

Preinduction techniques to relieve anxiety in children undergoing general anaesthesia



Michael O'Sullivan MRCS FCA(RCSI)

Gail K Wong FANZCA

Key points

Preoperative anxiety is associated with adverse postoperative clinical outcomes, such as emergence delirium and increased analgesic requirements.

Preinduction techniques, aimed at reducing preoperative anxiety, consist of: (i) sedative premedication, (ii) parental presence at induction of anaesthesia, and (iii) behavioural intervention.

Sedative premedication reduces preoperative anxiety and negative postoperative sequelae.

Evidence does not support routine parental presence at induction of anaesthesia as a means of reducing preoperative anxiety.

Several behavioural interventions reduce preoperative anxiety, but many are time-consuming.

Preoperative anxiety in children is a significant and challenging problem. If not managed in a considered and structured fashion, it can lead to distress for the child, parents, and the operating theatre staff involved. Of considerable concern is the link between preoperative anxiety in children and an increased incidence of adverse postoperative clinical outcomes. Preinduction techniques in paediatric anaesthesia are primarily focused on relieving the preoperative anxiety of the child, but consideration of parental anxiety is also important. The use of preinduction techniques is, in many respects, unique to paediatric anaesthesia, and therefore can be challenging for the anaesthetist who practices paediatric anaesthesia on an occasional basis.

A majority of children experience significant stress and anxiety before surgery.¹ Studies have demonstrated an association between preoperative anxiety and adverse postoperative clinical outcomes, such as emergence delirium, increased analgesic requirements, and negative behavioural changes (e.g. bed-wetting, altered appetite, sleep disturbance, and separation anxiety).^{1–3} Alarming some of these behavioural changes can persist for months into the postoperative period. Therefore, in order to improve the perioperative course of these children, it is essential that measures are taken to relieve their anxiety.

In broad terms, preinduction techniques can be classified into:

- Sedative premedication;
- Parental presence at induction of anaesthesia;
- Behavioural intervention.

Of these three categories, parental presence at induction of anaesthesia (PIPA) remains the most controversial, with opinion divided as to its role.

The practice of preinduction techniques can vary considerably between different hospitals, and within individual departments. The

approach taken is often influenced as much by the individual preferences of the anaesthetist as by robust scientific rationale. The authors of this article feel it is an area of anaesthetic training that deserves greater emphasis, and we have set out in this article to provide an evidence-based framework to assist in dealing with preoperative anxiety in the paediatric setting.

Sedative premedication

Midazolam

The role of sedative premedication is well established as a preinduction technique in paediatric anaesthesia. Midazolam has been the most widely used agent, with a long history of safety and efficacy. As a premedication, it offers several benefits, including a rapid and reliable onset, minimal respiratory depression, antegrade amnesia, and reduced emergence delirium. It is typically administered orally at a dose of 0.5–0.75 mg kg⁻¹ (to a maximum of 20 mg) after which sedation and anxiolysis are reliably achieved within 20 min. In addition to the oral route, it can alternatively be administered by the i.v. (0.1 mg kg⁻¹), intranasal (0.3 mg kg⁻¹), rectal (0.5 mg kg⁻¹), or sublingual (0.3 mg kg⁻¹) routes. Studies demonstrate reduced anxiety, increased cooperation, and decreased negative behavioural changes in children who receive midazolam preoperatively.⁴ Arguably, midazolam is established as the 'gold standard' method of preoperative anxiolysis against which other preinduction strategies are compared. Nonetheless, midazolam is not universally accepted as the optimal premedication available, and some experts have highlighted significant limitations including the potential for prolonged effect and for paradoxical reactions.⁵ Paradoxical reactions, although uncommon (<1% patients), can result in a restless and agitated child, and are most common after i.v. administration. The exact mechanism of these reactions is unclear—most are

Michael O'Sullivan MRCS FCA(RCSI)

Specialist Registrar in Anaesthesia (Ireland) and Clinical Fellow in Paediatric Anaesthesia
The Hospital for Sick Children
Toronto
Canada

Gail K Wong FANZCA

Assistant Professor
Department of Anaesthesia and Pain Medicine
The Hospital for Sick Children
555 University Avenue
Toronto
Canada M5G 1X8
Tel: +1 416 813 5586
Fax: +1 416 813 7543
E-mail: gail.wong@sickkids.ca
(for correspondence)

idiosyncratic, although a genetic link is postulated. If a child has a history of such a reaction, then midazolam should be avoided.

Clonidine

In recent years, the use of clonidine as a sedative premedication in paediatric anaesthesia is increasing. Clonidine is an α_2 -adrenergic agonist with sedative and analgesic properties.⁶ It can be administered orally ($4 \mu\text{g kg}^{-1}$) or intranasally ($2 \mu\text{g kg}^{-1}$). It is well tolerated with predictable effect, making it an excellent alternative to midazolam. Although it has a relatively long onset time (45 min approximately), its analgesic and anaesthetic-sparing properties offer potential advantages. In a situation where postoperative pain may be of particular concern, for example a patient with chronic pain, then clonidine's analgesic effect may be particularly beneficial.

Ketamine

Ketamine is an NMDA receptor antagonist with a long history of use as a sedative premedication. It can be administered by the oral (5 mg kg^{-1}), i.m. ($4\text{--}8 \text{ mg kg}^{-1}$), or i.v. ($1\text{--}2 \text{ mg kg}^{-1}$) route. Its long history, analgesic properties and its ability to produce sedation without significantly impairing respiratory drive explain its appeal as a premedication, although it can be associated with troublesome side-effects such as emergence delirium and prolonged recovery. Owing to the availability of agents like midazolam or clonidine, which have fewer side-effects, its role is often reserved for the older developmentally delayed or autistic child who is uncooperative or combative. In these patients, i.m. ketamine may be given effectively, particularly if the procedure cannot be delayed or rescheduled.

Other agents

Oral transmucosal fentanyl ($15\text{--}20 \mu\text{g kg}^{-1}$) is approved as a premedication for paediatric patients, with a typical onset time of sedation of 15–20 min. However the associated respiratory depression, and its potential to induce nausea and vomiting, limits its popularity for this particular purpose.

The use of anti-histamines, such as alimemazine, for premedication has declined with the availability of more suitable agents such as midazolam and clonidine.

Melatonin is used to treat sleep onset insomnia and delayed sleep phase syndrome in children. A role for melatonin as a sedative premedication has been suggested, although it has not been approved for this purpose.

Parental presence at induction of anaesthesia

PPIA remains a controversial strategy in reducing preoperative anxiety. Although initial reports suggested PPIA resulted in

decreased anxiety and increased cooperation in children, numerous prospective studies have refuted this.

Much of the evidence available regarding the role of PPIA is provided by a research group at Yale University, New Haven Children's Hospital, USA, under the direction of Dr Zeev Kain. Kain *et al.*⁷ designed and validated assessment tools for standardized evaluation of perioperative behaviour in children, including the modified Yale Preoperative Anxiety Scale (mYPAS) and the Induction Compliance Checklist (Tables 1 and 2).⁸ The mYPAS is an observational state anxiety measure for children comprising 27 items in 5 categories, and has demonstrated high reliability and validity for measuring children's anxiety in the preoperative holding area, on entering the operating theatre and during induction of anaesthesia. The Induction Compliance Checklist, also an observational scale with good reliability, contains 10 negative behavioural groups to assess the child's compliance at induction. Each negative behaviour accrues one score; high scores correlate with poor behavioural compliance. Subsequently, Kain *et al.* conducted several randomized controlled trials in which they compared PPIA, midazolam, and control groups.^{8–11} These studies consistently demonstrated that children benefitted from a sedative premedication, but that PPIA provided no additional advantage in terms of anxiolysis or postoperative outcomes. **Interestingly, however, parents who accompanied their children at induction tended to be more satisfied with the overall anaesthetic process. Studies by other investigators¹² have demonstrated similar findings, while a Cochrane review¹³ supports the assertion that routine PPIA does not confer benefit to the child. However, a *post hoc* subgroup analysis of a number of these previous studies^{9, 12} and a prospective study by Kain *et al.*¹⁴ demonstrated that certain children benefitted from PPIA. In particular, it appears that calm parents may confer an advantage, while highly anxious parents do not.**

Despite the lack of evidence to support PPIA, it is an issue which is controversial, and anaesthetists remain divided as to its

Table 1 Modified Yale Preoperative Anxiety Scale (mYPAS) categories

Activity
Emotional expressivity
State of arousal
Vocalization
Use of parents

Table 2 Induction compliance checklist

Crying, tears in eyes
Turns head away from mask
Verbal refusal, says 'no'
Verbalization indicates fear or worry
Pushes mask away with hand
Covers mouth/nose with hands/arms
Hysterical crying
Kicks, flails legs/arms, arches back
Requires physical restraint
Complete passivity

role. Certain children may benefit from PPIA, for example children of calm parents, and it is noteworthy that parents tend to be more satisfied with the anaesthetic process when their presence is facilitated at induction. The most notable limitation of several of the studies examining PPIA is the exclusion of children with chronic illness or previous surgeries. In our opinion, children who have multiple perioperative encounters may actually benefit most from PPIA. Furthermore, the majority of the relevant studies were single-centre studies, therefore reducing the external validity of their findings.

Behavioural interventions

Various behavioural interventions are gaining prominence as a means of alleviating preoperative anxiety in children. These interventions can be targeted at the child, parent, or both. Numerous strategies have been analysed, including the use of video games, interactive computer packages, clowns, hypnosis, and parental acupuncture. Benefit has been demonstrated with these techniques although, in general, they do not provide superior anxiolysis to the use of a sedative premedication.^{15, 16} The role of play therapists has proved particularly popular with both children and parents in the preparation of children undergoing general anaesthesia, and is reported to be of value in decreasing the anxiety associated with anaesthesia and surgery.

Evidence in support of behavioural techniques is provided in a study by Kain *et al.*¹⁷ demonstrating that a comprehensive, family-centred preoperative behavioural preparation programme significantly benefitted children in terms of reduced anxiety, increased compliance, reduced emergence delirium, and reduced analgesic requirements. However, widespread acceptance and implementation of such an intervention are restricted by its time-consuming and costly nature.

Organizers of the Positive Outcome and Experience Management Strategies (POEMS) course in the UK identified the potential to improve children's perioperative experience by teaching management strategies to care-givers that allow them to effectively reduce perioperative anxiety. This course provides an integrated approach to the prevention and management of general and procedure-related anxiety utilizing formal lectures, interactive scenarios, photographic and video illustrations.

Child psychologists emphasize the negative impact distressing procedures can have on hospitalized children. The British Psychological Society has published evidence-based guidelines which highlight the potential for significant psychological disturbance in such children, and provide guidance on how to avoid or reduce the negative impact.¹⁸ A cognitive-behavioural approach is advocated, incorporating distraction techniques, a child-friendly environment, and developmentally appropriate play materials. These guidelines, which are primarily focused on improved psychological outcomes, endorse the presence of the parent/carer, provided the parent/carer does not display a high level of distress themselves.

Conclusion

Preoperative anxiety in children is a common and challenging problem, associated with significant negative clinical outcomes. Measures used to reduce anxiety include the use of sedative premedication, PPIA, and various behavioural preparation techniques. Of these measures, the role of sedative premedication is firmly established, while behavioural techniques are gaining wider acceptance. PPIA remains controversial. Available evidence indicates that *routine* parental presence does not confer benefit to the child, although parental satisfaction is enhanced when their presence is facilitated. Furthermore, certain children are likely to benefit from parental presence, in particular children of calm parents, and the challenge remains to identify these children preoperatively. There is little evidence comparing preinduction techniques for children with chronic illness requiring repeated visits to the operating theatre, and further evaluation of this patient population is required.

Declaration of interest

None declared.

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Please see multiple choice questions 5–8.