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Article

Effect of KAP-Based Nursing Intervention on Patients Undergoing Coronary Artery Computed Tomography Angiography Review after Percutaneous Coronary Intervention

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Abstract

Objective: This study aimed to analyze the impact of nursing intervention based on knowledge, belief, and action theory (KAP) on patients undergoing coronary computed tomography angiography (CTA) review after percutaneous coronary intervention (PCI). **Methods**: The research subjects were post-PCI patients who underwent coronary CTA review in our hospital from July 2021, to July 2023. A total of 123 review patients were divided into two groups in accordance with whether they had experienced KAP-based care. The observation and control groups consisted of 65 and 58 cases, respectively (n = 58). The self-rating anxiety scale (SAS), heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP), CTA image quality, examination cooperation, and nursing satisfaction were compared between the two groups. **Results**: Compared with those of before nursing, the SAS scores of both groups after nursing were significantly reduced ($p < 0.05$). Compared with the control group, the observation group had significantly reduced SAS scores ($p < 0.05$). Compared with those before nursing, the HR, SBP, and DBP of both groups after nursing were significantly reduced ($p < 0.05$). Compared with the control group, the observation group showed significantly reduced HR, SBP, and DBP ($p < 0.05$). The grade I rate of the observation group significantly increased, the grade III rate was significantly reduced, and the image quality significantly improved compared with those of the control group ($p < 0.05$). No statistically significant difference was observed in the incidence of grade II between the two groups ($p > 0.05$). The total cooperation degree of the observation group was 93.86% (61/65), which was significantly increased compared with the total cooperation degree of 81.03% (47/58) in the control group ($p < 0.05$). The total satisfaction of patients in the observation group was 96.92% (63/65), which was significantly increased compared with the total satisfaction of 74.14% (43/58) in the control group ($p < 0.001$). **Conclusion**: Nursing based on the KAP model during coronary CTA review after PCI can significantly alleviate patients' negative emotions and improve CTA image quality. It can also improve patients' examination cooperation and nursing satisfaction.

Keywords

theory of knowledge; belief and action; percutaneous intracoronary intervention; computed tomographic vascular imaging; review

Introduction

In recent years, remarkable changes have occurred in people's living standards and way of life, and the incidence rate of coronary heart disease has been increasing in years, seriously affecting patients' health and living standards [1,2]. Percutaneous coronary intervention (PCI) is currently the main method of clinical treatment for patients with coronary heart disease, and the clinical effect is relatively ideal. However, the risk of coronary in-stent restenosis after PCI is high, and the mortality rate is as high as 20%–45% [3,4]. Therefore, patients with coronary heart disease need to undergo regular review after PCI surgery. This review is the key to ensuring the long-term success of the surgery and of paramount importance in reducing the risk of disease recurrence and major adverse cardiovascular events. Computed tomography angiography (CTA) is one of the commonly used methods for clinical diagnosis and treatment of cardiovascular diseases. It has high accuracy and the advantages of fast, simple, safe, and noninvasive. It is easily accepted by patients, and it makes a difference in the diagnosis and treatment of cardiovascular diseases. It plays a vital part in the process [5–7]. However, most patients experience negative emotions, such as nervousness and anxiety, during CTA examination; these emotions could cause accelerated respiratory rate and heart rate (HR), adversely affecting the accuracy of the examination [8]. A study [9] suggested that effective nursing intervention can improve the image quality and success rate of CTA examinations and enhance patients' compliance with re-examination and nursing satisfaction. The knowledge, belief, and action theory (KAP) is a model that can change people's health-related behavior, including the continuous behavior of acquiring knowledge, generating beliefs, and forming behavior. The three are progressively related, and

KAP has become one of the commonly used measures in community health education [10]. However, the application of KAP in patients undergoing coronary CTA review after PCI has not been reported. Therefore, the present research aimed to analyze the effect of KAP-based health education in our hospital on patients who undergo coronary CTA review after PCI to provide evidence for clinical research.

Materials and Methods

General Information

The research data comes from 123 patients with coronary heart disease who received PCI in our hospital from July 2021, to July 2023. These patients disease were categorized into observation group (n = 65) and control group (n = 58) by different nursing methods. The permission for this study was granted by the Ethics Committee of The First Affiliated Hospital of Qiqihar Medical University (approval no. 202219), and informed consent was acquired from the patients or their families. The study adhered to the Helsinki Declaration.

Inclusion and Exclusion Criteria

The inclusion criteria were as follows: (1) met the diagnostic requirements for coronary heart disease [11]; (2) received PCI treatment in our hospital; (3) mentally normal and able to communicate normally; (4) complete clinical data; (5) cooperate with follow-up research; (6) regularly reviewed in our hospital; and (7) no further PCI performed after the operation and no typical symptoms of angina pectoris, such as chest pain and stuffiness, at the time of the examination.

The exclusion criteria were as follows: (1) allergy to contrast agents; (2) severe myocardial infarction or arrhythmia; (3) abnormal function of important organs such as liver, lung, and kidney; (4) blood diseases and systemic immune system disease; (5) malignant tumors; and (6) New York Center Functional Class IV.

Method

The two groups underwent coronary artery examination through the Philips Brilliace 16B CT machine (Philips Corporation, Amsterdam, Holland) of our hospital. Before the examination, the control group was administered with routine care. (1) The patients' medical history and condition were carefully understood, changes in their vital signs were closely monitored, and any irregular heartbeats and other conditions were observed. The contraindications for CTA examination were strictly understood, and all preparations were made before the examination. (2) The patient's heart rate was controlled. If the patient's heart rate cannot reach the ideal state during the examination, such as the heart rate exceeding 75 beats/min, 50 mg of Betaloc (national drug approval number: H32025391, produced by AstraZeneca Pharmaceuticals Co., Ltd., London, Britain) is required before the CTA examination to be given orally. For patients who cannot stabilize their heart rate at 50–70 beats/min, 25 mg of Betaloc can be added. For patients whose heart rate is 65–75 beats/min, 25 mg of betaloc can be taken orally. (3) Before a CTA examination was performed, the patient needed to be informed that accessories containing metal components on the chest needed to be removed. If the chest had any pocket, the metal objects in the pocket needed to be taken out to prevent artifacts. (4) The patient was guided and assisted to assume a suitable posture and ensure that the patient's posture was comfortable. Nursing staff must explain machine inspection related knowledge to patients and inform them that no safety problems exist when the machine is rotating. (5) The patient needed to be given nitroglycerin (0.5 mg; H11021022; Beijing Yimin Pharmaceutical Co., Ltd., Beijing, China) before CTA examination to help the imaging become clearer.

The observation group was treated by KAP model nursing care on the foundation of the control group, including the following: (1) Establishing a nursing team: The head nurse of the department was selected to serve as the nursing team leader, learn the KAP model nursing skills, formulate a personalized nursing plan in accordance with the patient's condition, and select different nursing staff to provide different educations in accordance with the type of disease. (2) Knowledge explanation: Health education was provided to patients through symposiums, brochures, *etc*., and easy-to-understand language was used to explain CTA examination-related contents so that they can understand certain examination procedures and precautions. Patients were instructed to master the necessary key points of breathing and breath-holding, assisted to adapt to the instrument environment in the examination room to the greatest extent, and informed the radiation they are exposed to is safe and will not cause harm to the body. (3) Psychological care: The nursing staff actively communicated with patients and evaluated their mental status. If they found that the patient had negative emotions, the nursing staff needed to analyze the reasons for the negative emotions. Patients were guided to realize that the examination is non-invasive and treat the examination with a normal mind. (4) Nursing staff needed to pay close attention to the changes in the patients' expression during the CTA examination and listen carefully to their appeals. If they found that the patients were uneasy, they needed to provide timely and effective comfort to improve their mental state.

Evaluation Criteria

(1) Mental state: The Self-Assessment Anxiety Scale (SAS) was used to evaluate the patients' anxiety level. The scale includes 20 items, with all using the Likert four-level scoring method. The scores of each of the 20 items are added up and then multiplied by 1.25 to obtain the standard

score. An anxiety score under 50 is generally considered normal, 50–60 is mild, 61–70 is moderate, and above 70 is severe anxiety. The Cronbach's α coefficient of this scale is 0.777, which indicates good reliability and validity. The SAS scores of patients were obtained within 10 min of arriving at the examination site (before care) and 5 min before CTA (after care).

(2) Physiological indicators: Changes in heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) between the two groups were observed and compared. The normal range of HR is 60–100 times/min, the normal range of SBP is 60–80 mmHg, and the normal range of DBP is 100–120 mmHg. The patients' physiological indicators were obtained within 10 min of arriving at the examination site (before care) and 5 min before CTA (after care).

(3) CTA image quality: The CTA image quality was divided into levels I–III. In level I, the image development boundary is clear, and no artifacts or blood vessel interruptions are found. In level II, the image development is blurred, and mild artifacts can be observed. If the blood vessel is interrupted but does not affect the assessment, it is considered level II. If the image is very blurry, and the artifacts are severe, it is considered level III.

(4) Inspection cooperation: The CTA examination cooperation of both groups was measured and compared as follows: Total cooperation (%) = (number of cases with complete cooperation + number of cases with partial cooperation)/total number of cases $\times$ 100%.

(5) Nursing satisfaction: The nursing satisfaction of the two groups was evaluated using a questionnaire established by the hospital, including the four dimensions of nursing staff's service attitude, nursing skills, nursing environment, and nursing quality. The full mark is 100 points, with $<$60 points considered as dissatisfied, 60–80 points as generally satisfied, and $\geq$80 points as very satisfied. The nursing satisfaction was calculated as follows: Total nursing satisfaction (%) = (number of very satisfied cases + number of generally satisfied cases)/total number of cases $\times$ 100%.

Statistical Methods

Research-related data were processed by SPSS software package (version 21.0, IBM Corp., Chicago, IL, USA). Count data, such as inspection cooperation and nursing cooperation, were expressed as [n (%)]. Pairwise comparisons used χ^2 test. Grade data adopted Wilcoxon test. When $1 \leq$ theoretical frequency < 5, the chi-square test correction formula was used. SAS scores and other measurement data that are consistent with normal distribution are expressed as ($\bar{x} \pm$ s). Independent sample t test was used for comparison between the two groups, and paired t test was used for comparison between the same group before and after treatment. $p < 0.05$ indicated that the difference was statistically significant.

Results

General Information

The observation group and the control group had no significant difference in terms of gender, age, disease duration, body mass index (BMI), number of CTA, years of PCI surgery, proportion of diabetes, hyperlipidemia, family history, lesion type, and number of stents implanted ($p > 0.05$, Table 1).

Mental State

Compared with those before nursing, the SAS scores of both groups after nursing were significantly reduced ($p < 0.05$). Compared with the control group, the observation group had significantly decreased SAS scores ($p < 0.05$, Table 2).

Physiological Indicators

Compared with those before nursing, the HR, SBP and DBP of both groups after nursing were significantly reduced ($p < 0.05$). The HR, SBP and DBP of the observation group significantly decreased compared with those of the control group ($p < 0.05$, Table 3).

CTA Image Quality

Compared with the control group, the observation group had significantly increased grade I rate, significantly decreased grade III rate, and significantly improved image quality ($p < 0.05$). No statistically significant difference was observed in the grade II rate between the two groups ($p > 0.05$, Table 4 and Fig. 1).

Review Compliance

Thirty-nine patients in the observation group fully cooperated, and 22 patients partially cooperated, with a total cooperation degree of 93.86% (61/65). Meanwhile, 26 patients in the control group fully cooperated and 21 patients partially cooperated, with a total cooperation degree of 81.03% (47/58). The total cooperation degree of patients in the observation group increased sharply compared with that in the control group ($p < 0.05$, Table 5 and Fig. 2).

Satisfaction

In the observation group, 42 patients were very satisfied and 21 were basically satisfied, with a total satisfaction rate of 96.92% (63/65). In the control group, 27 were very satisfied and 16 were basically satisfied, with a total satisfaction rate of 74.14% (43/58) The total satisfaction of patients in the observation group increased sharply compared with that in the control group ($p < 0.001$, Table 6 and Fig. 3).

Table 1. Analysis of baseline data of the two groups [n (%), ($\bar{x} \pm s$)].

Index	Group		χ^2/t	p
	Observation group (n = 65)	Control group (n = 58)		
Gender			0.002	0.965
Male	35 (53.85%)	31 (53.45%)		
Female	30 (46.15%)	27 (46.55%)		
Age (years)	57.77 ± 3.73	58.02 ± 3.52	0.378	0.706
Duration of disease (years)	2.97 ± 0.56	3.07 ± 0.70	0.869	0.387
BMI (kg/m^2)	23.40 ± 2.78	23.97 ± 2.85	1.114	0.267
CTA times (times)	2.31± 0.50	2.24 ± 0.47	0.757	0.451
PCI operation years (year)	1.45 ± 0.71	1.67 ± 0.60	1.896	0.060
Diabetes			0.351	0.554
Yes	9 (13.85%)	6 (10.34%)		
No	56 (86.15%)	52 (89.66%)		
Hyperlipemia			0.182	0.670
Yes	30 (46.15%)	29 (50.00%)		
No	35 (53.85%)	29 (50.00%)		
Family history			0.390	0.532
Yes	19 (29.23%)	20 (34.48%)		
No	46 (70.77%)	38 (65.52%)		
Lesion types			0.406	0.939
Stable angina	26 (40.00%)	21 (36.21%)		
Unstable angina	14 (21.54%)	13 (22.41%)		
ST-elevation myocardial infarction	14 (21.54%)	15 (25.86%)		
Others	11 (16.92%)	9 (15.52%)		
Number of stents implanted	1.61 ± 0.52	1.62 ± 0.48	0.110	0.912

Note: BMI, body mass index; CTA, computed tomography angiography; PCI, percutaneous coronary intervention.

Table 2. Comparison of SAS scores between the two groups ($\bar{x} \pm s$).

Group	Before care	After care	t	p
Observation group (n = 65)	59.09 ± 7.98	40.28 ± 6.86	14.013	<0.001
Control group (n = 58)	59.55 ± 8.05	53.24 ± 7.11	4.525	<0.001
t	0.317	10.288		
p	0.751	<0.001		

Table 3. Comparison of HR, SBP, and DBP between the two groups ($\bar{x} \pm s$).

Group	HR (times/min)		t	p	SBP (mmHg)		t	p	DBP (mmHg)		t	p
	Before care	After care			Before care	After care			Before care	After care		
Observation group (n = 65)	88.55 ± 4.38	67.94 ± 4.94	24.550	<0.001	135.22 ± 9.32	124.98 ± 7.08	6.969	<0.001	87.31 ± 7.83	78.00 ± 6.24	6.879	<0.001
Control group (n = 58)	89.05 ± 4.30	73.19 ± 5.24	17.819	<0.001	136.29 ± 9.07	129.91 ± 8.19	3.958	<0.001	87.29 ± 8.20	83.67 ± 6.71	2.602	0.011
t	0.635	5.719			0.648	3.580			0.010	4.859		
p	0.527	<0.001			0.518	0.001			0.992	<0.001		

Note: HR, heart rate; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 4. Comparison of CTA image quality between the two groups [n (%)].

Group	n	I	II	III
Observation group	65	59 (90.77%)	3 (4.62%)	3 (4.62%)
Control group	58	41 (70.69%)	5 (8.62%)	12 (20.69%)
χ^2		8.129	0.284	7.396
p		0.005	0.594	0.007

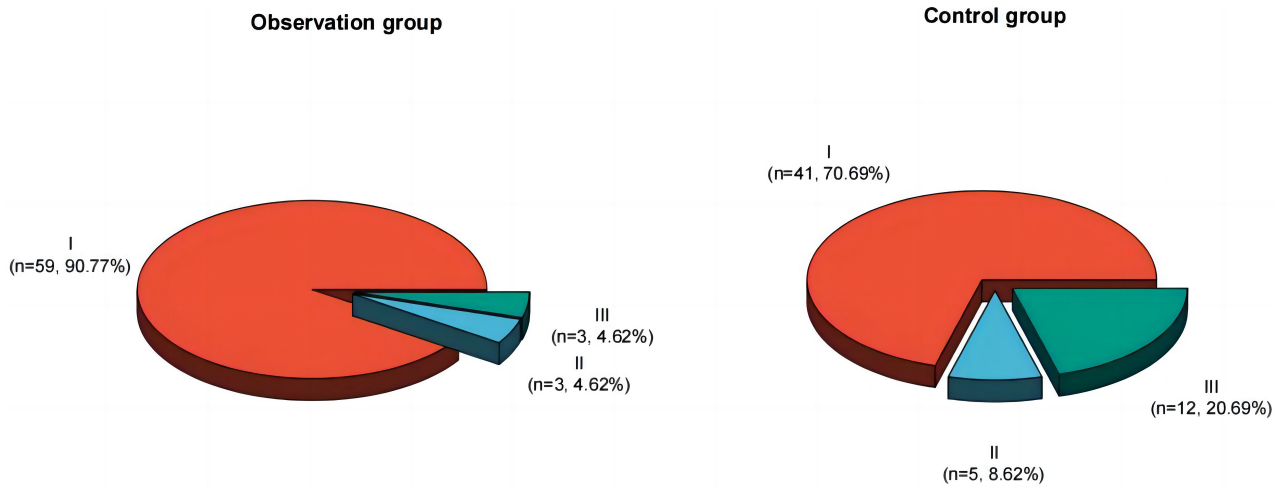

Fig. 1. Three-dimensional pie chart of computed tomography angiography (CTA) image quality distribution of the two groups.

Table 5. Comparison of examination cooperation between the two groups [n (%)].

Group	n	Fully cooperate	Partial cooperation	Uncooperative	Total fit
Observation group	65	39 (60.00%)	22 (33.85%)	4 (6.15%)	61 (93.85%)
Control group	58	26 (44.83%)	21 (36.21%)	11 (18.97%)	47 (81.03%)
χ^2					4.698
p					0.030

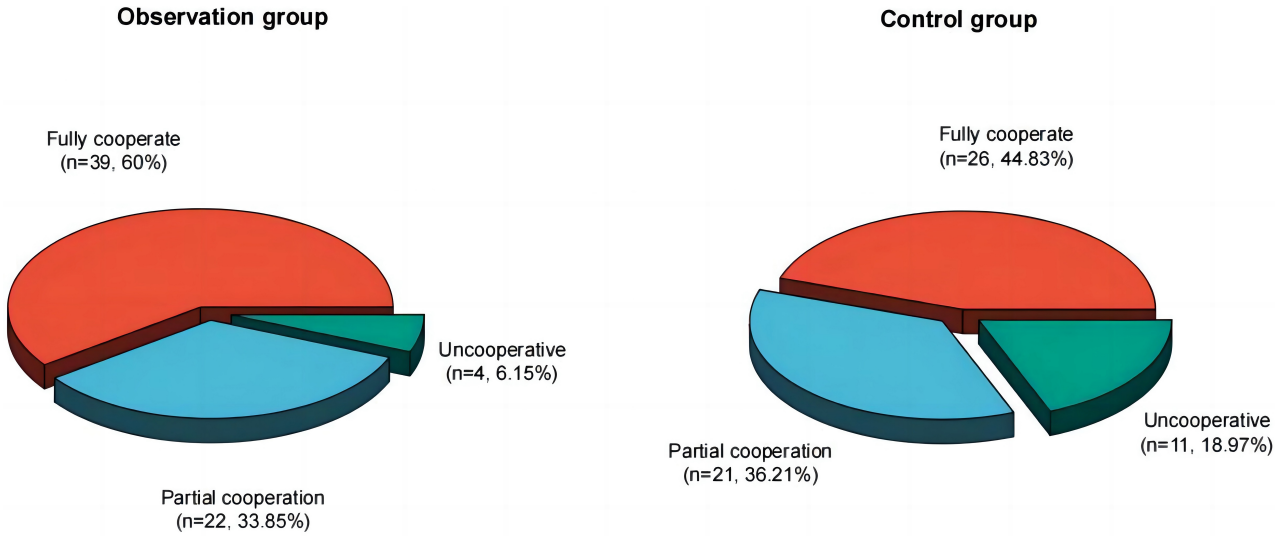

Fig. 2. Three-dimensional pie chart of the distribution of examination cooperation between the two groups.

Table 6. Comparison of total patient satisfaction with nursing care between the two groups [n (%)].

Group	n	Very satisfied	Basically satisfied	Not satisfied	Overall satisfaction
Observation group	65	42 (64.62)	21 (32.31)	2 (3.08)	63 (96.92)
Control group	58	27 (46.55)	16 (27.59)	15 (25.86)	43 (74.14)
χ^2					13.360
p					<0.001

Discussion

With the advancement of modern medicine, clinical medical detection technology has made considerable progress, and coronary artery CTA has gradually become one of the commonly used methods for clinical diagnosis of coronary artery lesions and variations [12,13]. CTA can clearly present coronary artery lesions, with high temporal, spatial, and density resolution; short examination time;

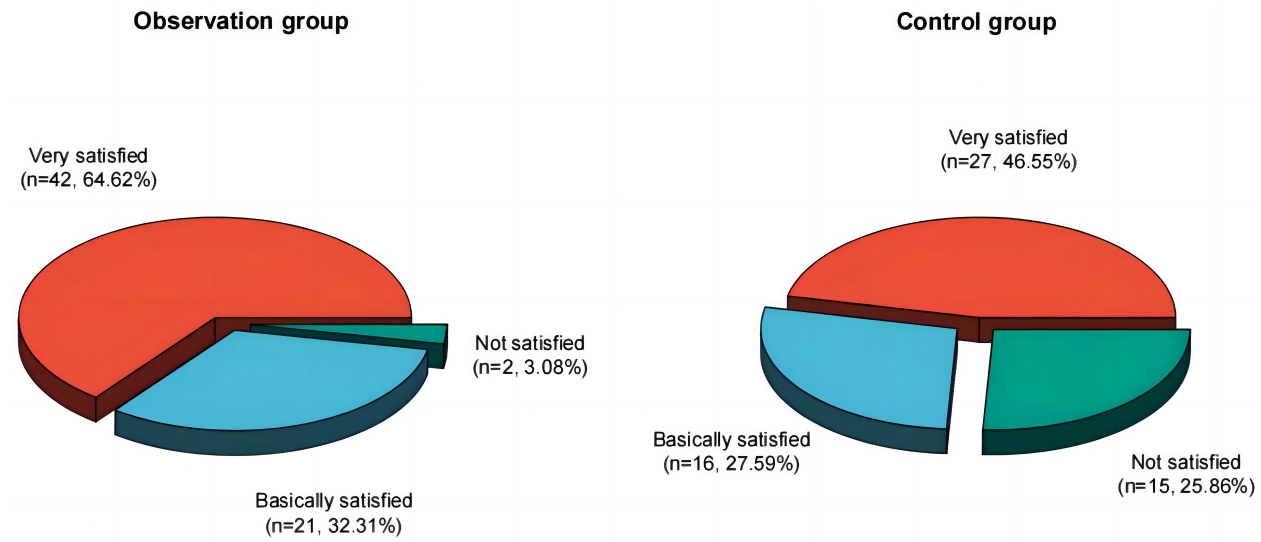

Fig. 3. Three-dimensional pie chart of the total nursing satisfaction distribution of the two groups.

simplicity; and non-invasiveness. In addition, CTA post-processing function is very powerful and suitable for clinical diagnosis of coronary artery disease [14–17]. Although the current CTA time resolution has significantly improved, and it only takes 0.33 seconds to rotate once, this examination still requires a low heart rate to achieve clear imaging [18,19]. If the patient has premature beats or arrhythmia, the CTA imaging may appear jagged, which has a huge impact on the patient's diagnosis [20]. The present study found that compared with the values before nursing, the SAS scores, HR, SBP and DBP of the patients in the observation and control groups after nursing were significantly reduced ($p < 0.05$). The SAS scores, HR, SBP, and DBP of the observation group decreased considerably compared with those of the control group ($p < 0.05$). This finding shows that KAP care for patients undergoing coronary CTA review is beneficial for improving patient anxiety and keeping vital signs stable. Traditional nursing intervention measures lack details and ignore patients' fear of unknown things, thus causing patients' blood pressure and pulse to fluctuate considerably before and during CTA examination, leading to a significant reduction in image quality [21,22]. The KPA nursing model can guide clinical medical staff to proactively improve patients' awareness of CTA examinations. Its core is the hierarchical progression between knowledge, belief, and behavior. This core is conducive to patients' correct understanding of CTA examination, and it develops a correct attitude towards CTA examination. Only then can it be possible to overcome anxiety and maintain heart rate at a good level. In this study, although the HR, SBP, and DBP levels of the observation group were lower than those of the control group, they were all within the normal range. However, this finding did not indicate that the physiological indicators of the observation group are more in line with the requirements for this examination.

Therefore, heart rate control is particularly important during CTA examination in patients with coronary heart disease. However, most patients with coronary heart disease have insufficient awareness of the disease and experience anxiety and tension, which trigger sympathetic nerve excitement and their heart rate to increase. If the heart rate exceeds 70 beats/min, it could cause the probability of CTA imaging for pseudo-shadow to greatly increase, seriously affecting clinical diagnosis and treatment [19,23–25]. Therefore, nursing staff need to carefully understand the influencing factors of coronary CTA re-examination and minimize the impact of these factors on CTA examination, which has positive significance for improving patients' negative mood [26,27]. The present study found that in comparison with the control group, the observation group had significantly increased grade I rate, significantly reduced grade III rate, and significantly improved image quality ($p < 0.05$). The total cooperation degree of the observation group was 93.86% (61/65), whereas that of the control group was 81.03% (47/58), indicating a significant increase ($p < 0.05$). This finding demonstrates that the KAP model nursing can significantly upgrade the quality of CTA imaging during coronary CTA review after PCI, because this mode of nursing can provide patients with personalized care plans, effectively communicate with patients before the examination, and provide a good job for patients. Ideological work is helpful to relieve bad emotions and enable them to actively adjust their mentality to cooperate with the nursing staff's examination. In addition, on the basis of the patient's condition, the disease and CTA examination-related knowledge are told in an easy-to-understand manner to improve awareness, and the patient is informed that the examination will not pose a threat to the body. Changes in expression are paid close attention, the patient is helped in solving the problem, and the patient's cooperation in the examination is improved, which plays a vital part in improving the quality of CTA images.

This study also analyzed the nursing satisfaction of the two groups and found that the total patient satisfaction of

the observation group was 96.92% (63/65), which was significantly higher than that of the control group, which was 74.14% (43/58, $p < 0.001$). This finding shows that adopting the KAP model nursing during coronary CTA review after PCI can build a good nurse–patient relationship.

Conclusion

KAP-based care for patients undergoing coronary artery CTA review after PCI can significantly alleviate patients' negative emotions and improve CTA image quality. It can also improve patients' examination cooperation and nursing satisfaction, further improve patients' medical experience, and help establish a good nurse–patient relationship.

Availability of Data and Materials

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

Author Contributions

Research concept and design: KJ, XG; data collection, analysis, and writing: JH, SS, XY, YL; research supervision and final approval of the submitted version: KJ. All authors read and approved the final manuscript. All authors contributed to editorial changes in the manuscript. All authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

Ethics Approval and Consent to Participate

The permission for this study was granted by the Ethics Committee of The First Affiliated Hospital of Qiqihar Medical University (approval no. 202219), and informed consent was acquired from the patients or their families. This study complies with the Declaration of Helsinki.

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Conflict of Interest

The authors declare no conflict of interest.

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