Medical - Surgical Nursing Journal 2016; 4(4): 35-40.

Published online 2016 February 16 Original Article

Effect of music on pain intensity among patients with loss of consciousness in an intensive care unit

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ARTICLE INFO

Article history:

Received: 14 September 2015
Revised: 19 December 2015
Accepted: 21 December 2015

Key words:

Pain
Music
Loss of consciousness
Intensive care unit

ABSTRACT

Background: Patients with loss of consciousness experience pain as a result of invasive procedures, mechanical ventilation, and the physical setting of the intensive care unit (ICU). The current study was conducted to determine the effect of music on pain intensity among ICU-admitted patients with loss of consciousness.

Methods: In this clinical trial, the study population consisted of intubated patients under mechanical ventilation, who were admitted to the ICU of a hospital in Zahedan, Iran in 2015. A total of 60 eligible patients were selected through convenience sampling and were divided into intervention (listening to music) and control groups (n=30 per group), using permuted-block randomization. During the intervention, the patients were exposed to Arnd Stein's instrumental music (via headphones), which was played in three 30-min sessions. On the other hand, the control group only received routine care for pain relief. Pain measurement was performed through Behavioural Pain Scale (BPS) at 5 min before the intervention and immediately after listening to music. In the control group, pain measurements were carried out within the same time intervals as the intervention group. For statistical analysis, independent t-test, paired t-test, Chi-square, and analysis of covariance (ANCOVA) were performed, using SPSS version15.

Results: Evaluation of the mean pain scores over three days of the intervention showed a major decline in the intervention group ($P<0.0001$). The difference was significant between the intervention and control groups ($P<0.0001$). However, as the findings revealed, the difference in the control group was insignificant.

Conclusion: According to the results of the present study, music can reduce pain intensity among patients with loss of consciousness. Therefore, this type of therapy can be used as a simple and practical method for pain relief.

1. Introduction

Pain is one of the most common and important problems among patients hospitalized in intensive care units (ICUs).[1] Pain, as a health-threatening phenomenon, requires particular attention by the medical staff. In fact, considering the importance of this phenomenon, the American Pain Society has introduced pain as the "fifth vital sign".[2] According to the literature, pain leads to the increased activity of the neuroendocrine system, improves the sympathetic tone and risk of tachycardia, and enhances myocardial oxygen demand. In addition, pain results in immunosuppression, increases the risk of hypercoagulation and catabolism, leads to physical limitations and respiratory problems, and impacts the patient's ability to leave the hospital bed.[3]

Pain can be considered as an important medical presentation in all patients. ICU-admitted patients experience pain as an important and stressful issue. Acute diseases, surgery, trauma, invasive procedures, and medical/nursing interventions are among the common causes of pain among patients.[4] In addition, ICU-admitted patients with loss of consciousness require mechanical ventilation, which is itself an important cause of pain,[5] requiring special care by the medical staff and nurses. However, pain is neglected in the majority of these cases, as the patients are assumed to be incapable of feeling or expressing pain due to lack of consciousness.[6] Pain measurement in patients with loss of consciousness can be challenging due to different factors, such as

the patient's inability to communicate (due to loss of consciousness), use of analgesics, and mechanical ventilation. Therefore, inadequate pain management for such cases is a greater problem in nursing care in comparison with pain control in conscious patients.[7]

Considering the high prevalence of pain during rest (33%) and medical interventions (56%),[8] accurate assessment by nurses and adoption of appropriate measures for pain management and alleviation are essential for ICU-admitted patients. Use of pharmacological and non-pharmacological interventions is among the possible options for pain management, although each intervention is associated with particular side-effects. For instance, although narcotics are regarded as effective analgesics, they may lead to adverse side-effects such as respiratory suppression, deep sedation, gastrointestinal symptoms, urinary retention, and hemodynamic instability.[1] Moreover, intravenous pain medications can cause complications such as infection and embolism.[9] Today, in addition to pharmacological methods, particular attention is being paid to nursing care strategies, such as guided imagery, progressive muscle relaxation, and music therapy.[10]

Music therapy is a cost-effective, non-invasive method, which can be simply applied by nurses, alongside other nursing strategies.[11] The ideal music for therapeutic purposes and stress relief is characterized by a steady rhythm, a low frequency, a relaxing melody, and a beat pattern of 60-80 beats per minute.[12] In addition, the music should have a steady tone and sound to prevent negative impacts on the listener.[13] Application of music therapy, as a branch of alternative medicine, has been proposed for the promotion of health indicators. According to the literature, music therapy as a nursing intervention can lead to a decline in treatment side-effects and medical costs.[14, 15]

In this regard, in a study by Naderi et al. (2014), music therapy could reduce pain intensity during dressing changes in burn patients.[16] In addition, in a study by Abolhasani et al. (2008), complementary therapies such as massage and music therapy could alleviate chest pain in patients hospitalized in the coronary care unit.[17] The effects of music therapy on pain management have been studied in conscious patients who can express their pain. However, since pain is often neglected in unconscious patients, pain assessment and management can be quite challenging for ICU nurses;[6] therefore, more evaluations are required in this area.

Further research is highly recommended on music therapy, as a cost-effective and complication-free strategy in comparison with widely-used narcotics, which can induce physical and mental side-effects in patients.[6, 7] In addition, use of complementary methods has been less noted in ICUs.[18]

With this background in mind, in the present study, we aimed to determine the effects of music on pain intensity among ICU-admitted patients with loss of consciousness.

2. Methods

2.1. Design

This randomized clinical trial was performed on non-trauma patients with loss of consciousness under mechanical ventilation. The selected patients were hospitalized in the ICU of a hospital in Zahedan, Iran during April–September, 2014.

2.2. Participants and setting

In this study, The sample size was calculated using the mean comparison formula ($Z_{1-\alpha/2}= 1.96$, $Z_{1-\beta}=1.28$, $S_1=1.77$, $S_2=1.54$, $x_1= 5.96$, and $x_2=7.4$), based on a study by Motahedian and colleagues (2012).[19] A sample size of 30 was considered adequate for each group (total: 60). The patients were selected through convenience sampling and were divided into control and intervention (music therapy) groups, using permuted-block randomization. As the present study comprised of two groups, blocks with a size of four were used in six different ways to equally assign the participants to a block (A: music group, B: control group; for instance: AABB, ABAB, BBAA, etc.); two patients (one from each group) were allocated to each block. The order of the blocks was randomly selected, using the table of random numbers. Then, the patients were assigned to either the intervention or control group, based on block randomization.

The inclusion criteria were as follows: 1) a consciousness level of 5-8, based on the Glasgow Coma Scale; 2) absence of hearing impairments; 3) hemodynamic stability; 4) intravenous injection of fentanyl according to the unit protocol; 5) age above 18 years; 6) patient's first experience of ICU admission within the first 24 h of patient admission; 7) lack of drug abuse, alcohol use, or cigarette smoking; 8) absence of neuromuscular or sensorimotor disorders; and 9) no chronic pain such as migraine or backache. The required information was collected from the patients' records or through inquiring the patients' families. Also, the patients' vital signs were examined for hemodynamic stability.

The exclusion criteria were as follows: 1) invasive catheter insertion with the exception of endotracheal tubes or angiocath during the study; 2) patient's consciousness; 3) extubation during the

study; 4) changes in the type or dosage of the prescribed analgesic by the physician or cessation of drug administration; 5) patient's transfer to the operating room for surgery; and 6) a substantial decline in the level of consciousness.

2.3. Instruments

The data were gathered using a demographic form and the Behavioral Pain Scale (BPS). The demographic form consisted of personal information such as the patient's age, gender, marital status, and underlying diseases. In addition, BPS was applied for monitoring pain in critically ill patients, who were unable to communicate with the clinical staff and were hospitalized in the ICU.[20- 22]

BPS, which was first designed by Payen and colleagues (2001),[23] consists of three main sections: facial expressions, compliance with mechanical ventilation, and upper limb movements. Each section is scored from 1 to 4, with the total score ranging from 3 (minimum pain) to 12 (maximum pain). Higher scores on each section indicate a higher level of pain and discomfort. The reliability of this tool has been confirmed in domestic and international studies.[20- 24] Also, the internal reliability of this scale has been evaluated in the literature, using Cronbach's alpha coefficient (94%).[23] In the present study, internal consistency was evaluated, indicating a correlation coefficient of 86%.

2.4. Data Collection

The intervention group was exposed to music. For this purpose, a light instrumental piece of music, called "Beach Walk" (Top-Hits, Zum Entspannen Vol. 1) by Arnd Stein was played over 30 min for three consecutive days between 4 p.m. and 6 p.m. to avoid interference with the hospital unit activities. This piece of music is not melancholic, stimulating, or exciting and is a combination of melodic and soft rhythms which distract the listener from distress without causing anxiety or anguish.[25] To perform the intervention, a music player (Sony, Japan), a headphone set (Sony, Japan), and a stopwatch (Sony, Japan) were used. The headphone set was used to prevent the interference of unit sounds with the music being played.[26] Also, the headphones were disinfected and the pads were replaced after use to prevent infection transmission.

The pain scores were documented for unconscious patients, using BPS at 5 min before the intervention and immediately after the intervention. Pain measurement was performed by the researcher in the same manner for all the patients. The control group received routine care, and the measurements were carried out within the same time intervals as the intervention group.

2.5. Ethical considerations

The data were collected after obtaining permission from the university ethics committee and the hospital authorities. Also, consent forms were obtained after explaining the study objectives and the intervention process to the families of eligible patients.

2.6. Statistical analysis

For statistical analysis, independent t-test (for the mean comparison of pain scores in the two groups), paired t-test (for the mean comparisons before and after the intervention), Chi-square (for examining the difference between the groups regarding variables such as marital status, underlying diseases, and gender), and covariance analysis (for controlling the effects of contributing variables) were performed, using SPSS version 15.

3. Results

Table 1 presents the demographic characteristics of the patients. As presented in this table, there was no significant difference between the groups in terms of demographic characteristics. On the first day, the results of independent sample t-test showed a significant difference between the intervention and control groups regarding the mean pain score before the intervention ($P<0.0001$). On this day, pain intensity significantly reduced in the intervention group following listening to music ($P<0.0001$). On the other hand, the decline in pain was minor and statistically insignificant in the control group (Table 2). Considering the fact that the mean pain score was different between the two groups on the first day before the intervention, covariance adjustment was carried out. By covariate adjustment of the effect of pain score on the first day before the intervention, the mean pain scores were found to be significantly lower in the intervention group compared to the controls, based on the covariance analysis. According to the findings, music could result in pain alleviation ($P<0.0001$).

On the second day, there was no significant difference between the two groups before the intervention, whereas the difference was significant following the intervention ($P<0.001$). Also, on the second day, the mean pain score significantly decreased in the intervention group after the intervention ($P<0.001$).

On the third day, there was a significant difference in the mean pain score between the two groups before the intervention ($P<0.0001$); the

difference between the groups was also significant after the intervention. Based on the findings, the mean pain score significantly decreased in the intervention group following listening to music (P<0.0001).

Considering the fact that the mean pain score in the pretest was different between the two groups on the third day before the intervention, covariance adjustment was performed. Based on the ANCOVA results, the mean pain score was significantly lower in the intervention group, compared to the controls in the posttest; therefore, listening to music could decrease pain intensity on the third day, as well (P<0.0001) (Table 2).

Table 1. Demographic characteristics of participants

Variables		Intervention N (%)	Control N (%)	P-value
Gender	Male	16 (53.3)	14 (46.7)	0.6*
	Female	14 (46.7)	16 (53.3)	
Marital status	Single	8 (26.7)	4 (13.3)	0.19*
	Married	22 (73.3)	26 (86.7)	
Underlying diseases	Renal	3 (10)	5 (16.7)	0.84*
	Cardiac	6 (20)	7 (23.8)	
	Gastrointestinal	6 (20)	7 (23.8)	
	Neurological	7 (23.3)	6 (20)	
	Respiratory	8 (26.7)	5 (16.7)	
Age	M±SD	50.3±7.69		0.16**

*Chi-square test; **Independent samples t-test

Table 2. The mean comparison of pain scores in the control and intervention groups

Time of pain control	Groups	Before the intervention M±SD	After the intervention M±SD	Changes M±SD	*P-value
First day	Intervention	7.2±1.03	4.57±0.97	2.63±0.76	<0.001
	Control	6±1.28	5.97±1.18	0.03±0.41	0.66
	**P	<0.001	<0. 001	<0.0001	
Second day	Intervention	5.83±1.14	3.73±0.86	1.2±0.84	0.001
	Control	6.33±1.09	6.33±1.06	0.00±0.37	1.00
	**P	0.89	<0.001	<0.0001	
Third day	Intervention	4.87±0.9	3.17±0.37	1.7±0.79	0.0001
	Control	6.2±0.99	6.2±0.99	0.00±0.26	1.00
	**P	<0.0001	<0.0001	0.003	

*Paired t-test; **t-test

4. Discussion

The results of the present study showed that use of instrumental music could alleviate pain in patients with loss of consciousness. In line with our findings, Ajri and colleagues (2011) showed that music could reduce the pain score in unconscious patients after the intervention.[27] In their study, the type of music differed from the present study and was selected by the patients' families; on the contrary, in the present study, the music was similar for all the patients. Regardless of the type of music, listening to music could result in reduced pain among patients in the intervention group through mechanisms such as increased endorphin secretion and interference with pain-processing pathways.[28, 29]

The study by Ajri et al. (2011) was similar to the present research regarding the study population; in their study, the sample consisted of patients with a consciousness level of 5 to 10. Also, in the present study, non-trauma patients were examined who seem to be different from trauma patients in terms of reactions to painful stimuli;[27] this was also in line with the study by Ajri and colleagues.

Several studies have confirmed the positive effects of music selected by the patients on pain relief.[30- 32] Although these studies differed from the present research regarding the type of music, therapy was still effective in pain relief. It should be noted that no specific type of music is superior to other genres in terms of relaxing effects; in fact, the most important factor is the patient's personal interest.[33] However, in our study, the patients were unable to choose their favorite music due to loss of consciousness. In the study by Ajri and colleagues (2011), the mean pain score after the intervention was lower than that reported in the present study. The difference in the reported pain scores might be

attributed to variations in pain measurement tools.[27] Furthermore, a study by Jasemi et al. (2013) on patients with cancer in Urmia, Iran showed that patients' exposure to their favorite music could significantly reduce their pain.[34] Similarly, based on a study by Iconomido et al. (2004), patients' exposure to music could reduce pain intensity after surgery.[26] The discussed findings were in congruence with the present results (which revealed the positive effects of music on pain alleviation), despite the differences between these studies in terms of the study population, type of music, and pain measurement tools.

Different theories have been proposed regarding music physiology. Some psychiatrists believe that listening to music leads to endorphin secretion and pain relief. Moreover, music by energizing the body through affecting brain neurons can influence respiratory and heart rates, which are in fact physiological indicators of relaxation or stress.[28] Also, the gate control theory of pain, proposed by Melzack and Wall (1983), suggests that pain perception and processing are complex phenomena, involving the transmission of signals which reach the brain through a series of specific neurons (the pathway is known as the pain gate). Now, if the gate is open, a painful input can create the feeling of pain. Some mechanisms can interfere with the processing pathways and partially or completely block the gate; in fact, music is able to suppress pain through these mechanisms.[29]

In a study by Motahedian et al. (2012), not only music reduced pain in postoperative patients under spinal anesthesia, but also it decreased the patients' need for narcotic analgesics after surgery.[19] In addition, in consistence with the present study, Sen et al. (2010) introduced music therapy as a method of pain relief after cesarean section.[28]

In general, conflicting results have been reported in several studies. For instance, in a study by Besel (2006) on patients under mechanical ventilation, the results showed no major difference in pain scores before and after listening to music. The discrepancy between the findings might be due to differences in the applied pain scales. It should be noted that in the study by Besel et al., a graphic rating scale was used,[35] which seems to lack sufficient sensitivity for pain measurement;[36] also, the mentioned research was a pilot study conducted on a limited sample size.

There were certain limitations in the present study, among which we can mention the small sample size and the research setting which was restricted to a teaching hospital.

These factors can in fact limit the generalizability of the findings. In addition, in this study, the effect of music on pain was investigated among patients with respiratory, renal, cardiac, gastrointestinal, and neurological problems. The control and intervention groups were homogenous in terms of the underlying diseases and the intervening factors were controlled by the researcher. However, the nature of the disease might have affected the pain intensity, which was uncontrollable by the researcher.

5. Conclusion

The findings of the present study showed that use of music, as a simple, economical, and practical method, alongside other pain relief methods, could be effective in reducing pain intensity among ICU-admitted patients. It is suggested that future studies investigate the effects of music on need for analgesics among unconscious ICU-admitted patients.

Conflicts of interest

The authors declare no conflicts of interest.

Authors' contributions

Fariba Yaghoubinia: was responsible for the study design, drafting, and final approval of the article. Ali Navidian: contributed to the study design, data analysis, and drafting of the manuscript. Seyed Mohammad Nasir-al-din Tabatabaei: contributed to the study design and drafting. Sara Sheikh: was responsible for the study design, data collection, and drafting of the manuscript.

Acknowledgments

This article was extracted from M.Sc. thesis in nursing, submitted to Zahedan School of Nursing and Midwifery (No.: 1502; Ethics Committee Code: IR.ZAUMS.REC.1394.52). This study was registered in the IRCT (IRCT2015051722300N1). Hereby, we would like to thank the authorities of Zahedan University of Medical Sciences and the selected hospital. We also express our gratitude to all the participants and their families for their sincere cooperation.

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How to cite: Yaghoubinia F, Navidian A, Tabatabaei S.M, Sheikh S. Effect of music on pain intensity among patients with loss of consciousness in an intensive care unit. Medical - Surgical Nursing Journal 2016; 4(4): 35-40.