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Assessing Preoperative Anxiety: Comparison of three simple Anxiety Scales

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Abstract

Background: Preoperative anxiety is a significant concern for many patients undergoing elective surgery as it can negatively impact many aspects of anesthesia. Perioperative anxiety is associated with increased autonomic variability, higher anesthetic and analgesic requirements, and a greater incidence of nausea, vomiting, and pain during the early postoperative period. This prospective study was designed to compare the assessment of acute preoperative (state) anxiety using a visual analog scale (VAS), the Categorical Anxiety Scale (CAS) and a novel emoji-based Visual Facial Anxiety Scale (VFAS).

Methods: 293 adult patients undergoing elective surgical procedures were enrolled **in this observational,** prospective cohort study. In the preoperative evaluation area, anesthesia providers were questioned about their methods for assessing preoperative anxiety. After the anesthesiologists completed their evaluations and left the area, a co-investigator administered three anxiety assessment tools to the patients in a random order in the preoperative holding area before they entered the operating room.

Results: There was a significant correlation ($p<0.0001$) among the anxiety scores of the three simplified scales [VFAS vs VAS ($r=0.738$), VFAS vs CAS ($r=0.759$), and VAS vs CAS ($r=0.861$)]. The means and standard deviations of the score values for each of anxiety scales were: VFAS 2.02±0.94, VAS 3.39±2.5, and CAS 2.41±1.29. The times to perform the VFAS (7.3 ± 1.6 sec), VAS (7.2 ± 1.6 sec), and CAS (7.3 ± 1.9 sec) assessments were similar for the three scales. The patient's top-ranked assessment scale was the VFAS (73%), followed by the VAS (15.6%) and the CAS (11%). The anesthesiologists' top ratings were given to the VFAS (64%), followed by the VAS (22%), and the CAS (14%).

Conclusions: All three of the simple analog-based scales were highly correlated for assessing acute (state) anxiety and required only a short time to complete (<15 sec). The emoji-based scale was rated most highly by the patients.

Highlights

- Assessment of preoperative anxiety was performed using three simplified anxiety scales, the Visual Analog Scale (VAS), and the Categorical Anxiety Scale (CAS) and a novel emoji-based Visual Facial Anxiety Scale (VFAS).
- These three simplified anxiety scales (VFAS, VAS, and CAS) were comparable for assessing anxiety in the immediate preoperative period and all required less than one minute to complete. However, the VFAS was the preferred measurement tool by the patients.

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- Simple anxiety assessment tools could be routinely employed in the preoperative period to minimize the under (and over) treatment of patients with anxiolytic premedicant drugs.

Keywords: Assessing preoperative anxiety; Simplified anxiety scales; Visual analog scale; Categorical anxiety scale; Visual facial anxiety scale

Introduction

During the immediate preoperative period, patients commonly experience significant anxiety [1,2]. Optimizing the management of preoperative anxiety has the potential to mitigate common perioperative complications and enhance recovery processes [3-11]. However, conducting an anxiety assessment can be time-consuming in busy preoperative holding areas. Therefore, it is crucial to employ a tool for measuring acute (state) anxiety that is both sensitive and can be administered rapidly in busy preoperative environment. Excessive preoperative anxiety levels has been correlated with higher requirements for anesthetic and analgesic medications, increased occurrences of nausea, vomiting, severe pain, and extended discharge times [11-15]. Furthermore, anxiety has been linked to a higher incidence of bronchospasm among asthmatic patients, elevated mortality rates post cardiac surgery, and delayed wound healing following surgery [16-19]. Anxiety often stems from concerns related to past surgical or anesthetic experiences [20-26].

Several tools have been used to assess preoperative anxiety including the 'gold standard' state-trait anxiety inventory (STAI), the Beck anxiety inventory (BAI), hospital anxiety and depression scale-anxiety (HADS-A), the Amsterdam preoperative anxiety and information scale (APAIS), Perioperative Anxiety Scale-7 (PAS-7), and the Yale preoperative anxiety scale (YPAS) [27-33]. Although highly accurate, mostly of these assessment tools are very time consuming to complete and therefore, impractical in a busy preoperative holding area [34,35]. Alternative evaluation tools which are less time consuming to administer include the visual analog scale (VAS), Visual Facial Anxiety Scale (VFAS), and categorical anxiety scale (CAS) [36-38].

The primary objective of this study was to compare the novel simplified VFAS to the VAS, and the CAS for assessing a patient's level of acute preoperative anxiety in the preoperative holding area. The secondary objective was to assess the causes of preoperative anxiety reported by this elective surgery population.

Methods

This observational, prospective cohort study (IRB # Pro00043383) was approved by the Institutional Review Board (IRB) at Cedars-Sinai Medical Center in Los Angeles, CA on [8/10/2016]. Of the 302 patients who met the study entrance criteria, 293 gave written-informed consent to participate in the study and all successfully completed the study. Inclusion criteria of the study population consisted of 293 ASA I-III patients (>18 yo), scheduled to undergo elective surgery (e.g., general, orthopedic, and OB/GYN procedures). Exclusion criteria included patients with Alzheimer's disease, dementia, any psychiatric diseases, or mental retardation, as well as patients taking chronic anti-anxiety, antidepressant, or sedative medications.

The attending anesthesiologists met with patients after they were admitted to the preoperative evaluation area and explained that the purpose of the study and obtained a signed written consent form from each patient. The investigator was present to observe the routine perioperative evaluations by the attending anesthesiologists and to record the method, if any, used to evaluate the patient's level of preoperative anxiety. When the preoperative evaluation by the attending anesthesiologist was concluded they left the area while a co-investigator performed the three anxiety assessments tools in the preoperative holding area. Patient demographics were obtained from the medical records and medical history provided by the patients including age, gender, ethnicity, psychiatric history, co-morbidities, smoking and substance abuse history. Additional demographic information included marital status, education level, current living situation, health insurance coverage, chronic anxiety and pain medication, type of elective surgery, anesthesia and surgical history, as well as any previous surgery and anesthesia-related complications.

Study procedure

Upon enrollment in the clinical trial, patients were administered the three anxiety measurement scales namely the VFAS (Figure 1a), VAS (Figure 1b), CAS (Figure 1c). All tools were administered in a random order to reduce bias associated with fixed-sequence testing administration. While patients completed the evaluation tools, a study staff member, not involved in administering the evaluations recorded the time it took patients to complete each of the 3 anxiety evaluation tools using a hand-held stopwatch. Time measurements were performed discreetly to minimize the 'Hawthorne' effect bias' [39]. All study evaluations were completed in the preoperative evaluation area prior to entering the operating room (OR). Participants did not receive any sedative-anxiolytic premedication prior to the completion of their anxiety evaluation tests.

Following completion of the three anxiety evaluation tools, patients were asked to rank their preferred evaluation tool (i.e., the assessment tool which most accurately reflected their level of anxiety), and the cause(s) of any preoperative anxiety. The specific causes of anxiety were selected by the patients from a list provided by the study personnel and included: (1) fear of death, (2) waiting to enter the operating room (OR), (3) insufficient information regarding surgery/

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anesthesia, (4) fear of the operation or anesthesia (e.g., being awake during operation), (5) fear of needles and other interventions, (6) postoperative pain, sedation and/ or postoperative nausea and vomiting, (7) need for a blood transfusion, (8) physical and mental harm, (9) lack of medical insurance coverage, (10) concerns about family and friends, potential financial loss due to time away from work, and being at the mercy of medical staff.

All surgical and anesthesia protocols followed the prescribed standard of care at Cedars-Sinai Medical Center in Los Angeles. Preoperative sedative, intraoperative and postoperative anesthetic and analgesic drugs were recorded. Data on anesthesia time, surgery time, and PACU stay time were also recorded. On admission to the PACU, the patients pain score was evaluated on a 10-point visual analog scale.

Explanations of the three assessment tools (Figure 1)

(1) **VFAS (1a.)**: face one (zero/no anxiety), face two (1-2/ mild anxiety), face three (3-4/ mild-moderate anxiety), face four (5-6/moderate anxiety), face five (7-8/ moderate-high anxiety), face six (9-10/ high anxiety).

(2) **VAS (1b.)**: zero (no anxiety), 1-2 (mild anxiety), 3-4(mild-moderate anxiety), 5-6 (moderate anxiety), 7-8 (moderate-high anxiety), 9-10 (high anxiety).

(3) **CAS (1c.)**: zero (no anxiety), 1-2 (mild anxiety), 3-4 (mild-moderate anxiety), 5-6 (moderate anxiety), 7-8 (moderate-high anxiety), and 9-10 (high anxiety).

Statistical analysis

A sample size of 293 patients was compared via means based on the type of anxiety assessment tool. Means were meant to be compared by power analysis based on the assumption that the time, preference of the VFAS test were similar among the groups. The correlation analysis between VFAS, VAS, and CAS were conducted via Spearman's rank correlation analysis utilizing ranked data, in order to draw comparisons similar to correlations to VAS, the Amsterdam Preoperative Anxiety and Information Scale, and STAI in the literature.[32] From the studies described in the literature, the coefficient alphas of VAS, and STAI (Cα1) were determined to be 0.80 and the coefficient alphas of VAS and STAI (Cα2) was determined to be 0.70. The sample size to achieve 80% statistical power to detect a difference between the alpha coefficients of each group was determined to be 293 participants.

The analysis was performed using SAS 9.4 for Windows (SAS Institute, Cary, NC, USA) and R. 3.0.1. Our dataset contained both categorical and continuous measurements. For categorical measures, we presented total numbers (n) with the percentages (%) and used Chi-squared test to conduct comparisons of the groups. For continuous measurements, mean values and standard deviations were presented for comparison. For comparisons among continuous and ordinal measures, the Kruskal-Wallis Test was conducted. Data are presented as mean ± SD, numbers (n), and percentages (%), with p-values less than or equal to 0.05 considered statistically significant.

Results

A total of 293 patients (53% females and 47% males) were recruited to participate in the study. 17% of the patients took an antianxiety medication on the night before surgery and 33% took a non-opioid analgesic medication on the night prior to surgery. Demographic and clinical characteristics of the study population are summarized in table 1.

The demographic variables which were associated with significantly-different mean preoperative anxiety scores on one or more of the three anxiety scales were: (1) Gender (female > male): (p<.0001), (2) Age (< 40 yo > 40-60 yo and >60 yo): (p=0.001), (3) Marital status (married > single): (p=0.032), (4) Patients who did not take anxiety medication on the night before surgery had higher anxiety scores than those who took an anxiety medication on the night prior to the operation (p=0.018), (5) Previous surgery had higher anxiety scores than those undergoing their first operation (p=0.0006), (6) Previous anesthetic complication (vs. no previous anesthetic complications) (p=0.035), and (7) Patients who had 3-5 previous surgical procedures (vs. none, 1-2 or > 5 previous surgical procedures) (p=0.026) (Table 1**).**

The preferred preoperative anxiety scale (using a 4-point rating scale) by patients was the VFAS scale (73%), followed by the CAS (15.6%) and the VAS (11.4%). The means and standard deviations of the score values for each of anxiety scales were: VFAS 2.02±0.94, VAS 3.39±2.5, and CAS 2.41±1.29 (Table 2). The times required for performing each of the anxiety evaluations were comparable: VFAS (7.3 ± 1.6 sec), VAS (7.2 ± 1.6 sec), and CAS (7.3 ± 1.9 sec) (Table 2). There was a significant Spearman's Correlation (SC) among the anxiety scores of the three simplified scales [VFAS vs VAS (r=0.738), VFAS vs CAS (r=0.759), and VAS vs CAS (r=0.861)], with p-values <0.0001) (Table 3).

No significant correlations were found between the scales based on the patient's preoperative anxiety score with respect to preoperative waiting time, surgery/anesthesia time, surgery-anesthesia start time, PACU stay, patients with and without preoperative pain, or pain score at PACU or during discharge PACU and PACU analgesic requirement in morphine equivalents (Table 4).

Furthermore, there was a significant correlation between the preoperative anxiety score and the maximum pain score in the PACU for the VFAS scale (p= 0.0359). In addition, there was a correlation between the preoperative anxiety score and the maximum pain score prior to discharge for all three scales: VFAS (p=0.0008), VAS (p=0.008), and CAS (p=0.0063), (Table 4).

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Table 1: Demographic, clinical characteristics, and types of surgery of adult patients undergoing elective surgery and Spearman's correlation between preoperative anxiety scores using the Visual Facial Anxiety Scale (VFAS), the Visual Analog Scale (VAS), and the Categorical Anxiety Scale (CAS) as anxiety assessment tools.

Variables/ *p values*	**VFAS**	**VAS**	**CAS**
Gender: female* (53%)/male (47%)	**0.0022***	**<.0001***	**<.0001***
Age: <40 *(21%)/ >40 <60 (32%)/ >60 (47%)	0.857	0.775	0.461
ASA: 1 (15%) /2 (50%) /3 (35%)	0.128	0.184	0.225
Marital status: married* (57%)/single (43%)	**0.0328***	0.503	0.742
Living condition: alone (79.2%)/ with others (20.8)	0.213	0.646	0.555
Educational status (years)	0.667	0.202	0.65
<10y (0.3%)/ 10-15y (15.7%)/ >15 (84%)			
Tobacco user: current (1%)/former (4.4%), nonsmoker (94.6%)	0.287	0.21	0.725
Patients who took anxiety meds before preadmission (17.41%)	0.277	**0.0314***	**0.0185***
Patients who took pain medications before preadmission (32.76%)	0.085	0.352	0.077
Type of surgery: general (46%), orthopedic (27%)_NeuroSpine (16%), cardiothoracic (5%), vascular (3%), OB/GYN (3%)	0.52	0.259	0.419
Type of anesthesia:	0.619	0.775	0.256
general anesthesia (76%), MAC sedation (24%)			
Current Surgery Sequence:	0.123	0.663	0.67
None (10%), 1-2 (34%), 3-5* (33%), >5 (22%), No answer (1%)			
Patients with prior Surgery (89%)	0.556	0.072	0.125
Patients with prior Surgery with complications (9%)	0.791	0.968	0.864
Patients with prior anesthesia (92%)	0.518	0.613	0.653
Patients with prior anesthesia with complications (7%)	0.06	0.1	0.155

Percentages (%), p value <0.05*

Table 2: Preoperative Anxiety scale scores using the Visual Facial Anxiety Scale (VFAS), the Visual Analog Scale (VAS), and the Categorical Anxiety Scale (CAS) as anxiety assessment tools.

Anxiety scale scores (minimum-maximum scores)	**Means value (± SD)**	**Median -Range values**
VFAS (1-6)	2.02 ± 0.94	2 (1-5)
VAS (0-10)	3.39 ± 2.50	3 (0-10)
CAS (1-6)	2.41 ± 1.29	2 (1-6)
Evaluation Times (sec)		
VFAS	7.29 ± 1.61	7 (1-13)
VAS	7.23 ± 1.60	7 (4-14)
CAS	7.29 ± 1.99	7 (1-13)

Values are presented in Mean ± Standard Deviation (SD)

Table 3: Spearman's correlation coefficients among the anxiety scores of the Visual Facial Anxiety Scale (VFAS), the Visual Analog Scale (VAS), and the Categorical Anxiety Scale (CAS) as anxiety assessment tools.

Preoperative Anxiety Scales	**Correlation Coefficient (r)**	**p-value**
VFAS vs VAS	0.738*	p<0.0001
VFAS vs CAS	0.759*	p<0.0001
VAS vs CAS	0.861*	p<0.0001

Significant p value <0.0001*

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Table 4: Preoperative, intraoperative and postoperative assessments of adult patients undergoing elective surgery and their preoperative anxiety scores correlations between the Visual Facial Anxiety Scale (VFAS), the Visual Analog Scale (VAS), and the Categorical Anxiety Scale (CAS) as anxiety assessment tool.

Variables	VFAS	VAS	CAS
Preoperative			
Preoperative pain score	p=0.469	p=0.533	p= 0.645
Waiting time (preoperative area)	p=0.278	p=0.653	p=0.421
≤120min/ ≥121 min			
Anesthesia start time:			
7-11AM			
11AM-3PM	p=0.798	p=0.359	p=0.307
3-7PM			
Intraoperative medications			
IV propofol	p= 0.596	p= 0.57	p= 0.879
Total IV Morphine Eq	p=**0.0171***	p= **0.0292***	p= **0.0269***
Surgery Time ≤120 min/ ≥ 121 min	p=0.729	p=0.457	p=0.42
Anesthesia Time ≤120 min/ ≥ 121 min	p=0.314	p=0.245	p=0.183
PACU Variables			
Duration of PACU stay	p=0.639	p=0.5005	p=0.6497
Pain scores upon admission to the PACU	p=0.149	p= 0.388	p= 0.4042
Maximum pain score in the PACU	p= **0.0359***	p= 0.13	p=0.1225
Pain score at discharge PACU	p=**0.0008***	p=**0.008***	p=**0.006***
Opioid analgesics (IV morphine equivalents)	p=0.293	p=0.451	p=0.4244

Significant p value <0.05*

The most frequent causes of preoperative anxiety reported were: (1) waiting in pre-operation area 165 (56%), (2) pain 125 (43%), (3) concern about their family 119 (41%), (4) lack of information about the operation, 117 (40%), (5) lack of information regarding anesthesia 92 (31%), (6) needles/ catheters 87 (30%), (7) fear of the operation 81 (28%), (8) not awakening from anesthesia 77 (26%), (9) loss of control 72 (25%), (10) "awareness" during anesthesia 69 (24%), (11) postoperative nausea and vomiting 64 (22%), (12) fear of anesthesia 58 (20%), (13) physical and mental harm 53 (18%), (14) financial loss 49 (17%), (15) inadequate insurance coverage 49 (17%), (16) being at the mercy of the medical staff 47 (16%), (17) requiring blood transfusion 46 (16%), (18) miscellaneous reason 30 (10.5%).

Discussion

The study focused on the comparison of the VFAS to the VAS and CAS for assessing preoperative anxiety. Results indicated high correlations among all three tools for evaluating anxiety during the immediate preoperative period, each requiring less than one minute to complete. According to published studies [40-42] the incidence of perioperative anxiety ranges from 40-95%, consistent with the finding in our current study.

Considering the significant impact of preoperative anxiety on perioperative outcomes, it remains unclear why many anesthesia practitioners do not routinely assess preoperative anxiety levels as part of their standard preoperative evaluation protocol. We would speculate that possible contributing factors include time constraints, lack of knowledge regarding simple validated assessment tools, and/or a focus on more pressing issues in the preoperative evaluation period.

A simple, rapidly administered anxiety scale as the ones we studied could easily be incorporated into anesthesia providers' routine preoperative evaluation protocol. Implementing this practice would assure that patients with significant anxiety receive appropriate premedication, while those without acute anxiety would avoid unnecessary medications and their potential adverse effects. However, it is noteworthy that some anesthesia providers refrain from administering anxiolytic premedication, even to anxious patients, due to concerns about potential delays in discharge times [43]. Consistent with findings from other studies, [31,44,45] perioperative anxiety was observed more frequently in female patients compared to males. In contrast to earlier studies [46,47] that suggested ASA physical status influenced preoperative anxiety levels, our study did not identify any correlation between anxiety levels and ASA physical status. (Table 1). While previous authors have posited that anxiety levels may be higher in individuals with higher education levels, [48,49] our study

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did not observe significant differences in anxiety levels across varying educational backgrounds. It is noteworthy that a substantial majority of our study participants (84%) had more than 15 years of formal education.

Consistent with our findings, previous studies reported that patients under 40 years of age experience a notably higher incidence of preoperative anxiety compared to older age groups [21,50]. However, a conflicting study did not find a significant difference between younger and older populations [51]. Additionally, it has been documented that patients scheduled to undergo general anesthesia tend to exhibit higher preoperative anxiety levels compared to those scheduled for local or regional anesthesia [1,36]. Interestingly, our study did not identify any statistically significant association between preoperative anxiety and the proposed anesthesia technique.

Patients with a history of prior surgery reported higher preoperative anxiety levels [52,53] Interestingly, other authors have reported a higher prevalence of preoperative anxiety in patients without a history of prior surgery [54]. Our study failed to find significant differences in anxiety levels related to the type of surgery in contrast to earlier studies reporting that the type and the severity of the surgical procedure has also been alleged to be a factor associated with higher levels of preoperative anxiety [52]. Consistent with an earlier study [54] the estimated surgical time did not have a significant influence on the level of preoperative anxiety. Our study also failed to confirm earlier findings that patients receiving anesthesia for the first time have higher levels of anxiety than those with previous anesthetic experiences [54].

It has been suggested that there is a correlation between preoperative anxiety and postoperative pain [55,56]. More accurate knowledge of the patient's level of preoperative anxiety could facilitate the anesthesiologist's ability to predict their patient's anesthetic and analgesic requirements [57,58]. Consistent with our results, previous studies [44,45,59-61] have reported that the most common causes of preoperative anxiety were fear of postoperative pain, awareness during surgery, complications of anesthesia and surgery, loss of control, fear about being "at the mercy" of healthcare professionals during the surgery and physical and mental harm. Future studies should examine the impact of administering anxiolytic medications to patients expressing high levels of acute anxiety on clinical outcomes.

None of the previously reported approaches to evaluating preoperative anxiety have attempted to correlate a visual (emoji-type) representation of a patient's anxiety level with a simple numeric anxiety scale like the VFAS. In this study, the patients preferred the VFAS for evaluating preoperative anxiety level, consistent with the earlier findings of Wong and Baker using a similar visual faces scale to evaluate postoperative pain [62]. These investigators reported that while no single pain assessment scale demonstrated superiority with respect to validity and reliability; however, the facial-based pain scale was preferred by the patients. This emoji-based scale has become a commonly used pain scale in clinical practice [62,63]. In a future study, we plan to evaluate preoperative anxiety by combining the VFAS, VAS and CAS scales into a single scale called the faces anxiety scale (Figure 1d).

Where 0 indicates no anxiety and 10 indicates high level of anxiety

Figure 1a: The Visual Facial Anxiety Scale (VFAS)

0-----1-----2-----3-----4------5-----6-----7-----8-----9-----10

Where zero indicates no anxiety and 10 the highest level of anxiety

Figure 1b: The Visual Analog Scale (VAS)

None ___ Mild ___ Mild-Mod___ Moderate___ Mod-High___ High___

Where None indicates no anxiety and High indicates highest level of anxiety.

Figure 1c: Categorical Anxiety Scale (CAS)

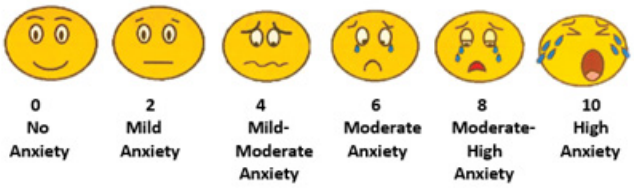

Figure 1d: Combined the Visual Facial Anxiety Scale (VFAS), the Visual Analog Scale (VAS), and the Categorical Anxiety Scale (CAS)

Study limitations

This study was performed at a single academic medical center with a limited number of anesthesiologists (89) participating. A multicenter study with a larger and more diverse population of patients and healthcare providers would have provided more generalizable results. Despite these limitations, the current study will hopefully encourage anesthesiologists and perioperative nurses to begin routinely evaluating preoperative anxiety in the preoperative period and utilize this information to optimize the use of anxiolytic premedicant drugs.

Conclusion

All three of the simple anxiety assessment tools (e.g., the VFAS, CAS and VAS) were highly correlated for assessing anxiety in the immediate preoperative period and required less than one minute to complete (~15 sec). Finally,

incorporating a simple assessment anxiety tool as part of the routine preoperative evaluation process could potentially improve overall patient care by avoiding both over- and under-treatment of surgical patients with sedative-anxiolytic premedicant drugs.

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