

The Mediating Effect of Perceived Control Between Perceived Health Competence and Kinesiophobia in Elderly Patients after Coronary Artery Bypass Grafting

ABSTRACT

Objective: To investigate the status quo of control attitudes, perceived health competence, and kinesiophobia in elderly patients with coronary disease after coronary artery bypass grafting (CABG), and to explore the mediating role of control attitudes in perceived health competence and fear of exercise.

Methods: By a convenient sampling method, 206 elderly patients with coronary heart disease who underwent CABG for the first time in the Department of Cardiovascular Surgery, First Affiliated Hospital of Anhui Medical University from June 1, 2021, to April 4, 2023, were investigated by using a general information questionnaire, the Perceived Health Competence Scale and Revised Control Attitudes Scale, and the Tampa Scale for Kinesiophobia to investigate the level of perceived health competence, perceived control, and kinesiophobia.

Results: Perceived health competence, control attitudes, and kinesiophobia scores were 25.47 (3.11), 26.18 (2.85), 44.64 (3.24) (25.47 ± 3.11 , $P < .05$), (26.18 ± 2.85 , $P < .05$), and (44.64 ± 3.24 , $P < .05$) in elderly patients after CABG. Control attitudes had a partial mediating effect between perceived health competence and fear of exercise ($\beta = -0.3382$, $P < .001$). The proportion of effect was 35.27%.

Conclusion: The levels of perceived control and perceived health competence of elderly patients after CABG were low, while the level of kinesiophobia was high. Kinesiophobia in patients is directly affected by perceived health competence or is indirectly affected through perceived control, which is an important direction for future kinesiophobia interventions.

Keywords: Coronary heart disease, coronary artery bypass grafting, perceived health competence, perceived control, kinesiophobia

Introduction

According to a report, the number of patients with coronary heart disease in China is as high as 11.39 million, accounting for the second highest prevalence of cardiovascular disease in China, while the mortality of coronary heart disease has been on the rise in the past decade.¹ Coronary artery bypass grafting (CABG) is one of the most effective treatments for coronary heart disease and can significantly improve the cardiac function and survival rate of patients with coronary heart disease.² However, after CABG, patients may suffer from loss of cardiopulmonary function and decreased exercise tolerance, which to a large extent limits the postoperative effect of CABG and affects the patient's rehabilitation process.³ According to the lung rehabilitation concept, exercise-based cardiac rehabilitation has been gradually introduced into clinical practice and can improve the prognosis of patients by increasing their exercise tolerance, reducing cardiac discomfort, enhancing cardiac function, and reversing the disease process.⁴ However, about 40%-70% of patients with coronary heart disease have different degrees of exercise fear.^{5,6}



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According to cognitive psychology, an individual's existing cognition will affect his/her internal psychological activities and external behavior, and perceived health ability is an individual's cognitive evaluation of his/her health management.^{7,8} After CABG surgery, elderly patients are characterized by a lack of knowledge, slow physical recovery, and a long rehabilitation period, which leads to a low level of perceived health ability, and thus they are prone to skepticism about the safety of physical activity and show fear of exercise. Perceptual control is an individual's belief that they can determine their internal state and behavior to affect the external environment to bring the desired outcome.⁹ Studies have shown that the perceived control of patients with coronary heart disease is closely related to their perceived health ability, and the perceived control may affect patients' compliance with motor rehabilitation.¹⁰

However, evidence of the effects of these 2 factors on kinesophobia in elderly patients after CABG is lacking. A mediation model can analyze the process and mechanism of the influence between variables and often provides more in-depth results than similar studies that simply analyze the influence of independent variables on dependent variables. Therefore, this study explored the relationship between perceived control, perceived health competence, and kinesophobia, in order to provide a reference for the formulation of programs to reduce kinesophobia in elderly patients with coronary heart disease after CABG.

Data and Methods

Research Subjects and Inclusion and Exclusion Criteria

From June 2021 to April 2023, convenience sampling was used to select elderly patients undergoing CABG in the Department of Cardiovascular Surgery, First Affiliated Hospital of Anhui Medical University. Inclusion criteria were as follows: (1) patient was aged >60 years old; (2) CABG was performed for the first time, and the lower limb vein was used as one of the bridging materials; (3) patient had no language or cognitive impairment and could communicate with researchers normally; and (4) patients and their families understood the procedures and purpose of this study and voluntarily participated in it. Exclusion criteria were as follows: (1) patient had an organ failure; (2) patient had severe ventricular arrhythmia after the operation; (3) patient had a mental illness, cognitive dysfunction, or intellectual disability; and (4) patient had limbs that were obviously disabled and whose daily activities were limited. Ethics committee approval was received from the Ethics Committee of The First Affiliated Hospital of Anhui Medical University (Approval no: Quick-PJ2023-10-36).

Research Tools

The general information questionnaire was self-designed by the researcher and included the patient's sex, age, number of bypass

grafts, educational level, marital status, deep vein thrombosis (DVT) risk score, activity of daily living (ADL) score, body mass index (BMI), and presence of other chronic diseases.

The Perceived Health Competence Scale (PHCS) was used to measure the perception of patients with coronary heart disease regarding their effective health management ability.¹¹ The scale included the 2 dimensions of behavioral expectation and outcome expectation, with a total of 8 items. The Likert 5-grade scoring system was adopted, with the total score ranging from 8 to 40. The higher the total score, the higher the patient's perception of his/her effective health management ability would be. Cronbach's α coefficient in this study was 0.776.

The Revised Control Attitudes Scale-Revised (CAS-R) was used to measure the patients' perception and control level of cardiovascular disease.¹² In this study, the Chinese version of the scale translated by Zhang¹³ was used, with 8 items in total. The scale was rated by a Likert 5-grade scoring system, with the total score ranging from 8 to 40. A higher total score indicated a higher attitude of perceived control in patients with cardiovascular disease. Cronbach's α coefficient in this study was 0.788.

The Tampa Scale for Kinesophobia Heart (TSK-SV Heart) was used to measure the fear level of heart disease patients regarding activity or exercise. In this study, the Chinese version of the scale was translated by Lei.¹⁴ The scale had 17 items in total, including 4 aspects: perceived heart risk, avoidance of movement, fear of injury, and decline in self-function. A Likert 4-grade scoring system was adopted, with the total scores ranging from 17 to 68. A score of >37 indicated the presence of motor fear. Cronbach's α coefficient in this study was 0.793.

Method of Data Capture

A cross-sectional survey was conducted, and standardized training was provided to investigators before the survey. The training content included the contents of the questionnaire, the filling method, and the purpose. Unified guidance was used to explain the purpose of the investigation to the patients. After informed consent was obtained, the patients were guided to fill in the questionnaire and submit it immediately. The completeness of the questionnaires was checked and the reasons for missing items were investigated immediately; these were supplemented or eliminated as needed. If there was any misunderstanding of the questionnaire items, the respondents were given a unified explanation. A total of 212 questionnaires were distributed, and 206 were successfully completed. The effective recovery effective rate was 97.17%.

Statistical Analysis

Statistical Package for Social Sciences (IBM SPSS Corp.; Armonk, NY, USA) was used for data entry and analysis. Measurement data were described as mean and Standard deviation (SD) or the interval between median and quartile. Enumeration data were described as frequency (percentage), and tests for normality were applied to continuous variables. Pearson correlation analysis was used to explore the correlation among perceived control, perceived health ability, and kinesophobia. According to previous studies, we initially built an intermediary model, using Process 3.5 to analyze the intermediary role of perceived control between perceived health and kinesophobia, input the data of independent variables, dependent variables, and intermediary variables to test the mediating effect and determine the path coefficient and the total effect, direct effect, and indirect effect

MAIN POINTS

- Levels of perceived control and perceived health competence in elderly patients after coronary artery bypass grafting (CABG) are low, while the level of kinesophobia is high.
- Perceived control played a partial intermediary role in the effect of perceived health competence on kinesophobia.
- The level of kinesophobia in patients is directly affected by perceived health competence or is indirectly affected through perceived control.

of independent variables on dependent variables. Bootstrapping was performed 5000 times and statistical significance was set at $\alpha = 0.05$.

Results

General Information of Patients

The mean (standard deviation (SD)) age of 206 patients was 70.13 (4.93) years, and there were 129 males (62.62%) and 77 females (37.38%). Assessing the general information of patients can help to better analyze their physiological and psychological states. Other information is shown in Table 1.

Perceived Health, Perceived Control, and Kinesiophobia Scores in elderly patients After Coronary Artery Bypass Grafting

The elderly patients’ perceived health competence mean (SD) score after CABG was 25.47 (3.11) (25.47 ± 3.11). The perceptual control mean (SD) score was 26.28 (2.85). The kinesophobia mean (SD) score was 44.64 (3.24). Scores of all dimensions are shown in Table 2.

Correlation Between Perceived Health Competence, Perceived Control, and Kinesiophobia in Elderly Patients After Coronary Artery Bypass Grafting

The perceived health competence of elderly patients after CABG was negatively correlated with kinesophobia ($r = -0.920, P < .001$), positively correlated with perceived control ($r = 0.803, P < .001$), and negatively correlated with motor fear ($r = -0.882, P < .001$).

Intermediary Effect of the Perceived Control Test

Perceived health competence can directly affect the level of kinesophobia in patients or indirectly affect exercise fear through the

Table 2. Kinesiophobia Scores in Elderly Patients After CABG (n = 206)	
Dimension	Entry Sharing
Perceived cardiac risk	10.96 ± 1.27
Avoidance exercise	11.85 ± 1.29
Fear of injury	11.63 ± 0.95
Self-function decline	10.19 ± 0.79
Total table	44.64 ± 3.24

CABG, Coronary Artery Bypass Grafting.

perception of control. The ability to perceive health and perception of control can jointly explain 95.89% of the total variation of exercise fear in elderly patients after CABG (see Table 3). Perceived control played a partial intermediary role between perceived health competence and kinesophobia, with anintermediary effect of 33.82%, as shown in Table 4 and Figure 1.

Discussion

Status of Perceived Health Competence, Perceived Control, and Kinesiophobia in Elderly Patients After Coronary Artery Bypass Grafting

The results of this study showed that the perceived health competence score of elderly patients with coronary heart disease was (25.47 ± 3.11), which was on the low side, lower than that in the study by Xu et al.¹⁵ The reason might be that in all the patients undergoing CABG surgery in this study, their physical strength had not yet fully recovered after surgery, they needed the assistance of family members to live independently, and their sense of self-efficacy was poor. Moreover, all patients needed to enter the intensive care unit for transition after the operation and return to the ward after the condition was stable. However, all kinds of drainage tubes, such as thoracic drainage tubes, pericardial drainage tubes and mediastinal drainage tubes, had not been removed, and their limb activities were severely limited. Therefore, their self-perception of health was poor, which is consistent with the result of Justin et al,¹⁶ that is, when a patient’s perception of health is low, its impact on physical activities is strong.

The cognitive control score of the middle-aged and elderly patients with coronary heart disease in this study was (26.28 ± 2.85), which was at a relatively low level, lower than that in the study by Wang et al.¹⁷ Although the 2 studies were on elderly patients with coronary heart disease, there were differences in treatment methods. Percutaneous coronary intervention (PCI) is a minimally invasive surgery, while CABG surgery requires thoracotomy. As a result, patients have significant differences in pain and activity limitation after surgery, which has a greater impact on their own sense of disease control, which is consistent with the results of Cui.¹⁸ In addition, the further development and treatment of the disease after thoracotomy are unknown to the patients and their families, and it is difficult to make an accurate evaluation of the actual controllability of their own situation, so the perceived control is at a low level.

In our study, the kinesophobia score was (44.64 ± 3.24), higher than that reported by Huang Rong et al.¹⁹ After CABG surgery, elderly patients, due to their poor cognition, often doubt whether physical activity is safe, and even confuse normal physiological reactions

Table 1. General Information of Patients (n = 206)			
Item		Number of Cases	Percentage (%)
Sex	Man	129	62.62
	Woman	77	37.38
Degree of education	Illiterate	83	40.29
	Primary school	59	28.64
	Junior and technical secondary schools	37	17.96
	High school and above	27	13.11
Marital status	Have a spouse	197	95.63
	No spouse	9	4.37
Other chronic diseases	Yes	144	69.90
	No	62	30.10
Mean age (SD), years	70.13 (4.93)	–	–
Bridging root number	3 (2,3)	–	–
BMI	0	8	3.88
	1	71	34.47
	2	45	21.84
	3	71	34.47
	4	11	5.34
DVT	14.98 ± 3.20	–	–
ADL	30.10 ± 11.13	–	–

BMI, 18.5 was considered Grade 0, indicating low body weight; 18.5-24.9, Grade 1, mean body weight; 23-24.9, Grade 2, overweight; 25-29.9, Grade 3, obese; ≥30, Grade 4, obese. ADL, activity of daily living; BMI, body mass index; DVT, deep venous thrombosis; SD, standard deviation.

Table 3. Analysis of the Intermediary Effect of Perceived Control on Perceived Health Competence and Kinesiophobia (n= 206)

Independent Variable	Kinesiophobia (y)		Perceptual Control		Kinesiophobia (y)	
	β value	t value	β value	t value	β value	t value
Perceived health competence (x)	-0.9589 (c)	-33.5497	0.7359 (a)	19.2235	-0.6207 (c')	-16.3938
Perceptual control	-	-	-	-	-0.4597 (b)	-11.1299
R2	0.8466		0.6443		0.9047	
Variance ratio	1125.5854		369.5444		963.7150	

All $P < .001$.

Table 4. Path Analysis of the Influence of Perceived Health Ability and Perceived Control on Kinesiophobia in Elderly Patients After CABG (n= 206)

Impact Path	Effect Value	Standard Error	95% Confidence Interval for Effect Value		Relative Effect Value (%)
			Upper Limit	Lower Limit	
Total effect	-0.9589	0.0286	-1.0153	-0.9026	-
Direct effect (perceived health competence–kinesiophobia)	-0.6207	0.0379	-0.6953	-0.5460	64.73
Indirect effects (perceived health competence–perceived control–kinesiophobia)	-0.3382	0.0369	-0.4069	-0.2612	35.27

caused by exercise, such as slight shortness of breath, slight sweating, and increased heart rate, with the pre-attack symptoms of coronary heart disease. This can result in the misunderstanding that being active will cause discomfort, inducing fear and rejection of exercise. Vogel et al.²⁰ showed that when patients amplify the risk stimulation of pain, they succumb to the emotions of avoidance and fear, i.e., kinesiophobia becomes even more severe.

Relationship Among Perceived Health Competence, Perceived Control, and Kinesiophobia in Elderly Patients After Coronary Artery Bypass Grafting

The results of this study showed that the correlation between perceived health competence and kinesiophobia was significant and negatively correlated. Studies have shown that perceived health competence is a psychological prediction index for individuals to maintain or enhance health, which will affect how elderly patients with coronary heart disease choose to cope with the disease, and perceived health competence can encourage patients to increase exercise behavior.¹⁵²¹ The better the level of patients' perceived health competence is, the lower the kinesiophobia and the more patients insist on exercise rehabilitation.

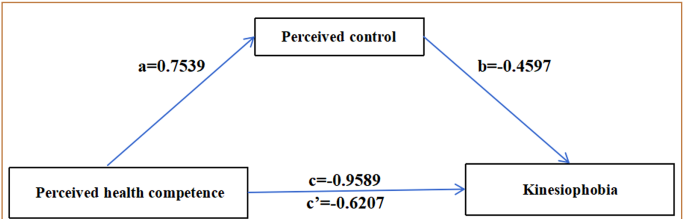


Figure 1. Mediation role of perceived control in the effect of perceived health competence on kinesiophobia in elderly patients after CABG. "a" represents the direct effect of perceived health competence on perceived control. "b" represents the direct effect of perceived control on kinesiophobia. "c and c'," represents the total effect of perceived health competence on kinesiophobia. represents the indirect effect of perceived health competence on kinesiophobia through perceived control, also called the intermediary effect of perceived control.

The correlation between perceived health competence and perceived control was significant and positively correlated. The cognitive, emotional, and behavioral functions reflected in perceived control are very important for individuals.²² When individuals have a high level of cognitive evaluation of their own health management, they have a higher level of perceived control over disease progression.

Perceived control was significantly and negatively correlated with kinesiophobia. Individual thinking patterns are affected by cognitive control. A high level of cognitive control encourages individuals to have positive and optimistic expectations and beliefs.¹³ At the same time, a high level of control reduces individuals' refusal, disgust, and fear of potential threat events. However, a severe sense of being out of control increases individuals' psychological pressure when dealing with adverse events and ultimately affects individuals' behavioral responses. Therefore, when patients have a higher level of sensory control, they will believe more in their ability to control disease progression, increase their confidence in participating in exercise rehabilitation, and reduce their fear and rejection of exercise rehabilitation. In addition, many studies have also shown that a strong sense of self-efficacy can encourage patients with coronary heart disease to increase healthy behaviors, maintain a good psychological state and positive coping styles, and thus effectively overcome the fear of exercise.^{4,23}

The Intermediary Role of Perceived Control

The results of this study showed that perceived health competence can directly affect the kinesiophobia of elderly patients after CABG, or indirectly affect the kinesiophobia of elderly patients after CABG through perceived control, which is an important psychological variable to help patients overcome fear of movement. Patients with a better ability to perceive health competence had a better understanding of their disease and a stronger belief in completing behavioral goals. They believed in their ability to cope with and control the disease, and thus had higher levels of perceptual control, less physical and psychological burdens, and less fear of exercise, which enabled them to adhere to cardiac exercise rehabilitation. In addition, perceived control is the driving force for individuals to engage

in healthy behaviors.¹³ In the self-management of coronary heart disease, a strong belief in disease control will help patients to regulate disease-related pressure, and thus the more incentive they will have to maintain healthy behaviors and coping mechanisms.

When patients have enough faith and resources for better disease management, they will actively improve their ability to maintain health, engage in behaviors to maintain health, and actively seek external assistance to help them recover.²⁴ Therefore, clinical medical staff should encourage patients to actively participate in medical care decision-making and help patients better predict their own disease progression and handle emergencies in disease progression. This will, to some extent, improve patients' perception and control level of disease progression and recovery status, reduce kinesophobia, and promote postoperative cardiac exercise rehabilitation.

Conclusion

The results of this study showed that elderly patients after CABG had a low level of perceived health competence and perceived control, and a high level of kinesophobia, which should be improved. Perceived control played a partial intermediary role in the effect of perceived health competence on kinesophobia. Therefore, perceived control may become an important intervention target to improve the fear of movement in elderly patients with coronary heart disease after CABG. In the future, researchers may try to improve the evaluation of patients' own health management ability and the level of perceived control of elderly patients after CABG, in order to achieve the goals of reducing the fear of movement and improving the self-efficacy and compliance of patients with cardiac rehabilitation. However, since this study was a cross-sectional design, it could not be deduced whether the level of kinesophobia in patients will change over time. In the future, longitudinal research should be conducted to further explore the change in the trajectory of kinesophobia in elderly patients after CABG.

Data Availability Statement: Data and materials supporting the findings of this study are available upon reasonable request from the corresponding author.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of The First Affiliated Hospital of Anhui Medical University (Approval no: Quick-PJ2023-10-36).

Informed Consent: Written informed consent was obtained from the patients/patient who agreed to take part in the study.

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