

## Preoperative Anxiety in Preschool Children-Observational Study

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### Abstract

**Objectives:** Pediatric preoperative anxiety (PPOA) has been a concerning matter for the past decades with a high prevalence and several adverse outcomes branching into social, developmental, behavioral and perioperative fields. The management of anxious children is a priority for minimizing PPOA of the upmost importance. The aim of the study was to assess the levels of preoperative anxiety and their relation to a group of selected variables in a pediatric population being submitted to ambulatory surgery under general anesthesia.

**Methods:** Children's anxiety was assessed using the modified Yale Preoperative Anxiety Scale-Short Version at the preoperative holding area (Time 1) and at the operation room during induction of anesthesia (Time 2). A cutoff value of 30 was used to differentiate anxious children from non-anxious children (scores  $\leq 30$ ).

**Results:** 67 children were included in the study. 9 (13.4%) were anxious children at T1 and 24 (35.8%) at T2. A gender difference was not present ( $p=0.634$  for T1,  $p=0.303$  for T2), but the boys presented higher scores at both times and tend to have a significant increase from T1 to T2 ( $p=0.049$ ). An overall change in the anxiety status from T1 to T2 does not tend to occur ( $p=0.01$ ). Younger children tend to have higher scores although not statistically significant. No statistical significant difference was found between the remaining variables.

**Conclusions:** The prevalence of anxious children presented is lower than the estimated worldwide and reveals both the result of correct practices and best use of resources. However, the scarcity of national studies exploring this topic renders an indication to implement similar future studies, with larger samples and further studying of the potential predisposing and contributing variables. The never-ending purpose should be to institute more customized programs for minimizing PPOA by means of multimodal combinations of anxiolytic practices.

**Keywords:** Anxiety; Children; Pediatric anesthesia; Preoperative care; Modified yale preoperative scale-short form; Surgery

### Introduction

Pediatric preoperative anxiety (PPOA) has been an increasing matter of interest for the past decades [1]. With PPOA being a common phenomenon, up to 60% of children receiving surgery with general anesthetic are anxious prior to the surgery in the holding area and during the induction [2]. These subjective feelings of tension, apprehension and nervousness [2] can be either verbalized or become noticeable by behavioral changes with an amplified autonomic nervous system activity. The consequences of high anxiety levels present nowadays as a double problem in modern healthcare, concerning both the child's well-being and the medical facility's logistics [3] and its management is crucial for achieving optimal treatment outcomes [4]. It is commonly believed that increased anxiety in the preoperative setting can be translated into augmented intraoperative anesthetic requirements [4] as well as an array of post-operative complications. Adverse outcomes include more pain after the procedure with increased analgesic consumption, prolonged recovery time and hospital stay, greater incidence of negative behavioral changes such as separation anxiety, re-emerging enuresis, sleep disorders and eating problems [2,4-8]. Indiscipline and lack of cooperation were described

as the main behavioral problems recurring from preoperative anxiety states and high levels of preoperative anxiety are associated with increased incidence of emergence delirium [9]. The perioperative period is particularly important in this scenario because it is very difficult to manage an anxious and fearful child posted for surgery.

It is of the upmost importance that the antianxiety measures should start immediately after admission to avoid such a scenario and the anesthesiologists have a crucial role in it [1].

### The Scale

Several scales have been developed to measure PPOA and have been used for both clinical and research purposes.

The Yale Preoperative Anxiety Scale, which was used in over 100 studies across diverse health fields, was first developed in 1995 [10]. Later, was revised to create the Modified Yale Preoperative Anxiety Scale [11] and enhanced for over a decade until the Modified Yale Preoperative Anxiety Scale-Short Form (mYPAS-SF) appeared in 2014 [12]. This observational scale comprises 4 domains-the children's activities, vocalizations, expression of emotions and state of apparent arousal-with Likert-type response options. Children's behavior can be rated from 1 to 4 or 1 to 6 (depending on the domain) and a higher

rating corresponds with a higher severity for that domain (Appendix 1).

This particular updated version of the observational scale (mYPAS-SF) still bears the advantage of being valid for younger children-from the age of 2-and it's more easily applied and completed in a shorter period of time since it has 2 times of assessment (in the preoperative holding area and when the anesthesia mask is introduced to the children), therefore being adapted to busy preoperative clinical research settings [12]. The mYPAS-SF has strong validity and reliability [12].

### Study Purpose and Hospital Framework

The purpose of this observational study is to evaluate the anxiety levels of a determined population of children being submitted to ambulatory surgery under general anesthesia. The study was conducted for 8 weeks in the Centro Integrado de Cirurgia de Ambulatório (CICA)-a center of ambulatory surgery that integrates the Centro Hospital do Porto (CHP), a tertiary, central and teaching hospital located in Porto, Portugal. CICA reserves one day per week (Tuesday) for pediatric ambulatory surgery (children till the age of 18) with only pediatric patients and pediatric-trained healthcare professionals.

No other study has ever assessed the question of PPOA in a Portuguese hospital setting; it is of particular interest to evaluate the implemented procedures of a district public hospital with an entire day per week dedicated to pediatric ambulatory surgery. The data obtained from this observational study can enlighten the standard of care and help establishing further improvements of the management of PPOA in pre-schooler age.

### Methods

#### Study design and criteria

After the ethics committee approval the transversal observational study was conducted. The study lasted for 8 weeks, comprising 7 different days of data collecting. The mYPAS-SF was applied to each child in the preoperative holding area (T1) and when the anesthesia mask is introduced to the children (T2). The children clinical file was accessed in order to obtain the additional information: date of birth, age, gender, American Society of Anesthesiologists physical status (ASA) and type of scheduled surgery. The inclusion criteria were the following: children aged between 2 and 6 years old that hadn't started primary school yet; children being submitted to scheduled outpatient surgery on CICA's second floor surgical ward; children with ASA physical status I and II and children that attended an anesthetic consultation prior to the surgery. The exclusion criteria were the following: use of psychoactive medication; neuromotor impairment; decompensated illness; history of previous surgery and being accompanied by a non-family member. This approach allowed for a randomized sample. Pre-anesthetic medication was not given to any subject of the present study and all children benefited from parental presence during induction of anesthesia.

#### Scale use, scoring and cut-off values

The mYPAS-SF was applied in two distinct times, proposed when the scale was transformed into a short version [12]. The first (T1) was in the holding area where the children were accompanied by their family

members, already dressed for the operation room, along with the other children planned for surgery on that specific day. The other moment (T2) was in the OR when the anesthesia mask was introduced to the child, with the family member still present in the room.

The only observer was the main author of the present study dressed as the remaining healthcare professionals (doctors and nurses). Direct personal contact between the observer and both the parents and children was not established at any time. Before the actual study, a pilot try out was elaborated for training purposes to master the use of the scale.

The total score of the scale was calculated as suggested by the authors that revised the scale [12]. For each domain the patient's partial score was divided by the maximum score obtainable in that domain (6 for the vocalizations domain and 4 for the remaining). The produced values for each domain are all added up, divided by 4 and multiplied by 100. A score ranging from 22.92 to 100 was obtained with higher values, representing higher states of anxiety. The domains and scores of the scale are presented in Table 1.

| Domains  | Activity | Vocalization | Emotional Expression | State Apparent Arousal |
|--|----------|--------------|----------------------|------------------------|
| N° of categories   | 4        | 6            | 4                    | 4                      |
| Category   | Scores   |              |                      |                        |
| 1  | 0.25     | 0.17         | 0.25                 | 0.25                   |
| 2  | 0.5      | 0.33         | 0.5                  | 0.5                    |
| 3  | 0.75     | 0.5          | 0.75                 | 0.75                   |
| 4  | 1        | 0.67         | 1                    | 1                      |
| 5  |          | 0.83         |                      |                        |
| 6  |          | 1            |                      |                        |
| Total Score=sum of the score of the 4 domains multiplied by 25 |          |              |                      |                        |

**Table 1:** Domains and scores of the modified Yale Preoperative Anxiety Scale-Short Form.

The original cut-off value of 30 [11] was used for the mYPAS-SF as advised by Jenkins [12], upon e-mail communication. Thus, for study purposes, children with scores superior to 30 were considered as having anxiety and children with scores from 22,92 to 30 were considered as not having experienced significant anxiety.

#### Hospital materials and staff

It is important to mention that the days when the data was collected were reserved for pediatric surgery only, with a trained healthcare staff (nurses, anesthesiologists, surgeons) with pediatric experience. On the holding area, a variety of toys were provided for children to play with, along with coloring books. Children were allowed to bring their electronic devices to play videogames or watch cartoons/series. There is also a retired kindergarten teacher that volunteers as a monitor to play and entertain the children.

### Statistical analysis

The results were presented in the form of descriptive tables and  $p < 0.05$  were considered significant. The statistical analysis was conducted by stages. First some groups were created for further analysis. Children were divided by age  $< 4$  years or  $\geq 4$  years, forming the Age Group 1 and 2 respectively. The surgical procedures were also divided by Ears/Nose and Throat (ENT) procedures and non-ENT procedures. The sex variable was divided by male/female and ASA status in 1 and 2.

A descriptive analysis was made using median, mean and standard deviation segregating for each variable-age, sex, surgery, ASA physical status and mYPAS-SF scores. When appropriate, the Mann-Whitney or T-Student's test were applied to study continuous variables, while the X<sup>2</sup> and Fisher's exact test was used for categorical variables analysis. Finally, the McNemar and Kappa agreement tests were used to analyze distribution of anxious and non-anxious children at time 1 and time 2. Statistical analysis was performed with SPSS Statistics, 22<sup>®</sup> (IBM<sup>®</sup>, EUA) for Windows software.

### Results

#### Descriptive

A total of 67 children undergoing general anesthesia for elective outpatient surgery met the inclusion study criteria, with no missing cases. The mYPAS-SF was applied to our sample. The mean age of the 42 (62.7%) boys and 25 (37.3%) girls was  $4.2 \pm 1.2$  years with 30 (44.8%) children younger than 4 years. The population comprised 56 (83.6%) children being classified as ASA 1 and the remaining 11 (16.4%) being ASA 2. The distribution by surgical field comprised 35 (52.2%) ENT related procedures.

Table 2 shows the number of children per category on each of the 4 domains of the scale, both on the holding area (T1) as at the operation room (T2).

| Category | Activity |    | Vocalization |    | Emotional Expression |    | State of apparent arousal |    |
|----------|----------|----|--------------|----|----------------------|----|---------------------------|----|
|          | T1       | T2 | T1           | T2 | T1                   | T2 | T1                        | T2 |
| 1        | 61       | 51 | 58           | 42 | 55                   | 39 | 62                        | 53 |
| 2        | 5        | 10 | 6            | 13 | 10                   | 21 | 5                         | 10 |
| 3        | 0        | 3  | 3            | 8  | 2                    | 4  | -                         | 1  |
| 4        | 1        | 3  | -            | 1  | -                    | 3  | -                         | 3  |
| 5        |          |    | -            | 1  |                      |    |                           |    |
| 6        |          |    | -            | 2  |                      |    |                           |    |

**Table 2:** Number of patients per category on each domain of the mYPAS-SF scale at the Holding Area (Time 1) and at the Operation Room (Time 2).

#### mYPAS-SF scores analysis

The median, percentile (25th-75th), mean and standard deviation values of the mYPAS-SF scores at the holding area (Time 1), at the OR when the child was introduced to the anesthesia mask (Time 2) and the difference between these two moments, are presented in Table 3. The

maximum score (10,000) was observed only at Time 2, by two boys that presented a physiologic response with enuresis, during the induction of the general anesthesia at the operation room (T2) (Table 3).

Using the established cutoff of 30 in the mYPAS-SF, there were 9 children fulfilling the anxious criteria at Time 1 and 24 children at Time 2, corresponding to a prevalence of anxious children of 13.4% for T1 and 35.8% for T2. Distribution of number, percentage and statistical p-value concerning the anxious children, at both of the times, is displayed at Table 4, for the variables previously mentioned.

|                            | Time 1           | Time 2           | Time 2-Time 1   |
|----------------------------|------------------|------------------|-----------------|
| Median (25th-75th)         | 22.9 (22.9-27.1) | 22.9 (22.9-35.4) |                 |
| Mean $\pm$ SD              | 26.2 $\pm$ 7.2   | 33.6 $\pm$ 17.9  | 7.4 $\pm$ 14.7  |
| <b>Sex</b>                 |                  |                  |                 |
| Boys                       | 25.7 $\pm$ 6.4   | 35.2 $\pm$ 19.1  | 9.5 $\pm$ 16.4  |
| Girls                      | 26.9 $\pm$ 8.5   | 30.9 $\pm$ 15.9  | 4.0 $\pm$ 10.6  |
| <b>ASA Physical Status</b> |                  |                  |                 |
| 1                          | 26.3 $\pm$ 7.5   | 32.5 $\pm$ 17.0  | 6.2 $\pm$ 12.4  |
| 2                          | 25.8 $\pm$ 6.3   | 39.4 $\pm$ 22.1  | 13.6 $\pm$ 23.0 |
| <b>Age (years)</b>         |                  |                  |                 |
| <4                         | 25.6 $\pm$ 6.3   | 36.2 $\pm$ 17.5  | 10.6 $\pm$ 13.9 |
| 4                          | 26.6 $\pm$ 7.9   | 31.5 $\pm$ 18.2  | 4.9 $\pm$ 15.0  |
| <b>Surgery</b>             |                  |                  |                 |
| ENT                        | 25.1 $\pm$ 6.1   | 33.9 $\pm$ 19.9  | 8.9 $\pm$ 17.4  |
| Other                      | 27.4 $\pm$ 8.2   | 33.3 $\pm$ 15.9  | 5.9 $\pm$ 11.0  |

**Table 3:** Median, percentile (25Th-75th), mean and standard deviation scores of the mYPAS-SF at Holding Area (Time 1) and at the operation room when the child is introduced to the mask (Time 2).

|                    | Anxious (Score>30) |      |       |        |      |       |       |
|--------------------|--------------------|------|-------|--------|------|-------|-------|
|                    | Time 1             |      |       | Time 2 |      |       | Total |
|                    | N                  | %    | p     | N      | %    | p     |       |
| <b>Sex</b>         |                    |      | 0.634 |        |      | 0.303 |       |
| Male               | 5                  | 11.9 |       | 17     | 40.5 |       | 42    |
| Female             | 4                  | 16   |       | 7      | 25   |       | 25    |
| <b>Age (years)</b> |                    |      | 0.458 |        |      | 0.95  |       |
| <4                 | 3                  | 10   |       | 14     | 46.7 |       | 30    |
| 4                  | 6                  | 16.2 |       | 10     | 27   |       | 37    |
| <b>ASA</b>         |                    |      | 0.644 |        |      | 0.157 |       |
| 1                  | 8                  | 14.3 |       | 18     | 32.1 |       | 56    |
| 2                  | 1                  | 9.1  |       | 6      | 54.5 |       | 11    |
| <b>Surgery</b>     |                    |      | 0.053 |        |      | 0.196 |       |

|         |   |     |  |    |      |  |    |
|---------|---|-----|--|----|------|--|----|
| ENT     | 2 | 5.7 |  | 10 | 26.8 |  | 35 |
| Non-ENT | 7 | 2.9 |  | 14 | 43.8 |  | 32 |

**Table 4:** Distribution of anxious children (mYPAS-SF score >30) at Times 1 and 2, discriminated for age group (Mann-Whitney), sex, ASA physical status and field of surgery (X<sup>2</sup> and Fisher's exact test).

Although a statistical significant difference between the number of anxious boys and girls was not present (p=0.634 for Time 1 and p=0.303 for Time 2), there was a statistical significant difference, using the Mann-Whitney test (p=0.049) demonstrating that the boys group tends to have an increase in anxiety from Time 1 to Time 2, in comparison to the girls.

No statistical significant difference was found between the anxiety status or the scale scores related to the variables ASA physical status (p=0.664 and p=0.157) or the different subset of surgical procedures (p=0.053 and p=0.196).

Finally, the distribution of anxious/non-anxious children at Time 1 and Time 2 is described by Table 5. Once again, children were considered anxious when scores superior to 30 were registered.

|                 |       | Time 2-Anxious |     | Total |
|-----------------|-------|----------------|-----|-------|
|                 |       | No             | Yes |       |
| Time 1- Anxious | No    | 40             | 18  | 58    |
|                 | Yes   | 3              | 6   | 9     |
| Total           | Count | 43             | 24  | 67    |

**Table 5:** Distribution of anxious/non-anxious children at Time 1 and Time 2.

Upon applying of the described cutoff at T1 and T2, a total of 46 (68.7%) children maintained their status (anxious/non-anxious) from T1 to T2 and this finding is not driven by randomness (McNemar p=0.01). Conversely, a total of 21 (31.3%) children changed their status with a proportion of 18 (26.9%) going from non-anxious to anxious. The Kappa agreement value found was 0.209 with a p=0.038.

## Discussion

On a first basis observation, it is of relevance to comment the sample composition. The difference between the number of boys (62.7%) and girls found on the randomized sample of the present study goes accordingly to the CHP patterns of distribution by sex (68.7% boys), upon request of the distribution of the 2 to 6 years old children submitted to general anesthesia, for scheduled ambulatory surgical procedure during the 8-week temporal frame shift of the study. Boys showed a higher percentage of the CHP admitted children and clarifying this potential bias.

## General findings

Since worldwide levels as high as 60% of PPOA are reported [2], it would be of interest to compare the prevalence of anxious children found (13.4% for T1 and 35.8% for T2) with similar ones encountered at Portuguese national hospitals but no comparable data was available until the moment of this study. Hence it becomes relevant to discuss what would be expected bearing in mind the hospital conditions and

healthcare staff qualifications as well as reviewing the methodology and guidelines applied in this specific setting. Observing the anxiety prevalence in the children comprised by the present study, the number of anxious children presented is lower than the estimated worldwide and reveals the benefits of merging correct practices and best use of all the resources available (toys, electronics, assistance). Children admitted to CICA contact with specialized pediatric nurses and doctors, benefit from the volunteer work of the monitor and have a myriad of equipment such as toys and coloring books or the option to bring the children's own electronics - offering the chance of playing videogames or watching videos/cartoons-all of what was showed, in previous studies, to help relief and diminish anxiety levels in children preoperative period [13-22]. The contact with the stated material occurs mostly during the holding area (T1) since not many children were carrying any of this equipment to the operation room. This observation may surface as an additional explanation to the prevalence observed in the operation room along with the already proved tendency for children to have and overall increase in anxiety once they enter the OR [2,3,23].

However, it can possibly suffer a downgrading by identifying children with intrinsic anxious traits that are more prone to suffer from anxiety in this setting and provide them pre-anesthetic sedation [3,15]. This measure is not stripped of negative effects but it has been proved to be of value in selected cases like the aforementioned [24,25]. Purposing children's distraction, activities more developmentally appropriate and contextualized such as storytelling and coloring were recently found to be an efficient alternative to traditional pharmacological premedication for children undergoing day surgery by a randomized controlled non-inferiority trial and present as valid option [22]. It might be of special concern to encourage these activities since there are already personnel volunteering for this specific task.

In addition, a complementary set of intervention, especially with psychological accompaniment was recently discovered to render children less anxious and more cooperative in the preoperative period and during the induction [26] as well as behavioral programs, despite showing mixed results and typically having higher costs associated [3,27-29].

In another topic, parental presence during induction of anesthesia (PPIA)-as seen in this setting -has been greatly discussed lately since the parents state of anxiety influences the child's state too [3,24,25,30]. The presence of parents in the OR has showed to reduced their level of anxiety and improved the overall satisfaction [25]; however, only calm parents seem to retain a benefice anxiolytic effect on an anxious children [31], disclosing the need to reevaluate the value of standardizing this intervention for every child in this hospital. Further developing of this matter would be better achieved by a purposely designed study.

## Variables interplay

Concerning sex differences, the boys group presented higher scores on both times, in comparison to the girls group. Findings in the present study demonstrate that the boys tend to have higher scores, corresponding to more anxious states, even though the number of anxious boys above the defined cut-off may not be significantly diverse from the number of anxious girls. In the past, studies have identified being male as a risk factor for a more anxious response [32], while more recent ones stated that sex was not found to be a factor capable of causing this distinction [2,33]. Hence, the need for additional studies with larger sample sizes is enforced for an enlightening of this topic.

From observing and studying the distribution of anxious/non-anxious children at Time 1 and Time 2, it is possible to infer that a change in the anxiety status from T1 to T2 does not tend to occur in most of the children. However, if such change actually occurs, it will most likely be in the way of converting from a non-anxious status into an anxious one. The described finding correlates with the previous described tendency of increasing anxiety levels at T2 [2,3,5,23].

Regarding the age groups, a tendency for the younger group of children (<4 years) to have higher scores was observed, although a statistical significance was not found between the delineated age groups. This corresponds with the findings from previous literature, seeing that younger ages have been associated with more anxious states [2,34-36].

## Conclusion

A main acknowledgement requiring distinction is the scarcity of studies exploring pediatric preoperative anxiety (PPOA) levels on a national basis. An indication for a future path materializes in the need to implement similar studies along national hospitals, with larger samples and further studying of the potential variables' weight in predisposing and contributing to PPOA. A crescendo of interest in this area should be fomented in practitioners, especially in healthcare facilities with dedicated programs of pediatric anesthesia.

As a final note, comprehensive psychological evaluation for children remains as a mainstay for further elucidation of the topic [37]. Particular attention should be given to incorporating the family to ensure a synergic acting with the healthcare team-that plays an essential and everlasting role - in promoting a positive perioperative experience, along with parallel development of increasingly tailored programs for lessening children's stress in preoperative settings by instituting multimodal combinations of PPIA, anxiolytic medications, behavioral and preoperative information interventional programs [28,29,38-40] and distraction and play activities.

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