

PREOPERATIVE ANXIETY AND STATE-TRAIT ANXIETY INVENTORY, SALIVARY ALPHA-AMYLASE, AND PHYSIOLOGIC MEASUREMENTS

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ABSTRACT

Objectives: To evaluate the presence of anxiety in individuals in the immediate preoperative period by applying the short version of the State-Trait Anxiety Inventory and measure the biomarker salivary alpha-amylase and physiologic parameters to verify the existence of an association between them and the effects of using psychotropic medications to control anxiety. **Methods:** Observational, analytical, and longitudinal study with 64 patients in their immediate preoperative period who would have elective mid-size surgeries. Anxiety was assessed by applying the short version of the State-Trait Anxiety Inventory (short version) and measuring the biomarker salivary alpha-amylase and physiologic parameters (systolic and diastolic blood pressure and heart rate) at two times: after admission of the patient to the infirmary and one hour before they were taken to the operating room. **Results:** there was a statistically significant difference between the results obtained at the two times for the Inventory and systolic and diastolic blood pressure ($p = 0.17$), as well as salivary alpha-amylase and use of psychotropic medications ($p = 0.002$). Additionally, a correlation was found between the differences measured by means of the Inventory at the two times and age ($p = 0.003$). **Conclusion:** the patients had anxiety during the immediate preoperative period. Use of psychotropic drugs showed a direct relationship with decreased salivary alpha-amylase. The score in the short version of the State-Trait Anxiety Inventory (short version) decreased as patient age increased.

Descriptors: Anxiety; Scales; Biomarkers; Elective Surgical Procedure; Preoperative Period.

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INTRODUCTION

Patients submitted to surgical procedures go through the successive pre-, trans-, and postoperative steps. The immediate preoperative period consists of the 24 hours that precede the surgery. Studies with patients in this period have showed prevalence of anxiety ranging from 40% to 79%, since these hours are characterized by moments of pronounced stress caused by the uncertainty about the upcoming events and concerns about the unknown⁽¹⁻⁴⁾.

Preoperative anxiety is an unfavorable emotional state that can have negative consequences in the postoperative period, such as delayed healing of the surgical wound, longer hospital stay, and need to increase anesthetic doses, in addition to psychological implications, including impaired learning and lack of concentration⁽⁵⁾.

There are subjective measuring instruments to assess anxiety. One example is the short version of the State-Trait Anxiety Inventory (IDATE, as per its acronym in Portuguese), a self-report tool considered a model for measuring anxiety that has been widely used, especially in preoperative evaluation. There are also objective measuring instruments, including salivary biomarkers,

which are affordable, easy to use, and noninvasive. Physiologic parameters can be measured for the same purpose too. Some examples are systolic and diastolic blood pressure (SBP and DBP, respectively), heart rate (HR), respiratory rate (RR), and body temperature (T)⁽⁶⁻⁷⁾.

Once anxiety is measured and identified, it can be alleviated. The role of nursing teams to manage patients' preoperative anxiety should be highlighted, since these professionals offer safety for the perioperative process to be dealt with effectively. Positive surgical results and, consequently, greater patient satisfaction, can then be achieved⁽⁴⁾.

Therefore, the present study aims to support the incorporation of simple objective measurements to assess preoperative anxiety in nurses' daily practice so these professionals can implement evidence-based actions capable of mitigating this problem and, consequently, its postoperative consequences.

The objectives of the present study were evaluating the presence of anxiety in patients in the immediate preoperative period by using the following resources: the short version of IDATE, the salivary alpha-amylase

biomarker, and physiologic parameters; and verifying the existence of an association between these measures and the effects of using psychotropic medications to control anxiety.

METHOD

This was an observational, analytical, and longitudinal study carried out in the surgical ward of a general hospital in a municipality in the south of Minas Gerais state, in Brazil, between July and August 2016.

The population of the present study was patients in the immediate preoperative period of elective mid-size surgeries.

The inclusion criteria were being 18 years old or older, being about to be submitted to any elective mid-size surgery, and not having reports regarding impaired cognitive comprehension in the patient record. Patients with diseases in the oral cavity, parotid glands, and salivary glands or mouth cancer were excluded, because these pathologies can affect secretion of salivary alpha-amylase.

By applying non-probability consecutive sampling, 64 participants who met the established eligibility criteria were selected. One of the researchers used her own

financial resources to purchase 100 strips for salivary alpha-amylase measurements, which were imported from China. The import procedures lasted approximately six months. Thirty-six strips were lost as a result of technical problems during the reading device calibration, causing the final sample to be limited to 64 patients.

The outcome variable was anxiety in the immediate preoperative period, and it was measured by means of the short version of IDATE, analysis of salivary alpha-amylase, and physiologic parameters (SBP, DBP, and HR).

In order to evaluate possible differences in anxiety levels, data were collected at two times during the immediate preoperative period: time 1 (t1), after admission of the patient to the infirmary, around 12 hours before the surgical procedure; and time 2 (t2), on the surgery day, one hour before they were taken to the operating room.

At t1, the participants were told about the study objectives and, after signing free and informed consent forms, they participated in an interview for collection of individual data that would be part of the sample characterization. Subsequently, the short version of IDATE⁽⁶⁾ was applied, and saliva

samples were collected for alpha-amylase analysis. The next step was measuring SBP, DBP, and HR. At t₂, the short version of IDATE was applied again, a new saliva sample was obtained to assess alpha-amylase levels, and a second measurement of SBP, DBP, and HR was carried out.

The interview was conducted by applying a semi-structured questionnaire designed by the authors. The tool had its content and face validated by three experts in the studied subject and addresses the independent variables by means of sociodemographic (sex, age, marital status, level of education, consumption of alcohol and tobacco) and clinical (use of psychotropic medications, surgery type, previous surgeries, previous anesthesia or surgery-related complications, and surgical experience) data and information about external events (socioeconomic conditions, family conflicts, diseases and/or deaths in the family), since these factors can trigger anxiety.

The short version of IDATE is a public-domain self-report instrument split into two subscales: one that assesses trace anxiety and another that measures state anxiety. Each is made up of 13 items followed by a 4-point Likert scale. The total score in each scale

ranges from 13 to 49 points, and the higher the score, the higher the anxiety level⁽⁸⁾. In the present study, only the state anxiety subscale was applied, since it evaluates the transitory reaction to an adverse situation that occurs at a certain moment.

Salivary alpha-amylase analysis is carried out by using a disposable test strip that is inserted into the oral or sublingual cavity, where it is kept for 30 to 60 seconds. During the process, 20 to 30 mL of saliva are collected. It is a simple and minimally invasive method, that includes a portable salivary alpha-amylase concentration monitoring device (Cocoro, Nipro, Osaka, Japan. This equipment has a digital display that shows values from 0 to 999 KU/mL. Anxiety levels were categorized according to the manufacturer's standardized classification: values from 0 to 30 indicate no anxiety; between 31 and 45, little anxiety; from 46 to 60, anxiety; and equal to or over 61, great anxiety⁽⁹⁻¹⁰⁾.

The physiologic parameters SBP, DBP, and HR were chosen because they are the vital signs most used in the literature to assess anxiety, given that they are the most sensitive to interventions for reducing anxiety. Measurements of these parameters were

performed by observing their specific reference values and using an Omron HEM-737 validated automatic oscillometric device⁽¹¹⁻¹⁴⁾.

Data were grouped into a database in an electronic spreadsheet by double typing. Descriptive and inferential statistical analyses were carried out by using SPSS software version 24.0.

Comparisons between t1 and t2 regarding the variables IDATE score, salivary alpha-amylase level, SBP, DBP, and HR were made by using Student's paired t-test. A multiple linear regression model was fit to analyze the relationship between the variables in question and changes in IDATE. All the assumptions, such as normality and homoscedasticity of residuals in the case of the regression and normality of the difference in the case of Student's paired t-test, were verified by means of normality tests and graphically, by obtaining histograms and dispersion graphs. Additionally, Spearman's rank correlation coefficients were calculated to quantify the degree of relationship between changes from t1 to t2 in the variables of interest. A level of significance of 5% was

adopted in all analyses.

The present study followed the ethical principles established by National Health Council Resolution no. 466/2012 and the proposal was approved by the Research Ethics Committee at Ribeirão Preto College of Nursing as per report 051/2016 and Certificate of Presentation for Ethical Evaluation 5156.0115.8.0000.5393 on March 04, 2016.

Before data collection, the participants were asked to sign free and informed consent forms that ensured their anonymity and the right to withdraw from the study at any time with no loss.

RESULTS

Half the participants were men, 64.1% completed middle school, 62.5% had no partners, 62.5% did not consume tobacco, and 56.3% did not drink alcohol. The average age was 49.7 years. Among the surgeries, 17 (26%) were in the gastrointestinal system, 14 (22%) were in the muscles, 14 (22%) were gynecologic, 5 (8%) were orthopedic, 4 (6%) were vascular, 4 (6%) were dermatologic, 3 (5%) were endocrinologic, and 3 (5%) were

urological. Regarding comorbidities, 51.7% of the participants had hypertension and 18.7% declared that they used psychotropic medications to control anxiety. More than half (53.1%) had been through more than three surgeries, of whom 89.1% and 93.7% did not have surgical or anesthesia-related complications, respectively.

Table 1 shows the comparison for each variable (t1 vs. t2). The values for all the variables decreased from t1 to t2, and the difference found for SBP was statistically significant ($p = 0.17$).

The presence of a correlation between the differences in salivary alpha-amylase measurements and IDATE scores between t1

Table 1 - Comparison of the measurements of physiologic parameters, salivary alpha-amylase levels, and IDATE scores of the participants ($n = 64$) at two moments (t1 and t2) in the immediate preoperative period in a general hospital. Alfenas, MG, Brazil, 2016.

VARIABLE	MEAN (SD)	ESTIMATED DIFFERENCE (95% CI)	P-VALUE*	TEST POWER [†]
SYSTOLIC BLOOD PRESSURE (SBP) (MMHG)				
Time 1	139.63 (22.4)	7.06 (3.65, 10.48)	< 0.01	0.99
Time 2	132.23 (21.18)			
DIASTOLIC BLOOD PRESSURE (DBP) (MMHG)				
Time 1	86.1 (13.71)	4.88 (2.26, 7.49)	< 0.01	0.95
Time 2	81.29 (13.88)			
HEART RATE (HR) (BEATS/MINUTE)				
Time 1	73.42 (10.2)	1.58 (-0.67, 3.82)	0.17	0.26
Time 2	71.9 (12.41)			
AMYLASE LEVELS (KU/ML)				
Time 1	38.82 (52.18)	6.22 (-5.61, 18.05)	0.30	0.14
Time 2	33.42 (56.45)			
IDATE SCORE				
Time 1	25.5 (5.12)			
Time 2	23.82 (4.46)	2.09 (1.12, 3.07)	< 0.01	0.99

*Paired t-test; [†]Based on a paired t-test, considering a level of significance of 5% and average differences and standard deviations obtained in the sample.

and t2 was checked, as well as between the differences in these two variables and in physiologic and age measurements (Table 2). There were no statistically significant correlations between the differences in salivary alpha-amylase levels and the cited variables. Measurements of differences and IDATE scores showed statistically significant correlations with SBP ($r = 0.249$; $p = 0.048$) and age ($r = -0.367$; $p = 0.003$).

The fraction of participants who used psychotropic medications to control anxiety was 18.7%. In order to test the effects of these drugs on anxiety, IDATE scores, salivary alpha-amylase levels, and measurements of

the physiologic parameters from patients who took these medications at t2 were compared to the data from patients who did not resort to these drugs at t2 (Table 3). A difference between these groups was found for salivary alpha-amylase only, with a lower average for the patients who took psychotropic medications ($p = 0.002$).

Multiple linear regression analysis carried out to analyze the contribution of the explanatory variables to anxiety indicated that the participants over 60 years old had an average IDATE score difference 2.96 points lower than the patients who were 40 years old or younger ($p < 0.01$). Evidence of a

Table 2 - Spearman's coefficients for the differences between t1 and t2 in IDATE scores, salivary alpha-amylase levels, physiologic measurements, and age of the participants ($n = 64$) in the immediate preoperative period in a general hospital. Alfenas, MG, Brazil, 2016.

VARIABLE		DIFFERENCES IN IDATE SCORES	DIFFERENCES IN SBP* (MMHG)	DIFFERENCES IN DBP [†] (MMHG)	DIFFERENCES IN HR [‡] (BEATS/MINUTE)	AGE (YEARS)
Differences in amylase levels (KU/mL)	Correlation coefficient	0.092	0.036	-0.005	0.099	-0.047
	p-value	0.471	0.779	0.966	0.436	0.712
Differences in IDATE scores	Correlation coefficient		0.249	0.216	0.097	-0.367
	p-value		0.048	0.087	0.445	0.003

*Systolic blood pressure; [†]Diastolic blood pressure; [‡]Heart rate

Table 3 - Comparison of mean values of IDATE scores, salivary alpha-amylase levels, and measurements of physiologic parameters between the groups of patients (n = 64) who used and did not use psychotropic medications at t2 during the immediate preoperative period in a general hospital. Alfenas, MG, Brazil, 2016.

VARIABLE	GROUP WITHOUT PRESCRIPTION OF PSYCHOTROPIC MEDICATIONS (N=52) M (DP)*	GROUP WITH PRESCRIPTION OF PSYCHOTROPIC MEDICATIONS (N=12) M (DP)*	P-VALUE†
IDATE score	23,65 (4,48)	24,25 (4,22)	0,669
Salivar alpha-amylase	38,15 (60,55)	10,33 (8,02)	0,002
SBP‡	132,04 (21,29)	129,92 (21,68)	0,763
DRB§	80,44 (14,16)	83,33 (13,28)	0,511
HR	71,35 (12,16)	75,17 (13,33)	0,377

*Mean (standard deviation); †Student's paired t-test; ‡Systolic blood pressure; §Diastolic blood pressure; ||Heart rate.

relationship between alteration in SBP and change in the IDATE score was not found ($p = 0.05$). No variable showed statistically significant differences regarding salivary alpha-amylase. The power of the test based on the estimated regression model was 0.94.

DISCUSSION

During the preoperative period, patients experience fears and agonies that can trigger anxiety. Studies have shown that levels of anxiety range from moderate to high during this interval. This feeling favors physical and mental unbalances that can impact the

postoperative period, leading to complications that can hinder patient recovery. In this context, it is fundamental that patients receive effective care and guidance and be encouraged by health teams, especially the nursing one, which will care for them in the surgical unit, to express their feelings and verbalize their emotions regarding the surgery to reduce their anxiety levels^(2-4,15-16).

A systematic review of prevalence with meta-analysis evaluated 28 studies, totaling 14,652 participants. It identified a combined global prevalence of preoperative anxiety in surgical patients of 48% (95% CI: 39 to 47%)⁽¹⁷⁾. According to a study that analyzed

402 patients in the preoperative period, 47% showed some level of anxiety on the surgery day, especially during the hours before they were taken to the surgical unit rather than immediately before their surgery⁽¹⁸⁾. These results were reinforced by the findings of the present study, which identified greater anxiety at the first moment (t1) followed by a decrease in the feeling at a posterior time (t2) by comparing IDATE scores. It was inferred that these values were higher at t1 because the participants stayed at the hospital reception room for a long period before being admitted to the operating room and that the main causes of anxiety were waiting time, followed by fear of pain in the postoperative period, the unknown, and the anesthetic-surgical procedure itself⁽¹⁹⁾.

The present study verified that the higher the patient age, the lower the score in IDATE. This data is compatible with the findings of other studies that reported that younger people had significantly higher preoperative anxiety scores in comparison with elderly people. This result was related to the fact that individuals experienced fear of death, dependence, and disability during the preoperative period, as well as family concerns, which tends to increase anxiety levels in younger people^(15,20).

It is noteworthy that anxiety is often detected by means of people's accounts and can be confirmed by evaluating vital signs, whose values can be higher as a consequence of the sympathetic stimulation triggered by anxiety, fear, pain, and emotional stress. In situations of stress and anxiety, heart rate can also increase because of the action of epinephrine, secreted by the adrenal medulla^(6,14,21). The findings of the present study corroborated the results of an investigation that proved the existence of a relationship between anxiety scores and HR. In this study, the individuals were evaluated in situations that involved physical and interpersonal threat. Both HR measurements and IDATE scores were used. Their values increased significantly during the stressful situation and returned to the baseline afterwards. Therefore, it can be concluded that cardiac parameters are reliable resources to measure preoperative anxiety⁽²²⁾.

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The present study did not find a correlation between IDATE scores and salivary alpha-amylase levels. This information corroborated an exploratory study that did not identify a relationship between basal levels of this enzyme and IDATE scores in drug-naïve patients with major depressive disorder during their first episode⁽²³⁾. It must be emphasized that these tests have distinct natures, since IDATE is a subjective measure, whereas concentration of salivary alpha-amylase is an objective physiologic measure, and the combination of these two resources is an important tool for anxiety assessment⁽²⁴⁾.

Regarding use of psychotropic

medications to control anxiety, 18.7% of the participants had taken benzodiazepines (clonazepam) the night before the surgical procedure. The average level of salivary alpha-amylase was significantly lower, whereas the other variables showed no difference. Therefore, it is suggested that this type of medication be included in the set of measures to control preoperative anxiety, as soon as it is recommended and prescribed by an anesthesiologist⁽²⁵⁾.

The negative impact of preoperative anxiety on patient recovery and the fact that this feeling contributes to increasing postoperative pain levels confirm the need to promote better adaptation of patients who will submit to a surgical procedure so its results are better. In order to achieve this goal, it is indispensable to adopt measures oriented toward reducing preoperative anxiety, including use of anxiolytic medications and nonpharmacological practices, such as guidance on the procedure and postoperative care^(16,26).

CONCLUSION

The participants were most anxious after admission to the surgical infirmary, around 12 hours before the procedure, rather

than at the moment immediately before they were taken to the operating room. There were statistically significant differences in IDATE scores, SBP, and DBP between these two times (t1 and t2). In addition, patients from an older age group had lower IDATE scores, which indicated that it is satisfactory to evaluate anxiety levels of people in the immediate preoperative period.

Participants who took psychotropic medications to control anxiety had a lower average salivary alpha-amylase concentration. Although an association between this enzyme's levels with IDATE was not found regarding anxiety evaluation, it is suggested that new studies about this subject involve the biomarker and have larger samples.

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