



# Factors associated with perioperative anxiety among patients undergoing coronary angiography or angioplasty: a cross-sectional study

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**Background:** Anxiety is commonly encountered in patients undergoing medical procedures or surgeries and contributes to adverse outcomes including physiological damage, prolonged postoperative care, and rehabilitation. This study aimed to identify factors related to anxiety among patients undergoing coronary procedures.

**Methods:** This cross-sectional study was conducted at a tertiary hospital in Vietnam. Patients were included in our study if they were scheduled for coronary angiography or angioplasty. Pre-operative Intrusive Thought Inventory was employed to assess the patient's anxiety level.

**Result:** Three hundred six patients scheduled for coronary procedure met inclusion criteria. High perioperative anxiety was reported by 56.2% of patients undergoing coronary angiography/angioplasty. Multivariable analysis showed that factors independently associated with high perioperative anxiety were no previous coronary angiography/angioplasty (odd ratio [OR]: 2.69 [1.44–5.01]), lack of pre-procedural anesthesia information (OR: 5.12 [2.54–10.31]) and prolonged indication-to-procedure duration (OR: 1.08 [1.05–1.11]).

**Conclusion:** Although coronary angiography or angioplasty were minimally invasive procedures, high perioperative anxiety was significant among patients scheduled for these procedures. Extended waiting time, no procedural experience, and inadequate anesthesia information were associated with increased levels of anxiety.

**Keywords:** anxiety, perioperative, PITI

## Backgrounds

Anxiety is defined as apprehension, tension, or uneasiness that originates from the danger which may be internal or external. Anxiety may manifest with symptoms related to behavior, emotions, and cognition. Anxiety is prevalent in patients before interventional procedures and deteriorates postoperative outcomes, for example, elevated level of postoperative pain, increased infection rate, and high mortality rate<sup>[1–3]</sup>.

Coronary artery disease is one of the leading causes of mortality, disability, and workforce loss, resulting from the narrowing or obstruction of one or more branches of the coronary arteries due to the accumulation of atherosclerotic plaques<sup>[4]</sup>. Coronary angiogram and angioplasty are among the most popular

## HIGHLIGHTS

- High perioperative anxiety was significant among patients scheduled for coronary angiography and angioplasty.
- Extended waiting time, no procedural experience, and inadequate anesthesia information were associated with increased levels of anxiety.

diagnostic and treatment tools available to cardiologists. However, patients and their families often experience anxiety before the procedure due to inadequate psychological preparation.

The majority of research about perioperative anxiety focused on surgery. Magnitude of preoperative anxiety as reported in some studies was in the range of 60%–80% in the Western population while some researchers showed a wider range, which was 11%–80%<sup>[5,6]</sup>. However, there is a lack of research reporting the prevalence of anxiety among patients arranged for minimally invasive procedures, especially coronary procedures. One might assume that smaller procedures would elicit lower levels of anxiety, yet some findings in literature challenge this assumption. To the best of our knowledge, a cross-sectional study conducted in Africa among 267 cardiac patients undergoing catheterization procedure found that up to 70.4% of them experienced perioperative anxiety<sup>[7]</sup>, which raises the need for further research focused on this population. Furthermore, previous studies on perioperative anxiety have included a wide variety of surgical types, and subanalyses from those studies

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have shown significant variation in anxiety levels depending on the type of surgery. Our study aimed to address this gap by focusing specifically on cardiac patients, as cardiac-related procedures carry a higher risk of mortality compared to many other types of surgery. We believe that this patient population may exhibit unique characteristics. There was significant variation of anxiety level across countries. A systematic review showed that preoperative anxiety level by country was the highest in India 67%, Saudi Arabia 60%, lowest in China 21%, America 24%<sup>[8]</sup>. As a result, it is unacceptable to extrapolate the magnitude of anxiety in one nation to another with different socio-demographic characteristics, healthcare systems, and family support. Moreover anxiety levels before surgery are influenced by various factors such as individual susceptibility, age, gender, prior surgical experiences, education, type and complexity of the surgery, current health condition, and socioeconomic status<sup>[5,9]</sup>. Identifying risk factors helps healthcare provider to support psychological services during the preoperative visit so that stress can be reduced. Thus, the aim of this study was to evaluate the extent of preoperative anxiety among patients scheduled for coronary angiography or angioplasty in Vietnam (an Asian country) and explore the factors associated with it within the context of Asian culture.

## Materials and methods

This is a cross-sectional study conducted at a tertiary hospital in Vietnam. The patients were included in our study when they were more than 18 years old and were able to comprehend Vietnamese language. The patients were excluded from our study if they were unconscious and not oriented. The patients with medical history of anxiety disorders and depression, as well as patients on long-term antidepressant or anxiolytic medication, were excluded. On the procedural day, when the patients were in waiting room at DSA unit, we distributed a self-administer questionnaire to patients who had accepted to participate. The questionnaire is constructed from three parts, namely, demographics, perioperative factors, and the anxiety scale. We employed “The Pre-operative Intrusive Thoughts Inventory (PITI)” as a tool to measure the anxiety scale. PITI 20, comprising twenty questions, was developed by Crockett *et al*<sup>[10]</sup>. This valid and reliable tool has Cronbach’s  $\alpha$  score of 0.91. Various scales have been developed to assess preoperative anxiety, but each has its own limitations. The state component of the Spielberger State-Trait Anxiety Inventory (STAI-state) has been applied in preoperative settings, but it is primarily designed to measure situational anxiety rather than anxiety specific to the preoperative period. The Yale Preoperative Anxiety Scale is specifically created for children, it focuses on anxiety during anesthesia induction. Another tool, the Amsterdam Preoperative Anxiety and Information Scale, is a six-item questionnaire with strong internal reliability and ease of use. However, its brevity limits the ability to capture the full range of patient concerns before surgery, which can be diverse. In contrast, the Perioperative Information and Tension Index (PITI) is a robust tool that is suitable to measuring perioperative anxiety. It includes questions related to key concerns such as general anesthesia, surgical outcomes, potential pain or discomfort, and the fear of being unconscious. The English questionnaire was adapted and translated into the Vietnamese language and back to English. The answers

contain four response options (four-point Likert scale ranging from “not at all” with 0 points, “some of the time” with 1 point, “often” with 2 points, and “most of the time” with 3 points). Zero and 60 points are the highest and lowest score, respectively, the author of the tool reported that patients with 15 or more scores on the PITI-20 scale reliably were classified as high preoperative anxiety while participants who scored less than fifteen were classified as low preoperative anxiety. Section A: Demographic characteristics (eight questions), Section B: perioperative factors (four questions), Section C: Preoperative Intrusive Thoughts Inventory (PITI) anxiety scale (20 questions).

Categorical and nominal variables were presented as percentages and continuous variables as means and standard deviations. Noncontinuous variables were compared using the chi-square test and continuous variables using Student’s *t*-test. Independent variables were identified via logistic regression. A two-sided *P*-value of <0.05 was considered to indicate statistical significance. Confounding factors were controlled by using multivariable logistic regression.

Ethical approval for this study (Ethical Committee N° 83GCN-HĐĐĐ) was provided by the Ethical Committee, Vietnam on 29 September 2022.

The work has been reported in line with the STROCSS criteria<sup>[11]</sup>.

## Result

There were 306 patients planned for the coronary procedure that met the inclusion criteria. The average age was 62.5 years old, 65.4% of patients were male, and 79.1% of patients were married. The majority of patients were retired. There were 31.0% of patients living in urban areas, and 14.1% living alone. Out of the total participants, 67.0% of them had a history of hospitalization. Table 1 presents the distribution of patient’s responses to PITI-20 questionnaire, highlighting the frequency of various concerns related to surgery, anesthesia, and postoperative recovery (Table 1). The bivariate analysis showed that high perioperative anxiety level were associated with educational status, average monthly income, locality, living situation, previous coronary angiography/angioplasty, pre-procedural anesthesia information, indication-to-procedure duration (hours) (Table 2).

All variables with *P* value <0.10 in Table 2 were selected for multivariable logistic regression. In multivariate analysis, there was an association between high anxiety levels and prolonged indication-to-procedure time, previous coronary procedures, and lack of preprocedural anesthesia information (Table 3).

## Discussion

Three hundred six patients were eligible for our study. High perioperative anxiety was reported by 56.2% of patients undergoing coronary angiography/angioplasty. Multivariable analysis showed that factors independently associated with high perioperative anxiety were no previous coronary angiography/angioplasty (OR: 2.69 [1.44–5.01]), lacking pre-procedural anesthesia information (OR: 5.12 [2.54–10.31]) and prolonged indication-to-procedure (OR: 1.08 [1.05–1.11]).

According to PITI 20 questionnaire, the leading cause of anxiety was “the thought of having the procedure” with 14.4% of patients worrying about it most of the time. The second was

**Table 1**  
**Specific anxieties listed on patients questionnaire with respective PITI 20 Scores**

Content	Not at all N (%)	Some of the time N (%)	Often N (%)	Most of the time N (%)
1 I worry that I won't wake up	201 (65.7%)	67 (21.9%)	33 (10.8%)	5 (1.6%)
2 Waiting for the surgical procedure makes me nervous	37 (12.1%)	134 (43.8%)	102 (33.3%)	33 (10.8%)
3 I worry about the time it will take to get the results	35 (11.4%)	144 (47.1%)	105 (34.3%)	22 (7.2%)
4 I worry about how sore I will be afterward	138 (45.1%)	115 (37.6%)	49 (16%)	4 (1.3%)
5 I worry that I will have to rely on others	109 (35.6%)	131 (42.8%)	60 (19.6%)	6 (2%)
6 The thought of having the procedure makes me feel out of control	39 (12.8%)	128 (41.8%)	95 (31%)	44 (14.4%)
7 I worry about being unconscious	159 (52%)	122 (39.9%)	25 (8.1%)	0 (0%)
8 I worry about what they are going to find	26 (8.5%)	115 (37.6%)	126 (41.2%)	39 (12.7%)
9 I worry about the outcome of the surgical procedure	22 (7%)	156 (51%)	113 (37%)	15 (5%)
10 I worry about how long the pain will last	150 (49%)	106 (34.7%)	46 (15%)	4 (1.3%)
11 I worry that I will have to call on people to help me	150 (49%)	102 (33.3%)	45 (14.7%)	9 (3%)
12 I worry about things happening during the procedure that I will not be aware of	50 (50%)	110 (36%)	49 (16%)	11 (3.6%)
13 I worry about surgical complications	91 (29.73%)	148 (48.37%)	63 (20.59%)	4 (1.31%)
14 I keep thinking about the surgical procedure When I'm on my own	111 (36.3%)	108 (35.3%)	74 (24.2%)	13 (4.2%)
15 I worry about feeling sick or fainting	133 (43.5%)	144 (47.1%)	29 (9.4%)	0 (0%)
16 I worry that I may feel uncomfortable When I wake up	126 (41.2%)	143 (46.7%)	36 (11.8%)	1 (0.3%)
17 I worry that I won't be able to do things for myself after the surgical procedure	137 (44.8%)	109 (35.6%)	51 (16.7%)	9 (2.9%)
18 I worry that something may be done When I am unconscious that I haven't agreed to	207 (67.7%)	79 (25.8%)	20 (6.5%)	0 (0%)
19 I worry about how long I will be unconscious for	96 (31.4%)	161 (52.6%)	46 (15%)	3 (1%)
20 I am pre-occupied by thoughts of having the surgical procedure	128 (41.8%)	109 (35.6%)	61 (21%)	8 (2.6%)

“what doctors are going to find” with 12.7% and the third was “waiting for the procedure” with 10.8%. Meanwhile, factors related to anesthesia were not a concern for patients. A majority of patients reported that they did not feel anxious about “being unconscious” and “whether they can wake up.” The explanation is that coronary procedure is a minimally invasive procedure, so anesthesia is unnecessary for a majority of cases. That is the reason why most of the patients in our study did not pay attention to anesthesia.

The prevalence of perioperative anxiety varies between studies due to applying different anxiety scores and criteria. In this study, PITI 20 was employed. Most of the studies related to anxiety focused on surgery, this is one of a few study performed on patients undergoing a procedure, more specifically, coronary angiography/angioplasty. Although coronary angiography/angioplasty is a minimally invasive procedure, the prevalence rate of high anxiety level was comparable to other studies including patients undergoing surgery. Kefelegn *et al*<sup>[12]</sup> showed that the rate of anxiety was 51.2% among patients scheduled for elective surgery including orthopedics, gynecology, urology, and others. Another study included 151 patients who used PITI 20 as a tool for anxiety measurement. This study showed that 72.8% of patients developed anxiety before surgery<sup>[13]</sup>. A meta-analysis including 27 studies showed that the perioperative anxiety rate ranged from 34% to 87.5%, pooled perioperative anxiety rate was 55.7%<sup>[14]</sup>. Due to the significant magnitude of the problem, anxiety should not be neglected in patients undergoing coronary angiography or angioplasty.

Prolonged indication to procedure time is associated with an increased odd ratio of high anxiety levels with an average of 15.1 hours in the low anxiety level group and 28.2 hours in the high anxiety level group. Moreover, in the PITI score, 10.8% of patients reported that waiting for a procedure makes them nervous most of the time. A study including 450 patients scheduled for breast surgery showed that the level of pain and anxiety increased significantly with the prolonged preoperative waiting

time<sup>[15]</sup>. Gilmartin and Wright<sup>[16]</sup> also noticed a rising demand for psychological support among patients with prolonged waiting times. The reason is that increased waiting periods elicit a sense of abandonment and erode the trust of patients in the healthcare system. Moreover, waiting can make patients feel powerless and out of control. These experiences can exacerbate feelings of anxiety and frustration.

In our study, the odds ratio of anxiety level among patients lacking pre-procedural anesthesia information is 5.12 times higher than others. In our study, it could be due to the fact that in the group of patients informed about the anesthesia procedure, they were aware that they would undergo local anesthesia. This reduced their anxiety. Meanwhile, in the group without information about the anesthesia technique to be used, the patients' anxiety levels increased because they were unsure whether they would undergo general anesthesia, and they also worried about issues surrounding general anesthesia. This finding is in line with other studies. Celik<sup>[17]</sup> reported that the anxiety scores of patients who underwent general anesthesia were found to be significantly higher than the patients who underwent regional anesthesia. Moreover, preoperative education has been shown to significantly reduce patient anxiety levels. A study published in *BMC Health Services Research* in August 2024 evaluated the effectiveness of systematic preoperative education on patients' anxiety, satisfaction, and postoperative recovery. The research found that patients who received structured preoperative education experienced lower anxiety levels, higher satisfaction, and improved postoperative recovery compared to those who did not receive such education<sup>[18]</sup>. These findings suggest that explaining and informing the anesthesia technique to patients before the procedure can avoid needless anxiety.

In this study, previous coronary procedure experience was associated with decreased perioperative anxiety levels. This result was reported in other studies in medical literature<sup>[19,20]</sup>. Matthias and Samarasekera<sup>[20]</sup> observed that 65% of first-time

**Table 2**  
**Demographic characteristics and health information of patients in low and high preoperative anxiety groups**

Variables	Low preoperative anxiety (n = 134)	High preoperative anxiety (n = 172)	P-value
Age (year)			
≥60 years old	79 (59.0%)	109 (63.4%)	0.431
18–59 years old	55 (41.0%)	63 (36.6%)	
Gender			
Female	41 (30.6%)	65 (37.8%)	0.189
Male	93 (69.4%)	107 (62.2%)	
Marital status			
Single	15 (11.2%)	25 (14.5%)	0.188
Married	112 (83.6%)	130 (75.6%)	
Divorced	7 (5.2%)	17 (9.9%)	
Occupation			
Others	37 (27.6%)	49 (28.5%)	0.697
Government	31 (23.1%)	33 (19.2%)	
Private	66 (49.3%)	90 (52.3%)	
Educational status			
High school and below	42 (31.3%)	93 (54.1%)	0.000
College	44 (32.8%)	36 (20.9%)	
University and above	48 (35.9%)	43 (25.0%)	
Average monthly income			
Lower than 5 million VND	77 (57.5%)	127 (73.8%)	0.010
5–10 million VND	31 (23.1%)	28 (16.3%)	
10–20 million VND	20 (14.9%)	10 (5.8%)	
More than 20 million VND	6 (4.5%)	7 (4.1%)	
Locality			
Rural	27 (20.2%)	68 (39.5%)	0.000
Urban	107 (79.8%)	104 (60.5%)	
Living situation			
Alone	125 (93.3%)	138 (80.2%)	0.001
With relatives	9 (6.7%)	34 (19.8%)	
Previous hospitalization			
Yes	97 (72.4%)	108 (62.8%)	0.077
No	37 (27.6%)	64 (37.2%)	
Previous coronary angiography/angioplasty			
Yes	86 (64.2%)	48 (27.9%)	0.000
No	48 (35.8%)	124 (72.1%)	
Pre-procedural anesthesia information			
Yes	117 (87.3%)	72 (41.9%)	0.000
No	17 (12.7%)	100 (58.1%)	
Indication-to-procedure duration (hours)	15.1 ± 1.1	28.2 ± 1.0	0.000

Continuous data are presented as mean ± standard deviation; categorical data are shown as n (%).

surgical patients reported high anxiety compared to only 38% of patients with prior procedural experience. This suggests that familiarity with medical processes alleviates fear and uncertainty, underscoring the value of targeted counseling for first-time patients. Contrary to this, several studies showed that previous surgical experience and level of preoperative anxiety were not significantly associated<sup>[21,22]</sup>. It could be that the surgery performed during this admission was not similar to previous surgery in this research. The two most popular factors making patients feel nervous most of the time were “what the doctors are

going to find” and “how long it will take to get the result.” The answers were highly dependent on the category of surgery. As a result, the experience with previous different types of surgery could not alleviate the anxiety of patients. In our study, because we focused on patients who experienced coronary angiography or angioplasty, patients experiencing previous coronary procedures tended to be less anxious compared to patients coming for the procedure for the first time.

A meta-analysis has shown a weak correlation between higher social support and lower levels of perioperative anxiety<sup>[23]</sup>. However, our study did not confirm this relationship. Marital status was not significantly associated with perioperative anxiety in the bivariate analysis. Living with relatives did show an association with anxiety in the bivariate analysis, this variable was included in a multivariable logistic regression, which revealed no independent relationship. One possible explanation for this finding is the source of support. Secor *et al*<sup>[24]</sup> demonstrated that support from friends was more impactful than support from partners or relatives in adults facing negative life events. Similarly, Peles *et al*<sup>[25]</sup> reported that social support from extended family and friends was significantly associated with reduced preoperative anxiety, whereas support from close family members showed no significant effect. As cultural context in Vietnam, where multiple generations often live together, fostering strong family bonds. As a result, individuals may view family support as a given, leading them to take it for granted. This expectation may explain why close family members support does not significantly influence perioperative anxiety levels in our study.

It can be concluded that patients with cardiac disease tended to exhibit higher levels of anxiety compared to other patient groups. Despite coronary procedures being relatively simple and typically performed with minimal or no anesthesia, the perioperative anxiety rates were found to be comparable to those observed in patients undergoing surgical interventions. When counseling and guiding patients before entering the operating room, healthcare professionals should focus more on providing specific information about anesthesia methods, explaining the procedure clearly, and reducing the waiting time to alleviate patient’s anxiety during perioperative period. In the context of Asian culture, close family member support did not appear to have a significant association with perioperative anxiety levels.

This study had several limitations with respect to the design and the conduct of the survey. First, the study’s cross-sectional design precludes the establishment of causal relationships between the identified factors and perioperative anxiety. Second, the study was conducted in a single tertiary hospital in Vietnam, and the findings may not be generalizable to populations in other cultural, healthcare, or socioeconomic contexts. Third, the study did not include physiological measures of anxiety, such as cortisol levels, heart rate variability, or blood pressure, which could have complemented the subjective assessments and strengthened the findings. Lastly, patients with known anxiety or depressive disorders and those on long-term psychiatric medications were excluded from the study. While this approach aimed to reduce confounding, it may have underestimated the prevalence and severity of perioperative anxiety in the general population. Moreover, the absence of patients with psychological disorders limits this study’s ability to explore the association between perioperative anxiety and psychological conditions.

**Table 3**  
**Factors associated with high preoperative anxiety on multivariable logistic regression**

Variables	Low preoperative anxiety ( <i>n</i> = 134)	High preoperative anxiety ( <i>n</i> = 172)	Crude OR (95% CI)	<i>P</i> -value	Adjusted OR (95% CI)
Previous coronary angiography/angioplasty					
Yes	86 (64.2%)	48 (27.9%)	1	0.002	1
No	48 (35.8%)	124 (72.1%)	4.63 (2.85–7.52)		2.69 (1.44–5.01)
Pre-procedural anesthesia information					
Yes	117 (87.3%)	72 (41.9%)	1	0.000	1
No	17 (12.7%)	100 (58.1%)	9.56 (5.29–17.28)		5.12 (2.54–10.31)
Indication-to-procedure duration (hours)	15.1 ± 1.1	28.2 ± 1.0	1.10 (1.07–1.13)	0.000	1.08 (1.05–1.11)

Continuous data are presented as mean ± standard deviation; categorical data are shown as *n* (%).

Future research should adopt longitudinal designs to explore the temporal and causal relationships between identified factors and perioperative anxiety. To enhance the generalizability of findings, multicenter studies conducted in diverse cultural, socioeconomic, and healthcare settings are necessary. Physiological measures of anxiety, such as cortisol levels, heart rate variability, or blood pressure should be integrated in the study. These objective biomarkers would provide a more robust and multidimensional assessment of perioperative anxiety. Expanding the inclusion criteria to encompass patients with preexisting anxiety or depressive disorders and those on long-term psychiatric medications would allow for a more accurate representation of the general population. Such studies could also explore the interaction between perioperative anxiety and underlying psychological conditions, offering tailored interventions for these high-risk groups.

## Conclusion

Although coronary angiography and angioplasty are minimally invasive procedures, high perioperative anxiety was significant among patients scheduled for this procedure. Extended waiting time, no procedural experience, and inadequate anesthesia information were independently associated with increased levels of anxiety.

## Ethical approval

Not applicable.

## Consent

Not applicable.

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## Provenance and peer review

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## Data availability statement

Not applicable.

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