Original Article

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The Effect of Augmentative Alternative Communication on Anxiety in Patients under Mechanical Ventilators in the Intensive Care Unit: Pilot Study

Ni Luh Seri Astuti, R.N., M.N.[1,2], Sri Setiyarini, R.N., Ph.D.[1], Ibrahim Rahmat, R.N., Ph.D.[1]

[1]Basic and Emergency Nursing, Faculty of Medicine, Public Health and Nursing, Gadjah Mada University, Yogyakarta 5581, Indonesia.
[2]STIKES Advaita Medika, Bali 82114, Indonesia.

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Abstract:

Objective: One of the main problems, for patients under a mechanical ventilator, is their inability to verbally communicate. This condition can cause psychological problems; such as anxiety. Additionally, as anxiety must be treated immediately to prevent adverse effects for the patient, one effective strategy is augmentative alternative communication (AAC). Hence, the purpose of this study was to determine the effect of AAC on anxiety in patients, who are on mechanical ventilators.

Material and Methods: This study was pre-experimental, consisting of a one-group pre-test post-test design: conducted using consecutive sampling. The AAC was conducted using a book while the anxiety instrument was the face anxiety scale (FAS). Conducting AAC and measurements of anxiety were carried out by a research assistant. Anxiety was based on anxiety scores and physiological parameters via. Bivariate data analysis using Wilcoxon Sign Rank Test.

Results: The patient's level of anxiety before and after AAC had difference scores of 2, wherein the pre-test was moderate anxiety and the post-test after being given AAC was no anxiety. The physiological parameters, before and after AAC, did not change clinically, because they were still within normal limits. Wilcoxon Sign Rank test results (p-value=0.001) with Cramer's v value (0.21)

Conclusion: AAC has a positive effect having statistically and clinically significant changes in anxiety and has a medium effect size on anxiety level.

Keywords: anxiety, augmentative alternative communication, intensive care unit, mechanical ventilator

Contact: Ni Luh Seri Astuti, R.N., M.N.
Basic and Emergency Nursing, Faculty of Medicine, Public Health and Nursing, Gadjah Mada University, Yogyakarta 5581, Indonesia.
STIKES Advaita Medika, Bali 82114, Indonesia.
E-mail: luhseriastuti12@gmail.com

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Introduction

Although the use of mechanical ventilators in the Intensive Care Unit (ICU) can save the patient's life, its administration also has risks. The risks posed include healthcare-associated infections (HAIS); such as ventilator-associated pneumonia (VAP), psychological problems and other disorders[1]. Another disorder that is still a major problem in the ICU is the patient's inability to speak which causes the inability to communicate verbally[2]. Another side effect of prolonged intubation is damage to the vocal cords wherein the process of vocal cord damage begins with unilateral paralysis[3], which is characterized by hoarseness, dysphonia and vocal fatigue. This process causes patients to experience communication disorders[4].

Nurses in the ICU currently still focus on the physical aspects of patient care, while, the patient wants to overcome pain, breathing problems, suction (suction of mucus) and be able to eat and drink[6]. Additionally, there is often the need for intravenous fluids and other specialized requirements while on a mechanical ventilator in the ICU[7]; therefore, the patient's communication needs are sometimes overlooked[7]. Psychological and emotional problems in patients on mechanical ventilators, due to communication inability, are of various types; starting from feeling uncomfortable, being bored and consequently wanting to do something in bed. 7 Other types include anxiety, depression, fear, anger, frustration, panic and sleep disturbances[5].

According to the Nursing Intervention Classification (NIC), there are various communication aids that can be used for patients on mechanical ventilators in the ICU. The augmentative alternative communication (AAC) method is classified into 2 types; namely based on low technology or high technology[8]. The low-tech communication method is the conventional method with the reasoning being that it uses in media such as; blackboards, paper, picture cards and symbols that can be pointed out directly by the patient. Conversely the high-tech communication methods use methods via the usage of electronic devices[9], the most frequently used AAC method in Indonesia is low-tech AAC.

Anxiety caused by communication problems in patients on mechanical ventilator must be addressed immediately. As the goal is to prevent adverse effects that threaten the patient's life[10]. Hence an AAC communication method is required that can be used to overcome the anxiety of patients on mechanical ventilators. Therefore the aims of this study were (1) to determine the described feelings of anxiety in patients on mechanical ventilators pre-test AAC and (2) to determine the effect of AAC on the anxiety of patients on mechanical ventilators.

Material and Methods

Study design

This research were a pilot study design with a one-group pre-test post-test design. Conducted from May-June 2021.

Participant

The study population was all patients on mechanical ventilators, who were treated in the ICU at the Universitas Gadjah Mada (UGM) Academic Hospital. The sample size was calculated using the Lameshow formula and the sampling technique used consecutive sampling. Inclusion criteria were: patients with an age range of 18 years and above, having good cognitive with compos mentis awareness (GCS: 14-15), being able to understand both oral and written instructions, and being able to read and understand pictures. Exclusion criteria consisted of patients who received moderate to high sedative therapy, were color blind and those having, used a mechanical ventilator <12 hours. There were 17 samples matching the inclusion and exclusion requirements. Two patients dropped out in the middle of the intervention session because they were attached to a mechanical ventilator for <12 hours. Finally, 15 samples actively participated throughout the duration of the trial.

Instrument

The AAC method implemented a guidebook in the form of images that had been modified based on the patient's needs. The AAC instrument was adapted in Bahasa Indonesia by Amila, 10 and continued with the face validity test. The validity test used 3 experts; namely 2 expert nurses in the intensive care unit having a minimum education of master's degree especially expertise in critical nursing and 1 academician having a minimum education of a doctorate with as a critical nursing expert. The results of the validity test stated that AAC was valid. The AAC book was printed in an A4 format. Anxiety variable used face anxiety scale (FAS) from Mckinley[11]. The scale was made on a card measuring 11x42 cm and consists of 5 types of faces with the interpretation of the score pointing to the right and increasing. The anxiety instrument has a strong valid test value with an r-value of 0.89 and a high reliability test value of r=0.888

Intervention

Before any data collection, the researcher provided the information required for the study and obtained informed consent from the patient. The researcher then undertook the information required for the study after receiving. The researcher took the information required for the study after receiving approval. The study began by collecting demographic data of respondents (age, gender, education, length of inpatient) and any data related to anxiety. The AAC method intervention was carried out from the time the patient was awake (CM) for a minimum of 12 hours and a maximum of 48 hours. Prior to the AAC intervention, the sample's level of anxiety was measured by a research assistant based on the respondent's facial expressions which were adjusted to the existing facial scale. After the sample was completed, the intervention was terminated. If samples that received AAC intervention within less than 1x12 hours, upon which the patient's condition then worsened or became critical, wherein they were unable to recover, died or moved to another treatment room, the sample was declared as a dropout. After the intervention of the AAC method was carried out with a minimum of 12 hours or a maximum of 48 hours, the nurse measured the level of post-test anxiety using FAS.

Data collection

The intervention was carried out by research assistants, namely nurses in the ICU room at the UGM Academic Hospital who had received training in the AAC method and anxiety measurement. The nurses involved were given informed consent and involved those whom were willing to become research assistants. To determine agreement and avoid bias the Kappa test was performed. The kappa test was carried out by 2 raters;, namely ICU expert nurses and researchers. The test was conducted on nurses who performed AAC and anxiety, from this the AAC Kappa test value was 0.8, while the anxiety Kappa test value was 1. Additionally, the nurses who performed AAC interventions were different from those who measured anxiety.

Ethical consideration

The research received ethical approval from the Medical and Health Research Ethics Committee of FMPHN (Faculty of Medicine Public Health and Nursing) UGM on April 21, 2021 number KE/FK/0361/EC/2021. After the researcher explained the purpose and objectives of the study clearly, respondents voluntarily signed a consent form to participate in the study. Respondents had the right to refuse to participate in the study without any sanctions. Researchers ensured that participants did not receive any consequences during treatment.

Data Analysis

The univariate analysis aimed to explain the characteristics of each variable of AAC and anxiety. Univariate analysis in this, study was the characteristics of the respondents; namely gender, age, duration of use of AAC, weaning failure and education. Bivariate analysis was conducted to test the hypothesis. Before testing the hypothesis, the data normality test was conducted first. The results showed that the data were not normally distributed, therefore the data were analyzed using non-parametric statistics with the Wilcoxon Sign Rank test. The test was continued with the Cramer's v to determine the effect of the intervention on the outcome. The degree of confidence used was 95% ($\alpha<0.05$).

Results

Respondents Characteristics

Table 1 shows That the highest number of the participant were women, accounting for 9 patients (60%). The highest proportion was within the age range of 46–55 years by 7 (46.7%), which had a median of 54 years the youngest age being 38, while the oldest was 71 years. The highest patient length of stay was 2 days, with a sum of 8 (53.3%). The majority of patient education was graduation from elementary school, with a total of 10 people (66.7%). Most of the patients did not experience weaning failure, approximately 14 (93.4%).

The overview of anxiety in patients on mechanical ventilators in the ICU before intervention (pre-test) of AAC communication method

Table 2 shows the overview of anxiety before the intervention as can be seen in 2 (two) parameters; namely anxiety parameters and physiological parameters. Based on Table 2, the highest anxiety parameter is slightly anxious; among 6 respondents (40.05). Physiological parameters: such as systole, have a mean of 128.9 mmHg. The patient's diastolic before the AAC method was given was 77.4 mmHg.

Table 1 Frequency distribution of respondents characteristics (n=15)

Description	Category	n	%	Median (min–max)
Gender	Male	6	40.0	
	Female	9	60.0	
				54 (38–71)
Age (years)	36–45	4	26.7	
	46–55	7	46.7	
	56–65	2	13.3	
	66–75	2	13.3	
The length on MV (days)	2	8	53.3	
	3	3	20.0	
	4	1	6.7	
	7	1	6.7	
	14	2	13.3	
Education	Elementary school	10	66.7	
	Junior high school	1	6.7	
	Senior high school	1	6.7	
	Diploma	1	6.7	
	Undergraduate	2	13.3	
Weaning failure	Yes	1	6.7	
	No	14	93.3	

MV=mechanical ventilation

With the mean pulse rate being 90.9 beats/minute. The respiratory rate has an average of 16x/minute, while the majority of respondents' electrocardiogram (ECG) rhythm descriptions are sinus rhythmic.

The effect of AAC on anxiety in patients on mechanical ventilators in the ICU of the UGM Academic Hospital

Based on the results of the Wilcoxon test in Table 3, it was found that there was a significant difference in anxiety in the pre-test and post-test measurements with a p-value of <0.05; namely p: 0.001. The difference in the decrease in anxiety is 2 which is greater than 1.33. Therefore it can be concluded that clinically the decrease in anxiety is significant[12]. Interestingly, the search of the magnitude of the effect between the AAC intervention and anxiety using Cramer's v. revealed the value of Cramer's v=0.21; therefore, it can be concluded that the AAC method clinically has a medium effect size on reducing anxiety[13].

Table 4 shows that physiological parameters experiencing statistically significant changes were pulse frequency with a difference of 9.47 and a p-value of 0.038. ECG rhythm also experienced a statistically significant change with a p-value of 0.014. Clinically, changes in pulse rate are not significant as the values fall within in normal range, while changes in ECG rhythm can be declared

Table 2 Anxiety and physiological parameters pre-test (before) AAC method in the ICU of the Academic Hospital UGM May-June 2021 (n=15)

Parameter	Category	n (%)	Average ± standard deviation	Median (min-max)
Anxiety	Not anxious	0 (0.0)	2.87±0.84	3 (2–4)
	A little anxious	6 (40,0)		
	Moderate anxious	5 (33.3)		
	Very anxious	4 (26.7)		
	Paniced	0 (0.0)		
Systole			128.9±21.0	
Diastole			77.4±8.8	
Pulse			90.9±18.7	
Respiratory rate				16 (12–31)
ECG Rhythm	Sine rhythm	9 (60)		
	Sine tachycardia	6 (40)		

ECG=electrocardiogram

Table 3 The comparison of anxiety scores before and after AAC intervention

	Average ±standard deviation	Median (min-max)	Difference	p-value	Effect size coefficient r
Pre-test	2.87±0.84	3 (2–4)	2	0.001*	0.6*
Post-test	1.33±0.62	1 (1–3)			

Description: p-value=significance value, significant difference in anxiety reduction=≥1.33, *=significance, effect size, with a value of 0.1-0.3= small effect, 0.3-0.5=intermediate effect, >0.5=strong effect

Table 4 The comparison of physiological parameters of anxiety before and after AAC intervention

Parameter	Pre	Post	Difference	p-value
Systolic	128.9±21.0	124.4±19.5	4.47	0.087
Diastoli	77.4±8.8	75.1±9.9	2.27	0.256
Pulse rate	90.9±18.7	81.5±12.9	9.47	0.038*
Respiratory rate	16 (12–31)	18 (12–21)	2	0.396
ECG rhythm				0.014*
Sine rhythm	9 (60%)	15 (100%)		
Sine tachycardia	6 (40%)	0 (0%)		

Description: p-value=significance, ECG=electrocardiogram, ±=standard deviation, *significance, sine rhythm=normal rhythm of the heart's electrical activity

clinically significant. There were 6 (40%) respondents with rhythm disturbances in the pre-test ECG rhythm of the AAC intervention. After receiving the AAC intervention, all respondents had a normal heart, and sinus rhythm (100%).

Discussion

The overview of anxiety in patients on mechanical ventilators in the ICU before intervention (pre-test) of the AAC communication method

The results of these study in Table 2 show that patients on mechanical ventilators before being given AAC intervention had a mean anxiety score of 2.87. The mean score of 2.87 is included in the medium score category. Based on the assessment data, it was found that there were several causes for the patient to feel moderately anxious. The first is the inability to communicate while on a mechanical ventilator. The second is the lack of information regarding their condition during hospitalization in the ICU. The third is the unfamiliar ICU care environment, and lastly is the patient's inability to breath due to insufficient air.

As to the inability to communicate while on a mechanical ventilator, these results are relatively similar to the research conducted by Aghaie[14]. Accordingly[15], patients who have an endotracheal tube (ETT) installed will have this pass through the respiratory tract; especially the upper respiratory tract. This makes it difficult for the patient to make a sound when speaking, and this situation causes the patient experience a failure in the verbal so that they are unable to interact with other people. Furthermore this communication failure can cause patients to feel anxious and feel as if they are not fully human[16].

As to the lack of information concerning the patients condition during hospitalization in the ICU, according to Jackson[19], patients who suffer from an illness and are on a respirator for the first time often do not have knowledge in regards to their conditions. This ignorance makes the patient feel uneasy, restless and anxious, therefore therapeutic communication is required to overcome the patient's psychosocial problems[20]. The function of communication is to improve the quality of individual knowledge with the aim of improving health outcomes via various information related to their health conditions. Patients who receive enough information will feel calmer[17]. Another cause of anxiety expressed by the patients in this study was the unfamiliar ICU care environment. These results are in line with the aformentioned research[17]. The reality for most is that they are faced by the fact that may share a room with other people; especially if the person next to them is in a state of death. This condition may also trigger the feeling that being in the ICU is like being in a room synonymous with misery and death[5,17,20].

The patient's inability to breathe due to insufficient air is also another cause of anxiety. These results are similar to those of Chlan[20] and research by Engstrom[17]. According to Rex22, patients who are attached to a mechanical ventilator will be disturbed by the ETT tube or hose, causing pain[24]. The pain caused makes the patient worried that they will not get enough oxygen hence the patient becomes anxious and panicked[25]. Overall, in this study, the patient's physiological parameters were still in the normal range. This supports the theory that the physiological response of individuals having moderate levels of anxiety is an increase in pulse rate which is in line with the rhythm of the ECG, blood pressure and respiratory rate. However this increase is not clinically significant because it is still within normal state[25].

Based on the results of this study, the average patient's systolic blood pressure was 128.9 mmHg. According to Smeltzer[27], systolic blood pressure in adult patients has a normal range of 120–127 mmHg, while the diastolic blood pressure between is 73.5–74.5 mmHg. A systolic blood pressure of 128.9 mmHg is at the upper limit of normal and has been included in the pre-hypertension category. Likewise, a diastolic blood pressure of 77.8 mmHg is included in the highest upper normal threshold. According to the theory, the explanation is that anxiety provides a stimulus to the sympathetic nervous system in the release of epinephrine and norepinephrine[28]. The secretion of epinephrine and norepinephrine into the blood by the glands is also the work of the sympathetic nerves in the adrenal medulla[29]. The heart, veins and arterioles experience strong vasoconstriction caused by norepinephrine but not strong epinephrine30. This physiological response to stressors is a both protective and adaptive mechanism to maintain body homeostasis[23]. Maintaining homeostasis also involves hormonal and neural actions that are activated by the hypothalamus; then, the hypothalamus will control neural and endocrine responses to anxiety[14]. Secretion is first by sympathetic nerves which is then followed by adrenal medullary stimulation; additionally, the pituitary hypothalamus will be activated if anxiety persists[31]. The response and action of the sympathetic nervous system are very fast, as norepinephrine exits through the nerve endings that are in direct contact with the target organ. This can improve the function of vital organs such as peripheral vasoconstriction resulting in an increase in blood pressure[5,27].

The second physiological parameter is the pulse rate. Based on the results of this study, the mean pulse rate of the pre-test AAC method was 90.9x/minute, this result is in line with the research. Anxiety will affect the activity of the central nervous system to activate the hypothalamus, pituitary, adrenal axis and parasympathetic nerves[30]. Which then causes an increase in the pulse rate. Patients who experience moderate anxiety will not experience a significant change in pulse rate, which is above 100x/minute[33]. However, according to Levinson[34], changes in pulse are not associated with patients that have less anxiety. Patients who experience an increase in pulse rate are patients who have a range of moderate to panic anxiety[35]. The mean pre-test pulse rate in this study, was within the normal range and via monitoring of the ECG, the mean normal, sinus rhythm was observed.

Based on these results, the mean respiratory rate was 16x/minute with the lowest rate being 12x/minute and the highest being 31x/minute. The results of this study are similar to the research conducted by Rosenthal[14] which showed that the patient's average respiratory rate was 17x/minute. According to the Nursing Center 36, patients on a mechanical ventilator will have their breathing set at 10–20x/minute. Therefore, it can be concluded that patients who experience a little anxiety have a respiratory rate within the normal range. Meanwhile, patients who have a respiratory rate of 31x/minute have not been able to adapt to a mechanical ventilator hence patients are anxious[14]. This causes an increase in the hormone adrenaline; there by, increasing the respiratory rate[31].

The effect of AAC on anxiety in patients on mechanical ventilators in the ICU of the UGM Academic Hospital

Based on Table 3, significant values were shown both statistically and clinically. Statistically, it can be seen from the value of p-value=0.001: <0.05, while clinically, there is a difference in decline, with a value of 2. The decrease in FAS anxiety is considered clinically significant as 1.3313. AAC also has a medium effect on reducing anxiety as indicated by the value of Cramer's v=0.21.

Several factors indicate the advantages of AAC in reducing patient anxiety in the ICU. These advantages are able to have a major influence on reducing anxiety in patients on mechanical ventilators. The first is the excellent acceptance of AAC by nurses as research assistants. The second is to facilitate communication between nurses and patients and the third is that the images on the AAC represent most of the patient's needs while using a mechanical ventilator.

This study found good acceptance of AAC by nurses. These results are in line with the research of Hanberd[10] and Hosseini[38]. Before usage of the AAC method, communication faced many challenges. Nurses stated that they often gave up communicating with patients on mechanical ventilators. When the patient tries to communicate, the nurse does not understand hence the patient feels anxious[40]. Similar results were also presented by Grossbach[9] that during the seminar, nurses considered AAC very important to be implemented in the ICU. The AAC method should be used as the standard for patient communication in the ICU[40]. According to Karlsson[16], a good welcome is able to stimulate the motivation of nurses in providing services additionally, AAC makes it easier for nurses to meet patient communication needs.

The second factor is the ease of communication. Similar results were presented by Grossbach[9]. According to Karlsson[16], communication between nurses and patients will increase interaction; therefore, they can optimize patient care. Patients realize that the images in low-tech AAC are able to represent their feelings and the ease of expressing all of these things can reduce patient anxiety[39]. The images on the AAC represent most of the patient's needs while on a mechanical ventilator and these results are in line with the research of Carruthers. According to Amila[11], patients facilitated by the AAC method to express pain have an increase in the accuracy of their therapy. The decrease in pain can make the patient calmer and not anxious[40]. Additionally, nurses can easily provide interventions according to patient complaints, so that patients anxiety decreases[11,40].

AAC has a great influence on the anxiety of patients that are attached to mechanical ventilators. According to researchers[14], AAC communication improves the quality of care in the ICU. These results are in line with the research of El-Soussi[36], in that there is an increase in effective communication between nurses and patients, especially the things that are most felt to threaten their condition and treatments to overcome them.

Prior research revealed the findings that effective communication between nurses and patients is the basis for providing good care[31]. Effective communication has 2 main functions, namely instrumental exchange and affective function. Instrumental exchange focuses on the tasks of providing care, information exchange and discussion of health issues[40]. This positive relationship will increase the interaction between nurses and patients thereby reducing patient anxiety.

Table 4 shows that the effect of AAC on anxiety can also be seen from the patient's physiological parameters. In this study, it was found that the difference between the pre-test and post-test values of systolic pressure was 4.47 mmHg. Statistically and clinically, this decrease was not significant, the same was true for diastolic pressure. There was a decrease of 2.27 mmHg. And these results

are in line with the research of Levinson[34] and Margret[37]. The second physiological parameter is the pulse rate. The results showed that the difference in post-test AAC pulse reduction was 9.47x/minute with an average pulse rate of 81.5x/minute and p-value=0.038. It can therefore concluded that the pulse rate after receiving the AAC intervention decreased statistically, significant; however this was not clinically significant. The normal value of the pulse rate was also observed through a normal ECG monitor; and sinus rhythm. ECG parameters were statistically and clinically significant because after the AAC intervention 100% of respondents' ECG rhythms were either sinus rhythmic or normal. These results are in line with research conducted by Broyles[33]. Another physiological parameter is respiratory rate. Based on the results of the study, it was shown that the difference in the decrease in respiratory rate after AAC intervention yielded a value of 2 with an average frequency of 18x/minute and indicated p-value=0.396. Statistically and clinically, the decrease in respiratory rate was not significant. The results of this study are in line with the research conducted by Karlsson[16]. Researchers concluded that the AAC intervention did not have a clinically significant effect on physiological parameters therefore it was safe to apply for patients who were on mechanical ventilators.

The researcher is aware that this study has a number of restrictions that should be taken into account for future work. These restrictions include the study's design and the small number of samples it used. This was because this study was conducted during the COVID-19 pandemic.

Conclusion

The category of anxiety scores was moderate anxiety while the physiological parameters did not experience clinical disturbances and were still in the normal range. However, there was a statistically and clinically significant effect, and this showed benefits of AAC implementation on the anxiety of patients on mechanical ventilators.

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Conflict of interest

All of the authors of this manuscript have no conflict of interest to declare.

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