

REVIEW ARTICLES

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PSYCHOLOGICAL ASPECTS OF PEDIATRIC ANESTHESIA

PSIHOLOŠKI ASPEKTI PEDIJATRIJSKE ANESTEZIJE

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Summary

Surgery and anesthesia cause a significant emotional stress in both parents and children. Since the consequences of this stress develop immediately after surgery and can last even when the hospital treatment is over, the role of the anesthesiologist is to ensure psychological as well as physiological well-being of the patient. In order to reduce emotional stress induced by anesthesia and operation, the anesthesiologist has to understand certain developmental phases that children go through and to identify situations which a child could potentially see as a danger or a threat. This can usually be achieved by careful preoperative assessment and by administering preoperative sedation. During the preoperative visit to the patient, the anesthesiologist can evaluate the levels of anxiety of both parents and children as well as assess the child's medical condition.

Key words: Pediatrics; Anesthesia; Child Behavior; Child; Stress, Psychological; Child Psychology; Preoperative Care; Anxiety; Fear; Risk Factors; Parents; Premedication

Preoperative Anxiety Definition, Frequency and Consequences

A great number of children undergo surgery every year and it is estimated that up to 70% of these children experience significant fear and anxiety before being operated on [1, 2]. Preoperative anxiety is defined as a subjective feeling of tension, nervousness, worry and loss of sleep associated with an increased autonomic nervous system activity [3]. Children may look scared and/or agitated, breathe deeply, tremble, stop talking or playing and/or start to cry. Other children may become nauseous, wet themselves, have increased motor tone and/or attempt to run away from the operating room staff [4].

Based on children's behavior and physiological parameters, the induction of anesthesia appears to be the most stressful moment for the child during the perioperative period [3, 5]. It has been proved that intravenous induction is more stressful for

Sažetak

Hirurgija i anestezija izazivaju značajan emocionalni stres kod dece i roditelja. Budući da se posledice ovog stresa javljaju neposredno posle postoperativnog perioda, ali se mogu zadržati i dugo nakon što prođe bolničko lečenje, jedan od zadataka pedijatrijskog anesteziologa jeste da obezbedi psihološku i fiziološku dobrobit za pacijenta. Da bi smanjio emocionalni stres anestezije i operacije, anesteziolog mora da razume razvojne odrednice i faze dečje psihologije i da predvidi situacije koje bi dete moglo doživeti kao opasnost i patnju. To se često može postići pažljivim preoperativnim razgovorom i preoperativnim davanjem sedacije. Preoperativnu posetu pacijentu anesteziolog može iskoristiti kako za procenu zdravstvenog stanja deteta, tako i za procenu nivoa anksioznosti i kod roditelja i kod deteta.

Ključne reči: Pedijatrijska anestezija; Ponašanje deteta; Dete; Psihološki stres; Dečja psihologija; Preoperativna priprema; Anksioznost; Strah; Faktori rizika; Roditelji; Premedikacija

children than inhalation induction [5, 6]. It is presumably due to the pain which the child experiences during the placement of peripheral intravenous line, as well as the pain during the application of an anesthetic (propofol) [7].

In addition to the fear of being separated from their parents, children are afraid of pain, loss of control, sense of insecurity due to "going to sleep" and unfamiliar uniformed faces who surround them in an unknown environment [2, 4]. Younger children are more concerned about being separated from their parents, while older children are more worried about anesthesia and surgery itself [2, 8].

Stress and anxiety experienced by children during the induction of anesthesia are associated with the child-related and environment-related factors. The child-related factors include their age, developmental stage, previous experience with medical procedures, the child's temperament, as well as the parental anxiety. The environment-related risk fac-

tors are the interaction with medical staff, brightness, level of noise made by medical staff as well as the preparation of the operating room instruments and the number of medical staff communicating with the child [3].

Three most common factors affecting the outcome of surgery are postoperative pain, nausea and vomiting and preoperative anxiety [3, 9]. Increased preoperative anxiety has been proved to be associated with increased postoperative pain, higher consumption of analgesics, general anxiety and sleeping problems [1, 2, 10, 11]. Anxiety on induction of anesthesia is also associated with emergence distress and postoperative behavioral problems [2, 4]. Children who are extremely anxious before the operation are at 3.5 higher risk of having negative postoperative behavioral patterns in comparison with those who showed lower anxiety levels. Some of the most common maladaptive behavioral patterns are general anxiety, crying during the night, wetting themselves, anxiety on separation from the parents, inadequate eating, apathy, drawing into themselves and irritability [2]. Preoperative anxiety triggers a stress response, which is associated with higher corticosteroid blood level, which increases susceptibility to infection, thus prolonging the process of recovery [2, 12, 13]. Although it has been reported that the incidence of postoperative behavioral changes reduces in time, these changes persist up to 6 months after surgery in about 20% of children and up to a year in 7.3% of children. Since they could potentially have long-term negative effects on the child's development, it is very important to understand psychological problems associated with operation and anesthesia [3, 4].

Identification of Children at Risk

The first step in psychological preparation of children who will undergo surgery is identification of children who are at a particularly high risk of developing extreme anxiety and fear of surgery. Risk factors that affect the behavioral responses of children during the preoperative period are their age, temperament, developmental stage, their parents' anxiety, various demographic characteristics as well as the previous experience of the child with medical procedures [1, 5, 8, 14].

Children between 1 and 5 years of age have been identified to be at the highest risk of developing significant preoperative anxiety [8, 14]. At this age, children are particularly vulnerable because they are both too young to be independent of their parents and old enough to recognize the parent's absence. Considering the fact that they are not aware of what is happening exactly, their major fear is to be separated from their parents by an unknown person. Although younger children may not have the ability to anticipate potential dangers or painful situations during the induction of anesthesia, children over 6 years of age may anticipate the pain and fear of "going to sleep". Older children rely on different techniques in order to cope with the stress, including

verbal (questioning) and cognitive (learning about medical equipment or what doctors do). This helps them relieve their anxiety [15].

Children who had bad experience with medical procedures and illness in the past are at a higher risk of developing high anxiety during the preoperative period and they cooperate poorly during the induction of anesthesia [5]. Repeated surgeries do not represent a risk factor themselves [8].

Several studies have shown that children who are shy and inhibited by temperament feel fear and anxiety of higher levels on the day of surgery compared with other children. Conversely, children who have a more socially adaptive temperament are less anxious when being prepared for surgery [15].

A child's predisposition towards anxiety before surgery is strongly affected by the behavior of the parents. Parental anxiety affects the child's stress response in two ways. Firstly, worrying parents are less capable of responding to their child's needs although parents can generally relieve the stress response of their child. In this case, the child's distress may be further increased by the parents' anxiety. Another pattern in which parental anxiety can affect a child's response reflects the genetics of parental disposition to being overanxious [15].

Preoperative anxiety in children can be managed by psychological (preoperative preparation programs, parental presence at the induction of anesthesia) or pharmacological approach, or both.

Psychological Approach Preoperative Preparation Programs

There are different preparation programs including playing, tour of the operating room, video program explaining what the child will go through at the day of surgery, conversation with the psychologist and written material adjusted to the child's age [5]. Their efficacy depends on how and how often they are conducted (just once or several times), as well as on the child's age [8, 14]. Children of and over 6 years of age benefit most if they participate in the program more than 5 to 7 days before surgery and benefit the least if the program is performed only one day before surgery [14]. This longer interval between the preparation and the surgery is needed for the older children to have adequate time to process new information acquired during the preparation program. Interestingly, there may be a negative effect of a preparation program on younger children. This could be the consequence of the inability of children under 3 years of age to separate fantasy from reality [14].

Designing a preparation program for children who have already been hospitalized is particularly challenging. Standard preparation programs have been proved to be inadequate for these children because they can often remind them of negative emotions associated with the previous surgery, and thus sensitize them. Alternative psychological programs, such as extensive individualized trainings for coping

with stress, combined with a practical situation, are more helpful for these children [14].

Program must be created according to the individual needs of every child, taking into account the child's age, previous experience with medical care and temperament of the child [5].

It is necessary for both the parents and the children to be included in the preoperative preparation. Multiple studies have suggested that the parents become very anxious when their children have to undergo surgery and this has been identified as a major risk factor for the increase preoperative anxiety in children [5, 8, 14]. Parents experience preoperative anxiety due to the separation from their child and the child's suffering from pains; they worry about the surgery outcome and have a feeling of guilt in addition to financial stresses. Mothers are more prone to anxiety than fathers [16]. Parents who undergo a preoperative preparation program or those who have viewed a video with factual information about anesthesia show a lower level of preoperative anxiety on the day of surgery, but not during the induction of anesthesia, after surgery, in the intensive care unit and during a two-week postoperative recovery [17].

Parental Presence

The presence of parents during the induction of anesthesia is sometimes an alternative to premedication with sedatives, although its influence on relieving child's anxiety remains controversial [18]. Potential benefits from parental presence include a reduced need for sedatives, reduced parental anxiety and stress due to being separated from their child before surgery, as well as better compliance of the child [4, 19]. However, most of the studies dealing with this issue have not established any benefit from the parental presence during the induction of anesthesia [2]. In addition, it has been found that the induction itself lasts longer if the parents are present and children of anxious parents are even more anxious in the presence of their parents [4, 18, 19]. On the other hand, several studies have identified the children who may benefit from parental presence during the induction of anesthesia. Those are older children who are less active and impulsive, as well as children whose parents are calm and appreciative of preparation programs [18].

A great number of studies have found that most of the parents prefer to be present during the induction of anesthesia regardless of the child's age because they believe that their presence helps their child [8, 19]. More than 80% of parents choose to be present in the operating room when returning for a second operation regardless of whether they were present the first time [20]. Although current evidence does not suggest that the parental presence alleviates anxiety in either children or parents, the presence of parents during the induction of anesthesia is associated with increased parental satisfaction [2, 4, 21].

Research in this area has been focused so far on the question whether the parent should be present

during the induction of anesthesia or not. However, more concern should be given to what parents should actually *do* during the induction rather than simply to their presence [5, 18].

Pharmacological Approach - Premedication

Midazolam is a short-acting benzodiazepine, which is most often used in premedication of anxious children due to its sedative, anxiolytic and amnesic effect. It has been proved to reduce anxiety in children in preoperative period, but it does not delay recovery and hospital discharge [2, 5, 22]. Many controlled randomized studies have found that midazolam is superior in reducing preoperative anxiety and increasing compliance of children during the induction of anesthesia when compared to preparation programs and parental presence during the induction of anesthesia [18, 21]. However, some authors have verified an increase in postoperative anxiety in children. This paradox can be explained by the influence of midazolam on explicit memory due to which children are unaware of the fact that the operation is over [23, 24]. Furthermore, if the child has not experienced the induction of anesthesia as negative, but just does not remember it, then another operation can be felt as a new and disturbing experience [5, 25].

Clonidine is an alpha 2-adrenergic agonist that has analgesic properties in addition to its sedative ones, therefore, it is increasingly being used in premedication. It has been proved that when given nasally or orally as a premedicant, it acts as an anxiolytic, reduces the requirement for volatile anesthetics, and increases perioperative hemodynamic stability and postoperative analgesia [2]. Almenrader et al. have shown that orally administered clonidine is superior to orally administered midazolam because children ingest it more easily, premedication is more efficient, it reduces agitation upon emergence and increases parents' satisfaction [26]. In addition, clonidine does not cause amnesia, and sedation thus induced resembles physiological sleep, which is not the case with midazolam [2].

Alternative Ways of Affecting Anxiety and Behavioral Changes

Music

A number of studies have shown that music can reduce anxiety in children, increase compliance and reduce the need for sedatives. The most probable mechanism of action is distraction [27]. Kain et al. have come to an interesting conclusion that the reduction in sensory stimuli (dimmed light, only one person communicating with the child in the operating theatre), combined with background music, alleviates anxiety in children during the induction of anesthesia [28]. The same authors have shown that interactive music therapy can be useful during the separation from parents and when entering operating theatre; however, they failed to prove its efficacy in reducing children's anxiety [29].

Clowns

Golan et al. have studied how the presence of specially trained clowns before surgery affects children's behavior and concluded that clowns significantly reduce preoperative anxiety, compared to the control group and the group which received premedication. However, upon application of a facial mask for inhalation induction of anesthesia, the presence of clowns did not prove efficient [30]. The Italian authors found that the children were significantly less upset during the induction of anesthesia when they were accompanied by two clowns and parents in the preoperative room and in the operating theatre compared with children premedicated with midazolam or children who were accompanied only by parents [25]. Clowns can make the induction of anesthesia smoother and more pleasant, which makes them an important alternative to midazolam, which causes amnesia for the event. As indicated previously, if children did not find the induction of anesthesia a traumatizing experience, without remembering it, future operations can be more stressful for them [5, 25].

Hypnosis

Hypnosis is the altered state of mind based on dissociation, with focused but directed attention which differs from sleep. A study conducted by French authors has proved that hypnosis, as a technique of premedication, is more efficient in reducing preoperative anxiety in children than midazolam, particularly during the induction of anesthesia. Hypnosis makes children relaxed and able to take active participation during the induction, leaving them with a pleasant memory, which is significant for possible future operations. Given that hypnosis makes the separation of children from their parents stress free, it can also reduce anxiety of parents and increase their satisfaction. Last, but not least, hypnosis reduces incidence of behavioral changes during the first two weeks after surgery [31].

Acupuncture

Acupuncture originates from China and has been gaining on popularity in the western world of medicine during recent decades, despite the lack of strong scientific evidence.

Wang et al. have shown that acupuncture of certain points on the ears reduces preoperative anxiety in 30 minutes in adults scheduled for elective surgery. This method is easy to use, relatively cheap and has minimal side effects [32].

Given that anxiety in parents who are present during the induction of anesthesia is related to increased anxiety in children, acupuncture was evaluated as treatment of anxiety in parents too. Wang and Kain had applied acupuncture in the mothers of children who underwent surgical intervention and concluded that ear acupuncture together with

the presence of mothers during the induction of anesthesia reduced anxiety in children and increased their compliance [33]. Wang also proved that parents were less anxious after acupressure of Yintang point than the control group after acupressure of sham points (which do not have any effect on anxiety) [34]. Acupuncture could easily become an integral part of treatment of preoperative anxiety in children because it requires minimal equipment, with minimal expenses, it is simple to apply, it has relatively quick onset of effect and practically no side effects.

Video Games

Video games are widespread in the modern society. Children can immerse themselves so much in playing video games that they become unaware of their surroundings and they disregard verbal and tactile stimuli. A prospective randomized controlled study showed that the children between 4 and 12 years of age who played a video game holding it in their hands were significantly less anxious during the induction of anesthesia than the children whose parents were present in the operating theatre. This method is cheap, easy to implement and efficient in stress reduction during the induction of anesthesia in children of both sexes [35].

Smartphones

A recent study performed by the Korean authors was aimed at using smartphones to reduce preoperative anxiety in children. The authors concluded that children who had used a phone application before surgery were significantly less anxious compared to the children who received standard premedication with midazolam. When smartphones were used in combination with a low-dose midazolam, the level of anxiety was significantly lower than in other two groups. The authors believe that low-dose midazolam converts anxiety to curiosity in children and thus increases their compliance. Smartphones are widely present today and their contents can be adjusted to the individual needs of a child [36].

Conclusion

Preoperative period can be very stressful for children. Fear and anxiety during this period are related not only with the imminent discomfort for both children and parents, but also with negative consequences on the postoperative behavior and clinical recovery of the child. There are a lot of possibilities to reduce preoperative anxiety in children. Some of these interventions are widespread and their efficacy is well known, while some are still being evaluated. It is important to understand psychological problems related to operation and anesthesia in order to help children and parents to cope with perioperative stress.

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