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The effect of hand reflexology on anxiety in patients undergoing coronary angiography: A single-blind randomized controlled trial

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ABSTRACT

Background: This study aimed to evaluate effects of hand reflexology on anxiety level in coronary angiography patients.
Materials and methods: This clinical trial recruited 80 eligible patients >6 months. The patients were randomly assigned to receive routine care plus either hand reflexology or a simple hand massage. Data were collected using the Spielberger State-Trait Anxiety Inventory. Both groups' anxiety levels were measured before (T0) and 30 min (T1) and 1 h after the intervention (T2).
Findings: The mean anxiety level in the intervention group decreased from 57.54 at baseline to 55.47 after the intervention ($P = 0.0001$). The values in the control group were 54.27 and 51.4, respectively. The two groups had statistically significant differences in the mean scores of anxiety at T0 and T1 ($P = 0.003$), T1 and T2, and T0 and T2 ($P = 0.0001$).
Conclusion: Hand reflexology could effectively decrease anxiety in coronary angiography patients.

1. Introduction

Reducing anxiety has a clinical significance and is one of the goals in nursing care. Several methods, often pharmacological or invasive, are used to relieve anxiety in patients. Anxiety activates the sympathetic nervous system through physiological and biochemical responses and causes the release of epinephrine and norepinephrine. As a result, blood pressure, heart rate, respiratory rate and myocardial oxygen demand are increased. Increased heart workload also increases the risk of ischemia and dysrhythmias [1]. Any actions taken to reduce anxiety in patients is therefore highly important. Anxiety in patients can be controlled through pharmacological or non-pharmacological methods. One of the pharmacological options available is the use of benzodiazepines; however, due to the temporary effects and side-effects of these drugs, most studies in recent years have focused on non-pharmacological methods for reducing anxiety, such as the use of complementary medicine [2]. The use of complementary medicine is increasing in developed countries. In Iran, a study showed that 80% of patients are interested in receiving complementary medicine from physicians [3]. Complementary medicine therapies include massage therapy, music therapy, therapeutic touch, medicinal plants, yoga and reflexology [4].

Cardiovascular diseases are a leading cause of death and disability throughout the world and their global incidence and prevalence are on the rise [5], so that a third of all deaths across the world are linked to this disease. Although most cases of death due to cardiovascular diseases in the early twentieth century occurred in developed countries, the prevalence of these diseases is rapidly increasing in developing countries, as, in recent years, 78% of deaths are caused by cardiovascular diseases [6].

The increased prevalence of cardiovascular diseases and the advances in diagnostic technologies in recent years have increased the use of invasive diagnostic procedures such as angiography, so that more than a million cardiac catheterizations and coronary angiographies are performed every year in the US alone [1]. Patients undergoing cardiac catheterization experience unfamiliar conditions and are physically separated from their family and may lack enough knowledge about medical interventions, the costs of treatment, hospitalization, the induction of anesthesia and pain [7];

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as a result, they experience stress and anxiety [8] and even emotional shock at times [7]. Several studies have shown that more than 82% of patients who undergo this procedure experience fear and anxiety before their angiography due to their lack of familiarity with the procedure and the details of their diagnosis [9]. Although anxiety before angiography is an inevitable phenomenon, it can lead to significant physical and psychological reactions in different parts of the body, especially the heart, if its intensity surpasses the usual [10]. Different approaches have been used for reducing the stress and anxiety level prior to CA. Educational interventions, music therapy, massage, guided imagery, therapeutic touches and stress management techniques revealed positive effects on anxiety before CA [11].

Studies have examined the different methods of reducing anxiety in patients undergoing coronary angiography. Mansoorzadeh et al. showed that acupressure is significantly effective in reducing anxiety in patients undergoing coronary angiographic [3]. Vardanjani et al. also showed that foot reflexology reduces anxiety in patients undergoing coronary angiography [5]. Astley et al. did not report significant differences in anxiety levels in patients undergoing coronary angiography with the use of audio-visual techniques [12]. Taylor also found no significant reduction in anxiety levels in Chinese patients undergoing music therapy or sensory information [9]. Moreover, a 10-min massage before CA procedure, was not sufficient to decrease stress level [13].

Complementary and alternative medicine including reflexology interventions have widespread acceptance, largely without the clinical evidence for safety and efficacy [14]. Reflexology is a non-pharmacological alternative for reducing anxiety [4]. In clinical terms, reflexology is the application of pressure primarily on the hands, feet and ears that causes physiological reactions in the body. Reflexology originated in China and dates back to 4000 years ago [15]. The effect of massaging manifests itself by affecting autonomic glandular neural and peripheral systems. The hormones affected by massage include dopamine, serotonin, epinephrine, norepinephrine, oxytocin and cortisol [16]. Hands are a body organ that has several reflexology points. Hand reflexology is a technique that is compatible with the time restrictions imposed before medical procedures and can be manually performed by trained personnel in 10 min [17].

Some studies have also examined the effectiveness of hand massage in reducing anxiety in patients. Brand reported hand massage to be significantly effective in reducing preoperative anxiety in patients undergoing outpatient surgeries [17]. Fu et al. showed that hand massage along with aromatherapy reduce disruptive behaviors in dementia patients [18]. Nevertheless, no studies have yet examined the effect of hand reflexology on anxiety in patients.

Reflexology is a non-invasive treatment used in different clinical settings. Most studies have examined the effect of foot reflexology in different clinical settings [2,4,5,19] and few have examined the effect of hand reflexology. Moreover, no studies have yet been conducted on the effect of hand reflexology on anxiety in patients undergoing coronary angiography. The present study was therefore conducted to determine the effect of hand reflexology on anxiety in patients undergoing cardiac angiography.

2. Materials and methods

2.1. Study design

The present single-blind controlled clinical trial was conducted in 2015 in the angiography ward of Shahid Beheshti Hospital in Kashan, Iran. The research project was approved by Kashan University of Medical Sciences. The patients who frequently visited the hospital for coronary angiography and who met the eligibility criteria entered the study and were randomly assigned to two groups.

2.2. Sample size

The hypothesis test formula was used to estimate the sample size required for assessing differences in quantitative variables in two or more groups. The parameters used in the estimation of sample size ($\mu_1 = 8, \mu_2 = 5.9, \sigma = 3.5, \alpha = 0.05, \beta = 0.2$) were derived from the study conducted by Masoudi [5]. Based on these calculations, sample size was estimated as 34. Ultimately, 40 participants were assigned to each group so as to take account of potential sample loss. From a total of 150 patients who visited the hospital, 45 did not meet the study inclusion criteria and 25 did not consent to participation in the study. A total of 80 patients ultimately entered the study and were randomly divided into an intervention and a control group (Fig. 1).

2.3. Inclusion criteria

The patients who consented to participation in the study and were having their first coronary angiography, had a stable hemodynamic status before their coronary angiography, had no history of heart surgery and heart attack, had no current addiction to drugs, had not used sedatives or anxiety medications such as propranolol at least 72 h before angiography, had no known history of thyroid disorders, epilepsy and local problems on the site of the hand reflexology and who had an anxiety score of 43 or above [20] were included in the study.

2.4. Exclusion criteria

The patients who were not willing to continue participation in the study or were not able to tolerate the intervention and developed unstable vital signs during the research were excluded from the study.

2.5. Data collection tools

The assessment tools used included a demographic information questionnaire and the Spielberger State-Trait Anxiety Inventory (STAI) and were self-reporting. The demographic information questionnaire inquired about the participant's gender, age, marital status, level of education, employment status and medical history. The Spielberger STAI is a well-known standard tool for measuring anxiety. The state anxiety scale of the STAI comprises 20 items and is scored on a response scale of “very much so” (4 points), “moderately so” (3 points), “somewhat” (2 points) and “not at all” (1 point); the total scores range from 20 (the lowest level of anxiety) to 80 (the highest level of anxiety). The Spielberger scale has frequently been evaluated in different groups in Iran and its validity and reliability have been confirmed.

Dehghan Nayeri and Adib-Hajbaghery [21] and Bayani et al. [22] calculated the Cronbach's alpha value of the STAI and reported its reliability as 94% and 92%.

2.6. Method of intervention

On the day of the coronary angiography, 1 h before undergoing the procedure, the patients who had frequently visited the hospital for coronary angiography completed an informed consent form after receiving the necessary explanations on the study methods. The patients' level of anxiety was measured using the state scale of the Spielberger STAI. Their anxiety was measured and recorded

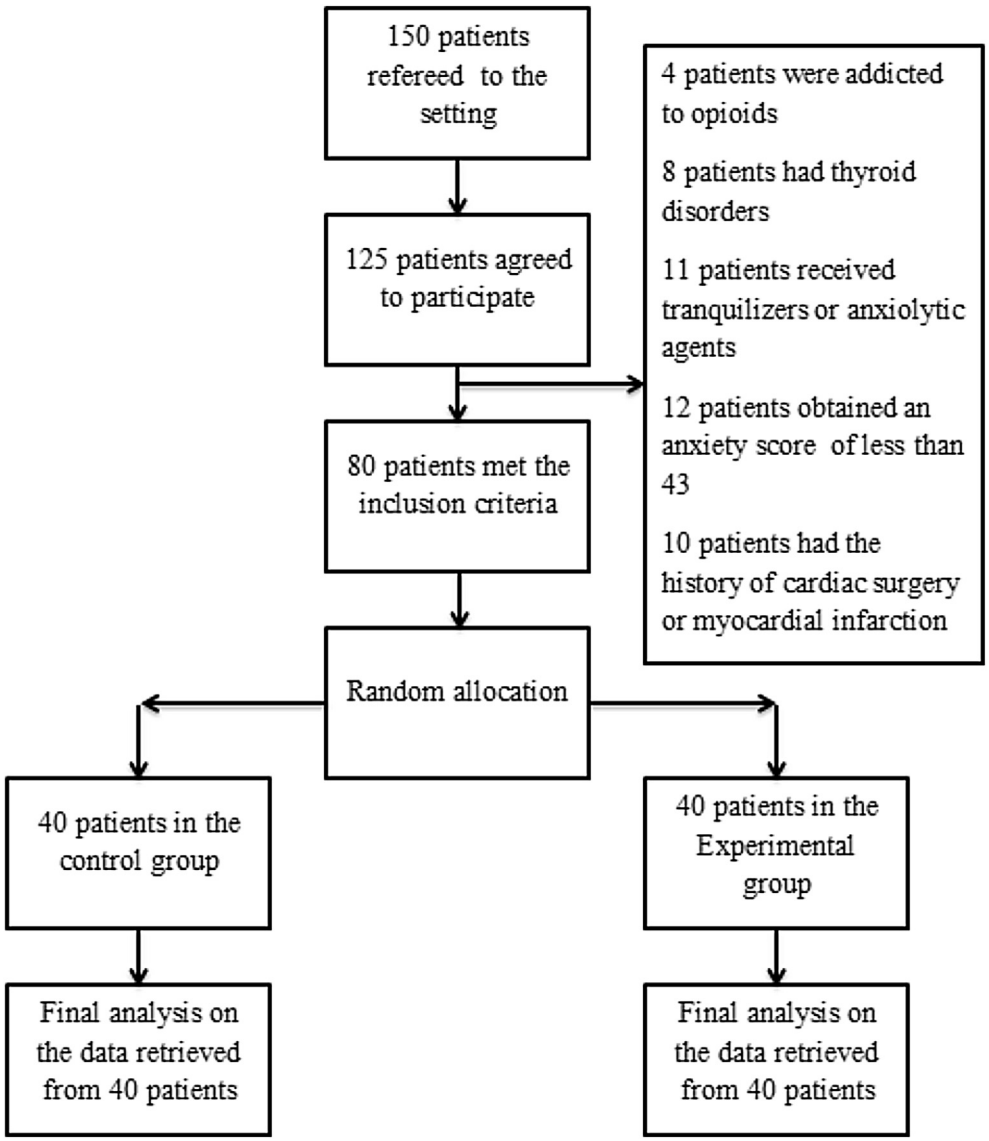

Fig. 1. Patient recruitment and research study procedures.

blindly by a colleague who was also a researcher and an experienced cardiac nurse. The patients whose anxiety levels were medium or higher and were not prohibited from participation in the study were randomly selected from a list of randomization in blocks of four. To perform the intervention, the therapist washed his hands with warm water and the patient remained in a seated position. The researcher performed the massage with his thumb and began with the left hand and then moved to the right hand, and started from the forearm, moving to the wrist, the palm, the back of the hand and finally the fingers; the massage was repeated eight to ten times. This technique relaxes the hand and prepares it for reflexology [5]. After general hand massage the six reflexology point were used for stimulation) The reflexology points for the cardiovascular system include 1) the solar plexus and diaphragm located in the center of the palm below the soft area on the base of the middle fingers, 2) the thyroid and parathyroid glands located on the inner side of the base of the thumb, 3) the lung point located on the palm on the soft area between the middle and fourth fingers, 4) the cardiac point located on the palm under the soft area on the bottom of the ring and small fingers, 5) the adrenal glands located on the top of the thumb tendon about one-third of the distance between the base of the index finger and the wrist, and 6) the kidney point located on the inside of the thumb tendon directly below the index finger (Fig. 2) [23,24]. The researcher pressed each of the reflexology points with his thumb so that the patient felt the pressure but sensed no pain. The reflexology points were massaged 14 times in a row in a clockwise direction and a circular motion without cutting contact with the skin [24,25] The patients in the control group received only the routine care for angiography along with a simple hand massage. The level of anxiety was measured in the patients at baseline and 30 and 60 min after the intervention.

2.7. Ethical considerations

This study was approved by the Research Center and the Ethics Committee of Kashan University of Medical Sciences (IR.KAUMS.-REC.1394.84). Permission was obtained from the authorities of the Research Center. All the patients reserved the right to accept or reject the invitation to participate in the study. All the participants submitted written consent forms and were ensured about the

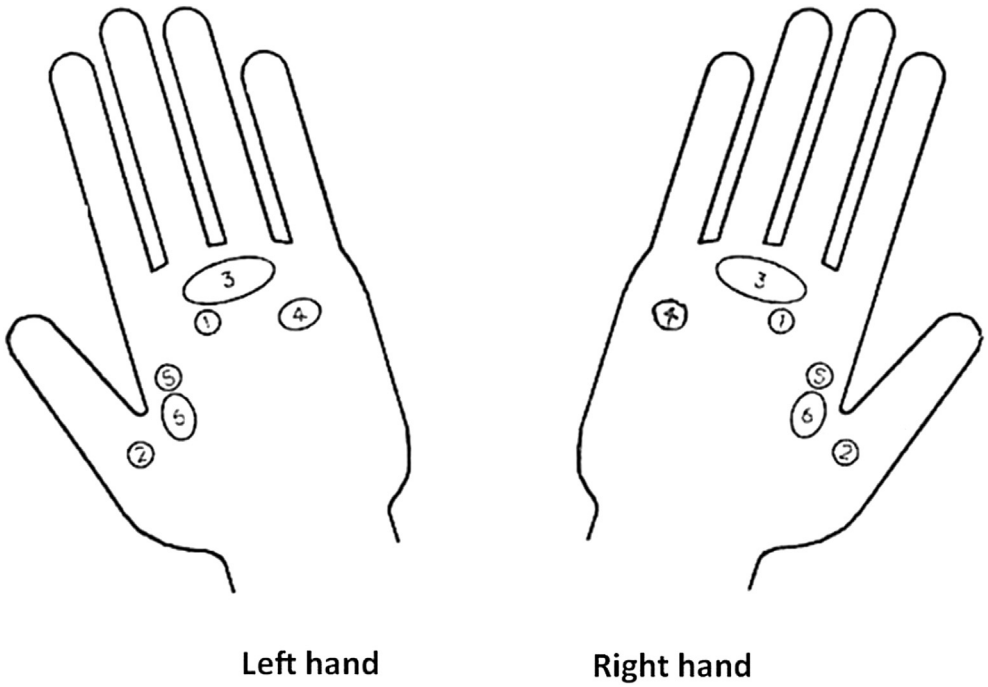

Fig. 2. Reflexology points on the palm of the hand: 1) The solar plexus and diaphragm, 2) The thyroid and parathyroid glands, 3) The lung point, 4) The cardiac point, 5) The adrenal glands, 6) The kidney points.

confidentiality of their data. If the patients were unwilling to continue participation in the study during the intervention, they were excluded and replaced.

2.8. Data analysis

Data were analyzed in SPSS-16. The independent *t*-test was used to compare the mean scores between the two groups, the dependent *t*-test to compare the scores throughout the stages in each group, and the Chi-square test to compare the qualitative data. The level of statistical significance was set at $P < 0.05$.

3. Results

The mean age of the patients was 62.7 ± 6.28 in the control group and 60 ± 7.8 in the reflexology group. The two groups were matching in terms of demographic characteristics such as age, gender, marital status, level of education, employment status, history of smoking, history of diabetes, hyperlipidemia and blood pressure (Table 1).

4. Discussion

The results showed a reduction in the level of anxiety before undergoing coronary angiography in both the hand reflexology and hand massage groups; however, the level of anxiety in the hand reflexology group reduced six times more than in the hand massage group, suggesting a statistically significant difference.

A study conducted by Mahmoudirad showed that foot reflexology reduces anxiety in patients undergoing coronary angiography [19]; however, in that study, the control group received only the routine care, while the intervention group received reflexology in addition to the routine care, which makes it difficult to determine the exact anxiety reduction mechanism in the reflexology group compared with the mechanism taking place in the control group. Several studies have shown that using a simple massage can also have beneficial hemodynamic effects and reduce the patients' anxiety [17,18,26]. Although reflexology and massage therapy have some common aspects, there are several key differences between them. In reflexology, pressure is applied to small muscles located in specific points on the hands and feet, while massage therapy involves larger muscles or the whole body [27]. In the cited study, the control group was given a placebo in the form of a simple hand massage.

According to Hudson et al., hand reflexology has a positive effect on anxiety in patients undergoing minor surgery with local anesthesia [28]; in that study, the patients' anxiety was measured before and immediately after surgery and anxiety levels were measured using a numeric rating scale; furthermore, that study measured anxiety on two occasions before angiography. The study used the standard Spielberger STAI as well [21,22].

In a study on patients undergoing coronary angiography, Vardanjani et al. showed that anxiety reduced after receiving foot reflexology [5]; furthermore, the patients' anxiety was only measured immediately after the intervention in the study and the researchers examined only the short-term effects of reflexology on anxiety levels. In the present study, however, the level of anxiety was also measured 1 h after the intervention so as to evaluate the persistent effects of reflexology.

The results obtained by Gunnarsdottir and Jonsdottir on the effects of foot reflexology on anxiety in patients undergoing CABG [29] were inconsistent with the present findings. The sample size of the cited study (five in the intervention group and four in the control group) differed from that of the present study. The inclusion criterion of 'not using anti-anxiety medications or other forms of complementary medicine that help reduce anxiety' was also not considered in the cited study, as opposed to the present one.

The mechanism of effect of reflexology is not yet fully determined; however, it appears that the type of contact and pressure used in reflexology has an effect beyond a simple contact. Reflexology leads to systematic physiological changes in the body

Table 1
The frequency distribution of participants' demographic characteristics.

Group characteristic		Hand reflexology N (%)	Control N (%)	P-value
Gender	Male	23 (51.1)	22 (48.9)	0.82
	Female	17 (48.6)	18 (51.4)	
Age (Years)	Mean ± SD	60 ± 7.8	62.7 ± 6.28	0.40
Marital status	Single	3 (37.5)	5 (62.5)	0.45
	Married	37 (51.4)	35 (48.6)	
Level of education	Illiterate	17 (54.8)	14 (45.2)	0.60
	Elementary education	18 (47.4)	20 (52.6)	
	Junior high school education	1 (25)	3 (75)	
	High school diploma	3 (75)	1 (25)	
	Post-secondary education	1 (33.3)	2 (66.7)	
Employment status	Employed	11 (50)	11 (50)	0.96
	Retired	12 (52.2)	11 (47.8)	
	Housewife	17 (48.6)	18 (51.4)	
Cigarette smoking	Yes	6 (37.5)	10 (62.5)	0.26
	No	34 (53.1)	30 (46.9)	
Reason behind the CA	Resting chest pain	10 (38.5)	16 (61.5)	0.15
	A positive exercise test	2 (100)	0 (0)	
	Repetitive chest pain in spite of treatments	28 (53.8)	24 (46.2)	
Underlying conditions	Yes	33 (51.6)	31 (48.4)	0.57
	No	7 (43.8)	9 (56.2)	
Hypertension	Yes	25 (50)	25 (50)	1
Diabetes mellitus	Yes	17 (44.7)	21 (55.3)	0.37
Hyperlipidemia	Yes	28 (58.3)	20 (41.7)	0.07

The results showed that the scores of anxiety were not significantly different between the two groups before the intervention (PV = 0.83; Table 2).

Table 2
Comparing the study groups in terms of the mean score of anxiety.

P-value (Independent Sample T-Test)	95% CI	Control	Intervention	Variable	
		Mean ± SD	Mean ± SD		
0.83	−3.1, 2.5	54.27 ± 5	54.57 ± 7.35	Before (T1)	Anxiety
0.04	0.03, 5.7	51.4 ± 4.95	48.5 ± 7.65	Half an hour after (T2)	
0.0001	3.97, 9.27	54.17 ± 5.6	47.55 ± 6.26	One hour after (T3)	

The mean score difference for anxiety was significant before and 1 h after the intervention in the intervention group (P = 0.0001), but it was not significant in the control group (P = 0.87, Table 3).

Table 3
The mean score difference of anxiety in the study groups between T1-T2, T2-T3 and T1-T3.

Group	Experimental			Control		
Mean Score of Anxiety	T1-T2	T2-T3	T1-T3	T1-T2	T2-T3	T1-T3
Mean ± SD	6.07 ± 5.42	0.95 ± 3.68	7.02 ± 6.49	2.87 ± 3.63	−2.77 ± 3.28	0.10 ± 3.91
95% CI	4.34, 7.80	−0.22, 2.12	4.94, 9.1	1.71, 4.03	−3.82, −1.72	−1.15, 1.35
P-Value (Paired Sample T-Test)	0.0001	0.11	0.0001	0.0001	0.0001	0.87

The comparison of the intervention and control groups showed a statistically significant difference in the mean score of anxiety before the intervention compared to half an hour after (P = 0.003), in the mean score of anxiety half an hour after the intervention compared to 1 h after and in the mean score of anxiety before the intervention and 1 h after (P = 0.0001; Table 4).

Table 4
Comparing the study groups in terms of the mean difference in the anxiety scores between T1-T2, T2-T3 and T1-T3.

Mean difference anxiety scores	Group	$\overline{X}$ ± SD	PV (T-Test)
T1-T2 mean difference	Control	−2.87 ± 3.63	0.003
	Intervention	6.07 ± 5.42	
T2-T3 mean difference	Control	2.77 ± 3.28	0.0001
	Intervention	0.95 ± 3.68	
T1-T3 mean difference	Control	0.1 ± 3.91	0.0001
	Intervention	7.02 ± 6.49	

resulting in relaxation and mental-physical balance and thus reduces symptoms of stress [30]. Reflexology may also relieve pain and improve the mood by stimulating the release of endorphins and enkephalins [31].

In the present study, despite the decline in anxiety after the intervention, the patients' anxiety increased in both groups 1 h after the intervention compared to half an hour before and as the patients were approaching the time of their angiography. This change can exacerbate physical symptoms in the patient and therefore affect his prognosis [32]. Therefore, any action taken to reduce the patients' anxiety should be performed as closely to the time of the coronary angiography as possible.

The reduction in anxiety in the control group can be attributed to the positive effect of hand massage. Given that the personal and external characteristics of the person who is contact with the patient may affect the patient's anxiety, it is imperative to further study the supportive role of nurses and the effect of the nurse's presence at the patient's bedside and her relationship with the patient. Nevertheless, as the researcher's completion of the questionnaire through interviews may affect the subjects' answers, it is recommended to simultaneously use other anxiety scales and to

also assess the patients' physiological parameters and the clinical symptoms of anxiety.

Reflexology is an ancient therapy re-emerging into modern healthcare with an increasing interest and continuing research as complementary therapies blend with traditional care; integrative reflexology can provide the nurse with a holistic tool to assess and manage individual stress. Naturopathic nursing is an evolving concept of advanced holistic practice and education, offering nurses additional opportunities to impact personal well-being.

5. Conclusion

Based on the findings, hand reflexology is six times more effective than simple hand massage in reducing patients' anxiety before coronary angiography. Hand reflexology is therefore recommended to be used by nurses as a simple, non-pharmacological and non-invasive method to reduce patients' anxiety before coronary angiograph.

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