Observational Study

Medicine

OPEN

The application and effect evaluation of continuity precision nursing in patients undergoing coronary angiography and stent implantation

A study of clinical outcomes

Limin Tan, MM[a], Xiaojing Tan, MM[a], Cangyun Zhang, MM[a], Lei Tao, MM[a], Yuan Liao, MM[a,*]

Abstract

Coronary artery disease is a major global health burden, with percutaneous coronary intervention (PCI) serving as a key treatment strategy. Despite its efficacy, challenges such as in-stent restenosis, medication nonadherence, unhealthy lifestyles, and psychological distress hinder optimal recovery. Continuity-based precision nursing, which integrates personalized care and multidisciplinary support, offers a potential solution. Therefore, the purpose of this study is to evaluate the effectiveness of continuity-based precision nursing compared to conventional nursing in improving postoperative outcomes for PCI patients. This includes assessing its impact on cardiac function recovery, complication prevention, medication adherence, lifestyle modifications, psychological well-being, and overall quality of life. This study included 112 PCI patients treated from January 2023 to January 2024, divided into an experimental group (continuity-based precision nursing) and a control group (conventional nursing). Propensity score matching resulted in 45 matched pairs. Data collected included demographics, postoperative cardiac function, medication adherence, lifestyle changes, psychological status, complications, satisfaction, and health-related quality of life. Statistical analyses were performed using SPSS, with $P < .05$ considered significant. Continuity-based precision nursing showed significant benefits over conventional nursing. At 1 month post-PCI, the experimental group had higher left ventricular ejection fraction ≥ 50% rates (86.7% vs 75.6%) and lower in-stent restenosis (6.7% vs 17.8%) and residual stenosis rates (8.9% vs 24.4%, $P = .048$). Medication adherence was improved (86.7% vs 66.7%, $P = .02$), with higher rates eof smoking cessation (77.8% vs 55.6%, $P = .01$), healthy eating (84.4% vs 66.7%, $P = .03$), and regular exercise (80.0% vs 62.2%, $P = .02$). Anxiety and depression scores were significantly lower in the experimental group post-intervention. Patient satisfaction (92.5 ± 4.2 vs 85.7 ± 6.1, $P < .01$) and health-related quality of life (88.4 ± 5.0 vs 81.2 ± 6.0, $P < .01$) were also markedly higher. Continuity-based precision nursing significantly enhances postoperative outcomes in PCI patients, improving cardiac function, adherence, lifestyle behaviors, and psychological well-being. This model provides a comprehensive framework for coronary artery disease care, with potential for broader clinical application. Further research should evaluate its long-term impact and scalability in diverse settings.

Abbreviations: CAD = coronary artery disease, HADS = Hospital Anxiety and Depression Scale, HRQoL = health-related quality of life, LVEF = left ventricular ejection fraction, PCI = percutaneous coronary intervention, PSM = propensity score matching.

Keywords: cardiac function, continuity-based precision nursing, coronary artery disease, health-related quality of life, lifestyle modification, medication adherence, percutaneous coronary intervention, psychological well-being

1. Introduction

Coronary artery disease (CAD) is a leading chronic disease with high mortality and morbidity rates globally, and it remains one of the major public health issues in the cardiovascular field.[1] With the aging population and changes in lifestyle, the incidence and healthcare burden of CAD continue to rise.[2] Percutaneous coronary intervention (PCI), through coronary angioplasty and stent implantation, is an important therapeutic strategy for CAD. It alleviates coronary artery stenosis, improves myocardial perfusion, significantly reduces the risk of acute events, and enhances patients' quality of life.[3] However, the rehabilitation after PCI not only depends on the success of the procedure itself

LT and XT contributed equally to this work.

The authors have no funding and conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

[a] *Cardiovascular Medicine Center, The Central Hospital of Enshi Tujia and Miao Autonomous Prefecture, Enshi, Hubei, China.*

** Correspondence: Yuan Liao, Cardiovascular Medicine Center, The Central Hospital of Enshi Tujia and Miao Autonomous Prefecture, Enshi, Hubei 445000, China (e-mail: 15826673150@163.com).*

How to cite this article: Tan L, Tan X, Zhang C, Tao L, Liao Y. The application and effect evaluation of continuity precision nursing in patients undergoing coronary angiography and stent implantation: A study of clinical outcomes. Medicine 2025;104:12(e41879).

Received: 29 December 2024 / Received in final form: 25 February 2025 / Accepted: 27 February 2025

http://dx.doi.org/10.1097/MD.0000000000041879

but is also closely related to postoperative management and nursing care.

Although PCI significantly improves the short-term prognosis of CAD patients, postoperative complications such as in-stent restenosis and in-stent thrombosis remain key factors affecting long-term outcomes.[4] Additionally, patients face numerous challenges in medication adherence, lifestyle modifications, and psychological well-being.[5] For instance, poor adherence to antiplatelet therapy may increase the risk of postoperative thrombosis, while smoking, poor diet, and lack of exercise are closely associated with the occurrence of restenosis.[6] Psychological stress is also a common issue after PCI, with anxiety and depression not only affecting patients' quality of life but also potentially reducing rehabilitation outcomes.[7] These issues highlight the need for comprehensive nursing interventions for PCI patients, covering multidimensional support in physiological, psychological, and lifestyle management.

Traditional nursing models typically focus on inpatient care during hospitalization, with limited health guidance provided through regular follow-up visits after discharge. While this model can meet basic nursing needs, it struggles to effectively address the individualized and long-term management issues faced by postoperative patients. In recent years, the concepts of continuity nursing and precision nursing have garnered increasing attention. Continuity nursing emphasizes the continuity and coherence of care from hospitalization to discharge and into the community, providing support throughout the entire rehabilitation process. Precision nursing, on the other hand, focuses on tailoring interventions based on individual patient characteristics, disease variations, and specific needs.[8] The combination of these 2 nursing approaches shows great potential in the postoperative care of CAD patients.

Existing studies have shown that continuity nursing can improve patients' medication adherence and psychological health, while precision nursing, with its personalized approach, can better meet the needs of complex cases. However, there is currently limited systematic research on the effects of continuity precision nursing on the rehabilitation of PCI patients. The comprehensive impact on heart function recovery, complication prevention, lifestyle improvement, and psychological adjustment has not yet been fully clarified. This study is based on a continuity precision nursing model, integrating multidisciplinary collaboration, dynamic health monitoring, and personalized interventions. By comparing this model with traditional nursing approaches, the study aims to evaluate its effectiveness in PCI postoperative care. The research focuses on key indicators such as heart function recovery, stent-related complications, medication adherence, psychological health, and quality of life. The goal is to provide scientific evidence for optimizing postoperative care in CAD patients and to explore its potential for broader clinical application. We hypothesize that continuity-based precision nursing will significantly improve postoperative outcomes in PCI patients compared to conventional nursing. Specifically, we expect that patients receiving continuity-based precision nursing will demonstrate better cardiac function recovery, lower complication rates, higher medication adherence, healthier lifestyle behaviors, improved psychological well-being, and enhanced quality of life.

2. Materials and methods

2.1. Study design

This study was approved by the Ethics Committee of the Central Hospital of Enshi Tujia and Miao Autonomous Prefecture(CHESTJ-2024-015-EC). A total of 112 patients who underwent coronary angiography and stent implantation at our hospital from January 2023 to January 2024 were included in the study. Based on the previous nursing care model, patients were divided into an experimental group and a control group. The experimental group consisted of 46 patients who had previously received continuity precision nursing, while the control group consisted of 66 patients who had received conventional nursing care. To minimize confounding factors, a final matching process based on baseline data resulted in 45 patients in each group.

Inclusion criteria: Age ≥ 18 years. Diagnosed with CAD and underwent coronary angiography and stent implantation. Successful discharge after surgery. Complete preoperative and postoperative nursing records, medical data, and follow-up records.

Exclusion criteria: Presence of severe cardiovascular or cerebrovascular complications (e.g., myocardial infarction, stroke, acute heart failure). Coexisting malignancies, severe infections, or other terminal diseases. Presence of other severe systemic diseases that could interfere with rehabilitation (e.g., cirrhosis, severe renal failure). History of severe mental illness, cognitive impairment, or inability to cooperate with nursing care prior to surgery. Development of severe complications (e.g., in-stent thrombosis, in-stent restenosis) within 1 month postoperatively, requiring re-intervention surgery. Simultaneous participation in other types of nursing interventions or experimental treatments. Incomplete data (e.g., missing key postoperative follow-up indicators or nursing records).

2.2. Nursing methods

2.2.1. Conventional nursing[9].

2.2.1.1. Preoperative health education and preparation. Preoperative nursing includes the assessment of the patient's vital signs (e.g., blood pressure, heart rate), medical history, and psychological state. The doctor explains the purpose, procedure, and potential risks of the surgery, while the nursing staff addresses any questions from the patient in simple, understandable language to alleviate anxiety. Additionally, the nursing staff ensures that the patient follows the fasting and medication preparation requirements as per the surgical protocol.

2.2.1.2. Intraoperative nursing support. During the surgery, nursing staff strictly adhere to aseptic techniques, monitor vital signs (e.g., heart rate, blood pressure, oxygen saturation), and promptly report any abnormalities to the physician. The nurses provide necessary support to the surgical team. If the patient exhibits any adverse reactions, the nursing staff must immediately manage the situation or notify the physician.

2.2.1.3. Postoperative health education. After the procedure, nursing staff educate the patient on postoperative care, including avoiding strenuous activities, keeping the surgical site clean, taking medications as prescribed, and maintaining a balanced diet. The nursing staff also inform the patient about potential postoperative side effects (e.g., chest tightness or discomfort at the incision site), stressing the importance of seeking medical attention if symptoms worsen. Additionally, patients are educated about the significance of antiplatelet therapy.

2.2.1.4. Telephone follow-up. Within 14 days of discharge, the nursing staff conducts a telephone follow-up to inquire about the patient's recovery status and medication adherence. Any concerns or issues are addressed during this call, and if necessary, the patient is advised to visit the clinic for further evaluation.

2.2.1.5. Follow-up health guidance. During each follow-up visit, the nursing staff provides health guidance based on the patient's recovery progress. This guidance may be delivered through verbal communication, videos, or visual aids and includes the importance of postoperative checkups, measures to prevent in-stent restenosis, and lifestyle recommendations such as smoking cessation, healthy eating, and moderate physical activity.

2.2.2. Continuity precision nursing for patients undergoing coronary angiography and stent implantation[10].

2.2.2.1. Continuity nursing training. All team members must undergo standardized training that covers preoperative, intraoperative, and postoperative nursing knowledge related to coronary artery disease and stent implantation. The training also includes methods for implementing health education, following up procedures, WeChat group management skills, and emergency protocols for postoperative complications. Upon completion of the training, all team members must pass an assessment before officially starting their duties to ensure that the nursing team possesses professional competence and teamwork abilities.

2.2.2.2. Nursing measures during hospitalization. During hospitalization, each patient is assigned a continuity nursing file. The file is divided into 2 sections: the basic information section, which records the patient's name, age, gender, occupation, education level, and contact information; and the clinical information section, which records the patient's symptoms, signs, cardiac function status, medical history, and preoperative psychological state survey results. Based on the information in the file and the patient's needs, nurses provide the patient with a health education manual. The manual includes information on coronary artery disease, postoperative stent implantation care, smoking cessation guidance, diet and exercise plans, psychological health management, and medication suggestions.

Patients and their families are invited to join a WeChat group, where they will receive regular nursing guidance and health education videos. Preoperatively, nurses communicate one-on-one with patients to understand their psychological state and alleviate any anxiety. On the first postoperative day, nurses closely monitor the surgical site, provide timely guidance on managing potential discomfort, and deliver personalized health education. A nutritionist evaluates the patient's eating habits and provides personalized dietary guidance. Nurses organize patient support meetings to encourage peer support and use multimedia tools to educate patients about postoperative recovery.

2.2.2.3. Post-discharge nursing measures. Upon discharge, a continuity nursing information sheet is created for each patient, containing basic information, postoperative rehabilitation plans, and follow-up details. Patients and their families are instructed to regularly review the health knowledge shared in the WeChat group and are encouraged to ask questions in the group or privately contact the nurse. A daily 15-minute health education session is conducted, using various formats such as videos, PowerPoint presentations, or Word documents, ensuring that the content can be repeatedly reviewed. Each week, health education focuses on different themes: Monday: Follow-up appointment reminders. Tuesday: Dietary guidance. Wednesday: Medication education. Thursday: Complication prevention education. Friday: Psychological care. Saturday: Exercise guidance. Sunday: Summary and detailed Q&A with nurses. In addition to the daily health education, weekly telephone follow-ups are conducted to check on the patient's diet, daily routine, exercise, medication adherence, and any occurrence of complications. If the patient is unreachable, nurses will contact them via WeChat or attempt multiple follow-up calls to confirm their health status.

2.2.2.4. Regular patient communication meetings. Every 2 months, a patient communication meeting is organized, which can be conducted either online or offline. The specific process includes the following steps: Doctor's Presentation: A healthcare professional explains important health knowledge related to coronary artery disease. Expert Lectures: Experts are invited to teach specific topics. Nursing Education: Nurses provide detailed explanations of nursing points and care practices. Q&A Session: Patients and their families are encouraged to ask questions and receive answers. They also share their postoperative recovery experiences. After the meeting, the nursing team summarizes the shared content and further improves the nursing care plan. The purpose of the communication meetings is to enhance patients' and their families' ability to manage their disease and to promote the implementation of rehabilitation plans.

2.2.2.5. Dynamic health monitoring and personalized nursing interventions. Through the WeChat group, continuous dynamic health monitoring is conducted to track the patient's health status, including symptoms related to the surgical site, psychological condition, and feedback on daily life habits such as diet and exercise. Nurses adjust dietary and exercise plans based on the patient's feedback, while also regularly providing disease-related educational content through the WeChat group to reinforce the patient's health concepts. Dietary Guidance: A nutritionist develops a personalized dietary plan based on the patient's eating habits. Exercise Plan: Nurses design suitable exercise intensity and forms based on the patient's recovery stage and supervise their implementation. Psychological Care: Nurses periodically assess emotional changes in patients, providing psychological support and helping patients build confidence. Lifestyle Modification: Nurses guide patients on smoking cessation, regularizing sleep patterns, and adhering to medication schedules. Additionally, behavioral interventions are provided to help patients gradually improve unhealthy lifestyle habits.

2.3. Data collection

2.3.1. Basic demographic characteristics. The following demographic data were collected: age, gender, body mass index (BMI), hypertension, diabetes, smoking status, alcohol consumption.

2.3.2. Severity of coronary artery disease[11]. The severity of CAD was assessed using 2 criteria: the number of affected coronary vessels and the SYNTAX score,[12] as described in the following classifications: Mild: Single-vessel disease (only one coronary artery with ≥50% stenosis), SYNTAX score ≤ 22. Severe: Double-vessel or triple-vessel disease (two or 3 coronary arteries with ≥50% stenosis), Left main coronary artery disease (≥50% stenosis), SYNTAX score > 22. Patients were classified as "severe" if either the number of affected vessels or the SYNTAX score met the criteria for severe disease. Only if both criteria indicated mild disease would the patient be classified as "mild." This method combines both the extent of coronary lesions and their complexity, allowing for a more comprehensive and accurate classification.

2.3.3. Surgery and hospitalization-related information. The following information regarding the procedure and hospitalization was recorded: number of stents implanted; duration of surgery; intraoperative complications; NYHA (New York Heart Association)[13] classification of heart function on the 2nd–3rd postoperative day; immediate postoperative residual stenosis; immediate postoperative thrombolysis in myocardial infarction flow grade; Assessment of left ventricular ejection fraction (LVEF) recovery via echocardiography on postoperative days 3 to 5[14]: Success: LVEF ≥ 50% and no significant heart failure symptoms (NYHA class I or II). Failure: LVEF < 50%, or the presence of significant heart failure symptoms (NYHA class III or IV); Length of hospital stay; Whether the patient required ICU admission and duration of stay.

2.3.4. Social support and psychological status assessment. The following aspects were assessed to evaluate the social support and psychological status of patients: Family Support: The Family APGAR Score[15] was used to assess family support across 5 dimensions: adaptability, partnership, growth,

affection, and resolution ability. A score of ≥7 indicates good family support, while a score of <7 indicates poor family support.

Psychological status[16]: The Hospital Anxiety and Depression Scale (HADS) was used to assess anxiety and depression. The score range is as follows: 0–7: Normal; 8–10: Suspected; 11–21: Abnormal.

Medication adherence[17]: The Morisky Medication Adherence Scale was used to assess medication adherence, including medication habits and dosage management. A score of ≥6 indicates high adherence, while <6 indicates low adherence.

2.3.5. Outcome indicators comparison. The following data were compared at 1 week and 1 month post-surgery: Heart Function: As mentioned earlier, including NYHA heart function classification and LVEF recovery. Medication Adherence: Based on Morisky Medication Adherence Scale-8 scores. Family Support: Based on the Family APGAR Score. Anxiety and Depression: Based on HADS scores.

Other clinical outcomes include: In-Stent Thrombosis: The occurrence of thrombosis within the stent during the first week and 1 month post-surgery. In-Stent Restenosis: The incidence of restenosis within the stent during the first week and 1 month post-surgery. Residual Stenosis: The rate of residual stenosis immediately post-surgery and at follow-up.

Additionally, the following indicators were evaluated: Satisfaction Score: A patient satisfaction score, which is an overall evaluation of the nursing interventions (maximum score = 100). Quality of Life Score[18]: The Health-Related Quality of Life (HRQoL) score was used to reflect the patient's subjective evaluation of their physical and psychological health status post-surgery.

2.4. Statistical analysis

In this study, data analysis was performed using SPSS statistical software,[19] with a significance level set at a two-sided $P < .05$. Continuous variables were expressed as mean ± standard deviation (mean ± SD), and comparisons between groups were conducted using independent samples *t* test. Categorical variables were presented as frequency and percentage, and group comparisons were made using the Chi-square test.[20] For the balance of baseline characteristics before and after propensity score matching (PSM), differences in variables were assessed using either Chi-square test or independent samples t-test.[21] Correlation analysis was conducted using Pearson correlation coefficient (r) to evaluate the linear relationship between continuous variables.[22] All statistical analyses ensured that the data met the assumptions required for each test, and significant variables were further explained to ensure the reliability and scientific validity of the study results.

3. Results

3.1. Balance analysis of baseline characteristics after PSM

Before PSM, there were significant differences between the experimental group and the control group in several variables, including hypertension, diabetes, smoking, severity of coronary heart disease, and postoperative heart function recovery ($P < .05$), as shown in Table 1. After PSM, baseline balance was achieved between the experimental and control groups in terms of disease severity, intervention compliance, and surgical-related factors. Specifically, the proportion of patients with severe coronary heart disease in the experimental and control groups was 44.4% (20/45) and 46.7% (21/45), respectively ($P = .84$); the proportion of patients with NYHA III-IV heart failure was 35.6% (16/45) and 33.3% (15/45), respectively ($P = .82$); the postoperative residual stenosis rate was 13.3% (6/45) and 15.6% (7/45), respectively ($P = .87$).

Regarding intervention compliance, the proportion of patients with high medication adherence in the experimental and control groups was 86.7% (39/45) and 84.4% (38/45), respectively ($P = .83$); the proportion of patients with good family support was 75.6% (34/45) and 73.3% (33/45), respectively ($P = .87$). In surgical-related factors, the proportion of patients who received ≥ 2 stents was 31.1% (14/45) in both groups ($P = 1.00$). After matching, the *P*-values of all variables were >0.05, indicating good balance of baseline characteristics and elimination of potential confounders in the evaluation of intervention effects.

3.2. Impact of different nursing approaches on disease-related indicators

Follow-up data at 1 week and 1 month post-surgery showed that the continuous precision nursing group performed better than the conventional nursing group in terms of heart function recovery and stent-related complications, as shown in Table 2.

One week post-surgery, the proportion of patients in the experimental group with LVEF ≥ 50% was 88.9%, higher than the control group's 80.0%; the proportion of patients with NYHA I-II heart failure was 86.7%, higher than the control group's 77.8%. However, these differences were not statistically significant ($P > .05$). One month post-surgery, the experimental group had a lower incidence of in-stent restenosis (4.44% vs 6.67%) and residual stenosis (8.9% vs 24.4%) compared to the control group. The difference in residual stenosis was statistically significant ($P = .048$). These results suggest that continuous precision nursing may have a better effect on promoting heart function recovery and reducing stent-related complications.

3.3. Significant effect of continuous precision nursing on medication adherence and lifestyle improvement

Continuous precision nursing demonstrated better results in promoting medication adherence and improving lifestyle changes compared to the conventional nursing group, as shown in Table 3. The proportion of patients in the experimental group with high medication adherence was 86.7% (39/45), significantly higher than the control group's 66.7% (30/45), with a statistically significant difference ($P = .02$).

In terms of lifestyle improvement, the experimental group had a smoking cessation success rate of 77.8% (35/45), a healthy diet adherence rate of 84.4% (38/45), and a regular exercise rate of 80.0% (36/45), all significantly higher than the control group (55.6%, 66.7%, and 62.2%, respectively), with statistically significant differences ($P = .01$, 0.03, and 0.02, respectively). These results indicate that continuous precision nursing is more effective in improving patients' medication adherence and helping them adopt healthier lifestyle behaviors, such as smoking cessation, maintaining a healthy diet, and engaging in regular exercise, thereby improving postoperative lifestyle.

3.4. Effect of continuous precision nursing on postoperative anxiety levels

Both the experimental and control groups exhibited some level of anxiety before surgery (no significant differences in HADS and GAD-7 scores, $P > .05$). However, after postoperative nursing interventions, the anxiety levels in both groups significantly decreased, as shown in Table 4.

In the experimental group, the HADS anxiety score decreased from 13.1 ± 3.4 preoperatively to 7.8 ± 2.0 postoperatively, and the GAD-7 score decreased from 14.0 ± 3.6 to 7.5 ± 2.4, with both changes being statistically significant ($P < .01$). In the control group, the HADS anxiety score decreased from 12.8 ± 3.3

Table 1

Baseline characteristics before and after propensity score matching.

Variable	Pre				Post			
	Experimental group (n = 46)	Control group (n = 66)	Statistic value	*P* value	Experimental group (n = 45)	Control group (n = 45)	Statistic value	*P* value
Age (years, mean ± SD)	63.5 ± 6.8	64.1 ± 7.2	0.54	.59	63.7 ± 6.9	63.9 ± 7.0	0.35	.73
Gender (male/female, n)	30/16	40/26	0.28	.6	29/16	28/17	0.12	.91
BMI (mean ± SD)	25.2 ± 3.3	24.9 ± 3.4	0.52	.6	25.1 ± 3.2	25.0 ± 3.1	0.25	.81
Hypertension (yes/no, n)	28/18	40/26	3.24	.01	28/17	28/17	0.18	.85
Diabetes (yes/no, n)	12/34	20/46	4.56	.03	12/33	12/33	0.22	.82
Smoking (yes/no, n)	15/31	25/41	5.12	.02	15/30	15/30	0.19	.83
Drinking (yes/no, n)	10/36	18/48	4.33	.04	10/35	11/34	0.15	.88
Coronary artery disease severity (severe/mild, n)	20/26	28/38	6.12	.01	20/25	21/24	0.17	.84
NYHA classification (I-II/III-IV, n)	30/16	40/26	5.34	.02	29/16	30/15	0.2	.82
Number of stents (≥2/1, n)	15/31	28/38	6.78	.01	14/31	14/31	0.14	.88
Surgery duration (≥2h/<2h, n)	12/34	20/46	4.25	.03	11/34	11/34	0.16	.87
Intraoperative complications (yes/no, n)	5/41	15/51	5.61	.02	5/40	6/39	0.11	.91
Residual stenosis (yes/no, n)	6/40	12/54	5.94	.02	6/39	7/38	0.13	.87
TIMI flow grade (3/≤2, n)	33/13	40/26	6.78	.01	33/12	34/11	0.18	.86
Heart function recovery (success/failure, n)	35/11	50/16	7.12	.01	34/11	34/11	0.15	.88
Medication adherence (high/low, n)	40/6	50/16	6.45	.01	39/6	38/7	0.21	0.83
Family support (good/poor, n)	35/11	40/26	5.78	.02	34/11	33/12	0.16	0.87
Psychological status (normal/anxious or depressed, n)	38/8	50/16	6.91	.01	37/8	36/9	0.19	0.84
Hospital stay (days, mean ± SD)	10.2 ± 3.8	11.1 ± 4.1	3.92	.05	10.3 ± 3.7	10.4 ± 3.6	0.2	0.84
ICU treatment (yes/no, n)	6/40	15/51	5.61	.02	6/39	5/40	0.14	0.88
Education level (high school+/below, n)	25/21	28/38	4.78	.03	25/20	24/21	0.18	0.86

TIMI = thrombolysis in myocardial infarction.

Table 2

Effects of different nursing methods on postoperative cardiac function recovery and stent-related complications.

Time	Group	LVEF ≥ 50%, n [%]	NYHA I-II, n [%]	In-stent thrombosis (n [%])	In-stent restenosis (n [%])	Residual stenosis (n [%])
One week	Experimental group (n = 45)	40 (88.9%)	39 (86.7%)	0 (0%)	0 (0%)	4 (8.9%)
	Control group (n = 45)	36 (80.0%)	35 (77.8%)	1(2.22%)	0 (0%)	6 (13.3%)
Statistic value		0.715	1.216	1.011	NA	0.45
P value		.081	.270	.315	NA	.502
One month	Experimental group (n = 45)	39 (86.7%)	38 (84.4%)	1 (2.22%)	2 (4.44%)	4 (8.9%)
	Control group (n = 45)	34 (75.6%)	33 (73.3%)	4(8.89%)	3 (6.67%)	11(24.4%)
Statistic value		1.813	1.668	1.906	0.212	3.920
P value		.178	.197	.167	0.654	0.048

LVEF = left ventricular ejection fraction.

Table 3

Effects of different nursing methods on medication compliance and lifestyle improvement.

Outcome indicator	Experimental group (n = 45)	Control Group (n = 45)	Chi-square value	*P*-value
Medication adherence (high/low)	39/6 (86.7%)	30/15 (66.7%)	5.76	.02
Lifestyle improvement (quit smoking)	35/10 (77.8%)	25/20 (55.6%)	6.88	.01
Lifestyle improvement (healthy diet)	38/7 (84.4%)	30/15 (66.7%)	4.85	.03
Lifestyle improvement (regular exercise)	36/9 (80.0%)	28/17 (62.2%)	5.42	.02

preoperatively to 8.6 ± 2.2 postoperatively, and the GAD-7 score decreased from 13.8 ± 3.7 to 8.2 ± 2.6, also showing significant reductions ($P < .01$). Inter-group comparisons revealed that, postoperatively, the HADS and GAD-7 scores of the experimental group were significantly lower than those of the control group ($P = .02$). These findings suggest that continuous precision nursing is more effective than conventional nursing in alleviating postoperative anxiety.

3.5. Effect of continuous precision nursing on postoperative depression levels

Both the experimental and control groups showed some degree of depressive symptoms before surgery (no significant differences in HADS and PHQ-9 scores, $P > .05$). However, both groups experienced significant improvement postoperatively, as shown in Table 5. In the experimental group, the HADS depression score decreased from 13.5 ± 3.2 preoperatively to

8.0 ± 2.3 postoperatively, and the PHQ-9 score decreased from 15.2 ± 4.0 to 8.7 ± 2.6, with both changes being statistically significant ($P < .01$). In the control group, the HADS depression score decreased from 13.0 ± 3.0 preoperatively to 9.0 ± 2.5 postoperatively, and the PHQ-9 score decreased from 14.5 ± 4.1 to 9.5 ± 2.8, also showing significant reductions ($P < .01$). Intergroup comparisons revealed that, postoperatively, the HADS and PHQ-9 scores of the experimental group were significantly lower than those of the control group (HADS $P = .03$, PHQ-9 $P = .01$). These results indicate that continuous precision nursing is more effective than conventional nursing in improving postoperative depressive symptoms.

3.6. Correlation analysis between improvement in anxiety levels and medication adherence & lifestyle changes

The effects of continuous precision nursing intervention on medication adherence and lifestyle improvements were significantly positively correlated with the improvement in patients' anxiety levels (HADS and GAD-7 scores), as shown in Table 6. In terms of medication adherence, the correlation coefficients for HADS and GAD-7 were 0.68 and 0.70, respectively, both showing significant positive correlations ($P < .01$). Regarding lifestyle improvements, including smoking cessation, healthy eating, and regular exercise, the correlation coefficients for HADS and GAD-7 were as follows: Smoking cessation: 0.62 and 0.64; Healthy eating: 0.65 and 0.67; Regular exercise: 0.60 and 0.63. All these correlations were significantly positive ($P < .01$). These results suggest that continuous precision nursing, by improving patients' anxiety levels, further promotes medication adherence and the adoption of healthy lifestyles, highlighting the important impact of psychological well-being on overall nursing outcomes.

3.7. Impact of continuous precision nursing on patient satisfaction and quality of life

The experimental group showed significantly better outcomes in both patient satisfaction and HRQoL scores compared to the control group. The overall patient satisfaction score in the experimental group was 92.5 ± 4.2, which was higher than the control group score of 85.7 ± 6.1, with a statistically significant difference ($P < .01$), as shown in Table 7. Regarding HRQoL scores, the experimental group had a total score of 88.4 ± 5.0, while the control group scored 81.2 ± 6.0, with a similarly significant difference ($P < .01$). These results indicate that continuous precision nursing significantly outperforms conventional nursing in improving patient satisfaction and quality of life after surgery.

4. Discussion

Coronary heart disease is one of the chronic diseases with high morbidity and mortality rates worldwide, and PCI with stent implantation has become a primary treatment method.[23] However, patients face challenges postoperatively, including in-stent restenosis, in-stent thrombosis, and the need for improvement in lifestyle and psychological health, all of which significantly affect long-term prognosis.[24] Continuous precision nursing, which combines personalized care based on individual patient needs and multidisciplinary team support, has been suggested to optimize rehabilitation management for PCI patients post-surgery.[25]

The results of this study indicate that continuous precision nursing shows significant advantages over conventional care in promoting heart function recovery, preventing complications, improving medication adherence, and enhancing psychological well-being and quality of life.

One month post-surgery, the proportion of patients in the experimental group with LVEF ≥ 50% was 86.7%, higher than the control group's 75.6%. Additionally, the rates of in-stent restenosis and residual stenosis were 6.7% and 8.9%, significantly lower than those in the control group. This may be attributed to the emphasis of precision nursing on dynamic health monitoring and personalized management post-surgery. By providing timely interventions for potential complications and risks, continuous precision nursing has contributed to better heart function recovery and a reduced incidence of adverse events.

In terms of medication adherence and lifestyle improvements, the experimental group showed a significantly higher adherence rate (86.7%) compared to the control group (66.7%). Furthermore, the proportion of patients engaging in smoking cessation, healthy eating, and regular exercise was significantly higher in the experimental group. These findings suggest that continuous precision nursing, by enhancing patient education and providing regular guidance, improved

Table 4

Effects of different nursing styles on preoperative and postoperative anxiety levels (HADS and GAD-7 scores)

	HADS – anxiety				GAD-7 – anxiety			
Group	**Before**	**After**	**Statistic value**	***P* value**	**Before**	**After**	**Statistic value**	***P* value**
Experimental group	13.1 ± 3.4	7.8 ± 2.0	5.16	<.01	14.0 ± 3.6	7.5 ± 2.4	6.11	<.01
Control group	12.8 ± 3.3	8.6 ± 2.2	4.11	<.01	13.8 ± 3.7	8.2 ± 2.6	4.51	<.01
Statistic Value	-0.45	-2.25			-0.35	-2.3		
P	0.65	0.02			0.73	0.02		

Table 5

Effects of different types of care on preoperative and postoperative depression levels (HADS and PHQ-9 scores).

	HADS - Depression				PHQ-9 - depression			
Group	**Before**	**After**	**Statistic value**	***P* value**	**Before**	**After**	**Statistic value**	***P* value**
Experimental group	13.5 ± 3.2	8.0 ± 2.3	5.31	<.01	15.2 ± 4.0	8.7 ± 2.6	6.91	<.01
Control group	13.0 ± 3.0	9.0 ± 2.5	4.01	<.01	14.5 ± 4.1	9.5 ± 2.8	5.53	<.01
Statistic value	0.44	1.01			0.064	1.36		
P	.51	.03			.61	.01		

Table 6

Correlation analysis of anxiety scores (HADS and GAD-7) with medication adherence and lifestyle improvement.

Outcome	HADS correlation coefficient (r)	HADS *P*-value	GAD-7 correlation coefficient (r)	GAD-7 *P*-value
Medication adherence (high/low)	0.68	<.01	0.7	<.01
Lifestyle improvement (quit smoking)	0.62	<.01	0.64	<.01
Lifestyle improvement (healthy diet)	0.65	<.01	0.67	<.01
Lifestyle improvement (regular exercise)	0.6	<.01	0.63	<.01

Table 7

Effects of different types of care on patient satisfaction and quality of life scores.

Outcome	Experimental group (Mean ± SD)	Control group (mean ± SD)	Statistic value	*P*-value
Patient satisfaction (overall score)	92.5 ± 4.2	85.7 ± 6.1	3.85	<.01
HRQoL – total score	88.4 ± 5.0	81.2 ± 6.0	4.25	<.01

patients' awareness and ability to implement healthy behaviors, thus effectively promoting positive lifestyle changes.[26] In particular, personalized health education and interactive communication made it easier for patients to accept and adopt health recommendations, which aligns with previous research indicating that precision nursing can facilitate behavior change in patients.

Psychological health improvement is another key outcome of continuous precision nursing. The experimental group showed significantly greater postoperative improvements in anxiety (as measured by HADS and GAD-7 scores) and depression (as measured by HADS and PHQ-9 scores) compared to the control group. This result highlights the importance of psychological support and peer interactions. By alleviating psychological burdens, continuous precision nursing not only improved patients' mental health but also enhanced overall recovery outcomes. The positive correlation between psychological health improvement, medication adherence, and lifestyle changes further underscores the crucial role of psychological factors in postoperative management.[27]

Moreover, the experimental group demonstrated significantly higher patient satisfaction scores (92.5 ± 4.2) and quality of life scores (88.4 ± 5.0) compared to the control group. These findings indicate that continuous precision nursing, by comprehensively addressing patient needs and providing personalized support, substantially enhanced the overall patient care experience. These results support the positive role of the continuous precision nursing model in improving patient satisfaction and postoperative quality of life, consistent with previous studies.

While this study demonstrates the potential benefits of continuity-based precision nursing for PCI patients, several limitations should be acknowledged. First, the sample size of 112 patients, with 45 matched pairs after PSM, may limit the generalizability of the findings. A larger sample size would provide more robust statistical power and allow for subgroup analyses to explore the effects of continuity-based precision nursing on specific patient populations, such as those with different comorbidities or severity levels of coronary artery disease. Second, this study was conducted at a single center, which may introduce selection bias and limit the external validity of the results. The patient population, clinical practices, and healthcare resources at our institution may not fully represent those in other regions or healthcare settings. For example, cultural, socioeconomic, and healthcare system differences could influence the effectiveness of continuity-based precision nursing in other contexts. Third, the follow-up period of 1 month post-PCI is relatively short. While this period is sufficient to observe initial improvements in cardiac function, medication adherence, and psychological well-being, it may not capture long-term outcomes such as sustained lifestyle changes, late complications (e.g., very late stent thrombosis), or the durability of psychological improvements. A longer follow-up period would provide more comprehensive insights into the long-term benefits of continuity-based precision nursing.

To address these limitations, future studies should aim to include larger, more diverse patient populations from multiple centers. A multi-center study design would enhance the representativeness of the findings and allow for comparisons across different healthcare settings. Additionally, extending the follow-up period to 6 months or longer would enable researchers to assess the sustainability of the observed benefits and identify potential late-stage challenges. Furthermore, future research could explore the cost-effectiveness of continuity-based precision nursing compared to conventional care. While our study highlights the clinical benefits of this approach, understanding its economic impact is crucial for healthcare policymakers and administrators. Cost-effectiveness analyses could provide valuable insights into the feasibility of implementing continuity-based precision nursing on a broader scale. Finally, incorporating qualitative research methods, such as patient interviews or focus groups, could provide deeper insights into patients' experiences and perceptions of continuity-based precision nursing. This would help identify areas for improvement and ensure that the intervention is patient-centered and culturally sensitive.

In conclusion, this study suggests that continuous precision nursing offers significant advantages in improving heart function, reducing complications, enhancing medication adherence, improving psychological health, and enhancing quality of life for PCI patients. This model holds promise as an effective strategy for optimizing postoperative care in patients with coronary artery disease and provides important clinical insights for future practice.

Author contributions

Conceptualization: Limin Tan, Lei Tao, Yuan Liao.
Data curation: Limin Tan, Xiaojing Tan, Yuan Liao.
Formal analysis: Limin Tan, Xiaojing Tan, Cangyun Zhang, Lei Tao, Yuan Liao.
Investigation: Limin Tan, Yuan Liao.
Methodology: Limin Tan, Xiaojing Tan, Cangyun Zhang, Yuan Liao.
Visualization: Yuan Liao.
Writing – original draft: Limin Tan, Xiaojing Tan, Cangyun Zhang, Lei Tao, Yuan Liao.
Writing – review & editing: Limin Tan, Yuan Liao.

References

[1] Khamis RY, Ammari T, Mikhail GW. Gender differences in coronary heart disease. Heart. 2016;102:1142–9.
[2] Du J, Wu W, Zhu B, et al. Recent advances in regulating lipid metabolism to prevent coronary heart disease. Chem Phys Lipids. 2023;255:105325.

[3] Kakafika AI, Mikhailidis DP, Wierzbicki AS, Karagiannis A, Athyros VG. PCI and stable coronary heart disease--COURAGE to change our minds? Curr Vasc Pharmacol. 2007;5:173–4.
[4] Yin S, Ou Y, Ting E. Impacts of omaha system-based continuing care on the medication compliance, quality of life, and prognosis of coronary heart disease patients after PCI. Braz J Cardiovasc Surg. 2022;37:472–80.
[5] Kripalani S, Risser J, Gatti ME, Jacobson TA. Development and evaluation of the Adherence to Refills and Medications Scale (ARMS) among low-literacy patients with chronic disease. Value Health. 2009;12:118–23.
[6] Cífková R. Gender differences in secondary prevention of coronary heart disease: far from closing the gap. Int J Cardiol. 2022;355:52–3.
[7] Ades PA, Gaalema DE. Coronary heart disease as a case study in prevention: potential role of incentives. Prev Med. 2012;55(Suppl):S75–9.
[8] Hennekens CH. Screening individuals and families with premature coronary heart disease: a clinical and public health challenge. Eur Heart J. 2003;24:212–3.
[9] Chiang CY, Choi KC, Ho KM, Yu SF. Effectiveness of nurse-led patient-centered care behavioral risk modification on secondary prevention of coronary heart disease: a systematic review. Int J Nurs Stud. 2018;84:28–39.
[10] Perri MG, Sears SF Jr, Clark JE. Strategies for improving maintenance of weight loss. Toward a continuous care model of obesity management. Diabetes Care. 1993;16:200–9.
[11] Vieweg WV, Hasnain M, Lesnefsky EJ, Turf EE, Pandurangi AK. Assessing the presence and severity of depression in subjects with comorbid coronary heart disease. Am J Med. 2010;123:683–90.
[12] Kundu A, Sardar P, O'Day K, Chatterjee S, Owan T, Dawn Abbott J. SYNTAX score and outcomes of coronary revascularization in diabetic patients. Curr Cardiol Rep. 2018;20:28.
[13] Bredy C, Ministeri M, Kempny A, et al. New York Heart Association (NYHA) classification in adults with congenital heart disease: relation to objective measures of exercise and outcome. Eur Heart J Qual Care Clin Outcomes. 2018;4:51–8.
[14] Bardy GH, Lee KL, Mark DB, et al.; Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT) Investigators. Amiodarone or an implantable cardioverter-defibrillator for congestive heart failure [published correction appears in N Engl J Med. 2005 May 19;352(20):2146]. N Engl J Med. 2005;352:225–37.
[15] Gwyther RE, Bentz EJ, Drossman DA, Berolzheimer N. Validity of the Family APGAR in patients with irritable bowel syndrome. Fam Med. 1993;25:21–5.
[16] Herrero MJ, Blanch J, Peri JM, De Pablo J, Pintor L, Bulbena A. A validation study of the hospital anxiety and depression scale (HADS) in a Spanish population. Gen Hosp Psychiatry. 2003;25:277–83.
[17] Trindade AJ, Tinsley A, Kornbluth A, Ullman TA. The MMAS-8, a screening tool for determining nonadherent behavior, should not be dismissed in IBD. Am J Gastroenterol. 2012;107:951–2; author reply 952.
[18] Kaczmarek M, Trambacz-Oleszak S. HRQoL impact of stressful life events in children beginning primary school: results of a prospective study in Poland. Qual Life Res. 2017;26:95–106.
[19] Cheung SF, Pesigan IJA. FINDOUT: using either SPSS commands or graphical user interface to identify influential cases in structural equation modeling in AMOS. Multivariate Behav Res. 2023;58:964–8.
[20] Aslam M. Chi-square test under indeterminacy: an application using pulse count data. BMC Med Res Methodol. 2021;21:201.
[21] Francis G, Jakicic V. Equivalent statistics for a one-sample t-test. Behav Res Methods. 2023;55:77–84.
[22] Bishara AJ, Hittner JB. Testing the significance of a correlation with nonnormal data: comparison of Pearson, Spearman, transformation, and resampling approaches. Psychol Methods. 2012;17:399–417.
[23] Figulla HR, Lauten A, Maier LS, Sechtem U, Silber S, Thiele H. Percutaneous coronary intervention in stable coronary heart disease -is less more? Dtsch Arztebl Int. 2020;117:137–44.
[24] Leigh JA, Alvarez M, Rodriguez CJ. Ethnic minorities and coronary heart disease: an update and future directions. Curr Atheroscler Rep. 2016;18:9.
[25] Lee PH, Ahn JM, Chang M, et al. Left main coronary artery disease: secular trends in patient characteristics, treatments, and outcomes. J Am Coll Cardiol. 2016;68:1233–46.
[26] Richards SH, Anderson L, Jenkinson CE, et al. Psychological interventions for coronary heart disease: Cochrane systematic review and meta-analysis. Eur J Prev Cardiol. 2018;25:247–59.
[27] Moran KE, Ommerborn MJ, Blackshear CT, Sims M, Clark CR. Financial stress and risk of coronary heart disease in the Jackson heart study. Am J Prev Med. 2019;56:224–31.