to use this tool for more extended periods and assess other physiological parameters because of physiological fluctuation of serum cortisol level.

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Acknowledgments

This article is part of a master's degree thesis in medical-surgical nursing, registered with grant number: 46304-100-1-99.

Financial support and sponsorship

Tehran University of Medical Sciences, Tehran, Iran

Conflicts of interest

Nothing to declare.

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