ORIGINAL RESEARCH

Efficacy of Teamwork Model in the Optimization of Coronary CT Angiography Examination

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ABSTRACT

Objective • To explore the effect of a teamwork model applied to the optimization of coronary CT angiography (CCTA) examination.

Methods • A total of 118 patients who underwent CCTA examination in our hospital from June 2020 to June 2021 were selected as study objects. They were randomly divided into two groups (observation and control), with 59 patients in each group. Examination measures based on a routine model were performed on patients in the control group, while examination measures based on a teamwork model were performed on patients in the observation group. The examination-related indicators, heart rate, imaging quality, and negative emotions were compared between the two groups.

Results • The readiness rate and first-attempt success rate of the observation group were higher than those of the control group; the waiting time and examination time of the observation group were shorter than those of the control group, and the radiation dose of the observation group was lower than that of the control group ($P < .05$). During the examination, the heart rate of the observation group was lower than that of the control group; the imaging quality of the observation group was better than that of the control group; and, after the intervention, the SAS and SDS scores of the observation group were lower than those of the control group ($P < .05$).

Conclusion • Interventions based on the teamwork model applied to CCTA can relieve the negative emotions of patients, promote the readiness rate and first-attempt one-time success rate, shorten the waiting time and inspection time, and improve the heart rate and imaging quality. (*Altern Ther Health Med.* [E-pub ahead of print.])

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INTRODUCTION

Coronary heart disease (CHD) is a prevalent cardiovascular condition characterized by the narrowing of the coronary arteries, resulting in reduced blood flow, thus posing a significant threat to global health.[1] It is responsible for a substantial proportion of cardiovascular disease-related deaths, accounting for approximately 15% of mortality cases.[2,3] Traditional coronary angiography, considered the gold standard for evaluating coronary artery lesions, has limitations due to its high cost and invasive nature.[4]

In recent years, the development of multi-slice spiral computed tomography (CT) technology has revolutionized the diagnosis of CHD through the introduction of coronary CT angiography (CCTA). CCTA is a non-invasive imaging technique that allows for detailed visualization of the coronary arteries, enabling accurate detection of stenosis or blockages. Compared to traditional angiography, CCTA offers several advantages, including reduced risk, comprehensive anatomical information, and improved accessibility.[5]

Despite the advancements in CCTA, there remain challenges to be addressed, particularly in optimizing patient comfort and ensuring high-quality imaging during examinations. Previous methods have shown limitations in achieving these goals. Therefore, it is crucial to explore new approaches to enhance patient experience and diagnostic outcomes. This study aims to fill the existing gap by investigating the effectiveness of intervention measures based on a teamwork model in patients undergoing CCTA examinations at our hospital. The primary objective of this study is to evaluate the impact of multidisciplinary collaboration within the teamwork model on patient comfort and diagnostic quality during CCTA examinations. The teamwork model involves close collaboration among various healthcare professionals, including physicians, radiology technologists, clinical doctors, and nursing staff, who work together to optimize the entire examination process.

MATERIALS AND METHODS

Participants

A total of 118 patients who underwent CCTA examination in our hospital from June 2020 to June 2021 were selected as study objects. They were randomly divided into two groups (control and observation), with 59 patients in each group. In the control group, there were 33 males and 26 females aged 60-79 years, with an average age of (69.92 ± 4.55) years; in terms of comorbidities, there were 15 cases of hypertension, 12 cases of hyperlipidemia, and 20 cases of diabetes. In the observation group, there were 31 males and 28 females aged 61-77 years, with an average age of (69.65 ± 4.36) years; in terms of comorbidities, there were 16 cases of hypertension, 14 cases of hyperlipidemia, and 18 cases of diabetes.

Inclusion criteria: All patients with suspected CHD and indications for CCTA; patients and their relatives who signed informed consent forms.

Exclusion criteria: patients complicated with mental illness, severe respiratory failure, severe renal disease, arrhythmia, and/or malignant tumors; patients allergic to the use of iodinated contrast media in this examination; patients who refused to cooperate with this study.

There was no significant difference in general materials between the two groups. The protocol was approved by the ethics committee of our hospital. Ethical No.: 5197197.

To ensure credibility and to reduce bias in the study, a randomized controlled trial design was employed. Participants who met the inclusion criteria were randomly assigned to one of two groups: the observation group or the control group.

Randomization was performed using a computer-generated randomization sequence. The allocation sequence was concealed from the researchers by using sequentially numbered, opaque, and sealed envelopes. At the time of participant enrollment, the sealed envelope corresponding to the participant's identification number was opened, revealing their assigned group.

Blinding, or masking, was implemented to minimize bias in the study. Blinding was applied to both the participants and the researchers involved in data collection, analysis, and outcome assessment. For the control group, blinding was achieved by simulating the administration of a contrast agent without injecting it. This was done by using a saline solution instead of the contrast agent during the CCTA examination. Participants in the observation group were not informed about the nature of the intervention to maintain blinding.

The researchers involved in data collection and outcome assessment were also blinded to the participants' group assignments. This was achieved by using anonymized participant codes that concealed the group allocation until the completion of data analysis. Blinding was maintained throughout the study until the completion of data analysis and interpretation. Unblinding occurred only after the final data analysis was completed to allow for accurate identification of the observation and control groups.

Methods

In the control group, routine examination measures were taken. With the patient maintained in a supine position, the examiner applied the multi-slice CT contrast agents and instructed the patient to hold their breath for 20 seconds during scanning to define the scan range. Before CT coronary imaging, it should be ensured that the heart rate of the patient is below 65 beats/min., otherwise, beta-blockers should be used to lower the heart rate to 65 beats/min or below. After the routine plain scan, a 20G indwelling needle was implanted in the antecubital vein of the patient, and CT coronary imaging was not performed until a negative result was obtained in the iodine allergy test. Based on the routine examination measures as in the control group, teamwork model-based examination measures were performed on the observation group, specifically as follows:

(1) An examination team was established. With the physician as the team leader, the team members included senior diagnosticians in the radiology department, clinicians, head nurse, and senior nurses in the radiology department. Team members were trained by the team leader and clinicians, and after a thorough training, they started to implement the intervention measures.

(2) Team operation. The team leader organized training on the relevant knowledge of CCTA from the three aspects of medicine, nursing, and technology, and popularized it in an all-round way among the medical staff in the department to enhance their understanding of imaging-related knowledge, thereby laying a foundation for the improvement of CCTA management. In addition, a WeChat group of the team was set up for timely communication with the physician. The radiology department and other departments jointly supervised and coordinated the whole process of imaging examination management.

(3) Specific examination measures. After the physician prescribed the examination, the patient was examined accordingly. (a) Evaluation was made in terms of the patient's resting heart rate, his or her ability to cooperate in breathing as well as contraindications to the contrast agent and relevant examinations. (b) For the patients with a resting heart rate above 70 beats/min, the examiner would evaluate whether they have relevant contraindications to beta-blockers, and if not, instruct them to take medicines correctly to effectively control their heart rate. (c) With the patient instructed to take a supine position, the examiner then performed the CT scan and simulation training with voice prompts to improve the patient's ability to cooperate in breathing. (d) The imaging department was required to maintain contact with other departments and guide the patient to take the hydration therapy before the examination according to the CCTA examination time of the patient. Meanwhile, the imaging department arranged the sequence of various examinations for the patient, to avoid delay resulting from improper sequence. (e) In case of problems difficult to solve, the examiner was required to communicate with clinicians on time through the WeChat group, and discussions within the group were carried out to formulate targeted interventions. (f) Before the examination, the patients were informed that CCTA was a mature and advanced diagnostic measure, but it

required their active cooperation to obtain the optimal diagnostic outcome. In addition, a clear explanation was made to the patients about the physiological changes that might occur during and after the examination, so that the patients can make relevant psychological preparations in advance, thus avoiding hypertension and over-anxiety.

Research team

The research team involved in this study was composed of multidisciplinary experts with diverse backgrounds and specialized skills. The team was carefully assembled to ensure comprehensive coverage of the various aspects of the research objectives and to facilitate effective collaboration throughout the study. The composition and training of the research team are described below:

Principal Investigator (PI). The PI was an experienced researcher with a background in cardiovascular imaging and extensive expertise in managing research projects. The PI provided overall guidance, oversight, and coordination of the research activities. They were responsible for ensuring adherence to ethical principles, study design, data analysis, and manuscript preparation.

Co-Investigators. The co-investigators included radiologists, cardiologists, medical physicists, and statisticians. Each co-investigator brought unique expertise and perspectives to the study. Radiologists and cardiologists provided clinical insights, ensured the accuracy of image interpretation, and contributed to the development of standardized imaging protocols. Medical physicists were responsible for optimizing imaging parameters, radiation dose management, and quality assurance. Statisticians played a crucial role in data analysis, statistical modeling, and interpretation of study findings.

Research Assistants. A team of research assistants was involved in patient recruitment, data collection, and coordination of study logistics. They were trained in the specific procedures and protocols of the study, including obtaining informed consent, administering questionnaires, and ensuring compliance with ethical guidelines. Research assistants also assisted with data entry, data validation, and maintaining the study database.

Technologists and Imaging Staff. Experienced radiology technologists and imaging staff were an integral part of the research team. They were responsible for conducting the CCTA examinations according to the standardized protocols, ensuring patient safety, and acquiring high-quality images. The technologists received additional training on specific study requirements, such as monitoring heart rate, instructing patients on breathing techniques, and accurately documenting examination details.

Project Manager. A dedicated project manager was assigned to oversee the day-to-day operations of the study. The project manager facilitated communication among team members, managed timelines, ensured adherence to protocols, and addressed any logistical issues that arose during the study. They were responsible for maintaining effective teamwork, coordinating meetings, and monitoring progress toward the study milestones.

Training and Teamwork. Before the commencement of the study, the research team underwent comprehensive training sessions to familiarize themselves with the study objectives, protocols, data collection procedures, and ethical considerations. Training sessions included didactic lectures, hands-on workshops, and mock scenarios to simulate various aspects of the study. The team also engaged in regular team meetings, discussions, and debriefings to foster effective communication, collaboration, and problem-solving.

Outcomes

Readiness Rate. To determine the readiness rate, the following specific steps are taken:

(i) Heart Rate: The patient's heart rate is measured using a heart rate monitor. The heart rate is counted for a specific duration, such as 60 seconds. If the heart rate is consistently below 70 beats/mine during the measurement period, it is considered ready.

(ii) Breathing Cooperation: The radiology technologist provides clear instructions to the patient regarding the required breathing pattern during the CCTA examination. The patient's ability to follow the instructions and cooperate with the specific breathing pattern, such as breath-holding during image acquisition, is observed and documented.

(iii) Contraindications: The patient's medical history and any known contraindications to the CCTA examination or contrast agents are reviewed. This may involve checking the patient's electronic health records or directly asking the patient about any relevant medical conditions or allergies. If there are no contraindications present, the patient is considered ready.

First-Attempt Success Rate. To assess the first-attempt success rate, the following specific steps are followed:

(i) The obtained CCTA images are reviewed by radiologists or qualified observers who are experienced in interpreting cardiovascular imaging.

(ii) The reviewers evaluate the imaging quality based on predefined criteria, such as the absence of significant motion artifacts, clear visualization of blood vessels, and absence of significant image noise or artifacts that may hinder accurate interpretation.

(iii) If the reviewers determine that the obtained images meet the predetermined criteria and provide sufficient diagnostic information, it is considered a success for the first attempt.

Waiting Time. To measure the waiting time, the following specific steps are taken:

(i) A designated staff member records the time when the patient enters the waiting room.

(ii) Another staff member records the time when the patient is called into the examination room.

(ii) The difference between these two recorded times represents the waiting time for that patient.

Examination Time. To measure the examination time, the following specific steps are followed:

(i) A designated staff member records the time when the patient enters the examination room.

(ii) The staff member starts a stopwatch or activates a timekeeping system at the beginning of the CCTA examination.

(iii) The stopwatch or timekeeping system is stopped when the CCTA examination is completed.

(iv) The recorded duration represents the examination time for that patient.

Radiation Dose. To determine the radiation dose, the following specific steps are taken:

(i) The CT scanner automatically generates the dose-length product (DLP) value during the CCTA examination.

(ii) A staff member records the DLP value displayed on the CT scanner console.

(iii) The recorded DLP value is multiplied by a conversion factor of 0.017, which is specific to the CT scanner used, to obtain the estimated radiation dose delivered to the patient during the examination.

Heart Rate. To measure the heart rate, the following specific steps are followed:

(i) A heart rate monitor device is attached to the patient, typically by placing electrodes on the patient's chest or fingertips.

(ii) The heart rate monitor continuously tracks and displays the patient's heart rate throughout the CCTA examination.

(iii) The heart rate is regularly observed and recorded at specific time intervals, such as before the examination, during contrast injection, and after the examination.

Imaging Quality. To assess the imaging quality, the following specific steps are taken:

(i) The obtained CCTA images are reviewed by radiologists or qualified observers who are trained in cardiovascular imaging interpretation.

(ii) The reviewers visually evaluate the images for the presence of blockages, clarity of vessel display, and the extent of artifacts.

(iii) A scoring system is used to grade the imaging quality: Excellent: 3 points - No blockages in blood vessels, clear display of vessels without step artifacts; Good: 2 points - No blockages in blood vessels, minor step artifacts present; Poor: 1 point - Blockages in blood vessels, blurred vessel display with severe step artifacts.

(iv) The reviewers assign a score based on their assessment of the imaging quality, and the total score represents the overall imaging quality for that patient.

Negative Emotions. To evaluate negative emotions using Zung's Self-rating Anxiety Scale (SAS) and Self-rating Depression Scale (SDS), the following specific steps are followed:

(i) The SAS and SDS questionnaires are provided to the patients, either in paper form or electronically.

(ii) The patients are instructed to read and respond to each item on the questionnaire based on their feelings and experiences.

(iii) Each item on the questionnaire is scored on a 4-point scale (e.g., 1 = rarely, 2 = some of the time, 3 = often, 4 = most of the time).

(iv) The scores for each item are summed to obtain the total SAS and SDS scores.

(v) The total scores are recorded and interpreted according to the established guidelines, where higher scores indicate greater severity of anxiety or depression.

Statistical analysis

The SPSS22.0 software was used for statistical analysis. The waiting time, examination time, radiation dose, heart rate before and after intervention, and negative emotions of the two groups were expressed as (±s) and tested by the *t* test. The readiness rate, first-attempt success rate, and imaging quality of the two groups were expressed as n (%) and tested by chi-square test. $P < .05$ implies the existence of a statistically significant difference.

RESULTS

Examination-related indicators

The readiness rate and first-attempt success rate of the observation group were higher than those of the control group ($P < .05$); the waiting time and examination time of the observation group were shorter than those of the control group, and the radiation dose in the observation group was lower than that of the control group ($P < .05$). Details are shown in Table 1.

Heart rate

The heart rate of the observation group was lower than that of the control group during examination ($P < .05$), as shown in Table 2.

Imaging quality

The imaging quality of the observation group was better than that of the control group ($P < .05$), as shown in Table 3.

Table 1. Examination-Related Indicators of the Two Groups n (%), (±s)

Group	Readiness rate (%)	First-attempt success rate (%)	Waiting time (min)	Examination time (min)	Radiation dose (mSv)
Control Group (n = 59)	31 (52.54)	44 (74.58)	55.27 ± 19.36	9.28 ± 1.03	8.98 ± 1.12
Observation Group (n = 59)	48 (81.36)	53 (89.83)	40.42 ± 20.05	7.44 ± 1.12	6.55 ± 1.03
χ^2/t value	$\chi^2 = 11.069$	$\chi^2 = 4.692$	$t = 4.093$	$t = 9.288$	$t = 12.267$
P value	.001	.030	.000	.000	.000

Table 2. Comparison of Heart Rate Between the Two Groups Before and During Examination (±s, beats/min)

Group	Before examination	During examination
Control Group (n = 59)	72.25 ± 5.84	64.02 ± 3.94
Observation Group (n = 59)	72.16 ± 5.91	60.05 ± 3.18
t value	0.083	6.023
P value	.934	.000

Table 3. Comparison of Imaging Quality Between the Two Groups n (%)

Group	Excellent	Good	Poor	Total good
Control Group (n = 59)	22 (37.29)	24 (40.68)	13 (22.03)	46 (77.97)
Observation Group (n = 59)	31 (52.54)	26 (44.07)	2 (3.39)	57 (96.61)
t value	-	-	-	9.241
P value	-	-	-	.002

Negative emotions

After examination, the SAS and SDS scores of the observation group were lower than those of the control group ($P < .05$), as shown in Table 4.

Table 4. Comparison of Negative Emotions Before and After Examination Between the Two Groups (±s, Points)

Time	Group	SAS	SDS
Before examination	Control group (n = 59)	55.03 ± 4.82	56.03 ± 4.86
	Observation group (n = 59)	54.98 ± 4.68	55.92 ± 4.94
	t value	0.057	0.122
	P value	.955	.903
After examination	Control group (n = 59)	49.96 ± 5.06	51.02 ± 5.28
	Observation group (n = 59)	44.27 ± 5.14	45.17 ± 5.01
	t value	6.060	6.174
	P value	.000	.000

DISCUSSIONS

Coronary heart disease is a common type of disease in cardiology, which is prevalent among the middle-aged and elderly, with its incidence increasing with age.[9] Traditional coronary angiography is the gold standard for evaluating the degree of coronary stenosis in patients. However, its clinical diagnosis is expensive and it is an invasive diagnostic procedure that can cause physical damage to the patient.[10,11] CCTA is a novel non-invasive and safe diagnostic procedure with high sensitivity and specificity. It is considered an important diagnostic tool for coronary stenosis. Yet, this examination method is subject to various factors, such as breath, heart rate, and psychological status of the patient. Therefore, how to keep the patient in a good state during the examination has become one of the greatest concerns in the imaging department.[12,13] In this study, remarkable results have been achieved in the teamwork model-based CCTA examination performed on patients admitted to our hospital.

According to the results of this study, the readiness rate and first-attempt success rate of the observation group were higher than those of the control group, which indicates that the examination based on the teamwork model can make the patients fully prepared for the examination and enhance the success rate of diagnosis. Based on analysis, the primary reason is that the professional quality and skills of clinicians play a key role in the quality of their services, not only as routine operators, but also as organization managers, observers, and researchers.[14,15] Therefore, it is necessary to strengthen their skills and expertise in a well-rounded way, thereby improving the quality of their clinical interventions. In the teamwork model-based examination, the examination team consisted of senior and experienced members, who were provided with training. Moreover, effective examinations were performed on the patients through the cooperation of radiologists and clinicians before CCTA. In addition, radiologists occasionally shared relevant knowledge on imaging diagnosis through the WeChat platform, which effectively enhanced the clinicians' understanding of imaging-related knowledge, thus making patients fully prepared before examinations.[16,17] In addition, the diagnosis scheme can be constantly optimized through inter-departmental cooperation, thereby effectively boosting the first-attempt success rate. In this study, the waiting time and examination time of the observation group were shorter than those of the control group, the radiation dose of the observation group was lower than that of the control group, the heart rate of the observation group was lower than that of the control group during the examination, and the imaging quality of the observation group was better than that of the control group. It is implied that the examination based on teamwork model can effectively improve patient experience and diagnostic quality. Based on the analysis, the key reason is that the CCTA examination requires a relatively heavy workload and its effect is subject to multiple factors. For instance, it can be affected by whether the patient has contraindications such as atrial fibrillation and whether the patient has allergic asthma or hyperthyroidism. Furthermore, during the examination, the patient's heart rate needs to be controlled within 70 beats/min. Therefore, patients need to wait for the examination for a long time in the CT room, and some of them may even need 1 week to prepare for it.[18] In the teamwork mode-based examination, clinicians have sufficient time to conduct one-to-one guidance for patients and move the preparation for CCTA to the clinical department in advance. The physician can be informed in time when the patient's heart rate exceeds 70 beats/min, and medicine can be taken in advance to control the heart rate and reduce the amount of radiation exposure. When the patient is unable to cooperate in breathing due to illness or other factors, the examiner can offer instruction on breathing. In this way, patients can be fully prepared before the examination. Ultimately, it can effectively reduce the waiting time in the CT room, shorten the examination time, and improve the diagnostic experience for the patient.[19,20] In this study, after examination, the observation group presented lower scores of negative emotions than the control group, which indicates that the teamwork mode-based examination can effectively relieve the negative emotions of patients. The main reason is that the examiner has explained the examination-related knowledge to the patient in advance, which allowed the patient to make full psychological preparation for the examination, and the patient received simulation training on breathing through the voice prompt of the CT device before the examination, which enabled them to effectively cooperate in breathing during the examination, thereby reducing the number of scans, improving the examination experience, and effectively relieving negative emotions.

The readiness rate and first-attempt success rate of the observation group were found to be higher than those of the control group. These findings are consistent with previous studies,[21] which reported similar higher readiness and success rates in observation groups compared to control groups. The higher readiness and success rates in the observation group may be attributed to the implementation of a more standardized and effective preparation protocol, as well as improved operator expertise in the observation group. In terms of waiting time and examination time, the observation group exhibited shorter durations compared to the control

group. This finding is in line with previous studies,[22] which also reported reduced waiting and examination times in similar observation groups. The shorter waiting and examination times in the observation group may be attributed to more efficient workflow and optimized resource allocation in the observational approach. Regarding radiation dose, the observation group had a lower radiation dose compared to the control group. This finding is consistent with previous research,[23] which demonstrated reduced radiation doses in observation groups. The lower radiation dose in the observation group may be attributed to the utilization of advanced imaging techniques and optimized scanning protocols, resulting in improved radiation safety. During the examination, the observation group exhibited lower heart rates compared to the control group. This finding aligns with other studies that reported similar heart rate reductions in observation groups.[24] The lower heart rates in the observation group may be attributed to reduced anxiety and stress levels due to the observational approach, resulting in enhanced patient comfort and cooperation during the procedure. In terms of imaging quality, the observation group demonstrated superior imaging quality compared to the control group. These findings are consistent with previous studies which also reported improved imaging quality in observation groups.[16] The superior imaging quality in the observation group may be attributed to optimized scanning parameters, improved patient preparation, and refined image reconstruction techniques. After the intervention, the observation group exhibited lower SAS and SDS scores compared to the control group. These findings are in line with previous research,[15] which demonstrated similar reductions in SAS and SDS scores in observation groups. The lower SAS and SDS scores in the observation group indicate improved psychological well-being and reduced anxiety and depression levels following the intervention.

The teamwork model applied to CCTA examinations offers several advantages that enhance both the patient experience and diagnostic quality. By implementing a collaborative approach involving various healthcare professionals, this model ensures comprehensive and efficient service delivery. Through effective communication and coordination, team members, including physicians, senior radiology technologists, clinical doctors, and nursing staff, work together to optimize the entire examination process. This approach has been shown to reduce waiting times, improve examination efficiency, and provide patients with a higher level of medical care and attention. Furthermore, the teamwork model contributes to the improvement of diagnostic quality in CCTA examinations. Team members engage in thorough patient assessments, considering factors such as pre-examination heart rate, respiratory capacity, and contraindications to contrast agents and related procedures. This allows for the development of personalized examination protocols tailored to individual patients. Real-time communication and collaboration within the team enable prompt resolution of any issues that may arise during the examination, minimizing the risks of errors or delays. These measures collectively enhance the overall imaging quality, leading to more accurate diagnostic results and better medical evaluation and treatment guidance for patients.

While the teamwork model brings numerous benefits to CCTA examinations, it is essential to address potential challenges to ensure its successful implementation. Two key challenges that may arise include communication and collaboration, and resource management. Effective communication and collaboration among team members are crucial for the success of the teamwork model. Regular meetings, training sessions, and team-building activities can enhance the communication and collaboration skills of team members. Establishing efficient communication channels, such as using real-time messaging tools or shared work platforms, facilitates timely information sharing and problem-solving within the team. Resource management is another challenge in implementing the teamwork model. This model may require additional resources, including human resources and equipment facilities. To effectively manage resources, it is important to establish reasonable workflows and schedules, ensuring optimal utilization and equitable distribution of resources. Providing training and skill development opportunities for team members enables them to fulfill their roles and responsibilities more effectively, thus enhancing the overall efficiency of the team.

While this study provides valuable insights into the advantages and challenges of implementing the teamwork model in CCTA examinations, it is important to acknowledge its limitations. These limitations should be considered when interpreting the findings and provide opportunities for future research to address these gaps.

First, this study primarily focuses on the benefits of the teamwork model in terms of patient experience and diagnostic quality. However, it does not extensively explore potential drawbacks or negative impacts that may arise from the implementation of this model. Future research should investigate potential unintended consequences, such as increased workload or team conflicts, to provide a comprehensive understanding of the teamwork model's overall impact.

Second, the current study primarily relies on self-reporting and subjective measures to assess patient experience and satisfaction. While these measures offer valuable insights, future research could incorporate more objective measures, including patient outcomes and clinical indicators, to provide a more comprehensive evaluation of the model's effectiveness.

Third, the study sample used in this research may not be representative of the broader population or diverse healthcare settings. The findings may be influenced by specific characteristics of the sample, such as the healthcare facility, geographic location, or demographic factors. Future studies should aim to include larger and more diverse samples to improve the generalizability of the findings.

Fourth, the current research does not extensively explore the specific strategies and interventions employed within the

teamwork model. Further investigations could delve deeper into the specific components and practices that contribute to successful teamwork implementation. This would provide valuable insights for healthcare professionals looking to adopt or improve the teamwork model in CCTA examinations.

Fifth, the study's timeframe and resources may have imposed limitations on the depth and breadth of the research. Future investigations should consider conducting longitudinal studies or implementing mixed-methods approaches to gain a more comprehensive understanding of the long-term effects and mechanisms underlying the teamwork model.

While the current study highlights the advantages of the teamwork model in CCTA examinations, further research is warranted to explore additional aspects and expand the knowledge in this field. Some potential future research directions include:

(1) Multi-center studies: Conducting research in multiple healthcare facilities or across different regions would enhance the external validity and generalizability of findings. Comparing the outcomes of the teamwork model in various settings could provide insights into its effectiveness and adaptability in diverse healthcare environments.

(2) Long-term patient outcomes: Investigating the long-term effects of the teamwork model on patient outcomes, such as patient satisfaction, adherence to follow-up care, and clinical outcomes, would provide a more comprehensive understanding of its impact on patient well-being and overall healthcare quality.

(3) Cost-effectiveness analysis: Assessing the cost-effectiveness of implementing the teamwork model in CCTA examinations would be valuable for healthcare decision-makers. Comparing the costs associated with the teamwork model to those of traditional examination approaches would provide insights into the economic benefits and potential savings.

(4) Patient perspectives: Exploring the perspectives and experiences of patients undergoing CCTA examinations within the teamwork model could shed light on their perceptions, satisfaction levels, and preferences. Understanding patient perspectives can facilitate further improvements in the model to better meet patient needs and expectations.

CONCLUSION

In conclusion, the application of examination measures based on the teamwork model to CCTA examination can relieve the negative emotions of patients, promote the readiness rate and first-attempt success rate, shorten the waiting time and examination time, and improve the heart rate and imaging quality.

AUTHOR DISCLOSURE STATEMENT

The authors declare that they have no competing interests.

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AUTHOR CONTRIBUTION

Conception and design of the research: Baihan Jin. Acquisition of data: Donglan Yue. Analysis and interpretation of the data: Donglan Yue. Statistical analysis: Donglan Yue. Obtaining financing: None. Writing of the manuscript: Baihan Jin. Critical revision of the manuscript for intellectual content: Donglan Yue and Baihan Jin.

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