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Effect of video games on preoperative anxiety in 3- to-6-year-old of a sample of Iranian children undergoing elective surgery

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Abstract:

BACKGROUND: As pediatric surgeries are rising and current methods to reduce perioperative anxiety are lacking in preschool children. The purpose of this study was to determine the effect of video games on preoperative anxiety in 3- to-6-year old of a sample of Iranian children undergoing elective surgery children.

MATERIALS AND METHODS: In the current quasi-experimental pretest posttest design, after standard translation, the modified Yale preoperative anxiety scale was administered to 102 children undergoing surgery from December 2016 to August 2017 in Kermanshah, Iran. Children are assigned to an intervention or control group. Each child's anxiety was measured at two points at the time of arrival and after waiting for 20 min in the holding area. Data were analyzed by SPSS, version 22. The Chi-square, independent *t*-test, and paired *t*-test at the significance level of $P < 0.05$ were performed.

RESULTS: There was no significant difference between the mean anxieties in control group (42.58 ± 18.54) and intervention group (46.11 ± 14.09) before the game ($P = 0.282$). However, after playing the video game in control groups (53.26 ± 18.00) and game groups (34.88 ± 10.81), there was a significant difference in favor of the video game ($P < 0.001$).

CONCLUSION: Findings of the present study suggest that approved video game by experts to decrease mean preoperative anxiety in 3- to-6-year-old children. Therefore, video games recommended to be implemented at the preventive level in hospital.

Keywords:

Anxiety, children, preoperative care, surgery, video game

Introduction

Anxiety is the most common feeling in children candidate for surgery, and 60% of children and their parents, experience this feeling especially in the form of preanesthetic anxiety.[1,2] Stay in an unfamiliar environment, presence of strangers, sound of devices, fear of physical injury, pain, and separation from parents are the major factors of anxiety.[3] Parental stress conditions also occur because of child illness, fear of child death under anesthesia, fear of complications, fear of adverse effects, concern of pain the child endures, fear of the unknown, and concern regarding lack of proper response of the treatment team to the needs of the child.[4] Nurses involved with child care in preoperative setting should consider the importance of disease prevention as well as health improvement.[5]

In pediatric preoperative anxiety may be harmful as it produces, for example, abnormal hemodynamic responses, negative behaviors, high score of pain, and delayed wound healing in the period of postoperative.[6,7] From a psychological point of view, negative behavioral changes such

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as recurrence of enuresis, separation anxiety, agitation, crying, sleep disturbances and nightmares, malnutrition, and the social aspect lead to insubordination and avoidance of healthy behaviors, and fear of doctors and medical staff.[8] In addition, these outcomes can also extended stays in recovery areas and increased need for postoperative care, an unreasonably high cost of long hospitalization is imposed on the family.[9] A child can express anxiety and perturbation after 6 years of age, but preschool children cannot express their anxiety and often show anxiety as physiological responses.[10,11] Furthermore, the development of anxiety in childhood increases the risk of anxiety and mood disorders; raises the probability of clinical depression, disrupts the social life, education, and occupation of an individual in adolescence.[12,13]

In a systematic review, examined 18 studies in 2015 in 14 studies, the positive effects of intervention were reported, but in four cases, there was no change in the mean of anxiety, in this study recommended that further studies should inspect the impact of audiovisual interventions to conclusively identify the mechanisms of the most effective interventions of audiovisual and guide practice.[14]

Children is the most vulnerable to anxiety disorders, it is necessary giving children the opportunity to reduce anxiety during painful invasive interventions in different ways.[9] Nowadays, nonpharmacological anxiety control is a priority,[6,15] video games in today's society are activities that are available everywhere. It is possible for children to be so enthralled by computer games through which they do not notice themselves or ignore spoken and touch stimuli. Although the trend toward treating preoperative anxiety is obvious, the quality of treatment is restricted by problems such as time constraints, adverse effects, increased health costs, or a combination of them.[16,17] In nonviolent games, not only are these effects resolved, but they have also proved to enjoy the benefits of enhancing visual-spatial skills and perceptual skills. The findings also suggest increased cooperation, participation, sympathy, and relief behaviors.[18] In all these stages, the nurse, as the only member of the treatment, continuously cares for the child and interacts with the child and the family. As defined by the American Nursing Association, nursing is the diagnosis and treatment of individual responses to actual or potential problems. Consequently, employing noninvasive methods in treatment and care is one of the main roles of a nurse; which could be applied to control anxiety in patients, specifically in children.[5] In a study, researchers reported that racial and ethnic differences play an important role in understanding pain and the occurrence of behaviors that indicate pain and anxiety in children.[19] It should be noted that the effect of video games on preoperative anxiety in children has not been evaluated in Iran. Therefore, the aim of this study was to examine the effects of video games on preoperative anxiety in 3- to-6-year old of a sample of Iranian children undergoing elective surgery.

Materials and Methods

Study design and setting

This quasi-experimental pretest posttest design was conducted in Kermanshah, Iran, from December 2016 to August 2017.

Study participant and sampling

The participants were comprised of 104 children (51 in the control and 53 in the game groups) who were candidates for elective surgery at the Pediatric Hospital of Dr. Mohammad Kermanshahi. The sample size was determined at a confidence level of 95% and test power of 80%, and for effect size (ES), a sample size of 51 for each group was deemed adequate. The standard deviation (SD) of the children's anxiety in intervention and control groups were estimated to be 14.1 and 12.[16]

Considering the possibility of 20% attrition, when the sample size reached 104, the research team decided to stop samplings. Children were assigned into two experimental and control groups by simple randomization, using the table of random numbers by list of children available in the clinic. The participants were children who were referred to the hospital for elective surgical procedures such as herniotomy, undescended testes, hydrocele, hypospadias, tonsillectomy, and extra masses. The patients were selected as classified in class I or II, according to the American Society of Anesthesiologists (ASA). ASA 1 refers to a normal healthy patient and ASA II describes a patient with mild systemic disease without substantive functional limitations (i.e., mild asthma).[20]

Sampling was performed in only one hospital with a specific pediatric surgeon to develop completely identical conditions and reduce intervening factors. In the intervention group, there were two cases of withdrawal, one for not completing the game for at least 15 min and the other due to a lack of familiarity with a variety of video games [Figure 1].

The inclusion criteria were parental unemployment in the hospital, being familiar with computer games, not having a history should be of the current chronic debilitating illness, and never having previous hospitalization history. The exclusion criterion was the failure to play the video game for 15 min.

Data collection tool and technique

Modified Yale Preoperative Anxiety Scale-Short Form (m-YPAS-SF): The instrument for measuring

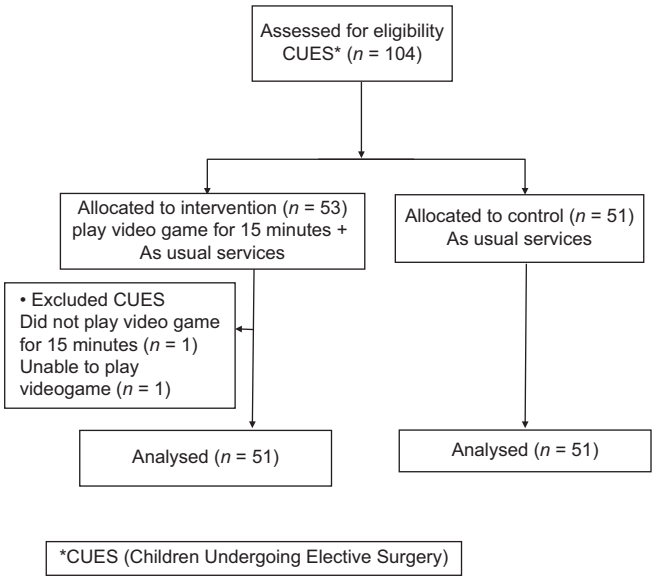

Figure 1: Diagram of the participants, enrolment in the study

anxiety in this study was the m-YPAS-SF. This observational scale was first developed in 1995. Then, it was revised to create the m-YPAS,[21] and finally, the m-YPAS-SF was introduced by Jenkins in 2014.[19] This scale has 18 items in four domains including activity, vocalization, emotional expressivity, and state of apparent arousal with Likert-type response options and the Cronbach α of at least 0.92.[19] m-YPAS-SF has proven to be a valid and reliable child anxiety measure for children between the ages of 2 and 12. The score is obtained through dividing each item by the highest possible score (6 for the "vocalizations" item and 4 for all other items), aggregating all the scores, dividing them by 4, and multiplying them by 100. Thus, a score of 22.92–100 could be gained, higher scores represent higher anxiety.[19] In order to determine the scientific validity of the instrument, the English text was translated into Persian based on accepted guideline;[22] translation and cultural adaptation of the scale were performed. According to this guideline researchers in this study accomplished simultaneous translations and blind back-translations followed by group discussion with bilingual experts. In addition, to enhance the efficacy and improve the cultural adaptation process, additional methods comprised of an expert panel and a committee review was used. Content validity of the m-YPAS-SF was based on the evaluation by four faculty members of Iran University of Medical Sciences (IUMS) who had a Ph.D. in nursing, an expert psychiatrist in children and adolescents, an anesthesiologist, and five senior psychologists from Kermanshah Consultation and Educational Disorders Center. mYPAS-SF Cronbach α's in the present study was 0.89, a Cronbach's alpha coefficient equal to or >0.70 was considered satisfactory.[23] For inter-rater and inter-rater reliability of the scale, the anxiety of 20 children of the selected surgical procedure was measured by two nurses simultaneously and separately using this scale. The Kappa value in the present study was in activity class = 1, vocalization = 0.724, emotional expressivity = 0.649, and the state of apparent arousal = 1). The Kappa Index for activity and state of apparent arousal is great, and is good for emotional expressivity and vocalization. In this study, the correlation between two evaluators was 0.98.

Ethical consideration

This study was approved by the Ethics Committee of IUMS (grant no. IR.IUMS.REC 1395.9311687005). All parents were informed of the objectives and design of the study. The participants signed a written consent form for their participation. In the end, all children were given a cotton doll as a small and inexpensive gift.

Intervention

The game was comprised of video games on preoperative anxiety in 3- to-6-year-old children to help mitigate their anxiety. Interesting games improve cooperation during anesthetic induction. In order to select the appropriate games; the authors corresponded with Iran's computer and video game foundation. A list of appropriate games for 3- to-7-old-year children was offered; some of them were chosen and proposed to be evaluated by psychotherapists. All of the selected games were confirmed by pediatric psychotherapists. The games were provided from Bazaar Marketplace.[24] These games included: Tabeta, Bally, Tiz Dast, Borjak1, Balloonsky, Jurchin, Ekhtelaf Tasavir Sina o Samin, Matarsak, Football Box, and ThreeSwipes. The games were offered to the children as a collection of games so they could play based on their own interests. However, in the 3–4-year-old children, Babae and Borjak1, were used, as they were easy to play.[25]

One day before surgery, all children and their parents were given explanations about the process and the study. As this was a blinded study, the first nurse completed the scale at the entrance to the holding area and then the second nurse completed the scale in the operating room, and both of them blind to the group. In order to reduce the movement constraints caused by the intravenous method in the child's hands, venipuncture was done on the forearm or antecubital space. To prevent the transmission of contamination by the tablet, tablets were covered with nylon coating and at the end of each use the cover was replaced. After preoperative preparations in the surgical ward (including venipuncture, intravenous infusion of fluids, and prescription of two 125 mg acetaminophen suppositories), the child and the parents were guided to the operating room. Furthermore, in order to minimize preoperative stressors on the study, the anxiety of all children was first measured at the time the child entered the holding area. The duration of stay in the holding area was 20 min for both the groups. In the control group, the children underwent routine care and

preparation for 20 min before the operation. One parent accompanied the child into the waiting room before the operation. The nurse said a few words to comfort the child and answered any questions raised by the child and his or her parent to address their concerns about the anesthesia and the operation. In the intervention group, in addition to routine procedure, each child played an age appropriate video game on the provided tablet for 15–20 min. If the child was not familiar with the video game, the game was taught to the child. After 20 min, playing video game that intravenous midazolam was injected in the amount of 0.5 mg/kg and the child was transferred to the operating room. In the operating room, children's anxiety was measured at T2.

All statistical analyses were performed using the Statistical Package for Social Sciences-version 22 (SPSS Inc., Chicago, IL, USA). The Chi-square test was performed when comparing independent groups for nominal data as well as student paired and unpaired *t*-tests on continuous data, and regression analysis at the significance level of $P < 0.05$. A clinically significant difference in the magnitude of m-YPAS-SF subscale scores was observed after calculating the ES, which was estimated by deducting the means of scales at T1 and T2 and dividing it by the SD of the same measure at T1. According to Cohen, an ES of 0.20 is considered low, 0.20 is small, 0.50 is moderate, and ≥0.80 is high.[26]

Results

To evaluate distribution of the variables result showed that the outcome variables were all normally distributed. The personal information of children is summarized in Table 1.

There were 102 children with mean ages of 4.50 (±1.02) years in the game group and 4.62 (±0.96) years in the control group, respectively. The majority of the children were boys (n = 82, 80.39%). Furthermore, there was no statistically significant relationship between the children characteristic and anxiety [Table 2]. In relation to anxiety changes, the average score of anxiety was significantly increased at T2 ($P < 0.001$). However, in the intervention group, the anxiety score significantly reduced ($P < 0.001$) [Table 2].

The mean score of children's anxiety in the two groups was not significantly different at T1 ($P = 0.28$). However, anxiety in the intervention group was significantly lower than control group at T2 ($P < 0.001$) [Table 2]. Large (ESs ≥ 0.80) was observed in the intervention group at T2, and a moderate (ES ≥ - 0.58) was observed in the control group [Table 2]. The effects of factors such as maternal education, age, gender, and birth rate on children's anxiety were not significant.

Table 1: Characteristics of children undergoing elective surgery in video game (*n*=51) and control (*n*=51) groups

Variables	Control, *n* (%)	Intervention, *n* (%)	*P**
Gender			
Boy	39 (76.50)	43 (84.31)	0.318
Girl	12 (23.50)	8 (15.69)	
Type of surgery			
Herniotomy	34 (66.70)	32 (62.74)	0.254
Other	17 (33.30)	19 (37.26)	
Birth order			
First	24 (47.06)	27 (52.94)	0.312
Second	15 (29.41)	19 (37.26)	
Third	9 (17.65)	4 (7.84)	
Forth	3 (5.88)	1 (1.96)	
Mother's level of education			
Primary school	12 (23.53)	11 (21.57)	0.860
Elementary	13 (25.49)	10 (19.61)	
Diploma	19 (37.25)	18 (35.39)	
University	7 (13.73)	12 (23.53)	

*Chi-square test

Table 2: Comparisons of means, standard deviation, and effect size of anxiety in the video game (*n*=51) and control (*n*=51) groups

Groups	Mean±SD		*P*** (inter group)	Effect size
	Prevideo game	Postvideo game		
Control	42.58±18.54	53.26±18.00	<0.001	−0.58
Intervention	46.11±14.09	34.88±10.81	<0.001	0.80
*P** (between group)	0.282	<0.001		

*Independent *t*-test, **Paired *t*-test. SD=Standard deviation

Discussion

This study shows that in a sample of Iranian children, the mean of anxiety in the intervention group after the approved video game was reduced compared to the mean of the initial anxiety, while in the control group, there was a significant increase. Overall, the anxiety changes were high clinically significant in the intervention group at T2 but anxiety increased with a moderate clinically significant effect in the control group. Researchers have found that in the control group, after receiving midazolam, the mean anxiety scores increased significantly compared to baseline, this finding consistent the result of previous study.[16,27] Furthermore, the mean score of anxiety in the intervention group decreased when compared with the control group. Unfamiliar environment, presence of strangers, sound of devices, and by a lack of understanding of the procedure increased anxiety of children.[28] Play with video game makes children unmindful to the new environment and engage them in a familiar imaginary world. Furthermore, games are very interesting to children. According to their young age and cognitive development level,

children do not understand the purpose or significance of a surgical operation and are prone to regard it as a threat. Engagement in an interesting game can reduce preschool-aged children's preoperative anxiety and improve their compliance with anesthetic induction.[29]

In this study, characteristics of children and the mean anxiety score in the two groups before the intervention were not significant that could affect the experience of the anxiety levels of children. Therefore, the participants were homogeneous in terms of gender, age, birth order, type of surgery, mother's educational level, employment status, and anxiety.

It seems that video games have had the most substantial effect on vocalization when children sat close to their parents and their minds were put at rest, while separation led to a decrease in the effect on activity. Playing game is an effective nonpharmacological way to reduce anxiety in children. According to Piaget, children are self-oriented, and have a view of egocentric, i.e., preoperational children can use these representational skills only to view the world from their own perspective.[30] Moreover, strategies and psychological resilience only develop in later years, young children tend to report high levels of anxiety and distress when confronting new situations, for example, operation room and induction of anesthesia. Therefore, we had participation of experts in children game and a pediatric psychologist for the use of game in due to reduce of anxiety in 3–6–year-old children.

Among the methods for reducing the preoperative anxiety in children, video games are a safe, understandable, and attractive method which is easy to use by the nurses. They also enjoy high acceptance by children and do not require special training. Other methods to reduce anxiety may be ineffective or have additional limitations. Music therapy, while helpful to reduce preoperative anxiety in some location, did not appear to relieve anxiety during the induction of anesthesia.[14,31] In the game room method, the need for user space and the required facilities are factors limiting application of the method. In the simulation and operating room tour, in addition to the problems mentioned for the game room method, the time factor should also be considered. Therefore, considering the simple, low cost, and effective use of the video game method and its absolute independence of preoperative spatial and temporal conditions, it can be used as a suitable method for reducing preoperative anxiety in children. The history of previous surgery and adolescence and parents' anxiety influence the anxiety of children. Therefore, complementary research can determine the use of approved video games to reduce the preoperative anxiety in children with known anxiety, children with physical disabilities, and also in emergency procedures. On the other hand, video game is more effective than other approaches like watching cartoon movies or parent's verbal interaction to reduce anxiety and pain perception in children during performing venipuncture.[32] Overall, our results support the feasibility and acceptability of video games as a short-term and low-cost intervention to provide better experience for children in the hospital.

Limitations and recommendation

Several factors limit the generalizability of the findings. First, there was no mention of the presence or absence of known anxiety disorders in children. Second, vital signs were not monitored and recorded due to the possibility of anxiety related to touch of strangers or fear of placement of unfamiliar monitoring devices. Further, the percentage of males was higher than that of females; therefore, this result should be interpreted with caution due to the fact that few females participated in the study.

According on the results, further studies are needed to investigate long-term effects of preoperative care. Also, further research concerning the children with developmental delay.

Conclusion

Overall, this sample of children decreased anxiety from T1 to T2, therefore, we suggest that approved video games were used in the preoperative area prior to elective surgery to reduce anxiety in children and improve surgical outcomes. In addition, video game is an easily accessible and effective method. Low-cost and practical, does not require special facilities and has high acceptance by both the child and parents and personnel of the medical staff.

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Conflicts of interest

There are no conflicts of interest.

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