Application of Green Model-Based Health Education in Exercise Rehabilitation for Patients After Cardiac Pacemaker Implantation: A Postprint

Authors: Qu Junmei

Date: 2023-05-12T00:00:00+00:00

Abstract

Objective To investigate the effect of Green model-based health education on exercise tolerance and cardiac function in patients following pacemaker implantation. Methods Ninety-eight patients following pacemaker implantation were enrolled and divided into a control group and an experimental group based on ward assignment, with 49 patients in each group. The control group received conventional health education, while the experimental group received Green model-based health education. The intervention duration for both groups was 3 months. At 3 months postoperatively, assessments were performed using the Chinese Cardiovascular Patient Quality of Life Questionnaire (CQQC), 6-minute walk test distance (6MWT), N-terminal pro-brain natriuretic peptide (NT-ProBNP), and left ventricular ejection fraction (LVEF). Results At 3 months postoperatively, the experimental group exhibited higher total CQQC scores, 6MWT distances, and LVEF values, along with lower NT-ProBNP levels, compared with the control group; these differences were statistically significant ($P < 0.05$). Conclusion Compared with conventional health education, Green model-based health education can further improve exercise tolerance, cardiac function, and quality of life in patients following pacemaker implantation.

Full Text

Application of Health Education Based on the PRECEDE-PROCEED Model in Exercise Rehabilitation After Cardiac Pacemaker Implantation

QU Junmei
Department of Cardiovascular Medicine, Tongji Hospital, Tongji Medical College of Huazhong University of Science and Technology, Wuhan, Hubei

Abstract

Objective To investigate the effect of PRECEDE-PROCEED model-based health education on exercise tolerance and cardiac function in patients after pacemaker implantation.

Methods Patients who underwent pacemaker implantation were selected and divided into a control group and an experimental group based on their hospital ward, with cases in each group. The control group received routine health education, while the experimental group received health education based on the PRECEDE-PROCEED model. The intervention duration for both groups was 6 months. Outcome measures included the Chinese Cardiovascular Quality of Life Questionnaire (CQQC) score, 6-minute walking test (6MWT) distance, N-terminal pro-brain natriuretic peptide (NT-ProBNP) level, and left ventricular ejection fraction (LVEF).

Results At 3 months post-surgery, the experimental group demonstrated higher CQQC scores, longer 6MWT distances, higher LVEF levels, and lower NT-ProBNP levels compared to the control group ($P < 0.05$).

Conclusion Compared with routine health education, PRECEDE-PROCEED model-based health education can significantly improve exercise tolerance, cardiac function, and quality of life in patients after pacemaker implantation.

Keywords: PRECEDE-PROCEED model; pacemaker implantation; cardiac rehabilitation exercise; health education

---

Introduction

Cardiac pacemaker implantation is an effective treatment for heart failure and arrhythmia, and its clinical value in preventing sudden cardiac death and improving patient quality of life has been well established. However, due to patients' lack of understanding about their condition, inconsistent health education from medical staff, and lack of professional guidance and supervision for rehabilitation exercise, patients often experience prolonged shoulder immobilization after surgery, which severely impacts their ability to perform daily activities. Exercise-based cardiac rehabilitation has been proven to improve patients' daily living capabilities, promote healthy lifestyle formation, slow disease progression, and enhance quality of life. Nevertheless, cardiac rehabilitation after pacemaker implantation started relatively late in China, with complex exercise rehabilitation protocols for medical education, low levels of disease-related knowledge among patients, and limited acceptance after education. Patients often give up midway due to inability to meet requirements, resulting in less than optimistic compliance with exercise rehabilitation.

Health education based on the PRECEDE-PROCEED model can improve patients' disease-related knowledge levels, enhance their attitudes, and promote

healthy behavior development, thereby achieving better exercise rehabilitation outcomes. This study introduces the PRECEDE-PROCEED model into health education for exercise rehabilitation after pacemaker implantation, developing personalized health education plans under its theoretical framework to eliminate limitations in daily living activities caused by postoperative conditions and reduce patient discomfort, enabling them to achieve a better state of recovery.

---

1. Materials and Methods

1.1 Study Participants Patients who underwent pacemaker implantation and were admitted to the cardiovascular medicine department of a tertiary Grade A hospital in Wuhan between [dates] were selected as study participants.

Inclusion criteria: (1) First-time pacemaker implantation; (2) Clear diagnosis of heart failure or arrhythmia; (3) Normal preoperative platelet count and coagulation time; (4) Preoperative discontinuation of antiplatelet or anticoagulant medication; (5) Informed consent obtained from patients and families regarding benefits and risks of participation.

Exclusion criteria: (1) Electrode displacement; (2) Pulse generator issues; (3) Coagulation dysfunction; (4) Concomitant severe diseases; (5) Severe tricuspid regurgitation; (6) Severe chronic disease or severe cognitive/communication impairments; (7) Limb dysfunction.

A total of patients were enrolled and divided into control and experimental groups based on their hospital ward, with cases in each group. There were no statistically significant differences between the two groups in general characteristics including gender, age, marital status, living arrangement, physical activity level, 6MWT distance, NT-ProBNP level, LVEF, or CQQC scores ($P > 0.05$), indicating comparability. See .

Comparison of General Data Between Two Groups

1.2 Cardiac Rehabilitation Team Formation Before implementing PRECEDE-PROCEED model-based health education, a nurse-led cardiac rehabilitation team was established, including: 1 head nurse, 1 attending physician, and 1 charge nurse. The team regularly reviewed latest literature and conducted online training on the PRECEDE-PROCEED model and post-pacemaker rehabilitation nursing. All nursing team members passed post-training assessments. The head nurse served as administrator to supervise project implementation, the physician was responsible for patient selection and disease assessment, the pacemaker technician handled parameter settings and programming, and nurses managed patient rehabilitation exercise, precautions during exercise, and training effectiveness evaluation.

1.3 Intervention Implementation Control Group Intervention: Patients received routine health education after pacemaker implantation, including: instruction to apply a 1 kg sandbag to compress the local wound on the day of surgery to prevent bleeding and infection and reduce pain; keeping the affected limb immobilized; functional exercises starting on day 3 post-surgery; enhanced condition monitoring and dietary guidance; pacemaker-related knowledge education before discharge; and instruction to engage in daily household activities according to capability. Education was provided at discharge and during outpatient follow-up at 1 and 3 months post-surgery.

Experimental Group Intervention: Based on routine health education, the experimental group received PRECEDE-PROCEED model-based health education. The PRECEDE-PROCEED model, first proposed by Green, is primarily applied to health education for chronic diseases. This model systematically assesses specific patient problems, comprehensively analyzes causes of individual problems, and categorizes factors influencing health behavior into predisposing, enabling, and reinforcing factors to develop personalized health education plans.

Predisposing Factors Intervention: Cardiac rehabilitation nurses provided pacemaker postoperative rehabilitation knowledge education, starting intensive education on the day of surgery to improve attitudes and promote predisposing factor formation. Once patients returned to the ward with stable vital signs, good pacing signals, no wound bleeding or drainage, and tolerable pain, designated personnel began health education and progressive rehabilitation exercise. Content is shown in .

Enabling Factors Intervention: Between postoperative months 1-3, patients were provided with exercise rehabilitation resources, environmental support, and social support to promote enabling factor formation. This included: (1) Distribution of a self-developed post-pacemaker exercise rehabilitation manual and establishment of a WeChat public account covering risk factor control, dietary guidance, emotion management, and limb exercise rehabilitation protocols; (2) Free six-minute walking tests, pacemaker programming, and bedside NT-ProBNP collection; (3) Distribution and guidance for completing CQQC questionnaires; (4) Exercise record books for tracking rehabilitation frequency, duration, and feelings; (5) Encouraging participation in monthly health education lectures organized by the department; (6) Establishing a WeChat group for post-pacemaker exercise rehabilitation where patients and families could consult medical staff.

Reinforcing Factors Intervention: Based on the previous interventions, reinforcement was provided through telephone follow-up and free re-examination opportunities to encourage and provide feedback on patients' exercise rehabilitation, promoting reinforcing factor formation and enhancing patient motivation. Cardiac rehabilitation nurses conducted monthly telephone follow-ups after discharge, focusing on adherence to exercise rehabilitation, exercise methods, whether prescribed intensity and duration were achieved, and problems encountered during exercise. Personalized guidance was provided based on individual

progress.

1.4 Outcome Measures At 3 months post-surgery, the following assessments were conducted:

1. **CQQC Questionnaire:** The Chinese Cardiovascular Quality of Life Questionnaire was used to evaluate changes in patients' exercise rehabilitation knowledge, attitudes, behaviors, and quality of life improvement.
2. **6MWT Distance:** The 6-minute walking test was used to assess exercise tolerance.
3. **Cardiac Function:** NT-ProBNP levels and LVEF were measured to evaluate cardiac function recovery. NT-ProBNP $>$ 900 pg/mL or LVEF $<$ 50% indicated cardiac dysfunction.

1.5 Statistical Methods SPSS software was used for data analysis. Measurement data were expressed as mean $\pm$ standard deviation ($\bar{x} \pm s$). Independent samples t-test was used for between-group comparisons, with $\alpha = 0.05$ as the significance level.

---

2. Results

At 3 months post-surgery, the experimental group showed significantly higher CQQC questionnaire total scores, longer 6MWT distances, and higher LVEF levels, along with significantly lower NT-ProBNP levels compared to the control group ($P < 0.05$). See .

Comparison of CQQC Scores, 6MWT, NT-ProBNP, and LVEF Between Two Groups ($\bar{x} \pm s$)

---

3. Discussion

The key to health education lies in promoting individual behavior change. Effective health education can improve patients' cognition of exercise rehabilitation, enhance their attitudes toward exercise rehabilitation, and thereby promote behavior change. Correcting adverse behaviors and cognitions in post-pacemaker implantation patients plays a crucial role in cardiac rehabilitation after discharge and is essential for improving patients' mastery of disease-related knowledge. Research by Tang et al. also showed that better patient awareness of cardiac rehabilitation correlates with better exercise compliance.

In this study, both health education models resulted in decreased NT-ProBNP levels, increased 6MWT distances and LVEF, and improved CQQC total scores,

indicating that active health education provides positive guidance for cardiac rehabilitation in post-pacemaker patients and benefits quality of life improvement. However, compared with routine health education, the PRECEDE-PROCEED model-based approach produced significantly greater improvements in 6MWT distance, LVEF, and CQQC total scores, along with significantly greater reductions in NT-ProBNP, demonstrating that this model substantially improves patients' exercise tolerance, cardiac function, and quality of life.

The PRECEDE-PROCEED model provides systematic, standardized rehabilitation guidance through one-on-one education during hospitalization and progressive, personalized instruction. After discharge, the use of WeChat, public accounts, telephone follow-up, and other methods delivers 图文并茂 (graphically-rich) and easily understandable post-pacemaker exercise rehabilitation education, making learning more convenient and accessible for patients. This results in more solid mastery of postoperative disease-related knowledge, more obvious behavior changes, and higher quality of life.

This study developed a progressive exercise protocol with gradually increasing intensity to improve exercise tolerance and restore cardiac function in post-pacemaker patients under the PRECEDE-PROCEED model framework. However, the study had a small sample size and only assessed cardiac function indicators and exercise tolerance at 3 months post-discharge. Future studies should extend intervention duration, strengthen follow-up data collection, and increase observational indicators.

Conflict of Interest Statement: The author declares no conflict of interest.

References

[1] HE Xiliya. Effect of early rehabilitation nursing on complications, shoulder function recovery and quality of life of patients after artificial pacemaker implantation[J]. International Journal of Nursing, 2020, 39(10): 1845-1848. (in Chinese)

[2] SONG Jianping, HU Xinyu, SANG Jing, et al. Analysis on related influencing factors of comfort degree after permanent pacemaker implantation for elderly patients[J]. Journal of Nursing and Rehabilitation, 2019, 18(1): 45-48. (in Chinese)

[3] TAYLOR R S. Home-based versus centre-based cardiac rehabilitation[J]. Cochrane Database of Systematic Reviews, 2015, 2015(9): CD007130.

[4] JIANG Jiangfen. Impacts of rehabilitation intervention on the shoulder function and life quality in patients after cardiac pacemaker implantation[D]. Hangzhou: Zhejiang University, 2015. (in Chinese)

[5] SCOTT C M. Health promotion planning: an educational and ecological approach (3rd ed)[J]. Canadian Journal of Public Health, 2005, 96(3): I1.

[6] ZHAO Xia. Application of health education based on Precede-proceed model in rehabilitation exercise for patients with coronary heart disease after PCI[D]. Lanzhou: Gansu University of Chinese Medicine, 2020. (in Chinese)

[7] ZHAO Hua. Effect of continuous nursing based on WeChat platform on compliance of cardiac function and health behavior of patients with pacemaker implantation[J]. International Journal of Nursing, 2020, 39(11): 2045-2048. (in Chinese)

[8] ZHANG Aiqin, WANG Yi, ZHU Juhua, et al. Application of special designed vest corporate early stage activity in prevention of upper extremity deep venous thrombosis after patients having cardiac pacemaker implantation[J]. Nursing Journal of Chinese People's Liberation Army, 2019, 36(1): 45-48. (in Chinese)

[9] POURNAGHASH-TEHRANI S, ETEMADI S. ED and quality of life in CABG patients: an intervention study using PRECEDE-PROCEED educational program[J]. International Journal of Impotence Research, 2019, 31(5): 347-353.

[10] ZENG Guiying, WU Linjing, CHEN Qiaosong. The level of quality of life in patients with pacemaker implantation[J]. Chinese Journal of Nursing Education, 2018, 15(5): 387-390. (in Chinese)

[11] XING Beibei, WANG Wei, SHEN Hong. Influence of phased rehabilitation training on patients after heart valve replacement[J]. Journal of Nursing Science, 2019, 34(7): 25-28. (in Chinese)

[12] HE Xiaoqin. Outcomes of respiratory function training with phased rehabilitation exercise in patients following heart valve replacement[J]. Acta Academiae Medicinae Wannan, 2020, 39(2): 185-188. (in Chinese)

[13] QU Baiming, HOU Qiaoli, MEN Xuezhong, et al. Research and application of KABP nursing model in cardiac rehabilitation of patients with acute myocardial infarction after PCI[J]. American Journal of Translational Research, 2021, 13(5): 5241-5248.

[14] ZHANG Sisi, ZHAO Li, MENG Xiaoping. Correlation between 6-minute walking test and cardiopulmonary exercise evaluation results in patients with coronary heart disease[J]. Chronic Pathematology Journal, 2020, 21(3): 456-459. (in Chinese)

[15] ZHU Qi, ZHOU Jingyi, YUAN Hongying. Effect of Green's model-based health education on disease cognition, self-care behavior and quality of life of type 2 diabetes mellitus high-risk patients[J]. International Journal of Nursing, 2020, 39(12): 2234-2237. (in Chinese)

[16] TANG Lian, LIU Chunxue, LI Yang, et al. Correlation of awareness on cardiac rehabilitation with exercise compliance in middle-aged and aged coronary heart disease patients after percutaneous coronary intervention[J]. Chinese Journal of Mult Organ Diseases in Elderly, 2019, 18(5): 345-348. (in Chinese)

[17] ZHOU Shuqun. Effect of staged rehabilitation training on prognosis recovery, self-esteem and social function of patients with schizophrenia[J]. Nursing Practice and Research, 2020, 17(3): 112-115. (in Chinese)

Note: Figure translations are in progress. See original paper for figures.