Original Article

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Assessment of Preoperative Anxiety using the APAIS Score from Ward to Day of Surgery: A Prospective Cohort Study

Anaesthesia Section

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ABSTRACT

Introduction: Preoperative anxiety is commonly associated with adverse outcomes like increased anaesthetic needs and prolonged recovery. However, its trajectory from ward admission to surgery remains poorly characterised.

Aim: To assess the trajectory of preoperative anxiety using the Amsterdam Preoperative Anxiety and Information Scale (APAIS) from ward admission to the day of surgery.

Materials and Methods: This prospective cohort study was conducted in the Department of Anaesthesiology, K S Hegde Medical Academy (a tertiary care hospital), Mangaluru, Karnataka, India, over six months from October 2022 to March 2023 and enrolled 65 adult patients (20-60 years, ASA I-II) undergoing elective major/minor surgery under general or regional anaesthesia using convenience sampling. Anxiety was assessed at three time points: before Pre-Anaesthetic Checkup (PAC), after PAC and on the day of surgery. Demographic data and its association with anxiety were recorded. Chi-square tests analysed associations. Paired t-tests assessed anxiety changes across time points using a Bonferroni-corrected significance threshold of $p<0.017$.

Results: Among 65 patients, mean age distribution was 20-34 years (23.1%), 35-44 years (46.1%) and >45 years (30.8%). Females comprised 64.6% and males 35.4%. American Society of Anaesthesiologists (ASA) status: I (72.3%), II (27.7%). Paired t-test showed a significant reduction in anxiety after PAC compared with pre-PAC levels (mean difference 0.969, $t=3.484$, $p=0.001$). Anxiety increased slightly on the day of surgery, but this was not significant compared with post-PAC scores (mean difference -0.277, $t=-1.893$, $p=0.063$). Anxiety remained significantly lower on the day of surgery compared with pre-PAC levels (mean difference 0.692, $t=2.347$, $p=0.022$). Chi-square analysis showed no significant associations between anxiety and age, gender, or co-morbidities at any time point ($p>0.05$). Information needs remained consistently low across all groups.

Conclusion: Preoperative anxiety significantly reduced following PAC and remained lower on the day of surgery, although this difference did not remain statistically significant after Bonferroni correction. Demographic characteristics such as age, gender and co-morbidities do not influence this trajectory, indicating that effective information delivery plays a greater role in reducing anxiety than patient demographics. The APAIS is a valuable tool for assessing anxiety trajectory in clinical practice.

Keywords: Amsterdam preoperative anxiety and information scale, Perioperative care, Premedication, Surgical procedures

INTRODUCTION

Preoperative anxiety is a common psychological stressor encountered among patients undergoing surgery. It encompasses feelings of fear, apprehension and physiological arousal triggered by the anticipation of anaesthesia, surgery and potential postoperative discomfort. The prevalence of preoperative anxiety varies widely, ranging from 11% to 80% depending on the patient population, surgical setting and assessment methods used [1,2]. This wide range highlights the significance of preoperative anxiety as a major perioperative concern requiring attention.

The clinical implications of unaddressed preoperative anxiety are substantial. Elevated anxiety levels have been associated with increased anaesthetic requirements, greater haemodynamic instability during induction, heightened postoperative pain, delayed recovery, prolonged hospital stay and reduced patient satisfaction [2,3]. Furthermore, preoperative anxiety can negatively impact the overall perioperative experience [4]. Despite these well-documented consequences, preoperative anxiety remains under-recognised and often goes unassessed in busy clinical settings, where many anaesthesiologists and surgeons rely on subjective impressions rather than validated screening tools [4].

Several tools assess preoperative anxiety, including the State-Trait Anxiety Inventory (STAI), Visual Analogue Scale for Anxiety (VAS-A) and the APAIS. The APAIS is a brief, validated tool that evaluates both anxiety and information needs regarding anaesthesia and surgery [5]. It contains six items on a 5-point Likert scale: four for anxiety and two for information needs. It is validated for different settings and it demonstrates good reliability, internal consistency and clinical feasibility [5,6].

Previous studies have established that preoperative anxiety is influenced by various demographic and clinical factors. Younger age, female gender, lower education level, absence of previous surgical experience and certain personality traits have been reported as risk factors for higher anxiety levels [1,2,7]. Additionally, patients with chronic co-morbidities such as hypertension or diabetes may experience heightened anxiety due to perceived surgical risk and previous healthcare experiences [8].

The PAC represents a crucial opportunity to assess and address preoperative anxiety. During PAC, patients receive detailed information about anaesthesia techniques, perioperative procedures and postoperative care, which may alleviate anxiety by reducing uncertainty [5,9]. Several studies have demonstrated that structured preoperative counselling and information delivery can significantly reduce anxiety levels [3,9]. However, previously anxiety was assessed at a single time point, limiting understanding of how anxiety fluctuates during the critical period from initial consultation to the day of surgery [5-7,9].

Despite the recognised importance of preoperative anxiety, there remains a significant gap in the literature regarding its temporal trajectory from the ward to the operating room. Most studies have assessed anxiety at a single time point, either before PAC or on the day of surgery, failing to capture the dynamic changes that occur

during this critical perioperative transition [5,7]. Furthermore, limited data exist on how demographic factors such as age, gender and co-morbidities influence this trajectory [1,3-7,9]. The APAIS, while validated for single-point assessment, has not been extensively utilised to evaluate longitudinal anxiety changes in routine clinical practice, particularly in the Indian context [4,5,7].

There is a clear need to assess whether the APAIS can effectively capture fluctuations in anxiety across multiple time points and to determine which factors influence these changes. Understanding the trajectory of preoperative anxiety would enable clinicians to identify patients at risk and optimise the timing of interventions such as counselling, information delivery and anxiolytic premedication. The present study, therefore, was undertaken to assess the trajectory of preoperative anxiety using the APAIS score from ward admission to the day of surgery and to evaluate the influence of age, gender and co-morbidities on this trajectory.

MATERIALS AND METHODS

The present prospective cohort study was conducted in the Department of Anaesthesiology, K S Hegde Medical Academy (a tertiary care hospital), Mangaluru, Karnataka, India, over a period of six months from October 2022 to March 2023. Institutional Ethics Committee approval (INST/EC/057/2022/EC/NEW/INST/2020/834), was obtained and written informed consent was obtained from all participants prior to enrollment. The study was conducted in accordance with the Declaration of Helsinki (2013).

Sample size calculation: Sample size was calculated based on the pooled Standard Deviation (SD) of APAIS anxiety score reported in a previous study by Çelik F and Edipoglu IS, the following parameters were used [6]: Pooled SD=3.7, Level of significance (α)=5% (0.05), Estimation error (d)=0.9, Zα/2=1.96 (for 95% confidence interval).

The sample size was calculated using the standard formula for estimating a single mean:

$n=(Z\alpha/2\times\sigma/d)^2$

$(n=(1.96\times3.7/0.9)^2=64.93\approx65$

The required sample size was calculated as 65 using nMaster software (version 2.0, Christian Medical College, Vellore). A total of 65 patients were enrolled in the main study.

Inclusion and Exclusion criteria: Patients aged 20-60 years, scheduled for elective surgical procedures, with American Society of Anaesthesiologists (ASA) Physical Status I or II, were included. Both male and female patients were eligible provided they had the ability to understand the questionnaire and give informed consent. Exclusion criteria included known psychiatric illness or current use of anxiolytic or psychoactive medications, emergency surgery, communication barriers (such as language difficulty, hearing impairment, or cognitive issues), history of major surgery within the preceding six months and refusal to participate. A total of 65 patients who met the inclusion criteria were enrolled. No patients were excluded during the study period among those screened who met the eligibility criteria.

A convenience sampling technique was used to recruit consecutive eligible patients scheduled for elective major surgeries performed under general and regional anaesthesia were included.

Study Procedure

On the day prior to surgery, during routine PAC, eligible patients were identified and informed consent was obtained. Demographic details were recorded. The APAIS was used as the study tool [5]. APAIS consists of six items: an anxiety subscale (4 questions, score range 2-10 interpreted as low 2-4, medium 5-7, high 8-10) and an information requirement subscale (2 questions). Patients with a score of 2-4 on the information scale can be classified as having no or little information requirement. Patients with a score of 5-7 can be classified as having an average information requirement and those with a score of 8-10 as having a high information requirement. The questionnaire was administered in the patient's preferred language on the previous day of surgery during the routine ward PAC by the anaesthesiology postgraduate who was not involved in the patient care. APAIS scores were recorded at three time points by the same anaesthesiology postgraduates who were not involved in the patient's PAC: 1. before PAC; 2. immediately after PAC (during which routine explanation of surgery and anaesthesia was provided and all patient questions were answered); and 3. on the day of surgery after standard anxiolytic premedication in the patient holding area. A pilot test was conducted on ten participants, ASA I and II belonging to the age group between 20-60 years coming for elective major and minor surgery to ensure clarity and ease of administration. The primary outcome of the present study was to evaluate the change in APAIS anxiety scores across three time points: before PAC, after PAC, and on the day of surgery. The secondary outcomes included assessing the change in APAIS information requirement scores, evaluating the influence of age, gender, and co-morbidities on both anxiety and information scores, and determining whether the APAIS effectively captures changes in anxiety following PAC and premedication.

STATISTICAL ANALYSIS

All data were analysed using IBM Statistical Package for Social Sciences (SPSS) Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarise demographic and baseline characteristics. Continuous variables (age) were presented as mean±SD, while categorical variables (gender, ASA status, co-morbidities) were presented as frequencies (n) and percentages (%). Normality of APAIS scores was assessed using the Shapiro-Wilk test and confirmed ($p>0.05$), justifying the use of parametric tests. Paired t-tests were used to compare APAIS scores across three time points (before PAC, after PAC and on the day of surgery) with a Bonferroni-corrected significance threshold of $p<0.017$. The Chi-square test was used to evaluate associations between categorical variables and APAIS anxiety/information categories.

RESULTS

A total of 65 patients were included in the study. The demographic characteristics of the study are shown in [Table/Fig-1]. The majority of participants were in the 35-44 years age group (46.1%), followed by 20-34 years (23.1%) and >45 years (30.8%). Females constituted nearly two-thirds (64.6%) of the study population, reflecting a significant female predominance in the study population. The majority of patients (72.3%) were classified as ASA-PS I (healthy individuals), while the remaining 27.7% were ASA-PS II (mild systemic disease). There were 5 (7.69%) patients with diabetes and 13 (20%) patients with hypertension disease.

In the present study, anxiety and information scores in different age groups were compared [Table/Fig-2]. No statistically significant

Variables		n (%)
Age (in years)	20-34	15 (23.1%)
	35-44	30 (46.1%)
	>45	20 (30.8%)
Gender	Male	23 (35.4%)
	Female	42 (64.6%)
ASA-PS	I	47 (72.3%)
	II	18 (27.7%)
Co-morbidities	No co-morbidities	47 (72.3%)
	Diabetes	5 (7.69%)
	Hypertensive	13 (20%)

[Table/Fig-1]: Showing demographic distribution of the study population.

association was observed between age and anxiety levels at different time points (p>0.05). Although younger patients showed slightly higher anxiety before the PAC, all age groups demonstrated a significant reduction in anxiety following PAC. This indicates that PAC effectively reduces anxiety regardless of age.

Comparison between the anxiety and the gender was done and shown in [Table/Fig-3]. There was no statistically significant association between gender and anxiety levels at any of the three time points (p>0.05). Both genders demonstrated a marked reduction in anxiety after PAC, indicating that pre-anaesthetic counselling is equally effective for males and females. Information-need scores were also comparable between genders at all-time points (p>0.05), suggesting that gender does not influence patients' desire for perioperative information.

Time point	Category	Total N	20-34 y n (%)	35-44 y n (%)	≥45 y n (%)	χ^2	p-value
Before PAC	Anxiety - low	12	4 (26.7)	6 (20.0)	2 (10.0)	2.00	0.736
	Anxiety – medium	13	2 (13.3)	6 (20.0)	5 (25.0)		
	Anxiety - high	40	9 (60.0)	18 (60.0)	13 (65.0)		
	Information - little	58	14 (93.3)	26 (86.7)	18 (90.0)	1.357	0.852
	Information - average	6	1 (6.7)	3 (10.0)	2 (10.0)		
	Information - high	1	0	1 (3.3)	0		
After PAC	Anxiety - low	58	14 (93.3)	25 (83.3)	19 (95.0)	4.05	0.399
	Anxiety – medium	5	0	4 (13.3)	1 (5.0)		
	Anxiety - high	2	1 (6.7)	1 (3.3)	0		
	Information - little	61	15 (100)	28 (93.3)	18 (90.0)	3.315	0.507
	Information - average	3	0	1 (3.3)	2 (10.0)		
	Information - high	1	0	1 (3.3)	0		
On day of surgery	Anxiety - low	55	13 (86.7)	23 (76.7)	19 (95.0)	3.48	0.480
	Anxiety - medium	4	1 (6.7)	3 (10.0)	0		
	Anxiety - high	6	1 (6.7)	4 (13.3)	1 (5.0)		
	Information - little	61	15 (100)	28 (93.3)	18 (90.0)	3.315	0.507
	Information - average	3	0	1 (3.3)	2 (10.0)		
	Information - high	1	0	1 (3.3)	0		

[Table/Fig-2]: Comparison of APAIS Score in different age group.

Time point	Category	Total N	Male n (%)	Female n (%)	χ^2	p-value
Before PAC	Anxiety - low	12	5 (21.7)	7 (16.7)	3.233	0.199
	Anxiety - medium	13	7 (30.4)	6 (14.3)		
	Anxiety - high	40	11 (47.8)	29 (69.0)		
	Information - little	58	20 (87.0)	38 (90.5)	1.858	0.395
	Information - average	6	2 (8.7)	4 (9.5)		
	Information - high	1	1 (4.3)	0		
After PAC	Anxiety - low	58	19 (82.6)	39 (92.9)	1.687	0.430
	Anxiety - medium	5	3 (13.0)	2 (4.8)		
	Anxiety - high	2	1 (4.3)	1 (2.4)		
	Information - little	61	21 (91.3)	40 (95.2)	1.856	0.395
	Information - average	3	1 (4.3)	2 (4.8)		
	Information - high	1	1 (4.3)	0		
On day of surgery	Anxiety - low	55	19 (82.6)	36 (85.7)	0.402	0.818
	Anxiety - medium	4	2 (8.7)	2 (4.8)		
	Anxiety - high	6	2 (8.7)	4 (9.5)		
	Information - little	61	21 (91.3)	40 (95.2)	1.856	0.395
	Information - average	3	1 (4.3)	2 (4.8)		
	Information - high	1	1 (4.3)	0		

[Table/Fig-3]: Comparison of APAIS score according to gender.

Comparison of co-morbidities and anxiety and information score in the study is represented in [Table/Fig-4]. There was no statistically significant association between co-morbidity status and preoperative anxiety scores at any of the three time points (p>0.05). Although hypertensive patients showed medium anxiety levels before PAC and diabetic patients consistently showed low anxiety, these differences were not statistically significant. All co-morbidity groups demonstrated a marked reduction in anxiety after the PAC, suggesting that counselling benefits patients uniformly. Information-need scores were also comparable across groups (p>0.05), indicating that co-morbid conditions such as diabetes or hypertension do not influence the patient's desire for perioperative information.

Anxiety scores were lower on the day of surgery compared to baseline; however, this difference did not remain statistically significant after Bonferroni correction (p=0.022; adjusted significance threshold p<0.017) shown in [Table/Fig-5,6]. These findings demonstrate that pre-anaesthetic counselling produces a meaningful and lasting reduction in preoperative anxiety.

DISCUSSION

Preoperative anxiety was significantly lower immediately after the PAC compared to baseline (p=0.001). Although anxiety scores on the day of surgery remained lower than baseline, the difference did not retain statistical significance after Bonferroni correction (p=0.022). A consistent and significant reduction in anxiety scores was observed after PAC across all demographic groups. Although anxiety showed a mild increase on the day of surgery, this change was not statistically significant. Kindler CH et al., (2000) used Visual analogue scale at time points and reported a significant post-PAC reduction (p<0.01) with no significant change on surgery day, closely mirroring the present results [10]. In contrast, Caumo W et al., (2001) found that patients receiving only an unstructured pre-anaesthetic visit experienced a significant increase in anxiety on the surgery day (p=0.03), suggesting that the parameter of consultation thoroughness directly influences the durability of anxiety reduction-a factor well-controlled in the PAC protocol [11].

Regarding age, the study observed no statistically significant association between age and preoperative anxiety and information-need scores. Although younger patients demonstrated slightly higher initial anxiety levels, the overall patterns across different age groups were not significant. Similar studies comparing the parameter of age stratification (e.g., <45 vs. >60 years, or continuous age as a linear variable) have produced mixed results. Eberhart L et al., similarly found no independent effect of age on APAIS scores after controlling for co-morbidities and prior surgical experience, consistent with the current study's results [2]. More recent evidence has highlighted that factors such as prior surgical experience, personality traits and coping style may influence anxiety levels more strongly than chronological age [12-14]. A systematic review and meta-analysis by Abate SM et al., identified previous exposure to anaesthesia or surgery as a significant protective factor against preoperative anxiety, whereas age alone was not a consistent predictor across diverse study populations [12]. Acar et al., demonstrated that younger age, female gender, and the presence of systemic disease were associated with higher preoperative anxiety, while the need for information remained elevated among patients with chronic illness regardless of anxiety

Time point	Category	Total N	No co-morbidity n (%)	Diabetes n (%)	Hypertension n (%)	χ^2	p-value
Before PAC	Anxiety - low	12	10 (21.3)	0	2 (15.4)	4.319	0.365
	Anxiety - medium	13	9 (19.1)	0	4 (30.8)		
	Anxiety - high	40	28 (59.6)	5 (100)	7 (53.8)		
	Information - little	58	41 (87.2)	5 (100)	12 (92.3)	1.07	0.898
	Information - average	6	5 (10.6)	0	1 (7.7)		
	Information - high	1	1 (2.1)	0	0		
After PAC	Anxiety - low	58	42 (89.4)	5 (100)	11 (84.6)	2.351	0.671
	Anxiety - medium	5	3 (6.4)	0	2 (15.4)		
	Anxiety - high	2	2 (4.3)	0	0		
	Information - little	61	43 (91.5)	5 (100)	13 (100)	1.63	0.803
	Information - average	3	3 (6.4)	0	0		
	Information - high	1	1 (2.1)	0	0		
On day of surgery	Anxiety - low	55	39 (83.0)	5 (100)	11 (84.6)	4.836	0.305
	Anxiety - medium	4	2 (4.3)	0	2 (15.4)		
	Anxiety - high	6	6 (12.8)	0	0		
	Information - little	61	43 (91.5)	5 (100)	13 (100)	1.63	0.803
	Information - average	3	3 (6.4)	0	0		
	Information - high	1	1 (2.1)	0	0		

[Table/Fig-4]: Comparison of APAIS score and co-morbidities.

Parameters	Mean±SD	p-value
Anxiety score		
Before PAC	5.2615±2.27264	0.002
After PAC	4.2923±1.01123	
Day of surgery	4.5692±1.39160	
Information score		
Before PAC	3.0615±1.40175	<0.001
After PAC	2.3538±1.05224	
Day of surgery	2.4923±1.11975	

[Table/Fig-5]: Anxiety and information scores across time points.
Values are expressed as Mean±Standard Deviation (SD). Overall p-values were calculated using repeated measures ANOVA to compare anxiety and information scores across the three assessment time points (before pre-anaesthetic check-up, after pre-anaesthetic check-up, and on the day of surgery).

Anxiety score	Mean difference	t	df	p-value
Before PAC vs after PAC	0.96923	3.484	64	0.001
After PAC vs day of surgery (after premedication)	-0.27692	-1.893	64	0.063
Before PAC vs day of surgery (after premedication)	0.69231	2.347	64	0.022
Information score				
Before PAC vs after PAC	0.70769	4.881	64	0.001
After PAC vs day of surgery (after premedication)	-0.13846	-1.760	64	0.083
Before PAC vs day of surgery (after premedication)	-0.56923	-3.502	64	0.001

[Table/Fig-6]: Pairwise comparison of anxiety and information scores using paired t-test.

status. [13]. Furthermore, findings from Napora J et al., suggest that perioperative anxiety cannot be explained by age alone, with psychological and perception-related factors appearing to play a more substantial role in influencing anxiety levels among surgical patients [14]. These contemporary findings support the conclusion that the lack of age-related differences across all three time points in the present study aligns with current literature, reinforcing that prior healthcare experiences and psychological characteristics outweigh demographic factors in determining preoperative anxiety levels.

Gender-related differences were not statistically significant at any time point. However, it is important to note that the sample did not have an equal distribution of male and female participants, which limits the validity of direct gender comparisons for anxiety scores. Similar studies comparing the parameters of gender distribution balance (equal vs. unequal), sample size per gender group and type of information needs measured (APAIS information sub-score vs. separate questionnaires) have shown consistent findings [15-17].

The study assessed chronic illnesses such as diabetes and hypertension in relation to anxiety scores. These co-morbidities showed no significant association with anxiety or information-need scores. This is consistent with Bedaso A and Ayalew M and Wang R et al., who reported that chronic illness alone does not predict preoperative anxiety unless symptomatic or poorly controlled [7,8]. Patients with diabetes demonstrated uniformly low anxiety after PAC, possibly due to greater healthcare familiarity. This aligns with Williams JB et al., who found that well-controlled chronic conditions do not independently elevate anxiety [17]. These findings reinforce that effective PAC counselling reduces anxiety more than the mere presence of co-morbidities.

A major strength of the present study was the use of a validated tool (APAIS) administered at multiple time points, allowing objective assessment of anxiety changes. The real-world clinical setting enhances the applicability of the findings to routine perioperative practice. In the present clinical setting, the APAIS proved to be a highly useful tool for assessing preoperative anxiety and information needs and future large-scale multicentre studies are recommended to confirm these findings across diverse surgical populations.

A consistent and significant reduction in anxiety scores was observed after PAC across all demographic groups. This validates the well-established role of preoperative counselling in alleviating patient anxiety, as reported in the past adequate and effective preoperative communication lowers anxiety and may even reduce anaesthetic requirements. The authors findings indicate that structured PAC benefits all patients equally, regardless of age, gender, or co-morbidity status.

Limitation(s)

The single-centre design with convenience sampling may limit the generalisability of the findings. The assessors administering the APAIS questionnaire were not blinded to the study objectives, which may introduce measurement bias. Anxiety was assessed only up to the day of surgery; postoperative anxiety scores were

not evaluated. Finally, the absence of a control group without PAC counselling makes it difficult to attribute anxiety reduction solely to the PAC.

CONCLUSION(S)

The PAC plays a far more significant role in reducing preoperative anxiety than any demographic or clinical characteristic of the patient. Routine explanations provided during PAC are sufficient to address most patient concerns, eliminating the need for additional or specialised psychological interventions in typical cases. Unlike factors such as age, gender, education level, or surgical history- which have only minimal influence- the quality and delivery of the PAC itself consistently predicts lower anxiety scores. These findings demonstrate that PAC is universally effective across diverse patient populations, making it an indispensable component of routine anaesthesia practice. By prioritising and standardising the PAC, anaesthesia providers can substantially enhance patient comfort, reduce preoperative distress and improve the overall surgical experience. Therefore, healthcare systems should reinforce the consistent implementation of PAC as a simple, cost-effective and highly impactful strategy for perioperative anxiety management.

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