Journal of Surgery and Medicine

The effect of cardiac rehabilitation on anxiety and depression in percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG) patients

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Abstract

Background/Aim: It is well-known that Cardiac Rehabilitation (CR) brings about a marked improvement in depression and anxiety. As far as we know, there are no studies that research the effect of CR, Percutaneous Coronary Intervention (PCI), and Coronary Artery Bypass Grafting (CABG) on anxiety and depression. This study aimed to investigate the effects of the CR program on anxiety and depression and the change of anxiety and depression symptoms in patients who underwent PCI and CABG.

Methods: This cross-sectional study included 27 patients with PCI and 16 patients who had undergone CABG admitted to the CR program. The Beck Depression Inventory (BDI) was used to determine the severity of depression symptoms, and the Situational and Trait Anxiety Inventory (STAI I-II) were used.

Results: After CR, the BDI, STAI-1, and STAI-2 significantly decreased in both the PCI ($P<0.001$, $P=0.002$, and $P=0.006$, respectively) and CABG groups ($P<0.001$, $P=0.001$, and $P=0.015$, respectively) compared to before CR. The change in BDI was higher in the CABG group ($P=0.033$), while there were no significant differences between the changes in STAI-1 and STAI-2 scores ($P=0.378$ and $P=0.361$).

Conclusion: The results of this study demonstrate the CR benefits for depression and anxiety in patients undergoing CABG and PCI. On the other hand, CABG patients show relatively more benefit in terms of depressive symptoms. Prospective and controlled studies with larger sample sizes are needed to support our findings.

Keywords: Anxiety, Depression, Cardiac rehabilitation, Coronary artery bypass grafting, Percutaneous coronary intervention

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Introduction

Coronary Artery Disease (CAD) increases morbidity and mortality and decreases the quality of life [1, 2]. Coronary artery bypass grafting (CABG) and Percutaneous Coronary Intervention (PCI) are commonly used in the treatment of CAD, which requires myocardial revascularization [3, 4]. Despite their successful results, those procedures are stressful life events for many patients and can cause anxiety and depression before and after treatment [5]. This can negatively affect the treatment processes and the quality of life of the patients [6].

Depression and anxiety are two significant and common debilitating mental disorders [7]. Studies are reporting an association between these diseases and poor prognosis and mortality, especially among cardiac disease patients [8]. Cardiac Rehabilitation (CR) is a multidisciplinary program that includes the increase of physical exercise capacity, nutrition counseling, biopsychosocial management, and identification of metabolic cardiac risk factors [9]. Various practices, such as training the family members, support in lifestyle change, group training, and stress management, are also included in CR [10]. It is a well-known approach that CR not only increases the exercise capacities in cardiac patients but also brings about a marked improvement in depression and anxiety [11-13]. However, it is still not an easy-to-come-by treatment method due to the lack of specialized centers.

After the cardiac rehabilitation program was seen to improve anxiety and depression, the researchers investigated whether these effects changed with the cardiac diagnosis [11, 12, 14]. Solak et al. [12] compared the CAD and CABG patients and reported that CR improved the depressive symptoms among the CAD patients, but not among the CABG patients. This is mostly due to the limited number of CABG patients. On the other hand, Sharif et al., who researched the effect of CR on anxiety and depression in CABG patients, indicated its effectiveness [14]. As far as we know, no studies are examining the change in the anxiety and depression severity of patients who received CR after PCI. Similarly, we did not encounter any studies which research the effect of CR, PCI, and CABG on anxiety and depression.

In the light of such information, the present study aims first to research the effect of CR on anxiety and depression in patients who underwent PCI and CABG. The second aim is to compare the changes in the anxiety and depression symptoms of the PCI and CABG patients.

Materials and methods

The files of the patients, who joined and finished the Phase II CR program at Sultan Abdulhamid Han Training and Research Hospital between February 2017 and September 2018 were examined retrospectively. Twenty-seven patients who received Percutaneous Coronary Intervention (PCI) (removing the obstructive lesion in a coronary artery with balloon angioplasty and/or coronary stent implantation), and 16 patients who underwent Coronary Artery Bypass Grafting (CABG) were included in the study. The inclusion criteria were as follows: a) Having undergone PCI or CABG, b) Not having any physical or metabolic diseases preventing the patient from joining the CR program, c) Having finished the CR program, d) Not having any psychiatric disorders and/or history of psychiatric drug use before and during CR. After the protocol of the study was approved by the Ethics Committee of Zeynep Kamil Training and Research Hospital (IRB: 2018/128), the data were collected, and all the rights of the patients were protected following the Helsinki Declaration.

The CR program consisted of 36 exercise sessions performed over 12 weeks, 3 times a week. The vital signs of the patients, including pulse, arterial blood pressure, cardiac rhythm, and oxygen saturation, were monitored during the program. Each session consisted of a 10-minute warm-up, a 30-minute continuous aerobic exercise and the use of light hand weights, and then a 10-minute cooling period. In addition to an exercise program, the patients were trained in terms of diet, cardiac risk factors, stress management, diabetes management, hypertension, and smoking cessation.

The patients were asked to fill in the scales before the CR started. The depression symptoms of the patients were measured with the Beck Depression Inventory (BDI); their anxiety statuses were measured with STAI I-II. The vital signs of the patients, measured by the ergometer, were recorded before and after the program.

Beck Depression Inventory (BDI), one of the most used self-report scales to determine depressive symptoms in the general population, consists of 21 items scored between 0 and 3. The score interval is 0-63 and the recommended cutoff score is 17. Its validity and reliability studies were carried out in Turkish [15].

State and Trait Anxiety Inventory (STAI I-II) was used to determine the trait and situational anxiety levels of the patients. It is a self-report scale that consists of two scales with twenty items each. The situational part is used to determine how the individual feels and what his/her feelings are at a certain time and under certain conditions. The trait part is used to determine how the individual generally feels. The scores of each part range between 20-80. Elevated scores indicate a high anxiety level [16].

Statistical analysis

Power analysis was conducted with the G*Power software. Twenty-eight patients were needed for an 80% power, a 5% margin of error, and a 0.5 effect size. A total of 43 patients were included in the study; we predicted that the total patient population loss would be around 20%. The data were analyzed with SPSS (Statistical Package for the Social Sciences Inc., Chicago, IL, USA) 20.0 version. Descriptive statistics were used to identify the properties of the data. Separation norms of continuous variables were evaluated with the Kolmogorov-Smirnov test. The paired t-test was used to compare results obtained before and after CR. The student t-Test and the Mann Whitney U test were utilized to compare two independent groups, when suitable. The chi-square test was used for the comparison of categorical data. P-value of <0.05 was considered statistically significant.

Results

Socio-demographic features of the patients were presented in Table 1. The mean age of the patients was 61.30

(12.53) years and 37.2% were female. The mean body mass index was 27.44 (4.31) kg/m^2. Among all, 88.4% of the participants were married and 37.2% were smokers. The demographic data of the PCI and CABG patients were similar ($P>0.05$ for all).

A comparison of the participants' BDI and STAI I-II scores before and after CR based on the diagnosis was shown in Table 2. After CR, the BDI, STAI-1, and STAI-2 significantly decreased in both the PCI ($P<0.001$, $P=0.002$, and $P=0.006$, respectively) and CABG groups ($P<0.001$, $P=0.001$, and $P=0.015$, respectively) compared to before CR. The change in BDI was higher in the CABG group ($P=0.033$), while there were no significant differences between the changes in STAI-1 and STAI-2 scores ($P=0.378$ and $P=0.361$).

Table 1: Socio-demographic features of the percutaneous coronary intervention and coronary artery bypass grafting patients who underwent cardiac rehabilitation

Variable	Total	Percutaneous coronary intervention patients	Coronary artery bypass grafting patients	t/U Value	P-value
N	43	27 (62.8)	16 (37.2)		
Age; Mean (SD)	61.30 (12.53)	62.37 (13.43)	59.50 (11.03)	0.722	[a]0.475
Gender n (%)					
Female	16 (37.2)	11 (40.7)	5 (31.2)	0.387	[c]0.534
Male	27 (62.8)	16 (59.3)	11 (68.8)		
BMI; Mean (SD)	27.44 (4.31)	27.53 (4.54)	27.30 (4.07)	-0.124	[b]0.901
Marital Status; n (%)					
Married	38 (88.4)	23 (85.2)	15 (93.8)	0.045	[c]0.831
Single	5 (11.6)	4 (14.8)	1 (6.2)		
Smoking; n (%)					
Yes	16 (37.2)	9 (33.3)	7 (43.8)	0.467	[c]0.495
No	27 (62.8)	18 (66.7)	9 (56.2)		

a: Sutudnet t test, b: Mann Withney U test, c: Chi square test

Table 2: Comparison of depression and anxiety scores of the patients before and after cardiac rehabilitation

Variable	Diagnosis	Before Cardiac Rehabilitation	After Cardiac Rehabilitation	t Value	P-value	Difference	T/U Value	P-value
BDI; Mean(SD)	PCI	12.55 (8.50)	6.74 (4.67)	5.113	[a]<0.001**	-5.81 (5.90)	2.212	[b]0.033*
	CABG	19.0 (9.91)	8.31 (3.53)	4.926	[a]<0.001**	-10.75 (8.75)		
STAI-1 Mean(SD)	PCI	36.85 (9.90)	32.48 (6.94)	3.388	[a]0.002**	-4.37 (6.70)	0.891	[b]0.378
	CABG	39.00 (8.42)	32.81 (8.42)	4.108	[a]0.001**	-6.18 (6.02)		
STAI-2 Mean(SD)	PCI	39.48 (9.01)	37.25 (8.92)	2.994	[a]0.006**	-2.22 (3.85)	-0.913	[c]0.361
	CABG	41.62 (11.30)	37.43 (10.03)	2.731	[a]0.015*	-4.18 (6.13)		

BDI: Beck Depression Inventory, [a] Paired T-test, [b] Student T Test, [c] Mann Whitney U Test, * $P<0.05$, ** $P<0.001$, PCI: Percutaneous Coronary Intervention, CABG: Coronary Artery Bypass Grafting

Discussion

We found that the CR program was associated with significant improvement in the anxiety and depression levels of the outpatients who underwent PCI and CABG. The improvement in the depression levels of the CABG patients was significantly higher than that of the PCI patients. The changes in the anxiety levels of the CABG and PCI patients were similar.

Anxiety and depression are among the frequent problems in patients with coronary artery disease and according to many studies, they can lead to negative outcomes [1, 6]. Previous studies revealed that the CABG patients had more severe depression and anxiety than the PCI patients [17]. In our study, the BDI and STAI I-II scores of the CABG patients were higher, which may be due to the high-risk surgical operation performed, follow-up in the intensive care unit, longer hospital stays, and more frequent outpatient follow-up visits.

The CR program improved anxiety and depression, as expected [18-20]. Although not exactly clear, the exercise program implemented during CR is the most probable mechanism for this improvement [21]. Also, we think that stress

management and behavioral change training provided to the patients contributed greatly. Socialization with the other patients going through the same process may have also played a role [22]. The studies revealed that sympathetic activity, hypothalamic-pituitary axis stimulation, and inflammatory process may be of significance in the effects of depressive symptoms on the cardiovascular system [23-25]. More extensive studies are needed to clarify this mechanism.

The depressive findings of the CABG patients improved significantly more compared to the PCI patients, a finding that is first reported by our study. This is mostly because the CABG patients have relatively more severe depressive symptoms. Furthermore, the fact that CABG is performed on relatively more severe CAD patients causes an increase in the depression severity of the patients. On the other hand, the improvement in anxiety scores was similar between the two groups.

Our study had some limitations, including the small sample size and the retrospective design. Also, the anxiety and depression scores of the patients were measured with self-report scales. It should be noted that such scales may be easily manipulated by the patients. Further studies should focus on multidisciplinary interventions to increase the quality of life of cardiac patients to improve both physical and mental health. Prospective and controlled studies with bigger sample sizes are necessary to support our results.

Conclusion

Our results shed light on the beneficial effect of CR on the depression and anxiety of the CABG and PCI patients. The CABG patients' depressive symptoms improved more compared to those of PCI patients. Even though the changes seen in our study seem limited, we believe that its cumulative effect shall be high. We recommend increasing rehabilitation programs to prevent depression and anxiety among these patients, which may decrease health expenses and increase the quality of life.

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