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Original Research Paper

Cardiology

CLINICAL OUTCOMES OF PATIENTS WITH ACUTE MYOCARDIAL INFARCTION AFTER PERCUTANEOUS CORONARY INTERVENTION AMONG CARDIAC REHABILITATION AND NON CARDIAC REHABILITATION GROUPS-A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

OBJECTIVES To determine clinical outcome and to find out the association between participation of patients with acute myocardial infarction (AMI) after percutaneous coronary intervention (PCI) in cardiac rehabilitation programme. **DESIGN** A Prospective observational study. **STUDY AREA :** Department of Cardiology, Institute of Postgraduate Medical Education and Research,Kolkata. **PARTICIPANTS:** Patients aged ≥18 years who underwent PCI due to AMI. **OUTCOME MEASURES** The outcomes were subsequent myocardial infarction, revascularisation, all-cause readmission, cardiac readmission, all-cause mortality and cardiac mortality. **RESULT:** The data of 1107 patients were included and 60.07%% of them participated in CR program. The risks of revascularisation, all cause readmission and cardiac readmission among CR participants were compared. The results of those analysis were consistent and showed that the CR participants had lower all-cause mortality ,cardiac mortality,all cause readmission, cardiac admission. However no effect was observed for subsequent myocardial infarction or revascularisation. **CONCLUSIONS:** It was suggested CR participation may reduce the risk of all-cause mortality ,cardiac mortality, all cause readmission and cardiac admission.

KEYWORDS :

INTRODUCTION

Acute myocardial infarction (AMI) and other coronary artery diseases (CADs) have been the leading cause of death worldwide for more than 15 years and are one of the most socially burdensome diseases.[1] Although the mortality of patients with AMI has declined in the past decade,[2] approximately 20% of AMI survivors have experienced major adverse cardiac events within 1year after hospital discharge.[3] Therefore, the secondary preventive care of these patients is recognised to be important. Cardiac rehabilitation (CR) is one of the secondary preventive care measures for patients with AMI, which is a multidisciplinary programme consisting of exercise therapy and patient education on secondary prevention and lifestyle modification. Many randomised controlled trials have been conducted, and meta-analysis of these results showed that CR reduced the mortality, readmissions and improved the management of risk factors.[4–6] Based on this evidence, CR implementation is strongly recommended by relevant clinical guidelines.[7–11]

Since a major component of CR is the outpatient programme implemented after hospital discharge, the established benefits of CR are mainly dependent on the implementation of the outpatient programme. In the outpatient programme, participants start the programme after discharge and implement it regularly for weeks or months. In some cases, patients participate in the CR programme during hospitalisation. This in-hospital programme consists of programmes for prevention of deconditioning and recovery of daily activity in the acute phase, as well as supervised exercise therapy and patient education in the early recovery phase.[9] Given that AMI survivors have a higher incidence rate of readmission or major adverse cardiac events early after discharge,[12–15] they need secondary preventive care immediately after onset. In addition, since an early enrolment in a CR programme is associated with a positive effect on exercise capacity,[16] participation in the in-hospital CR programme may have beneficial effects on clinical outcomes. Some studies in Germany have reported that implementation of in-hospital CR improved risk factor modification and reduced all-cause mortality.[17,18] However, the associations of in-hospital CR and clinical prognosis such as revascularisations or readmissions are not fully revealed. In Japan, an in-hospital CR programme is predominantly conducted for patients with AMI based on the programme presented in the Japanese CR guideline.[9]

Here, we aimed to verify the associations between participation in CR programme and clinical outcomes among patients with AMI after percutaneous coronary intervention (PCI).

METHODS

Study design: Prospective Observational study

Study population: Patients aged ≥18 years who underwent PCI for AMI and survived to discharge between 1 January 2019 and 31 December2019 in Department of Cardiology in IPGMER&H. In this study, we targeted patients who were admitted to the hospitals, authorised to provide CR and perform outpatient treatment of patients after discharge.The International Classification of Diseases, 10th Revision (ICD-10) codes, I21 and I22, were used to identify patients with AMI.The study included patients who received outpatient CR after discharge in the hospital and patients who received in hospital CR. Patients who received other modes of rehabilitation for other comorbidities were excluded.

Cardiac rehabilitation:

The CR programme usually starts within several days after admission and consists of a progressive exercise programme with an appropriate medical evaluation, aimed to help regain the ability of daily activities (Phase I programme). In about a week, it shifts continuously to the in-hospital Phase II programme, which is generally implemented on weekday during hospitalisation. In the programme, conducting risk assessment and exercise prescription based on the anaerobic threshold level or at 40%–60% of the heart rate reserve is recommended. The exercise intensity is recommended to be determined based on a submaximal cardiopulmonary exercise test performed 4–7 days after the onset. In addition to the exercise therapy, the programme also includes patient education and counselling. Along with the shortened hospitalisation, it is difficult to complete the CR programme during hospitalisation. Therefore, it is recommended that patients continuously participate in the outpatient CR

programme after discharge. We defined patients as in-hospital CR participants when they participated in the inpatient exercise-based CR program ≥1 session within 30 days from admission.

Outcome The primary outcomes were time to revascularisation, all-cause readmission and cardiac readmission. Revascularisation was defined as a new PCI after the primary PCI was performed based on the clinical need. All-cause readmission was defined as a readmission after the index admission regardless of the main diagnosis. Cardiac readmission was defined as a readmission for cardiac disease, which was ascertained using codes I11, I13 and I20–I52 of the ICD-10 after the index admission. We also evaluated all-cause mortality and cardiac mortality as secondary outcomes. We defined all-cause death as death occurring in the hospital during readmission regardless of the main diagnosis, and cardiac death as death occurring in the hospital during readmission with cardiac disease as the main diagnosis.

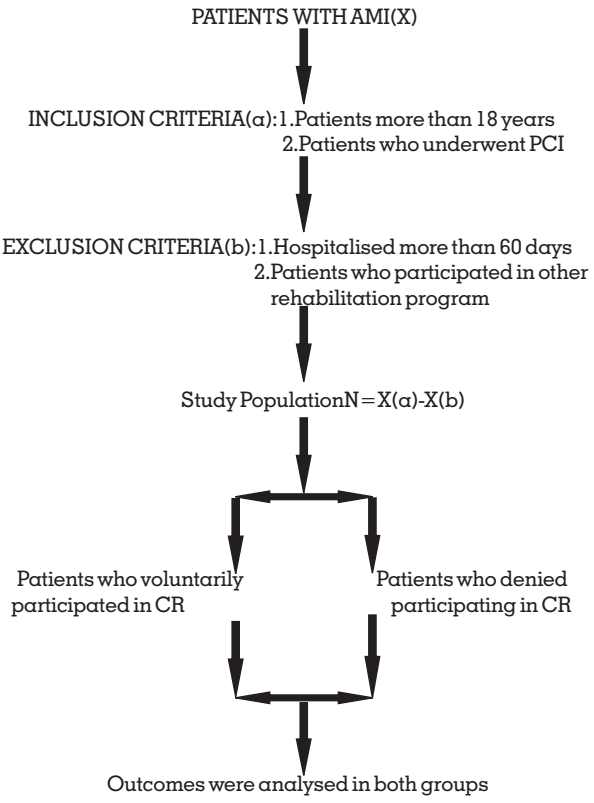

Table1: PATIENT CHARACTERISTICS:

	Non-CR (n= 442)	CR (n=665)	P value
Age(years)Mean±SD	66.2±12.4	66.4±12.1	0.79*
Males	68%	72%	0.53
Females	32%	28%	
BMI (kg/m^2)	24.0±3.8	24.4±4.5	0.22*
Smoker	58%	66%	0.24
Non smoker	42%	34%	
Comorbid conditions			
Hypertension	76.1%	73.8%	0.74
Dyslipidemia	66.3%	69.2%	0.66
Diabetes Mellitus	42.9%	52.6%	0.16
Heart Failure	26.8%	22.3%	0.45
Cerebrovascular Disease	4.2%	2.1%	0.40
Peripheral artery disease	5.3%	4.8%	0.87
Length of hospital stay(days)mean	14±3.5	15±2.5	0.001*

*paired t test and others chi-square test $p<0.05$ significant

Table2: INCIDENCE RATES OF OUTCOMES AMONG MATCHED PAIRS

	Non-CR	CR
Outcomes	Events	Events
Subsequent MI	22(1.98%)	24(2.16%)
Revascularisation	12(1.08%)	13(1.17%)
All cause admission	74(6.68%)	42(3.79%)
Cardiac readmission	56(5.05%)	30(2.71%)
All cause death	46(4.15%)	22(1.98%)
Cardiac death	29(2.61%)	12(1.08%)

RESULTS:

Between January 2019 and December 2019, 1107 patients underwent PCI for STEMI at Institute of Postgraduate Medical Education and Research, Kolkata. Of 1107 STEMI patients who were eligible for the exercise program, 665 patients (60.07%) participated in CR with an exercise program the during study period (CR+ group) and 442 (39.93) constituted Non CR− group that included patients undergoing standard medical care for myocardial infarction, including medication, abstinence from smoking, and diet modification during study period. Baseline clinical characteristics according to the CR group are presented in Table 1. There were no significant differences in baseline characteristics, including age, sex, body mass index, smoking habit, diabetes, hypertension, dyslipidemia, cerebrovascular disease. Those who received CR stayed in hospital for a longer time than their counterparts that was observed to be statistically significant.

Outcomes are presented in Table 2.CR participants had lower all-cause mortality ,cardiac mortality,all cause readmission,cardiac admission.However no effect was observed for subsequent myocardial infarction or revascularisation.

DISCUSSION:

Our study shows Patients who undergo Cardiac rehabilitation had lower all cause mortality,cardiac mortality,all cause readmission,cardiac admission but no effect was found with subsequent myocardial infarction or revascularisation.

Natsuko Kanazawa et al showed in their study that the CR participants had lower risk of revascularisation all-cause readmission and cardiac readmission but all-cause mortality and cardiac mortality were not associated with participation in the CR.[19]

Hye Young Lee et al in their study showed that CR including exercise training was associated with lower Major adverse cardiovascular events (MACEs), including death, myocardial infarction, and revascularization, particularly in patients with lower preprocedural TIMI flow during primary PCI for STEMI in the current DES era.[20]

Limitation to our study is that we did not include factors such as ejection fraction, exercise capacity, vital sign, functional status, frailty or social risk factors, which are important prognostic factors. Although we evaluated the procedures, medications and all other available variables to adjust patient deviation, we could not adjust for imbalance in unmeasured confounders.

The treatment of AMI has reached a higher level, but the CR is still hysteretic in the whole treatment, and the studies on community rehabilitation are rarely reported. After 50 years of research and development, the benefit of CR was now fully supported by clinical research evidence. Meta-analysis confirmed that exercise-based CR was associated with significant reductions in cardiac mortality, post-MI reinfarction, and all cause mortality.[21-24] Mortality was negatively correlated with the participation time of rehabilitation. As an independent intervention factor after

myocardial infarction, CR can reduce the incidence of cardiac events and mortality and their quality of life.[25,26]

The conception of CR has been gradually applied in clinical treatment. It was clearly put forward in the 5 prescriptions in Chinese expert consensus about rehabilitation and secondary prevention of coronary heart disease,[27] which was consisted of medication, exercise, psychological counseling, education, and smoking cessation. As a core part, exercise rehabilitation has many advantages, such as reducing the vascular inflammation,[28] enhancing vascular endothelial function, and increasing the coronary collateral blood flow.[29,30] It has been confirmed that exercise rehabilitation could significantly reduce the incidence of in-stent restenosis for AMI patients who underwent PCI.[31]

Treatment of AMI patients has always been the spotlight-subject. By strengthening the operability of the community rehabilitation, popularizing the application of appropriate technology, collaborating with cardiologists and community general practitioners,[32] we can develop the continuity of rehabilitation for AMI patients to improve their prognosis, help them have a better quality of life.

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