South Afr J Anaesth Analg. 2024;30(6):185-189
https://doi.org/10.36303/SAJAA.3173

South Afr J Anaesth Analg
ISSN 2220-1181 EISSN 2220-1173

ORIGINAL RESEARCH

Audiovisual distraction for preoperative anxiety in paediatric patients at a regional hospital

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Background: Although distraction therapy has shown benefits, studies have not been done in developing countries. This study aimed to compare audiovisual distraction to standard practice to decrease preoperative anxiety at induction in children undergoing surgery at Rahima Moosa Mother and Child Hospital (RMMCH).

Methods: A contextual pre- and post-intervention control group study was conducted with children aged 3–10 years. Each group was allocated 30 children. During the preoperative assessment, children in the intervention group watched a cartoon from a preselected list. The modified Yale Preoperative Anxiety Scale (mYPAS) was used to assess anxiety on arrival and at induction, with a score > 30 regarded as anxious. The Induction Compliance Checklist (ICC) was used to assess compliance at induction.

Results: At induction, the control group had significantly higher median (interquartile range [IQR]) mYPAS scores (60, 42.5–67.5 versus 31.7, 28.3–39.2; $p < 0.001$) and were significantly less compliant ($p = 0.001$). Fewer children in the intervention group were anxious at induction (17, 56.6% versus 29, 96.7%; odds ratio [OR] = 0.05, 95.0% confidence interval [CI] = 0.00 to 0.37; $p = 0.0004$). Between arrival and induction, the control group had significantly increased mYPAS scores ($p < 0.001$), while the intervention group had significantly decreased scores ($p < 0.001$). There was a significant correlation between mYPAS and ICC scores in both the control ($r = 0.74$, $p < 0.001$) and the intervention ($r = 0.74$, $p = 0.03$) groups at induction. There was no correlation between cartoon-watching time and mYPAS scores ($r = -0.29$, $p = 0.125$), no difference between the mYPAS scores of males and females ($p = 0.933$), or those with or without a traumatic experience ($p = 0.441$) at induction.

Conclusion: This study demonstrates a significant decrease in anxiety at induction in the children receiving audiovisual distraction. The intervention group was more compliant at induction. Smartphone-based audiovisual distraction offers a cost-effective, easy-to-use mobile intervention.

Keywords: preoperative, paediatric anxiety, modified Yale Preoperative Anxiety Score, Induction Compliance Checklist, audiovisual distraction, non-pharmacological

Introduction

Preoperative anxiety is described as "an unpleasant state of uneasiness or tension, which may be associated with abnormal haemodynamics as a consequence of sympathetic, parasympathetic, and neuroendocrine stimulation."[1] Preoperative anxiety in children peaks at induction, but its harmful effects transcend the procedural experience.[2-4] Concerns with preoperative anxiety include delayed induction, spontaneous urination, and flailing, which may require restraint that could lead to further trauma.[4] Postoperative maladaptive behavioural changes, higher analgesic requirements, and more incidences of emergence delirium are also seen with increased preoperative anxiety.[2,3,5] There are many subjective and objective measures for anxiety, but the modified Yale Preoperative Anxiety Scale (mYPAS) is the most widely used and has been validated in the paediatric population.[7-9]

Paediatric preoperative anxiety has a high cost to children, their families, and the health sector.[3,5] Pharmacological and non-pharmacological measures can be used as prevention. Pharmacological agents have a delayed onset, adverse effects, and medical costs, and some children may have paradoxical reactions.[7] Non-pharmacological interventions such as distraction therapy are used more frequently, with audiovisual interventions being the most popular.[7]

Distraction therapy at induction has shown benefits.[10] The aim is to focus attention on a pleasant stimulus in the presence of a potentially unpleasant event.[11] Video clips viewed at induction have shown promising results; however, they should be sufficiently engaging.[7,12-16] This form of distraction therapy is equal or superior to other interventions and has fewer side effects and lower costs.[10,12-15]

Of the children presenting for elective surgery at Rahima Moosa Mother and Child Hospital (RMMCH), 69.2% experience anxiety.[17] Parental presence at induction is routine practice. There are limited pharmacological agents and non-pharmacological interventions to reduce preoperative anxiety due to resource limitations. The hospital has limited beds available, with no dedicated day-case ward. Staff, monitoring, and pharmacological constraints make the appropriate dosing of premedication challenging. Distraction therapy is versatile in this resource-

constrained setting. This study aimed to compare audiovisual distraction to standard practice to decrease preoperative anxiety at induction in children undergoing surgery.

Methods

This study used a contextual pre- and post-intervention control group design. Approval to conduct the study was obtained from the Human Research Ethics Committee (Medical, M191131) and other relevant authorities.

The study population included paediatric patients presenting for surgery at RMMCH, an academic hospital affiliated with the University of the Witwatersrand. Convenience sampling was used. Consent for study participation was obtained from parents or caregivers in addition to assent from children six years and older. The children were allocated to either a control or intervention group. These allocations were based on days rather than individual patients, as true randomisation was not possible when patients were in the same room preoperatively. Therefore, theatre lists were alternated as intervention and non-intervention days.

Due to the COVID-19 pandemic, elective lists were delayed, and the study length increased substantially. American Society of Anesthesiologists (ASA) I and II children, aged 3–10 years, accompanied into theatre by their caregivers and who received inhalational induction were included. Children with visual or cognitive impairment, a known psychiatric condition, or those who received sedative premedication preoperatively were excluded. Further exclusions were caregiver or child refusal and where the intervention could not be completed.

Following a literature review, a data collection sheet that included the mYPAS and the Induction Compliance Checklist (ICC) was compiled.[9,18] The mYPAS is a validated scoring system consisting of 27 items in five domains to assess preoperative paediatric anxiety. A child scoring > 30 on the mYPAS was regarded as anxious. A weighted score > 30 out of 100 has an 85% sensitivity, a 92% specificity for anxiety, a positive predictive value of 79%, and a negative predictive value of 54%.[9] The ICC is a 10-point checklist that serves as a surrogate to assess behavioural compliance at inhalational induction.[18] A perfect induction is when a child exhibits no "negative behaviours, fear, or anxiety".[18] In this study, the ICC was scored in three categories: perfect (0), moderate (1–3), and poor (4–10) compliance.

No selection criteria for audiovisual distraction (cartoons) could be identified in the literature. Cartoons deemed appropriate for children were chosen, namely Shaun the Sheep™, Power Rangers™, Peppa Pig™, Doc McStuffins™, Ben 10™, and Sofia the First™. The cartoons were shown on one smartphone, cleaned between uses with Webcol™ (70% isopropyl alcohol wipes).

Data were collected between June 2020 and July 2021. All data collection, except the ICC scoring, was done by one author (ED). The attending anaesthetist completed the ICC score at induction. The ICC score was explained to the attending anaesthetist before commencing anaesthesia.

As shown in Figure 1, on the morning of the surgery, ED enrolled the children during the preoperative assessment. The children in the control group waited in the reception area with a caregiver but did not have access to toys or television due to the pandemic. The children in the intervention group chose a cartoon from the preselected selection and started watching during the preoperative assessment. ED and the caregiver accompanied the children into the theatre. Routine ASA monitoring commenced: a three-lead electrocardiograph, an oxygen saturation probe, and non-invasive blood pressure monitoring was connected to the child. The attending anaesthetist administered an inhalational induction with a mix of sevoflurane and oxygen via a face mask. ED and the caregiver assisted the child in holding the smartphone while the child was induced. The anaesthetic then continued as per routine.

A biostatistician was consulted and determined the sample size using Epi Info™ version 7. Using a difference of > 15 points in the mYPAS score (considered clinically significant in other studies), a minimum sample size of 30 children in each group was determined.[12,13,15] This gave a significance level of 5% and a power of 80%. Data were analysed using R version 4.01 (Lucent Technologies, Murray Hill, USA). Categorical variables

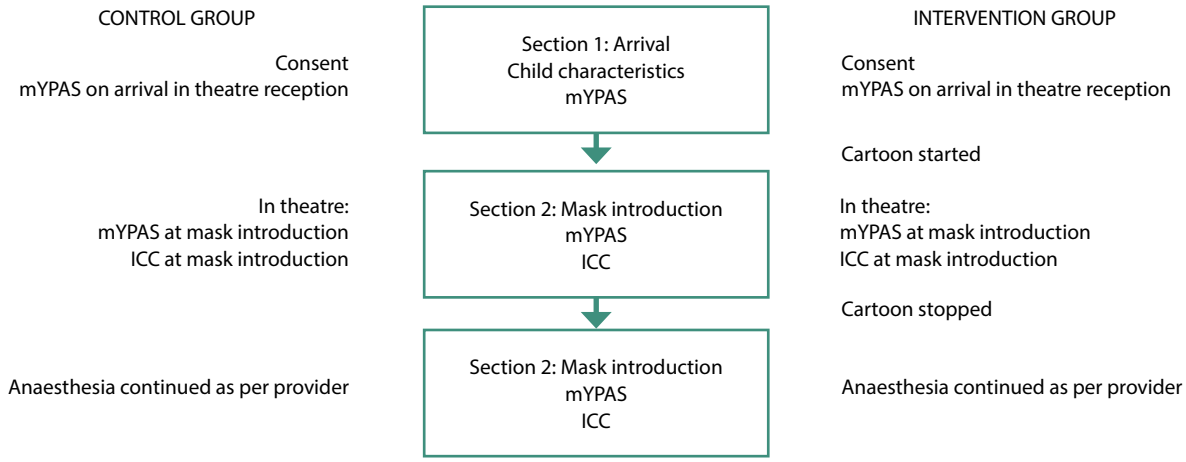

Figure 1

Table I: Characteristics of children

Characteristic	Control group *n* = 30	Intervention group *n* = 30	*p*-value
	Median (IQR)		
Age in years	4.5 (3.8–5.0)	4.6 (4.0–6.7)	0.382
	Number (%)		
Sex			1.000
• Male	19 (63.3)	18 (60.0)	
• Female	11 (36.7)	12 (40.0)	
ASA classification			
• I	26 (86.7)	28 (93.3)	0.671
• II	4 (13.3)	2 (6.7)	
Previous anaesthesia	0 (0)	4 (6.6)	0.112
Traumatic experience	5 (16.7)	9 (30.0)	0.360

ASA – American Society of Anesthesiologists, IQR – interquartile range

were described using frequencies and percentages. Continuous variables were reported using medians and IQRs.

Preliminary analysis to assess baseline differences in age, sex, ASA classification, history of traumatic experience, and history of prior anaesthesia was done using Fisher's exact test. Between-group differences for mYPAS and ICC scores on arrival and at induction were analysed using Mann–Whitney U tests. Within-group comparisons of mYPAS scores for the control and intervention groups were done using a Wilcoxon rank-sum test. Correlations were made with Spearman's correlations for cartoon-watching time and mYPAS scores, and mYPAS and ICC scores for the control and intervention groups. For sex and traumatic experience, a Mantel–Haenszel chi-square test assessed for association. A p-value < 0.05 was considered clinically significant.

Results

Of the 61 children screened, 60 were included in the study. One child received midazolam in the ward and consequently did not meet the inclusion criteria. The characteristics of the children are shown in Table I. All children underwent minor surgeries: dental extractions, minor ear, nose and throat (ENT), and orthopaedic or urological procedures. There were no significant differences in the baseline characteristics of the children in each group. All caregivers were present at the induction. Caregivers reported medical interventions such as dental procedures, vaccination, and circumcision as traumatic experiences for children when there were associated behavioural changes, such as crying, bedwetting, and nightmares.

In the intervention group, 23 children (77.0%) chose to watch the cartoon Peppa Pig. The median (IQR) time spent watching cartoons was nine minutes (5.0–16.8). There was no significant

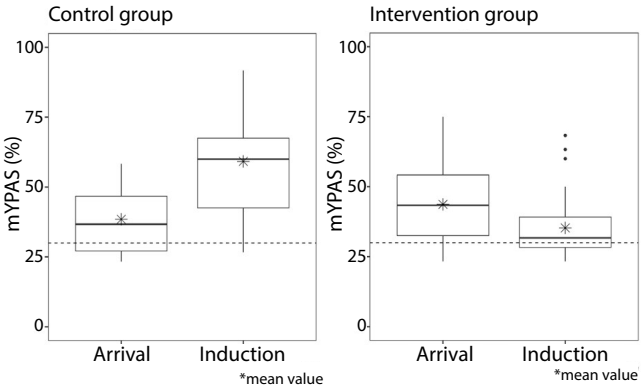

Figure 2: Within-group difference between mYPAS scores on arrival and at induction

Table II: Anxiety mYPAS and ICC scores

Anxiety (mYPAS > 30)	Group		*p*-value
	Control group	Intervention group	
On arrival – *n* (%)	20 (66.7)	24 (80.0)	0.382
At induction – *n* (%)	29 (96.7)	17 (56.6)	0.0004
mYPAS score			
On arrival – median (IQR)	36.7 (27.1–46.7)	43.4 (32.5–54.2)	0.127
At induction – median (IQR)	60.0 (42.5–67.5)	31.7 (28.3–39.2)	< 0.001
ICC score			
Poor – *n* (%)	8 (26.7)	0 (0.0)	
Moderate – *n* (%)	11 (36.7)	8 (26.7)	
Perfect – *n* (%)	11 (36.7)	22 (73.3)	
Overall – median (IQR)	1.0 (0–3.8)	0 (0–0.8)	0.001

ICC – Induction Compliance Checklist, IQR – interquartile range, mYPAS – modified Yale Preoperative Anxiety Scale

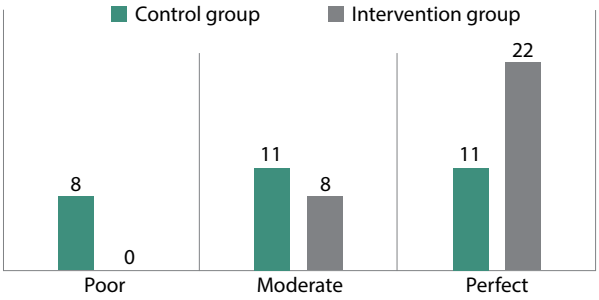

Figure 3: ICC score at induction

correlation between the cartoon-watching time and the mYPAS score at induction (r = -0.29, p = 0.125).

The comparisons of anxiety (mYPAS > 30 denoted as *), the mYPAS scores on arrival and at induction, and the ICC score between the two groups are shown in Table II, and Figures 2 and 3, respectively. Anxiety was significantly lower in the intervention group (n = 17, 56.6%) compared to the control group (n = 29, 96.7%) at induction (OR = 0.05, 95.0% CI = 0.00 to 0.37; p = 0.0004). At induction, the control group had significantly higher mYPAS scores than the intervention group. There was a statistically significant difference in ICC scores between the control and intervention groups, with the control group being less compliant (Figure 3). The number of children per ICC category is also shown.

There were significant within-group differences between the mYPAS scores on arrival and at induction for the control and intervention groups, as shown in Figure 3. The within-group difference between arrival and induction in the control group showed that children had significantly increased mYPAS scores at induction (p < 0.001). There was a statistically significant decrease in mYPAS scores at induction in the intervention group from arrival (p < 0.001).

There was a significant correlation between mYPAS and ICC scores at induction for the control (r = 0.74, p < 0.001) and intervention (r = 0.74, p = 0.03) groups. There was no significant difference in mYPAS scores on arrival (p = 0.825) and at induction (p = 0.933).

Discussion

The stressful perioperative period has acute and chronic physiological, behavioural, and psychological consequences for the paediatric patient.[19] Therefore, paediatric anaesthesia requires a safe environment for optimal surgery and recovery. The study found that exposure to audiovisual distraction at induction effectively reduced anxiety and improved compliance in a resource-limited setting. The intervention group was significantly more compliant at induction and exhibited decreased anxiety compared to the control group. Studies have shown a correlation between anxiety and compliance, where increased anxiety correlates with decreased compliance.[14,20]

The reported incidence of preoperative anxiety in children varies in the literature and generally ranges from 40% to 60%, but higher incidences have been reported.[4,20,21] Previous studies at RMMCH, one for all surgeries and one for dental extractions, showed respective preoperative anxiety incidences of 57% and 69.2%.[17,22] In our study, 56.6% of children in the intervention group and 96.7% in the control group were anxious at induction. However, the audiovisual distraction significantly lessened anxiety from arrival (median mYPAS = 43.4) to induction (median mYPAS = 31.7) in the intervention group. In other studies, the control group had a significant increase in anxiety from arrival (median mYPAS = 36.7) to induction (median mYPAS = 60.0).[2,4,14,20,22-24]

The methodologies of audiovisual distraction studies vary in the literature, making direct comparisons difficult. Lee et al.[13] and Mifflin et al.[12] showed similar results to our study, with significant benefits for audiovisual distraction.

A complex interplay of factors contributes to anxiety at induction, and one intervention may not be sufficient to reduce anxiety in all children. In our study's intervention group, of the 24 children who were anxious on arrival, 17, although less anxious, were still anxious at induction. Various factors may have influenced our higher incidence of anxiety at induction compared to a previous study done at the institution.[17] The authors postulate that the COVID-19 pandemic was responsible, where hospital services were limited and both the child and parent had increased anxiety. At the time of submitting the protocol and starting the study, this had not been a factor and, therefore, was not a variable.

The influence of parental presence at induction is controversial.[7] Kim et al.[14] compared audiovisual distraction and parental presence at induction and found no significant difference in preoperative anxiety between interventions. In our study, caregivers were present at induction for both groups; thus, their role in mitigating anxiety cannot be determined. Parental anxiety and its impact on children were not within the scope of the study.

Other factors that may have influenced anxiety are younger age, sex, child maturity, temperament, and previous traumatic experiences.[6,7,19] The risk for anxiety is highest at 1–5 years of age.[19] The median age in this study was 4.5 years for the control group and 4.6 for the intervention group. Child maturity and temperament require in-depth psychological assessments beyond this study's scope. Previous traumatic experiences have been associated with increased anxiety but were not significant in our study.[6]

There were limitations to our study. The study was done contextually at RMMCH. Consequently, the results may not be generalisable to other contexts. Our study did not assess children's and parental satisfaction with audiovisual distractions, which should be evaluated in future studies. The study did not measure parental anxiety and the impact of the COVID-19 pandemic. Daily differences in anaesthesia provider and theatre staff interactions with the parents may have influenced parental anxiety. This study may have had inherent bias, as blinding was

not possible. Objective assessment for the mYPAS and ICC using validated scales was used to mitigate this risk.

Conclusion

This study demonstrated a significant decrease in anxiety at induction in children receiving audiovisual distraction. This was associated with better compliance in the intervention group at induction. Smartphone-based audiovisual distraction offers a cost-effective, easy-to-use mobile intervention to decrease preoperative anxiety in a resource-limited setting. Additional staff members are unnecessary as this intervention can be done using the parent or caregiver (if present) or the anaesthesia nurse. We recommend using this form of distraction for children undergoing inhalational anaesthesia induction, as well as additional interventions to decrease anxiety as necessary for some children. Further study is required.

Acknowledgements

This research was done in partial fulfilment of a Master of Medicine degree.

Conflict of interest

The authors declare that no financial or personal relationships have inappropriately influenced them in writing this paper.

Ethical approval

Ethical approval to conduct the study was obtained from the University of the Witwatersrand Human Research Ethics Committee (Medical, M191131) and other relevant authorities.

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