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Predictors of Preoperative Anxiety in Children

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SUMMARY

This study aimed to identify factors contributing to anxiety at induction of anaesthesia in children. One hundred and twenty children aged five to twelve years and scheduled for surgery requiring general anaesthesia were included. Children were interviewed and assessed prior to surgery. Parents completed anxiety measures prior to surgery and were interviewed after the induction of anaesthesia. The level of children's anxiety was determined at the time of induction of anaesthesia by the modified Yale Preoperative Anxiety Scale. Factors associated with increased levels of anxiety in the children included increased number of people in the room at induction of anaesthesia; longer waiting time between admission at the hospital and induction of anaesthesia; negative memories of previous hospital experiences; and having a mother who does not practise a religion. Suggestions for implementation of the findings and for future research are provided.

Key Words: ANXIETY: preoperative, anaesthesia induction, children

Induction of anaesthesia can be a frightening event for children[1,2]. It is estimated that 40 to 60% of children suffer anxiety in the presurgical period[3]. A high level of anxiety at induction can be associated with negative postoperative consequences including nightmares, food rejection, enuresis, anxiety and negativity[4,5].

Several strategies have been proposed to reduce anxiety at this time, such as operating room tours[6], in vivo techniques[7] and the use of educational videos[8]. Following the findings of Kain et al[9], who examined predictors of anxiety in children in the preoperative holding area and at separation to the operating room, this project examined predictors of anxiety at induction of anaesthesia.

Strategies for managing preoperative anxiety can be broadly classified into two groups: pharmacological and psychological. Pharmacological techniques include premedications, such as midazolam, which may reduce anxiety levels, but side-effects such as loss of balance, blurred vision and dysphoria[10], and possibly negative postoperative behaviours[4] make their routine use unattractive. Psychological preparation may be as effective as premedication[11,12]. A number of reports have compared hospital based psychological preparation techniques for children, using anxiety levels at induction of anaesthesia as the outcome[6,8,13].

If children who are at high risk of excessive anxiety could be identified preoperatively, then use of pharmacological or other interventions might be more effectively targeted. The present study explored associations between anxiety at induction of anaesthesia and demographic, psychological and institutional factors. It was hypothesised that anxiety could be predicted from a few easily measured factors, allowing more effective management.

METHODS

This study was approved by ethics committees of all participating hospitals and that of the University of South Australia. Children aged five to twelve years scheduled for surgery requiring general anaesthesia, whose anaesthetist and surgeon were agreeable, and whose parent provided written informed consent, were eligible. Children who received any premedication were excluded. The study was explained in

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simple terms to the child, and only those who gave verbal agreement were included. All eligible children having surgery at any of the participating hospitals were included, except where two or more lists ran concurrently, in which case the list with the greatest number of eligible children was chosen. All hospitals were general hospitals that admitted both adults and children.

The outcome variable was the child's score on the modified Yale Preoperative Anxiety Scale (mYPAS)[14] at the time of induction. The mYPAS is an observational behavioural checklist, which takes less than one minute to administer.

Preoperatively, children were interviewed on the ward. This included administration of the State-Trait Anxiety Inventory for Children (STAIC)[15] and a hospital knowledge quiz designed by the authors. The hospital knowledge quiz consisted of ten questions relating to the child's knowledge of the procedure they were about to have (Table 1). The child's response to each item was categorised as "accurate", "inaccurate" or "don't know". For example, in response to the question "Do you know why you've come to hospital today?", an answer of "To have an operation" was scored as accurate, "To see a doctor" as inaccurate, and "No" was scored as "don't know". The number of responses in each category was summed to produce three scores reflecting "accuracy of knowledge", "misinformation" (inaccuracy of knowledge) and "lack of knowledge".

TABLE 1
Hospital knowledge quiz

1	Do you know why you've come to hospital today?
2	Do you know what's going to happen today?
3	Are you going to have an operation?
4	What is the operation for?
5	What is an operation?
6	Do you know where Mummy and Daddy will be when this is happening?
7	Do you think it hurts people when they have an operation?
8	Do you know why it won't hurt?
9	Will you be awake or asleep for your operation?
10	How will you go to sleep?

A structured interview was used to elicit information about the child's feelings. Parents completed the State Trait Anxiety Inventory (STAI)[16] and were asked to predict how anxious they felt their child would be at induction of anaesthesia on a four-point scale (not at all anxious, a little anxious, quite anxious or very anxious). Information was collected about the anaesthetic induction, including the number of people in the room (including the researcher and parent), methods used by the anaesthetist to build rapport, whether intravenous or inhalational induction was used, and whether a parent was present. Parents were then interviewed about their child's anxiety.

Data were collected on over fifty possible predictors of anxiety. In order to examine this number of variables in a structured manner, variables were classified into five domains—demographic factors, preparation of the child for hospital, psychological factors, factors associated with the hospital or hospital environment, and factors associated with the induction of anaesthesia (Table 2). Domains were chosen to concur with previous research findings[5] as well as to allow testing of new hypotheses that the induction room environment, demographic factors and childrens' knowledge about their forthcoming operation influenced anxiety.

The analysis was conducted in two stages. In the first stage, domains were examined separately to determine whether any of their variables were predictive of anxiety level at induction. This was carried out by regression analysis using mYPAS score as the outcome and the domain factors as explanatory variables. Variables denoting different hospitals and different anaesthetists were included in the models as random factors[17]. Due to non-normality of the mYPAS scores, significance tests and confidence intervals were based on the Huber/White robust variance estimator[18,19], which allows valid inference in the presence of non-normality and non-uniform variance. Backward elimination was used to identify important predictors. Initially, all domain factors were entered into the regression model. The least significant variable (or set of variables in the case of a polychotomous factor) was removed from the model, the reduced model was fitted, and the process was repeated. All variables remaining in the model with P values less than 0.1 were considered to be possible predictors of anxiety and were recorded for examination in stage 2 of the analysis. All variables remaining in the final model with P values less than 0.05 were considered to be important predictors of anxiety within that domain.

In stage 2, variables identified in stage 1 as possible predictors of anxiety from all domains were included as explanatory variables in a regression model. A backward elimination procedure was again used, all variables remaining with significance levels less than 0.05 were considered to be predictors of preoperative anxiety. Statistical analyses were conducted using the software Stata version 6 (Stata Corp, College Station, TX, U.S.A.). A total of 120 children were included. Based on variability in mYPAS scores at induction of

TABLE 2
Variables making up the five domains

Demographic	Self Reported Feelings and Emotions of the Child and Parent on the Day
Age of child	State-Trait Anxiety Inventory Score for mothers
Gender of child	State-Trait Anxiety Inventory for Children
Mother's working status (full time or not full time)	Children's Hospital Fears Rating Scale Score
Father's working status (full time or not full time)	Answers to questions on the feelings component of the questionnaire
Mother practising a religion (yes or no)	Mother's prediction of how her child would react at induction of anaesthesia (not at all anxious, a little anxious, quite anxious, very anxious)
Father practising a religion (yes or no)	
Mother's highest education level achieved	
Father's highest education level achieved	
Which country the mother was born in	
Which country the father was born in	
Age of mother at birth of child	
Age of father at birth of child	
Whether parents were in a relationship with each other	
Number of siblings	
Number of brothers	
Number of sisters	
Birth order of child	
Socio-economic status of suburb lived in	

Child's preparation for hospital	Hospital Settings and Procedures
How many times the child had been to hospital before	Type of surgery (wedge resection of toenail, hernia, plastic, orthopaedic, dental, tonsillectomy, intubation of the ears, genital and other)
Whether previous hospital admissions were remembered as pleasant or unpleasant (according to the child and to the parents)	How many people accompanied the child to hospital
Whether any of the child's family or friends had been to hospital (according to the child)	Whether both parents were present at the hospital
Whether the child remembers visiting someone in hospital	Whether a grandparent was present at the hospital
If the child attended a preadmission clinic	Whether the child was expected to stay the night
How long the child had known that he/she would be coming to hospital	Whether the child had his/her own room
Scores derived from the hospital knowledge quiz	The length in minutes of the operation

The Induction Room
Whether a mask or needle was used to induce anaesthesia
Techniques used by the anaesthetist to make the induction of anaesthesia less stressful for the child: *Sweet smelling lip-balm on the mask, Child sitting on mother's lap, Explaining the equipment to the child, Chatting to the child about school etc, Making the induction of anaesthesia "game like", Giving the child a helium balloon, Allowing the child to wear his/her own clothes into theatre or bring in a toy, Using any of the above techniques versus using none*
Waiting time between admission at the hospital and induction of anaesthesia
Time of the day of the general anaesthetic
Number of people in the room at induction of anaesthesia
Whether a parent was present in the room at induction of anaesthesia

anaesthesia reported by Kain et al[14], this provided 80% power, at a type 1 error of 0.05, to detect a factor which increased mYPAS scores by 8 units, if the factor was present in 50% of the children, or an increase of 13 units if the factor was present in 10% of the children.

RESULTS

Demographic data are given in Table 3. The distribution of the mYPAS scores is given in Figure 1. Sixty-four children (53%) had scores above 35, indicative of high anxiety. The first stage of the analysis identified predictors of anxiety in four of the five domains: demographic, pre-hospital preparation, feelings and induction room environment. These predictors are shown in Table 4.

In stage 2 of the analysis, four variables (from the demographic, preparation and induction domains) were identified as predictive of mYPAS score. These were mother practising a religion, negative memory of a previous hospital admission, waiting time from admission to induction, and the number of people in the room at induction of anaesthesia (Table 4). The random factors, anaesthetist and hospital, accounted for 12 and 14% of the unexplained variability, respectively.

Table 5 shows estimated effect sizes for a number of factors not identified as important predictors of

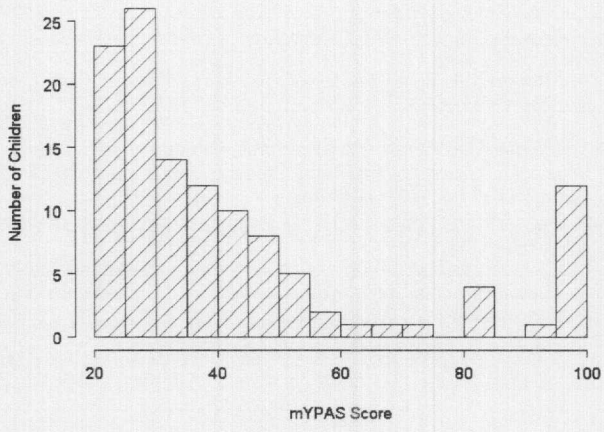

FIGURE 1: Distribution of mYPAS scores at the time of induction for the 120 children in the study.

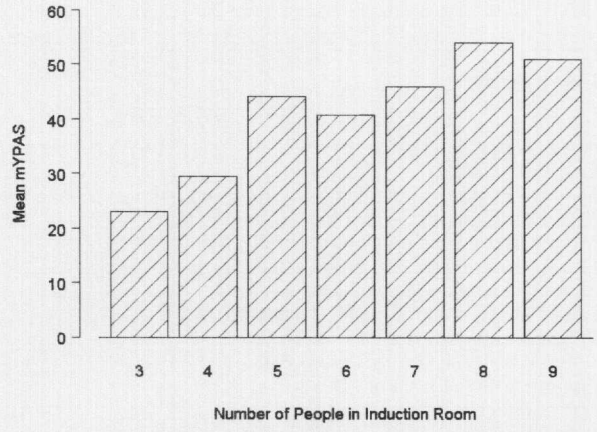

FIGURE 2: Association of mean mYPAS score at the time of induction, and number of people in the room.

TABLE 3
Demographic data

Sex		
	Male	68
	Female	52
Age (y)		
	5-6	38
	7-10	59
	11-12	23
Surgery type		
	ENT	62
	Genital	13
	Dental	6
	Plastic	8
	Orthopaedic	5
	Ophthalmology	7
	Hernia	8
	Wedge resection (toenail)	5
	Other	6

TABLE 4
Factors affecting anxiety at induction

Domain/factor	Effect size*	95% CI
Demographic		
Mother practises a religion	–11	–3 to –19
Pre-hospital preparation		
Friends admitted to hospital	–13	–0.4 to –25
Feelings		
Mother's prediction of anxiety	+7 per category	+1 to +13
Induction room		
Number of people in room	+5 per extra person	+2 to +9
Waiting time	+11 per 90 min	+5 to +16
All domains		
Mother practises a religion	–8	–1 to –16
Negative memory of previous admission	+14	+3 to +24
Number of people in induction room	+5 per extra person	+2 to +9
Waiting time	+9 per 90 min	+4 to +14

*A negative effect indicates a reduction in anxiety.

TABLE 5
Factors not found to be important predictors of anxiety

Domain/factor	Effect size*	95% CI
Gender		
male vs female	+0.6	–7 to +8
Age category		
5-6y (reference category)		
7-10y	–0.6	–10 to +9
11-12y	–5	–16 to +5
Intravenous induction used	–2	–11 to +7
Child has no siblings	–8	–15 to 0.2
Hospital Knowledge Quiz		
Accuracy score	–1 per unit	–3 to 0.3
Inaccuracy score	+2 per unit	–4 to +7
Lack of knowledge score	+1 per unit	–0.4 to +3

*A negative effect indicates a reduction in anxiety.

anxiety. Notably, there was no significant influence of method of induction (intravenous vs inhalational). Children who had no siblings tended to be less anxious, but this was not statistically significant. Likewise, scores on the Hospital Knowledge Quiz were consistent with expectations, greater knowledge being associated with lower anxiety and inaccurate knowledge or lack of knowledge associated with increased anxiety, but none of these trends was statistically significant.

DISCUSSION

This research showed that it is possible to predict anxiety levels in children awaiting an induction of anaesthesia prior to surgery. As children were studied in six different hospitals, it is reasonable to suppose that results can be generalized to other similar hospitals. The variability due to differing hospitals was small compared to variability among children. This

limits the potential problem that drawing cases from multiple hospitals may increase variability in the data, and so make it more difficult to identify factors associated with anxiety. Items associated with increased anxiety at induction can be divided into two categories—those which are essentially beyond the control of the anaesthetist and those where interventions could be made with possible beneficial effects. Having a mother who practises a religion or friends who have been admitted to hospital fall into the first category. A number of previous studies have also identified predictors of anxiety which fall into this category—for example, negative reactions to previous medical procedures[4,9], anxiety of the mother and previous hospitalization[4]. The mother's prediction of how anxious her child will be is also an easily obtained predictor. Knowledge of these factors may help identify children at increased risk but does not offer a solution. Our observations in the induction room allowed us to identify predictive factors from the second category, such as number of people in the induction room and waiting time from admission to induction. In this study, the mean number of people in the room at induction was 6, with a range of 3 to 9. It is not surprising that a large number of people, mostly unknown to the child and often wearing masks, should prove overwhelming for a child. The anaesthetist's efforts to build rapport may be hampered by such distractions. At least for the institutions included in this study, there is scope for improvement in this area.

Parental presence at induction of anaesthesia was not predictive of anxiety levels of the child, but in our sample a parent was not present in only 5% of cases. In Australia it is now common practice for parents to accompany their child throughout the induction of anaesthesia, following much research which has shown the benefits for children's coping at that time[20,21]. We found no difference in anxiety between children in whom anaesthesia was induced by mask and those in whom it was induced by injection. Anaesthetists were free to choose the technique they felt would be most appropriate. Our results might then be interpreted to indicate that they made the right choice. Similarly, we did not find evidence that various techniques used by anaesthetists reduced anxiety, either when techniques were assessed individually (e.g., use of scented lip balm on the mask vs non-use) or globally (use of any technique vs use of none). Anaesthetists may have tended to use these techniques more for children they considered likely to be anxious. The true effects of these interventions could only be assessed in a randomized study.

Some factors associated with preoperative anxiety, such as previous unpleasant hospital experiences, may be useful in predicting risk of anxiety but are not controllable at the time of the current admission. Other factors, such as waiting time and number of people in the induction room, are at least potentially modifiable and might be suitable targets for interventions aimed to prevent heightened anxiety.

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REFERENCES

1. Schwartz BH, Albino JE, Tedesco LA. Effects of psychological preparation on children hospitalized for dental operations. J Pediatr 1983; 102:634-638.
2. Kennedy CM, Riddle II. The influence of the timing of preparation on the anxiety of preschool children experiencing surgery. Maternal-Child Nursing Journal 1989; 18:117-132.
3. Kain ZN, Mayes LC. Anxiety in children during the perioperative period. In: Bornstein MH, Genevro JL, eds. Child Development and Behavioral Pediatrics, Lawrence Erlbaum Associates, New Jersey 1996.
4. Lumley MA, Melamed BG, Abeles LA. Predicting children's presurgical anxiety and subsequent behavior changes. J Pediatr Psychol 1993; 18:481-497.
5. McGraw T, Kendrick A. Oral midazolam premedication and postoperative behaviour in children. Paediatr Anaesth 1998; 8:117-121.
6. Kain ZN, Caramico,LA, Mayes LC, Genevro JL, Bornstein MH, Hofstadter MB. Preoperative preparation programs in children: A comparative examination. Anesth Analg 1998; 87:1249-1255.
7. Demarest DS, Hooke JF, Erickson MT. Preoperative intervention for the reduction of anxiety in pediatric surgery patients. Children's Health Care 1984; 4:179-183.
8. Robinson PJ, Kobayashi K. Development and evaluation of a presurgical preparation program. J Pediatr Psychol, 1991; 16:193-212.
9. Kain ZN, Mayes LC, O'Connor TZ, Cicchetti DV. Preoperative anxiety in children: Predictors and outcomes. Arch Pediatr Adolesc Med 1996: 150:1234-1245.
10. McMillan CO, Spahr-Schopfer IA, Sikich N, Hartley E, Lerman J. Premedication of children with oral midazolam. Can J Anaesth 1992: 36:545-550.
11. Mansson ME, Fredrikzon B, Rosberg B. Comparison of preparation and narcotic-sedative premedication in children undergoing surgery. Pediatr Nursing 1992; 18:337-342.
12. McCann E, Kain Z. The management of preoperative anxiety in children: an update. Anesth Analg 2001; 93:98-105.

13. Peterson L, Shigetomi C. The use of coping techniques to minimize anxiety in hospitalised children. Behavior Therapy 1981; 12:1-14.
14. Kain ZN, Mayes LC, Cicchetti DV, Bagnall AL, Finley JD, Hofstadter MB. The Yale preoperative anxiety scale: How does it compare with a "gold standard"? Anesth Analg 1997; 85:783-788.
15. Spielberger CD, Edwards CD, Lushene RE, Montuori J, Platzek D. STAIC preliminary manual for the State-trait anxiety inventory for children ("how I feel questionnaire"). California USA, Consulting Psychologists Press 1973.
16. Spielberger CD, Gorsuch RL, Lushene RE, Vagg PR, Jacobs GA. Manual for the state-trait anxiety inventory. California USA, Consulting Psychologists Press 1983.
17. Brown H, Prescott R. Applied Mixed Models in Medicine. John Wiley & Sons Ltd, Chichester UK, 1999.
18. Huber PJ. The behavior of maximum likelihood estimates under nonstandard conditions. In: Le Cam LM, Neyman J eds. Proceedings of the fifth Berkeley symposium on mathematical statistics and probability: Vol. 1. Statistics. California USA, University of California Press 1967.
19. White H. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. Econometrica 1980; 48:17-38.
20. Glazebrook CP, Lim E, Sheard CE, Standen PJ. Child temperament and reaction to induction of anaesthesia: Implications for maternal presence in the anaesthetic room. Psychol Health 1994; 10:55-67.
21. Hannallah RS, Rosales JK. Experience with parents' presence during anaesthesia induction in children. Can J Anaesth 1983; 30:286-289.