Original Article

Assessment of potential predictors affecting preoperative anxiety in Indian children- A prospective observational study

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Abstract

Background and Aims: Preoperative anxiety is a common problem among children undergoing surgery. The aim of the study was to assess the incidence and identify various predictors of preoperative anxiety in Indian children.

Material and Methods: A prospective, observational study was conducted on 60 children of the American Society of Anesthesiologists Physical status 1/2, aged 2–6 years and scheduled for elective surgery under general anesthesia in a tertiary care teaching hospital. Preoperative parental anxiety was assessed using the State-Trait Anxiety Inventory questionnaire. The children's anxiety was assessed in the preoperative room, at the time of parental separation, and at the induction of anesthesia using modified Yale Preoperative Anxiety Scale (mYPAS) scoring by an anesthesiologist and a psychologist. Sedative premedication was employed prior to parental separation. Logistic regression analysis was carried out to identify the possible predictors of anxiety.

Results: The incidence of high preoperative anxiety among the studied children was 76% in the preoperative room, 93% during parental separation, and 96% during anesthetic induction. Among the nine possible predictors identified on univariate regression, the presence of siblings was found to be a significant independent predictor on multivariate regression analysis ($P = 0.04$). The inter-rater agreement was excellent for the assessment of preoperative anxiety using mYPAS by the anesthesiologist and psychologist (weighted Kappa, $\kappa = 0.79$).

Conclusion: The incidence of preoperative anxiety in Indian children in the age group of 2–6 years is very high. The preop anxiety escalates progressively at parental separation and induction of anesthesia despite sedative premedication. The presence of siblings is a significant predictor of preoperative anxiety.

Keywords: Pediatric anesthesia, predictors of anxiety, preoperative anxiety

Introduction

Preoperative anxiety is relatively common among children with an estimated incidence of 40–60% in published literature from developed countries.[1] The consequences of high preoperative anxiety in children include delay in induction and recovery from anesthesia, increased likelihood of emergence delirium, and maladaptive behavior such as night-time crying, enuresis, temper tantrums, etc.[2,3] The healthcare providers led by the anesthesiologists employ various pharmacological as well as non-pharmacological techniques to reduce preoperative anxiety in children.[4,5] Since the majority of the literature on childhood preoperative anxiety—incidence, predictors, and interventions—comes from research in the developed world. The validity and

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applicability of these findings in a developing world setting may be quite different.[6,7]

Trait anxiety and state anxiety reflect the state of mind shaped by the affective domain of an individual which in turn is influenced by the sociocultural aspects of life. The manifestation and management of preop anxiety also depend on the coping skills of the individual in stressful situations, which again is influenced by the sociocultural aspects of society. Although India has varied ethnicities, there are many commonalities in the sociocultural milieu across the country which is different from the setting of a Western/developed world.

Establishing the predictors of preoperative anxiety in our setup will help us to identify the children who are at a high risk of anxiety. Such identification will subsequently help us to make a judicious decision to target an appropriate intervention effectively. Therefore, the primary objective of the current study was to assess the incidence of preoperative anxiety in Indian children and identify its various predictors. The secondary objective was to evaluate the pattern of the progress of preop anxiety from baseline (before premedication) through the periods of parental separation and induction of anesthesia.

Material and Methods

After the approval of the Institutional Ethics Committee and written informed consent from the parents, a prospective, observational study was conducted in 60 children aged 2–6 years who were the American Society of Anesthesiologists (ASA) physical status 1 or 2 and scheduled for an elective procedure under general anesthesia from December 2011 to December 2012. The study was registered in the Clinical Trials Registry of India (CTRI/2018/03/012631). The exclusion criteria were delayed developmental milestones, psychiatric illness, neurodevelopment anomalies, visual impairment, known hypersensitivity to benzodiazepines, and children whose parents were unable to answer the State-Trait Anxiety Inventory (STAI) questionnaire in English or Hindi.

Preoperatively, one or both the parents accompanying the child completed the 'state' part of the STAI.[8] Data were collected on various possible predictors of anxiety, viz. age of the child, whether the mother was working, father and mother's education, age of father and mother, number of siblings, history related to previous exposure to surgery, etc. The socioeconomic status of the parents was assessed using Aggarwal's scale[9] and the temperament of the children was assessed using the Temperament Measurement Schedule[10] in the preop room by an anesthesiologist. The following five dimensions of temperament were evaluated: Sociability—the tendency to seek social interactions; Emotionality—the tendency to become easily and intensely upset; Energy—included activity and intensity; Distractibility—extent to which the extraneous stimuli may interfere with an ongoing behavior; and Rhythmicity—regularity regarding eating habits, sleep, and daily habits.

All children were premedicated with 0.5 mg/kg midazolam syrup about 30 min prior to the start of the surgery. The child's anxiety was assessed using the modified Yale Preoperative Anxiety Scale (mYPAS)[11] after video recording the child's behavior at three time points, viz. in the preoperative room prior to premedication, at parental separation, and at induction. All video recordings were done by the same anesthesiologist. The recorded videos were subsequently scored on mYPAS by another independent anesthesiologist. The children were induced with sevoflurane. The number of personnel around the child at induction was also recorded. The preop behavior video clip was assessed independently by the psychologist also to determine the Kappa (κ) statistics. A mYPAS score of >30 was considered highly anxious.[11] An STAI score of >37 was taken as a cut-off for the anxiety of parents.[8]

The inter-rater reliability of the assessment of preop anxiety using mYPAS scoring between the anesthesiologist and psychologist was analyzed using weighted κ statistics for overall chance corrected agreement (κ_w). The clinical significance of the output was assigned as follows: κ< 0.40 = poor, 0.40–0.59 = fair, 0.60–0.74 = good, and 0.75–1.00 = excellent.

The primary outcome was to assess the predictors of preoperative anxiety in Indian children. The secondary outcomes were to estimate the incidences of preop anxiety at the baseline (before premedication) as well as during the periods of parental separation and induction of anesthesia.

Sample size calculation: We intended to evaluate 24 variables as potential predictors of preop anxiety and anticipated a maximum of 10–12 of these variables to be included in the multivariate regression model. Considering the minimal requirement of a ratio of 5:1 for the number of subjects to independent variables, we estimated that a minimum of 60 patients would need to be studied. Since this study was conducted as a preliminary study to plan a multicentric trial, the minimum sample size was considered adequate.

Data were summarized for quantitative variables in terms of mean ± SD, or median (IQR) as appropriate and for qualitative variables using frequencies and proportions. For the normally distributed data, comparison between groups was done by an independent t-test. The Mann–Whitney U-test was used for statistical analysis of skewed continuous

variables. The categorical variables were compared using the Chi-square test or Fisher's exact test. The relation between the demographic and clinical variables and the occurrence of preoperative anxiety was examined by using univariate and multivariate techniques. We carried out regression analysis using the mYPAS score assessed by the anesthesiologist in the preoperative room as the dependent outcome and various possible predictive factors as explanatory variables. Backward elimination was performed to examine the independence of variables with P value ≤0.25 in the univariate analysis. The test was performed at a significance level of $\alpha = 0.05$. The Statistical Package for the Social Sciences (SPSS) version 21 was used for statistical analysis.

Results

Sixty children completed the study successfully out of the 62 enrolled children who were drawn from 68 children who were assessed for eligibility [Figure 1]. Surgery was postponed in two children after the enrolment. The studied children underwent a variety of elective surgeries including urogenital, gastrointestinal, orthopedic, and superficial surgeries. The inter-rater reliability of the mYPAS scoring between the anesthesiologist and psychologist was confirmed as the weighted kappa value was 0.79 indicating excellent inter-rater reliability. Hence, the subsequent analysis was carried out using mYPAS assessed by the anesthesiologist.

The incidence of high preoperative anxiety among the children was found to be 76% (46 out of 60 children). The

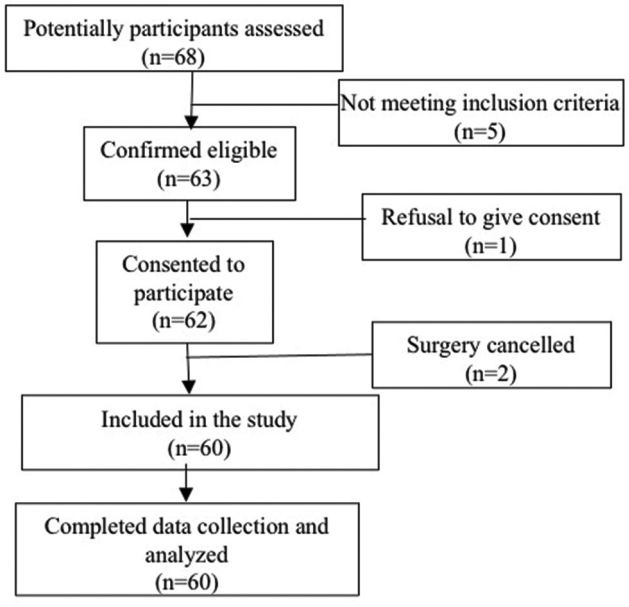

Figure 1: Flow diagram of the participants

various possible predisposing factors were divided into three domains: (i) individual domain pertaining to the patient, (ii) family domain, and (iii) clinical domain related to the healthcare factors. The distribution of these characteristics among all the studied children as well as their distribution in the highly anxious and less anxious subgroups are depicted in Table 1.

The univariate analysis identified variables with P value ≤0.25 to be included in the multivariate regression model analysis. The number of siblings was found to be a significant factor associated with high preop anxiety ($P = 0.03$), with single children being less anxious than those with siblings. In the family domain, the father's education ($P = 0.25$), mother's education ($P = 0.1$), and socioeconomic status ($P = 0.12$) were found to be possible predictors as children of fathers and mothers who were not graduates/postgraduates were found more anxious. Similarly, children from a lower socioeconomic status also were more anxious than children from a better socioeconomic background. Among the temperamental characteristics, sociability ($P = 0.14$), emotionality ($P = 0.07$), and energy ($P = 0.25$) were potential factors as children with lower scores for sociability, emotionality, and energy levels were observed to be highly anxious. A shorter waiting time preoperatively ($P = 0.14$) and higher number of theater personnel around the child at induction ($P = 0.16$) were also associated with higher anxiety. In the second stage of the analysis using backward elimination, only the number of siblings was found to be a significant independent predictor of high anxiety in children ($P = 0.04$).

The incidence of high anxiety increased from the baseline of 76–93% (56 out of 60 children) at parental separation and peaked at 96% (58 out of 60 children) at the induction of anesthesia. Correspondingly, the median mYPAS scores at induction (54.2, IQR: 45–82.5) were higher than the scores at the baseline (45; IQR: 31.7–53.3), and at parental separation (45; IQR: 40.0–55.0) [Figure 2].

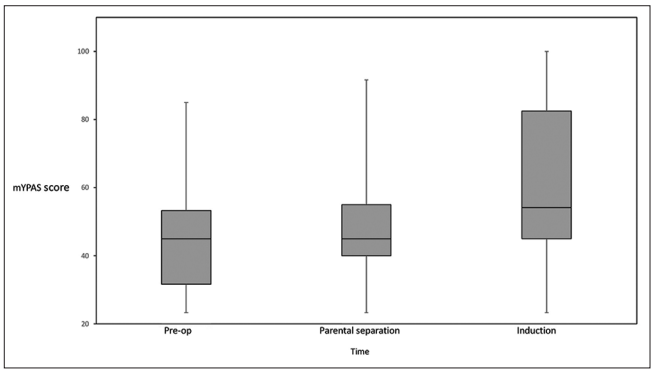

Figure 2: Distribution of mYPAS scores in preop, at parental separation, and at mask induction

Table 1: Distribution of predisposing factors in highly anxious and less anxious children

Potential predisposing factors	All children (*n*=60)	Highly anxious children (*n*=46) (mYPAS ≥30)	Less anxious children (*n*=14) (mYPAS <30)	*P*
Individual domain				
Age in months	47.4±16.3	47.4±16.5	47.6±16.4	0.96
Gender- Male: Female	43:17	32:14	11:3	0.74
Education- Non-school going: School going	25:35	20:26	5:9	0.61
Temperament measurement schedule: (mean)				
Sociability	3.58	3.53	3.75	0.14*
Emotionality	3.54	3.46	3.80	0.07*
Energy	3.34	3.31	3.42	0.25*
Distractibility	3.43	3.42	3.45	0.8
Rhythmicity	3.01	2.97	3.14	0.56
Family domain				
Siblings- Yes: No	25:35	23:23	2:12	0.03*
Father's education- $<8^{th}$:8^{th}-12^{th}: Graduate: Postgraduate	5:29:17:9	4:25:5:12	1:4:5:4	0.25*
Mother's education- $<8^{th}$:8^{th}-12^{th}: Graduate: Postgraduate	10:25:14:11	8:23:9:6	2:2:5:5	0.1*
Father's occupation- Unskilled labor: Skilled labor: White collar job: Business	8:29:18:5	5:23:13:5	3:6:5:0	0.44
Mother's occupation-Homemaker: Occupied	51:9	40:6	11:3	0.42
STAI mother- >37: <37	57:3	44:2	13:1	0.56
STAI father- >37: <37	52:8	39:7	13:1	0.67
Residential area- Rural: Urban	24:36	20:26	4:10	0.37
Family type- Joint: Nuclear	44:16	35:11	9:5	0.49
Socioeconomic status- Upper middle/Lower middle/High/Poor	24/25/10/1	17/22/6/1	7/3/4/0	0.12*
Clinical domain				
Previous surgery- Yes: No	36:24	26:20	9:5	0.61
PAC visit- Yes: No	35:25	27:19	8:6	0.92
Admission type- Inpatient: Outpatient	32:28	25:21	7:7	0.78
Duration of fasting (min)	657±234	662±250	638±177	0.95
Waiting time (min)	126±98	117±99	156±91	0.14*
Number of theater personnel at induction	4.4	4.7	4.1	0.16*

**Indicates P≤0.25. †Values are expressed as mean±SD or number of patients*

Discussion

The current observational study in tertiary care public-funded university hospital found an incidence of preoperative anxiety of up to 76% in Indian children aged 2–6 years which is higher than the average reported incidence of 40–60% in the literature. The average mYPAS scores of 43 ± 14 at baseline, 48 ± 13 at parental separation, and 62 ± 21 at mask induction were much higher than those reported from the developed world at similar time points: 35.8 ± 13.8 at baseline, 36.7 ± 17.1 at parental separation, and 41.2 ± 19.7 at mask induction.[12] Since the majority of publications on pediatric preop anxiety is from the developed world, this would be the first scientific study to evaluate the incidence and predictors of preop anxiety among pre-school children in the developing world.

The sociocultural aspects that influence the preoperative psychological preparation of children in our setup are different from the developed world. A majority of parents in our setting accept a physician's advice readily and are hesitant to actively seek information regarding anesthesia or surgical complications.[13] This is in contrast to parental expectations for detailed information in the developed countries. Family-centric specific psychologic preoperative preparatory programs are integrated into a majority of Western centers with an emphasis on non-pharmacological interventions to lessen preop anxiety of children.

In the Indian setup, the information shared with the parent/family regarding the peri-operative preparation of children is often not provided in a methodical manner by the healthcare personnel; be it the surgeon, the anesthesiologist, or the nurse. Owing to the larger numbers of patients, the time available to explain the preparation details is also minimal. These factors lead the Indian anesthesiologist to rely on pharmacological premedication as the main strategy to decrease pediatric preoperative anxiety. Despite premedication, the incidences of preop anxiety were very high at parental separation (93%) and mask induction (96%). This finding urges the need for widespread adoption of simple non-pharmacological measures described in the literature such as preoperative play sessions, coping skills, cartoon videos, a tour of the operating room, and parental presence during induction.[14,15]

There are conflicting findings on the influence of socioeconomic background on the incidence of preop anxiety. We did not find socioeconomic status to influence preop anxiety in younger children. However, a similar study found socioeconomic status to be a significant predictor in the older children in the Indian setup.[16] Although parental anxiety was high (90% in mothers and 86.6% in fathers) in our study, it was not a significant predictor of the child's anxiety. In contrast, Malik *et al.*[16] had found parental anxiety to be a significant predictor of anxiety in children aged 7–12 years. The high incidence of parental anxiety in our study could be attributed to greater parental dependence of these younger children. Davidson *et al.*[17] had found that state anxiety of the parent was a significant predictor of a child's anxiety whereas trait anxiety was not significant in their study on children aged 3–6 years.

The effect of a child's prior experience with surgery on the behavior during subsequent anesthesia has also been studied earlier with conflicting results: few studies showed that previous exposure increased the anxiety levels[17-19] whereas others[11,20,21] showed no such effect. In our study, 60% of the children had undergone previous surgery, but this exposure was not a significant predictor of high anxiety subsequently. In our setup, we often encounter parents who conceal the exact purpose of a hospital visit to elicit their children's cooperation while bringing them for a surgery or procedure. This could be the reason why previous exposure was not found to be significant as the child may not be able to associate a previous experience to a new anticipated exposure to surgery.

Our study found that single children were less anxious than those with siblings. However, Davidson *et al.*[17] did not find the number of sibling/birth order to significantly predict preoperative anxiety. The interactions of a child within the family affect their ability to cope with stressful situations. Negative domination and control, differential attention, and parental favoritism among siblings may lead to the development of traits of anxiety.

Although a child's temperament is not a modifiable factor, it is quite intuitive that temperament may influence the anxiety exhibited during stressful events. Pre-anesthetic identification of such children at risk for increased anxiety based on temperament could help in selecting those children for a structured preoperative preparation in our resource-poor setting. The current study found a possible association between sociability, emotionality, and energy components of temperament and higher anxiety. However, multivariate logistic regression could not identify this as a significant predictor, possibly because of the lower number of studied children. Earlier studies by Fortier *et al.*[20] and Kain *et al.*[22] also had found that a child's temperament was a significant predictor of preop anxiety. Recently, a meta-analysis of 12 studies including 1,064 children aged 1–18 years found that certain temperament styles—emotionality, the intensity of reaction, and withdrawal—were associated with significant preoperative anxiety whereas activity level was associated with reduced anxiety.[23]

The small sample size was a limitation of our study. If we had a higher sample size, we could have probably elicited a significant relationship between a child's anxiety and factors like the child's age, temperament, parental anxiety, and a history of previous surgery similar to that reported in the literature. A multicentric study is desirable on this topic in the setting of the developing world.

Conclusion

In conclusion, this observational study showed a very high incidence of preoperative anxiety in Indian children of age group 2–6 years, and this anxiety escalates during parental separation and induction despite sedative premedication. The presence of siblings was found to be a significant predictor of preoperative anxiety.

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Nil.

Conflicts of interest
There are no conflicts of interest.

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