

Preoperative Anxiety in Pediatric Population: Anesthesiologist's Nightmare

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Abstract

Surgery in a child is one of the most important events of its life. Exposure to hospital environment including operating room away from own area of comfort, meeting with new peoples and visualising sick people in agony creates a significant impact on a child's mind. Any unfavourable experience in this circumstance not only creates a fear towards medical systems for the lifetime but also sometimes lead to serious psychological consequences like post-traumatic stress disorders. The perioperative period is particularly important in this scenario because it is very difficult to manage an anxious and fearful child posted for surgery. It is of utmost importance that the antianxiety measures should start immediately after admission to avoid such a scenario and the anaesthesiologists have a crucial role in it.

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Introduction

Factors that evoke anxiety in children

In 1975 Visintainer and Wolfer [1] described five dimensions of surgical experiences that evoke anxiety to the children. Later in 1995 Squires [2] further elaborated the factors in relation to stress and anxiety in hospital admitted children. In general, in the operating room, the child is exposed to new surroundings with new people in command and in the fear of repeated painful physical stimuli, the exaggerated sense of helplessness crawls over the child's mind. Parental absence, anxiety or reduced control over the situation further demoralise the child and fear and anxiety overshadows the soothing effort of the healthcare providers. Researchers have found several factors which contribute to the preoperative anxiety in children which includes:

- Fear of physical harm or bodily injury in the form of pain, mutilation, or even death [1,2];
- Separation from parents and absence of trusted adults, especially for preschool children¹; witnessing of parental anxiety [2]
- Unknown and unfamiliar place, persons and routines [1,2] hospital food, clothing, and play;
- Uncertainty about "acceptable" and normative behaviour in a hospital setting [1];

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- Loss of control, autonomy, and competence [1]
- Exposure and touching of "private parts" by strangers [2]; Shame
- Medical jargon [2];

In the preoperative period there are also certain time points when the anxiety reaches the maximum. These periods or the 'stress points', if not appropriately taken care of, the children try to put maximum resistance to the caregivers. The stress points includes,

- Separation from the parents and/ or trusted adults
- Entry to operating room
- Placement of the child on O.T. table
- Visualisation of syringes

- Attachment of monitors
- Placement of intravenous cannula
- Placement of mask... etc

Factors determining level of anxiety

The level of preoperative anxiety depends on several factors including child related, parent related and the operating room environment related factors (**Table 1**). Age is considered as one of the most important factors and different presentations of anxiety are noted in children before and after six years of age. Shy or introvert children often demonstrates more anxiety than their extrovert counterpart.

Psychological effect of surgery

In 1934 Forsyth [9] first described postoperative psychological response in children. He noted a feeling of betrayal by the family members and a fear towards doctors as well as persons in everyday life in the children after surgery. In 2003 Leroy and colleagues [10] stressed upon the fact that surgical stress can produce physiological, emotional, cognitive, behavioural, and interpersonal changes in children and these changes can persist beyond the immediate postoperative period. In 1996 Kaine and co-workers [3] found, negative behavioural response in 54% children (2 to 10 years) after 2 weeks, 20% after six months and 7.3% after one year of surgery.

In addition to behavioural response preoperative anxiety also activates the endocrine, metabolic and humoral response [5,10-14]. Stress increases the secretion of corticotropin-releasing hormone and activates the locus ceruleus-norepinephrine/autonomic systems and their peripheral effectors, the hypothalamic pituitary-adrenal axis and the limbs of the autonomic system resulting in increased level of stress markers in blood namely glucocorticoids, epinephrine, cytokines (IL-6 and others) etc [15,16]. There is increased natural killer cell activity

as well as alteration in the immunological barrier in children [17]. All these factors culminate in hemodynamic, metabolic (Hyperglycemia, electrolyte disturbances, acid base disorder) adversary in the intraoperative and immediate postoperative period. Lately the children may suffer from, delayed wound healing, negative nitrogen balance, immunosuppression and postoperative infections and chronic ill health.

Parental presence

Presence of either or both the parents in the operating room during induction or recovery is a fairly common practice and used as a good alternative to sedative premedications. In spite of a fact that parental presence brings about a sense of security and wellbeing in a child, there are controversies regarding this practice. Behavioural patterns in parents, psychological impact of surgery and medicolegal issues has put this strategy to a big dilemma to the clinicians.

Effect on the children

In 1967 Schulman and associates [18] found presence of mother during anesthesia induction might reduce preoperative anxiety in children. Later in 1983 Hanallah and Rosales [19] observed for some preschool children, allowing the parents to support an anxious child during anaesthesia induction could be very effective in relieving anxiety and could minimize the need for premedication. These studies, however were nonrandomized, did not control for confounding variables and lacked an appropriate anxiety measurement tool for children. Later several well-structured studies had been done on this respect and most of the researchers concluded, parental presence does not result in reduced anxiety in children [20-23]. Kain and co-workers [23] in 1998 found oral midazolam is more effective than either parental presence or no intervention for managing a child's and parent's anxiety during the preoperative period. Research in this field further elaborated that presence of an anxious parent during

Table 1 Factors determining increased anxiety in preoperative period.

Child Factor		Parental factor		Environment factor
Age	Present as early as 9 months and peaks at 1 year. Highest risk at 1 to 5 years of age [3,4]	Anxious parents	Parental anxiety depends on, personality trait, socioeconomic condition, education, gender of the parent (mothers are more anxious), parents of infants, of children who have been through repeated hospitalizations and baseline temperament of the child [5,6]	More anxiety found in, <ul style="list-style-type: none"> • Increased number of people in the room at induction of anesthesia [8], • Longer waiting time between admission at the hospital and induction of anesthesia [8] • Negative memories of previous hospital experiences [8], • Having a mother who does not practice a religion [8] • IV induction • Untrained personnel [6] • Intensity of light • Noisy operating room
Personality	Shy or inhibited children, High IQ with poor social adaptive abilities [4]	Separated or divorced parents [6]		
Previous medical encounter	Previous negative hospital experiences, pediatrician or dentist visits [4]	Quality of parent child relationship	Poorly attended infant may develop poor coping skills in new settings [7]	
Education	Not attended pre-school	Number of siblings,	No siblings	

induction of anesthesia may aggravate anxiety in the child [23-26]. In 2006 Kain and co-workers [24] found the presence of a calm parent does benefit an anxious child during induction of anesthesia and the presence of an overly anxious parent has no benefit. Caldwell-Andrews and co-workers [25] observed that mothers who have a high desire to be present in the operating room are very anxious and that their children are likely to exhibit high anxiety levels during induction of anesthesia. This finding was supported by Wang and associates [26] who found, auricular acupuncture significantly decreased maternal anxiety during the preoperative period and children of mothers who underwent acupuncture intervention benefitted from the reduction of maternal anxiety during the induction of anesthesia. Kita and associates [27] found parental presence during induction of anesthesia (PPIA) is not much wanted in children above 10 years of age. In 2009, Chundamala and associates [28] evaluated 14 studies with level II or II evidence and concluded against effectiveness of PPIA in alleviating parents' or children's anxiety. They opined in favour of premedication with midazolam or other anxiety-reducing solutions, such as distracting children with video games as a viable alternative. Recently in 2015, Manyande and associates in a Cochrane database systematic review, examined 28 trials including 2681 children and found no significant benefit in terms of reduction of anxiety in PPIA model [29].

Effect on the parents

Parental presence during induction of anesthesia (PPIA) has several psychological as well as physiological impacts on the parents too. Kita and Yamamoto found an acceptance rate of 90% for PPIA in parents and more satisfaction among parents with this technique [27]. A number of surveys have indicated that most parents prefer to be present during induction and believe it to be helpful for the child and the anaesthesiologist [30,31].

The physiological responses of the parents vary with stages of anesthesia and surgery. Kain and co-workers [32] in 2003 recorded hemodynamic responses in parents and observed significantly increased heart rate and skin conductance level in parents in PPIA group especially when the child entered the room and when the child was induced. However, examination of holter data revealed no signs of ischemia or rhythm disturbance during this period.

Effect on the operating room (OR) team

The presence of a person not accustomed to the operating room environment may create disruption of mobility and functioning of the OR personnel. Researchers have reported concern of increased stress on the OR team, reduced efficiency, distraction from the care of patient and teaching of trainees, liability for the parental injury [6]. If the parents are not properly trained, there are possibilities of interference with management of emergency situations which may arise during induction. In case of communication gap between the parents and operating room personnel, functioning of OR may be severely hampered.

Medicolegal Issues

Medicolegal problems may arise due to presence of parents during induction of anesthesia. There is no clear legal literature regarding the role of anaesthesiologist in case of any adverse

effect in the parents during PPIA. In case the parents are invited to the OR rather than allowed, the hospital owes a legal responsibility towards the nonpatient. It is also not clear, in case of any mismanagement arising on behalf of the parents due to their ignorance or lack of medical knowledge, will the parents be held responsible or not. To avoid such disputes it is better to obtain a separate informed written consent from the parents before entering the OR.

Non-Pharmacological Management

Behavioural interventions

The preoperative interview: This is the most important step to build trust and develop rapport with the child and family. Explanation of details of OR, surgery and anesthesia in age and education appropriate terms not only helps to alleviate anxiety of the parents but also develops a sense of self confidence in the child.

Preoperative information programme: The children and the parent should be informed adequately regarding the perioperative incidences beforehand through any or multiple communications appropriate to their age, education and intellect [6,33,34] in preoperative clinic within 2 weeks of surgery [35]. Modes include leaflet [36], children's book [37,38], pamphlets [39], videos [40], tours of the facility [41] etc.

Researchers have found variable responses to the child and the parent by this method. Fincher et al., [42] observed preoperative preparation to be more effective in parents than children. In children it permitted to reduce pain experience in the postoperative period [42,43]. Tourigny and Chartrand [44] found no significant improvement after preoperative virtual tour. Deyirmenja et al., [45] found no improvement in terms of preoperative and postoperative anxiety in Lebanese patient and emphasised on assessment of patient's social and cultural background. Kain and co-workers [46] examined effect of combination of different modes of preoperative information programme and concluded; extensive preoperative preparation is helpful to lower levels of anxiety during the preoperative period, but not during the intraoperative or postoperative periods.

Behavioural education programme: Several behavioural interventions have been used successfully to reduce preoperative anxiety and among them development of coping skill was found to be most effective [6]. Other modes include modeling, therapeutic play [43,47], operating room tour and printed material [6], music therapy, clown nurse or clown doctors therapy [48-55]. Coping therapy may include deep breathing, counting, watching a video or handheld game. Distraction is very effective form of coping for young children [56-58]. A child-life specialist (or play specialist) may have an important role in this respect [6].

Music therapy: Music therapy has been found to be effective in adults as anxiolytic and its effectiveness has also been extended to reduction of requirement of anesthetics and muscle relaxants [59]. Kain and co-workers found interactive music therapy to be effective on separation and entrance to the operating room but less effective during the induction of anesthesia [60].

Behavioural interventions targeting healthcare providers:

Behavioural adaptation of the healthcare personnel to a child friendly one had been proved to be significantly important in management of preoperative anxiety in children. Coping promoting behaviour are desired from the parents and health care delivery.

'Let us play Doctor- Doctor': The authors practise a method of pretend play which is immensely helpful to relieve preoperative anxiety and very easy to conduct in any set up. Although the authors don't have any strong statistics or comparative model to support its usefulness, this technique is being employed for a long time and the authors' found it's quite helpful to alleviate operating room related anxiety in children. At the weekend, after the end of preoperative clinic session, the children posted for surgery in the next 2 weeks are taken to the preoperative preparation room. Each of them is allotted a role to play (e.g. surgeon, anaesthesiologist, patient, sister, or assistant etc depending on number of children). The anaesthesiologist guides them by preparation of a script and the parents help them to follow their roles. A bed as an OT table, an unused anesthesia machine, face mask without attached circuit, empty saline bottles, infusion sets, venous cannulas, ecg leads are used to mimic a perioperative situation. The cannula is attached (not introduced) to the child (playing the role of a patient) with adhesive tapes. Fake injections are administered through tubing. The end point of the play is regaining consciousness in recovery room. The primary target of this play is to make the children aware of the perioperative environment and thereby reduction of anxiety at several stress points, such as, separation from the parents and/or trusted adults, entry to operating room, placement on O.T. table, visualisation of syringes, attachment of monitors, placement of mask and to some extent intravenous cannulation. This period also helps in development of rapport with the child as well as the parents and creates a feel good effect on the child's mind (**Table 2**).

Pharmacological Management

Pharmacological measures against preoperative anxiety in children include use of sedative premedication in the preoperative room (**Table 3**). Oral route is preferred although parenteral route is also used where the child allows a venous access. Painful

intramuscular injections are usually avoided. Colourful syrup with a sweet taste and flavour is usually preferred and may be administered by the mother prior to surgery in the preparation room. Ideal drug for this purpose should be effective via the oral route, with immediate onset and short duration, should produce amnesia, should not precipitate respiratory depression, should not delay recovery, should not have any serious adverse effect of its own and should not produce paradoxical agitation. The practice of sedative premedication varies widely among different set ups, age groups, regions as well as the choice of the anaesthesiologists [41].

Future trend in pharmacological management

Future research efforts are directed not only towards discovery of better, safer, more tolerable drugs, but also evaluation of newer modes of drug delivery systems. Melatonin, a drug used to treat sleep onset insomnia and delayed sleep phase syndrome is being evaluated for this purpose [64]. Among newer delivery routes transdermal application of drugs with iontophoresis has gained popularity in the recent period for its painless application, early and predictable onset and is being investigated [66,67].

Conclusion

Control of preoperative anxiety in children is an important challenge to the anesthesiologists and considered as a primary objective in current day anesthesia practice. Sedative premedications, parental presence at induction of anaesthesia and behavioural intervention forms the mainstay of anxiety management. Identification of 'stress points' are important and significant improvements are noted if these periods are taken care of appropriately. Parental presence should not be mandatory, rather should be case specific. An informed consent should be obtained from the parents for medicolegal purposes. Preoperative interview, videos, clowns, virtual tour all is effective if practiced appropriately. Distractions in the form of deep breathing, videos or toys are very effective and should be used particularly during the 'stress points'. The authors strongly recommend use of pretend play, as described in the article, to get better control over the stress points.

Table 2 Effects of preoperative anxiety.

Intraoperative and Immediate Postoperative	Psychological and Behavioral [3-6,10,61]	Resistance to healthcare provider Susceptibility to injury. Increase motor tone, Stop playing Crying Restlessness, agitation
	Metabolic and Humoral [5,10-14]	Sympathetic stimulation, Increased stress markers in blood Hemodynamic instability: high heart rate and blood pressure [13]. Hyperventilation [61] Hyperglycemia, electrolyte disturbances, acid base disorder
	Others [61-63]	Emergence delirium [62] Delayed awakening. Involuntary micturition Precipitation of cyanotic spell in tetralogy of Fallot
Early Postoperative	Delayed wound healing, Negative nitrogen balance, Immunosuppression Postoperative infections	
Delayed Postoperative	Fear of physicians Behavioural changes, Nightmares, Separation anxiety, Eating problems, Increased fear of physicians General anxiety Nighttime crying Temper tantrum Apathy and withdrawal Aggressive behaviour	

Table 3 Drugs to manage preoperative anxiety in pediatric patients.

Drugs	Route	Dose	Onset	Disadvantage	Advantage
Midazolam [64]	Oral	0.25-0.75 mg kg ⁻¹ (to a maximum of 20 mg) [38,42]	20 minutes [64,65]	Paradoxical reaction (<1%) [66] Delayed recovery	Rapid and reliable onset, Minimal respiratory depression, Antegrade amnesia, Reduced emergence delirium.
	IV	0.1 mg kg ⁻¹		Needs cannulation, painful	
	Nasal	0.3 mg kg ⁻¹	10 minutes [67]	Nasal irritation [67]	
	Rectal	0.5 mg kg ⁻¹	10 minutes [67]	Hiccup (22-26%) [68]	
	SL	0.3 mg kg ⁻¹			
Clonidine [64, 69-71]	Oral [64]	4 µg kg ⁻¹	45 minutes	Long onset time	Well tolerated, Palatable, Predictive effect, Reduce nausea and vomiting [72] Anesthetic and analgesic sparing property [64,69-77]
	Nasal [73-75]	2-4 µg kg ⁻¹	30 minutes	Erratic absorption	
	Rectal [76,77]	2.5 µg kg ⁻¹	20 minute	Postoperative sedation	
Dexmedetomidine	Nasal [78-79]	0.5-1 µg. Kg ⁻¹	20-40 minutes	More sedation, Prolonged onset	Acceptable cooperation, Arousable sedation

	IV [80]	0.4 µg/kg diluted in 10 ml			Excellent parent separation, Favourable induction conditions, Lower incidence of postoperative agitation and shivering, Hemodynamic stability, No respiratory depression.
Ketamine [64,67,81-83]	Oral [64,67]	3-6 mg kg ⁻¹	10-20 minutes	Emergence delirium [83]	No respiratory depression Analgesic sparing. Combination with midazolam preferred [82].
	Nasal	3-5 mg. Kg ⁻¹	<10 minutes	Agitation	
	Rectal	5-6 mg kg ⁻¹	20-30 minutes	Excessive salivation [83]	
	IM	4-8 mg kg ⁻¹		Vomiting [83]	
	IV	1-2 mg kg ⁻¹			
Fentanyl [67, 84-86]	Oral transmucosal	15-20 µg Kg ⁻¹	15-20 minute	Respiratory depression Vomiting facial pruritus No reduction in apprehension.	Sedation Analgesia

N.B., IV: Intravenous, SL: Sublingual, IM: Intramuscular

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