Chapter

4

Preoperative Anxiety

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> A four-year-old female presents for a tonsillectomy. She is accompanied by her mother and father. She is extremely anxious and will not separate from her parents.

At What Age Are Patients Most Likely to Develop Separation Anxiety?

Between 7–10 months of age, infants will become anxious when being separated from their parents. This separation anxiety can persist throughout all ages of childhood.

What Is the Incidence of Preoperative Anxiety in Children?

Estimates reveal that at least 60% of children develop significant fear and anxiety before surgery. Many children and families list the separation from parents and induction of anesthesia as the most stressful time during the surgical experience.

What Are the Risk Factors for Preoperative Anxiety in Children?

There are child, parent, and environmentally related risk factors for children having preoperative anxiety.

Child-Related

- Age: 1–5 years
- Poor previous experience with medical procedures
- Chronic illness
- Shy/inhibited temperament
- Lack of developmental maturity/social adaptability
- High cognitive ability
- Not enrolled in daycare

Parent-Related

- High anxiety
- Parents who use avoidance coping mechanisms
- Parents who have undergone multiple medical procedures
- Divorced parents

Environment-Related

- Sensory overload and conflicting messages
- Parental anxiety

The preoperative period is often a stressful and anxiety-provoking phase for children and their family. It is not unusual for the parents to be frightened and to project their fear and anxiety on the child, thereby unintentionally contributing to the child's fear and anxiety. Increased parental anxiety is noted in parents of children less than one year of age, and in children with repeated hospital admissions.

What Are the Overall Benefits of Reducing Preoperative Anxiety?

The most important outcomes related to preoperative distress in children are postoperative behavioral disorders. These include nightmarish sleep disturbances, feeding difficulties, apathy, withdrawal, increased level of separation anxiety, aggression toward authority, fear of subsequent medical procedures and hospital visits, and regressive behaviors such as bed wetting. Although these disturbances are primarily present within the first two postoperative weeks, in some children they may last for several months. Much has been made of this issue in the recent literature, but the concept is not new.

Children who were anxious in the preoperative period were found to have more postoperative pain, require more pain medications while hospitalized and during their first 3 days at home, and have a greater

incidence of emergence delirium, postoperative anxiety, behavioral changes (apathy, withdrawal, enuresis, temper tantrums, eating disturbances), and sleep disturbances. In adults, increased preoperative anxiety is associated with poor postoperative clinical and behavior recovery.

How Should You Prepare the Parents Prior to Induction?

One of the most important preoperative responsibilities of the pediatric anesthesiologist is to allay anxiety in the parents and other family members. During the preoperative visit the anesthesiologist, while talking to the parents, should initiate contact and communication with the child. It does not matter if the child is too young to understand or is too premedicated to remember any events. The parents will key in on the anesthesiologist's manner and how he or she relates to the child. Asking children about their interests and performing a simple fist-bump will establish confidence and minimize parental anxiety.

A controversial issue in pediatric anesthesia is the extent to which the anesthesiologist should reveal the risks of anesthesia to the parents. Will this discussion increase or decrease parental (or child) anxiety? Should the anesthesiologist discuss the risk of death? What risks are appropriate to reveal? The answers to these questions are not easily found and may partly depend on the informed consent laws of the state in which one practices. Studies universally demonstrate that anxiety is decreased with more information, even though that information may allude to more harmful risks. For example, in a questionnaire study, most parents whose anesthesiologist mentioned the risk of death indicated they were satisfied to hear about this rare risk. Many parents whose anesthesiologist did not specifically mention the risk of death indicated that it should have been mentioned.

During the preoperative informed consent process, it is helpful to know the modern-day risks of general anesthesia in children. A study from the Mayo Clinic revealed an incidence of cardiac arrest in anesthetized children (for noncardiac surgery) of 2.9 per 10,000, although when attributed only to anesthetic causes, the incidence decreased to 0.65 per 10,000 anesthetics. Only a small percentage of these patients were initially healthy prior to the procedure.

What Are the Methods Used to Reduce Preoperative Anxiety?

Many different modalities have been used in an attempt to decrease fear and anxiety in patients and their families. There are two broad categories of interventions:

- *Behavioral interventions*: preoperative preparation programs (child life therapy), distraction techniques, parental presence at induction, preoperative interview, and tour of hospital and/or operating complex.
- *Pharmacological/premedication*: midazolam (IV, oral, nasal, or rectal routes of administration), dexmedetomidine (oral or nasal).

What Is the Efficacy of Behavioral Interventions?

In carefully performed and controlled studies, these aforementioned behavioral interventions do not fare much better than placebo in decreasing the incidence of postoperative behavioral disturbances. Although distraction techniques are often effective for allaying anxious behavior during induction of anesthesia, premedication with an anxiolytic drug is the only proven intervention to decrease these undesirable outcomes.

What Are the Benefits and Risks Associated with Parental Presence During Induction?

There is controversy surrounding the benefits to parental presence during induction of anesthesia. Potential benefits include reducing the need/amount of preoperative sedatives and avoidance of anxiety caused by parental separation. Parental presence during induction has been correlated with greater parent satisfaction with the anesthetic experience. However, parental presence can place additional stress on the anesthesiologist, crowd the OR, and may not be all that effective in decreasing the child's anxiety.

One randomized controlled trial found that only children younger than 4 years of age who have a calm baseline personality, or who have a parent with a calm baseline personality, benefit from parental presence during induction. Another study comparing parental presence versus oral midazolam found that children

who were given midazolam were significantly less anxious and more compliant than children with only parental presence during induction. However, sedative and parental presence together has been shown to be more effective than sedative alone. Furthermore, many parents are terrified as they observe the placing of a mask over their child's face, watching their child become limp as consciousness is lost, and the occasional episode of upper airway obstruction that may occur. Yet when queried, parents who have been with their child in the OR during induction universally feel that they have done the right thing for their child and are happy to have experienced a sense of schadenfreude.

If a decision is made to allow a parent into the OR during induction, the anesthetist should fully explain the events that will occur during induction. Three major points should be addressed:

1. There should be an explanation of the nature of the procedure and the possible effects on the child (excitation, limpness, airway obstruction, etc.).
2. The parent must agree to leave immediately at any time when requested by an OR staff member.
3. The parent must agree to leave immediately once the child has lost consciousness. One of the surgical team members or another OR staff member should accompany the parent from the OR to the parents' smoking area.

Some institutions will ask parents to sign a written agreement to these terms, as well as a waiver of liability should parents suffer an injury secondary to fainting or other calamity.

What Premedication Can Be Used to Reduce Preoperative Anxiety?

Premedication of pediatric patients prior to induction of anesthesia can accomplish several goals, the primary one being anxiolysis, with a subsequent decrease in the incidence of postoperative negative behaviors. Other indications include preinduction of anesthesia, pain relief, drying of secretions prior to airway manipulation, vagolysis, and decreasing the risk for pulmonary aspiration of gastric contents. Preoperative sedation may be administered via any route, the most common being oral administration since the vast majority of children do not have an existing IV catheter. Rectal premedication is acceptable in toddlers, and in some centers the nasal route is preferred

for midazolam. Few centers in the United States administer intramuscular premedication, or place IV catheters preoperatively.

There are various options for treatment of preoperative anxiety. None, however, are ideal; each has drawbacks. A benzodiazepine is the best treatment for preoperative anxiety. Options include midazolam, the most commonly administered premedication, and diazepam.

Midazolam

Oral midazolam is the most common preoperative anxiolytic for children. This is because it possesses most of the properties of the ideal premedication. The one exception is that it usually leaves a bitter aftertaste when administered orally, even as a specially formulated oral syrup and given with an apple juice chaser. Therefore, many children will attempt to spit it out if it is not swallowed rapidly. After oral administration, the commercially available midazolam syrup is rapidly absorbed from the stomach. The absolute bioavailability of midazolam averages 36%, within a variable and large range (9–71%). This large range in bioavailability is consistent with most oral medications administered to children. In a large study, the plasma concentration/time curves of midazolam and its α-hydroxy metabolite were highly variable, and independent of the age of the child and the dose administered. Approximately 14% of children who receive oral midazolam do not demonstrate effective anxiolysis.

Caution should be observed in children who are receiving erythromycin (or its derivatives), since it can prolong the duration of action of midazolam via cytochrome P-450 inhibition. In children who are currently receiving erythromycin, the midazolam dose should be reduced by at least 50%.

Clinical sedative effects are seen within 5–10 minutes of oral midazolam administration and appear to peak 15–30 minutes after administration. By 45 minutes, its sedative effects have dissipated in most children. Pharmacodynamic studies indicate that sedation level is directly correlated with plasma concentration of midazolam. Plasma midazolam concentrations greater than 50 ng/mL are associated with adequate preoperative sedation. However, plasma concentrations of midazolam do not correlate with anxiety scores at the time of mask induction of anesthesia.

The sedative effect of midazolam is best described as inebriation rather than sleepiness. Therefore, after administration, children should be confined to a bed or their parent's arms and be directly observed at all times by medical personnel. Clinically important cardiorespiratory side effects are not observed in healthy children but may be seen in children at risk of upper airway obstruction. Dysphoria may occur in some children. Anterograde amnesia is a favorable clinical effect following most doses of oral midazolam and may be responsible for the decrease in postoperative behavioral disturbances.

Most anesthesiologists find that an oral dose of 0.5–0.7 mg/kg results in the best clinical efficacy. However, a pharmacodynamic study showed that a dose as low as 0.25 mg/kg results in reliable preoperative anxiolysis. There are no data to indicate the most appropriate maximum dose, but most anesthesiologists use between 10 and 20 mg.

Studies are conflicting, but some evidence indicates that midazolam premedication results in longer times to discharge postoperatively following surgeries of relatively short duration. Nevertheless, its preoperative advantages outweigh this disadvantage.

Nasal administration of midazolam can be accomplished in the form of nose drops or a nasal spray. The required dose (0.2–0.3 mg/kg) is lower than with oral administration and its reliability in producing anxiolysis is excellent. However, its administration is associated with an unpleasant burning of the nasal cavity and most children are quite upset following its use. In addition, plasma concentrations of midazolam are generally higher after nasal administration when compared to the oral route. Respiratory depression has been reported on occasion following nasal administration. For these reasons, pediatric anesthesiologists tend use the nasal route of administration infrequently.

If a child has a preexisting IV catheter, it should be used to administer midazolam. Pharmacokinetic studies indicate a β-elimination half-life of less than two hours in children. The half-life of both midazolam and its major metabolite tend to increase with advancing age during childhood. The onset of IV midazolam is 2–3 minutes and the peak sedative effect is shortly thereafter. The duration of action varies between two and six hours, with most of the sedative effect dissipating within 30 minutes of a single dose. A standard dose of IV midazolam is 0.05 mg/kg, which can then be titrated to effect, depending on the clinical situation.

Diazepam

Since the advent of midazolam, diazepam has not been used routinely for premedication of children. This is primarily due to its relatively long onset of action and greater duration of action. Diazepam may be indicated for children or adolescents who require anxiolysis prior to approximately one hour before surgery. It can be administered orally at a dose of 0.3 mg/kg. It should not be given IV because of the extreme pain associated with injection.

Clonidine

Clonidine, an α_2-adrenergic agonist, has been tested as an orally administered sedative premedication in children. In doses between 2 and 4 mcg/kg, oral clonidine will produce adequate sedation and anxiolysis prior to induction of general anesthesia. A distinct advantage of clonidine is its ability to decrease intraoperative anesthetic requirements. However, its onset of action is greater than 90 minutes, so it is not suitable for use in the ambulatory setting. Furthermore, when compared with oral midazolam for children undergoing tonsillectomy, clonidine provides less anxiolysis at the time of separation of the child from the caretaker and at induction of anesthesia. An additional disadvantage of clonidine is its ability to blunt the heart rate response to administration of atropine. For these reasons, clonidine is not used routinely as a premedication in children.

Ketamine

Ketamine can be used as a premedication in children, in both oral and rectal forms. At a dose of 5 mg/kg, it reliably produces a state of sedation and disassociation within 20 minutes of its administration. Larger doses have been associated with more reliable anxiolysis at the expense of longer postoperative times to awakening and discharge. Advantages of its use include a low incidence of respiratory depression, and a possible decrease in intraoperative anesthetic requirements. It also possesses analgesic and amnestic properties. Disadvantages include increased oral and airway secretions, an increased incidence of postoperative emesis, and an occasional association with adverse psychological reactions such as delirium,

dysphoria, nightmares, and hallucinations. These latter effects have not been observed when ketamine has been used as a premedication. To date, studies have not demonstrated any clear advantages of ketamine over midazolam as a premedication in children. However, it may be a useful substitute in children known to exhibit dysphoric reactions to midazolam, or as an additive to midazolam in children who may be in pain, or difficult to calm.

Intramuscular ketamine is used when children are unusually combative and refuse all attempts at medical attention, including refusal to ingest an oral premedication. It is most often used in developmentally delayed adolescents who are unable to understand their circumstances and will not cooperate with IV catheter placement or inhalational induction. To reduce the volume of the amount injected, the concentrated form (100 mg/mL) should be used, in a dose of 2–6 mg/kg. Larger doses result in greater efficacy at the expense of longer times to emergence from general anesthesia, especially for surgeries of relatively short duration. We prefer a lower dose with the modest goal of obtaining sufficient sedation to facilitate IV catheter insertion or mask induction. Some anesthesiologists will include atropine in the injectate in an attempt to reduce airway secretions.

Suggested Reading

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