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Visual Analogue Scale for Anxiety and Amsterdam Preoperative Anxiety Scale Provide a Simple and Reliable Measurement of Preoperative Anxiety in Patients Undergoing Cardiac Surgery

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ABSTRACT

Background: Anxiety is an emotional state characterized by apprehension and fear resulting from anticipation of a threatening event.
Objectives: The present study aimed to analyze the incidence and level of preoperative anxiety in the patients scheduled for cardiac surgery by using a Visual Analogue Scale for Anxiety (VAS-A) and Amsterdam Preoperative Anxiety and Information Scale (APAIS) and to identify the influencing clinical factors.
Patients and Methods: This prospective, longitudinal study was performed on 300 cardiac surgery patients in a single university hospital. The patients were assessed regarding their preoperative anxiety level using VAS-A, APAIS, and a set of specific anxiety-related questions. Their demographic features as well as their anesthetic and surgical characteristics (ASA physical status, EuroSCORE, preoperative Length of Stay (LoS), and surgical history) were recorded, as well. Then, one-way ANOVA and t-test were applied along with odds ratio for risk assessment.
Results: According to the results, 94% of the patients presented preoperative anxiety, with 37% developing high anxiety (VAS-A ≥ 7). Preoperative LoS > 2 days was the only significant risk factor for preoperative anxiety (odds ratio = 2.5, CI 95%, 1.3 - 5.1, P = 0.009). Besides, a positive correlation was found between anxiety level (APAISa) and requirement of knowledge (APAISk). APAISa and APAISk scores were greater for surgery than for anesthesia. Moreover, the results showed that the most common anxieties resulted from the operation, waiting for surgery, not knowing what is happening, postoperative pain, awareness during anesthesia, and not awakening from anesthesia.
Conclusions: APAIS and VAS-A provided a quantitative assessment of anxiety and a specific qualitative questionnaire for preoperative anxiety in cardiac surgery. According to the results, preoperative LoS > 2 days and lack of information related to surgery were the risk factors for high anxiety levels.

►*Implication for health policy/practice/research/medical education:*
This study analyzed the incidence and level of preoperative anxiety in the patients scheduled for cardiac surgery by using a visual analogue scale for anxiety (VAS-A) and Amsterdam Preoperative Anxiety and Information Scale (APAIS), along with any influencing clinical factors. Extended preoperative length of stay along with lack of information mainly related to surgery were the crucial factors involved in preoperative anxiety in these patients.

1. Background

Anxiety is an emotional state characterized by apprehension and fear resulting from anticipation of a threatening event. The incidence of preoperative anxiety ranges from 11% to 80% in adult patients, and also varies among different surgical groups (1). Diverse studies performed on patients scheduled for cardiac surgery estimated preoperative anxiety as a leading cardiovascular risk factor (2-4).

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These studies showed that preoperative anxiety might increase the occurrence of complications, such as prolongation of mechanical ventilation, higher incidence of hemodynamic impairment, increase in postoperative pain, major consumption of analgesics, and increased anesthetic requirements, in the immediate postoperative period (2-4). It has also been shown that high preoperative anxiety levels were related to an altered neuroendocrine response which might be deleterious in postoperative period (5, 6). A recent study indicated that anxiety, but not preoperative depression, was associated with an increase in cardiovascular morbidity and mortality, with anxiety being an independent predictor for cardiovascular postoperative events and 4-year mortality (7).

Furthermore, patients scheduled for cardiac surgery may present additional worries and nervousness due to the nature of their cardiac pathology, the concept of heart surgery, and uncertainty about the result. Therefore, it may be desirable to evaluate or quantify anxiety in patients scheduled for cardiac surgery. Up to now, several diverse instruments have been used to evaluate anxiety, including Visual Analogue Scale for Anxiety (VAS-A) (8), State-Trait Anxiety Inventory (STAI) (9), Hospital Anxiety and Depression Scale (HADS) (10), and Amsterdam Preoperative Anxiety and Information Scale (APAIS) (11). HADS and STAI have been widely used in psychological studies on cardiac surgery patients (3, 12-15). However, despite their utility and simplicity, no studies have reported the use of APAIS and VAS-A quantitative scales for assessment of degree of anxiety and preoperative information in these patients.

2. Objectives

The present study aims to analyze the incidence and level of anxiety experienced by non-psychiatric patients scheduled for cardiac surgery by means of APAIS and VAS-A psychological study scales and to identify the clinical determinants of preoperative anxiety.

3. Patients and Methods

After gaining the approval of the Institutional Review Board (IRB) in December 2012, this prospective observational cohort study was performed on 300 consecutive patients scheduled for cardiac surgery with cardiopulmonary bypass who had accepted their participation in the study. The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki. Written informed consents were also obtained from all the patients. The exclusion criteria of the study were being above 18 years old, not being willing to participate in the study, suffering from psychiatric disorders, being under treatment with anti-anxiety agents and/or antidepressants, and having obvious cognitive deficits or language disorders that prevented effective communication.

Pre-anesthetic evaluation and information about anesthesia and surgical proceedings were offered in a pre-anesthesia consultation clinic by an anesthesiologist 10 - 15 days before surgery for the outpatients scheduled for cardiac surgery or in the ward within 24 - 48 hours before surgery for the admitted patients. The day before surgery, the selected patients were interviewed by the main researcher using a questionnaire including demographic characteristics, such as age, sex, and Body Mass Index (BMI), and preoperative data, such as diagnosis, kind of surgery (valve replacement, coronary bypass, other), physical status by using American Society of Anesthesiology (ASA) score, level of operative risk assessed by the European System for Cardiac Operative Risk Evaluation (EuroSCORE), surgical history, and preoperative Length of hospital Stay (LoS) in days. In order to measure the anxiety level, VAS-A scale was applied, asking the patients to indicate their anxiety level using a number between 0 (no anxiety) and 10 (highest anxiety level). Also, APAIS scale was used which included six questions receiving a score between 1 (none) and 5 (most), with a total score of 30. APAIS has an anxiety component (APAISa, 4 questions, maximum 20 points) and a knowledge component (APAISk, 2 questions, maximum 10 points) (Table 1). In addition, a questionnaire including short yes/no questions was applied in order to assess the sources or causes of anxiety preoperatively (Table 2).

The study patients were selected through non-probability convenience sampling. Using the sample size formula and considering the Confidence Interval (CI) of 95% ($\alpha = 0.05$), precision of 6%, planned proportion of 50%, and loss rate of 10%, a 291-patient sample size was determined for the study.

After all, a database was created in the SPSS statistical software for Windows, version 22.0. At first, normal distribution of the data was confirmed using Kolmogorov-Smirnov test. The quantitative variables were expressed as mean ± Standard Deviation (SD), while the categorical ones were presented as percentages. The data were statistically analyzed by student's t-test and one-way analysis of variance (ANOVA) with Bonferroni post-hoc test. For risk assessment, Odds Ratio (OR) was calculated with its 95% CI. A multivariate logistic regression analysis was also applied to evaluate the associations between the variables, with VAS-A distributed in a dichotomous way (VAS-A < 7/VAS-A ≥ 7) (8). P value < 0.05 was considered as statistically significant.

4. Results

This study was conducted on 300 patients (25% female and 75% male). The mean age of the patients was 65 years (range, 28 - 85 years) and their mean of BMI was 28.2 ± 4.2 Kg/m^2. The most common cardiac surgery proceeding was valve replacement (57%) followed by coronary bypass (35%) and other interventions (8%). Additionally, the mean preoperative LoS was 4.2 ± 5.6 days (median, 2 [quartiles 27 - 75, 1 - 4] days). Moreover, 40% of the patients had ASA physical status of III and 60% presented an ASA score of IV. The mean surgical risk measured by EuroSCORE was 7.4 ± 8.5% (median, 4.3 [quartiles 25 - 75, 2.2 - 8.8%]).

In the interview, 94% of the patients showed preoperative anxiety (VAS-A > 0), with 37% developing high anxiety levels (VAS-A ≥ 7).

The mean preoperative anxiety assessed by means of VAS-A scale was 4.6 ± 2.1. No significant difference was found between males and females in this regard (4.6 ± 2.4 vs. 5.3 ± 2.6; P = 0.150). The results revealed a moderate correlation between VAS-A and APAISa score (Pearson coefficient = 0.61). APAIS questions and scores have

Table 1. Amsterdam Preoperative Anxiety and Information Scores

APAIS Question	Female	Male	Total
1. Worried about anesthesia [a]	1.94 ± 1.3	1.6 ± 1.2	1.7 ± 1.2
2. Thinking about anesthesia [a]	1.1 ± 0.3	1.2 ± 0.7	1.2 ± 0.6
3. Wants information about anesthesia [a]	2.0 ± 1.2	2.1 ± 1.3	2.1 ± 1.2
4. Worried about surgery [a]	2.9 ± 1.5	2.7 ± 1.6	2.7 ± 1.6
5. Thinking about surgery [a]	1.5 ± 0.9	1.6 ± 1.2	1.6 ± 1.2
6. Wants information about surgery [a]	2.2 ± 1.2	2.4 ± 1.3	2.4 ± 1.3
APAIS total score (t)	11.6 ± 3.6	11.7 ± 4.6	11.7 ± 4.3

Abbreviations: APAIS, Amsterdam Preoperative Anxiety and Information Scores

[a] Questions 1, 2, 4, and 5 are the anxiety component and 3 and 6 are the knowledge component; Each question was scored from "1" (none) to "5" (most)

Table 2. Questionnaire: Percentage of the Patients who Answered "Yes"

	VAS-A < 7, n = 188	VAS-A ≥ 7, n = 112	Total, n = 300
Results of operation	150 (83%)	106 (95%) [a]	256 (88%)
Waiting for surgery	48 (27%)	56 (50%) [b]	104 (36%)
Not knowing what is happening	40 (23%)	40 (35%) [c]	80 (28%)
Postoperative pain	106 (60%)	88 (79%) [a]	194 (67%)
Awareness during anesthesia	64 (36%)	56 (50%) [c]	120 (41%)
Not awakening from anesthesia	28 (16%)	34 (30%) [a]	62 (21%)
Postoperative nausea/vomiting	60 (34%)	36 (32%)	96 (33%)
Discomfort from needles	32 (18%)	28 (25%)	60 (21%)
Being at mercy of staff	16 (9%)	18 (16%)	34 (12%)

[a] P < 0.01, [b] P < 0.001, [c] P < 0.05; VAS-A < 7 versus VAS-A ≥ 7; The variables are expressed as numbers and percentages

been detailed in Table 1. Besides, APAISa and APAISk components and their scores based on sex, anesthesia, and surgery have been presented in Table 3. Accordingly, the means of APAISa and APAISk were 7.1 ± 3.3 and 4.3 ± 2.1, respectively and no significant differences were observed between males and females in this respect (P = 0.636 for APAISa, P = 0.667 for APAISk). APAISa and APAISk scores were significantly higher for surgery than for anesthesia (P < 0.001 and P < 0.001, respectively) (Table 3). Besides, the patients with preoperative high anxiety levels (VAS-A ≥ 7) showed significantly higher APAISa scores compared to those presenting lower anxiety levels (9.4 ± 3.3 vs. 6.3 ± 2.7, respectively; P < 0.001). Moreover, a positive correlation was observed between anxiety level (APAISa) and requirement of knowledge (APAISk) (APAISa scores 6.6 ± 2.8, 7.4 ± 3.3, and 8.7 ± 4.2 for low (APAISk 2 - 4), medium (APAISk 5 - 7), and high (APAISk 8 - 10) (11) requirement of information, respectively (ANOVA, P = 0.005)).

Age distribution in a dichotomous way, such as ≤ 65 years old and > 65 years old, showed no statistically significant differences (P = 0.610) regarding preoperative anxiety (OR = 1.2, CI = 95%, 0.7 - 1.9). Also, no statistically significant differences were found in this regard according to ASA physical status III/IV (OR = 0.7, CI = 95%, 0.4 - 1.3, P = 0.267), EuroSCORE ≤ 4 /> 4 (OR = 0.9, CI 95%, 0.4 - 1.7, P = 0.705), and previous surgical interventions ≤ 2/> 2 (OR = 0.7, CI 95%, 0.3 - 1.5, P = 0.344). In contrast, the results demonstrated a relationship between the preoperative LoS and preoperative high anxiety levels. Accordingly, the risk of development of higher anxiety levels was 2.5 folds higher in the group with preoperative LoS > 2 days compared to the one with lower preoperative LoS (OR = 2.5, CI = 95%, 1.3 - 4.1, P < 0.001).

The results of multivariate analysis revealed no preoperative variables as the risk factors for anxiety (previous surgical interventions (P = 0.116), EuroSCORE index (P = 0.589), and ASA physical status (P = 0.585)). However, the results of logistic regression analysis determined that preoperative LoS > 2 days significantly contributed to experiencing higher preoperative anxiety levels (P = 0.009).

The results of the questionnaire related to the specific factors of preoperative anxiety according to a significant anxiety level have been described in Table 2. Accordingly, the factors related to higher anxiety levels included the results of the operation, waiting for surgery, not knowing what is happening, postoperative pain, awareness during anesthesia, and not awakening from anesthesia. Yet, the most common anxieties resulted from the operation, postoperative pain, and awareness during anesthesia.

5. Discussion

In the present study, the incidence of anxiety in the

Table 3. APAIS Anxiety and Knowledge for Anesthesia and Surgery

	APAIS Anxiety			APAIS Knowledge		
	Female	Male	All	Female	Male	All
Anesthesia	2.9 ± 1.4	2.8 ± 1.5	2.8 ± 1.5	2.0 ± 1.2	2.0 ± 1.2	2.0 ± 1.2
Surgery	4.6 ± 2.1	4.3 ± 2.5	4.4 ± 2.2 [a]	2.2 ± 1.3	2.4 ± 1.4	2.4 ± 1.4 [b]
Total	7.3 ± 2.6	7.1 ± 3.3	7.1 ± 3.1	4.2 ± 2.0	4.4 ± 2.1	4.3 ± 2.1

[a] P < 0.001, [b] P < 0.01; anesthesia versus surgery; Scores are presented as mean ± SD. The maximum scores of APAIS anxiety and knowledge were 10 and 5, respectively

patients scheduled for cardiac surgery reached 94%, with 37% of the patients developing significant anxiety levels. Similarly, several studies have reported the incidence rate of high anxiety levels to range from 20% to 35% (3, 12-14). This wide range could be explained by the use of different scales and questionnaires (HADS and STAI) for assessing the anxiety level as well as by different groups of patients under study. STAI is the least common scale used for preoperative assessment of anxiety, because it is more time-consuming, often requires the help of a psychologist, and is not situation-specific for anesthesia. Moreover, HADS is a psychometric questionnaire that measures psychological stress expressed as anxiety by patients during the week before surgery. However, neither it is related to the anesthetic and surgical procedures, nor does it evaluate the patients' knowledge level before surgery. Hence, two alternatives; i.e., APAIS and VAS-A, were used in this study which provided a quantitative assessment of anxiety and a specific qualitative questionnaire for evaluation of preoperative anxiety.

It is difficult to compare the results of the present study to those of the previous studies on preoperative anxiety in patients scheduled for cardiac surgery, because of variations in the anxiety measurement methods. VAS-A is a useful and easily applicable method for evaluation of preoperative anxiety which has been used in several anxiety surveys, allowing detection of high anxiety levels in various surgical groups (8, 16-20). Evidence has indicated that VAS-A performs as well as STAI in surgical patients (8). In our research, the mean VAS-A score was 4.8 ± 2.4, which is consistent with the results of the studies on non-cardiac surgical patients with high anxiety levels (19-21). The APAIS questionnaire used in our study was validated against STAI and VAS-A scales as a method for evaluation of preoperative anxiety (8, 16, 17). APAISa showed moderate to good sensitivity (53 – 75%) and strong specificity (79 – 97%) for clinically significant anxiety (22). Coinciding with several researches which used APAIS questionnaire to assess anxiety level and need for preoperative information (9, 11), the present study findings demonstrated a positive correlation between significant preoperative anxiety levels and knowledge requirement. With respect to anesthesia and surgery, our study patients showed higher anxiety levels (APAISa) and higher knowledge requirement (APAISk) for surgery than for anesthesia. These results were in contrast to those obtained by Moerman et al. (11) revealing no differences between fears from surgery and anesthesia. A possible explanation for these findings could be the performance of a preoperative evaluation for our patients in an ambulatory pre-anesthesia consultation clinic. In fact, adequate assessment and preoperative education in the ambulatory clinic could reduce preoperative anxiety compared to preoperative consultation after hospital admission (23, 24).

In this study, the questionnaire of short and specific queries about surgery and anesthesia was adapted from the previous surveys. This test assessed various aspects, such as fears of dependency, control, postoperative pain, and anesthesia (19, 25). According to the results, higher anxiety levels in our patients resulted from the operation, postoperative pain, awareness during anesthesia, and waiting for surgery. Previous studies on the patients scheduled for non-cardiac surgery concluded that the most common preoperative fears after the questionnaire application were worrying about the efficacy of surgery, postoperative pain, and awareness during anesthesia (19, 20). Moreover, other authors, such as Fitzsimons et al. (26), mentioned that the lengthy waits experienced by coronary artery bypass graft patients could create significant psychological disturbances, including high anxiety levels and uncertainty about the future.

The current study also assessed the possible factors that could influence the incidence and severity of anxiety. The results revealed no significant difference between males and females regarding the incidence and severity of anxiety, which is in agreement with the results obtained by Navarro-García et al. (3). On the contrary, Koivula et al. (27) and Vingerhoest (28) observed a higher preoperative anxiety level in the females compared to the males scheduled for cardiac surgery. This can be justified, coinciding with Navarro-García et al. (3), by low percentage of females in contrast to males in our study, which could limit the statistical power of the study. Also, a higher risk of preoperative anxiety was found in the patients above 65 years old, which is inconsistent with the results of other studies only showing significant differences in below-65-year-old patients (3, 26, 29).

In the current study, the results of multivariate analysis indicated no association between preoperative anxiety and ASA physical status, EuroSCORE index, and previous surgical experiences. Besides, the intra-operative risk level determined by EuroSCORE index and supported by the severity and complexity of cardiac patients' disease was not associated with high levels of preoperative anxiety. This was consistent with the results of the study by Domar et al. (30), demonstrating no differences between the patients with and without cancer regarding the incidence and level of anxiety (30). Also, anesthetic risk determined by ASA physical status score was not associated with higher preoperative anxiety levels. However, some other researchers have shown elevated preoperative anxiety levels in other groups of surgical patients relative to ASA physical status (31). Overall, studies have come to contradictory results about the role of surgical history and incidence of preoperative anxiety in the patients scheduled for non-cardiac surgery (19, 20, 30, 32). In our study, previous surgery was not shown as a factor for reduction of anxiety in the patients, which is consistent with the previous studies conducted on the issue (19, 30). Nevertheless, the results indicated an association between preoperative anxiety and preoperative LoS > 2 days, which is in line with the findings of the study by Navarro Garcia et al. on cardiac patients with preoperative LoS > 3 days (3). In case patients are in the hospital longer before surgery, they are more likely to experience severe preoperative anxiety due to worsening of their clinical conditions. Also, some studies on non-cardiac surgical patients have demonstrated that anesthetic assessment in an outpatient consultation clinic reduced preoperative anxiety compared to assessment of inpatients prior to surgery (24). Hence,

it seems that prolonged preoperative LoS is a harmful factor to the patients' emotional well-being. Therefore, preoperative LoS must be minimized to the extent possible and anti-anxiety agents should be used in patients without contraindication.

The main limitation of this study was its performance in a single center; thus, the results may not be generalized to other similar surgical populations. Another study limitation was the relatively small sample size and low statistical power of the study, underestimating the possible associations between the variables. On the other hand, a strong point of this research, in contrast to other similar ones, is the use of easily applicable scales for assessment of anxiety that are concrete for anesthetic and surgical procedures, such as APAIS and VAS-A, previously applied for non-cardiac patients (19). These scales require a shorter period of time to be completed due to a lesser number of queries (APAIS = 6, STAI = 20), and were validated with respect to the classical ones (16). Oddershede et al. proposed VAS-A along with other visual analogue scales to assess health in the patients scheduled for cardiac surgery (18).

To conclude, our results suggested that the patients undergoing cardiac surgery presented high levels of preoperative anxiety with modestly elevated requirement of information, especially related to surgery. Moreover, preoperative LoS > 2 days was a risk factor for high anxiety levels. Pre-anesthetic consultation clinic could be the right place to transmit the necessary information, clarify the patients' inquiries, and use anxiolytics in order to diminish preoperative anxiety.

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Authors' Contribution

Joaquín Hernández-Palazón: concept/design, statistics, approval of the article; Diego Fuentes-García: data analysis/interpretation, data collection, approval of the article; Luis Falcón-Araña: drafting the article, approval of the article; Antonio Rodríguez-Ribó: drafting the article, critical revision of the article, approval of the article; Carlos García-Palenciano: critical revision of the article, approval of the article; María José Roca-Calvo: drafting the article, approval of the article.

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