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Care of Patients with Coronary Heart Disease

Anxiety in patients undergoing percutaneous coronary interventions

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ABSTRACT

Objective: Many patients undergoing percutaneous coronary intervention (PCI) experience symptoms of anxiety; however, it is unclear whether anxiety is an issue in the early recovery period and the types of factors and patient concerns that are associated. This study set out to determine the patterns of anxiety and concerns experienced by patients undergoing PCI and the contributing factors in the time period surrounding PCI.

Methods: A convenience sample of patients undergoing PCI (n = 100) were recruited, and anxiety was measured using the Spielberger State Anxiety Inventory immediately before the PCI, the first day postprocedure, and 1 week postdischarge. Patients were also asked to identify their most important concern at each time. Independent predictors of anxiety at each time were determined by multiple regression analysis.

Results: Anxiety scores were highest pre-procedure (35.72, standard deviation [SD] 11.75), decreasing significantly by the postprocedure time (31.8, SD 10.20) and further still by the postdischarge time (28.79, SD 9.78) (repeated-measures analysis of variance: $F = 39.72$, $P < .001$). The concerns patients identified most frequently as most important were the outcome of the PCI and the possibility of surgery pre-procedure (37%) and postdischarge (31%), and the limitations and discomfort arising from the access site wound and immobility postprocedure (25%). The predictor of anxiety at the pre-procedure time was taking medication for anxiety and depression (b = 7.12). The predictors of anxiety at the post-procedure time were undergoing first-time PCI (b = 4.44), experiencing chest pain (b = 7.63), and experiencing pre-procedural anxiety (b = .49). The predictors of anxiety at the postdischarge time were reporting their most important concern as the future progression of CAD (b = 7.51) and pre-procedural anxiety (b = .37).

Conclusion: Symptoms of anxiety were common, particularly before PCI. These symptoms are important to detect and treat because pre-procedural anxiety is predictive of anxiety on subsequent occasions. Patients who have had chest

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pain or their first PCI should be targeted for intervention during the early recovery period after PCI, and information on CAD should be provided postdischarge.

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Coronary artery disease (CAD) is a leading cause of mortality, morbidity, and loss of quality of life globally.[1] One of the most common treatments for CAD is percutaneous transluminal coronary angioplasty/stent placement, collectively labeled "percutaneous coronary intervention" (PCI). PCI is recommended to treat unstable or chronic stable angina and ST-segment elevation myocardial infarction (STEMI) when only 1 or 2 arteries are involved.[2,3] PCI has been demonstrated to improve prognosis, relieve symptoms, reduce ischemic events, and improve functional capacity in a relatively low-risk procedure with a rapid recovery.[4-6] In addition, because CAD is a progressive illness, an individual may have multiple procedures, so it is not surprising that PCI is one of the most commonly performed procedures in the United States and Australia. For instance, 35,121 PCIs were performed in Australia between 2006 and 2007, and 1,131,000 PCIs were performed in the United States in 2006.[7,8]

Although PCIs are common and relatively low risk, many patients undergoing these treatments experience clinically relevant anxiety, with an estimated prevalence rate of 24% to 72%.[9-14] Anxiety involves feelings of fear, tension, or panic, or an expectancy that something unpleasant is going to happen, and has 2 closely related dimensions: state (a fluctuating response to stimuli) and trait (an enduring and predictable behavioral response).[15,16] State anxiety may be more clinically relevant for patients undergoing PCI because it is transitory in nature and amenable to nursing interventions.[17,18]

Anxiety is important to assess and treat in PCI for several reasons. First, anxiety is often accompanied by physical symptoms that can be distressing,[19] such as chest pain, which patients may interpret as having a cardiac origin, which is distressing for the patient and difficult for health professionals to differentiate. Second, the physiologic changes associated with anxiety have been found to be detrimental to cardiac function,[10,17,20-24] and higher than normal anxiety is predictive of several adverse outcomes in the hospital, including chest pain, rhythm disturbances, and poor recovery patterns.[9,23,25-27] Finally, anxiety limits a patient's capacity to process[28] and retain information provided by health professionals, which is important to his/her well-being and ongoing health.[18]

There are multiple potential sources of anxiety for patients undergoing PCI, including the concerns that patients have.[29] These concerns include fear of discomfort, uncertainty, and fear about survival,[12,30-33] and have been reported in qualitative studies to be more distressing than chest pain.[34] For many patients undergoing PCI, the pre-procedural period includes a period of escalating angina symptoms or acute chest pain and urgent hospitalization, so it is not surprising that anxiety levels are reported to peak before the PCI and then to reduce over time when outcomes are more certain.[9-13,17,29,30,32,33] For patients who have not experienced an acute event, there may be more anxiety about the potential to be diagnosed with CAD for the first time and the implications that the diagnosis may have for them.[12,24] These concerns recur each time a PCI is undertaken, so patients having repeat procedures are reported to have similar levels of anxiety.[13] However, no study was found that asked patients to identify their primary concern, which could reasonably include personal issues.

Although anxiety levels decrease after a PCI, clinically relevant anxiety may still be common, with one study noting that 21% of patients remained anxious 6 to 8 weeks after the procedure.[10] Concerns that may contribute to patients' anxiety at this time are multiple and relate to the recurrence of chest pain,[9,35,36] uncertainty regarding the impact CAD may have on their lives, the potential progression of CAD,[13,29,33,34,37] and the effect CAD may have on their future working ability. Concerns early in recovery center on chest pain,[9] femoral site discomfort, back pain, and immobilization.[32,35,36]

Few studies have investigated anxiety levels and patients' expressed concerns in the very early recovery period within 24 hours after the procedure or the early recovery period in the week after discharge. This time period is important because it includes the brief time available to assess and treat anxiety before patients are discharged from the hospital. It is also a period when patients are potentially vulnerable at home before cardiac rehabilitation services commence. Furthermore, few studies have identified the independent predictors associated with anxiety at these time periods; therefore, our study sought to determine 1) the level of anxiety and the concerns expressed by patients undergoing PCI pre-procedure and postprocedure in the early recovery period and 2) the factors contributing to anxiety at each point in time.

Materials and Methods

The study used a descriptive design with measures repeated immediately before the PCI procedure, the

first day postprocedure, and 1 week postdischarge. Approval was granted by the ethics committee of all institutions involved before its implementation.

Sample and Setting

A convenience sample was collected from a 350-bed, tertiary-referral hospital in Sydney, Australia, which provides PCIs for privately insured patients. Routine care for patients undergoing elective PCI in this institution involves admission 1 to 2 hours before the procedure, whereas patients with chest pain but not STEMI are admitted to the hospital and treated until undergoing PCI, which is then undertaken during normal business hours. All patients receive a drug-eluting stent and Phase One cardiac rehabilitation information before discharge.

Patients were considered eligible if they were aged more than 18 years, scheduled for a coronary angiogram and had an elective PCI, and able to read and understand written and spoken English sufficient to give informed consent and complete the survey. Patients were excluded if they had experienced urgent PCI for STEMI or a PCI within the last month, had received any premedication or were already prepared for the PCI, were being treated by a psychiatrist for a major psychiatric illness, or were not able to be contacted by telephone for the postdischarge interview. Patients who were taking medications to manage symptoms of anxiety and depression were eligible.

Instruments

State anxiety was measured using the Spielberger State Anxiety Inventory (SAI).[15] The scale consists of a 20-item self-report questionnaire that asked patients to describe how they felt "at that moment" on a 4-point Likert scale ("not at all," "somewhat," "moderately so," and "very much so"). The score ranged from 20 to 80 points, with higher scores reflecting more anxiety. The SAI has been used frequently in those with cardiovascular disease and those undergoing PCIs,[10,18,20,31,38-42] and has been successfully administered by non-psychiatrically trained health researchers, such as nurses.[15] The SAI has proven reliability, with a Cronbach's alpha coefficient of .92, and in this study, coefficients of .91 pre-procedure, .92 postprocedure, and .94 postdischarge were determined.

For the purpose of this study, patients were considered to have clinically relevant symptoms of anxiety if their SAI score was 35 or more. This classification is consistent with the score selected for a study on a similar sample of Australian patients undergoing PCI[10] and with age-related mean anxiety levels for working adults (50-69 years) of 34.51 for men and 32.20 for women.[15] The SAI was administered in person for the pre-procedure and postprocedure interviews and via telephone postdischarge.[43]

Concern has been defined for this study as patients' verbal expression of the situation that is the most important source of anxiety. Each participant's most important concern at each time point was elicited using the question, "What is causing you the most anxiety or concern at the moment?" The responses were recorded verbatim. Sociodemographic and specific clinical data that characterized the sample were collected from participants or taken from their medical records, including age, gender, marital status, education and employment, concurrent illnesses, anxiety and depression medications, cardiac history, and cardiac risk factors (which included diabetes, hypertension, and smoking). Several of these variables were identified or potentially associated with anxiety in PCI samples by previous researchers.[10,13,22,38] Circumstances that followed the PCI, including complications and chest pain experienced, as well as patients' contact with health care professionals or presentation to hospital, which could logically be connected with patient's concerns identified in the literature, were also collected.

Procedure

From June 2005 to March 2006, screening visits to the cardiac catheter laboratory and the critical care unit identified eligible study patients who had been scheduled for an elective angiogram or PCI. Of the 162 patients approached, 159 were recruited, of whom 44 patients did not have PCI and therefore were not eligible. Participants were withdrawn if they did not complete the postprocedure ($n = 5$) or postdischarge interviews ($n = 10$). In total, 100 participants completed all 3 surveys. Three attempts were made to complete the postdischarge telephone interview before they were considered lost to follow-up. Interviews were conducted 2 to 3 hours before the procedure, between 12 and 18 hours after the procedure while in the hospital, and between 7 and 10 days postdischarge. Participants completed the SAI, and then the research nurse collected the additional data, including the open question. Patients were provided with the SAI during admission to use as a reference for the postdischarge interview. Any patient identified with a high SAI score (a score of > 35) with their permission was referred to the relevant health professional, in most cases the clinical nurse consultant for cardiology.

Data Analysis

All data were entered into a database, and data analysis was conducted using the Statistical Package for Social Science (SPSS) version 15.0.[44] Data were described using frequencies, percentages, means, and standard deviations. The differences in the means for anxiety among the 3 time points were determined using repeated-measures analysis of variance followed by Tukey's test, with the P level set at less than .02 to account for multiple testing.

The concerns that patients verbalized were organized into 5 major categories independently for each

time point from patients' responses by 2 of the researchers (RT and RG), using a process of independently developing categories followed by discussion to reach consensus. Responses that were infrequently reported were combined into broader categories. The number of participants whose response was congruent with the final categories has been reported. The 2 most common categories of concerns were then entered into the multiple regression models for each corresponding point in time.

The predictors of anxiety were determined by multiple regression analysis using backward and stepwise methods as recommended by Field.[45] The variables entered included age, gender, marital status, education, previous PCI, hospitalization before PCI, anxiety/depression medication, and the 2 most important concerns. These variables were entered into all analyses, along with the pre-procedure anxiety score and the occurrence of chest pain for the postprocedure and postdischarge models.

Table 1 – Sociodemographic and clinical characteristics (n = 100)

Characteristic	Mean (SD)
Age in years, mean (SD)	65.63 (10.17)
Education in years, median (minimum to maximum)	13.50 (7-32)
	No. %
Male	80
Married	83
Employed	45
Previous cardiac diagnosis[a]	
None	30
PCI ± stent	41
Myocardial infarction	10
Coronary artery bypass graft surgery	17
Unstable angina	47
Treatment: hospitalized pre-PCI for UAP	13
Cardiac risk factors[a]	
Diabetes	11
Hypertension	67
Smoker anxiety or depression medications	6

SD, standard deviation; *PCI*, percutaneous coronary intervention; *UAP*, unstable angina pectoris.
[a] Numbers total > 100 because of multiple diagnoses.

Results

Sample Characteristics

The sample participants had an average age of 65.63 years, most were male (80%), and 83% of them were married (Table 1). A typical participant had 1 vessel treated (70%) and received only 1 stent (54%) as opposed to multiple stents. Complications were experienced by 30% of participants, of which chest pain was the most common both postprocedure (9%) and postdischarge (31%). A small proportion (3%) experienced a myocardial infarction after discharge and sought emergency department treatment.

Anxiety

Table 2 shows the mean scores for anxiety preprocedure, postprocedure, and postdischarge. Anxiety decreased significantly over time (repeated-measures analysis of variance: $F = 39.72$, $P < .001$), by 3.88 score points from pre- to postprocedure ($P = .002$) and then by a further 3 points postdischarge ($P = .014$), making a total decrease of 6.89 points or 19% from preprocedure to postdischarge.

Participants' Most Important Concerns

Participants identified their most important concern most often as the outcome of the PCI and the possibility of coronary artery bypass graft surgery both before and after the procedure when they had been discharged (Table 3). After the procedure, while still an inpatient, the most common concern (26%) was specific to physical limitations and access site pain. Personal issues and uncertainty regarding the future progression of the CAD were also relatively common concerns.

Predictors of Anxiety

Table 4 provides detail on the models developed for anxiety and the significant predictors at the preprocedure, postprocedure, and postdischarge times. Pre-procedure, participants taking medications for anxiety and depression were more anxious, which explained only 6% of the variation in anxiety. After PCI, anxiety was highest in participants undergoing the procedure for the first time if they had experienced chest pain after the PCI and had been more anxious pre-procedure. Together these variables accounted for 36% of the variation in anxiety postprocedure. After discharge, participants with pre-procedure anxiety and concern regarding progression of the CAD and potential for further treatment were more anxious. These variables accounted for 29% of the variation in anxiety postdischarge.

Discussion

This study demonstrated that anxiety in patients undergoing PCI is generally mild before the procedure and decreases further after the procedure; however, clinically relevant anxiety was not uncommon. Both before the procedure and after discharge, the most frequent important concern patients expressed was that the PCI may be unsuccessful, resulting in further invasive procedures (eg, coronary artery bypass

Table 2 – Anxiety over time[a]

Anxiety	Pre-procedure	Postprocedure	Postdischarge	Test statistic	P level
SAI mean ± (SD)	35.72 (11.15)	31.8 (10.20)[b]	28.79 (9.78)[b]	$F = 39.72$	<.001
Clinically relevant anxiety (SAI ≥ 35)	49%	32%	19%	$\chi^2 = 41.66$	<.001

SAI, Spielberger State Anxiety Inventory; *SD*, standard deviation.
[a] Repeated-measures analysis of variance; ± score range 20-80; higher scores more anxious.
[b] $P < .02$ for differences between each time point.

Table 3 – Participants' most important concerns

Category of concern	Pre-procedure	Postprocedure	Postdischarge
Outcome of PCI and potential for CABG	37%	13%	31%
Procedural discomfort, including limitations after PCI	25%	26%	7%
Personal issues: family, work finance	15%	13%	23%
Uncertainty regarding potential progression of CAD	-	13%	17%

PCI, percutaneous coronary intervention; *CABG*, coronary artery bypass grafting; *CAD*, coronary artery disease.

Table 4 – Predictors of anxiety: Pre-procedure, postprocedure, and postdischarge

Variables	b	95% CI	P value
Pre-procedure			
Taking medication for anxiety/depression	7.12	1.43-12.95	.014
$r^2 = .06$, $F = 6.29$, $P = .014$, Durbin-Watson = 2.07, VIF = 1			
Postprocedure			
Pre-procedure anxiety	.49	.34-.64	<.001
Chest pain post-PCI	7.63	3.43-11.85	<.001
Previous PCI	−4.44	−7.82 to .11	.011
Age	−.17	−.33 to −.02	.09
$r^2 = .37$, $F = 18.37$, $P < .001$, Durbin-Watson = 1.82, VIF = 1			
Postdischarge			
Pre-procedure anxiety	.37	.23-.53	<.001
Concern: uncertainty regarding potential progression of CAD	7.51	3.12-11.96	.001
No. of comorbid conditions	1.74	−.96 to 3.05	.10
$r^2 = .29$, $F = 19.82$, $P < .001$, Durbin-Watson = 1.79, VIF = 1			

CI, confidence interval; *b*, unstandardized beta; *VIF*, variance inflation factor; *PCI*, percutaneous coronary intervention; *CAD*, coronary artery disease.

grafting). This concern was independently associated with anxiety postdischarge. Immediately after the PCI the most common important concern was discomfort related to the PCI procedure and the recovery requirements. Patients were more anxious if they experienced chest pain postprocedure or if it was their first PCI. Patients with more anxiety before the procedure continued to have more anxiety after the procedure.

The prevalence of symptoms of anxiety was greatest before the procedure, with approximately half of the sample reporting clinically relevant anxiety, which is a larger proportion than in many previous reports.[10] This increase may result from a number of factors. First, there may be an increase in anxiety as the procedure time approaches; in the current study, assessments of anxiety were performed closer to the procedural time than those reviewed. Second, our study used a threshold for clinically relevant anxiety that was based on equivalent-aged normal samples, whereas other studies used a norm reference of general medical surgical patients, who presumably may be more likely to be anxious.[10,22] Third, the current study included patients hospitalized with chest pain awaiting PCI, whereas most other published studies excluded these patients. However, the pattern of decreasing anxiety over time from before the procedure is consistent with the findings of other researchers[9-14] and highlights the need to assess and manage pre-procedural anxiety. This time point may be a particularly important time for nurses to interact with patients.

It may be possible to help patients manage their anxiety by addressing the concerns that participants identify as most important. Because the most common patient concern pre-procedure was related to procedural outcomes, information on overall PCI success

rates and risk probabilities may be reassuring.[34] However, there is clearly a need to repeat this information postdischarge, because this concern became more prevalent when patients had been discharged. It may be that although patients have had a successful PCI, they now have had time to reflect on their diagnosis and the implications for their life plans.[36] This may be especially the case for patients undergoing PCI for the first time, who were more anxious than those undergoing repeat PCIs. There is also some evidence that patients undergoing first-time PCIs anticipate a set recovery trajectory, which may not occur in reality.[34]

The occurrence of chest pain during early recovery was clearly anxiety provoking. Although chest pain can also be a symptom of anxiety, it is not surprising that having chest pain would heighten anxiety because chest pain would make any patient doubt the success of the PCI.[9,35,36] Therefore, it is important to quickly determine whether chest pain is ischemic in origin, to manage the chest pain, and to keep the patient informed. Patients also need to be advised that progress through recovery varies both during their hospital stay and after discharge.

Participation in cardiac rehabilitation would help address some of the concerns identified,[46] because cardiac rehabilitation facilitates improvement in cardiac risk factors, decreases anxiety, and improves quality of life in patients.[47,48] However, patients undergoing PCI have low participation rates in cardiac rehabilitation. Future research should address the development of interventions, such as post-acute care that could address these issues and promote cardiac rehabilitation participation.

Many participants were also concerned with potential or actual discomfort both before and after the procedure. In the time after the PCI, the imposition of immobility and access site pain may be addressed by multiple interventions, including analgesia, position support, and encouragement of movement within the range (eg, fidgeting) to prevent unnecessary immobility and tension.[34,35] The opportunity to express and share feelings and concerns associated with the PCI may help decrease anxiety. Women participating in 2 hourly group discussions weekly for 10 weeks had improved anxiety levels.[49] Counselors helped participants improve coping with stressors and used applied relaxation to make rest more efficient in this study. Other strategies include the use of a cognitive behavioral approach that addresses unrealistic and erroneous beliefs and expectations, distraction, hypnosis techniques, and slow breathing, although these strategies have not shown consistent benefits for all patients.[32,50-52]

Strengths and Limitations

A key strength of the study included the use of assessments at key times for patients undergoing PCI, immediately pre-procedure, postprocedure before going home, and during early recovery at home. The use of repeated measures and a sample that completed all 3 assessments was a strength; however, this method reduced the sample size and most likely the explanatory capacity of the regression models. Given the influence of pre-procedure anxiety on subsequent anxiety, it is possible that the inclusion of trait anxiety may have enhanced the explanatory capacity of the model; however, there is limited potential for nurses to address trait anxiety. Finally, an untested single open question was used to determine patients' most important concern, and further research is required to determine whether this question is adequate for the purpose.

Implications for Nursing Practice

Given the potentially serious consequences of untreated anxiety, the assessment of anxiety is warranted, yet this assessment rarely occurs as a part of routine care.[40,41] Critical care nurses commonly rely on behavioral and physiologic indicators in their clinical evaluations of patients' anxiety,[53] although anxiety may not be reflected in these outward signs, so anxiety can be underestimated.[40,41] There is a need to use a straightforward, quick, and reliable anxiety assessment instrument, which can be incorporated into care guidelines for patients undergoing PCI.[41] Routine screening for anxiety with such a tool would enable rapid identification of patients with clinically relevant anxiety and commencement of intervention. Several tools are available for this purpose, although not always tested in PCI samples, and include the Brief Symptom Inventory, which is a 53-item, 5-point survey, which also has shortened versions that can be used in a variety of clinical settings and completed in as little as 8 minutes and is well suited for repeated administrations to evaluate patients' progress.[24,38,54-58] This instrument has been widely used to measure anxiety in populations with cardiovascular disease sufficient to identify patients who have clinically relevant anxiety. Interventions must then be tailored to the different phases of the PCI experience to accommodate differing patient concerns and referral to a psychologist for specialist care if necessary when high SAI scores are identified. Finally, inclusion of psychologic or psychiatric specialists into routine team care would be justified.

Conclusions

Symptoms of anxiety are a significant issue for some patients undergoing PCI, particularly before the procedure, although they are not uncommon across

the whole time period; therefore, assessment of anxiety should be a routine component of care for patients undergoing PCI. This assessment would enable nurses to help patients manage anxiety or provide resources for mental health, stress management, or behavioral medicine services. Interventions aimed at managing anxiety need to be tailored to patients' profile and according to the phase of the PCI process. For instance, because anxiety is highest pre-procedure and anxiety at this time is predictive of subsequent pre-procedural anxiety, it is important to detect and treat. After PCI, interventions should be directed to patients who have had their first PCI or who have experienced chest pain after the procedure. Finally, information should be provided on the CAD process and the potential for disease progression after discharge, which may occur ideally in the cardiac rehabilitation setting.

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