

**Review Article**

## Preparation for General Anesthesia in Children

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**Abstract**

Children and parents experience significant anxiety and stress prior to surgery. Many endeavours were made by anesthesiologists to reduce anxiety during preoperative and pre-induction periods. Various techniques were used to minimize induction time because prolonging the time of induction leads to negative psychological effect during postoperative period such as nightmares, eating disturbances, apathy and withdrawal, enuresis, and separation anxiety. In the preoperative period there are 'stress points' when the anxiety reaches the maximum in pediatric patients. The stress points include separation from the parents, entry to operating room, placement of child on the operating table, visualization of syringes, attachment of monitors, placement of intravenous cannula, and placement of mask, etc. The aim of anesthesiologists should be to reduce these stress points as much as possible until the patient transitions into an anesthetized phase. This review article will cover various anxiolysis preinduction techniques from a traditional pharmacological intervention, moving to a parental intervention, and the most up to date distraction technique using electronic devices. By incorporating a traditional and a new pre-induction practice, anesthesia providers can develop their own set of pre-induction technique to prepare children for general anesthesia.

### Traditional Pharmacological Intervention

#### Midazolam

Midazolam has been a "gold standard" method of preoperative anxiolysis. Midazolam is a short acting benzodiazepine that is very lipophilic in physiological pH, which explains its properties in the rapid onset of action. Other than its quick onset of action, midazolam carries many other benefits such as minimal respiratory depression,

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anterograde amnesia, and reduced emergence delirium. Due to its rapid onset of action, midazolam induces satisfactory sedation and anxiolysis within 20min with a dose of 0.5-0.75 mg/kg with a maximum dosage 20 mg taken orally [1,2]. This dose results in a satisfactory sedation in 10-15 minutes with a peak effect in 20-30 minutes. Drugs and foods that inhibit cytochrome p3A isoenzymes such as erythromycin, diltiazem, verapamil, ranitidine, cimetidine, grape juice, etc. may alter metabolism of midazolam and prolong sedation [3]. The oral midazolam comes in raspberry or chocolate syrup to mask its bitter taste to provide a better experience for children [3]. Intramuscular administration of midazolam with dosage 0.08-0.3 mg/kg has an onset time of less than 1 minute with a peak effect in 10-15 minutes. Intramuscular administration of midazolam has several disadvantages such as a needle that threatens children, pain in injecting, a risk of sterile abscess, and a child remembering the shot they received [3]. Other routes of administration is intravenous (0.1 mg/kg), intranasal (0.3 mg/kg), rectal (0.5 mg/kg), and sublingual (0.3 mg/kg).

#### Clonidine

Clonidine is another medication that is used for preinduction anxiolysis. Clonidine is an alpha2-adrenergic agonist that has sedative and analgesic properties. Clonidine administered 4 mcg/kg orally or 2 mcg/kg nasally acts as an analgesic, decreases volatile anesthesia requirements and improves perioperative hemodynamic stability [4]. Despite clonidine's drawback of having relatively long onsets time 45 minutes, its analgesic and anesthetic-sparing properties offer advantages. In cases where postoperative pain is a main concern, clonidine's analgesic effect is beneficial [4].

#### Ketamine

Ketamine is an NMDA receptor antagonist with sedative and analgesic properties. Oral ketamine 3-10 mg/kg with atropine 0.02-0.04 mg/kg has been successfully used to calm children within 10-15 min after administration [3]. The reasoning behind using an antisialogogue such as atropine with ketamine is to reduce the potential for laryngospasm caused by increased secretion [3]. Ketamine is associated with adverse events such as emesis. Ketamine can be administered in oral (5 mg/kg), intramuscular (4-8 mg/kg), or intravenous (1-2 mg/kg) route.

#### Parents Involvement Techniques

The traditional pharmacological intervention has some drawbacks that are linked with nausea and vomiting, long onset of effect and duration of action, children's refusal to take oral medication, and an elevated risk of delirium, agitation, and pain in postoperative period [3]. The concern for side effects from sedative premedication has raised the parental involvement technique. This technique has expanded in various forms that have undergone clinical trials starting from a simple parental presence during induction, family centered preparation kit, in-hospital video preparation, and an at-home video preparation.

## Parental presence during induction technique

Parents of children who undergo surgery prefer to be present during the induction of anesthesia. In the research done by Kain et al., 83 children were randomly assigned into four groups to receive oral midazolam without parental intervention, Parental Presence during Induction of Anesthesia (PPIA), parental presence during induction of anesthesia with midazolam (PPIA+midazolam), or no intervention at all [5]. At a subsequent surgery, more than 80% of the parents chose parental presence (with or without midazolam) regardless of the intervention their children received in the previous surgery. In contrast, only 23% of the parents whose children received midazolam in the initial surgery requested midazolam at the next surgery. And only 15% of the patients who received no intervention requested for no intervention in the subsequent surgery [5]. Thus, for most children and parents, a parental presence decreases anxiety for both parties and is the preferred method of intervention above a pharmacological intervention.

## Family-centered preparation for surgery

An advanced version of parental presence during induction technique would be a family centered preparation. A family involvement for a behaviour management is deemed as a highly effective intervention. The Institute of Medicine's published a report on "Crossing the Quality Chasm: A New Health System for the 21st Century" and its recommendation was to establish new partnerships with patients and families. In response to this report, a controlled trial was done by Kain et al in which 408 patients were randomly divided into four groups: oral midazolam, parental presence during induction, Advance group with family centered preparation, and a control group [6]. In the Advance group, parents were given a preparation package that consisted of a videotape, three pamphlets, and a mask kit. Parents were instructed to watch the videotape twice before the surgery. The three pamphlets consisted of helping the child in the operating room, how to distract the child before and during induction of anesthesia, and an instruction on how to practice induction with a mask. The mask practice kit contained an induction mask, a hairnet, and a face mask. Phone calls were made to the parents two days before the surgery to check parents' adherence and a day before surgery to ask parents' specific plans on how to distract the child during surgery day. On the day of surgery, children were given a bag of distracting toys to play with, which could be carried into the operating room. The total amount of time that direct staff-parents took was 30 minutes or less. The Advance group had many positive results. The children and also the parents in the Advance group were significantly less anxious in the preoperative holding area compared to other groups. Children in the Advance group were also least likely to exhibit severe emergence delirium such as thrashing, inconsolable crying, and a need for restraint compared to control, midazolam, and parental presence group. Moreover, children in the Advance group needed only half as much fentanyl compared to parental presence group and one third much fentanyl compared to midazolam and control groups for pain control after surgery. Discharge times for children in the Advance group were also significantly earlier than children in the other groups with an average of 20 minutes. The result of this study shows that Advance intervention is superior to the use of midazolam for antianxiety, emergency delirium, analgesic consumption, and discharge times [6]. Moreover, the preparation program provides families with a new skill set that can be applied to other medical procedures that their children

need in the future. The family-centered preparation is an effective way to reduce anxiety for both children and parents.

## In-hospital preparation video

Studies show that lack of communication and information is what causes children's anxiety. Patient training is therefore one of the significant methods to decrease anxiety. Training programs decrease health expenditure, stress, anxiety, and complications while increasing patients' endurance and positive behaviour [7]. In the study done by Karabulut and Duygu, 90 children for inguinal hernia were randomly divided into three groups; 30 for the control, 30 for the video and 30 for the booklet group. The children and their parents in video group were made to watch a 12 minutes video in the surgery clinic. Afterwards, anxiety inventory was done with the children and parents 24 hours before and 24 hours after the operation. Booklet group received training with booklets in an empty room which lasted for 20 to 30 minutes, and the same inventory was done as video group. The video and booklet contained information on physical structure of the hospital, hospital life, staff members, operating room, procedures, tools, and the recovery room. The results showed that the anxiety levels of children and the parents 24 hours before and after the operation were most decreased in video group than booklet and control group. In video group, the children and parents' stress levels affected one another positively which shows the importance of parents' presence [7]. Therefore, video program, which stimulates both eyes and ears, is an effective method to decrease both children and the parent's anxiety level [7]. In-hospital preparation video decreases anxiety to both children and parents by informing what to expect before the surgery.

## At-home preparation video

A specially designed at-home preparation program can be used to encourage parent-child verbal interaction concerning surgery and reduce both children and the parents' anxiety. In the study done by Wakimizu et al., 161 patients were randomly assigned to a control group and the experimental group [8]. Both two groups viewed a patient-educational video for hemiorrhaphy as outpatients once prior to hospitalization. The experimental group watched the same video at home with a booklet prior to hospitalization while the control group underwent surgery without further preparation. The children and parents that received home video instruction were satisfied with the audiovisual intervention because they could talk about the surgery more comfortably at home rather than in a busy hospital environment. Therefore, at-home video can encourage children to gain a sense of control over the stressful situation by being exposed to procedure related materials before the surgery [8].

## Newest Trend: Distraction Technology

The "Traditional" methods of distraction technology were challenging children to "blow up the balloon" or physicians dressing up in clown costumes. The new trend is using the electronic technology for distraction. Electronic technology has become popular even among children from a young age. Distraction method using electronic devices offers a more complete distraction and anxiety management. There is a global trend toward use of distraction method using the newest technology such as handheld video games, smart phones, YouTube clips, video glasses, and Handheld Video Game.

Cognitive engagement with video games has been shown to achieve superior anxiolysis as compared with midazolam and parental presence. In a study done by Patel et al., 112 children aged 4-12 years were randomly divided into three groups: Parent Presence (PP), PP+ a hand held video game, and PP+0.5mg/kg oral midazolam (M) given 20 minutes before entering the operating room [9]. The results show that there was a significant increase in anxiety in group M and PP at induction of anesthesia compared with baseline, but not in video game group. Instead, a video game group demonstrated a decrease in anxiety from baseline, significantly different compared with parent presence group. A hand held video game is a low cost, portable, and easy to implement method to provide anxiolysis to pediatric patients [9].

### Smartphone game application

Lee et al. research on using smart phone game applications as a behavioral intervention program showed that it is a fast and effective reduction of preoperative anxiety in children [10]. A total of 120 patients (aged 1-10 years old) were randomly grouped into three for intravenous midazolam sedation (M group), smart phone application group (S group), and low dose IV midazolam 0.05 mg/kg plus smart phone application program (SM group). Using smart phones for antianxiety is cost effective in that most parents already own smart phones and hospital does not need additional devices, and age-customized games, animation and video clips are all on the same device. Since most children are exposed to smart phones at a young age, they do not need additional training in using smart phones. One drawback is that some children may experience excessive separation anxiety that they do not show interest in Smartphone applications [10].

Despite this drawback, SM group found to be the most effective anxiety reducer followed by smart phone group (S group) then midazolam group (M group) as the last. The Smartphone is an effective alternative to premedication for anti anxiety that can tailor to children's individual characteristics [10]. Thus, interactive games appear to be more effective than parental presence or midazolam alone in reducing anxiety in children.

### Video (YouTube) clips

Video and television distraction are often used in minor medical and dental procedures to reduce anxiety. Mifflin et al. performed a control trial study to examine if video distraction helps reduce anxiety during anesthesia induction [11]. 89 children between age 2 and 10 years were randomly divided into two groups; video distraction and control group. In the video distraction group, a YouTube video clip of child's preference was played during induction, and the control group received a traditional distraction methods during induction. Children in the video distraction group was found to be significantly less anxious at induction and showed a smaller change in anxiety level from holding area to induction than the control group [11]. Thus, video clips can be an alternative method to provide a smooth transition in pediatric anesthesia.

### Video glasses

Video glass is a more advanced version of showing video clips because it provides a portable way of viewing video on a magnified scale. This video glass can completely isolate both auditory and visual senses from the perioperative environment upto the induction of

anesthesia. Due to their narrow dimensions, the video glasses can be used during inhaled induction as well. In the study done by Kerimoglu et al., 96 children aged 4 to 9 years old were randomly divided into four groups; control group, midazolam group, video glasses, and both [12]. The result showed that there was no difference in anxiety level within any groups between baseline and operating room transport. However, a small increase in anxiety was observed during induction time in the midazolam and controlled groups [12]. Moreover, parents themselves find relief when their children are given with audiovisual aid for distraction [13]. The advantage of video glasses over other technologies such as handheld smart phone, computer, and video games is that they can be used continuously during mask induction [12]. Thus, video glass is a pleasant alternative to midazolam in providing safe, non-pharmacological, and a safe anxiolysis.

### Conclusion

Putting children to sleep for surgery can be a stressful event for the child, the parents, and anesthesiologists as well. Part of anesthesiologists' job is to prepare both children and the parents before surgery to minimize anxiety and stress. Preparation can be done with pharmaceutical such midazolam, clonidine, and ketamine. Along with medications, parental involvement techniques can be combined such as having parents present during induction, psychologically preparing both parents and children through kits, in-hospital and at-home videos. Now a new trend incorporating electronic technology such as handheld video games, smart phones, YouTube clips and video glasses are becoming more popular because it is a safe, non-pharmacological, and a cost effective practice that brings pleasant experience for both children and parents. Anesthesiologists can develop their own set of preinduction practices by combining techniques such a combination of pharmacological and parents involvement, pharmacological and distraction technique using electronics, or a combination of parent's involvement and distraction technique using electronics. By incorporating these evidence-based pre-induction practices, anesthesia providers can deliver the most advantageous and safe pre-induction technique for children.

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