# Psychosocial Factors in Patients With Noncardiac Chest Pain

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**Objective:** This study sought to explore some psychosocial factors that distinguished individuals with noncardiac chest pain (NCCP) from those without NCCP, and whether these psychosocial factors were associated with anxiety and depression that are co-morbid factors of NCCP. **Methods:** A matched case-control design was adopted to compare differences in psychosocial factors among a target group of patients with NCCP (N = 70), a pain control group of patients with rheumatism (N = 70), and a community control group of healthy individuals (N = 70). **Results:** Compared with subjects from the two control groups, NCCP patients tended to monitor more, use more problem-focused coping, display a coping pattern with a poorer strategy-situation fit, and receive less emotional support in times of stress. Moreover, monitoring perceptual style and problem-focused coping were associated with higher levels of anxiety and depression. **Conclusions:** The present new findings suggest that monitoring perceptual style and inflexible coping style are risk factors that enhance one's vulnerability to NCCP. Emotional support may be a resource factor that reduces one's susceptibility to NCCP. **Key words:** atypical chest pain, coping, noncardiac chest pain, psychosocial factors, stress.

ANOVA = analysis of variance; EMBSS-SF = Extended Miller Behavioral Style Scale–Short Form; ISSB-SF = Inventory of Socially Supportive Behaviors–Short Form; MAAC-R = Multiple Affect Adjective Checklist–Revised; MANOVA = multivariate analysis of variance; NCCP = noncardiac chest pain; PFCI = problem-focused coping index; SES = socioeconomic status; SSFI = strategy-situation fit index

Chest pain is a common problem encountered in clinical practice. More than half of the patients referred to coronary arteriography suffer from chest pain that is not of a cardiac origin (1-3). This type of chest pain, commonly known as noncardiac chest pain (NCCP) or atypical chest pain, differs from cardiac chest pain in that there is no angiographic evidence of coronary heart disease (4, 5). Anxiety and depression are major co-morbid factors of NCCP (4, 6-8).

Based on the literature in psychology and psychosomatic medicine, three psychosocial factors were proposed to be associated with NCCP. First, NCCP patients were hypothesized to differ from individuals without NCCP in having a unique perceptual style. This hypothesis was derived from two lines of findings that suggest their hypersensitivity to stress and bodily

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conditions, respectively. Although there were no differences in the number of stressful life events experienced between NCCP subjects and healthy controls, NCCP subjects gave higher negative life-change scores to stressful life events than did their counterparts (9). Moreover, previous experimental studies showed that compared with their counterparts with coronary artery disease, NCCP patients were more sensitive to both cardiovascular (10-13) and noncardiovascular pain stimuli (14). They were also found to have a greater extent of bodily awareness than patients with coronary artery disease (15, 16). Our previous studies (17, 45) showed that patients with functional gastrointestinal disorder tend to have a monitoring perceptual style, which predisposes them to focus attention on negative cues related to their environment and bodily functioning. Functional gastrointestinal disorder is similar to NCCP in that its gastrointestinal symptoms cannot be explained by biochemical or organic factors, and thus NCCP patients' perception of their normal cardiac functioning may be related to a monitoring perceptual style.

Second, NCCP patients were speculated to have a unique coping style that differs from the coping style of individuals without NCCP. Coping has been found to play an influential role in psychological adjustment to stressful situations and psychological well-being (eg, 19, 20). Two major functions of coping have been proposed (eg, 21, 22): problem management (ie, problem-focused coping) and emotion regulation (ie, emotion-focused coping). Although these functions of coping both have beneficial effects (23-26), it is noteworthy that excessive or inappropriate use of these strategies can be debilitating. The strategy-situation fit hypothesis (19, 27-29) posits that adaptive coping requires a good fit between the nature of coping strategy and the controllability of stressful situation. The stress-induction study by Roll and associates (30)

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showed that NCCP subjects were less able to use relaxation strategies to relieve stress-related distress. Their findings suggest that NCCP patients' higher levels of anxiety and depression are related to inflexible use of coping strategies.

Third, NCCP patients were hypothesized to have fewer social resources to cope with stress than do individuals without NCCP. This proposition stems from a number of studies (3, 31-34), which consistently revealed that NCCP patients have impaired social functioning. The social environment should be examined because it is an important resource factor that protects an individual from stress-related distress (35-38). Studies (39-41) have shown that social support can have a) a direct influence by solving problems at hand or facilitating goal-attainment (ie, instrumental support); and b) an indirect influence by fulfilling a strong affiliative need, or distracting the self from worries, or boosting positive affective moods (ie, emotional support). Because NCCP patients frequently encountered interpersonal problems, they were predicted to receive less social support in times of stress.

In summary, the present study aimed at exploring psychological factors that characterize NCCP patients, and whether these factors were related to anxiety and depression. Compared with individuals without NCCP, NCCP patients are speculated to be a) more likely to monitor negative cues related to their bodily conditions and the environment; b) more likely to display an inflexible coping pattern with a poor strategy-situation fit; and c) less likely to receive social support when encountering stress.

# **METHODS**

### Subjects

Subjects were 210 Hong Kong adults (75 men and 135 women). Their ages ranged from 31 to 80 (M = 58.40, SD = 10.84). SES was assessed based on their education level, occupational status, and income level.

This sample comprised three groups, with 70 subjects (25 men and 45 women) in each group. The first group was the target group of NCCP patients. The following criteria were used for admission to the study: a) a chief complaint of midline chest pain or discomfort, which needs not be consecutive for at least 12 weeks in the preceding 12 months; b) normal coronary angiogram; and c) normal upper endoscopy. However, patients who met these criteria but had a) a past history of coronary artery disease or other organic cardiac problems (congenital or valvular heart disease, congestive heart failure, arrhythmia, mitral valve prolapse, left ventricular hypertrophy, or abnormal left ventricular function); b) a past history of gastrointestinal surgery or peptic ulcer diseases; c) connective tissue disorder; or d) an intake of  $H_2$  receptor blockers and bismuth or proton pump inhibitors in the preceding four weeks were excluded. Based on these inclusion and exclusion criteria, the first 70 consecutive eligible NCCP patients were recruited from the cardiology division of the Department of Medicine, Queen Mary hospital.

The second group was the pain control group of individuals with rheumatism who were recruited from a clinic in the same region. They have been suffering from chronic knee pain related to degenerative changes for at least three months in the past year. Subjects were asked to rate their pain severity along a visual analog scale, which ranges from 0 (having no pains at all) to 10 (having severe pains). This single-item visual analog scale was used because they have been found as informative as multi-dimensional measures (42). Results revealed that individuals with rheumatism (M = 6.96, SD =1.06) and those with NCCP (M = 7.28, SD = 1.27) appraised a highly similar level of pain severity, F(1,48) = 0.97, *ns*. For both the NCCP and the rheumatic groups, the patients were explained about the nature of their symptoms and diseases, with emphasis on the negative results on investigations and reassurance that the conditions were not life-threatening.

The third group was the community control group of healthy individuals. This group of subjects had no past history of cardiac illness, peptic ulcer, gallstones, rheumatism, chronic disabling medical condition, or psychological disorders. Each of these subjects was paid \$50 Hong Kong (about \$6 US) as transportation fee for attending the interview.

Adopting a matched case-control design, subjects in these two control groups matched those of the target group of NCCP patients on sex, age, and SES. These three variables are included as control variables because individuals of different sex, age, and SES have different extents of exposure to stress and encounter different types of stressful events (eg, 43, 44).

To eliminate the possibility of overlap among different subject groups, the recruited subjects with NCCP or rheumatism were screened in advance to ensure that they a) had experienced only the target symptoms for at least 12 weeks in the past year; and b) had not experienced symptoms from the other disorder. Healthy subjects were screened in advance to ensure that they had experienced none of the cardiac or rheumatic symptoms, and those who had any of those symptoms were excluded.

### Design

Blinding was carried out at four different levels: a) the interviewer who conducted the interview and questionnaire session; b) cardiologists who made diagnoses based on cardiac test results; c) gastroenterologists who made diagnoses based on endoscopic and 24-hour pH results; and d) the research assistants who performed subject-matching and data-coding. To minimize the potential experimenters' effects on subjects, all of them were not told of the research hypotheses until the statistical analyses had been completed. The interviewer was blind to the diagnosis of the subjects.

### Measures

*Coping style.* The Coping Flexibility Interview Schedule (45, 46) was used to examine flexible coping style and situation-appropriateness of coping. Subjects were asked to describe two controllable and two uncontrollable hassling events, and all the strategies deployed to handle each event. Then they classified the goal of using each strategy as problem-focused or emotion-focused. A PFCI was derived to indicate the tendency of using problem-focused coping (vs. emotion-focused coping). It ranges from 0 (ie, did not use problem-focused coping at all) to 1 (ie, used problem-focused coping to handle every event). A SSFI is derived to reflect the extent of situation-appropriateness of coping patterns (see 46 for the scoring criteria). A higher value of SSFI indicates a greater extent of strategy-

situation fit. Weighted kappa (47) was used to examine the extent of consistency in coding of interview data between the two research assistants. Results revealed a high interrater reliability,  $\kappa_w = 0.84$ , p < .001. This interview schedule displays good test-retest reliability, criterion-related validity, and discriminative validity in both healthy (46) and patient (17, 45) samples.

Monitoring perceptual style. Subjects' perceptual style was measured by the EMBSS-SF (48). This scale taps both monitoring and blunting perceptual styles (cf 49). The EMBSS-SF consists of four hypothetical stressful situations, and subjects' responses reflect their tendency to monitor or to blunt. This measure has good testretest reliability, internal consistency, and criterion-related validity in both healthy (48) and patient (17) samples.

*Social support.* Social support was assessed by the ISSB-SF (50). The ISSB-SF comprises 15 items tapping instrumental (9 items) and emotional (6 items) supportive behaviors available when needed. A higher ISSB-SF score indicates a greater level of social support available. Previous Hong Kong studies have shown that the reliability and criterion-related validity of the Chinese ISSB-SF are adequate in both healthy (51) and patient (52) samples.

Anxiety and depression. The anxiety and depression subscales (trait form) of the MAACL-R (53) were used to examine levels of anxiety (9 items) and depression (11 items), respectively. Subjects gave ratings on a 5-point Likert scale. A higher score indicates a greater level of anxiety or depression. The Chinese MAACL-R has been found to be reliable and valid in both healthy (54) and patient (52) samples.

### Procedures

A trained interviewer conducted interviews with one subject at a time in a cubicle. Each was asked to sign a written consent form. Then they were interviewed, and asked to fill in a package of questionnaires (EMBSS-SF, ISSB-SF, MAACL-*R*) after the interview.

### Statistical Analyses

MANOVA was used to examine the overall differences in sex, age, and SES in all the variables. Statistical comparisons were then made by employing ANOVA to test the hypothesized differences in psychosocial factors among the groups. Correlation analysis was used to show the interrelationships among different variables.

### RESULTS

The MANOVA results showed that the overall sex, age, and SES differences were nonsignificant for all the variables, *F* values < 0.97, *ns*. Compared with individuals without NCCP, NCCP patients were speculated to be a) more likely to monitor negative bodily and environmental cues; b) more likely to display an inflexible coping pattern with a poor strategy-situation fit; and c) less likely to receive social support. The ANOVA results showed that the group effect was significant in monitoring, PFCI, SSFI, and emotional support, F values (2,207) > 6.28, p values < 0.001. Results of the Tukey honestly significant difference tests further indicated that compared with subjects from the two control groups, NCCP subjects a) had higher scores in monitoring, b) used more problem-focused coping and had a poorer strategy-situation fit, and c) received less emotional support (all p values < 0.05). These results provided support for all the hypotheses. Table 1 presents descriptive statistics of all the variables for the three groups.

The interrelationships among all the variables are

	NCCP Patients (N = 70)		Rheumatic Patients (N = 70)		Healthy Subjects (N = 70)		p
	Mean	SD	Mean	SD	Mean	SD	
PFCI	0.66 <sub>b</sub>	0.19	0.53 <sub>a</sub>	0.19	0.46 <sub>a</sub>	0.18	<.001
	(0.62-0.71)*		(0.49-0.58)		(0.42-0.51)		
SSFI	0.87	0.85	2.19 <sub>b</sub>	1.22	2.11 <sub>b</sub>	1.34	<.001
	(0.58–1.16)		(1.91–2.46)		(1.84–2.39)		
Monitoring	12.70	1.72	11.30 <sub>b</sub>	2.61	10.09	3.61	<.001
	(12.05–13.35)		(10.65–11.95)		(9.44–10.74)		
Blunting	6.91	2.79	7.96	3.32	9.72 <sub>b</sub>	3.88	<.001
	(6.12–7.70)		(7.17–8.75)		(8.93–10.51)		
Instrumental support	14.68	4.93	17.38	8.01	17.12	7.68	>.05
	(13.03–16.33)		(15.73–19.03)		(15.47–18.77)		
Emotional support	10.31	5.55	14.43 <sub>b</sub>	5.24	14.84 <sub>b</sub>	5.42	<.001
	(9.03–11.58)		(13.16–15.70)		(13.56–16.11)		
Anxiety	28.18	4.47	19.71 <sub>b</sub>	5.78	18.95	5.73	<.001
	(26.92-29.45)		(18.45–20.98)		(17.69–20.21)		
Depression	33.27	8.20	29.27 <sub>b</sub>	8.52	17.34	6.03	<.001
	(31.47–35.08)		(27.47–31.08)		(15.54–19.15)		

 TABLE 1. Descriptive Statistics of Major Variables for the Three Groups

Note: Within each row, means that do not share a common subscript differ significantly from each other (Tukey's honestly significant difference post hoc test, p < .05).

\* The upper and lower limits of the 95% confidence interval are given in parentheses.

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shown in Table 2. Both anxiety and depression were positively related to PFCI and monitoring, but inversely related to SSFI and emotional support. Both the use of problem-focused coping and monitoring were generally associated with higher levels of anxiety and depression, whereas emotional support was generally associated with lower levels of anxiety and depression. A greater extent of fit between the coping strategy and the controllability of stressful situations was related to lower levels of anxiety and depression. Although such patterns of results provided evidence that these psychosocial factors were related to anxiety and depression, it is noteworthy that the strength of these correlations was modest.

# DISCUSSION

The present study revealed new findings that compared with rheumatic and healthy subjects, NCCP patients a) had a greater tendency to monitor danger cues in their bodily conditions and the environment; b) tended to use more problem-focused coping strategies, regardless of the nature of stressful situations, and had a poorer strategy-situation fit; and c) received less emotional support from others.

### Psychosocial Factors and NCCP Symptoms

Psychiatric reviews of somatization (55–57) have emphasized the notion of mind-body connection, but the mechanisms of how psychological and physical factors interact remain unknown. The present results may provide insights to the mind-body connection for NCCP.

Both psychodynamic (7, 58, 59) and cognitive-behavioral (60-63) theories emphasize the close relationship between the mind (eg, unresolved psychological conflicts, maladaptive cognitions) and feelings of

TABLE 2. Zero-order Correlation Coefficients among Major Variables (N = 210)

	2	3	4	5	6	7	8
<ol> <li>PFCI</li> <li>SSFI</li> <li>Monitoring</li> <li>Blunting</li> <li>Instrumental support</li> <li>Emotional support</li> <li>Anxiety</li> <li>Depression</li> </ol>	18	.15 06 -	.02 .03 13 -	04 .09 13 .08 -	19 .20 14 .14 .10 -	.29* 25* .29* 17 11 23*	.26* 24* .28* 16 06 24* .30*

*Note:* All the significant coefficients are significant at 0.001 level, which is equivalent to an overall alpha level of less than 0.05 (by Bonferroni procedure, 28 correlation coefficients  $\times$  0.001 = .028). \* p < .001.

tension. Enhanced tension in the thoracic muscles elicited by anxiety might explain the mechanism of chest pain (58). This study suggests that one way in which psychological factors may interact with chest pain is through the cognitive pathway, that is, monitoring perceptual style. This type of perceptual style predisposes a person to be hypersensitive to normal bodily functioning (64–66). The present study showed that monitoring perceptual style is related to high anxiety levels. Because an autonomic and hormonal sequel of anxiety can influence esophageal and cardiac functioning (67, 68), NCCP patients' persistent chest pain may be due to their monitoring perceptual style and anxiety associated with this perceptual style.

This study also suggests that another way in which psychological factors may interact with chest pain is through the behavioral pathway, that is, inflexible coping style. The present findings showed that NCCP patients prefer to handle all the problems directly, but are less likely to handle their stress-related emotions while encountering stress. The use of problem-focused coping to handle stressful situations with uncontrollable outcomes will not solve the problem and may elicit more stressful feelings (17, 18, 45, 69-71). Stressful feelings have a significant effect on the breathing pattern (72). Contraction abnormalities of the esophagus have been shown to be associated with emotional stress and anxiety (72-76), which are outcomes related to ineffective coping (77, 78). Therefore, NCCP patients' inflexible problem-focusing coping style, which is anxiety provoking, may precipitate and further exacerbate their dyspnoea and chest pain.

The social environment may be another pathway through which psychological factors interact with chest pain. The present findings showed that compared with rheumatic and healthy individuals, NCCP patients received less emotional support to deal with their stress. It is possible that less social support is related to a poorer quality of interpersonal relations. Several studies (3, 31-34) revealed that NCCP patients frequently encounter problems in interpersonal relations, which may limit their social resources available in times of stress. It is also possible that social support may be available but the NCCP patients do not accept the support rendered by others. Hsi and associates' (79) study showed that NCCP patients tended to perceive others as a threat to them. If NCCP patients interpret the provision of social support as a threat to their esteem, such support will not be effective even it is available (80, 81). Having little social support may itself be a kind of stress (82, 83), and thus create additional distress that may aggravate the chest pain of NCCP patients in stressful situations.

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# Practical Implications

The present results may have practical implications for psychological intervention of NCCP. Based on the present findings, three elements may be added to the current intervention program for NCCP patients. First, NCCP patients may be taught distraction techniques that aim at diverting their attention away from experiences of chest pain and modifying pain-related cognitions (cf 84). Second, the NCCP patients' problemfocused coping pattern may be balanced by the acquisition of more emotion-focused coping strategies (eg, relaxation and catharsis) to pacify their heightened stress-related distress. More importantly, coping effectiveness may be increased by showing them how to flexibly deploy these two types of coping strategies to fit the specific demands of stressful situations. Third, the social skills of NCCP patients may be strengthened to foster social adjustment and to enhance their social resources in times of need. Including these elements in the intervention program of NCCP may provide a more effective reduction in both NCCP symptoms and psychological distress.

### Cautionary Notes and Research Directions

Some caveats for this study are also noteworthy. This study is the first to examine differences in psychosocial factors between NCCP patients and individuals without NCCP. Because biological factors were not included in this study, the mechanisms of how these psychosocial factors influence NCCP symptoms remain unexplored. Also, it is important to note that the present study adopted a cross-sectional design, and the nature of relationships among the variables was correlational. Future studies should include biological or physiological measures, and adopt an experimental or multi-wave longitudinal design to address these unexplored issues.

The target group of NCCP subjects recruited in this study was confined to a limited number of outpatients who sought medical consultations. Caution should be taken when attempting to generalize the present results to individuals with NCCP who have never consulted physicians or those who do not receive continuity of care for their problems. To increase the generalizability of our new findings, population-based studies should be conducted for more heterogeneous samples of individuals with NCCP.

Finally, it is important to note that subjects in this study were all ethnically Chinese. The ability to generalize the present findings to Western populations is unknown. Previous studies (85, 86) have revealed some cultural differences in physiological and psychological variables associated with cardiac functioning and problems. Moreover, elderly Chinese patients who have acute myocardial infarction are more likely to report typical pain than their American counterparts (87), thus implying certain cultural differences in pain perception related to cardiac problems. These findings suggest the need to replicate the present study with a cross-cultural design.

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