

[ ORIGINAL ARTICLE ]

# The Association of Depression with Type D Personality and Coping Strategies in Patients with Coronary Artery Disease

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## Abstract:

**Objective** Depression in patients with coronary artery disease (CAD) has been a risk factor for adverse cardiovascular events. However, personality types, strategies for coping with stressors, and their associations with depression have not been fully elucidated in patients with CAD. This study explored depression in patients with CAD and examined its association with personality types and coping strategies.

**Methods** A prospective observational study of 89 patients with CAD was conducted between August 2016 and July 2018. The presence of depression and type D personality and types of coping strategies were measured one month after percutaneous coronary intervention. A logistic regression analysis was performed to identify characteristics associated with depression.

**Results** Generally, the incidence of depression and type D personality was 55.1% and 44.9%, respectively. The incidence of depression in patients with type D and non-type D personality was 72.5% and 40.8%, respectively. Patients with type D personality coped less frequently using a planning strategy but frequently using a responsibility-shifting strategy. A logistic regression analysis showed that the presence of depression was significantly associated with type D personality and inversely associated with a planning strategy.

**Conclusion** The high prevalence of depression in patients with CAD was associated with type D personality and a low rate of adoption of a planning strategy. Specific coping interventions in patients with CAD with type D personality may be potential targets for improving coping skills and preventing the development of depression.

**Key words:** coronary artery disease, depression, type D personality, coping strategy

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## Introduction

The importance of traditional cardiometabolic risk management in patients with coronary artery disease (CAD) has been widely established (1, 2), but unmet care needs still exist for psychological distress, such as depression and anxiety (3, 4). The prevalence of depression in patients with acute coronary syndrome (ACS) is approximately 45%, which is significantly higher than that in the general population (men, 2-3%; women, 5-9%) (5, 6).

Depression has been a risk factor for the development and progression of CAD, and a significant relative risk exists (1.5-2.5) (7). Furthermore, patients with persistent depression after the onset of ACS were found to have lower rates

of adherence to quitting smoking, using medications, exercising, and attending cardiac rehabilitation than those without depression (8, 9).

Type D personality has been characterized as a joint tendency toward negative affectivity and suppression of emotional expression by social inhibition (10). Patients with CAD with type D personality have shown higher dropout rates from cardiac rehabilitation (11), higher levels of depressive and anxious symptoms (11, 12), and a higher prevalence of hypertension, smoking, and a sedentary lifestyle (13). Importantly, rates of cardiovascular mortality and morbidity have been reported to be higher in patients with CAD with type D personality than in others (10, 14). Patients with CAD with type D personality were also associated with depression at the 10-year follow-up (15). There-

fore, type D personality and its association with depression are critical factors to address in patients with CAD to prevent secondary life-threatening events and encourage adherence to behaviors that reduce cardiovascular risks (8, 11, 12).

Patients with CAD should employ optimal strategies for coping with stressors and reducing adverse stress responses (16). Previous studies have reported that avoidance-oriented coping was associated with anxiety after ACS (14). Importantly, a number of patients with CAD have been reported to utilize maladaptive coping strategies, which mediate the association between type D personality and morale (17). Effective psychotherapeutic interventions should be devised for patients with CAD. However, while analyses with a few subscales and types of coping strategy have been reported (18, 19), there is little evidence supporting optimal behavioral instructions for coping with stressors, and to which CAD patients the intervention should be provided is unclear.

This study examined the following: (i) prevalence of depression and type D personality in patients with CAD; (ii) behavioral characteristics of the coping strategy utilized in patients with CAD; and (iii) relationships among depression, type D personality, and coping strategies in patients with CAD who underwent percutaneous coronary intervention (PCI).

## Materials and Methods

### Participants and study design

Patients with CAD who underwent PCI after being admitted to our university hospital between August 2016 and July 2018 were included in this observational study. Participants were not consecutively enrolled if they had the following: (i) a history of heart failure; (ii) history of dementia; (iii) an inability to communicate verbally; (iv) an inability to complete the questionnaire; (v) a severe illness that prevented their participation in the study, and (vi) failure to provide informed consent. Patients were also excluded if they had the following diseases that have been associated with the presence of depression: myocardial infarction (3, 4), chronic kidney disease (20), cerebrovascular disease (21), malignant neoplasm (22, 23), or chronic respiratory failure (24, 25).

Patient characteristics included the age, sex, employment status (e.g., employed or unemployed), living situation (e.g., with family or alone), cardiovascular risk factors (e.g., hyperlipidemia, hypertension, diabetes mellitus, current smoker, body mass index), peak creatine kinase and brain natriuretic peptide (BNP) levels, numbers of coronary artery lesions, number of repeated PCI procedures, length of hospital stay, and CAD type. The presence or absence of background diseases, a medical history, and exclusion criteria were carefully extracted from the medical records and the physician's diagnosis.

This study was conducted in accordance with the Declara-

tion of Helsinki. All participants received an oral and written explanation of the study and an informed consent form explaining that participation was completely voluntary and that participants could withdraw at any time without penalty. An anonymous questionnaire and return envelope were mailed to the homes of the participants who provided informed consent. This study was approved by the Ethics Committee of Shinshu University School of Medicine.

### Questionnaires

#### Type D personality

We used the Japanese version of the Type D Personality Scale (26), developed by Denollet (27). The scale consists of 14 items and 2 factors (negative affectivity and social inhibition) with reported reliability coefficients (Cronbach's  $\alpha$ ) of 0.799 and 0.826, respectively. Items are rated on a 4-point Likert scale, ranging from 0 (disagree) to 4 (agree). Patients were diagnosed with a type D personality if each score of both factors (i.e. "negative emotion" and "social inhibition") was  $\geq 10$ . In this study, the Cronbach's  $\alpha$  values for "negative affectivity" and "social inhibition" were 0.857 and 0.817, respectively.

#### Coping strategies

The Tri-axial Coping Scale (TAC-24) developed by Kamimura et al. (28) was used to measure coping strategies. The scale was developed to measure how an individual usually thinks and acts in response to stressful situations. The scale consists of 24 items and 8 subscales, and the reliability (Cronbach's  $\alpha = 0.74-0.84$ ) and validity of the scale have been confirmed. The eight subscales are as follows: catharsis, abandonment or resignation, information gathering, distraction, evasive thinking, positive interpretation, planning, and responsibility shifting. Items are measured on a 5-point Likert scale, ranging from 1 (never) to 5 (always). The lowest and highest scores for each subscale were 3 and 15, respectively. Higher scores indicate better coping. Cronbach's  $\alpha$  of the TAC-24 in this study was 0.797.

#### Depression

The Japanese version (29) of the Self-Rating Depression Scale (SDS) developed by Zung (30) was used to measure depression. The reliability and validity of the scale have been confirmed (31, 32). It includes 20 items with 4-point Likert scales, ranging from 1 (never or rarely) to 4 (very often). Patients with total scores  $\geq 40$  were diagnosed with depression. Cronbach's  $\alpha$  of the SDS in this study was 0.707.

### Statistical analyses

All analyses were performed using the IBM SPSS Statistics software program for Windows, version 25.0 (IBM, Armonk, USA). Three participants with missing values were excluded from the analysis. A p value  $< 0.05$  was considered statistically significant.

Mann-Whitney U-tests were used to compare the means between the two groups to assess the presence or absence of depression. Chi-square tests were used to compare depres-

**Table 1. Patient Characteristics and Differences between Patients with Depression and Non-Depression.**

	All	Depression	Non-Depression	p
n	89	49	40	
Age	66 [58-73]*	69 [59-74]*	65 [58-70]*	0.161
Male / female	79 (88.8)/10 (11.2)	42 (85.7)/7 (14.3)	37 (92.5)/3 (7.5)	0.254
Living with family / alone	81 (91.0)/8 (9.0)	45 (91.8)/4 (8.2)	36 (90.0)/4 (10.0)	0.524
Employed / unemployed	53 (59.6)/36 (40.4)	24 (49.0)/25 (51.0)	29 (72.5)/11 (27.5)	0.025
Current smoker	7 (7.7)	6 (12.2)	1 (2.5)	0.089
Acute myocardial infarction	35 (39.3)	22 (44.9)	13 (32.5)	0.128
Hypertension	54 (60.7)	27 (55.1)	27 (67.5)	0.234
Dyslipidemia	65 (73.0)	35 (71.4)	30 (75.0)	0.706
Diabetes mellitus	28 (31.5)	14 (28.6)	14 (35.0)	0.516
Peak creatine kinase (U/L)	204 [980-1,837]*	270 [100-2,867]*	147 [96-1,341]*	0.293
BNP (pg/mL)	43.4 [22.3-143.3]*	92.2 [30.2-270.3]*	35.1 [17.5-103.1]*	0.010
Coronary artery lesion				
Single vessel disease	59 (66.3)	35 (71.4)	24 (60.0)	
Double vessel disease	23 (25.8)	12 (24.5)	12 (30.0)	0.401
Triple vessel disease	7 (7.9)	2 (4.1)	4 (10.0)	
PCI count 1st	64 (72.0)	35 (71.4)	29 (72.5)	
2nd	19 (21.3)	10 (20.4)	9 (22.5)	0.829
3rd	6 (6.7)	4 (8.2)	2 (5.0)	
Length of hospital stay (days)	6 [4-12]*	7 [4-13]*	6 [4-12]*	0.813
Body mass index (kg/m <sup>2</sup> )	24.2 [21.9-26.9]*	23.8 [21.2-25.6]*	24.3 [22.8-27.6]*	0.088
Type D / non-type D	40 (44.9)/49 (55.1)	29 (59.2)/20 (40.8)	11 (27.5)/29 (72.5)	0.003

Data are shown as n (%) or median [interquartile range]\*

BNP: brain natriuretic peptide, PCI: percutaneous coronary intervention

sion rates between the two groups.

To identify the characteristics of coping strategies in patients with type D personality, subscales of the TAC-24 were compared between patients with type D and non-type D personality using the Mann-Whitney U test.

Univariate and multivariate analyses were conducted to identify the presence or absence of depression as a dependent variable. Variables of age, gender, and those that were significant at a p value <0.10 were entered into the multivariate logistic regression model as independent variables. Independent variables with a p value <0.05 were considered candidates for the multiple linear regression analysis after checking for multicollinearity ( $r < 0.9$  between tested independent variables).

## Results

### Patients' characteristics

Of the 138 patients who received an explanation of the study, 111 signed the consent form. Ninety-two of those 111 patients returned the questionnaire (response rate, 82.9%). After excluding 3 patients with missing values, 89 patients were included in the analysis (effective response rate, 96.7%). Although this study may have had a sample-selection bias, the following characteristics of participants were similar to those of Japanese PCI patients in previous large-scale studies (33, 34): age, body mass index, and pro-

portions of gender, hypertension, dyslipidemia, and diabetes mellitus. The incidences of type D personality, depression, and type D personality with depression in patients with CAD who underwent PCI were 45.0%, 55.1%, and 32.6%, respectively (Table 1).

### Relationships among depression, patient characteristics, and coping strategies

The Mann-Whitney U tests showed that serum BNP levels were significantly higher in patients with depression than in those without depression ( $p = 0.010$ ). Chi-square tests showed that the incidence of depression was significantly higher in unemployed patients than in employed patients ( $p = 0.025$ ). The incidence of depression in patients with type D personality was 72.5% (29/40), which was significantly higher than the incidence of 40.8% (20/49) in patients with non-type D personality ( $p = 0.003$ ) (Table 1). Mann-Whitney U tests showed that scores for planning (a subscale of the TAC-24) were significantly higher in patients without depression than in those with depression ( $p < 0.001$ ) (Table 2).

### The comparison of coping strategies between patients with type D and non-type D personality

The Mann-Whitney U-test showed significantly lower scores for planning ( $p = 0.037$ ) and higher scores for responsibility shifting ( $p = 0.046$ ) (both are subscales of the TAC-24) in patients with type D personality than in those with non-type D personality (Table 3).

**Table 2. Subscales of the Tri-Axial Coping Scale in Patients with Depression or Non-Depression.**

	Depression	Non-Depression	p
n	49	40	
Catharsis	8.0 [6.5-9.0]	9.0 [6.0-10.0]	0.568
Abandonment or Resignation	7.0 [5.0-9.0]	6.0 [4.0-8.0]	0.191
Information gathering	9.0 [6.5-11.0]	10.0 [8.0-12.0]	0.050
Distraction	9.0 [6.0-10.5]	8.0 [7.0-9.0]	0.491
Evasive thinking	9.0 [7.0-11.0]	8.0 [6.0-10.0]	0.457
Positive interpretation	9.0 [8.0-11.5]	11.0 [9.0-13.0]	0.051
Planning	9.0 [8.0-11.0]	12.0 [10.3-13.8]	<0.001
Responsibility shifting	5.0 [3.0-6.0]	4.0 [3.0-6.0]	0.275

Data are shown as median [interquartile range].

**Table 3. Subscales of the Tri-Axial Coping Scale in Patients with Type D or Non-Type D Personality.**

	Type D	Non-Type D	p
n	40	49	
Catharsis	8.5 [7.0-10.8]	8.0 [6.0-9.0]	0.104
Abandonment or Resignation	7.0 [5.0-10.0]	6.0 [4.5-8.0]	0.060
Information gathering	9.0 [8.0-11.0]	10.0 [7.0-11.0]	0.332
Distraction	8.0 [6.0-10.8]	9.0 [6.5-10.0]	0.944
Evasive thinking	9.0 [8.0-11.8]	8.0 [6.0-10.0]	0.083
Positive interpretation	10.0 [9.0-12.0]	10.0 [8.0-12.5]	0.977
Planning	10.0 [8.0-11.8]	11.0 [9.5-13.0]	0.037
Responsibility shifting	5.0 [3.3-7.0]	4.0 [3.0-6.0]	0.046

Data are shown as median [interquartile range].

### The association of variables with the presence of depression

The logistic regression analysis identified a significant association between type D personality and the presence of depression [odds ratio (OR), 3.82; 95% confidence interval (CI), 1.56-9.38]. The analysis also identified information gathering (OR, 0.86; 95% CI, 0.75-0.99) and planning (OR, 0.69; 95% CI, 0.57-0.85) as types of coping strategies, in addition to being employed (OR, 0.36; 95% CI, 0.15-0.89) and high BNP level (OR, 1.01; 95% CI, 1.00-1.01). The multivariate analysis identified an independent association between type D personality and the presence of depression (OR, 4.50; 95% CI, 1.38-14.72) and an inverse association between a planning coping strategy and the presence of depression (OR, 0.73; 95% CI, 0.56-0.94) (Table 4).

## Discussion

This study demonstrated the following in patients with CAD at 1 month post-PCI: (i) the prevalence of depression in all patients and in those with type D personality was 55.1% and 72.5%, respectively; (ii) type D personality was independently associated with the presence of depression; and (iii) a low rate of adopting a planning strategy was associated with the presence of depression.

Depression is reportedly a risk factor for CAD and secon-

dary cardiovascular events (35, 36). The univariate analysis in this study showed that high BNP levels were associated with the presence of depression, supporting the influence of heart failure in addition to CAD on the psychophysiology of depression (37).

Studies on characteristic personalities among patients with CAD reported that type D personality is significantly associated with depression (12), the severity of CAD (17), and the long-term mortality in patients with established CAD (14). Depression in patients after a coronary event has been associated with psychological stress associated with forced lifestyle changes for secondary prevention (38, 39). Consequently, patients with persistent depression are less likely to adhere to the lifestyle changes needed for secondary prevention (8). Patients with type D personality actually experience anxiety and distress (i.e. negative affectivity) and suppress emotional expression in social interactions (i.e. social inhibition) (11). In accordance with these previous studies, the present study showed that type D personality was associated with the presence of depression at one month post-PCI, when these patients have a low mental health status (40). Patients with type D personality seemed to be at risk for further progression of depression if they were less able to cope with their fear of future cardiovascular events and psychological stressors triggered by changes in their lifestyle.

Previous studies have shown that specific coping strategies mediate the association between type D personality and

**Table 4. Analysis of the Association between Variables and the Presence of Depression.**

	Univariate analysis			Multivariate analysis		
	OR	95% CI	p	OR	95% CI	p
Type D personality	3.82	1.56-9.38	0.003	4.50	1.38-14.72	0.013
Subscales of the tri-axial coping scale						
Catharsis	0.98	0.85-1.13	0.797			
Abandonment or Resignation	1.09	0.94-1.26	0.265			
Information gathering	0.86	0.75-0.99	0.047	1.03	0.82-1.29	0.823
Distraction	1.05	0.90-1.22	0.513			
Evasive thinking	1.06	0.91-1.23	0.466			
Positive interpretation	0.86	0.74-1.00	0.052	0.93	0.74-1.18	0.557
Planning	0.69	0.57-0.85	<0.001	0.73	0.56-0.94	0.015
Responsibility shifting	1.16	0.95-1.43	0.152			
Age	1.02	0.98-1.06	0.385	1.03	0.97-1.10	0.388
Male / female	2.06	0.50-8.53	0.321	1.52	0.19-12.16	0.694
Living with family / alone	1.25	0.29-5.35	0.764			
Employed / unemployed	0.36	0.15-0.89	0.026	0.54	0.17-1.73	0.300
Current smoker	5.44	0.63-47.2	0.124			
Acute myocardial infarction	1.69	0.71-4.03	0.235			
Hypertension	0.59	0.25-1.40	0.235			
Dyslipidemia	0.83	0.32-2.15	0.706			
Diabetes mellitus	0.74	0.30-1.82	0.516			
Peak creatine kinase	1.00	1.00-1.00	0.215			
BNP	1.01	1.00-1.01	0.018	1.01	1.00-1.01	0.062
Coronary artery lesion	0.63	0.31-1.26	0.189			
PCI count	1.13	0.56-2.27	0.741			
Length of hospital stay	1.02	0.94-1.10	0.618			
Body mass index	0.89	0.80-1.00	0.053	0.92	0.78-1.09	0.348

OR: odds ratio, CI: confidence interval, BNP: brain natriuretic peptide, PCI: percutaneous coronary intervention

anxiety or depressive mood (12, 17). Strategies utilizing avoidance-oriented, but not task-oriented, coping have been associated with the presence of depression (12). The behavioral characteristics of planning, which were examined in the present study, consisted of three components: examining the cause, reflecting on it, and taking action based on previous experience (28). The planning strategy is also a key component of cognitive behavioral therapy, i.e. stress management training, which has reduced stress and depression levels as well as adverse clinical events when combined with cardiac rehabilitation (41). Insufficient planning as shown in the present patients with type D personality, therefore, may play a role in the development of depression, which can progress through a type D personality.

Screening for mental status and personality types provides an opportunity to identify patients at risk for depression. In particular, patients with CAD after the onset of coronary events require mental health evaluation to devise strategies to help them cope with anxiety and/or prevent the development of depression. The present findings suggest that patients with CAD with type D personality should receive close attention concerning mental care with instructions to promote effective coping strategies. Patients with CAD with both a type D personality and depression (accounting for 32.6% of this study population) bear a particularly substan-

tial burden on their mental health and need tailored strategies to cope with psychological stressors. A low frequency of adopting a planning strategy in patients with CAD with depression suggested the potential benefit of promoting planned psychotherapeutic intervention to cope with various stressors.

Several limitations associated with the present study warrant mention. First, the single-center setting and cross-sectional nature of this study prevented us from clarifying the causal relationship between the types of personalities, presence of depression, and coping strategies. Second, there may be some sampling bias due to the small population size, especially of women, as well as our failure to enroll consecutive patients because of the multiple exclusion criteria. Third, the presence of depression was based a self-rated SDS score of  $\geq 40$ , which has not been shown to equate perfectly with an exact diagnosis of depression. In addition, psychiatrists were not involved in the diagnosis of depression, and patients with temporary depressive symptoms may have been included.

### Conclusions

A high prevalence of depression was associated with type D personality and a low rate of adoption of a planning strategy in patients with CAD post-PCI. Specific instructions,

particularly with regard to adopting planning behaviors against stressors, for patients with CAD with a type D personality may help improve coping skills and prevent the development of depression.

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**The authors state that they have no Conflict of Interest (COI).**

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