



# The Effect of Virtual Reality on Anxiety in Patients Admitted to the Cardiac Care Unit

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## ABSTRACT

Background: By stimulating the sympathetic nerves, anxiety exacerbates cardiac ischemia, arrhythmias and heart failure. Applying virtual reality technology as a simple, non-invasive and low-cost method can alleviate the anxiety in patients hospitalized in cardiac care units through the distraction of thought. The present investigation aimed at examining the influence of virtual reality on the anxiety level of patients admitted to the CCUs. Methods: The current study is a clinical trial research conducted on 60 patients hospitalized in Cardiac Care Unit (CCU) of Shahid Modarres Hospital of Kashmar. Random selection method was used to choose the samples, then they were appointed into two groups of control and intervention (virtual reality) by the method of Permuted Block Randomization. The anxiety level was measured on the second day of admission and two days later using Spielberger's Test Anxiety Inventory (STAI). The phase of intervention was administered in the form of playing high quality videos of natural landscapes in 15-minutes interval through the virtual reality headset on the second and third night of the admission. Data analysis was performed using SPSS 20, as well as descriptive and inferential statistics (Chi-square, independent T, paired t-test). Results: The mean anxiety score of the intervention group was significantly decreased after the intervention ( $P < 0.001$ ). There was also a significant difference between the mean score of anxiety in the intervention group and the control group ( $P < 0.001$ ). Conclusion: Employing virtual reality technology exhibiting relaxing images of natural landscapes can effectively reduce the anxiety in hospitalized patients in the cardiac care unit. Nurses can particularly use this technology to improve their relaxing services provided to patients.

**Key Words:** Virtual Reality, Anxiety, cardiac Care Unit, CCU.

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## INTRODUCTION

Cardiovascular diseases are among the most common diseases in human societies [1], being responsible for more than 30% of deaths in the industrialized world [2]. Based on World Health Organization, cardiovascular diseases would be responsible for 44.4% of deaths worldwide by the year 2030 [1]. Studies have shown that 1.5 million Americans suffer from myocardial infarction

each year, 500,000 of which lead to death [3]. In Iran, cardiovascular diseases have grown remarkably compared to the previous years, and mortality from these diseases has been risen from 27% to 46% [2, 3]. Of the total number of 700 to 800 deaths per day in the country, 317 of them are due to cardiovascular diseases, of which 166 were reported due to myocardial infarction [4]. Cardiovascular diseases not only account for high mortality rates, but also plague the quality of life of the

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patients by unsettling their general health due to their incapacitating nature, thus leading to lower life expectancy [5]. Many patients are referred to Cardiac Care Units due to heart disease, the most prominent of which are Acute coronary syndrome (ACS) and Myocardial infarction (MI) [6]. Patients hospitalized in the CCUs were challenged with several stressors that rather intensify their anxiety. Anxiety increases the cardiac load and has been related to the increase in complications and adverse outcomes in patients [7]. Based on evidence from some studies, 50 to 90 percent of patients suffering from acute coronary syndrome experience anxiety, patients admitted to CCUs face severe anxiety in the first 48 hours [5, 8]. Factors such as fear of death and uncertainty about the future life, lack of awareness about care methods and family expectations from patients cause significant anxiety in these patients. Anxiety can correspond to trait or state. State anxiety is usually situational, abrupt and short-lived, leading to agitation, tension, excessive response to the situation, and inconsistent coping behaviors. Trait anxiety is usually long-lasting, causing the patient to consider most situations as dangerous and threatening needing radical responses [7]. Both types of anxiety stimulate the sympathetic nerves and lead to the secretion of epinephrine and norepinephrine, ultimately causing heart impairment, dysrhythmia, ischemia, heart failure, and delirium [9]. Crowley et al. reported that state and trait anxiety are associated with a control impairment of the vagus nerve in the heart [10]. Miu et al. reported the association between trait anxiety and heart rate and rhythm [11]. Although using mild sedative and hypnotic drugs may reduce anxiety, they come with side-effects like fatigue, confusion, or agitation [3]. Nursing researchers are pursuing non-prescriptive therapies to treat anxiety in patients who are admitted to CCUs due to long-term ineffectiveness of drug and harmful effects of sleeping medications [4]. Music therapy, therapeutic touch and continuous muscle relaxation are among non-pharmacological methods employed for controlling anxiety. One of the methods that have been recently used in the field of medicine is Virtual Reality (VR) [12]. Virtual reality is a new technology that, the user not only feels the physical presence in a virtual world, but can also interact constructively with that environment. This technology offers high-quality 3D images on its sensor [12]. Giordano concluded in his research that virtual reality technology can play an important role in improving psychological symptoms, particularly anxiety [13]. Researchers also compared the effect of relaxation techniques with virtual reality technology and the traditional method of relaxation in people with anxiety. The findings showed that the modern relaxation methods using virtual reality technology is more effective in the reduction of anxiety compared to rather traditional

methods, ultimately leading to the improvement of the life quality [14]. Ganry et al. reported that using VR with relaxing images for 5 minutes significantly decreases the level of anxiety in patients in line for surgery.

Virtual reality has been recently introduced as a way of managing and alleviating pain and distress in a wide range of painful medical practices, such as blood transfusions, wound care, chemotherapy, dental treatments and immunization [15]. The virtual reality technique is easy and non-invasive, and can be used indefinitely and without recurring costs, does not require a high level of personnel training, and costs less than many other intervention methods such as hypnosis and drug therapy [16].

Hence, awareness of effective non-pharmacological interventions in reducing cardiac anxiety is of great interest to nurses, so that they can alleviate stress in patient with non-pharmacological methods that are less associated with side effects. Given the high prevalence and unwelcome effects of anxiety on patients with Ischemic heart diseases, and due to the numerous side effects of anxiety-reducing drugs, the researchers sought to examine the influence of virtual reality on anxiety level in patients admitted in cardiac care units.

#### **METHODS AND MATERIALS:**

The current study is a clinical trial performed on 60 patients admitted to the Cardiac Care Unit of Shahid Modarres Hospital of Kashmar, Iran, during months of May to July 2018. The samples were randomly chosen and assigned to control and intervention groups by permutation block method. Criteria for entering the study included written informed consent to take part in the study, completion and signature of the consent form; age of 30 to 60 years; high level of awareness (awareness of time, place and persons), and not afflicted with mental disorders (based on medical records); lack of severe pain due to underlying illness; no drug addiction or strong analgesia; no history of a recent crisis, such as the death of relatives of the first degree in the past six months; the absence of narcotic drugs 5 to 6 hours before bedtime; the absence of visual and auditory disorders, and hemodynamic stability; not having a known sleep-disturbing disorder (such as rheumatoid arthritis, migraine, etc.); and having no known sleep disorder before the heart. Exit criteria included the patient's unwillingness to continue to participate in the study; the discharge or transfer of the patient to the other wards before three nights; hemodynamic impairment during the study; decreased consciousness; the need to take opiate and/or sedatives 6 hours before bedtime.

The instrument used in this study were demographic information questionnaire and Spielberger State-Trait

Anxiety Inventory. The demographic information form included age, gender, occupation, marital status, educational level, known underlying illnesses, consumption of drinks affecting sleep (tea, coffee, etc.), and smoking. This questionnaire was prepared after studying of the applicable sources on the subject of research and using the experts' comments regarding the necessary reforms. State-Trait Anxiety Inventory includes two separate questionnaires for state- and trait-related anxiety. Both questionnaires, each containing 20 items, is answered on the Likert scale. For items with positive attitudes in the state anxiety questionnaire (items 1, 5, 8, 10, 11, 16 and 20), the following scores are assigned: 4 for never, 3 for sometimes, 2 for most of the times, and 1 for almost always. Items with negative attitudes (items 3, 4, 6, 7, 10, 11, 13, 14, 17, 18) are scored inversely. In the state anxiety questionnaire, positive items (including questions 1, 3, 6, 7, 10, 11, 13, 14, 16, 19) and negative ones (including numbers 2, 4, 5, 8, 9, 12, 15, 17, and 18) are calculated as above. The scores of each anxiety questionnaire vary from 20 to 80. Scores 20-42 were regarded as mild anxiety, scores 42 to 64 were considered as moderate anxiety and scores 65 to 80 were considered as severe anxiety. The validity and reliability of the Spielberger questionnaire were confirmed by Spielberg in 1983 [17, 18].

In a study in Tehran, the content validity of the Spielberger anxiety test was confirmed by the professors of the University of Tehran and its reliability coefficient was calculated to be 94% with Cronbach's alpha [19].

Data collection was conducted after the final approval of the research project at the Graduate Council of the Faculty of Nursing of Gonabad University of Medical Sciences and coordinating with the treatment centers and relevant authorities, and approval by the Regional Committee for Ethics in the Gonabad University of Medical Sciences (IR.GMU.REC.1397.005) and The registration at the Iranian Center for Clinical Trials (IRCT20180517039698N1).

After receiving written consent from the research units, the samples were randomly appointed to two groups of intervention and control using permutation blocks (15 quadruple blocks).

For the control group, the researcher visited the patients, introduced herself, and obtained written consent from them. Then, the demographic information questionnaire, and after the first night of admission (the second morning), Spielberger State-Trait Anxiety Inventory, which includes 40 quadrant questions, was read out to the patient and marked by a response. During the two nights of admission, there was no intervention devised for the patient other than the usual care. At the end of the third night (morning of the fourth day of admission), the researcher completed the anxiety inventory.

for the intervention group, the initial phases were performed similar to the control group, except that on the second and third night of admission, the patients were exhibited a virtual reality video featuring relaxing and high-quality images of the nature in 15-minute interval. The tool used for virtual reality technique was a virtual reality headset device (Remax-RT-V03 audio-visual glasses with internal memory). After the third night of the intervention (on the morning of the fourth day of admission), the patient's anxiety level was measured again by the researcher and then compared with the pre-intervention and control group.

Descriptive statistics and inferential statistics methods using SPSS software version 20 were used to analyze the collected data. Descriptive statistics were used to identify the central tendency and dispersion indices for quantitative variables and frequency determination for qualitative variables. Independent t-test, fisher and paired t-test were used to test the hypothesis and achieve the goals. The results of the statistical tests were considered to be less than 5% significant.

## FINDINGS

The demographic characteristics of the two groups are presented in Table 1.

According to Table 1, the two groups are homogeneous in terms of demographic characteristics. According to the results of the study, which is shown in Table 2, the two groups don't have a significant difference in the state anxiety ( $P = 0.09$ ), trait anxiety ( $P = 0.95$ ) and general anxiety ( $P = 0.17$ ) before intervention. Moreover, the results of Independent t-test showed significant changes in the mean of anxiety scores between the two groups after intervention ( $P < 0.001$ ). Also, based on the results of paired t-test, there was no significant difference between the mean state anxiety scores in the control group ( $P = 0.055$ ), while the mean difference in the intervention group was significant ( $P < 0.001$ ).

**Table 1: The Demographic Characteristics of the Research Units**

Variable	Group	Control Frequency (%)	Intervention Frequency (%)	P
Age	Mean±SD	49.92±7	52.03±6	**P=0.13
Gender	Male	15 (50)	15 (50)	*P=1
	Female	15 (50)	15 (50)	
Income Level	Low	3 (10)	2 (6)	*P=0.82
	Medium	15 (50)	14 (46)	
	High	12 (40)	14 (46)	
Educational Degree	School education	16 (53)	22 (73)	*P=0.43
	Diploma	11 (36)	6 (20)	
	Above	3 (11)	2 (7)	

	<b>Diploma</b>			
<b>Marital Status</b>	<b>Single</b>	1 (3)	0	***P=0.52
	<b>Married</b>	26 (83)	27 (90)	
	<b>Deceased spouse</b>	3 (11)	3 (10)	
<b>Occupation status</b>	<b>Employee</b>	4 (13)	2 (6)	*P=0.75
	<b>Free trader</b>	11 (36)	13 (43)	
	<b>Retired</b>	2 (6)	1 (3)	
	<b>Housekeeper</b>	13 (43)	14 (46)	
<b>Place of Residence</b>	<b>Urban</b>	16 (53)	16 (53)	*P=1
	<b>Village</b>	14 (46)	14 (46)	
<b>Background Diseases</b>	<b>Blood pressure</b>	8 (26)	9 (30)	*P=0.91
	<b>Diabetes</b>	6 (20)	7 (23)	
	<b>Blood Fat</b>	4 (13)	5 (16)	
	<b>Obesity</b>	6 (20)	4 (13)	
	<b>Other</b>	2 (6)	3 (10)	
	<b>Items</b>	4 (13)	2 (6)	
<b>Consumption of Drinks</b>	<b>Tea</b>	16 (53)	18 (60)	*P=0.79
	<b>No</b>	14 (46)	12 (40)	
<b>Smoking</b>	<b>No</b>	25 (83)	25 (83)	*P=1
	<b>Yes</b>	5 (16)	5 (16)	

Chi-square\*, independent T\*\*, Fishers exact test\*\*\*

The results of the statistical tests regarding trait anxiety showed significant changes after the intervention between the control group and the intervention group ( $P < 0.001$ ). According to Table 2, no significant difference was found between the mean of trait anxiety before and after the intervention in the control group ( $P = 0.06$ ), while in the intervention group, there was a statistically meaningful decrease ( $P < 0.001$ ).

The mean of total anxiety scores before and after the intervention in both groups was significantly different ( $P < 0.001$ ). Moreover, the results of paired t-test indicated that the mean difference between the total anxiety score before and after the intervention in the control group was not significantly different ( $P = 0.94$ ), while it was decreased significantly for the intervention group ( $P < 0.001$ ).

**Table 2: Comparison of the mean of anxiety score before and after the intervention in two groups**

Phase	Group	Control Mean±SD	Intervention Mean±SD	P*
<b>State Anxiety</b>	Before intervention	53.3±6.48	56.40±7.31	p=0.09 p<0.001
	After intervention	56.56±6.62	34.66±3.67	
		p=0.055	p<0.001	
<b>Trait Anxiety</b>	Before intervention	60.86±5.82	60.80±3.18	p=0.95 p=0.001
	After intervention	59.46±4.01	34.93±3.46	
		p=0.06	P<0.001	

<b>Overall Anxiety</b>	Before intervention	114.2±9.34	117.2±7.67	p=0.17 p<0.001
	After intervention	114.03±9.31	69.60±6.47	
		p=0.94	p<0.001	
		P**		

independent T\*, paired t-test\*\*

## DISCUSSION AND CONCLUSION:

It can be established from the findings of this study that the use of virtual reality technology bearing relaxing images of natural landscape can greatly alleviate the anxiety of patients admitted to the cardiac care units. The findings of this study regarding the test group are consistent with the results of other studies conducted in this field. The study by Ganry et al. in 2018 showed that the use of nature images with virtual reality technology for five minutes significantly reduced the anxiety among outpatient candidates [16]. Also, Soleimani et al. verified that effectiveness of employing the technology of virtual reality for curing the anxiety disorders [20]. In the study of Ali Akbari et al. (2017), the influence of virtual reality technology on psychological disorders in people with cancer was measured. The psychological disorders in this study were the components of anxiety, depression and stress that the results of the analysis showed that this Technology has a significant effect on reducing the psychological symptoms of cancer patients [21]. In a study by Arne et al. In 2017 to examine the influence of virtual reality on children's pain and anxiety management, it was found that the use of virtual reality imagery to reduce pain and anxiety in patients is much more effective than current standard care [22].

Giordano research, which studies the impact of virtual technology on the improvement of psychological symptoms, especially stress in cancer patients, has shown that this technology helps patients experience higher levels of mental health [23]. Moreover, Vilani et al. showed in their research that the virtual reality technology, along with other relaxation techniques, plays an important role in alleviating the symptoms of anxiety [14].

Among the reasons for the positive effect of this technology is the visual and auditory nature and simulations in which the patients, while being aware of its unrealism, interact with the environment [21].

Anxiety affects the physiological responses of patients including heart rate, respiration, blood pressure and plasma concentration in epinephrine and norepinephrine [24]. Therefore, it goes without saying that nurses, especially nurses of cardiac care unit, should identify anxiety and its cause in the patient, and do their best to resolve it. Given the side effects of anxiety-reducing medications, familiarity with modern non-

pharmacological methods such as virtual reality is a valuable development in nursing practices. Therefore, it is recommended that non-pharmacological nursing interventions, such as employing virtual reality imagery, be used as a laid-back, non-invasive, low-cost, cost-effective way, without the need for more staff training, as alternatives to pharmaceutical methods or complementary therapies.

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