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Review article

Children's preoperative anxiety and postoperative behaviour

AGNES T. WATSON FRCA AND ANIL VISRAM FRCA
Department of Anaesthesia, The Royal London Hospital, Whitechapel, London, UK

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Introduction

Reduction of anxiety experienced by children is important for humanitarian reasons and to improve cooperation with medical staff. Anxiety at induction of anaesthesia is associated with distress on awakening in the recovery area and with later postoperative behaviour problems (1–4).

Good anaesthetic practice, as well as attention to pharmacological and physiological issues, should address the psychological aspects of the perioperative care of children. Preoperative anxiety and postoperative behaviour of children and parental anxiety are becoming more important issues, which is evident by recent work using newly validated measures of these outcomes. Motivation for interventions directed at relieving children's anxiety, such as parental presence at anaesthetic induction and preparation programs, has increased. This is due partly to increased parent participation in children's hospital stay and a more holistic approach to children's care by nursing and medical staff. Another intervention, that of sedative premedication, has changed due to the advent of short-acting benzodiazepines.

Recent editorials have highlighted some aspects in this field (5–7). Here, all the issues are comprehensively reviewed, from factors affecting child anxiety to interventions directed at relieving it. Importantly, the validity and reliability of anxiety and behaviour measures are analysed, which is vital to evaluate studies in this field.

Correspondence to: Agnes Watson, Anaesthetic Dpt., St Andrews Centre, Broomfield Hospital, Broomfield, Chelmsford, CM1 7WE (email: agnes.watson@ntlworld.com).

History

Over 40 years ago, in 1958, Eckenhoff recognized a link between 'unsatisfactory' anaesthetic inductions and negative personality changes postoperatively in a retrospective study of over 600 children (8). This led the way to a recognition of the importance of addressing children's anxiety in the perioperative period.

In the 1960s and 1970s, issues of parental presence and preparation of the child for surgery were examined by several workers, but the results were hampered by a lack of validated, reliable measures of child anxiety (9–12). Venham *et al.* developed anxiety scales in the late 1970s for use in children having dental treatment, and these were later used to measure anxiety at anaesthetic induction (13–15).

The studies mentioned above were published mainly in journals of paediatrics, psychology and dentistry. Interestingly, it is only in the last decade that work in this field has appeared in the anaesthetic literature. This has coincided with the development of anxiety measures specifically for use at induction of anaesthesia.

Measures

To evaluate studies in this field, the validity and reliability of measures of anxiety, temperament and behaviour must be assessed. Validity is a measure of accuracy and a test of whether the score measures the specific outcome it is designed to do. Content or face validity simply means that the measures ask questions that are reasonable and adequately cover the area they are supposed to assess. Comparing results between two measures can be performed by correlation and, when comparing with a recognized gold standard, this is called concurrent validity. However, if a standard method of measurement does not exist, evidence can be collected in other ways to support that the measure is accurate, and this is known as construct validity.

Reliability is a measure of consistency. For observer measures, this can be between observers (interobserver) or between the same observer on more than one occasion (intraobserver). Test–retest reliability is recorded for measuring the same test at different time points.

Anxiety measures

Child

The accurate measurement of child anxiety is essential in order to assess the size of the problem and to evaluate interventions. The validity and reliability of observer and self-report measures are shown in Table 1.

Observer measures. Preoperative anxiety in children is mainly assessed by observer measures which can be completed more quickly and be performed by an independent observer, the anaesthetist or the parent if present.

Detailed measures such as the modified Yale Preoperative Anxiety Score (mYPAS) appear to be more sensitive than global measures [e.g. Clinical Anxiety Rating Scale (CARS), Global Mood scale (GMS)]. The mYPAS, which was specifically developed for anxiety measurement at anaesthesia induction, scores five behavioural categories: the child's activity, facial expression, alertness and arousal, vocalization and interaction with adults. Therefore, small changes in anxiety can be measured more accurately than by a scale recording the overall behaviour of the child (16–20).

The measures listed in Table 1 are not exhaustive and some studies have used simple rating scales to assess anxiety, but the validity and reliability of these measures is not recorded (9,21).

Assessing anxiety of very young children is difficult and no measures have been developed and validated for children under 2 years of age. Simple rating scales are used in the literature.

Self-report measures. Self-report measures generally take 5–10 min to complete, which may not be practical in a busy induction room and, for obvious reasons, they are not suitable during induction of anaesthesia. They cannot be used by preverbal children.

Measures of cooperation. Measurement of cooperation of the child during induction can be used as a surrogate outcome for anxiety. Some studies (10) use simple scores of cooperation but a more sensitive measure, the Induction Compliance Checklist (ICC), was developed by Kain *et al.* (19) and is detailed in Table 1.

Physiological measures. Physiological measures, although frequently used to assess anxiety, are not well validated. Heart rate and blood pressure will be affected by a range of factors other than anxiety (e.g. by premedication). Serum cortisol concentration has been used to assess anxiety levels of children immediately after induction of anaesthesia (22). Studies of adults have shown serum cortisol to be associated with stress (23–25). Ideally, samples should be taken at baseline, in a calm setting and after induction of anaesthesia, and any change recorded, but this is not practical in children.

Parent

The validity and reliability of two self-report measures of parental anxiety are shown in Table 2. The State Trait Anxiety Inventory (STAI) is the gold standard for assessing anxiety in adults and has been used in more than 1000 studies. Trait anxiety measurement is used as a baseline to compare control and intervention groups of parents in studies. State anxiety measurement is used to assess situational

Table 1
Measures of preoperative anxiety in children

Measure	*Year*	*Developed for:*	*Scale*	*Age*	*Validity*	*Reliability*
Observer measures						
Clinical Anxiety Rating Scale (CARS)	1977	Dental procedures	Score 0–5, 0 = relaxed and smiling to 5 = out of contact with reality, loud crying	2–5 years	Good validity (13)	Good interobserver reliability, $r = 0.78–0.98$ (14)
Global Mood Scale (GMS)	1990	Intramuscular injections	Score 1–7, 1 = playing happily to 7 = screaming	2–10 years	Not documented	Interobserver agreement > 90% (16)
Yale Preoperative Anxiety Scale (YPAS)	1995	Inhalation induction of anaesthesia	Score 23–100, 5 categories – activity, emotional expressivity, state of arousal, vocalization and use of adults. Total of 21 items	2–6 years	Good validity against an observer VAS anxiety score, $r = 0.59–0.63$ and to a 7-point global scale, $r = 0.61–0.64$ (17)	Good intra- and interobserver reliability kw = 0.66–0.94 (17)
Modified Yale Preoperative Anxiety Scale (mYPAS)	1997	Inhalation induction and holding area	Score 23–100, 5 categories as above. Total of 22 items. Takes 1 min to complete	5–12 years	Good validity against STAIC, $r = 0.79$ good construct validity with increasing scores from holding area to induction (18)	Good intra- and interobserver reliability kw = 0.63–0.90 (18)
Visual Analogue Score (VAS)*			Score 0–100, recorded on a 100-mm line from 0 = not anxious to 100 = extremely anxious		Not documented in children	Not documented in children
Induction Compliance Checklist (ICC)	1998	Inhalation induction of anaesthesia	Score 0–10, measures cooperation by a checklist of 10 items	1–9 years	Not documented	Excellent inter- and intraobserver reliability interclass, $r > 0.995$ (19)
Self-report measures						
State Trait Anxiety Inventory for Children (STAIC) (20)	1973		Score 20–80, two parts, each of 20 questions, measuring trait (baseline) anxiety and state (situational) anxiety	> 5 year read to children aged 5–8 years	Not available	Not available
Venham Picture Test (VPT)	1977	Dental procedures	Score 0–8, child chooses between eight pairs of anxious and nonanxious faces	2–8 years	Good validity against other self-report, physiological and observational measures (15)	Moderate test–retest reliability between two successive dental visits (15)

*VAS can be used as self-report measure. r, correlation coefficient; kw, chance corrected agreement kw values < 0.4 are poor and values > 0.8 are high.

Table 2
Measures of anxiety in parents

Measure	Scale	Validity	Reliability
State Trait Anxiety Inventory (STAI)	Score 20–80 Two parts each of 20 questions measuring trait (baseline) anxiety and state (situational) anxiety	Good construct and concurrent validity (26)	Test–retest reliability good, $r = 0.73–0.86$ (26)
Visual Analogue Scale (VAS)	Score 0–100 recorded on a 100-mm line from 0 = not anxious to 100 = extremely anxious	Good validity against STA I (27)	Test–retest reliability good, $r = 0.5–0.83$ (27)

r, correlation coefficient.

anxiety of parents immediately after being present for anaesthesia induction of their child.

Temperament measures

The temperament of the child may influence their reaction to stressful situations. Temperament is similar to personality and four temperaments are defined (28). These are emotionality (E), activity (A), sociability (S) and impulsivity (I).

This can be measured by the EASI instrument of child temperament developed by Buss *et al.* (28). For each of these four temperaments, the parent is given five patterns of behaviour and is asked to rate their child on a scale ranging from 1 to 5. Scores range from 5 to 25 for each temperament. Test–retest reliability of the EASI instrument of child temperament is good ($r = 0.58–0.8$) over an interval of 1 week (29).

Postoperative behaviour measures

Excitement score

The excitement score measures behaviour immediately after surgery in the recovery area. It is an observer 3-point score from 0 (child lying quietly, no crying) to 3 (thrashing and/or needs restraint and/or constant crying). Interobserver reliability is high (interclass $r > 0.997$) (30).

Posthospitalization behaviour questionnaire (PHBQ)

Only one measure (or modifications thereof) has been used to measure behaviour after discharge from hospital: the PHBQ. This measure was developed by Vernon *et al.* in 1966 in a study of 387 children aged from 1 month to 16 years, after a mean hospital stay of 8.8 days (31). The questionnaire for parents about their child's behaviour has 27 items in six categories, comprising general anxiety, separation anxiety, sleep anxiety, eating disturbance, aggression towards authority and apathy and withdrawal. Examples of questions are: Does your child have bad dreams at night or wake up and cry?, Does your child follow you everywhere around the house?

For each item, the behaviour is compared with that before hospital admission on a 1–5 scale, with low scores indicating positive behaviour change and high scores indicating negative behaviour change. Another method of use is completion of the questionnaire before and after hospitalization and a comparison of these two absolute ratings, although this is less sensitive than the comparative method of scoring (32). As positive and negative behaviour scores are combined in many studies, this can underestimate the degree of negative behaviour change.

Although widely used in the literature, the validity of the measure has only been assessed once when compared with psychiatric interviews of children ($r = 0.47$) (31). Construct validity is supported by a metaanalysis of studies using the PHBQ as a primary endpoint (33). It was designed for all children but the validity for different age groups is not known. It is not an independent observer measure and parents may bias the scores according to their own expectations of their child's behaviour and will usually not be blinded as to whether their child is in an intervention or control group. Test–retest reliability is acceptable ($r = 0.65$) (31).

The link between anxiety and postoperative behaviour

Anaesthetic induction can be one of the most stressful experiences for the child during the perioperative period (34). Early studies showed stormy anaesthetic inductions were associated with a disturbance in postoperative behaviour (8,35).

A significant correlation between anxiety at induction of anaesthesia and postoperative excitement in the recovery room exists. Children who were more anxious preoperatively were more distressed in the immediate postoperative period (1,2).

The association between preoperative anxiety and negative postoperative behaviour after hospital discharge has been demonstrated in two studies by Kain *et al.* (2,4). Ninety-one children, aged 1–7 years, who were having daycase surgery, were studied (2). Many confounding factors were excluded and children were not premedicated, nor was parental presence allowed. Preoperative anxiety was an independent predictor for the presence of postoperative negative behaviour. A child who was more anxious had 3.5 times the risk of postoperative negative behaviour compared with a child who was less anxious (2).

The frequency of negative behaviour decreased with time after surgery (2,4). Kain *et al.* found 67% of children had new negative behaviours on the day after surgery, 45% on day 2 and 23% at 2 weeks after surgery (2). Behaviour problems persisted for up to 6 months for 20% of children and for up to 1 year for 7.3% of children (4). These studies allowed for all known confounding factors preoperatively but the possibility that postoperative events altered children's behaviour should also be considered.

Common behaviour problems after surgery were bad dreams/waking up crying, disobeying parents, separation anxiety and temper tantrums (2,4). More serious behaviour changes, such as new onset enuresis, were uncommon (0.8% at 2 weeks) (4). However, studies have shown that some children experience positive behaviour change following surgery which may be due to their improved medical condition (3,36).

This work shows that we should anticipate postoperative behavioural problems in children who have a stormy anaesthetic induction. Anaesthetists should consider offering information and advice to parents of these children. Postoperative negative behaviour changes are important if they persist for an extended time, have a negative effect on the child's response to medical care in the future or interfere with the normal development of the child. Studies on the effect of anaesthetic stress on later development of the child are lacking, although we do know negative memories of anaesthesia persist into adulthood (37). From experience, we observe that some children can become anaesthetic phobic particularly when returning for several anaesthetics. Whether this has a cumulative effect on disturbance in behaviour is unknown.

Factors influencing anxiety and behaviour

Factors pertaining to the child, anaesthesia and surgery can affect the degree of anxiety the child experiences at anaesthetic induction and of later postoperative behaviour problems. Also, stressful life experiences outside hospital can affect how a child reacts to anaesthesia and surgery. Studies evaluating interventions directed at reducing anxiety need to exclude as many of these confounding factors as possible.

Age

The psychological issues for children of different ages having surgery, based on general observation and knowledge of personality development, were reviewed by McGraw (38). Infants can be comforted by medical staff and are less likely to experience separation anxiety from a parent. At 1–3 years of age, children are well bonded to their parents and will experience separation anxiety. They may be too young to accept explanations but they respond to distraction and comforting measures. At 4–6 years of age, children want more explanations and to feel in control of events. Older children, aged 7–12 years, may want to be involved in decision making but this is best discussed preoperatively and not in a stressful situation. Adolescents, aged 13 years and over, may fear losing face or failure to cope. They need privacy and are more independent.

Studies looking at the effect of age on anxiety at induction have conflicting results. Bevan *et al.* found younger children to be more anxious at induction than older children (as measured by GMS) (16). Other work showed younger children were more anxious at separation from their parents (39) and they were less cooperative at anaesthesia induction (3).

However, in a large survey of children, distress at induction did not vary with age (1). A cross-sectional study by Kain *et al.* actually found children older than 7 years to be more anxious than children aged 4–7 years in the preoperative holding area (observer VAS) (4). Anxiety at induction was not measured in their study.

Postoperative behavioural problems seem to be more prevalent in the younger child. As early as 1958, Eckenhoff found younger children, aged less than 3 years, to be more at risk from postoperative behavioural problems (8). In 1966, Vernon *et al.* (31) found children aged 6 months to 4 years of age had more postoperative negative behaviours than older children, especially separation anxiety. Other more recent studies also found postoperative behaviour problems occurred more frequently in younger children (3,10,40), including work by Kain *et al.* showing that younger children were more affected for up to 6 months postoperatively (4).

Gender

The sex of the child does not influence preoperative anxiety (4,39) or the development of postoperative behavioural problems (3,4,31).

Temperament

Kain *et al.* showed that shy, inhibited children (i.e. low EASI score for activity) had higher levels of anxiety in the preoperative holding area and at separation from parents (measured by observer VAS) (4).

Impulsive children (i.e. high EASI score for impulsivity) had an increased risk of general anxiety and of separation anxiety at 2 weeks postoperatively (PHBQ) (4).

Previous hospital experience

Several studies have shown that previous distressing medical experiences increase child anxiety. Kain *et al.* showed that increased anxiety in the preoperative holding area and at separation from parents (measured by observer VAS) was significantly related to poor quality of previous medical experiences (4). This was supported by other work which showed children with previous bad experiences of health care were more distressed or less cooperative at anaesthetic induction (3,36).

This is important because increased anxiety during anaesthesia may increase anxiety for the next visit. Avoiding this spiral of events is vital for children requiring several repeated anaesthetics (e.g. for haematological procedures).

Mode of anaesthetic induction

A study looking at the effect of mode of induction on anxiety and subsequent behavioural problems was conducted on 92 children, aged 2–7 years, having daycase ENT surgery in Finland (41). Patients were randomized to three groups, an intravenous group (EMLA cream was not used), an inhalation group and a rectal group (using methohexitone). All children were heavily premedicated and parents were not present at induction. Anxiety was measured using a 5-point scale based on cooperation at induction. The inhalation group caused the least stormy inductions, followed by the rectal group and the worst inductions were in the intravenous group. Measurement of postoperative behaviour changes showed no differences between the groups, although more children had negative memories of inhalation induction compared with the other two methods.

This study could have given a more relevant clinical message by the use of EMLA cream and a more sensitive measure of anxiety.

Surgery

A large survey found no difference in preoperative anxiety between elective and emergency surgery but a validated measure was not used and confounding variables existed (1).

Further studies have examined the effect of surgical factors on postoperative behaviour.

Genitourinary surgery was associated with the most negative postoperative behavioural changes and insertion of grommets the least (measured by PHBQ in the 2 weeks after surgery) in one study (2); however, another study (3) and a metaanalysis (32) found surgical category did not affect the incidence of postoperative behaviour problems.

Children for inpatient surgery had increased postoperative behaviour problems compared with daycase surgery in one study (36), whereas another study found no difference (40). However, neither of these were randomized and children were either treated as an inpatient or daycases according to surgical procedure.

Postoperative symptoms

The effect of postoperative pain on behaviour problems is unclear. In one study, pain was a significant predictor of behavioural changes for the observation period of 4 weeks (measured by 17 items of PHBQ) (3). The behaviour problems lasted at least 2 weeks longer than the report of pain (measured by parents). However Kain *et al.* found poor correlation between the extent of postoperative pain in recovery (measured by observer VAS) following general surgery and the number of behavioural changes at 2 weeks (4).

Interventions

Interventions to reduce child anxiety can be psychological (e.g. parental presence or preoperative preparation programs) or pharmacological (e.g. sedative premedication). The purpose of interventions is to reduce child anxiety and postoperative behavioural problems but other outcome measures have been examined, such as cooperation at induction, parental anxiety and parental satisfaction.

Parental presence

The avoidance of separation from parents during hospitalization has been considered beneficial for the child for several decades (38). Parental presence at induction of anaesthesia is more controversial and discussion was provoked in the UK in 1985 when a consultant ophthalmologist published his experience of not being permitted to accompany his 3-year-old daughter for induction (42). Parental presence at induction is now common practice in the UK; however, this is not so in the USA. A survey in 1996 showed 58% of American anaesthetists allowed parental presence in less than 5% of cases, whereas 84% of British anaesthetists allowed parental presence in more than 75% of cases (43). British anaesthetists were more inclined than their US colleagues to believe that parental presence decreased child anxiety, increased cooperation and would benefit both the parent and the anaesthetist. Differences between the countries, such as place of induction and fear of litigation, may explain these differences in attitude towards parental presence.

Child preoperative anxiety

The published controlled trials of parental presence at anaesthesia induction are summarized in Table 3. Two early studies and a more recent one found child anxiety to be reduced by parental presence (9,21,44). However, these trials were not all randomized, confounding factors existed and the measures of anxiety were not all validated.

Other work has shown no benefit of parental presence (16,22,45). Kain *et al.* published a randomized controlled trial of children having daycase surgery who either had a parent present at inhalation induction or not (22). Children with possible confounding factors were excluded from participation in the study. There was no significant difference between the two groups for anxiety of the child in the holding area, entrance to the operating room or at induction (measured by observer YPAS, CARS and cortisol level after induction).

A positive finding of this study was that serum cortisol level was lower in the parental presence group for some children: those who had a calm parent (low trait anxiety measured by STAI), shy, inhibited children (with low EASI activity score) and children older than 4 years. However, the YPAS has better documented validity than a single measurement of serum cortisol for measuring child anxiety at induction and so these results must be questioned.

Bevan *et al.* studied children having daycase surgery, randomized according to the day of the week (16). No differences were found in child anxiety between the two groups (measured by GMS). The drawbacks of this study were that some confounding factors were not allowed for, method of induction was not stated and a power analysis was not performed.

Another study by Palermo *et al.* in infants found no benefit from parental presence (45). This might be expected in an age group who are less likely to

Table 3
Controlled trials of parental presence at induction of anaesthesia: effect on children's preoperative anxiety

Reference	*Year*	n	*Age*	*Surgery*	*CE*	*Premed*	*Randomized*	*Mode of induction*	*Anxiety measure*	*Results and significance level*	*Comments*
Schulman *et al.* (9)	1967	32	2–6 years	Tonsillectomy	II	Not stated	Yes	Inhalation	Score 1–7 at induction ? by anaesthetist or observer	Significantly lower scores in pp group *vs* control group	Unvalidated anxiety measure, possible confounding factors
Hannallah *et al.* (21)	1983	100	1–5 years	Various as daycase	II	No	No	Intravenous through scalp vein	Score 1–5 at induction ? by anaesthetist or observer	Lower scores in pp group *vs* control $P < 0.001$	Unrandomized, some parents approached refused to be present at induction, unvalidated anxiety measure, unusual induction method, possible confounding factors
Bevan *et al.* (16)	1990	134	2–10 years	Various as daycase	I	Not stated	Yes (by day of week)	Not stated	GMS at induction by observer	No significant difference between groups	Unvalidated anxiety measure, mode of induction not stated, no power analysis, possible confounding factors
Cameron *et al.* (44)	1996	74	1–8 years	Various as daycase	II	Variable	No	Inhalation or intravenous	Score 1–5 at induction or at separation by parents	Lower scores in pp group *vs* control $P < 0.001$	Parental presence decided by anaesthetist, unaccompanied children tended to have more major surgery and be premedicated, anxiety measured at different time points by parents using unvalidated measure
Kain *et al.* (22)	1996	84	1–6 years	Various as daycase	I	No	Yes	Inhalation	YPAS, CARS at induction by observer serum cortisol after induction	No significant difference between groups for all anxiety measures used	Good exclusion of confounding factors, serum cortisol not validated as anxiety measure in this setting, power analysis performed based on YPAS
Palermo *et al.* (45)	2000	73	1–12 months	Various as daycase	II	No	Yes	Not stated	Score 1–4 at induction by anaesthetist	No significant difference between groups	No anxiety measure validated for infants available, power analysis performed

CE, Class of evidence: I = large prospective randomized trials, II = prospective, nonrandomized trials or retrospective studies, III = case series reports, expert opinions. GMS, Global Mood Scale; YPAS, Yale Preoperative Anxiety Scale; CARS, Clinical Anxiety Rating Scale.

experience separation anxiety from a parent; however, no measure of anxiety in infants has been validated as yet.

Child cooperation

Cooperation of children at induction was only recorded in one of these studies, where Kain *et al.* found that compliance during inhalation induction of anaesthesia (measured by an observer visual analogue score) was not improved by parental presence (22).

Postoperative behaviour

Parental presence at anaesthesia induction did not reduce the incidence of children's behavioural problems postoperatively at 1 week (9,16), 2 weeks (21,31) or 6 months (22), measured by PHBQ.

Parental anxiety

Three studies have shown no significant difference in parental anxiety postinduction, whether they were in parental presence or control groups (16,22,45) (measured by self-report VAS or STAI). Bevan *et al.* stated that parents who were calm before induction (measured by self-report VAS) tended to feel less anxious after being present at their children's induction, while anxious parents found that separation from their child relieved their anxiety (16). One controlled study did show a significant decrease in parental anxiety in the parental presence group but this was not randomized (44).

Parental satisfaction

Parent's satisfaction with the anaesthetist, nursing and overall preoperative care did not differ between parental presence and control groups in work by Kain *et al.* (22). A similar finding occurred with parents of infants accompanying their child for induction (45).

Concerns about parental presence

Concerns exist about possible adverse effects of parental presence, such as whether the presence of some parents could actually increase the anxiety of their child, and over safety issues.

There is a link between parental anxiety and child anxiety. Bevan *et al.* showed that children of anxious parents were more anxious themselves (measured by GMS) whereas children of calm parents were not adversely affected by their presence (16). Anxious parents were defined as those with high anxiety scores measured by self-report VAS prior to their child's anaesthetic. Kain *et al.* found that a child's anxiety in the holding area and at separation to the operating room was greater if parental anxiety was high (measured by STAI) (4). A child with an anxious parent was actually 3.2 times more likely to have persistent behavioural problems at 6 months after operation than a child with a calm parent (4).

The prevalence of parental preoperative anxiety appears to be high (46,47). Factors identified as causing parental anxiety are separation after induction, seeing their limp child, their child's distress and worries about anaesthesia, surgery and pain (46,48). Mothers are more anxious than fathers (46,48,49). Other predictors of an anxious parent are the child being aged less than 1 year, having their first operation, being a single child or if the parent is working in health care (48,49). However, parents usually wish to accompany their child for anaesthetic induction and feel they are of benefit to the child, regardless of their anxiety level (47).

Concerns over safety of anaesthesia induction with a parent present seem to be unfounded. Generally, it is safe and without major problems (22,50,51), except for one anecdotal report in the literature (52). In this case, a grandmother removed her grandchild during inhalation induction of anaesthesia to the reception area, the child was partially anaesthetized but recovered without problems. Anxiety of the anaesthetist is not increased by parental presence (measured by STAI) (22).

Logistical factors may hinder parental presence in some hospitals, such as the provision of induction rooms, availability of nursing staff to accompany the parent after induction and the availability of interpreters for non-English speaking parents.

Summary of parental presence

Current work suggests that although parental presence is not effective in relieving anxiety for all children, it may be beneficial for some (22).

The reasons for the lack of effect of parental presence may include the high anxiety levels of some parents and also that the role for parents at their child's induction is not delineated. We suggest that further work should address how to identify anxious parents and provide a preparation program for them to lessen their anxiety. Also, the role of parents at induction should be examined, including the interaction between parent and child. Parents could be taught to be proactive during the induction process (e.g. by use of distraction therapy).

Parental presence has been assessed mainly at inhalation induction of anaesthesia. Our feeling is that it may be more effective at intravenous induction, due to the advent of EMLA cream and by using distraction, but well conducted randomized trials are needed.

Large differences in practice between North America and the UK do exist, such as place and method of induction. These should be considered when analysing these studies in relation to practice in the UK. In the UK, parental presence is almost a universal practice and new studies involving a control group would be difficult to conduct.

Preoperative preparation

Preparation may consist of one or all of the following: normal nonmedical play, medical play (e.g. with dolls to act out a medical procedure), information given by means of a tour around the operating theatre or a videotape depicting a child going to theatre (described as peer modelling) and finally teaching of relaxation techniques or coping measures (e.g. counting the number of a cartoon character, deep breathing).

Preparation of children for surgery through play is increasing in the USA, as shown by postal surveys of children's hospitals in America (53,54).

Child preoperative anxiety

Studies in the 1970s in the paediatric and psychology literature showed some benefit of preoperative preparation but these studies did not measure anxiety at induction of anaesthesia (11,12).

More recent studies are summarized in Table 4. This is a complex issue and whether preoperative preparation is effective depends on several factors.

Kain *et al.* have published two studies on preparation. The first was a cross-sectional study (55). The intervention was a preoperative preparation program consisting of information, a tour of the operating room and role play by child-life specialists conducted 1–10 days prior to surgery. The study was not randomized but demographic and clinical data (e.g. premedication and previous hospital experience) were similar between groups. Anxiety of the child in the holding area and at separation from parents was similar between intervention and control groups (measured by observer VAS and CARS). Anxiety at induction was not recorded.

Further analysis identified factors influencing the effectiveness of preparation. Children older than 6 years who had the intervention more than 5 days prior to surgery were less anxious on separation from parents. This age group was most anxious if they received the preparation 1 day prior to surgery, suggesting older children benefit from a longer interval between preparation and the day of surgery.

Some subgroups of children were actually more anxious after preparation: children with previous hospital experience, emotionally labile children (high EASI emotionality score) and young children aged 2–3 years (55).

In a subsequent study by Kain *et al.*, children were randomized to three groups: a tour of the operating room, a tour and a videotape that showed a child having surgery from admission to discharge or a tour, videotape and medical role play using dolls for 30 min (56). No control group was used. Children aged 2–4 years received the preparation 1–2 days before surgery and children aged 5–12 years received the preparation 5–10 days before surgery based on the findings in a previous study by Kain *et al.* (55).

A significant reduction in child anxiety (measured by observer VAS) in the holding area was found for the third group, having the most extensive preparation, compared with the other two groups. However, there was no difference in child anxiety (measured by YPAS and indirectly by serum cortisol level) between the groups after separation from parent or at induction.

Margolis *et al.* evaluated preparation using an interactive teaching book about anaesthesia induction (57). The group receiving the book had it read aloud to them by their parent 1–3 days prior to surgery. No significant difference was seen in the child's anxiety in the holding area or at induction (measured by GMS) between the two groups. No power analysis was performed.

Table 4
Trials of preoperative preparation: effect on children's anxiety

Reference	*Year*	n	*Age*	*Surgery*	*CE*	*Blinded*	*Premed*	*PP*	*Randomized*	*Mode of induction*	*Groups*	*Anxiety measure*	*Results and significance level*	*Comments*
Kain *et al.* (55)	1996	143	2–10 years	Various as daycase	II	Yes	Variable	No	No	Not stated	(i) Information, orientation tour of operating room and medical role play (ii) Control	CARS and VAS in holding area and at separation to the operating room, by observer (no measure at induction)	No significant difference between groups	Not randomized and groups unequal in size, some parents not offered preparation, preparation from 1–10 days before surgery, possible confounding factors, no power analysis performed
Kain *et al.* (56)	1998	75	2–12 years	Various as daycase	I	Yes	No	No	Yes	Inhalation	(i) Orientation tour of operating room (ii) Orientation tour + videotape (iii) Orientation tour + videotape + medical role play No control group	VAS in holding area by observer → YPAS at induction by observer serum cortisol after induction →	Group 3 less anxious than group 1, $P = 0.02$ No significant difference between groups	Preparation at different times before surgery according to child's age, good exclusion of confounding factors, no control group, power analysis performed based on YPAS
Margolis *et al.* (57)	1998	143	2–6 years	Various as daycase	I	Yes	Variable	Yes	Yes	Inhalation	(i) Teaching book about anaesthesia induction read aloud to child by parent (ii) Control	GMS at induction by observer	No significant difference between groups	Preparation from 1–3 days before surgery, unvalidated anxiety measure, possible confounding factors, premedication variable, no power analysis performed

CE, Class of evidence: I = large prospective randomized trials, II = prospective, nonrandomized trials or retrospective studies; PP, parental presence; CARS, Clinical Anxiety Rating Scale; VAS, Visual Analogue Score; YPAS, Yale Preoperative Anxiety Scale.

Child cooperation

Only one study, from the 1970s, assessed cooperation of children at induction after three different types of preparation (10). No difference between groups was seen at induction using an unvalidated measure.

Postoperative behaviour

Early studies found preparation decreased behaviour problems postoperatively (10,11) but more recent work by Kain *et al.* found no effect on behaviour at 2 weeks postoperatively (55,56). The study, involving the use of an interactive teaching book, found significantly less aggressive behaviour in the intervention group compared with the control group at 2 weeks postoperatively, but found no difference in other behaviour categories (57).

Parental anxiety

Preoperative preparation programs for children can reduce parental anxiety (10,57). One study, using an observer measure, showed parental anxiety appeared to be increased but self-report of anxiety was unchanged (55).

Preparation designed for parents can also be effective. This was assessed in a two phase study (58). The first phase was a cross-sectional study of 334 parents. The majority (> 95%) wished to have comprehensive information regarding their child's anaesthetic, including information about all possible complications. Phase two was a randomized controlled trial of 47 parents of children having daycase surgery, who either received routine or detailed anaesthetic risk information. The anxiety (assessed by STAI) of the detailed risk group was not significantly different compared with the control at four time points: prior to intervention, immediately after the intervention, day of surgery in the holding area and after separation from their child. This was not affected by parent educational level or baseline parental anxiety. Another study demonstrated that an informational videotape on paediatric anaesthesia decreased parental anxiety and increased anaesthesia knowledge (59). These studies were all of parents of children having daycase surgery but parents of more seriously ill children having major or emergency surgery may behave differently.

Parental satisfaction

Parental satisfaction has been increased by different types of child preparation (10,57). Margolis *et al.* (57) found parents in the intervention group were significantly more satisfied with the preoperative information they received.

Concerns about preoperative preparation

Not all preparation is suitable for all children and sometimes may be counterproductive. As previously stated, the timing of preparation appears to be important. Older children who received preparation the day before surgery were more anxious than controls and so preparation should be planned approximately 1 week before surgery for these children (55).

Previous hospital experience may sensitize children and preparation may increase their anxiety as shown by Kain *et al.* (55). This was also shown by earlier work which found anxiety to be increased in children with past hospital experience after viewing a preoperative videotape (60,61).

Kain *et al.* also demonstrated that the temperament of a child is important and highly emotionally children who received preparation were more anxious (55).

Preoperative preparation for young children may not be beneficial and may increase anxiety levels (55). This may be because young children may have difficulty in distinguishing fantasy from reality and a reality based preparation program may sensitize them to surgery.

Depending on the type of preparation, it can be time consuming and costly. More intensive preparation programs appear to have greater benefit (10,56).

Summary of preoperative preparation

Studies on preoperative programs for children do not show them to be universally helpful in reducing anxiety or postoperative behaviour problems. Programs should be tailored to the individual child, taking into account their age, previous hospital experiences and temperament. Also, the timing of the program is important. Anecdotal reports exist of individual children who have 'anaesthetic phobia', where play therapy has helped to overcome their problems (62).

Providing information for parents, either as part of their child's preparation or preparation specifically designed for the parent, is beneficial in reducing parental anxiety.

Sedative premedication

For this review, the merits of different drugs for sedative premedication are ignored; instead, the focus is on trials of midazolam, a short acting benzodiazepine used commonly for sedative premedication of children.

Child preoperative anxiety

The randomized controlled trials of midazolam for anxiolysis in children at induction of anaesthesia are summarized in Table 5. These studies all demonstrate a decrease in preoperative anxiety in children premedicated with oral midazolam.

Child cooperation

One of these studies also measured cooperation at inhalation induction by recording the number of 5% halothane inductions (68). Rapid inductions with 5% halothane were performed in distressed uncooperative children instead of the normal practice of slowly increasing the halothane concentration in calm children. Twenty percent of children in the control group required 5% halothane induction compared with 2% in the midazolam group, suggesting that premedication resulted in smoother anaesthetic induction.

Postoperative behaviour

Kain *et al.* showed that, at postoperative days 1–7, negative behavioural changes were fewer in the midazolam group (measured by PHBQ) and decreased over time so that at 2 weeks there was no difference between the two groups (70). Postoperative behaviour problems most reduced by the intervention were separation anxiety and eating disturbances. A further study also found midazolam premedication significantly reduced postoperative behaviour problems at 2 weeks (66). Unexpectedly, one study found significantly increased negative behaviour in the midazolam group compared with the control group at 1 week (69).

Parental anxiety and satisfaction

Of these randomized controlled trials of midazolam, only one measured either of these outcomes. Parental satisfaction with the overall daycase experience was no different between intervention and control groups (64).

Concerns about sedative premedication

The two main concerns with premedication with midazolam are safety and recovery times. In seven studies using doses of midazolam from 0.2–0.75 $mg{\cdot}kg^{-1}$, no reports of complications were recorded (63,64,66–70). In only one of these studies was monitoring with pulse oximetry after premedication felt necessary (68). One study reported two children having dysphoric reactions at doses of 0.75 and 1.0 $mg{\cdot}kg^{-1}$ (65).

Recovery times were not significantly increased by midazolam in four studies (63,65,67,69). Doses of 0.5–0.75 $mg{\cdot}kg^{-1}$ did not increase recovery time after long procedures lasting 106–113 min (63). Another study showed recovery and hospital discharge were not delayed after short procedures lasting approximately 10 min with doses of 0.2–0.3 $mg{\cdot}kg^{-1}$ midazolam (67). However, two other studies found recovery times were delayed by midazolam at a dose of 0.5 $mg{\cdot}kg^{-1}$ (64,66).

Summary of sedative premedication

In summary, premedication with oral midazolam appears safe and effective in reducing preoperative anxiety and postoperative negative behaviours in children without unduly delaying recovery and discharge.

Negative postoperative behaviour may be reduced due to reduced preoperative anxiety or due to midazolam related amnesia. It has been shown that recall of going to sleep is less in midazolam treated children compared with control (63). Anterograde amnesia occurs as early as 10 min after administration of oral midazolam (71).

But is amnesia for the induction period always beneficial? Children may wake up from surgery and not realize their operation has been peformed. One study found more behaviour problems in children who had received midazolam and it is suggested this could be due the effect of amnesia causing increased anxiety postoperatively.

Table 5
Randomized controlled trials of midazolam: effect on children's preoperative anxiety

Reference	*Year*	n	*Age*	*Surgery*	*CE*	*Blinded*	*PP*	*Mode of induction*	*Dose of midazolam and route*	*Anxiety measure*	*Result and significance level*	*Comments*
Feld *et al.* (63)	1990	124	1–10 years	Various daycase	I	Yes	No	Inhalation	0.25, 0.5, 0.75 $mg \cdot kg^{-1}$ oral	Score 1–4 at induction by observer	More calm children in midazolam 0.5 and 0.75 $mg \cdot kg^{-1}$ vs. placebo, $P < 0.05$	Possible confounding factors, unvalidated scoring system
Parnis *et al.* (64)	1992	200	1–10 years	Various as daycase	I	Yes	Variable	Majority inhalation	0.25, 0.5 $mg \cdot kg^{-1}$ oral	Score 1–4 at induction by anaesthetist	Midazolam 0.5 mg group less anxious vs. placebo, $P < 0.05$	Two modes of induction, parental presence not standard, possible confounding factors, unvalidated scoring system by anaesthetist
McMillan *et al.* (65)	1992	80	1–6 years	Various as daycase	I	Yes	No	Inhalation	0.5, 0.75, 1.0 $mg \cdot kg^{-1}$ oral	Score 1–4 at induction by observer	Better mask acceptance by all midazolam groups .vs. placebo, $P < 0.05$	Possible confounding factors, unvalidated scoring system
McCluskey *et al.* (66)	1994	54	1–10 years	Various as daycase	I	Yes	Yes	Intravenous with EMLA	0.5 $mg \cdot kg^{-1}$ oral	Score 1–4 at induction by observer	33% satisfactory in placebo, 88% satisfactory in midazolam, $P < 0.001$	Possible confounding factors, unvalidated scoring system
Davis *et al.* (67)	1995	88	10–36 months	Insertion of grommet	I	Yes	No	Inhalation	0.2, 0.3 $mg \cdot kg^{-1}$ intranasal	Score 1–4 at induction by observer	More satisfactory induction scores in combined midazolam groups vs. placebo, $P < 0.05$	Possible confounding factors, unvalidated scoring system
Gillerman *et al.* (68)	1996	72	3–10 years	Various as daycase	I	Yes	Yes	Inhalation	0.5 $mg \cdot kg^{-1}$ oral	OSBD-R at induction →	No significant difference	Good exclusion of confounding factors
										Parent VAS of child anxiety →	Significant decreased anxiety in midazolam vs placebo, $P < 0.05$	
McGraw *et al.* (69)	1998	70	1–10 years	Various as daycase	I	Variable	Variable	Inhalation	0.5 $mg \cdot kg^{-1}$ oral by observer	Score 1–4 at induction by observer	38% crying in placebo 11% crying in midazolam, $P < 0.02$	Two centres with different policies on parental presence and blinding, possible confounding factors, unvalidated scoring system
Kain *et al.* (70)	1999	86	2–7 years	Various as daycase	I	Yes	No	Inhalation	0.5 $mg \cdot kg^{-1}$ oral	mYPAS in holding area, at separation, entrance to theatre and induction by observer	Decreased mYPAS at separation, entrance to theatre and induction, $P < 0.05$ in midazolam vs. placebo	Good exclusion of confounding factors, validated measure

CE, Class of evidence; PP, parental presence; OSBD-R, Observational Scale of Behavioural Distress, measures eight behaviours; mYPAS, Modified Yale Preoperative Anxiety Scale.

Sedative premedication and parental presence

Work by Kain *et al.* has sought to determine whether premedication is more effective than parental presence in reducing preoperative anxiety and whether these two interventions have an additive effect.

Eighty-eight children, aged 2–8 years, were randomized to either receive oral midazolam 0.5 $mg{\cdot}kg^{-1}$ or have a parent present at induction, or neither of these (control group) (19). Children in the midazolam group were significantly less anxious at the entrance to the operating room and introduction of the anaesthesia mask (measured by mYPAS) compared with parental presence and the control group. Compliance at induction (measured by ICC) was significantly poorer in the control group compared with the midazolam and parental presence groups. Recovery times were similar between groups. There were no significant differences in the incidence of reported negative behavioural changes at 2 weeks (measured by PHBQ).

Parental anxiety (measured by STAI) was significantly less after separation from their child in the midazolam group compared with the other two groups.

A second study of 103 children, aged 2–8 years, compared premedication with oral midazolam 0.5 $mg{\cdot}kg^{-1}$ alone with premedication and parental presence at inhalation induction of anaesthesia (72). There was no difference in child preoperative anxiety (measured by mYPAS) between the two groups. However, parental anxiety after separation was reduced in the midazolam/parental presence group separated after induction compared with the midazolam alone group separated before induction. Parental satisfaction, which is becoming an increasingly more important outcome measure, was improved in the midazolam/parental presence group. These parents were more satisfied with the overall care and the experience of separation from their child. Child postoperative behaviour was not measured.

Premedication is a more effective intervention than parental presence in reducing preoperative anxiety of children having inhalation induction of anaesthesia (19). Parental presence does not further reduce child anxiety if sedative premedication is given but, in this study, anxiety scores for the midazolam group were low and an additional effect of parental presence may have been difficult to detect (72).

Conclusions

Relieving the anxiety of the child during the preoperative period is important. Postoperative behaviour problems may be reduced and subsequent anaesthetics would not be viewed with terror.

Parental presence at induction and good preoperative preparation of child and parent may be important for selected children and should be encouraged in the era of the patient–doctor partnership. Although the literature suggests limited benefit for all children, some do benefit, parental satisfaction can be improved and, importantly, the family is not excluded in a major life event.

Examining whether parents may be more effective in reducing their child's anxiety, and if they themselves are less anxious and have a role to play during induction, may allow us to reassess the present data. This could be by parents providing distraction for their child, which may be particularly suitable for intravenous induction. Distraction can reduce a child's anxiety for other medical procedures, such as venepuncture and immunizations (73,74). Identification of the anxious child is important and parents' opinion should be sought because they are good predictors of their child's anxiety (36).

In an age of cost containment, can we justify expensive preparation programs? In health systems driven by patient funding, they may be a good marketing tool and, in state funded systems, they would satisfy the patient's recent concerns for a more customer sensitive health care system.

Sedative premedication with benzodiazepines is clearly effective in reducing anxiety and the amnesic effects may also help to reduce future distress with anaesthesia. Some would argue that all children should be premedicated. We believe that further studies are needed in reassessing the efficacy of parental presence and play preparation. It is possible that giving parents a more active role in preparation and induction of anaesthesia may show that parental presence and play preparation are indeed effective in reducing children's anxiety at induction.

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Blood Transfusion Tidbits for the Anesthesiology Department (August 2011)

Blood Product	**How fast it will arrive in OR after ordering and cross-matched.**	**Storage location in the OR**	**Length of time the product can be out of the Blood Bank and placed back into inventory.**
pRBC	5-10 minutes transport*	Fridge	As long as temp dot is not completely red and is within expiration date/time.
Washed pRBC	5-10 minutes transport* but it takes 1 hour to wash a pack	Fridge	If washed pRBC has been in the refrigerator in the Blood Bank for at least 60 minutes a temp dot will be present on the product. As long as temp dot is not completely red and is within expiration date/time. If the pRBC has just been washed it will not have a temp dot. In this instance if it is returned to the Blood Bank after 20 minutes from the time of issue, it will be considered a wasted product and will undergo disposal. Expires 24 hours from washing time.
Irradiated pRBC	5-10 minutes transport* but it takes 10 minutes to irradiate	Fridge	As long as temp dot is not completely red and is within expiration date/time.
Platelets	5-10 minutes*	Room temperature	Must be returned to Blood Bank within four hours of issue to avoid wastage.
Irradiated platelets	5-10 minutes transport* but it takes 10 minutes to irradiate	Room temperature	Must be returned to Blood Bank within four hours of issue to avoid wastage.

Blood Product	How fast it will arrive in OR after ordering and cross-matched.	Storage location in the OR	Length of time the product can be out of the Blood Bank and placed back into inventory.
Thawed plasma (formerly FFP)	5-10 minutes transport* If plasma requires thawing, please add an additional 10 minutes to the processing time	Fridge	If thawed plasma has been in refrigerator in Blood Bank for at least 60 minutes a temp dot will be present on the product. As long as the temp dot is not completely red and within expiration date/time. If the plasma has just been thawed or has not been in the refrigerator for at least 60 minutes it will not have a temp dot. In this instance, if it is returned to the Blood Bank after 20 minutes from the time of issue, it will be considered a wasted product and will undergo disposal. With new protocol in place the Blood Bank would like to avoid plasma wastage by asking that thawed plasma be **ordered as needed.**

Blood Product	How fast it will arrive in OR after ordering and cross-matched.	Storage location in the OR	Length of time the product can be out of the Blood Bank and placed back into inventory.
Irradiated Thawed Plasma	5-10 minutes transport* but takes 10 minutes to irradiate		If thawed plasma has been in refrigerator in Blood Bank for at least 60 minutes a temp dot will be present on the product. As long as the temp dot is not completely red and within expiration date/time. If the plasma has just been thawed or has not been in the refrigerator for at least 60 minutes it will not have a temp dot. In this instance, if it is returned to the Blood Bank after 20 minutes from the time of issue, it will be considered a wasted product and will undergo disposal. With new protocol in place the Blood Bank would like to avoid plasma wastage by asking that thawed plasma be **ordered as needed.**
Cryo	5-10 minutes transport* but takes 10 minutes to thaw	Room temperature	If returned to the Blood Bank after 20 minutes from the time of issue, it will be considered a wasted product and will undergo disposal.
Irradiated Cryo	5-10 minutes transport* but takes 10 minutes to irradiate	Room temperature	If returned to the Blood Bank after 20 minutes from the time of issue, it will be considered a wasted product and will undergo disposal.

*This time is when blood bank is in full force. So please ask Blood Bank when calling for blood from OR.

Cross-matching

It takes 45 minutes to perform a STAT type and screen. If the antibody screen is negative, the cross-match takes an additional 15 minutes. In the event of an unexpected antibody the subsequent workup takes at least 3 additional hours to complete.

All unused blood products should be returned to Blood Bank ASAP. Please inform the front desk or OR nurse in charge to return the blood when you do not need it anymore. Please do not transport unused (un-spiked) blood products out of the OR to PACU, Intensive Care Units or the floors unless you are certain that the blood products will be used by you or the next care team. Unused blood products may be transferred from the CVOR to the CICU and placed in the CICU refrigerator per the validated protocol.

Split Blood

- Elective/planned pre-operative splitting of units is preferred. It takes at least 1.5 hours for the whole process including cooling down.
- In the event of the need for intraoperative splitting of units, please allow at least 1 and a half hours for blood bank to split blood bags and have time to cool them down to required temperature (30 minutes for splitting procedure, 60 minutes for cool down).
- If you do not need both bags of split units up at the same time, please request for 1 split unit and have blood bank hold the 2nd split bag in their facilities.

Temperature Dots

- Temp dots are placed on each bag of red blood product that is issued from Blood Bank. It will also be placed on FFP if the FFP has been thawed and allowed to cool down for at least 60 minutes in Blood Bank.
- It turns from white to pinkish to completely red when the temperature rises
- It should be stuck onto bag well and be in contact with the area that has blood content (i.e. it should *not be* placed at the top of the bag towards the "exit" sites)
- When placing unused bags of blood products in fridge, please lay them such that the temp dot is in the area with the most blood volume usually means lying flat on the shelf of fridge with temperature dot facing up.
- Please do not touch or handle the temperature dots as they are very sensitive to temperature changes. Hold bag by the sides.
- Once the temp dot starts turning from white to pink, it may be very hard to stop that process as the blood bag needs to be very quickly cooled down for the color to stop progressing.
- Blood bank will accept returned blood bags with pink temp dots on (i.e. they cannot be completely red)

Cath lab

There are plans for the presence of a blood fridge in each Cath lab.

CVOR

Each CVOR has its own blood fridge at the present time.

Massive Transfusion Protocol

In times of need, we can activate this protocol by calling the Blood Bank and ask for its activation.

Please remember to notify the Blood Bank when the patient is stabilized and there is no longer a need for additional products.

POLICY

1. MTP may be ordered/activated by any Licensed Independent Practitioner (LIP).
2. Upon notification to Blood Bank, Blood Bank will immediately prepare and send up initial units of un-crossmatched PRBCs, according to table below.
2. Transfusion verification will be conducted by 2 RNs or other qualified transfusionist per TCH Blood/Blood Product Transfusion Procedures.
3. MTP is transfused in batches of 1:1:1 (PRBC:FFP:PLT) to more closely mimic whole blood. Approximate quantities of each unit are:
    - Packed Red Blood Cells (PRBC): units PRBCs 200(+)ml each
    - Fresh Frozen Plasma (FFP): units FFP 200(+)ml each
    - Platelets (PLT): prepared as one bag containing xRDE (random donor equivalents)

   Please reference the weight based table below for appropriate quantities of products to be prepared and sent by the blood bank.

Patient Weight	Initial # Uncross-matched Units to be sent	Products Prepared
Less than 20 kgs	1 Unit PRBCs	1 unit PRBC 1 unit FFP 1 RDE PLT
20 -50kgs	2 Units PRBCs	2 units PRBC 2 units FFP 2 RDE PLT
Adult (Greater than 50 kgs)	5 Units PRBCs	5 units PRBC 5 units FFP 5 RDE PLT