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Article

Effects of Early Cardiac Rehabilitation Training on Cardiac Function and Quality of Life in Elderly Patients Undergoing Coronary Artery Bypass Grafting: A Retrospective Study

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Abstract

Objective: This study aimed to explore the effect of early cardiac recovery training on the cardiac function and life quality of elderly patients undergoing coronary artery bypass grafting (CABG). **Methods**: Elderly patients who underwent CABG in our hospital from January 2022 to November 2023 were selected as the subjects, and their clinical data were retrospectively analyzed. In accordance with the different rehabilitation intervention methods of the patients, they were separated into control group (C group) and research group (R group). The C group received conventional rehabilitation intervention, and the R Group received early cardiac recovery training intervention. The cardiac function indices and quality of life of the two groups were compared at baseline (T1) at admission, 1 day before surgery (T2), 7 days after surgery (T3), and 30 days after surgery (T4). **Results**: At T2 and T4, the left ventricular ejection fraction (LVEF) levels and 6-min walking test (6-MWT) of the C and R groups were sharply higher than those at T1 ($p < 0.05$). At T3, the LVEF levels and 6-MWT distance of both groups were sharply lower than those at T1 ($p < 0.05$). Compared with the levels at T3, the LVEF levels; the 6-MWT; and the global, physical, emotional, and social levels of the C and R groups at T2 and T4 significantly increased ($p < 0.05$). At T1, the LVEF level; the 6-MWT; and the global, physical, emotional, and social levels of the C group was not statistically significant compared with those of the R group ($p > 0.05$). At T2, T3, and T4, the LVEF levels; the 6-MWT; and the global, physical, emotional, and social levels of the R group were sharply higher than those of the C group ($p < 0.05$). **Conclusion**: Early cardiac recovery training can effectively ameliorate the cardiac function and improve the quality of life of elderly patients undergoing CABG.

Keywords

early cardiac rehabilitation; coronary artery bypass grafting; cardiac function; quality of life

Introduction

Atherosclerotic heart disease (or coronary heart disease) is the most common serious cardiovascular disease in the world, with high morbidity and mortality. It seriously affects patients' quality of life and aggravates their economic burden [1–3]. With the gradual improvement and development of cardiovascular surgical technology, coronary artery bypass grafting (CABG) has become one of the most commonly used surgical methods to treat coronary heart disease [4,5]. However, patients who undergo CABG usually experience a decline in cardiopulmonary function after surgery due to the progression of primary coronary disease, which affects their prognosis. Therefore, timely cooperation with effective cardiac rehabilitation training after surgery is crucial [6,7].

Cardiac rehabilitation training can enhance the patient's heart function, improve the body's immunity and coronary reserve function, and prevent respiratory infections by reasonably planning the patient's exercise program [8,9]. Research has revealed that cardiac rehabilitation training can sharply decline the recurrence and mortality rates of patients with cardiovascular disease, significantly reduce the consumption of medical resources, and increase clinical benefits [10]. The effects on physical functions relatively differ because patients start training at different times [11]. The American Association of Cardiopulmonary Rehabilitation proposes dividing the different development stages of cardiac recovery for coronary heart disease into three stages: acute phase I rehabilitation (in-hospital rehabilitation period), phase II recovery (outpatient rehabilitation period), and phase III rehabilitation at home [12]. Phase I recovery (in-hospital rehabilitation period) is the early rehabilitation carried out for patients post-CABG while they are hospitalized. In the past, bed rest was believed to be required early after CABG, but in recent years, studies have found that patients have improved cardiopulmonary function after CABG and delayed disease progression after early cardiac rehabilitation training [13].

Therefore, this study aimed to evaluate the influence of early cardiac recovery training on the cardiac function and quality of life of elderly patients after CABG through a retrospective study design, provide a basis for formulating a more scientific and reasonable rehabilitation program, and promote the comprehensive recovery of elderly patients with coronary heart disease.

Materials and Methods

General Information

Patients who underwent CABG in our hospital from January 2022 to November 2023 were selected as the subjects, and their clinical data were retrospectively analyzed. In accordance with different rehabilitation intervention methods, the patients were divided into control group (C group) and research group (R group). This study has been approved by the ethics committee of Central Hospital Affiliated to Shandong First Medical University (approval no. 2023-114-01). All subjects signed informed consent forms.

The inclusion criteria were as follows: (1) Age ≥60 years old; (2) diagnosed with coronary atherosclerotic heart disease and undergoing CABG; (3) postoperative patients who received routine rehabilitation guidance and care in the same ward; (4) stable circulation; (5) no contraindications to exercise; (6) no other serious systemic diseases; (7) well-healed postoperative incision; and (8) complete clinical data.

The exclusion criteria were as follows: (1) Serious postoperative complications; (2) people undergoing surgical treatment for other cardiac lesions like valvular lesions, large vessel lesions, and ventricular wall tumors; (3) motor dysfunction caused by other diseases; (4) mental disorders, cognitive impairment, and inability to communicate normally; (5) vital organ dysfunction, malignant tumors, *etc*.; (6) exercise-induced syncope or ventricular arrhythmia; (7) tracheal intubation time of longer than 24 h; and (8) incomplete postoperative follow-up.

Rehabilitation Training Plan

The C group adopted conventional rehabilitation intervention, which included providing psychological counseling, dietary intervention, and other measures to patients; explaining relevant disease knowledge; and providing postoperative rehabilitation education and medication guidance. One week before the operation, the patients were required to carry out appropriate and reasonable exercise in accordance with their physical condition, without professional exercise prescription nor supervision guidance. The first 2 days after surgery were mainly about bed activities and assisting the patients with turning training. On the third and fourth days after surgery, the patients should be able to get out of bed appropriately, perform sit-up exercises at the bedside, and perform walking training with assistance. From the fifth day to the seventh day after surgery, the patients' ability to perform activities of daily living was further trained in accordance with their recovery status.

The R group received early cardiac rehabilitation training on the basis of the C group and referred to expert consensus on cardiac recovery after CABG [14]. (1) Receive pre-rehabilitation guidance training 1 week before surgery: (A) Improve pre-operative lung capacity through abdominal breathing and pursed-lip breathing. (B) Develop a rehabilitation training plan on the basis of the actual situation of the individual patient, and perform exercises in the ward and at the bedside. The exercise methods were mainly low-to-medium exercise such as walking and *in-situ* scooters. The activities required on-site guidance from professional rehabilitation therapists, and they were based on the patients' test indicators. The corresponding amount of exercise was dynamically adjusted. (C) Conduct adaptive training for patients to familiarize them and adapt to changes in postoperative living habits in advance, such as simulating how to turn over in bed after surgery and performing bowel movements in bed. (2) Within 1 week after the operation, professional rehabilitation therapists provided respiratory training and exercise therapy to the patients. The patients' respiratory and circulatory systems were stable, and early activities were started after no orthostatic hypotension was observed. All cardiac rehabilitation treatment projects were conducted in the hospital. On the first day after surgery, the patients performed breathing training and simple body movements in bed. They were instructed to stay in a supine position, inhale through the nose, exhale through the mouth, slow down, and deepen the breath, 20 groups/time for two times a day. Then, with the limbs on the bed, they were asked to passively or actively move the joints of the upper and lower limbs and raise the head voluntarily. On the second day after surgery, the patients were instructed to perform abdominal breathing training and pursed lip breathing and slowly exhale air within 4–6 seconds. Each group repeated 5–10 movements, with three groups each time for two times a day. Then, they were asked to cooperate with bedside exercise, walking training in the ward, starting from walking 20–50 m indoors and gradually increasing to walking 100–300 m outdoors. Every day in accordance with the patients' recovery, the intensity of walking training was increased and training of going up and down the stairs, and step by step increase to low-medium intensity aerobic exercise. Next, 4–7 days after surgery, the exercises mainly included heart training exercise in lying position, increasing cardiac endurance with an instrument, and low-intensity and rhythmic exercise. If the patients experienced chest pain, chest tightness, or other discomfort during training, they should stop exercising in time and notify the doctor for appropriate treatment. The C group underwent outpatient exercise rehabilitation after discharge, that is, exercise rehabilitation program with physician participation and electrocardiogram (ECG) monitoring, usually three times a week. The patients were usually prescribed to adopt moderate-intensity exercise, such as 40%–60% peak oxygen uptake, over time. If the patients showed tolerance, the duration of exercise can be appropriately increased. When the heart rate response decreased with the increase in training intensity, the exercise intensity can be increased and gradually reach 80% peak oxygen uptake. After discharge, the R group underwent respiratory muscle training + aerobic exercise + resistance training, including 30 min of aerobic training on treadmill and power treadmill, 20 min of resistance training (dumbbell and ankle weight training), and 10 min of stretching and relaxation training, two times a week. In accordance with the requirements of exercise prescription, 8–10 muscle groups were trained each time, the upper limb, lower limb, and trunk muscle groups can alternate training. A notable detail that 5–10 min of warm-up or stretching exercise must be included before training. Flexibility training focuses on the major muscles of the upper limbs, lower limbs, and trunk, stretching in a slow manner. The stretching time of each part was gradually increased from 6 s to 15 s, and gradually increased to 30–90 s. During the normal breathing period, the intensity was pulling without pain. Each movement was repeated 3–5 times, and the total time was about 10 min, 3–7 times/week. Both groups were followed up for 30 days after surgery and returned to the hospital's outpatient clinic every 15 days. When the patients returned to the hospital's outpatient clinic for a second visit, the responsible rehabilitation therapist conducted various indicators of the study subjects at T4.

Evaluation Indicators

Basic patient information, including age, gender, and date of surgery, was collected from hospital files. Cardiac function assessment data before surgery and records of early cardiac rehabilitation training after surgery were obtained. The indicators of cardiac function evaluation comprise left ventricular ejection fraction (LVEF), exercise tolerance, myocardial infarction size, *etc*. Rehabilitation training records included training start time, training frequency, training method, and training duration.

(1) Echocardiography (Philips Investment Co., Ltd., iEElite type, Shanghai, China) was used to detect the baseline of the two groups on admission (T1) and changes in LVEF levels 1 day before surgery (T2), 7 days after surgery (T3), and 30 days after surgery (T4).

(2) Six min walking test (6-MWT): The patients were required to walk as fast as possible within 6 min at T1, T2, T3, and T4, and the maximum walking distance was recorded. If any discomfort, such as dizziness, chest tightness, and shortness of breath, occurred during the test, the test was stopped immediately, and the walking distance was recorded.

(3) The Heart Disease Health-Related Quality of Life Tool (MacNew) [15] was used to evaluate patients' quality of life at T1, T2, T3, and T4. The Cronbach's alpha coefficient of the total scale was 0.82, which has good reliability and validity. This scale is composed of 27 questions, divided into three dimensions (physical, psychological, and social), and it adopts a 7-level scoring strategy. The higher the score, the better the patient's life quality.

Statistical Methods

SPSS Statistics for Windows was used for data analysis (version 21.0, IBM Corp., Armonk, NY, USA). Count data are expressed as [n (%)]. The (χ^2) test was used for pairwise comparisons. For measurements consistent with normal distribution, data are shown as ($\bar{x} \pm$ s), and t test was applied for pairwise comparisons. Multivariant analysis of variance with repeated measurements was used for statistical analyses of time-, group-, and treatment-related changes and differences. $p < 0.05$ indicated statistically significant.

Results

Comparison of Baseline Data between the Two Groups of Patients

No statistical differences were found between the two groups in terms of gender, age, body mass index (BMI), history of hypertension, diabetes, hyperlipidemia, smoking, drinking, regular exercise, New York Heart Association (NHYA) classification, number of coronary artery lesions, forced vital capacity (FVC), forced expiratory volume in the first second (FEV_1), FEV_1/FVC, and preoperative hospital stay ($p > 0.05$). During the early cardiac rehabilitation training, exercise intolerance occurred in 10 and six patients in the R and C groups, respectively, without statistical significance ($\chi^2 = 0.868$, $p = 0.352$, Table 1).

Comparison of LVEF between the Two Groups of Patients

At T2 and T4, the LVEF levels of the C and R groups were significantly higher than those at T1 ($p < 0.05$). At T3, the 6-MWT distance of both groups were significantly lower than those at T1 ($p < 0.05$). Compared with the LVEF levels at T3, those at T2 and T4 significantly increased in both groups ($p < 0.05$). At T1, the LVEF level of the C group was not statistically significant compared with that of the R group ($p > 0.05$); At T2, T3, and T4, the LVEF levels of the R group was significantly higher than that of the C group ($p < 0.05$, Table 2).

Table 1. Comparison of general information between two groups [n, ($\bar{x} \pm$ s)].

	C group (n = 58)	R group (n = 62)	χ^2/t	p
Gender (men/women)	35/23	40/22	0.222	0.637
Age (years)	67.03 ± 3.35	67.34 ± 4.55	0.553	0.581
BMI (kg/m^2)	23.98 ± 2.34	23.21 ± 2.58	1.705	0.091
History of hypertension	10/48	9/53	0.167	0.683
History of diabetes	15/43	21/41	0.915	0.339
History of hyperlipemia	7/51	5/57	0.534	0.465
Smoking history	19/39	24/38	0.462	0.497
drinking history	25/33	30/32	0.337	0.562
History of regular motion	11/47	10/52	0.167	0.683
NHYA rating (level II/III)	28/30	33/29	0.294	0.588
Number of coronary artery lesions (1/2/3)	19/22/17	21/25/16	0.189	0.910
FVC (L)	1.39 ± 0.14	1.43 ± 0.16	1.530	0.129
FEV_1 (L)	1.09 ± 0.13	1.16 ± 0.13	1.746	0.083
FEV_1/FVC (%)	79.20 ± 11.45	79.74 ± 10.17	0.275	0.784
Preoperative hospital stay (d)	5.98 ± 0.95	6.02 ± 0.86	0.203	0.840

C group, control group; R group, research group; BMI, body mass index; NHYA, New York Heart Association; FVC, forced vital capacity; FEV_1, forced expiratory volume in the first second.

Table 2. Comparison of LVEF between patients ($\bar{x} \pm$ s, %).

Index	T1	T2	T3	T4
C group (n = 58)	45.62 ± 4.66	49.82 ± 5.15*	39.56 ± 4.18*$^{\#}$	49.27 ± 5.74*$^{\&}$
R group (n = 62)	46.03 ± 4.41	53.35 ± 5.46*^{a}	44.11 ± 4.54*$^{\#a}$	54.71 ± 5.92*$^{\&a}$
F_{time}	183.813			
p_{time}	<0.001			
F_{group}	53.362			
p_{group}	<0.001			
$F_{interaction}$	6.374			
$p_{interaction}$	<0.001			

Note: * represents comparison with T1 in the same group, $p < 0.05$; $^{\#}$ represents comparison with T2 in the same group, $p < 0.05$; $^{\&}$ represents comparison with T3 in the same group, $p < 0.05$; ^{a} represents comparison with C group, $p < 0.05$. F, F-statistic.

Comparison of 6-MWT between Two Groups of Patients

At T2 and T4, the 6-MWT distance of the C and R groups significantly increased compared with that at T1 ($p < 0.05$). At T3, the 6-MWT distance in both groups significantly decreased compared with that at T1 ($p < 0.05$). Compared with the 6-MWT distance at T3, that at T2 and T4 significantly increased in both groups ($p < 0.05$). At T1, the 6-MWT distance of the C group was not statistically significant compared with that of the R group ($p > 0.05$). At T2, T3, and T4, the 6-MWT distance of the R group was significantly higher than that of the C group ($p < 0.05$, Table 3).

Comparison of Life Quality between the Two Groups

At T2, the global, physical, emotional, and social levels in the R group were significantly higher than those at T1 ($p < 0.05$). At T3, these levels in the C group were significantly lower than those at T1 ($p < 0.05$). Compared with the levels at T3, the global, physical, emotional, and social levels in both groups significantly increased at T2 and T4 ($p < 0.05$). At T1, these levels in the C group was not statistically significant compared with those in the R group ($p > 0.05$); At T2, T3, and T4, these levels in the R group were significantly higher than those in the C group ($p < 0.05$, Table 4).

Discussion

This retrospective study showed that early cardiac recovery training for 2 weeks before and after CABG in elderly patients (≥60 years old) can effectively improve preoperative their cardiac function (LVEF), exercise capacity (6-MWT), and quality of life. This study focused on early cardiac rehabilitation training for elderly patients post-CABG during the perioperative period. The results confirmed that early cardiac rehabilitation training has certain effectiveness and feasibility for this population. Multi-

Table 3. Comparison of 6-MWT between two groups of patients ($\bar{x} \pm s$, m).

Index	T1	T2	T3	T4
C group (n = 58)	434.62 ± 59.23	459.34 ± 44.77*	327.94 ± 58.25*#	463.48 ± 62.81*&
R group (n = 62)	437.68 ± 62.59	480.24 ± 51.58*a	369.77 ± 63.87*#a	497.73 ± 69.25*&a
F_{time}	117.251			
p_{time}	<0.001			
F_{group}	23.092			
p_{group}	<0.001			
$F_{interaction}$	2.376			
$p_{interaction}$	0.071			

Note: * means compared with T1 in the same group, $p < 0.05$; # means compared with T2 in the same group, $p < 0.05$; & means compared with T3 in the same group, $p < 0.05$; a represents comparison with C group, $p < 0.05$.

Table 4. Comparison of life quality between the two groups ($\bar{x} \pm s$, points).

Index		T1	T2	T3	T4
Global	C group (n = 58)	5.10 ± 0.99	5.19 ± 0.87	4.38 ± 1.01*#	5.12 ± 1.03&
	R group (n = 62)	5.13 ± 0.97	5.61 ± 0.86*a	4.85 ± 1.10#a	5.69 ± 0.97*&a
	F_{time}	16.975			
	p_{time}	<0.001			
	F_{group}	21.065			
	p_{group}	<0.001			
	$F_{interaction}$	1.782			
	$p_{interaction}$	0.150			
Physical	C Group (n = 58)	5.02 ± 1.03	5.10 ± 0.97	4.21 ± 0.85*#	5.09 ± 1.01&
	R group (n = 62)	5.08 ± 1.08	5.56 ± 0.88*a	4.77 ± 0.97#a	5.53 ± 0.95*&a
	F_{time}	20.063			
	p_{time}	<0.001			
	F_{group}	17.461			
	p_{group}	<0.001			
	$F_{interaction}$	1.591			
	$p_{interaction}$	0.191			
Emotional	C group (n = 58)	4.97 ± 0.95	5.00 ± 0.88	4.57 ± 0.98*#	5.07 ± 0.97&
	R group (n = 62)	5.06 ± 1.05	5.60 ± 0.91*a	5.24 ± 0.95#a	5.65 ± 0.94*&a
	F_{time}	6.395			
	p_{time}	<0.001			
	F_{group}	26.063			
	p_{group}	<0.001			
	$F_{interaction}$	2.297			
	$p_{interaction}$	0.077			
Social	C group (n = 58)	5.21 ± 1.02	5.07 ± 0.93	4.36 ± 1.18*#	5.12 ± 1.09&
	R group (n = 62)	5.29 ± 1.03	5.65 ± 1.07*a	4.85 ± 1.17*#a	5.71 ± 1.05*&a
	F_{time}	13.903			
	p_{time}	<0.001			
	F_{group}	22.718			
	p_{group}	<0.001			
	$F_{interaction}$	1.425			
	$p_{interaction}$	0.235			

Note: * represents comparison with T1 in the same group, $p < 0.05$; # represents comparison with T2 in the same group, $p < 0.05$; & represents comparison with T3 in the same group, $p < 0.05$; a represents comparison with C group, $p < 0.05$.

ple studies have shown that early cardiac rehabilitation after CABG can effectively ameliorate patients' quality of life and exercise capacity and reduce mortality [16,17]. Elderly patients with multiple underlying diseases have achieved significant recovery results and improved physical functions after early cardiac rehabilitation intervention [18]. Snowdon *et al*. [19] found that preoperative exercise rehabilitation intervention in cardiac surgery patients can reduce postoperative pulmonary complications and the hospitalization time of elderly patients. Studies have also shown that preoperative exercise consisting of inspiratory muscle training, aerobic exercise, resistance training, and stretching can accelerate recovery after cardiac operation and shorten the patient's stay in the intensive care unit (ICU) [20].

MWT is a simple, safe, and objective means to assess athletic ability [21]. 6-MWT can predict the mortality of elderly patients undergoing cardiac recovery after CABG. 6MWT $\geq$300 m has a protective effect on the elderly, but it has no protective effect on adult patients [22]. Studies have shown that early cardiac rehabilitation training after CABG in male patients can significantly improve the 6-MWT distance in elderly patients, and 6-MWT can be used to modify exercise prescription intensity [23]. The present study revealed that at T2 and T4, the 6-MWT distance of the C and R groups significantly increased compared with that at T1 ($p < 0.05$). At T3, the 6-MWT distance of both groups sharply decreased compared with that at T1 ($p < 0.05$). At T2, T3, and T4, the 6-MWT distance of the R group was significantly higher than that of the C group ($p < 0.05$), indicating that after 2 weeks of early cardiac rehabilitation training, the R group had better. The decrease in 6-MWT distance was low at 7 days after surgery, and the patients' exercise ability recovered significantly at 30 days after surgery. Sawatzky *et al*. [24] found that patients awaiting elective CABG who underwent a cardiac prehabilitation program significantly increased their walking distance before and 3 months after surgery. Another study showed that after moderate-to-high-intensity inspiratory muscle training (IMT) intervention was added to short-term aerobic exercise and resistance exercise (combined training [CT]) after CABG, the distance covered by the IMT + CT group during 6MWT (78.8 m) significantly improved compared with that covered by the sham IMT + CT group [25]. Compared with other studies, the present study is not limited to preoperative or postoperative rehabilitation training for patients but early cardiac rehabilitation training during the perioperative period, which has a greater positive effect on the patient's 6-MWT distance.

CABG has a significant effect in treating coronary heart disease, but factors, such as intraoperative anesthesia and traumatic stimulation, can easily increase the burden on the heart, trigger abnormal fluctuations in blood pressure, and lead to abnormal changes in patients' cardiac function indicators [26]. LVEF ratio is the main indicator to evaluate left ventricular function and predict the incidence of major adverse cardiovascular events after CABG [27,28]. Previous studies have shown that cardiac rehabilitation is beneficial to the improvement of cardiac function in patients after CABG, and the improvement in cardiac function is more obvious during the phases II and III recovery stages [29]. The present study found that at T2, T3, and T4, the LVEF levels of the C and R groups were significantly higher than those at T1 ($p < 0.05$), with the LVEF levels of the R group being significantly higher than those of the C group ($p < 0.05$). This finding shows that early cardiac rehabilitation training intervention in elderly patients with CABG benefits the establishment of cardiac collateral circulation and significantly improves cardiac function. Shan *et al*. [30] found that LVEF increased significantly after early exercise rehabilitation intervention in patients after CABG, which is consistent with the outcomes of the present study.

The results implied that at T2, the global, physical, emotional, and social levels of the R group significantly increased compared with those at T1 ($p < 0.05$). At T3, the global, physical, emotional, and social levels of the C group significantly decreased compared with those at T1 ($p < 0.05$). At T2, T3, and T4, these levels in the R group were significantly higher than those in the C group ($p < 0.05$). These findings exhibit that after early cardiac rehabilitation training intervention, the quality of life of elderly patients with CABG significantly improved, suggesting that early cardiac recovery training is safe and effective. Early cardiac recovery training can also maximize the recovery of patients' motor functions, improve their metabolism, enhance their immunity, reduce their psychological burden, ensure that they can perform rehabilitation training in an enhanced state, and further improve their cardiac rehabilitation effects, thereby improving their quality of life. Steinmetz *et al*. [31] found that an exercise prehabilitation program significantly improved the postoperative quality of life of patients waiting for elective CABG, which is in accordance with the outcomes of the present research. In this study, early cardiac rehabilitation training was conducted in patients with CABG during the perioperative period. During the rehabilitation training period, the changes in relevant indicators before and after surgery were analyzed and studied, and a follow-up study was conducted on the patient's recovery 1 month after surgery. A relatively comprehensive and systematic analysis of the positive influence of early cardiac recovery training on the cardiac function and quality of life of patients with CABG was performed.

Conclusion

Early cardiac rehabilitation training can effective improve the cardiac function of elderly patients after CABG and improve their quality of life.

Availability of Data and Materials

Promise to bear the responsibility for all breaches of obligations and infringements, the data involved in the paper is available, has been stored in accordance with relevant regulations, can be accepted for verification.

Author Contributions

The conception, design and realization of this work are composed of HS. LZ contributed to the acquisition of information, and MW contributed to the analysis and interpretation of working data. LZ, MW, HS drafted the manuscript and made critical revisions to the manuscript. All parties finally approve and agree to take responsibility for all aspects of the work to ensure completeness and accuracy. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

This study has been approved by the ethics committee of Central Hospital Affiliated to Shandong First Medical University (approval no. 2023-114-01). Because this study is a retrospective study, patients do not need to sign informed consent.

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Conflict of Interest

The authors declare no conflict of interest.

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