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Article

Effects of Home-based Remote Cardiac Rehabilitation on Left Ventricular Function and Fear of Exercise in Patients after Percutaneous Coronary Intervention (PCI): A Retrospective Cohort Study

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Abstract

Aim: This study aims to explore the effects of home-based remote cardiac rehabilitation on left ventricular function and exercise fear in patients after percutaneous coronary intervention (PCI). **Methods**: A total of 232 patients with coronary heart disease after PCI treated in Tianshan Traditional Chinese Medicine Hospital from January 2020 to December 2022 were retrospectively analyzed. The patients were divided into the remote rehabilitation group (169 cases) and the routine group (63 cases) according to the exposure factor (home-based remote cardiac rehabilitation). Changes in left ventricular function and sports phobia Tampa Scale in patients with coronary heart disease after PCI were compared using propensity score matching to reduce selection bias and confounding factors. **Results**: After the intervention, the scores of patients in the tele-rehabilitation group were significantly higher than those in the conventional group in terms of fear of movement, perception of danger, fear of movement, avoidance of movement, and dysfunction (p-value < 0.05). Left heart function was compared between the tele-rehabilitation group and the conventional group. Patients in the tele-rehabilitation group had significantly higher peak mitral valve blood flow in the early diastolic period (E), peak mitral valve blood flow in the late diastolic period (A), six-minute walk test (6MWT), and ratio of the peak mitral valve blood flow in the early diastolic period to the peak mitral valve blood flow in the late diastolic period (E/A) than those in the conventional group (p-value < 0.05). However, the peak deceleration time and isovolumic diastolic time in the early mitral valve diastolic period were significantly higher in the tele-rehabilitation group than in the conventional group (p-value < 0.05). **Conclusions**: Home-based remote cardiac rehabilitation instruction can improve the heart function and exercise fear state of patients after PCI.

Keywords

home remote; cardiac rehabilitation; percutaneous coronary intervention; left ventricular function; kinesophobia

Background

With the improvement of people's living standards, the risk factors of coronary heart disease continue to increase. The number of cardiovascular patients in China has exceeded 290 million, of which 11 million have coronary heart disease, and the rate of increase is 20% every year [1]. Percutaneous coronary intervention (PCI) is used to treat coronary heart disease and revascularization and has given patients with coronary heart disease a new life; however, PCI cannot reverse or delay the biological process of atherosclerosis. The possibility of restenosis or thrombus cannot be ruled out after surgery [2].

The probability of intrastent restenosis in patients with coronary heart disease within six months after PCI is 10% to 20%, which has a serious effect on the long-term efficacy of the treatment [3]. Therefore, cardiac rehabilitation is the key to prevent the recurrence of coronary heart disease and improve the quality of life of patients after PCI [4]. Developing a complete rehabilitation system is difficult due to China's unbalanced economic development, and the existing rehabilitation mode is dominated by cardiac rehabilitation in hospitals [5]. Although studies have confirmed the benefits of cardiac rehabilitation for patients with coronary heart disease, its use is limited by various reasons, such as time, transportation conditions, and medical insurance policies [6]. Patient compliance with hospital cardiac rehabilitation treatment is generally low, resulting in an increasing rate of rehospitalization and recurrence of adverse cardiovascular events after PCI and, consequently,

heavy economic and mental burden to the country and patient families [7]. Home-based remote cardiac rehabilitation is a new form of out-of-hospital rehabilitation and uses modern medical technology, computer network technology, and remote communication technology to collect patient's physiological parameters; data are then displayed on a mobile phone and sent to the patient's electronic health system through wireless network so the service center can record the user's health status in time and dynamically track the patient's physical condition for rapid communication and feedback between doctors and patients [8]. Home-based cardiac rehabilitation is inexpensive and has been carried out in developed countries, but it has not been widely promoted and popularized in China. Home-based cardiac rehabilitation has different specific intervention measures and monitoring methods, and its training effect should be further verified [9]. Therefore, we used sports bracelet application (APP) to carry out home-based remote cardiac rehabilitation in patients with coronary heart disease after PCI to explore influencing factors on improving left ventricular function and exercise fear.

Materials and Methods

Survey Subjects

A total of 232 patients with coronary heart disease after PCI treated in Tianshan Traditional Chinese Medicine Hospital from January 2020 to December 2022 were retrospectively analyzed. The patients were divided into the tele-rehabilitation group (169 cases) and the routine group (63 cases) according to the exposure factor (home tele-cardiac rehabilitation). Our study has been approved by the Ethics Committee of Tianshan Traditional Chinese Medicine Hospital and is in line with the relevant provisions of the Declaration of Helsinki. The inclusion criteria of the subjects were as follows: (1) complete clinical medical records of the patients and diagnosis based on the requirements of the Association of Acute Cardiovascular Care (ACVC) of the European Society of Cardiology [10]; and (2) patients aged 18–75 years with coronary heart disease who underwent PCI by radial artery puncture for the first time and were successfully operated. The exclusion criteria included the following: (1) high-risk patients, such as those with massive myocardial infarction, malignant arrhythmia, cardiogenic shock, *etc*.; patients who have undergone coronary bypass surgery; patients who had a recent acute infection; people with frequent resting pain; (2) patients with malignant tumors, severe renal insufficiency, anemia, and severe lung disease; a bone and joint disease that interferes with movement; severe neurological, mental illness, or speech and cognitive dysfunction or cannot cooperate with the examination and treatment; and (3) patients with no one to care for them at home or who are far away from the rehabilitation hospital (more than 1 hour by car) and those with severe coronary artery lesions requiring rehospitalization for PCI during the intervention period.

Retrospective Cohort Investigation

Routine group: A nursing staff observed and documented patients' condition, provided guidance for their activities, and maintained weekly contact following their discharge. Cardiologists evaluated patients' conditions by conducting cardiopulmonary exercise tests, formulating comprehensive cardiac rehabilitation plans encompassing exercise, nutrition, and psychology, and overseeing safety measures throughout the rehabilitation process. Nutrition prescriptionists elucidated the correlation between nutrition and disease to patients through various channels, including online platforms, offline venues, such as rehabilitation clinics and lectures, and WeChat groups, thereby offering tailored guidance to patients. Patients who were diagnosed with dual heart conditions underwent psychological scale assessments at the rehabilitation clinic, followed by drug therapy and psychological counseling. Remote rehabilitation group: Patients were advised to wear a Huawei TER-B09 sports bracelet (Huawei Technologies Co, Ltd, Shenzhen, China) on their wrist while engaging in physical activity for real-time monitoring of heart rate, blood pressure, and metabolic equivalent and recording of movement trajectory. Data were transmitted to smartphone applications via Bluetooth smart technology during the exercise session. In the event of an electrocardiogram anomaly, such as arrhythmia, arising during physical exertion, the system will prompt a message to the patient to cease or temporarily suspend the exercise or modify its intensity. The system will transmit the collected data to the data center in real-time for expert analysis. In this regard, adjustments are made promptly to the patient's remote cardiac rehabilitation guidance plan, thereby ensuring timely modifications to their home-based rehabilitation program. Prior to discharge, the patient was instructed on the proper utilization of the bracelet, including the downloading and installation of the bracelet application on their smartphone, account binding, and inputting pertinent patient information, such as age, height, gender, body mass index, and pre-set exercise goals. The patient was also guided on the correct wearing of the bracelet and encouraged to walk within the ward to demonstrate the successful acquisition of data pertaining to the patient's heart rate, exercise steps, and duration of physical activity. After guiding the patient to exercise, the data will be uploaded to the mobile APP cloud, shared through a mobile phone, and transmitted to the rehabilitation team members for real-time monitoring.

Follow-up Patients

A rehabilitation therapist conducted a telephone follow-up of the patients once a week to understand each patient's diet, medication, rehabilitation program implementation status, and emotional state and timely answered the problems of the patients and recorded them. Home visits were conducted by rehabilitation therapists and caregivers every Friday from 6:00 pm–8:00 pm. At each visit, patients' vital signs, disease recovery, and exercise compliance were assessed, and they were given exercise, medication, diet guidance, and psychological counseling. During each subsequent visit, potential issues were collected through the assessment of left ventricular function index and exercise fear score of patients in relation to their heart disease. Furthermore, patients were provided with an explanation regarding the effect of adverse mental states on their condition and given positive psychological suggestions. By considering emotional circumstances at the individual patient level, individuals are empowered to devise effective coping strategies for managing daily stressors. At the same time, we should mobilize family members to actively exert their subjective initiative, improve their ability to cope with diseases, guide other family members to carry out family self-rescue, improve the ability of caregivers to prevent and intervene, and help family members establish and use an effective social support system. Before the start of the study, rehabilitation therapists and nurses were given unified training on follow-up calls and visits, and unified guidance was required. Telephone and home visits were initiated one week after the start of the home cardiac rehabilitation program and were completed within four months.

Evaluation Tools

6MWT: Six-minute walk test (6MWT) mainly measures distance walked within 6 minutes and is an important index used to evaluate the exercise endurance of patients [10]. The interventionist delimited the range of distance to 30 m, made marks at both ends, let the patient be familiar with the site before the experiment, and informed the purpose, method, and precautions of the experiment. The patient was also instructed to avoid strenuous exercise within 2 hours before the experiment, walk back and forth within the delimited range, and attempt to walk farther within 6 minutes according to their physical strength, but not to run. If the physical strength is insufficient, then the patint will be advised to slow down the walking speed or stop to rest properly and continue to move forward as soon as possible after the physical strength recovers. Before the test, the patient's condition was strictly assessed by a professional physician, and emergency supplies (oxygen, nitroglycerin, salbutamol, *etc*.) were prepared. During the trial, the investigator closely observed the patient's physical condition. If the patient develops chest pain, sweating, pale face, intolerable dyspnea, walking instability, and malignant arrhythmia, then the trial should be terminated. The distance walked by the patients within six minutes was recorded at the end of the trial. The 6-minute walking distance results were interpreted as follows: $<$150 m indicates severe cardiac insufficiency, 150–425 m indicates moderate cardiac insufficiency, and 426–550 m indicates mild cardiac insufficiency.

Left ventricular function index: GEVivid-7 color Doppler ultrasonic diagnostic instrument (General Electric Company, Boston, MA, US) was used, and the probe frequency was 1.7–3.4 MHz. The patient was placed on the left side of the bed by a special person. Two-Dimensional (2D), M-type, color Doppler, and electrocardiogram were routinely performed, and the patient was asked to breathe peacefully. The peak of R-wave was regarded as the prediastolic period, and the end of T-wave was regarded as the pre-systolic period. The measurements included M-type of aorta, left ventricular anterior–posterior diameter, interventricular septum, and left ventricular wall thickness. A volume sampler was placed 1 cm above the mitral valve orifice to measure the peak value of mitral blood flow in the early diastolic period (E), the peak value of mitral blood flow in the late diastolic period (A), the ratio of E/A, and the peak deceleration time of E (DT). The apical five-chamber section of the heart was taken, and the pulsed Doppler volume sampler was placed between the left ventricular outflow tract and the anterior mitral valve to measure isovolumic relaxation time (IVRT). All indices were measured for three consecutive times and averaged.

Fear of exercise of patients with heart disease: The Tampa Scale for Kinesiophobia (TSK) is used to evaluate exercise fear among patients with heart disease [11]. TSK was developed by Dr. Back in 2012. The scale initially assessed patients with coronary heart disease in terms of risk perception (items 3, 8, 11, 16), exercise fear (items 1, 7, 9, 13), exercise avoidance (items 2, 4, 12, 14, 17), and dysfunction (items 5, 6, 10, 15), with a total of 17 items; these dimensions represent the disease risk perception of heart disease, fear of adverse outcomes from exercise, avoidance of exercise due to heart problems, and physical, psychological, and social disorders caused by fear exercise. Likert 4 scores were used for each item of the scale, with 1 point representing "strongly disagree", 2 points representing "disagree", 3 points representing "agree", and 4 points representing "strongly agree". The total score was between 17 and 68 points, among which items 4, 8, 12, and 16 were reverse scoring items. High scores indicate a high level of sports fear. The Cronbach's α coefficient of the scale was 0.78, which showed good temporal stability (intra-group correlation coefficient 0.83). Since its development in 2012, the scale has been introduced in Portugal, Turkey, and other countries for studies on patients with pulmonary hypertension and heart failure and shown good reliability and validity.

Statistical Methods

The data of all patients with coronary heart disease after PCI were evaluated and organized into a database by using Excel software (Microsoft Excel 2013 version 15.19.1 ; Microsoft, Redmond, WA, USA). After logical verification, the data were imported into SPSS26.0 software (IBM Corp., Armonk, NY, USA) for data analysis. Count data were expressed as integers or percentages, and χ^2 test was used for comparison between groups. Measured data were represented by mean $\pm$ standard deviation, and t test was applied when the left ventricular function index and Tampa Scale for Kinesiophobia (TSK) score of patients after PCI followed normal distribution. Values with p-value < 0.05 indicated significant statistical difference.

Results

General Comparison of Survey Results

Propensity score matching was performed on patients after PCI to minimize the effects of selection bias on drug allocation and confounding factors, and baseline characteristics with significant differences in the two groups of patients were strictly adjusted. The propensity score was estimated by multiple Logistic regression model, and the groups were input into the regression model as dependent variables. Baseline features with significant differences were used as covariates. In 1:1 nearest neighbor matching without replacement, the caliper value was set to 0.02. Finally, 50 cases were successfully matched between the remote rehabilitation group and the conventional group.

The clinical data of the two groups were not comparable. Subsequently, 74 patients in the tele-rehabilitation group and 74 patients in the conventional group were successfully matched. No statistically significant differences were found between the two groups in terms of gender, age, payment method, comorbidities, medication history, high-density lipoprotein, low-density lipoprotein, fasting blood glucose, surgical method, number of stents, occupation, and residence area (p-value > 0.05, Table 1).

Comparison of Sports Fear Scores

Before intervention, the differences in exercise fear scores were not statistically significant between the two groups (p-value > 0.05). After the intervention, the scores of exercise fear, risk perception, sports avoidance, and dysfunction in the tele-rehabilitation group were higher than those in the conventional group, and the difference was statistically significant (p-value < 0.05, Table 2).

Comparison of Left Ventricular Function

Before the intervention, left ventricular function was comparable between the two groups, and the difference was not statistically significant (p-value > 0.05). After the intervention, left heart function was compared between the tele-rehabilitation group and the conventional group. The tele-rehabilitation group had significantly higher peak mitral valve blood flow in the early diastolic period (E), peak mitral valve blood flow in the late diastolic period (A), 6MWT, and ratio of the peak mitral valve blood flow in the early diastolic period to the peak mitral valve blood flow in the late diastolic period (E/A) than the conventional group (p-value < 0.05). The peak deceleration time (DT) and isovolumic diastolic time (IVRT) in the early mitral valve diastolic period were significantly higher in the tele-rehabilitation group than in the conventional group (p-value < 0.05, Table 3).

Discussion

The primary approach to family cardiac rehabilitation involved encouraging patients to engage in timely rehabilitation training through telephone follow-up. To mitigate potential inaccurate findings resulting from patients' inaccurate or incomplete reports, we implemented remote monitoring of patients' physical activity by using sports bracelets. The bracelet application on the server and mobile phone can continuously track patients' exercise status and intensity, thereby minimizing any discrepancies arising from patients' unreliable self-reports. Therefore, the effect of using this remote rehabilitation model is discussed. Our results show that the use of home tele-rehabilitation mode such as tele-rehabilitation exercise training intervention in patients with coronary heart disease after PCI can improve the cardiac function indicators of patients and reduce the occurrence of end events.

A sports bracelet was employed to monitor the implementation of home-based remote cardiac rehabilitation for patients following PCI to facilitate prompt communication and feedback between healthcare professionals and patients. This approach resulted in a more pronounced improvement in cardiac function and psychological well-being during the rehabilitation process. The possible reasons are as follows. (1) Before the intervention and after the preliminary investigation of the exercise conditions of the two groups, home-based remote cardiac rehabilitation training was implemented not only to establish collateral circulation but also to improve the function of vascular endothelial cells to slow down the development of atherosclerosis [12]. Patients with coronary heart disease who received home-based remote cardiac rehabilitation for 3 to 6 months had 11%–36% increase in peak oxygen uptake [13]. (2) The sports bracelet was used to implement

Table 1. General comparison of survey results (n).

	Remote rehabilitation group (169)	Regular group (63)	χ^2	*p*-value	Remote rehabilitation group (50)	Regular group (50)	χ^2	*p*-value
Gender			11.649	0.001			0.421	0.517
Male	55	36			36	33		
Female	114	27			14	17		
Age			23.907	<0.0001			0.071	0.790
≤60 years old	109	18			9	8		
>60 years old	60	45			41	42		
Payment method			20.354	<0.0001			0.056	0.812
Self-financing	112	21			12	11		
Medical insurance	57	42			38	39		
Mode of operation			15.708	<0.0001			0.051	0.822
Elective operation	56	39			37	36		
Emergency operation	113	24			13	14		
Number of brackets			9.597	0.002			0.041	0.839
1	49	32			30	29		
>1	120	31			20	21		
Occupation (n)			10.812	0.001			0.407	0.523
Mental work	115	28			15	18		
Manual labor	54	35			35	32		
Area of residence (n)			7.413	0.006			0.644	0.422
Town	135	52			25	29		
Village	74	11			25	21		
Complication			1.166	0.251			1.037	0.595
Yes	175	48			35	39		
None	34	15			15	11		
Medication history			0.802	0.558			0.962	0.618
Yes	115	28			45	41		
None	54	35			5	9		
High-density lipoprotein	1.07 ± 0.21	1.14 ± 0.30	–1.267	0.208	1.25 ± 0.59	1.22 ± 0.40	0.069	0.693
Low-density lipoprotein	2.84 ± 0.90	2.93 ± 0.89	–0.522	0.603	2.98 ± 0.27	2.67 ± 0.83	0.946	0.835
Fasting blood glucose	6.58 ± 2.25	7.49 ± 3.04	–1.760	0.081	6 ± 1.65	6.04 ± 1.75	0.048	0.276

home-based remote cardiac rehabilitation for patients after PCI. The bracelet APP was used to check the implementation of home-based remote cardiac rehabilitation at any time, and data on misunderstandings and emotional disorders of patients in home-based remote cardiac rehabilitation were collected through regular home visit and telephone follow-up [14]. The home-based remote cardiac rehabilitation program should be timely adjusted according to the patients' physical condition, and corresponding psychological counseling should be given [15]. Patients in the routine group may gradually lose understanding of the importance of home cardiac rehabilitation due to the absence of supervision and guidance from medical staff after discharge [16]. The present results showed that E, A, and E/A in the tele-rehabilitation group were significantly higher than those in the conventional group, while DT and IVRT in the tele-rehabilitation group were significantly higher than those in the conventional group. This finding differs from the results of Thomas *et al*. [17]. Several studies demonstrated the positive effect of elevated levels of E, A, and E/A on coronary blood flow and myocardial oxygen supply, thereby enhancing the coronary blood flow reserve ca-

Table 2. Comparison of sports fear scores ($\bar{x} \pm$ sd, scores).

	Risk perception	Fear of exercise	Movement to avoid	Disorder of function	Total score	6MWT
Pre-intervention						
Remote rehabilitation group (50)	9.52 ± 1.03	12.23 ± 1.05	14.68 ± 3.52	9.32 ± 1.08	45.75 ± 2.98	478.23 ± 62.78
Regular group (50)	9.70 ± 1.37	12.54 ± 1.50	15.43 ± 4.09	8.93 ± 1.27	46.60 ± 3.72	468.24 ± 68.63
T	0.704	1.135	0.929	–1.564	1.193	2.463
p-value	0.484	0.259	0.355	0.121	0.236	0.231
Post-intervention						
Remote rehabilitation group (50)	8.32 ± 1.12	11.03 ± 1.09	8.11 ± 1.32	8.35 ± 1.09	33.82± 3.52	532.65 ± 76.57
Regular group (50)	7.68 ± 1.05	10.32 ± 1.08	7.83 ± 1.12	7.62 ± 1.15	32.55 ± 2.53	596.26 ± 79.35
T	2.948	3.272	2.369	3.258	2.072	1.756
p-value	0.004	0.001	0.020	0.002	0.041	0.038

6MWT, Six-minute walk test.

Table 3. Comparison of left ventricular function ($\bar{x} \pm$ sd).

	E (m/s)	A (m/s)	E/A	DT (ms)	IVRT (ms)
Pre-intervention					
Remote rehabilitation group (50)	0.8 ± 0.0	1.3 ± 0.3	0.8 ± 0.5	183.3 ± 12.0	150.7 ± 12.9
Regular group (50)	0.8 ± 0.3	1.3 ± 0.2	0.8 ± 0.1	180.9 ± 12.2	150.60 ± 13.7
T	0.201	0.136	0.929	1.564	0.193
p-value	0.682	0.851	0.155	0.121	0.736
Post-intervention					
Remote rehabilitation group (50)	0.8 ± 0.2	1.1 ± 0.1	0.9 ± 0.1	174.5 ± 26.8	136.2 ± 19.3
Regular group (50)	0.7 ± 0.1	0.9 ± 0.2	0.8 ± 0.2	150.6 ± 23.1	123.5 ± 13.9
T	–3.162	–6.325	3.162	2.778	3.776
p-value	0.002	<0.0001	0.002	0.007	<0.0001

Note: E: mitral valve early diastolic peak blood flow. A: Late mitral valve diastolic peak blood flow. DT: E peak deceleration time. IVRT, isovolumic relaxation time.

pacity and heart function. However, other works reported that tele-rehabilitation does not exert significant short-term improvements in patients' heart function [18].

Reducing exercise fear is of great significance to the prognosis of patients. After PCI, patients with coronary heart disease will have exercise fear due to many factors, which will reduce their exercise compliance and affect their rehabilitation progress. The results of our study showed that patients in the tele-rehabilitation group had higher scores on the dimensions of fear of movement, risk perception, avoidance of movement, and dysfunction than those in the conventional group [19].

The reasons may lie in the following aspects. (1) The tele-rehabilitation group makes personalized home tele-cardiac rehabilitation guidance program for patients, and rehabilitation exercise has a certain preventive effect on factors that induced patients' diseases. It cannot only promote the recovery of patients' physical activity ability but also contribute to the enhancement of heart function and the release of pressure [20]. In addition, exercise may improve the exercise fear state of patients by increasing the levels of β-endorphins and brain neurotransmitters in the body, thereby improving the quality of life of the patients [21]. (2) The tele-rehabilitation group provides patients with all-round care of psychological, physiological, and social function, so they can continue to feel the care and guidance of the hospital after discharge; as such, their fear of sports will greatly improved [22]. (3) Hospital cardiac rehabilitation projects require direct face-to-face observation of patients, while home-based remote cardiac rehabilitation projects transmit patients' vital signs and physical and mental state on demand through intelligent monitoring systems to ensure completion of optimal exercise training and improvement of exercise fear [23]. This rehabilitation model aims to encourage patients to complete scheduled activities according to the home-based remote cardiac rehabilitation guidance plan formulated by rehabilitation doctors for rapid communication and feedback between doctors and patients [24]. Therefore, home-based remote cardiac rehabilitation mode is easy to integrate into patients' lives and can guide patients to adhere to long-term exercise to improve their fear of exercise [25]. (4) Our wearable sports bracelet can assess whether the exercise intensity of patients is up to the standard by heart rate, ensure that the exercise intensity is within the range specified in the home-based remote cardiac rehabilitation guidance program, provide guarantee for the exercise safety of patients, and encourage patients to overcome their fear and insist on exercise [26]. (5) In addition,

rehabilitation training can reduce the use of related drugs and the occurrence of exercise fear in patients after PCI and improve the quality of life.

We have encountered some problems in the implementation process. Patient compliance with the home-based remote cardiac rehabilitation guidance program is poor. Many patients will arbitrarily increase the amount of exercise during the implementation process, mistakenly believing that the greater the amount of exercise, the more conducive to the recovery of heart function. The benefit of cardiac rehabilitation is a long-term process, so some patients may not have significant rehabilitation effect in the short term; these patients lost their confidence and courage to continue to participate in rehabilitation treatment. In this regard, medical personnel should actively communicate with patients during follow-up and door-to-door visits, clarify their psychological misunderstandings, and provide psychological counseling. Patients should be informed of the significance and necessity of long-term cardiac rehabilitation.

Conclusions

We used a retrospective cohort study to collect data of patients with coronary heart disease after PCI and found that the application of home-based remote cardiac rehabilitation guidance could improve their heart function and exercise fear.

Availability of Data and Materials

The original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding authors.

Author Contributions

XG and LZ designed the research study. LZ and ZC performed the research. XG and ZC analyzed the data. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This study was approved by Tianshan Traditional Chinese Medicine Hospital (Approval number: 20190713). All patients or their families had informed consent and signed an informed consent form.

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Conflict of Interest

The authors declare no conflict of interest.

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