International Journal of New Findings in Health and Educational Sciences (IJHES)
ISSN 2980-0641
DOI: 10.63053/ijhes.162

The Effect of Music Videos on Pain Intensity in Children with Leukemia during Lumbar Puncture and Bone Marrow Aspiration

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ARTICLE INFO

Keywords: *Music video, leukemia, child, lumbar puncture, bone marrow aspiration*

ABSTRACT

Background and Objective: The present study was designed to investigate the effect of music videos on pain intensity in children with leukemia during lumbar puncture and bone marrow aspiration.

Materials and Methods: The present study was a randomized clinical trial (RCT) conducted on 60 children with leukemia referred to Mohammad Kermanshahi Hospital during lumbar puncture and bone marrow aspiration. Eligible children were randomly divided into two intervention groups (n = 30) and control groups (n = 30). In the intervention group, 15 domestically licensed pop video clips were displayed on a tablet 2 minutes before the start and end of the injections, corresponding to different injection durations. In the control group, the procedure was performed according to the usual procedure. Then, in both groups, pain intensity was measured and recorded 30 minutes before the injection, immediately after the injection, and 30 minutes after the injection. SPSS24 software was used to analyze the data, and a significance level of less than 0.05 was considered. Results: The results of the present study showed that the two intervention and control groups did not have a statistically significant difference in terms of baseline variables of age, gender, parental education, place of residence, parental occupation, type of surgery, and duration of treatment (P-Value>0.05). The results showed that the average pain intensity at different time points in the two intervention and control groups was statistically significantly different, so that at all time points the average pain intensity in the intervention group was lower than the control group (P-Value<0.001).

Conclusion: The present study showed that music videos can be effective in reducing the pain intensity of children with leukemia during lumbar puncture and bone marrow aspiration, so the researchers of this study recommend its prescription to reduce pain in these children.

Introduction

Acute lymphoblastic leukemia (ALL) is a disease caused by the abnormal and excessive production of immature white blood cells in the bone marrow (1). This cancer is one of the most important chronic diseases of children, and the number of children affected by it varies from 200 to 50 cases per million children worldwide (2). Acute leukemia is the most common cancer in children, accounting for approximately 30% of all childhood malignancies. Acute lymphoblastic leukemia accounts for approximately 75% of acute leukemia cases (3, 4). The incidence of childhood cancers in Iranian girls and boys has been reported to be 48 to 112 and 51 to 141 cases per million people, respectively. In Iran, the mortality rate from childhood cancers in children under 5 years and 5 to 15 years is estimated to be 4% and 13%, respectively (5, 6).

Leukemia or blood cancer is divided into four groups, acute and chronic myeloid leukemia (CML, AML) and acute and chronic lymphoid leukemia (ALL, CLL) based on the type of cell (lymphoid or myeloid) and the course of the disease (chronic or acute) (7, 8). Acute lymphocytic leukemia (ALL) is a disease that manifests itself with uncontrolled proliferation and cessation of maturation of lymphoid precursor cells in the bone marrow, causing the formation of malignant cells (9). Although the causes of leukemia have not yet been precisely determined, factors such as age at diagnosis, white blood cell count, parental occupational exposures, nutritional factors, and chromosomal or molecular genetic abnormalities play a role in this cancer (10, 11).

Fear of pain and injury is one of the most important problems for children with leukemia. This fear prevents them from receiving appropriate medical care. Pain is the most common symptom in patients with cancer, which can affect their functioning and quality of life (12, 13). Cancer pain may be caused by pathology, disease progression and metastasis, tumor growth, or diagnostic and therapeutic procedures. Pain intensity increases as the disease progresses. Despite advances in pain relief, many patients with cancer endure very severe pain (14, 15). Therefore, pain relief for children with leukemia is important, and lack of pain relief leads to significant changes in quality of life, including eating, sleeping habits, self-confidence, fear, depression, and hopelessness, and disrupts the child's natural growth and development, and the resulting stress also disrupts the body's physiological systems (15, 16).

In recent years, the use of non-pharmacological methods to reduce pain and anxiety in children has attracted the attention of many researchers and therapists (17, 18). One of these methods is the use of distraction techniques such as watching music videos, cartoons or animations that the child likes. Watching music videos can reduce the intensity of the pain experience by stimulating the brain's reward system and reducing the child's focus on painful stimuli (19, 20). Given the lack of studies on the use of music videos as an effective distraction method in children with leukemia, this study was designed to investigate the effect of playing music videos during lumbar puncture and bone marrow aspiration on the intensity of pain experienced by children with leukemia.

Materials & Methods

I. Study Design and Subjects

This double-blind clinical trial study was conducted on 60 children with leukemia referred to Dr. Mohammad Kermanshahi Hospital, Kermanshah University of Medical Sciences. Inclusion criteria included: 1- Obtaining informed consent from parents to participate in the intervention , 2-Awareness of time, place, and person (by asking verbal questions about the child's diagnosis in relation to time, place, and person) 3. Ability to communicate verbally 4. No history of seizures or any life-threatening emergency (acute cardiac or respiratory disease, etc.) 5. No analgesic medication prior to intervention 6. Able to count from 1 to 100. Exclusion criteria included 1- Lack of cooperation of the child or family 2. Death of the child during the study 3. Any restlessness of the child that makes it impossible to distract him/herself 4. Continuing treatment with general or local anesthesia.

II. How to do the intervention

Before the study began, the research objectives were explained for the patients and informed consent was obtained from them. Then, eligible patients divided into two groups using permuted balanced block randomization (Interventional group, n=30; Control group, n=30). For the intervention group, 15 domestically licensed pop video clips were displayed on a tablet. The video clips were shown to the children two minutes before the start and until the end of the injections. The reason for choosing the video clips was their short duration, so it was possible to show several video clips corresponding to the different duration of the injections until the end of the treatment. In contrast, in the control group, the procedure was performed as usual without viewing the video clip. Then, in both groups, pain intensity was measured and recorded 30 minutes before injection, immediately after injection and 30 minutes after injection.

The standard OUCHER pain assessment tool was used to measure pain intensity. This tool was developed by Beyer in 1984 to assess pain intensity in children aged 3-12 years, and uses real faces of children in painful situations to measure pain intensity. This tool consists of 6 photographs of children showing different levels of pain, and a vertical scale with numbers from 0 to 100 is placed to the left of the photographs (Zero = no pain, 1-29 = mild pain, 30 - 69 = moderate pain, 70 - 99

= severe pain, and 100 is the most severe pain possible) **(Figure 1)**.

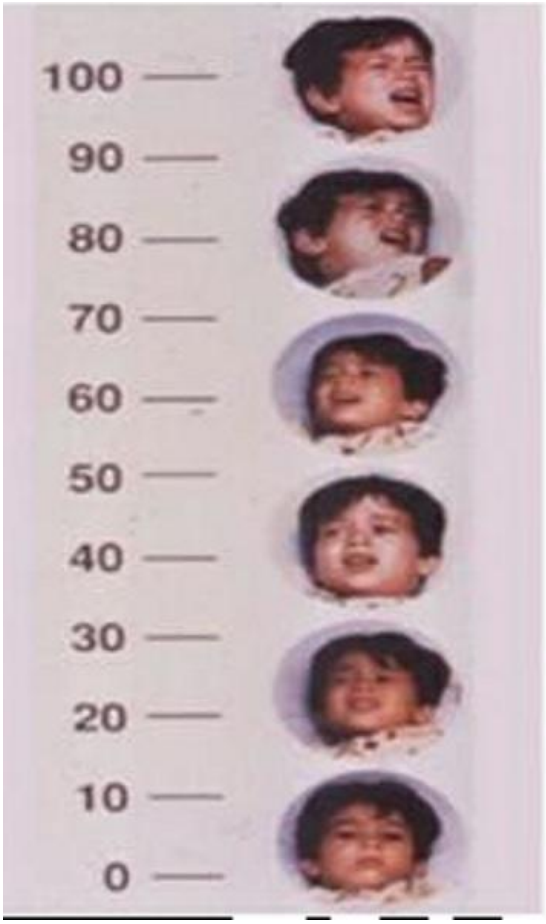


Figure 1. Oucher's standard pain measurement tool (OUCHER)

III.Statistical Analysis

In descriptive analysis, mean (S.D) and number (%) were used for quantitative variables. In analytical analysis, the independent-samples T-test and Chi square test were used to compare the quantitative and qualitative variables in two groups; respectively. In addition, Repeated Measure ANOVA test was used to compare the means of pain intensity at different time periods in the two groups. It should be noted that the data were analyzed using SPSS26 software and P-Value <0.05 was considered as a significant level.

IV. Ethical Considerations

The protocol study was conducted according to the principles expressed in the Declaration of Helsinki and was approved by the Deputy of Research and Ethics Committee of Kermanshah University of Medical Sciences (ID-number: IR.KUMS.MED.REC.1400.010). Additionally, this clinical trial study was registered in Iranian Registry of Clinical Trials (registration ID: IRCTID: IRCT20130812014333N178).

Results

This clinical trial study was conducted on on 60 children with leukemia referred to Dr. Mohammad Kermanshahi Hospital. These patients were randomly divided into intervention (n= 30) and control (n= 30) groups. **Table 1** shows baseline and clinical variables before intervention in two groups. As can be seen, the mean (±S.D) age was 39.64 (±9.46) vs. 36.20 (±9.44) in intervention and control groups; respectively. The number (%) of men in the two groups under study was 14 (46.7 %) and 17 (56.7 %), respectively. The mean (±S.D) duration of treatment was 19.00 (±12.62) vs. 17.30 (±1.52) in intervention and control groups; respectively. In the intervention and control groups, 46.7% and 53.3% of surgeries were lumbar puncture, respectively. Also, the mean (±S.D) pain intensity 30 minutes before injection was 2.67 (±1.24) vs. 2.36 (±0.99); respectively.

Table 1. Comparison of baseline and clinical variables before intervention in two groups

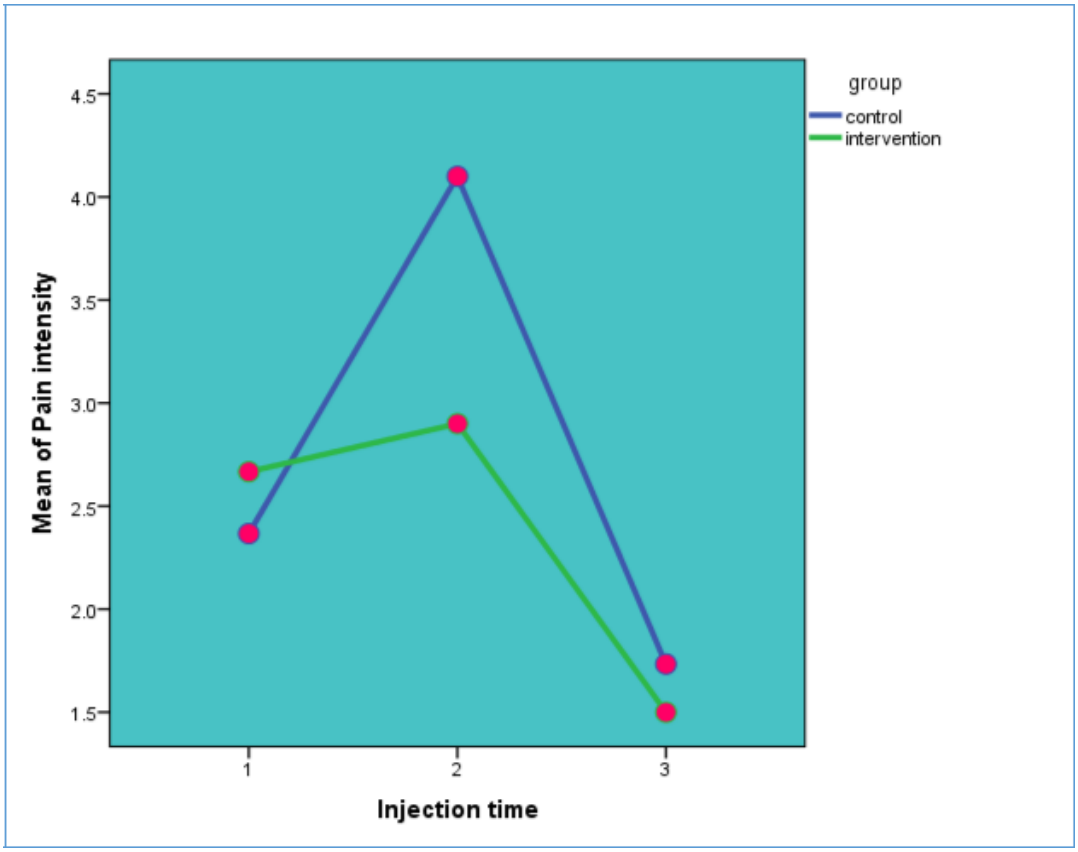
Qualitative Variables		**Intervention**	**Control**	**P-Value**
		Number (%)	**Number (%)**	
Sex	Girl	16 (53.3)	13 (43.3)	0.438*
	Boy	14 (46.7)	17 (56.7)	
Mother's education	Non-academic	27 (90)	28 (93.3)	0.520**
	Academic	3 (10)	2 (6.7)	
Father's education	Non-academic	24 (80)	28 (93.3)	0.127**
	Academic	6 (20)	2 (6.7)	
House of residence	Personal	17 (56.7)	20 (66.7)	0.426*
	Renal	13 (43.3)	10 (33.3)	
Mother's occupation	Housewife	28 (93.3)	30 (100)	0.246**
	Employed	2 (6.7)	0 (0)	
Father's occupation	Freelance	23 (76.7)	20 (66.7)	0.543*
	Employed	7 (23.3)	10 (33.3)	
Type of surgery	Lumbar puncture	14 (46.7)	16 (53.3)	0.506*
	Bone marrow aspiration	3 (10)	5 (16.7)	
	Both	13 (43.3)	9 (30)	
Quantitative variable	**Group**	**N**	**Mean**	**S.D**	**P-Value*** **
Age (year)	Intervention	30	8.29	2.03	0.261
	Control	30	9.03	2.83	
Treatment duration (days)	Intervention	30	19.00	12.62	0.588
	Control	30	17.30	11.52	
Pain intensity 30 minutes before injection	Intervention	30	2.67	1.24	0.687
	Control	30	2.36	0.99	

*: Chi square test
**: Fisher's exact test
***: Independent sample t-test

Table 2. Comparison of the means pain intensity at different time periods in two **groups**

Pain intensity according to VAS	Group	N	Mean	S.D	P-Value*
T1: 30 minutes before injection	Intervention	30	2.67	1.24	**<0.001**
	Control	30	2.36	0.99	
T2 : Immediately after injection	Intervention	30	2.90	1.32	
	Control	30	4.10	1.21	
T2 : 30 minutes after injection	Intervention	30	1.50	0.93	
	Control	30	1.73	0.74	

***P-Value :** Significant Level for Interaction Group and Time by Repeated Measure ANOVA Test



Graph 1. Average pain intensity at different time points in the two intervention and control groups

Generally, there were no significant statistical difference between the two groups in terms of baseline and clinical variables before intervention (P-Value>0.05). This lack of significant statistical difference between the two groups can be a reason that randomization process has occurred correctly (**Table 1**).

We used Repeated Measure ANOVA test to compare the mean of pain intensity between the two groups at different time periods, which, the results of this test showed a statistically significant difference between the two groups in terms of pain intensity at different time periods ; in other words, the mean pain intensity at different time points after the intervention was significantly lower in the intervention group than in the control group (P-Value>0.05) (**Table 2**). **Graph 1** also shows the means of pain intensity at different time periods in two groups.

Discussion

The present study showed that music videos can be effective in reducing pain intensity in children with leukemia during lumbar puncture and bone marrow aspiration. These findings are consistent with previous

research showing that music can reduce pain perception and improve negative experiences related to treatment. For example, a study by Makaeli et al. (2019) showed that watching cartoons and making bubbles helps reduce the pain felt by children during chemotherapy. Also, making bubbles helps reduce the pain felt by children during chemotherapy more than watching cartoons. Finally, it was stated that using distraction methods reduces pain in cancer patients (21). A study by Askari et al. (2018) showed that music therapy was effective in reducing the severity of pain and perceived stress and increasing the happiness of adolescents with leukemia. Therefore, music therapy can be an appropriate short-term treatment method for reducing the severity of pain and perceived stress and also increasing the happiness of adolescents with leukemia (22). The results of the study by Khalel et al. (2024) aimed to investigate the effect of music on pain in children with leukemia during bone marrow aspiration and lumbar puncture, and showed that the pain score decreased during and after the intervention. These researchers stated that music therapy is one of the most widely used methods in complementary medicine that is easily accepted by the patient (23).

A study by Huang et al. (2021) aimed to investigate the effect of music videos on pain after cardiac surgery in children and showed that music videos can be effective as a non-pharmacological intervention in reducing postoperative pain, reducing analgesic doses, shortening ICU stay, and hospitalization in preschool children after cardiovascular surgery (24). Another study by Casale et al. (2018) with the aim of investigating the effect of music during ear, nose and throat surgery based on pain reduction showed that music can be useful as a complementary method to reduce the perception of pain. The patient is more relaxed and experiences less discomfort. Therefore, the surgeon and nurse can work with more confidence (25).

Music and videos act as a distraction. When a child is watching a music video, their attention is diverted from the pain and discomfort of the treatment. This distraction can lead to a reduction in the sensation of pain. According to the Gate Control theory, non-painful sensory stimuli (such as music) can reduce the sensation of pain through neural pathways (26, 27). Studies have shown that music can reduce the perception of pain. According to psychological theories, music can act as a distraction, diverting the patient's attention from pain and discomfort (28). These positive effects can be especially evident in children, who may not be able to express their feelings. Music videos can provide a more engaging and effective experience for children because they combine sound and image (29, 30). Research has shown that using music videos in medical settings can help reduce anxiety and pain. This type of media can help children feel more comfortable during medical procedures (31, 32). Based on the findings of this study, the researchers recommend prescribing music videos as an adjunct to pain relief in children with leukemia. This method can be used as a non-pharmacological tool alongside other treatments to improve the quality

of life of these patients.

Conclusion

The present study showed that music videos can be effective in reducing pain intensity in children with leukemia during lumbar puncture and bone marrow aspiration. Given the ease of access to technology and digital media, it is suggested that doctors and nurses incorporate this method into their treatment protocols and use it to reduce anxiety and pain in pediatric patients.

Acknowledgements

Not applicable.

Authors' contributions

ED and MRG conceived the study, collected data and performed statistical analysis. ED and MR participated in the study design, drafted the manuscript and contributed to data analysis. MRG, ED, and MR helped to draft the manuscript and revised it critically. All authors read and approved the final manuscript.

Funding

This study was funded by Kermanshah University of Medical Sciences, Kermanshah, Iran.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The study was approved by the Deputy of Research and Ethics Committee of Kermanshah University of Medical Sciences (ID-number: IR.KUMS.MED.REC.1400.010). Additionally, this clinical trial study was registered in Iranian Registry of Clinical Trials (registration ID: IRCTID: IRCT20130812014333N178).

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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