

Single-Blinded Randomized Controlled Study on Use of Interactive Distraction Versus Oral Midazolam to Reduce Pediatric Preoperative Anxiety, Emergence Delirium, and Postanesthesia Length of Stay

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Purpose: *The purpose of this study was to compare effects of tablet-based interactive distraction (TBID; 1 minute preseparation) with oral midazolam (15 to 45 minutes of preseparation) on preoperative anxiety, emergence delirium, and postanesthesia length of stay in children, 4 to 12 years undergoing outpatient surgery.*

Design: *Single-blinded prospective design with randomized assignment to TBID or oral midazolam group was conducted at a large pediatric hospital in southwestern United States.*

Methods: *A total of 102 children and caregivers were enrolled. Outcome measures included anxiety scores at baseline, separation, and mask induction; postemergence delirium scores; caregiver ratings of child anxiety and satisfaction; and time from postanesthesia care unit arrival to discharge and posthospital behaviors.*

Findings: *The TBID group demonstrated significantly lower anxiety at separation and mask induction ($P < .001$) and emergence delirium at 15 minutes postawakening ($P = .001$), were extubated earlier ($P = .007$), arrived to phase II earlier ($P = .03$), and discharged earlier ($P = .0001$).*

Conclusions: *TBID was more effective than oral midazolam in reducing preoperative anxiety, emergence delirium, and postanesthesia length of stay.*

Keywords: *preoperative anxiety, postanesthesia emergence delirium, interactive distraction, oral midazolam.*

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CHILDREN OFTEN EXPERIENCE ANXIETY before outpatient surgical procedures when separated from parents and at mask (anesthesia) induc-

tion. They are not emotionally or cognitively equipped to understand the need for a procedure or separation from their caregivers. This anxiety

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can lead to problems of fear and distress preoperatively and beyond the immediate postoperative period.¹⁻³ The most common treatment for preoperative anxiety is the administration of benzodiazepines, most frequently oral midazolam. This medication, known for its bitter taste, has its own undesired side effects, such as prolonged sedation, emergence delirium, and behavioral changes.⁴

The existing literature of comparing anxiolytic medication to the use of a handheld interactive distractive device in pediatrics is minimal. There is evidence, however, of various other effective methods of distraction in reducing preoperative anxiety. Kerimoglu et al² compared the efficacy of oral midazolam and behavioral distraction with video glasses in managing preoperative anxiety in children aged 4 to 9 years. The researchers concluded that the use of video glasses alone, midazolam alone, or in combination maintained baseline anxiety during transport to the operating room and prevented significantly increased anxiety during anesthetic induction of children. Chow et al⁵ completed a systematic review of the use of audiovisual interventions in reduction of pediatric preoperative anxiety and concluded that audiovisual games, specifically interactive games, were valuable alternatives to oral midazolam.

The study by Seiden et al³ was the first comparative study between preoperative tablet-based interactive distraction (TBID) and oral midazolam in children aged 1 to 11 years. The findings suggested that TBID, when compared with the usual practice of preoperative oral midazolam, was as effective in reducing preoperative anxiety, emergence delirium, and time to discharge, as well as increasing parental satisfaction. This was the first study on preoperative TBID intervention in pediatrics.

Clinical preoperative and postanesthesia care unit (PACU) nurses, nurse managers, and a child life specialist, at a large freestanding urban pediatric medical center in the southwestern United States, identified the need to evaluate nonpharmacological interventions to enhance the patient experience by decreasing preoperative anxiety, further promote patient safety by reducing postemergence delirium, and increase patient and family

satisfaction with their outpatient surgical experience. The purpose of this study was to increase the evidence for use of interactive distraction in pediatric preoperative patients. The overall research question was as follows: In children, 4 to 12 years old, undergoing outpatient surgery, was interactive distraction with a tablet (1 minute before parental separation) effective in reducing preoperative anxiety (at parental separation and mask induction), postemergence delirium, and length of stay in the PACU when compared with administration of preoperative oral midazolam?

Methods

Design

The study used a single-blinded prospective comparative preinterventional and postinterventional research design with randomized assignment to either the TBID experimental group or the oral midazolam control group. Research personnel in the PACU were blinded to the intervention that patients received in the preoperative area. This study was conducted in the main surgical services department and the ambulatory surgery center of a large urban pediatric medical center in the southwestern United States from February 2016 to September 2016. All enrolled patients were administered the same inhalation induction and maintenance during the surgical procedure (sevoflurane, oxygen, and nitrous oxide).

Approval was obtained from the institutional review board of the pediatric medical center. Informed consent was attained from caregivers or legally authorized representatives, and verbal assent was attained from children aged 8 to 12 years. Research personnel included frontline preoperative and PACU nurses, child life specialist, and medical director of anesthesia, under the supervision of the Director of Nursing Research.

Sample

A total of 102 patients and their caregivers were recruited: 51 pediatric patients were randomly assigned to the TBID experimental group and 51 to the oral midazolam control group. The G*Power³⁶ software program was used to estimate an a priori sample size needed using *t* test (differences between two independent means—two groups).

Based on a two-tailed hypothesis, an effect size of 0.50 (calculated from Seiden et al³), alpha of significance of 0.05, study power of 0.80, and a total sample size of 102 child and caregiver participants were estimated for adequate study power.

Inclusion criteria included children aged 4 to 12 years who were scheduled for outpatient surgical procedures lasting 1.5 hours or less, American Society of Anesthesiologists (ASA) I or II, never having undergone any surgical procedure requiring anesthesia or have had anesthesia before 2 years of age, and English-speaking patient and caregiver. Exclusion criteria included previous diagnoses with behavioral or psychiatric disorders, neurosensory disorders or developmental delays, emergent surgical procedures, and children with a known allergy to midazolam.

On obtaining informed consent and assent, if needed, each child was asked to select a card from a colorful whimsical hat. If the child participant picked the dinosaur card, the child received the control intervention of oral midazolam (0.3 mg/kg of midazolam; 20 mg of maximum dose) 15 to 45 minutes before separation. When the robot card was selected, the child was given an iPad mini with an age-appropriate gaming application 1 minute before parental separation to be continued through mask induction. The age-appropriate games were selected by the child life specialist based on the listing of games from the study by Seiden et al.³

Measures

DEMOGRAPHIC SURVEY. A researcher-developed tool consisted of five items related to caregiver's age and gender, patient's age and gender, ASA class, and procedure type (general, urology, otolaryngology, and other); the latter two items were obtained by research personnel from the preoperative medical record. In addition, the caregiver was asked to select a preference (electronic mail [e-mail] or telephone) to be contacted by a member of the research team at 7 and 14 days postoperatively for a posthospital behavior questionnaire.

MODIFIED YALE PREOPERATIVE ANXIETY SCALE—SHORT FORM. The *Modified Yale*

Preoperative Anxiety Scale—Short Form (mYPAS-SF) was developed and psychometrically established as an observational measure of children's preoperative anxiety.⁷ The research team decided to use the most recent revisions to the mYPAS,^{7,8} which is now a shorter form for nurse observations of preoperative anxiety; the parent observations were removed. The mYPAS-SF consists of four observational items: activity, vocalizations, emotional expressivity, and state of apparent arousal. Each item has Likert-style response options reflecting the behaviors of the pediatric patient. On admission (baseline), at time of parental separation, and at mask induction, each child's behavior was rated from one to four (for activity, emotional expressivity, and state of apparent arousal items) or one to six (for vocalizations item), with the higher numbers indicating the highest severity of anxiety within that item. For total scores, each item rating was divided by the highest possible rating (ie, 6 for vocalizations item and 4 for all other items), added all the produced values, divided by four, and multiplied by 100; and range of scores was 23 to 100. The internal consistency reliability coefficient (Cronbach's α) for this revised scale was 0.92.⁸

Two lead frontline nurse researchers attended a two-day training session on the use of the mYPAS-SF at the University of California Irvine Center for Pain and Stress, where the tool was developed. The nurse researchers provided training to additional research team members and achieved inter-rater reliability (IRR) before beginning observations on study participants.

PEDIATRIC ANESTHESIA EMERGENCE DELIRIUM SCALE.

The Pediatric Anesthesia Emergence Delirium (PAED) Scale has established reliability and validity in the measurement of emergence delirium in children.⁹ The scale consists of five items scored from zero to four (with three reverse-scored items). The five items relate to observation of eye contact with caregiver, purposeful actions, awareness of surroundings, restlessness, and inconsolability.⁹ The scores were summed to obtain a total score with a range from 0 to 20; higher scores correlate with higher severity of delirium. The cutoff score of ≥ 10 on the PAED scale to describe emergence delirium was selected based on previously reported

sensitivity data.⁹ A different research team member, one blinded to the intervention, observed the child in the PACU on emergence and 15 minutes later for signs of emergence delirium using the PAED scale. All PACU research team members were trained on this observational measure, and IRR was achieved before data collection.

CAREGIVER'S PERCEPTION OF CHILD'S LEVEL OF ANXIETY. Each caregiver study participant was asked to rate their child's level of anxiety at two periods: (1) on admission to the preoperative area and (2) immediately after time of caregiver separation when their child was wheeled into operating room. Item responses were developed on a seven-point Likert scale with scores from zero (not at all) to six (very anxious). Higher scores described increased levels of caregiver-perceived anxiety of their child at each of the periods.

CAREGIVER SATISFACTION WITH EASE OF CHILD-CAREGIVER SEPARATION. Once the caregivers joined their child in PACU, the caregivers were asked to rate their satisfaction at the time of child-caregiver separation. Responses to this question were rated on a seven-point Likert scale from zero (not satisfied) to seven (very satisfied).

LENGTH OF STAY IN PACU. A member of the research team reviewed each child participant's electronic medical record to obtain data on time in minutes from (1) PACU arrival to emergence, (2) PACU arrival to phase II, and (3) PACU arrival to discharge home.

POSTHOSPITALIZATION BEHAVIOR CHANGE QUESTIONNAIRE FOR AMBULATORY SURGERY. The Posthospitalization Behavior Change Questionnaire for Ambulatory Surgery (PHBQ-AS) surveys were administered to the caregivers at day 7 and day 14 postoperatively, via phone call or e-mail, whichever caregivers preferred. The PHBQ-AS survey was designed to assess new-onset postoperative behavioral changes in children who had undergone ambulatory surgery.¹⁰ This questionnaire consisted of 11 items relating to issues on appetite, dreams, wakefulness, interest in play, talking, or temper tantrums. Responses were scored on a five-point Likert scale as (1) much less than before, (2) less than before, (3)

same as before, (4) more than before, and (5) much more than before. Caregivers were also given the response option of not applicable. From the advice of the PHBQ-AS developers, any not applicable responses were given a value of three to reflect same as before or no behavioral change. To achieve total PHBQ-AS scores, items were averaged by summing the items for each respondent and then dividing by total number of items. Total PHBQ-AS scores produced continuous variables with scores above three indicating greater maladaptive behavioral changes, scores lower than three suggesting improvements in behavioral changes, and scores equal to three implying no behavioral change. The Cronbach's α for the PHBQ-AS was 0.80; moderate to strong concurrent validity was reported as $r = 0.49$ between PHBQ-AS and Functional Disability Inventory.¹⁰

Statistical Analyses

Data analyses were performed using IBM SPSS 25 software (SPSS Inc, Chicago, IL). Alpha of significance was set at < 0.05 for this study. For demographic data, frequencies and percentages were obtained for nominal level of data and means, SDs, and ranges were calculated for ages of child and caregiver participants. To assess for any group differences between demographic variables, appropriate statistics were completed based on levels of data: (1) analysis of variance (ANOVA) for age, (2) Mann-Whitney U test for ASA class, and (3) χ^2 tests for gender and surgery type. Descriptive statistics (means and SDs) were also obtained for all study measure scores and lengths of PACU stay in minutes. To determine if there were any statistical differences in mYPAS-SF total scores between three periods (admission, separation, and mask induction) within each group (TBID and oral midazolam), repeated-measures ANOVA were used with Bonferroni post hoc tests to identify specific differences within groups. Multifactorial ANOVA was used to examine for any statistical differences in mYPAS-SF scores between the two study interventions and the three periods with Bonferroni post hoc test to identify any specific differences between groups. To compare differences between TBID and oral midazolam groups on PAED scores at two time points, ANOVA was calculated to assess for main effects (time or group) and interaction effect (time \times group). For the caregiver perception of child's

level of anxiety survey, paired sample *t* tests were used to identify any within-group differences between two periods (admission and separation), and ANOVA was calculated to assess for main effects (time or group) and interaction effect (time \times group) between groups. Independent-sample *t* tests were completed to examine if differences existed between groups for caregiver satisfaction survey responses and amount of minutes from PACU arrival to phase II and to discharge home.

Findings

DEMOGRAPHICS. A total of 102 patients and their caregivers participated in the study, randomly assigned to either TBID ($n = 51$) or oral midazolam group ($n = 51$). As noted in Table 1, both groups were demographically matched (no statistically significant differences). In both groups, most participants were almost 7 years old, male, ASA class 1, with most scheduled for general surgical procedures. Most caregivers were females and in their mid-30s.

MODIFIED YALE PREOPERATIVE ANXIETY SCALE—SHORT FORM. Figure 1 describes the mean total mYPAS-SF scores at three periods: baseline, parental separation, and mask induction. Between groups, statistically significant differences in total mYPAS-SF scores were found: mean total scores were significantly lower in the experimental TBID group at parental separation ($P = .006$) and mask induction ($P < .001$). A moderate effect size of 0.497 was calculated from between-group differences at time of mask

induction. No statistically significant differences were found in mean total mYPAS-SF scores at baseline between TBID and oral midazolam groups ($P = .31$).

Within groups, statistically significant differences in mean total mYPAS-SF scores were obtained. In the oral midazolam control group, there were significant increases in mean total scores between baseline to parental separation ($P = .006$), between parental separation and mask induction ($P = .001$), and between baseline to mask induction ($P < .001$). In the TBID group, there were significant increases in mean total scores between parental separation and mask induction ($P = .02$) and between baseline to mask induction ($P = .04$). No statistically significant differences were found in mean total mYPAS-SF scores between baseline and parental separation ($P = .77$). Internal consistency reliability alphas for mYPAS-SF were obtained: 0.78 for oral midazolam group and 0.83 for TBID group.

PAED SCALE SCORES. At time of emergence in the PACU, there were no statistically significant between-group differences in PAED mean total scores (oral midazolam: 10.6 [2.9] vs TBID: 9.6 [4.7]; $P = .19$). Fifteen minutes postemergence, PAED mean total scores were significantly lower ($P = .001$) in the TBID group (3.9 [3.7]) than the oral midazolam group (6.7 [4.3]); large effect size of 0.71 was found for this significant difference. Internal consistency reliability alphas for PAED were obtained: 0.77 for oral midazolam group and 0.76 for TBID group.

Table 1. Demographic Data

Variables	Oral Midazolam Group ($N = 51$)	TBID Group ($N = 51$)
Caregiver age (mean/SD/range)	35.3 (6.3) y (24-50 y)	35.7 (8.5) y (22-67 y)
Caregiver gender (frequency/percentage)	Male: 13 (25.5%); female: 38 (74.5%)	Male: 8 (15.7%); female: 43 (84.3%)
Patient age (mean/SD/range)	6.9 (2.5) y (4-12 y)	6.8 (2.4) y (4-12 y)
Patient gender (frequency/percentage)	Male: 33 (64.7%); female: 18 (35.3%)	Male: 26 (51%); female: 25 (49%)
ASA status (frequency/percentage)	ASA I: 40 (78.4%); ASA II: 11 (21.6%)	ASA I: 36 (70.6%); ASA II: 15 (29.4%)
Procedure type (frequency/percentage)	General surgery: 28 (56%); urology: 13 (26%); otolaryngology: 6 (12%); other: 3 (6%)	General surgery: 21 (41.2%); urology: 16 (31.4%); other: 7 (13.7%); otolaryngology: 5 (9.8%); ophthalmology: 2 (3.9%)

TBID, tablet-based interactive distraction; ASA, American Society of Anesthesiologists.

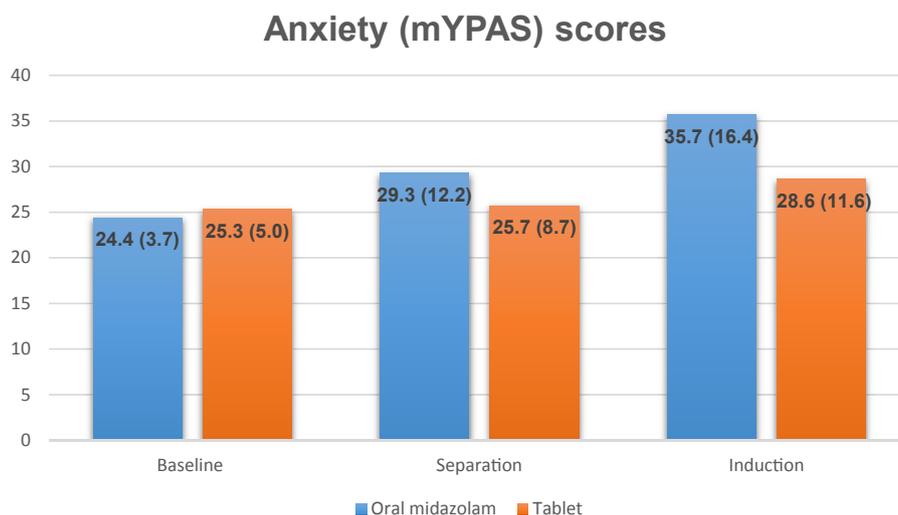


Figure 1. Comparison of total anxiety (mYPAS-Short Form) scores (means/SDs) between control (oral midazolam) and experimental groups (tablet-based interactive distraction). mYPAS, Modified Yale Preoperative Anxiety Scale. This figure is available in color online at www.jopan.org.

CAREGIVER PERCEPTION OF CHILD LEVEL OF ANXIETY. There were no statistically significant differences between groups in caregiver ratings of their child's level of anxiety at baseline (oral midazolam 1.6 [1.6] vs TBID 1.8 [1.7]; $P = .44$) or separation (oral midazolam 1.2 [1.6] vs TBID 1.1 [1.3], $P = .40$). Within groups, caregivers with children in the TBID group rated their child's anxiety level significantly lower at separation compared with their perception of their child's anxiety level on admission ($P < .0001$).

CAREGIVER SATISFACTION WITH EASE OF CHILD-CAREGIVER SEPARATION. With response options ranging from 0 (not satisfied) to 6 (very satisfied), all caregivers from both groups rated their satisfaction with separation from their child as very satisfied (oral midazolam 5.7 [0.7] vs TBID 5.8 [0.6], $P = .40$).

LENGTH OF STAY IN PACU. As noted in Table 2, there were statistically significant reductions on length of stay (in minutes) for patients in the TBID group at all three time points: (1) almost 5 minutes earlier extubation after arrival to PACU for TBID group ($P = .007$); (2) almost 7 minutes earlier arrival to phase II after PACU arrival for TBID group ($P = .003$); and (3) almost 25 minutes earlier discharge to home from PACU arrival for the TBID group ($P < .0001$).

POSTHOSPITALIZATION BEHAVIOR CHANGE QUESTIONNAIRE FOR AMBULATORY SURGERY. One member of the research team, the child life specialist, contacted every caregiver participant, by either e-mail or telephone, to obtain a 7-day and 14-day report on their child's posthospitalization behaviors. Unfortunately, from the oral midazolam group, only 12 caregivers, at

Table 2. PACU Length of Stay (in Minutes)

Variables	Oral Midazolam	TBID	<i>P</i>
	Mean (SD)		
PACU arrival to awakening	24.2 (9.4) min	19.4 (8.2) min	$P = .007$
PACU arrival to phase II	40.3 (11.1) min	33.8 (10.4) min	$P = .003$
PACU arrival to discharge home	124.1 (34.6) min	99.7 (34.6) min	$P < .0001$

PACU, postanesthesia care unit; TBID, tablet-based interactive distraction.

7 days, and nine, at 14 days, completed the questionnaire. Similarly, nine caregivers from the TBID group completed both the 7-day and 14-day questionnaires. Although no statistical comparisons were obtained, because of low response rate, descriptive data were gathered. On 7-day PHBQ-AS responses, caregivers of children who received oral midazolam ($n = 12$) reported higher percentages of poor appetite (25%) and temper tantrums (17%), whereas caregivers of children in the TBID group ($n = 9$) reported more bad dreams (11%). By 14 days, most PHBQ-AS responses returned to baseline except for continued temper tantrums (11%) and poor appetite (11%) in the oral midazolam group ($n = 9$); caregivers from the TBID group ($n = 9$) reported that their children had more trouble getting to sleep (22%).

Discussion

Preoperative Anxiety

This study sought to replicate the study design and measurements from the study of Seiden et al,⁵ address its reported limitations, and add to the current body of evidence on interactive devices in the preoperative setting. With an initial sample including children, 1 to 11 years old, Seiden et al⁵ found that a TBID was as effective than oral midazolam in reducing anxiety at parent separation and mask induction. When children, 2 years old and younger, were removed from analyses because mYPAS had not been validated in this age group, their results showed significant decreases in preoperative anxiety for the TBID group at both time points; results now confirmed by this present study.

To ensure that the observations from the preoperative anxiety measure, mYPAS, were consistently collected at both parent separation and mask induction, the two lead frontline nurse researchers were trained by observing multiple videos of children at parent separation and mask induction and scoring their anxiety with mYPAS. IRR was achieved between the training staff and the nurse researchers. The two lead nurse researchers then trained three additional perioperative nurses by observing actual patients until IRRs of 1.0 were achieved. In two previous studies^{3,11} that used mYPAS to measure pediatric preoperative anxiety, no mention was made as to specific training or IRR trials before use, although

Marechal et al¹¹ stated that observations were completed by reliable psychologists.

Since this present study was conducted, there have been multiple recent international publications by researchers from Canada,⁵ Turkey,¹² Brazil,¹³ and France,^{11,14} on interactive distraction strategies to alleviate pediatric preoperative anxiety. When tablet distraction was administered 20 minutes before parent separation and using mYPAS, Marechal et al¹¹ reported no significant differences between tablet and oral midazolam on preoperative anxiety in children, 4 to 11 years old ($n = 118$). The effectiveness and novelty of the distraction may have been reduced when the child was allowed to play on the tablet for a longer period. Although more research is needed on the impact of the timing of distraction, administering the tablet distraction (and its novelty) only 1 minute before parent separation may have contributed to the present study's findings of significant reductions in preoperative anxiety levels.

Differing from this study where only interactive tablet distraction with age-appropriate interactive games were selected, Aytekin et al¹² offered multiple distraction options (computer games, music, cartoons, and books) for child participants in their experimental group up to 40 minutes before moving to the operating room. Using a convenience sample ($n = 83$; 9 to 18 years old), these researchers did find that children in the experimental distraction group at separation were observed to have lower mean anxiety scores from a self-report anxiety scale and researcher-developed observation tool.¹² The challenge for use of multiple distraction options is identifying which options were most effective in reducing perioperative anxiety. Using an audiovisual noninteractive distraction via cartoon or movie digital video discs in children aged 2 to 12 years, Sola et al¹⁴ found that both oral midazolam and video distraction, either used alone or in combination, were effective in the control of anxiety at parent separation. Although Cumino et al¹³ did not use oral midazolam as a study variable, they did administer to children, 4 to 8 years old, age-appropriate smartphone applications in the holding area; results included significantly lower mYPAS anxiety scores before surgery and through mask induction than children who did not play with a smartphone. In a systematic review, Chow et al⁵ identified 18

randomized and nonrandomized studies and suggested that the most effective audiovisual interventions in pediatric preoperative anxiety reduction were videos, multilayered combinations, and interactive gaming versus music and options from the Internet. When reviewing distraction effectiveness, further research is needed on the use of interactive versus passive distraction strategies and their impact on pediatric preoperative anxiety.

Emergence Delirium

Using the PAED scale⁹ in this study, children in the tablet distraction group scored lower 15 minutes postemergence than those who received oral midazolam. These findings confirmed the results of Seiden et al³ as their PAED scores were also significantly lower at 15 minutes postemergence for the TBID group, although Seiden et al³ used scores ≥ 12 as absolute delirium, and this present study used the PAED developer's criterion of ≥ 10 to determine postemergence delirium.⁹ Sola et al¹⁴ also examined postemergence delirium between the oral midazolam and digital video disc cartoon/movie groups. Although no significant differences between groups were reported, PAED scores > 10 defined postemergence delirium, but the timing of PAED scoring (whether at extubation of specified minutes postemergence) was not divulged.

The results from the present study suggest that children receiving no premedication exhibited less irritability, greater awareness of surroundings, and more purposeful behaviors. In a recent study detailing the predictors of pediatric postoperative emergence delirium, Berghmans et al¹⁵ identified the child's age (1 to 5 years old) and first experience with anesthesia as significant predictors. The present study did include children within this younger age grouping and inclusion criteria that this was child's first anesthesia experience. Further studies could analyze the PAED scores by age groups to evaluate impact of tablet distraction or oral midazolam on postemergence delirium.

Postanesthesia Length of Stay

This study validated the findings by Seiden et al³ that children in the TBID group were discharged home earlier than those who received oral midazolam. Children in the tablet distraction group were

discharged home 25 minutes sooner, virtually matching the 24 minutes in the results of Seiden et al.³ This outcome can likely be attributed to the tablet group experiencing less sedation than the oral midazolam group, as evidenced by PAED scores. This result has important implications related to patient flow in PACU, nurse and caregiver satisfaction, and possible financial impact.

Limitations

This study investigated preoperative anxiety in relatively healthy children undergoing outpatient surgery; therefore, these results cannot be generalized to patients with chronic or complex medical conditions, to those requiring lengthy surgeries, or to children with psychiatric issues or developmental delays. Future studies could examine the effectiveness of interactive distraction strategies on preoperative anxiety and postemergence delirium in these special pediatric populations.

Possible bias may have occurred as the observer scoring the preoperative anxiety scores on mYPAS was present during parent separation and mask induction and was visually aware of which study group the child was enrolled. All mYPAS observers were robustly trained in scoring at both time points; strong IRR was achieved even with nonblinding. Child life specialists, who accompanied each patient to the operating room, could have had some influence on the distraction intervention as occasionally, they would hold the tablet, if needed during mask induction.

Although sevoflurane has been associated with emergence delirium in the pediatric outpatient surgery setting,¹⁶ the decreased levels of emergence delirium in the TBID group can still be confidently interpreted because all enrolled surgical patients received a standardized anesthesia protocol. In addition, all children received a combination of sevoflurane, oxygen, and nitrous oxide; the two latter agents are not associated with emergence delirium.¹⁶

As reported in this study and the study by Seiden et al,³ low response rates to the 7- and 14-day post-PHBQ-AS were obtained; the data could not be robustly analyzed for differences between study groups. Although multiple methods (e-mail, text, and phone calls) and multiple attempts were tried, creative strategies are needed to enhance the

motivation of caregivers to complete these questionnaires.

Conclusion

This is the first known prospective randomized controlled trial conducted by frontline nurses examining the differences between distraction with a tablet computer device and oral midazolam on preoperative anxiety in children undergoing outpatient surgery. This study found children, 4 to 12 years old, who played age-appropriate interactive games on a tablet had significantly lower anxiety scores at both parent separation and mask induction compared with those who received oral midazolam. Those in the tablet group also demonstrated significantly lower emergence delirium scores and were discharged home sooner than those in the oral midazolam group.

Alleviation of pediatric preoperative anxiety has become an important international issue based

on the increasing number of research publications. This well-powered robust nurse-initiated study has added to the body of evidence that tablet distraction is significantly superior in reducing anxiety at parent separation and mask induction, in decreasing postemergence delirium, and in decreasing length of stay in the PACU. The findings from this study have changed nursing and anesthesiology's clinical practices in this pediatric medical center; all caregivers of patients admitted for outpatient surgery are given the option to choose tablet distraction or oral midazolam in preparation for parent separation and mask induction.

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