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ORIGINAL ARTICLE

Effect of Pre- and Post-Operative Pain on Anxiety and Vital Signs in Patients Undergoing Percutaneous Coronary Intervention

Perkütan Koroner Girişim Geçiren Hastalarda Pre- ve Postoperatif Ağrının Anksiyete ve Hayati Bulgular Üzerine Etkisi

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Abstract

Introduction: This study was conducted to determine the relationship between pre- and post-operative chest pain and anxiety and vital signs in patients undergoing percutaneous coronary intervention.

Methods: The research was conducted as a descriptive-relationship study. The data were collected between October and December 2022 through a face-to-face survey method in the coronary intensive care unit of a heart hospital in the European side of Istanbul. A total of 185 patients who underwent percutaneous coronary intervention and lasting pain after the procedure responded to the questionnaire. The data were obtained by using the Patient Information Form, Numerical Rating Scale (NRS), State–Trait Anxiety Inventory (STAI), and vvital signs follow-up form.

Results: The NRS score before the procedure was 7.06, while that after the procedure was 3.21 ($p<0.05$). The State Anxiety Score before the procedure was 61.56, while that after the procedure was 32.36 ($p<0.05$). The pre-procedural pain varied by 78.7% in the anxiety score and 29.8% in the post-procedure anxiety score. The effect size of pain was 2.90, while that of anxiety was 3.10. Age, gender, and marital status of the patients were insignificant ($p>0.05$) in terms of the pre- and post-operative pain, anxiety, and life follow-up. The relationship between previous hospitalization and stent placement and pain, anxiety, and vital signs ($p=0.00$, $p<0.05$) was significant. A positive correlation was found between the NRS and the STAI ($p<0.05$). While it was significant in pain, anxiety, heart rate, blood pressure, and respiratory count before and after the procedure ($p<0.05$), it was insignificant in saturation and body temperature ($p>0.05$).

Discussion and Conclusion: While the increase in pain increased the measurements of the anxiety level and vital signs, it improved the anxiety level and vital signs with its decrease. According to the results, research can be recommended about the ability of patients to identify pain to provide education for early hospital admission before the pain score increases.

Keywords: Anxiety; Pain; Percutaneous coronary intervention; Vital signs

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From the statistical data reported by the World Health Organization, coronary artery disease (CAD) affects the death percentage to a great extent.[1]

As a result, of cholesterol and lipid accumulation, CAD brings about sudden death with atherosclerosis and decrease or interruption of blood flow in the arteries leading to the heart and providing circulation.[2] While CAD results in myocardial infarction when it is not controlled, medical drug treatment with coronary angiography (CAG) and percutaneous coronary intervention (PCI) are applied when the vessels fit the stent, and coronary artery bypass graft is applied as a result of the vessels not being suitable for the stent.[3]

Patients describe chest pain before the procedure. According to the International Pain Research Organization, pain is defined as a painful feeling that disturbs the person's body in the presence of an underlying factor or without any factor.[1,4] The persistence of pain brings anxiety. As the levels of pain and anxiety increase in a person, increases in the heart rate and blood pressure and difficulty in breathing may also be observed.[5]

The long PCI duration, thinness of the patient's vascular structure, and continuation of chest pain after the procedure depending on the physician's hand experience affect a patient's physiological and psychological mental status.[5,6] The age of patients, their follow-up in the intensive care unit, uncertainties about the disease, lack of adequate information about the procedure, complications, and loss of labor force bring anxiety and cause changes in the heart and respiratory rates and in blood pressure.[5] Determining the factors affecting pain, planning interventions to reduce the patient's pain level, and following up on the anxiety and vital signs can lead to positive changes.

This study was conducted to determine the relationship between the pain scores of the patients before and after the procedure and the anxiety and vital signs in patients undergoing PCI.

Materials and Methods

Design, Participants, and Setting

This research was conducted according to a descriptive-relationship plan. The study population consisted of patients who underwent PCI in the coronary intensive care unit of a heart hospital on the European side of Istanbul between October and December 2022. The annual data of 705 patients were accessed, and the sample size was calculated through a statistical analysis. The study sample size was calculated as 182 people in the known sample count of the universe, with 5% error level and 95% confidence interval. The sample was created using the random sampling method, a non-probability sampling method. Of the 200 patients who underwent percutaneous intervention and experienced pain, 15 were not included because they did not have post-operative pain, and 185 people were sampled. Artificial intelligence-enabled technologies (e.g., large language models, chatbots, or image generators) were not used in this study.

Data Collection

Data collection was performed using a face-to-face questionnaire. Four main questionnaires were used for this study and described as follows:

1. Introductory Information Form: This form comprised 17 questions related to socio-demographic characteristics, such as gender, age, education, marital status, pain, and anxiety before the procedure.
2. Numerical Rating Scale (NRS): The patients chose the lowest number (0) if they did not have pain and the highest number (10) for the worst pain. The fact that patients did not need a ruler or a paper on the NRS score scale makes it easier to use than other pain scales.[7] Cohen's effect size was calculated as low at 0.1, medium at 0.25, and high at 0.8 in the analysis of variance.[8] The effect size of pain was calculated as 2.90.
3. State–Trait Anxiety Inventory (STAI): The State–Trait Anxiety Inventory was developed by Spielberger et al.[9] in 1970, and the validity and reliability study in Turkish was conducted by Öner and Le Compte.[10] The scale comprises 40 items, 20 of which are situational, and 20 are intended to measure persistent anxiety. The State Anxiety Scale was used to measure the patients' momentary anxiety. The scale is quadruple licarth (1=none; 2=somewhat; 3=many; and 4=all), and each item is selected by the patient. Items 1, 2, 5, 8, 10, 11, 15, 16, 19, and 20 of the scale are negative statements. The Cronbach alpha value of the Öner and Le Compte[10] scale was calculated as 0.94. For this study, it was 0.93. The effect size of anxiety in the study was 3.10.
4. Vital Signs Follow-up Form: A vital signs follow-up form was used, in which the blood pressure, heart rate, respiration, body temperature, and saturation were recorded before and after pain.

Statistical Analyses

The data were analyzed using the SPSS 22.0 statistical program. The results were evaluated at 95% confidence interval and $p<0.05$ significance. Frequency and percentage analyses were used to determine the descriptive characteristics of the patients participating in the study. The mean and standard deviation statistics were used in the scale analysis. For the data comparison, analysis of variance and independent group t-test were used. Whether or not the research variables showed normal distribution was examined using flatness and skewness values. The results were obtained by using Pearson correlation analyses to examine the relationships between the variables.

Ethical Considerations

Ethics approval was obtained from the ethics committee (05-08-2022 2022-13 Decision No: 02). To conduct the research, permission was obtained from the Provincial Health Directorate (00175578848) and a 27-inpatient treatment (E-10678112-000-4190) institution. An Informed Voluntary Consent Form was prepared for the participants, and verbal and written consent was obtained. The study complied with the Helsinki rules.

Results

In total, 70.8% of the patients were male; 54.1% were secondary and high school graduates; 87.0% were married; 32.4% were retired; 64.9% had chronic diseases; 69.2% were previously hospitalized; 88.1% of the patients were admitted to the intensive care unit once; 66.5% of them did not have angiography; 68.6% did not have a stent; 64.2% of the patients were worried about the procedure to be performed; 82.2% felt that the pain made them aggressive; 84.9% increased the heart rate; 54.1% increased their blood pressure; and 80.0% felt that it made breathing difficult (Table 1).

The preoperative NRS score of patients who experienced pain was x=7.06, while the post-procedure NRS score was x=3.21. The decrease between the two measures (t=44.87) was significant. The statefulness anxiety value was x=61.56 in the pre-procedure pain, while that post-procedure was x=32.36. The decrease between the two measures (t=44.22) was significant. While the effect size of the NRS was 2.90, that of the anxiety inventory was calculated as 3.10 (Table 2).

In patients that did not experience pain, after describing pain, the decrease in the body temperature obtained before and after the procedure (p=0.33) and the oxygen saturation measurement (p=0.30) were insignificant (Table 3).

Table 1. Patient distribution by descriptive characteristics (n=185)

Groups	n	%
Age (Mean: 57.110±10.638)		
50 years and under	57	30.8
51–60	53	28.6
61–70	56	30.3
70 years and older	19	10.3
Sex		
Famale	54	29.2
Male	131	70.08
Level of education		
Illiterate	18	9.7
Literate and primary school graduate	46	24.9
Secondary and high school graduate	100	54.1
Graduated from a universty	21	11.4
Marital status		
Married	161	87.0
Single	24	13.0
Job		
Housewife	40	21.6
Officer	9	4.9
Employee	35	18.9
Private sector	41	22.2
Retired	60	32.4
Presence of chronic disease		
Yes	120	64.9
No	65	35.1
Previous hospitalization status		
Yes	128	69.2
No	57	30.8
Previous intensive care unit hospitalization		
No	2	1.1
1 time	162	88.1
2 time	20	10.8
Previous coronary angiography procedure		
Yes	62	33.5
No	123	66.5
Stent insertion status		
Yes	58	31.4
No	127	68.6
Worrying about the action to be taken		
Yes	120	64.9
No	65	35.1
Thinking pain is making you aggressive		
Yes	152	82.2
No	33	17.8
Feeling that pain increases heart rate		
Yes	157	84.9
No	28	15.1
Thinking that pain is raising your blood pressure		
Yes	100	54.1
No	85	45.9
Pain causes difficulty in breathing		
Yes	148	80.0
No	37	20.0

Table 2. Comparison of the NRS and State Anxiety Inventory before and after transactions

Measurements	Before operation		Post-processing		N	T	P	Cohen'sd
	Mean	SD	Mean	SD				
NRS pain score	7.065	1.527	3.210	1.090	185	44.877	**0.000**	2.906
Situational anxiety	61.568	10.818	32.362	7.772	185	44.220	**0.000**	3.101

NRS: Numerical Rating Scale; SD: Standard deviation.

Table 3. Differentiation status of body temperature and oxygen saturation in pre- and post-procedure measurements

	Mean±SD	F^b	P
Normal body temperature	36.450±0.734		
Body temperature before the procedure	36.512±0.084	0.956	0.330
Post-process body temperature	36.469±0.083		
Normal oxygen saturation	95.090±0.705		
Pre-procedural oxygen saturation	95.050±0.082	0.948	0.302
Post-procedure oxygen saturation	95.064±0.083		

SD: Standard deviation; F^b: Repeated measures.

Table 4. Differentiation status of heart rate, respiration rate, and blood pressure in pre- and post-procedural measurements

	Mean±SD	F^b	P	Bonferroni	Eta Squared
Normal HR	69.570±11.742				
Pre-procedural HR	95.840±16.471	702.295	**0.000***	**1<2,3;2>3**	0.792
Post-procedure HR	84.120±12.827				
Normal systolic BP	116.050±14.525				
Pre-procedure systolic BP	160.810±16.531	1836.664	**0.000***	**1<2,3;2>3**	0.909
Post-procedure systolic BP	141.300±14.307				
Normal diastolic BP	63.280±10.373				
Procedure diastolic BP	94.290±13.986	48.603	**0.000***	**1<2,3;2>3**	0.209
Post-procedure diastolic BP	83.4505±3.067				
Normal RR	19.730± 2.588				
Pre-procedural RR	28.350±4.778	535.874	**0.000***	**1<2,3;2>3**	0.744
Post-procedural RR					

HR: Heart rate; RR: Respiration rate; BP: Blood pressure; SD: Standard deviation; F^b: Repeated measures; *: Bonferroni post-hoc analysis.

The heart rate, systolic and diastolic blood pressures, and respiratory rate measured when the patients were free of pain were low and significant compared to the measurement of pain before and after the procedure (p=0.00). The measurements of the heart rate, systolic and diastolic blood pressures, and respiratory rates were higher in the pre-procedure pain than after the procedure. The decrease in the postoperative measurements (p=0.00) was significant (Table 4).

A high positive correlation was found between the statefulness anxiety of the patients with pre-procedure pain and an NRS pain score of r=0.88 (p=0.00) and the anxiety and NRS score in post-voiding pain of r=0.78 (p=0.00) (Fig. 1).

In the regression analysis conducted to examine the cause-and-effect relationship between preoperative pain and anxiety score, pain increased the anxiety level by 78.7% and resulted in significant results (F=678.91; p=0.00) (ß=0.88). Regression (F=77.37; p=0.00) was significant in investigating the cause-and-effect relationship between the patients' anxiety score and preoperative and postoperative pain. Regression analysis showed significant scores by examining the cause-and-effect relationship between the pre-procedure pain score and the pre-procedure heart rate (F=20.52) of 9.6%, systolic blood pressure (F=69.26; p=0.00), diastolic blood pressure (F=19.21; p=0.00) of 9%, and respiratory rate (F=57.81; p=0.00) of 23.6%. Preoperative pain increased in the follow-up on vital signs (Table 5).

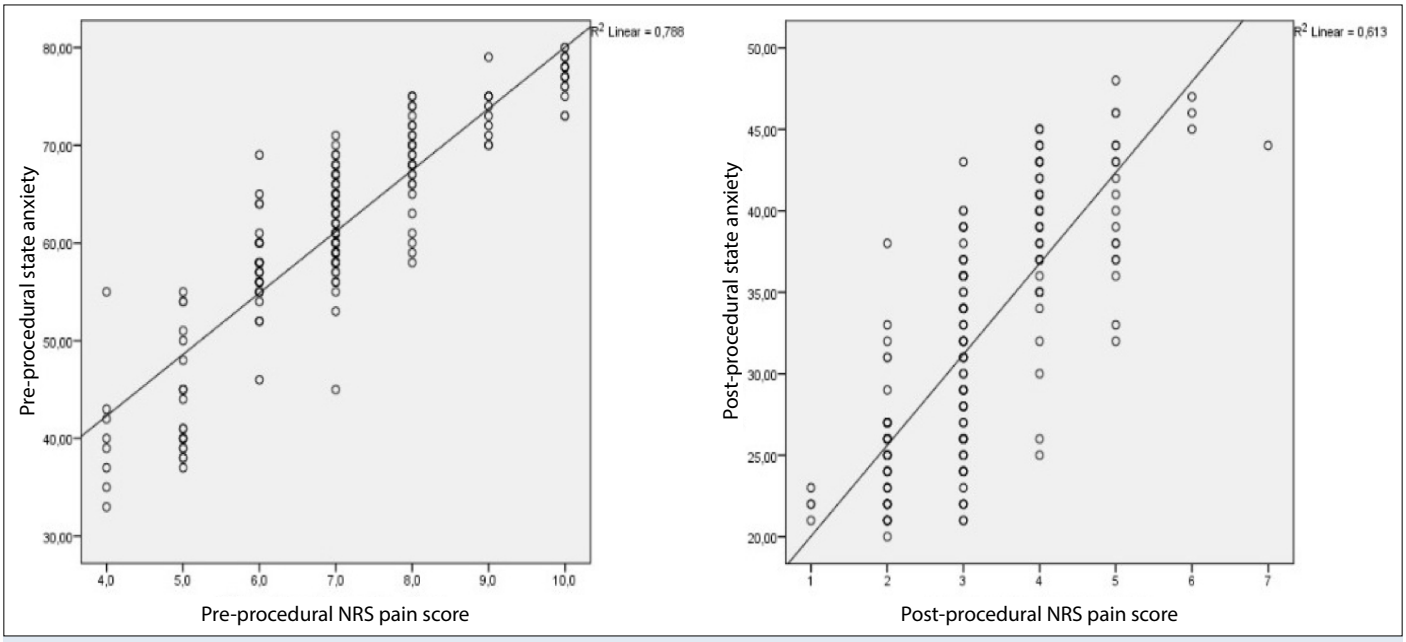

Figure 1. Correlation analysis between pre-procedural numerical rating scale (NRS) and anxiety and post-procedural NRS and anxiety.

Discussion

Barker et al.[11] conducted a study on post-procedure pain, anxiety, and shortness of breath in 138 patients who underwent PCI, with 102 (77%) male and 36 (33%) female participants. Of these, 32.7% had previously undergone PCI. They noted that PCI was more common in men, and those with prior procedures reported lower pain and anxiety levels. We examined 167 patients—128 (76.6%) male and 39 (23.4%) female—who were admitted to the emergency department for ST-elevation myocardial infarction and underwent PCI. The study concluded that men had a higher risk of heart disease than women. Şimşek's study, which involved 256 patients (165 male and 56 female) who received drug-eluting stents via PCI, also found that cardiovascular diseases were more common in men, depicting an average patient age of 62.29±10.31 years.[12,13]

Delew et al.[14] examined the pain scores and anxiety levels in 2.604 patients who underwent PCI. Seventy percent of the participants were male. Participants with lower educational levels reported higher anxiety scores both before and after the procedure when compared to those with higher educational levels. In our research, the pain and anxiety scores of the patients before and after the procedure were not correlated with their education levels. For example, the hospital involved was a specialized heart hospital. The relationship between the pain and the anxiety experienced by individuals and their educational level was not found to be significant. The pain levels among individuals were not related to their education status. Moreover, factors like fear of death, concerns about the procedure, and worries about the future could be given as examples.

In the study conducted by Yıldırım and Durna,[15] which examined the vital signs and anxiety levels of 104 patients undergoing PCI (i.e., 86 males and 18 females), the average age was 57 years. Sixty patients had a chronic illness, and 23 previously had stents inserted. Additionally, 24 patients had been previously hospitalized in the intensive care unit. Upon analyzing the data, no significant relationship was found between pain and anxiety and variables, such as age, gender, and chronic disease. The pain and anxiety levels decreased after the procedure. In Uzunok's[3] study involving 100 PCI patients and 100 control group participants, the mean age of patients undergoing PCI was 59.7±13.3 years, while that of the control group was 61.9±11.8 years. Seventy-nine percent of the participants were male, and 21% were female, of which 72% had chronic diseases. In this study, pain was not significantly related to age, gender, educational level, or marital status. However, the presence of chronic disease was significantly associated with PCI application.

In this work, no significant relationships were found between pre- and post-operative pain and variables, such as age, gender, and marital status. PCI was performed in 64.9% of individuals with chronic diseases. The finding was aligned with that of other studies indicating a positive relationship between pain levels and anxiety, with increased pain correlated with increased anxiety. The presence of chronic diseases contributes to a higher atherosclerosis rate, which necessitates PCI. Our results are consistent with findings from

Table 5. Regression analysis between numerical rating scale (NRS), anxiety, and vital signs

The dependent variable	Independent variable	ß	T	P	F	Model(p)	R^2
State anxiety while there is pre-procedure pain	Still	17.156	9.839	0.000	678.911	0.000	0.787
	NRS pain score while there is pre-procedure pain	0.888	26.056	**0.000**			
NRS pain score while there is pre-procedure pain	Still	12.764	5.600	0.000	77.372	0.000	0.293
	NRS pain score while there is pre-procedure pain	0.545	8.796	**0.000**			
Body temperature while there is pain before the procedure	Still	36.512	9.956	0.000	0.485	0.302	0.002
	NRS pain score while there is pre-procedure pain	0.258	0.606	0.302			
Heart rate with pain before the procedure	Still	71.649	13.115	0.000	20.524	0.000	0.096
	NRS pain score while there is pre-procedure pain	0.318	4.530	**0.000**			
Systolic blood pressure with pre-procedure pain	Still	120.737	24.515	0.000	69.265	0.000	0.271
	NRS pain score while there is pre-procedure pain	0.524	8.323	**0.000**			
Diastolic blood pressure with pre-procedure pain	Still	74.345	15.974	0.000	19.213	0.000	0.090
	NRS pain score while there is pre-procedure pain	0.308	4.383	**0.000**			
Respiratory rate with pain before the procedure	Still	17.518	12.025	0.000	57.811	0.000	0.236
	NRS pain score while there is pre-procedure pain	0.490	7.603	**0.000**			
Oxygen saturation with pain before the procedure	Still	95.424	138.051	0.000	0.375	0.541	0.003
	NRS pain score while there is pre-procedure pain	-0.045	-0.612	0.541			
State anxiety while there is post-procedure pain	Still	14.444	12.999	0.000	289.832	0.000	0.611
	NRS pain score while there is post-procedure pain	0.783	17.024	**0.000**			
Body temperature while there is pain after the procedure	Still	44.026	7.957	0.000	1.217	0.271	0.001
	NRS pain score while there is post-procedure pain	-0.081	-1.103	0.271			
Heart rate while there is post-procedure pain	Still	74.310	26.104	0.000	13.235	0.000	0.062
	NRS pain score while there is post-procedure pain	0.260	3.638	**0.000**			
Systolic blood pressure with post-procedure pain	Still	122.999	41.533	0.000	42.582	0.000	0.184
	NRS pain score while there is post-procedure pain	0.434	6.526	**0.000**			
Diastolic blood pressure with post-procedure pain	Still	74.923	6.153	0.000	0.547	0.460	0.002
	NRS pain score while there is post-procedure pain	0.055	0.740	0.460			
Respiratory rate with post-procedure pain	Still	19.846	39.110	0.000	84.735	0.000	0.313
	NRS pain score while there is post-procedure pain	0.563	9.205	**0.000**			
Oxygen saturation with post-procedure pain	Still	95.834	141.489	0.000	0.994	0.320	0.000
	NRS pain score while there is post-procedure pain	-0.074	-0.997	0.320			

1: Linear regression analysis; [2]F: Analysis of variance regression; ß: Standardized regression coefficient [3]T: Significance of regression coefficient; P: significance of regression coefficient; R^2: Square of multiple correlation coefficients.

other studies. When the anxiety level of 35 controls and 35 intervention groups undergoing PCI of Caries was compared, the anxiety score of patients who had the procedure before was lower than those who did not undergo the procedure. [16] Ciğerci[17] found that the pain level of patients who were previously hospitalized and had the procedure was lower. Lin et al.[18] conducted a study on 121 patients with chest pain to correlate pain and anxiety and showed a high positivity in relation to anxiety. The anxiety level increased as the pain score increased. A positive correlation was found between the pain and anxiety scales we used in the study. Pain and anxiety are positively and negatively related to each other. From the moment a person begins to feel pain, he begins to worry about the state of his health. The feeling of deterioration of the body integrity, the process complications, and the thinking that pain will not go away bring anxiety. Our results were consistent with those found for the pain and anxiety scales.

In a study by Saini et al.,[19] post-procedure anxiety levels were higher than pre-procedure anxiety in 60 patients undergoing stent placement. Chaudhury et al.[20] observed that successful PTCA procedures resulted in decreased post-procedure anxiety despite initially higher anxiety levels. Gu et al.[21] reported high pre-procedure pain and anxiety levels among 170 PCI patients, with decreased post-procedure anxiety and pain following a successful stent placement.[22]

Oura et al.[22] found a positive correlation between musculoskeletal pain and heart rate in a study of 2.373 women and 1.813 men examining cardiovascular autonomic functions. Lentini et al.[23] noted that increased pain scores in 36 athletes led to elevated heart rates and blood pressures. Barker et al.[11] studied 129 out of 138 PCI patients, finding that pre-procedure pain, anxiety, and shortness of breath negatively affected anxiety, quality of life, and respiratory rate post-procedure. While pre-procedure pain was correlated with anxiety and shortness of breath, changes in breathing rate post-procedure were not significant.

Our study found that increased pain scores were associated with higher blood pressure and heart rate. Post-stent treatment for atherosclerosis, combined with anticoagulant use, reduced pain, blood flow issues, heart and respiratory rates, and blood pressure, ultimately decreasing anxiety. A significant positive correlation was found between blood pressure and respiratory and heart rates. Meanwhile, the relationship between diastolic blood pressure and pain score was not significant likely because of the low post-procedure pain levels.

Gheith et al.[24] treated a 68-year-old patient with myocardial infarction without ST elevation, observing pain regression and shortness of breath post-PCI, although the patient had a high body temperature caused by thrombotic thrombocytopenic purpura. Tandon et al.[25] examined a male patient with chest pain and fever, diagnosing NSTEMI and viral myocarditis following troponin elevation and ECG changes. PCI alleviated the patient's pain, with the high body temperature attributed to myocarditis.

Studies investigating the comfort, anxiety, mood, and personality changes in patients undergoing coronary angiography (CAG) are crucial for understanding the psychological and physiological impacts of this medical procedure. Türker and Bedük examined the comfort and anxiety levels of patients undergoing CAG, focusing on identifying the anxiety and the discomfort experienced by patients during this process. The study emphasized the negative effects of anxiety on patients' overall well-being and suggested that high anxiety levels could also influence patients' comfort levels both before and after the procedure. Patients with higher anxiety levels experienced more post-procedural discomfort, highlighting the need for healthcare professionals to be more sensitive to these psychological conditions when caring for patients.[26]

Similarly, Gül et al.[27] investigated the mood and personality changes of patients undergoing CAG, drawing attention to the long-term effects of this procedure on patients. The study revealed that mood changes following CAG were not limited to temporary anxiety, but could also lead to significant personality trait alterations. Notably, patients who previously exhibited a calm demeanor displayed increased irritability, stress, and signs of depression. These findings suggest that CAG is not merely a physical procedure, but one that can profoundly affect patients' psychological well-being.

The findings of both studies underscored the need for a holistic evaluation of the physical and psychological dimensions of CAG. Anxiety management and psychological support play a crucial role in the treatment process of these patients. Addressing patients' mood and personality changes may lead to more effective outcomes in their long-term recovery. Therefore, healthcare professionals should pay attention to both the physical health of patients undergoing CAG and to their emotional and mental states.

Limitations

The study was conducted in a single center, which may limit the result generalizability.

Conclusion

The increase in the pain score of patients who underwent PCI before the procedure increased the anxiety score and vital sign follow-up. The pain score reduction by providing blood flow by inserting a stent in the procedure reduced anxiety and showed improvement in vital signs.

Ethics Committee Approval: The Provincial Health Directorate Ethics Committee granted approval for this study (date: 05.08.2022, number: 02).

Authorship Contributions: Concept: FNY; Design: FNY, BDD; Supervision: BDD; Fundings: FNY, BDD; Materials: FNY, BDD; Data Collection or Processing: FNY, BDD; Analysis or Interpretation: FNY, BDD; Literature Search: FNY, BDD; Writing: FNY, BDD; Critical Review: FNY, BDD.

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