Original Article

HEALTH SCIENCES
MEDICINE

DOI: 10.32322/jhsm.1588509

J Health Sci Med. 2025;8(1):115-118

Investigation of the effect of video-based game application on acute pain in children under surgery

Sabiha Bezgin[1], Sevde Kuyulu[1], Ahmet Atıcı[2]

[1]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Hatay Mustafa Kemal University, Hatay, Turkiye
[2]Department of Pediatric Surgery, Faculty of Medicine, Hatay Mustafa Kemal University, Hatay, Turkiye

Cite this article as: Bezgin S, Kuyulu S, Atıcı A. Investigation of the effect of video-based game application on acute pain in children under surgery. *J Health Sci Med.* 2025;8(1):115-118.

Received: 20.11.2024 ◆ **Accepted**: 30.12.2024 ◆ **Published**: 12.01.2025

ABSTRACT

Aims: The aim of this study is to investigate whether video-based game application is effective on post-surgical acute pain in children.

Methods: A randomized controlled trial was conducted between September 2022 and February 2023 in the department of pediatric surgery at a research and practice hospital affiliated with the university. Eighteen children aged 2-4 who were hospitalized after undergoing surgery due to illness and/or trauma, who did not have any problems grasping the upper extremity, and whose parents allowed them to participate in the study were included in the study. Children who had chronic pain complaints for more than 3 months, regardless of the pathology requiring surgery, and children who needed to be given painkillers in the postoperative period were excluded from the study. In our study, the Postoperative Pain Scale for preschool children was applied to all children after the effect of anesthesia wore off. Children in the game group were allowed to play video-based games for 30 minutes via a handheld game console called Nintendo Switch Lite. Pain assessment was performed three times before starting the game, at the 15th minute, and at the end of the 30th minute. Children in the control group were assessed for pain three times at 15-minute intervals within 30 minutes after the effect of anesthesia wore off without any intervention. The result was calculated by taking the average of 3 evaluations in both groups.

Results: 18 children with an mean age of 3.05±0.89 years, 4 girls and 5 boys in the game group and 9 boys in the control group, were included in the study. The age and preoperative pain values were similar between the two groups ($p>0.05$). In the post-surgical pain evaluation, the pain mean of the play group was 1.72±0.89, while the pain mean of the control group was 4.03±1.25. A statistically significant difference was found in post-surgical pain values between the two groups ($p=0.003$).

Conclusion: As a result of our study, it was determined that video-based game application had a positive effect on acute pain in children undergoing surgery.

Keywords: General surgery, pain, video game

INTRODUCTION

Pain is a sensory and emotional symptom caused by the perception in the brain of signals that reach the medulla spinalis through tissue receptors and peripheral nerves as a result of tissue damage that occurs in many orthopedic and/or neurological diseases.[1] Many conditions such as foreign body aspiration, anterior chest wall deformities, inguinal hernia, umbilical hernia, gastroesophageal reflux, constipation, undescended testicle, circumcision, and trauma require surgical intervention in childhood.[2] Since surgical intervention involves procedures that cause trauma to tissues, moderate to severe pain has been reported in children after surgery.[3] Pain delays recovery, leading to family and child unhappiness, increased incidence of post-surgical complications and increased length of hospital stay, and thus higher costs. In addition, pain has been shown to be associated with sleep and eating disorders, avoidance of medical interventions and anxiety during hospitalization in children.[4] Studies have reported that pain memory, which develops early in children, will emerge during all future experiences involving pain and will play an important role in quality of life.[5] It has been reported that children who experience postoperative pain recall more pain-related words, experience anxiety in adulthood, and try to avoid medical interventions when compared with their healthy peers.[6] Determining the level of pain and treating it with the right approaches is very important to prevent other pain-related symptoms, reduce the duration of hospitalization, and prevent psychological trauma.[7]

After surgical interventions, as the anesthesia wears off, children begin to feel pain at the incision site. Since it is difficult for children, especially in the younger age group, to perceive

Corresponding Author: Sabiha Bezgin, sabihasahilog@gmail.com

pain locally, they may experience general restlessness, and it becomes difficult to comfort them. In such cases, it is very important to identify alternative methods to reduce children's restlessness in order to minimize the effects of using higher doses of medication to reduce the pain felt. Video-based gaming applications are known to be effective in creating a positive emotional state in players.[8] Many methods are used to minimize the sensation of pain in children undergoing medical procedures. Distraction is a method that aims to control the sensation by directing the patient's attention to something else. Although it is not possible to eliminate pain with this method, pain tolerance is increased.[9] Active methods such as inflating balloons, squeezing plastic balls, breathing exercises, singing, playing video-based games, as well as passive methods such as watching videos, listening to songs and audio stories are also preferred for distraction.[10]

Video-based gaming applications are known to be used as an active distraction method to reduce stress and anxiety in children during pain-inducing hospital stays such as blood draws, dental procedures, and burns and cancer treatment.[11] Distraction is a non-pharmacological intervention that has been recognized as a useful approach to improve the child's experienceduringpainfulprocedures,isasafe,easy,inexpensive, effective and practical psychological pain management strategy for brief painful procedures, and is clearly effective in improving pain control during invasive procedures.[12]

The aim of this study was to investigate whether video-based gaming is effective on acute postoperative pain in children.

METHODS

Ethics

Ethics committee approval for the study was obtained from Hatay Mustafa Kemal University Clinical Researches Ethics Committee (Date: 27.06.2022, Decision No: 04). A signed parental informed consent form was obtained from the families of all children participating in the study. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Participants

This study was conducted in the Department of Pediatric Surgery, Hatay Mustafa Kemal University Hospital between September 2022 and February 2023. The study included children between the ages of 2-4 years who were hospitalized in the hospital because of a surgical operation due to a disease and/or trauma, who did not have problems with grip in the upper extremity and whose parents consented to participate in the study. Children with chronic pain complaints for more than three months and children who underwent surgery for diseases requiring analgesic administration in the postoperative period were excluded from the study. In the post-hoc power analysis, when the statistical significance of alpha was found to be 5% and the confidence interval was taken as 95%, the power (1-β) of the study was found to be 99%.

Randomization

Surgery dates and list order were determined before the study. A randomization scheme was created using a computer program. Study consents were obtained from the families and the group they would be in was determined according to the randomization list. Eighteen children who met the inclusion criteria were randomly divided into two groups.

Assessments

In our study, the Postoperative Pain Scale in preschool children was administered to all children after the effect of anesthesia wore off.[13] The Postoperative Pain Scale in preschool children is a seven-item scale developed by Tarbell et al.[14] in 1992 to assess the postoperative pain of preschool children. It consists of seven items in three behavioral categories: vocal pain expression, facial pain expression, and bodily pain expression. The Cronbach alpha coefficient of the scale was found to be 0.88 in the total three behavioral categories. It was chosen because it is a highly reliable, simple and applicable scale that uses both self-report and behavioral measurements in the assessment of pain. The score obtained varies between 0 and 7. The higher the score, the more severe the pain. The children were assessed three times at intervals after the effect of anesthesia wore off and the scores obtained were averaged to calculate the evaluation score.

Intervention

All children stayed in a standard two-person hospital room. The hospital rooms where the children were located after surgery were similar in terms of sound, human density and light. During the study, children in the control group were informed not to use the companions' phones or watch the hospital television. Children in the control group were comforted in bed or by being held in their arms. Children in the play group played video-based games for 30 minutes after anesthesia wore off, while children in the control group spent time in or out of bed without any technological devices. The Nintendo Switch Lite was used for playgroup children to play video-based games. The Nintendo Switch is a recently released video game console. It can be used as both a stationary and portable device; it is handheld, has a joystick, buttons and a screen. The children in the play group played a video-based game of their choice for 30 minutes. Since the mean age of the sample group is small and car racing games such as Asphalt and Season 7 were preferred in our study.

Pain assessment was performed 3 times before starting the game, at 15 minutes and at the end of 30 minutes. Children in the control group underwent pain assessment three times in 30 minutes at 15-minute intervals without any intervention after the effect of anesthesia wore off.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) version 21.0 (SPSS inc., Chicago, IL, USA) was used for statistical analysis. The conformity of the variables to normal distribution was examined visually (histograms and probability plots) and analytically (Kolmogorov-Smirnov/ Shapiro-Wilk tests). Descriptive analyses were expressed as mean and standard deviations and categorical variables were expressed as numbers and percentages. Since parametric test assumptions were not met, Mann-Whitney U test was used to compare independent group differences. A value of $p<0.05$ was considered statistically significant in all analyses.

RESULTS

Eighteen children, 4 girls and 5 boys in the play group and 9 boys in the control group, with a mean age of 3.05±0.89 years, were included in the study. There was no significant difference between the two groups in terms of age (p=0.165) (Table 1). All children were discharged on the same day after surgery.

Table 1. Demographic characteristics of the groups

	Play group	Control group	p
Age (mean±SD) (year)	3.33±1.0	2.75±0.70	0.165
Gender [G (B)] (n)	4 (5)	(9)	
Surgical interventions (n)			
Distal hypospadias	3	3	
Circumcision	1	1	
Undescended testicle	4	3	
Inguinal hernia	1	2	

n: Number of children

There was no difference between the preoperative pain values of the two groups (p>0.05). A statistically significant difference was found in postoperative pain values between the two groups (p=0.003). Accordingly, the pain values of the children in the play group were significantly lower than those in the control group (Table 2).

Table 2. Postoperative pain values of the groups

	Postoperative pain	p
Play group	1.72±0.89	0.003*
Control group	4.03±1.25	

*: p<0.05

DISCUSSION

As a result of our study, it was determined that video-based game application had a positive effect on acute postoperative pain in children. When the results of studies on video-based gaming applications are examined, it is reported that it has positive results on anxiety and pain and that its use before or during applications involving pain in children will be beneficial.[15,16] It is also known that video-based play increases psychosocial well-being in children and helps children feel happier.[17] Dwairej et al.[18] examined the effects of video-based games on children's anxiety in preparation for surgery and emphasized that distraction through video games is a reliable method that can be used to reduce anxiety in children. Demeter et al.[19] reported that the pain score in the virtual reality group was significantly lower than the control group as a result of their study on the effects of virtual reality application in acute pain control in 2015.

Playing video-based games includes elements that will trigger fun and positive mood in children. Video-based game-based interventions are effective in reducing traditional pain and anxiety by distracting attention.[20] They can also improve social and communication skills, help reflect fears, feelings and emotions, and promote cooperation during medical procedures.[21] The fact that the games are constantly oriented towards moving to the next level also allows players to quickly develop new strategies without experiencing anxiety and frustration. This has been shown to help them feel more positive.[22,23] As a result of a systematic review and meta-analysis investigating the effect of play-based approaches on preoperative pain in children, Suleiman-Martos et al.[24] emphasized that the management of the preoperative process in children is quite challenging for healthcare professionals. They emphasized that game-based strategies can improve the emotional health of patients and accelerate postoperative recovery.

Our study is a randomized controlled trial including the results of pain management during hospital stay in children who underwent surgical procedures in preschool period. The results showed that pain was reduced with video-based game application during the hospital stay after surgery in children. The results obtained will be useful for families and healthcare professionals to use this simple, easily applicable and effective method to reduce pain during hospital stay after surgical procedures in preschool children.

Limitations

One of the limitations of our study is that pain was evaluated with a single scale. In addition, sociocultural characteristics that may affect pain were not evaluated in this study. In future studies, it is recommended to evaluate other factors that may affect pain in addition to objective assessment of pain. In addition, it is recommended to plan the study with larger sample groups to make the results more widespread.

CONCLUSION

As a result of our study, it was determined that video-based game application had a positive effect on acute pain in children undergoing surgery. Accordingly, it can be said that video-based game applications can be utilized during hospitalization after surgery.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Hatay Mustafa Kemal University Clinical Researches Ethics Committee (Date: 27.06.2022, Decision No: 04).

Informed Consent

A signed parental informed consent form was obtained from the families of all children participating in the study.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

This study was supported by TÜBİTAK 2209-A University Students Research Projects Support Program.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Perquin CW, Hazebroek-Kampschreur AAJM, Hunfeld JAM, et al. Pain in children and adolescents: a common experience. *Pain.* 2000;87(1):51-58. doi:10.1016/S0304-3959(00)00269-4
2. Stone ML, Lapar DJ, Kane BJ, Rasmussen SK, McGahren ED, Rodgers BM. The effect of race and gender on pediatric surgical outcomes within the United States. *J Pediatr Surg.* 2013;48(8):1650-1656. doi:10.1016/j.jpedsurg.2013.01.043
3. Yahya Al-Sagarat A, Al-Oran HM, Obeidat H, Hamlan AM, Moxham L. Preparing the family and children for surgery. *Crit Care Nurs Q.* 2017;40(2):99-107. doi:10.1097/CNQ.0000000000000146
4. Çelikol Ş, Tural Büyük E, Yıldızlar O. Children's pain, fear, and anxiety during invasive procedures. *Nurs Sci Q.* 2019;32(3):226-232. doi:10.1177/0894318419845391
5. von Baeyer CL, Marche TA, Rocha EM, Salmon K. Children's memory for pain: overview and implications for practice. *J Pain.* 2004;5(5):241-249. doi:10.1016/j.jpain.2004.05.001
6. Franck LS, Greenberg CS, Stevens B. Pain assessment in infants and children. *Pediatr Clin North Am.* 2000;47(3):487-512. doi:10.1016/s0031-3955(05)70222-4
7. Singh P. Effect of distraction techniques in behaviour responses to pain among toddlers receiving immunisation. *Nurs J India.* 2012;103(4):176-179.
8. Russoniello CV, O'Brien K, Parks JM. The effectiveness of casual video games in improving mood and decreasing stress. *CyberPsychol Behav.* 2009;12(5):555-562. doi:10.1089/cpb.2009.0006
9. Godino-Iáñez MJ, Martos-Cabrera MB, Suleiman-Martos N, et al. Play therapy as an intervention in hospitalized children: a systematic review. *Healthcare (Basel).* 2020;8(3):239. doi:10.3390/healthcare8030239
10. Ali RR, Selim AO, Abdel Ghafar MA, Abdelraouf OR, Ali OI. Virtual reality as a pain distractor during physical rehabilitation in pediatric burns. *Burns.* 2022;48(2):303-308. doi:10.1016/j.burns.2021.04.031
11. Eijlers R, Utens EMWJ, Staals LM, et al. Systematic review and meta-analysis of virtual reality in pediatrics: effects on pain and anxiety. *Anesth Analg.* 2019;129(5):1344-1353. doi:10.1213/ANE.0000000000004165
12. Raeder SM, Bone JK, Patai EZ, Holmes EA, Nobre AC, Murphy SE. Emotional distraction in the context of memory-based orienting of attention. *Emotion.* 2019;19(8):1366-1376. doi:10.1037/emo0000506
13. Sezer TA, Işık Esenay F, Korkmaz G. Okul öncesi çocuklarda ameliyat sonrası ağrı ölçeği: Türkçe geçerlilik ve güvenirliliği. *Güncel Pediatri.* 2021;19(1):84-91.
14. Tarbell SE, Cohen TI, Marsh JL. The Toddler-Preschooler Postoperative Pain Scale: an Observational Scale for measuring postoperative pain in children aged 1-5. Preliminary report. *Pain.* 1992;50(3):273-280. doi:10.1016/0304-3959(92)90031-6
15. Lobel A, Engels RC, Stone LL, Burk WJ, Granic I. Video gaming and children's psychosocial wellbeing: a longitudinal study. *J Youth Adolesc.* 2017;46(4):884-897. doi:10.1007/s10964-017-0646-z
16. Lobel A, Granic I, Stone LL, Engels RC. Associations between children's video game playing and psychosocial health: information from both parent and child reports. *Cyberpsychol Behav Soc Netw.* 2014;17(10):639-643. doi:10.1089/cyber.2014.0128
17. Granic I, Lobel A, Engels RC. The benefits of playing video games. *Am Psychol.* 2014;69(1):66-78. doi:10.1037/a0034857
18. Dwairej DA, Obeidat HM, Aloweidi AS. Video game distraction and anesthesia mask practice reduces children's preoperative anxiety: a randomized clinical trial. *J Spec Pediatr Nurs.* 2020;25(1):e12272. doi:10.1111/jspn.12272
19. Demeter N, Josman N, Eisenberg E, Pud D. Who can benefit from virtual reality to reduce experimental pain? A crossover study in healthy subjects. *Eur J Pain.* 2015;19(10):1467-1475. doi:10.1002/ejp.678
20. Alqudimat M, Mesaroli G, Lalloo C, Stinson J, Matava C. State of the art: immersive technologies for perioperative anxiety, acute, and chronic pain management in pediatric patients. *Curr Anesthesiol Rep.* 2021;11(3):265-274. doi:10.1007/s40140-021-00472-3
21. Lilik Lestari MP, Wanda D, Hayati H. The effectiveness of distraction (cartoon-patterned clothes and bubble-blowing) on pain and anxiety in preschool children during venipuncture in the emergency department. *Compr Child Adolesc Nurs.* 2017;40(1):22-28. doi:10.1080/24694193.2017.1386967
22. Boyle EA, Hainey T, Connolly TM, et al. An update to the systematic literature review of empirical evidence of the impacts and outcomes of computer games and serious games. *Comput Educ.* 2016;94:178-192. doi:10.1016/j.compedu.2015.11.001
23. Boyle EA, Connolly TM, Hainey T, Boyle JM. Engagement in digital entertainment games: a systematic review. *Comput Human Behav.* 2012;28(3):771-780. doi:10.1016/j.chb.2011.11.020
24. Suleiman-Martos N, García-Lara RA, Membrive-Jiménez MJ, et al. Effect of a game-based intervention on preoperative pain and anxiety in children: a systematic review and meta-analysis. *J Clin Nurs.* 2022;31(23-24):3350-3367. doi:10.1111/jocn.16227