Original Article

Effects of Auditory and Audiovisual Presentations on Anxiety and Behavioral Changes in Children Undergoing Elective Surgery

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ABSTRACT

Background: Preoperative anxiety is a critical issue in children, and associated with postoperative behavioral changes. **Aims:** The purpose of the current study is to evaluate how audiovisual and auditory presentations about the perioperative period impact preoperative anxiety and postoperative behavioral disturbances of children undergoing elective ambulatory surgery. **Materials and Methods:** A total of 99 patients between the ages of 5–12, scheduled to undergo outpatient surgery, participated in this study. Participants were randomly assigned to one of three groups; audiovisual group (Group V, n = 33), auditory group (Group A, n = 33), and control group (Group C, n = 33). During the evaluation, the Modified Yale Preoperative Anxiety Scale (M-YPAS) and the posthospitalization behavioral questionnaire (PHBQ) were used. **Results:** There were no significant differences in demographic characteristics between the groups. M-YPAS scores were significantly lower in Group V than in Groups C and A ($P < 0.001$ and $P < 0.001$, respectively). PHBQ scores in Group C were statistically higher than in Groups A and V, but, no statistical difference was found between Groups A and V. **Conclusion:** Compared to auditory presentations, audiovisual presentations, in terms of being memorable and interesting, may be more effective in reducing children's anxiety. In addition, we can suggest that both methods can be equally effective for postoperative behavioral changes.

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INTRODUCTION

Hospitalization and surgery are a serious and memorable event for children and their parents. Children undergoing surgery and their parents can be anxious in the preoperative period, and it occurs up to 65% of children.[1] Preoperative anxiety is associated with postoperative pain, emergence delirium, and postoperative behavioral changes (e.g., general anxiety, appetite changes, sleep disturbances, enuresis, and temper tantrums).[2-4]

Pharmacological and nonpharmacological methods are utilized to treat preoperative anxiety in children. In the recent years, nonpharmacological methods are preferred due to possible adverse effects (e.g., excessive sedation and delayed discharge) of pharmacological methods.[5] Nonpharmacological methods are as follows: the presence of parents, distraction techniques, fun transportation systems, preoperative information programs, hypnosis, music, and acupuncture.[2]

Behavioral interventions that are used as preoperative preparation programs are applied through coping skills, modeling, and play therapy.[2] The aim of behavioral programs is to teach coping skills through modeling for anxiety to children and also to provide information about the perioperative process. These interventions should be prepared taking into consideration a child's age, developmental stage, and previous experience.[2,6]

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There are three methods which are known to be effective in learning; i.e., visual (pictures, images, demonstrations), auditory (reading, words, listening), and kinesthetic (touch, taste). Visual images are important to visual learning, in which body language is also used. It is also important to be informed by listening to auditory learning.[7] Most people learn best using a combination of both, although visual learning is usually the prominent component.[8] To the best of our knowledge, an auditory-related (listening) study outside of music therapy is not available for preoperative anxiety management while there are limited audiovisual studies involving children in the literature.[9-11]

The current study was designed to compare the effects of audiovisual and auditory presentations on preoperative anxiety and postoperative behavioral disturbances of children undergoing elective ambulatory surgery. The primary end point was the preoperative anxiety levels of patients. The secondary end point was the behavioral changes of children in the postoperative period.

Materials and Methods

Patients

The study protocol was approved by the Institutional Ethics Committee of the Cukurova University, Faculty of Medicine (no: 45/2015). We enrolled patients between March 2015 and February 2016. Written informed consent was obtained from all the parents. Ninety-nine patients with the American Society of Anesthesiologists physical Status I-II, aged 5–12 years old and scheduled for outpatient surgery (e.g., orchiopexy, hypospadias surgery, inguinal hernia, tonsillectomy, adenoidectomy, and strabismus surgery) were accepted in the present study. Children with chronic illness, undergoing emergency surgery, cognitive disorders, and parents who refuse to participate were excluded from this study.

Study design

The study participants were allocated to the groups using a computer-generated randomization list at preoperative visit: audiovisual group (Group V, n = 33), auditory group (Group A, n = 33), and the standard of care group (Group C, n = 33).

After all patients were examined by an anesthesiologist at hospital admission 1 week before surgery, the following applications were presented: the patients in Group V were shown an audiovisual presentation to inform about preoperative preparation and postoperative period [Appendix 1]. The sound recording of this video was listened to by the patients in Group A without the visual element of the audiovisual presentation. The patients in Group C were verbally informed on usual the anesthesia practice of our hospital (e.g., anesthesia and analgesia management, preoperative fasting, and regular use of the drug to be administered after surgery). Parents accompanied their children during this time. Patient's age, gender, history of previous surgery, type of surgery, and parent's age, gender, and educational level were recorded.

Measurements

The children in all groups were admitted with one of the parents into the preoperative holding room. The preoperative anxiety levels of children were measured with the Modified Yale Preoperative Anxiety Scale (M-YPAS) at induction of anesthesia after being taken into the operating room. This assessment was made by an anesthesiologist who was blinded to the groups. In brief, the M-YPAS is used to measure children's anxiety in the preoperative holding area and during induction of anesthesia. The M-YPAS contains 22 items in five categories (activity, emotional expressivity, state of arousal, vocalization, and use of parents). The scoring in each category is done with a different number of items (either four or six). A total adjusted score is calculated with a formula after evaluating partial weight ([activity/4+ emotional expressivity/4+ state of arousal/4+ use of parents/4+ vocalization/6] ×100/5). The cutoff point of 30 on the M-YPAS leads to balance in which the sensitivity and specificity are high, and the predictive value is 79%.[12]

Postoperative maladaptive behaviors of children were assessed using the posthospitalization behavioral questionnaire (PHBQ). Parents were contacted by telephone 7 days after hospital discharge, and this assessment was performed by the same anesthesiologist. In brief, the PHBQ contains a total of 27 items in the following six subscales: general anxiety and regression, separation anxiety, eating disturbance, aggression toward authority, apathy/withdrawal, and anxiety about sleep. The PHBQ is scored by parents using five response options: much less than before (1), less than before (2), same as before (3), more than before (4), and much more than before.[13] Psychometric properties of the PHBQ have been shown in a study of Vernon *et al*.[14] We considered the negative behavioral change as a response of 4 or 5 for an item of the PHBQ.[15]

Anesthesia management

After 6 h of fasting, the children were taken into a preoperative holding area and none of the children used any premedication. The children were taken accompanied by their parents into the operating room from the preoperative holding area. Standard monitoring was applied to patients (electrocardiogram, pulse oximeter, and noninvasive blood pressure). Anesthesia induction was provided with 6%–8% sevoflurane and

a gas mixture of (40%–60%) oxygen/nitrous oxide. After placing intravenous (IV) cannula on the hand, rocuronium 0.6 mg/kg was administered and all patients were intubated. Fluid resuscitation was accomplished with Ringer's lactate solution (3–5 ml/kg/h). After anesthesia induction, the parents were taken out of the operating room with a nurse. Maintenance of anesthesia was provided with 1%–2% sevoflurane and a gas mixture of (40%–60%) oxygen/nitrous oxide. For intraoperative analgesia, fentanyl 1 μg/kg was given. Tramadol (2 mg/kg, IV) was administered for postoperative analgesia in all patients. After the end of the surgery, anesthesia was terminated, and the neuromuscular blockade was antagonized with atropine (0.015 mg/kg, IV) and neostigmine (0.05 mg/kg, IV). The awakened patients were transferred to the recovery room accompanied by their parents. After recovery, the children were transported to their clinical wards.

Statistical analysis

Sample size analysis was performed using G*Power version 3.1.9.2 (G*Power Software, Kiel, Germany). We calculated the sample size with a power of 0.80 and an α of 0.05 as 24 patients for each group to detect 10 points difference in M-YPAS scores between the groups. A control mean M-YPAS score of 50 with an SD of 12 was reported in a previous study.[16] All analyses were performed using IBM SPSS Statistics software package (IBM SPSS Statistics for Windows, Version 20.0; IBM Corp., Armonk, New York, USA). Categorical variables were expressed as numbers and percentages, whereas continuous variables were summarized as a mean and standard deviation and as median and range where appropriate. The normality of distribution for continuous variables was confirmed with the Kolmogorov–Smirnov test. For comparison of continuous variables between two groups, the Student's *t*-test was used. For comparison of three groups, the One-way ANOVA or Kruskal–Wallis test was used depending on whether the statistical hypotheses were fulfilled or not. For normally distributed data, regarding the homogeneity of variances, Bonferroni, Scheffe, Tamhane tests were used for multiple comparisons of groups. For abnormally distributed data, a Bonferroni adjusted Mann–Whitney U-test was used for multiple comparisons of groups. To evaluate the correlations between measurements, the Pearson correlation coefficient was used. Multivariate logistic regression analysis was used to determine the predictors of postoperative maladaptive behaviors. According to the "cutoff points," patients were divided into two subgroups; a calm group that included patients who scored <30th percentile of the M-YPAS and an anxious group that included patients who scored >30th percentile of the M-YPAS.[12] The statistical level of significance for all tests was considered to be 0.05.

Results

Flow diagram for the study is shown in Figure 1. The demographic characteristics of patients and parents were similar between the three groups [Table 1]. No significant differences were found in terms of surgical data between the three groups [Table 2].

Table 2: Surgical data

	Group V	Group A	Group C	*P*
Surgery				
ENT (other)	19	15	7	0.55
Ear tube insertion	3	5	2	
Strabismus	4	6	11	
Dental surgery	2	2	3	
Circumcision	2	3	1	
Other	3	2	9	
Time of surgery (min)[a]	50.0±14.3	46.1±14.2	51.9±21.8	0.38

[a]One-way ANOVA test was used. Values are presented as number or mean±SD. ENT=Ear-nose-throat; ENT (other)=Adenoidectomy, tonsillectomy, adenoidectomy and tonsillectomy; SD=Standard deviation

Table 1: Patients and parents' demographic data

	Group V	Group A	Group C	*P*
Patients				
Age (years)[a]	7.6±2.0	7.4±1.9	7.6±2.3	0.93
Gender (female/male)	16/17	17/16	15/18	0.88
Birth order (first born/middle/later)	16/10/7	23/4/6	15/13/5	0.37
Previous surgery (yes/no)	10/23	10/23	17/16	0.12
Time of previous surgery				
Last 1 year	6	4	6	0.21
Last 1 years ago	4	6	11	
Parents				
Age (years)[a]	36.9±5.4	34.6±5.1	36.7±5.3	0.13
Gender (female/male)	19/14	21/12	20/13	0.88
Education (literate/primary school/higher/university)	1/10/22	0/11/22	0/17/16	0.28

[a]One-way ANOVA test was used. Values are presented as number or mean±SD. SD=Standard deviation

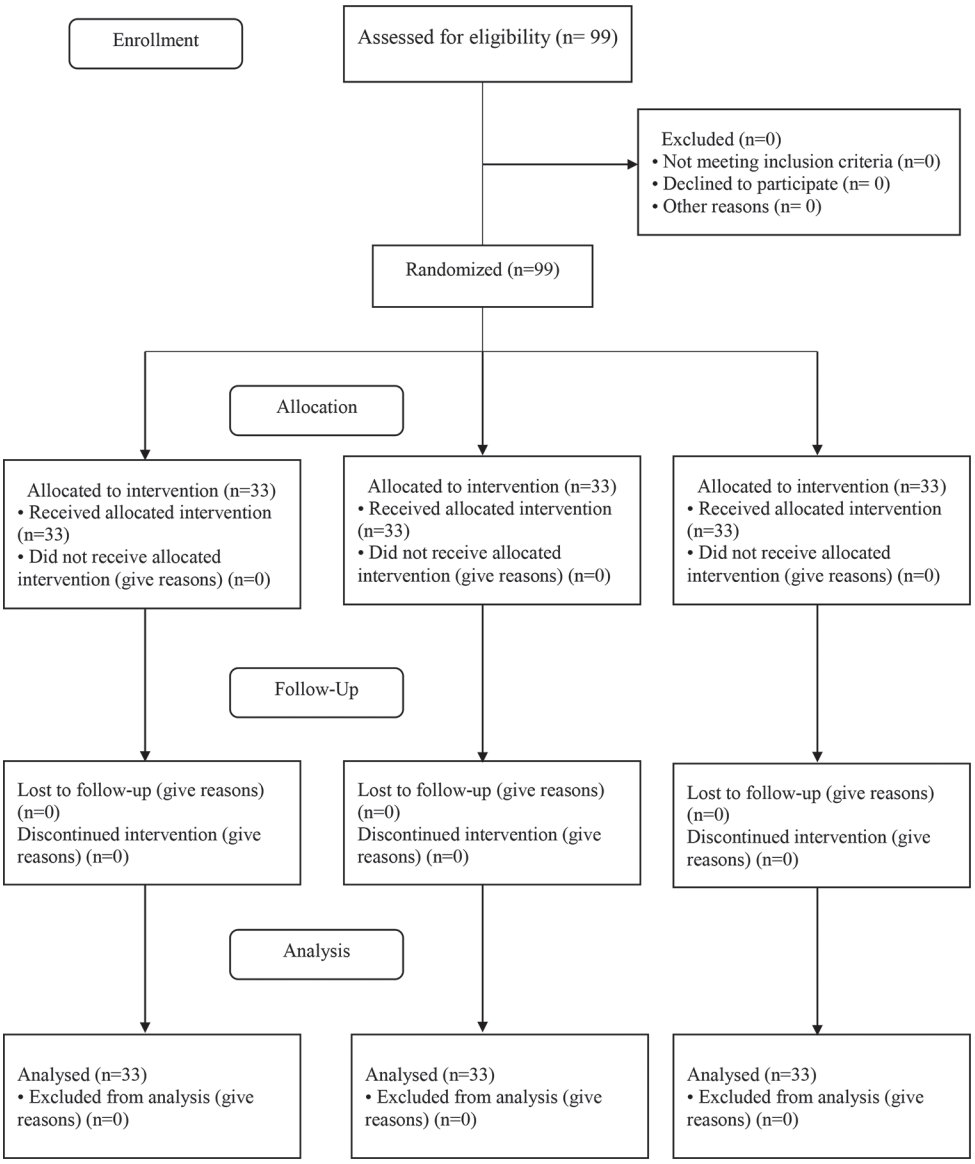

Figure 1: Flow diagram of the study

Table 3: The means of the Modified Yale Preoperative Anxiety Scale and Posthospitalization Behavioral Questionnaire

	Group V	Group A	Group C	*P*
M-YPAS	27.4±7.1	39.3±19.2	73.1±18.0	<0.001[a,b,c]
PHBQ	81.4±2.6	82.1±1.8	87.6±3.4	<0.001[a,b]

[a]*P*<0.001 for Group C versus Group V; [b]*P*<0.001 for Group C versus Group A; [c]*P*<0.001 for Group A versus Group V. PHBQ=Posthospitalization Behavioral Questionnaire; M-YPAS=Modified Yale Preoperative Anxiety Scale

Table 4: Predictors for postoperative maladaptive behavioral changes

Predictors	OR	95% CI	*P*
M-YPAS[a]	1.03	1.01-1.06	0.002
Parent gender (female/male)[b]	4.05	1.39-1.06	0.01
Age[c]	0.40	0.13-1.16	0.09

[a]Anxious children (>30%) compared to less anxious (<30%); [b]Male compared to female; [c]<7 years of age compared to >7 years of age. OR=Odds ratio; CI=Confidence interval; M-YPAS=Modified Yale Preoperative Anxiety Scale

The M-YPAS scores were significantly lower in Group V than Groups C and A ($P < 0.001$) [Table 3]. When comparing the three groups, there were no statistically relationships among age, previous surgery, type of surgery, the education level, and gender of parents on the M-YPAS scores. However, on the basis of the evaluation of all patients, preschool children (<7 years old) had more anxiety (43.0 ± 23.3 vs. 52.3 ± 26.6, $P = 0.071$). Similarly, the M-YPAS scores of 37 children who underwent a previous surgery were compared with 62 nonoperated children, nonoperated children had lower M-YPAS scores (42.2 ± 23.9 vs. 54.0 ± 25.1, $P = 0.022$).

Table 5: New postoperative maladaptive behavioral changes

Behavioral changes	Calm group (*n*=44)	Anxious group (*n*=55)
Difficulty about going to bed at night	3	20*
When left alone for a few minutes, upset	1	11*
Need help to do things	1	8*
Avoid or afraid of new things	0	6*
Temper tantrums	2	13*
Negative reaction to doctors or hospitals	2	28*
Follow you everywhere around the house	1	8*
Sleeping problems	0	19*

*P<0.05 between the groups. Anxious children (M-YPAS >30%) compared to calm children (M-YPAS <30%). *n*=Number of patients; M-YPAS=Modified Yale Preoperative Anxiety Scale

The patients in Group C had statistically higher PHBQ scores than those in Groups A and V ($P < 0.001$) [Table 3]. For all patients, no correlation was found between PHBQ and children's age, whereas there was a correlation between PHBQ and parent gender ($P = 0.01$). In addition, anxious child (<30th percentile) had 1.03 times greater risk of adopting negative behaviors than a calm child (>30th percentile) [Table 4]. Especially, in anxious children, there was a significant correlation between M-YPAS and general anxiety, separation anxiety, apathy, and sleep disturbances ($P < 0.05$), and the number of new postoperative maladaptive behavioral changes is summarized Table 5.

Discussion

The results of the present study showed that audiovisual presentation related to preanesthetic information in children is an effective approach in reducing preoperative anxiety. Furthermore, children who were informed with audiovisual and audio presentation had less behavioral changes 1 week after discharge.

In the literature, there are some trials that used audiovisual presentations for providing information to patients.[17-19] Gaskey showed that the addition of audiovisual presentation to the routine preoperative anesthesia visit did not produce a significant reduction in preoperative anxiety levels in adult patients. However, patients were less nervous and had higher levels of knowledge about anesthesia procedures.[18] In contrast, the study findings demonstrated exposure to an audiovisual presentation significantly reduced anxiety at anesthesia induction. In this regard, Kain *et al*. stated that behavioral preparation program (ADVANCE: Anxiety-reduction, Distraction, Video modeling, Adding parents, No excessive reassurance, coaching, and exposure/shaping) is efficient in the reduction of children's anxiety.[20] Similarly, Web-Based Tailored Intervention for Preparation of Parents and Children for Outpatient Surgery (WebTIPS) is a web-based preoperative preparation program with features, including information provision, modeling, and coping skills. The study showed that WebTIPS reduces the anxiety of children in the preoperative settings.[21] Although both studies are comprehensive programs and effective on preoperative anxiety, the cost of these programs is quite expensive. In another study, Batuman *et al*. concluded that informational videos about preoperative preparation help to decrease children's preoperative anxiety.[22] Unlike our study, they evaluated the effects on the preoperative anxiety of only audiovisual presentation. The result of these studies shows that an audiovisual presentation about preoperative information produces improved outcomes on children's anxiety, and it is considered a low-cost method.

A systematic review reported that music therapy might be an ineffective method for coping with anxiety, and an audiovisual presentation is more effective than music therapy in reducing preoperative anxiety in children.[9] Similar to the findings in our study, preoperative information video has a stronger impact on children's anxiety than an auditory presentation. Although both methods include the same information, an audiovisual presentation may be more memorable and interesting to children. Since children have broad imaginations, the mental visualization in an auditory presentation will be unique for each child. This may cause them to misperceive the given information from auditory methods in unfavorable ways and become afraid of the upcoming surgery.

In this study, there is no relationship between the children's age and M-YPAS. This is consistent with the study by Vagnoli *et al*.[23] Although there was no statistical difference, children under the age of 7 years were more anxious. Surgery creates a greater emotional stress in younger children due to poorer comprehension increased dependency on the mother, less communication with the social environment, and decreased the ability to manage anxiety.[24] The study also shows that children without any previous operations had less anxiety. This should be noted as preoperative information programs may adversely affect the emotional status in previously hospitalized children.[6]

Risk factors for negative postoperative behavior changes have been reported to include the following; preoperative anxiety, younger age, previous anesthesia experiences, premedication, and increased parental anxiety.[1,4] In this study, the children who received a standard information had more PHBQ scores. Similarly, Hilly *et al*. indicated that workshops for preoperative preparation decrease

both preoperative anxiety levels and postoperative behavioral changes in children.[3] Regardless of the format of presentation, we demonstrated a positive effect on behavioral changes in children in the postoperative period. In addition, we found that there is an association between preoperative anxiety and postoperative maladaptive behaviors such as separation anxiety, general anxiety, apathy, and sleep disturbances, which is consistent with the results of previous studies.[1] This study also shows that maternal presence may prevent the development of postoperative negative behavioral changes, regardless of other personal information of the parents. This situation can be explained by the emotional bond between mother and child.[25,26]

The present study has a number of limitations. First, the anxiety levels of parents were not evaluated. Parental anxiety has an effect on the child in the preoperative period.[2] McEwen *et al*. have reported that preoperative information videos can lessen the anxiety of parents.[27] Cassady *et al*. also agree with this study, but Chundamala *et al*. presented a different viewpoint that parental presence does not reduce the parents' or the children's anxiety.[28,29] Considering these results, we cannot eliminate the effect of parental anxiety on children. Second, the relationship between pain and behavioral changes is a controversial issue.[4,30] Pain may have a negative effect on a child's behavior; however, we did not evaluate the children's pain scores as an indicator of postoperative behavioral changes. Thus, we recommend the evaluation of pain in future studies. Third, M-YPAS was measured only at the point of anesthesia induction. We do not know anxiety levels of the children in the preoperative waiting room or at hospital admission. Finally, there was no validity and reliability of the Turkish version of the M-YPAS and PHBQ.

Conclusion

Audiovisual presentation is an effective and inexpensive method to preoperative anxiety reduction in children. It is a more memorable and interesting approach compared to auditory presentations for children. Both audiovisual and auditory presentations have equal effects on postoperative behavioral changes.

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Conflicts of interest

There are no conflicts of interest.

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Appendices

Appendix 1: The content of the audiovisual presentation

The total duration of the video recording was 344 s and it consisted of two sections: Part 1 and 2. Doctors, nurses, an 11-year-old female, and her mother took part in the video and special permission was received from them to be recorded. The audiovisual presentation was recorded in the anesthesia clinic and operating room of our hospital.

Part 1: This section is 300 s long and includes the verbal explanation by the anesthesiologist of preoperative information, anesthesia management, and the postoperative period. Three people were involved in this section: the anesthesiologist, the child, and her mother. The teddy bear was used as model. The child and her mother visit the anesthesiologist for preoperative information in the anesthesia clinic. The anesthesiologist meets with them and then informs them about the surgery and the anesthesia methods. First, the child asks "What is surgery?" and then she mentions "I am afraid of the pain." The doctor explains that "You will not be in any pain" and continues by saying, "The duties of the anesthesiologist are to apply anesthesia to patients, to reduce their pain and ensure their well-being during operation." After the child relaxes, the anesthesiologist describes how anesthesia is administered by two methods. The first method is to insert a small plastic tube into a vessel on the hand and some anesthetic drugs are administered via the small tube. The anesthesiologist uses a teddy bear for the second method. The doctor explains "This is a face mask and it smells nice." She puts a small face mask on the face of the teddy bear and says, "It is connected to the anesthesia machine by a plastic tube. Anesthetic gases are given through the plastic tube." The doctor pretends to tell the teddy bear to take deep breaths and says, "This will help you fall asleep quickly and after that the surgery will be performed. At the end of surgery, you will be awakened by the administering of some drugs. Furthermore, I will administer drugs for pain relief." After explaining anesthesia, the doctor says to the child's mother "Your child will be safe and you should not feel restlessness related to the surgery or anesthesia." The anesthesiologist explains that preoperative fasting is six hours and postoperative drugs are given regularly. They leave and plan to meet again the next day for the operation.

Part 2: This section is 44 s long and contains preoperative preparation, anesthesia induction, and a recovery period. The child and mother come into the operating room with the personnel. The nurse meets them in the preoperative holding area. The anesthesiologist comes into the preoperative holding area and takes the child and mother into the operating room. The doctor inserts a device in the child's finger and explains that "The device measures the amount of oxygen in the blood." The doctor performs anesthesia with the face mask and says, "Take deep breaths and have a good sleep." After completing the operation, the doctor wakes the child and takes her into the recovery room. The anesthesiologist talks with the child and mother and leaves from the recovery room.