Impact of early rehabilitation programs on post myocardial infarction recovery and quality of life

Impacto de los programas de rehabilitación temprana en la recuperación y la calidad de vida tras un infarto de miocardio

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Abstract

This study will investigate the impact of early rehabilitation treatment on the recovery process and quality of life in myocardial infarction patients in Uzbekistan. The study will be conducted as a randomized clinical trial in 120 myocardial infarction patients (mean age 58±7 years, 65% men). Participants will be randomized to two treatment groups (receiving a formal programme of rehabilitation during the initial 6 weeks post-discharge) and one control group (standard care without early rehabilitation). Main outcomes will be improved cardiorespiratory ability (with the 6-minute walking test), fewer complications (e.g., readmission to hospital within 12 months), and assessment of quality of life (with the SF-36 questionnaire). The intervention group is expected to demonstrate a 30-40% improvement in physical function assessments and a 35-35% improvement in quality of life measurements compared to the control group. Furthermore, it is expected that readmission in the rehabilitation group will decrease by 50%. This study proves that the integration of early rehabilitation programs into standard treatment regimens after myocardial infarction can significantly accelerate clinical and psychosocial recovery of patients in the Uzbek population.

Keywords: myocardial infarction, early rehabilitation, quality of life, cardiac rehabilitation, Uzbekistan, clinical trial

Resumen

Este estudio investigará el impacto del tratamiento de rehabilitación temprana en el proceso de recuperación y la calidad de vida de pacientes con infarto de miocardio en Uzbekistán. El estudio se realizará como un ensayo clínico aleatorizado en 120 pacientes con infarto de miocardio (edad media de 58 ± 7 años, 65 % hombres). Los participantes serán asignados aleatoriamente a dos grupos de tratamiento (que recibirán un programa formal de rehabilitación durante las primeras 6 semanas tras el alta) y un grupo control (atención estándar sin rehabilitación temprana). Los principales resultados serán la mejora de la capacidad cardiorrespiratoria (con la prueba de marcha de 6 minutos), la reducción de complicaciones (p. ej., reingreso hospitalario en los 12 meses siguientes) y la evaluación de la calidad de vida (con el cuestionario SF-36). Se espera que el grupo de intervención presente una mejora del 30-40 % en las evaluaciones de la función física y del 35-35 % en las mediciones de la calidad de vida, en comparación con el grupo control. Además, se espera que los reingresos en el grupo de rehabilitación se reduzcan en un 50 %. Este estudio demuestra que la integración de programas de rehabilitación temprana en los regímenes de tratamiento estándar tras un infarto de miocardio puede acelerar significativamente la recuperación clínica y psicosocial de los pacientes uzbekos.

Palabras clave: infarto de miocardio, rehabilitación temprana, calidad de vida, rehabilitación cardíaca, Uzbekistán, ensayo clínico

Introduction

Myocardial infarction (MI) is recognized as one of the greatest killers and top causes of disability in the world, imposing an enormous health burden on the system. The World Health Organization indicates that cardiovascular disease alone causes over 17.9 million deaths per year worldwide and accounts for approximately 31% of all global deaths[1]. In middle-income and developing countries, such as Uzbekistan, the impact on health is further aggravated by limited access to sophisticated diagnostic and treatment centers[2]. In Uzbekistan, cardiovascular risk factors of diabetes, hypertension, and obesity are increasing, and special interventions are needed to improve patient outcomes[3].

Despite recent advances in treatments for acute myocardial infarction like primary angioplasty, which have reduced short-term mortality, the biggest challenge remains how to return patients to normal life and prevent long-term complications[4]. Research indicates that as many as 20% of survivors of myocardial infarction have a recurrence during the first year following discharge, emphasizing the need for rehabilitation interventions[5]. But in most Central Asian nations, including Uzbekistan, formalized cardiac rehabilitation programs do not exist on a large scale, and a mere 10–15% of patients are able to access specialized services[6]. Early cardiac rehabilitation has been noted as an effective means of restoring physical capacity, reducing depression, and facilitating adherence to medication routines[7]. Meta-analyses evidence is cited as that which suggests participation in rehabilitation programs may reduce the risk of mortality overall by as much as 26% as well as readmission by up to 18%[8]. But it needs localizing procedures and training the multidisciplinary team to use these programs in health systems limited by resources[9]. In Uzbekistan, the lack of national statistics regarding the efficacy of cardiac rehabilitation has been an obstacle to planning and resource distribution[10].

Quality of life for patients after myocardial infarction is another significant measure when assessing the success of treatment. Longitudinal research suggests that denial of rehabilitation access is associated with a 30-40% decrease in quality of life scores[11]. This diminishment does not only affect physical health but also social and economic functioning of the patients[12]. Under the cultural setting in Uzbekistan, where treatment of patients depends largely on family effort, a lack of programs to offer professional assistance may create an extra workload on families[13]. Since the research gaps in literature in the region are evident, this study evaluates the impact of early rehabilitation programs on patients' recovery and quality of life in Uzbekistan. This research can contribute

to the development of operational strategies to execute cardiac rehabilitation in the country's health system and reduce health inequalities in the Central Asian region[14].

Heart attack is a global phenomenon with significant health, social, and economic effects. More than 85% of cardiovascular mortality occurs in middle- and low-income nations, which is fostered by inaccessibility to enhanced health services[1,2]. Nationally in Uzbekistan, an increasing number of risk factors such as hypertension (34% of adults) and diabetes (9.2%) are said to exist and necessitate the introduction of formal interventions[3,6]. However, only 12% of patients who have had a myocardial infarction can avail themselves of rehabilitation programs, a deficit which indicates the health system's flaws[6,10]. Acute care has evolved recently with new procedures like the primary angioplasty, decreasing in-hospital mortality by 80%[4]. Recovery and return to everyday life necessitate multimodal therapy. The evidence indicates that inactivity from rehabilitation programs leads to an up to 35% increased risk of recurrent myocardial infarction[5,8]. Early rehabilitation therapy, including supervised exercise training, nutritional counseling, and psychological counseling, not only improves cardiorespiratory function but also facilitates patients' adaptation to lifestyle changes[7,9].

Meta-analysis data suggest that cardiac rehabilitation results in a 20–30% reduction in total mortality and a 15–25% reduction in one-year readmissions after discharge[8,11]. For example, a European longitudinal study found that 12-week rehabilitation programs improved patients' exercise capacity by up to 40% and improved quality of life scores in physical and psychological domains[11,12]. However, in Central Asian countries, barriers like the lack of trained personnel, lack of standardized protocols, and physical activity myths have prevented the implementation of these programs[9,13].

Quality of life after myocardial infarction, being a multifaceted indicator, is defined by physiological, psychological, and social determinants. According to a study conducted in Uzbekistan, 60% of the patients experienced a significant reduction in occupational functioning and social interactions within the first 6 months of discharge[10,13]. These results are in line with international studies that have shown that lack of access to rehabilitation is associated with a 2-fold increase in depression and anxiety risk[12,14]. On the contrary, organized programs of rehabilitation with psychological counseling can improve mental health scores by up to 50%[7,12].

Although the effectiveness of cardiac rehabilitation in industrialized countries is well proven, evidence from resource-limited countries is weak and insufficient. A 2022 systematic review highlighted the fact that only 5% of studies related to cardiac rehabilitation have been published in Central Asia[9,14]. This has left a knowledge gap that made it difficult to plan health policy. For example, in Uzbekistan, the lack of local evidence for the most effective models of rehabilitation (length of program, exercise intensity, and blending of intervention) has made policymakers unable to prioritize sufficiently[6,10]. Comparative studies have established that the integration of rehabilitation into primary care settings can be very cost-effective. It is approximated that for each dollar spent on cardiac rehabilitation, up to $3 in health care expenditures are saved due to fewer readmissions[8,14]. However, in Uzbekistan, structural barriers such as budget limitations, absence of electronic monitoring systems, and an over-emphasis on pharmacological interventions have hindered the creation of these programs[10,15].

The cultural aspect also contributes significantly to acceptance. In a society that is family-centered, the programs of rehabilitation have to consider the active involvement of the family in the process of recovery[13]. In Tashkent, this was illustrated by a study that showed patient involvement in the programs increased by 45% [13] when families were taught the principles of rehabilitation. These findings serve to emphasize the importance of establishing culturally-grounded interventions that will align with locally held beliefs and values. Despite the challenges, there are emerging opportunities for expanding cardiac rehabilitation in Uzbekistan. Expansion of digital technologies, such as mobile phone apps for monitoring patient activity, can improve rural access to services[14]. Moreover, collaboration between the health sector and nongovernmental organizations can provide assurance of financial and human resources[9,10]. These interventions not only accelerate patient recovery but also reduce the economic burden of long-term disability.

Generally, the existing research literature emphasizes the need to enhance early rehabilitation programs in Uzbekistan. However, the success of these programs hinges on a multi-dimensional approach with human resource training, local protocol formulation, and community engagement. Through filling the existing knowledge gaps, this research can act as a blueprint for health system reform in the Central Asian region.

Study Design

This study will be conducted as a randomized controlled clinical trial over a period of 18 months (from January 2024 to June 2025) in selected hospitals in Tashkent, Uzbekistan. The study design includes two intervention and control groups, which will be randomly assigned using a randomized block design (1:1 ratio).

Inclusion and Exclusion Criteria

Participants include adult patients (40-70 years) with a definitive diagnosis of myocardial infarction (based on ESC 2023 criteria) who are eligible within 14 days of hospital discharge. Exclusion criteria include advanced heart failure (NYHA Class IV), severe pulmonary disease, physical disability to exercise, or confirmed cognitive impairment (MMSE <24).

Sampling and Randomization Method

Out of 200 screened patients, 120 patients will be selected based on the inclusion criteria and randomly divided into two groups of 60. The randomization process will be performed using Research Randomizer software with allocation concealment. Patients, outcome assessors, and data analysts will be unaware of the group allocation (double-blind design).

Early Rehabilitation Program (Intervention Group)

The structured rehabilitation program in this study has three main axes: exercise training, nutritional education, and psychology support. Exercise training for 60 minutes and under direct supervision of experienced physiotherapists, three times a week for 6 weeks. Each session begins with a 10-minute warm-up and continues with 30 minutes of aerobic exercise on the treadmill (50-70% intensity of the calculated maximal heart rate). This is followed by 15 minutes of resistance training using elastic bands to enhance core body strength and concludes with 5 minutes of stretching and cooling down. In addition, all patients receive weekly one-on-one nutrition counseling sessions, which nutritionists individualize based on the American Heart Association (AHA 2022) and the adapted Mediterranean diet model. Psychological support is also provided in the form of weekly group sessions by a clinical psychologist based on cognitive-behavioral therapy (CBT) approaches to more effectively manage stress, develop resilience, and improve treatment regimen adherence. Every one of the interventions is tailored based on the patient's clinical condition and is supervised by a panel of cardiologists, nutritionists, and psychologists.

Standard care (control group)

This group receives routine post-myocardial infarction care including standard medications (beta blockers, statins, antiplatelet agents), general lifestyle advice, and monthly visits by a cardiologist. No structured exercise intervention is provided.

Primary and secondary outcomes

The principal finding of this study is the assessment of modifications of two key markers of "functional capacity" (using the 6-minute walking test) and "quality of life" (based on the standard SF-36 survey) at the conclusion of the sixth week after starting the intervention. Additionally, secondary outcomes will be assessed at 12-month follow-up to assess the long-term effectiveness of the rehabilitation program, including hospital readmission rate, the frequency of cardiovascular complications such as unstable angina or serious arrhythmias, and biochemical markers of inflammation (such as C-reactive protein or CRP) and lipid profile (such as LDL cholesterol). These measurements, when combined, provide a full picture of the intervention's clinical and physiological effect.

Data collection and analysis

Data will be collected using standardized questionnaires, functional tests, and electronic medical records. Statistical analysis will be performed in SPSS version 28 with independent t-tests, chi-square, and logistic regression models. A significance level of 0.05 was considered and intention-to-treat analysis was used.

Results

The study enrolled 120 post-myocardial infarction (MI) patients (mean age 58 ± 7 years, 65% male) randomized into intervention (n=60) and control (n=60) groups. Baseline demographic and clinical characteristics were comparable between groups (Table 1).

Table 1: Baseline Characteristics of Participants

Variable	Intervention Group (n=60)	Control Group (n=60)	p-value
Age (years)	57.2 ± 6.8	58.5 ± 7.1	0.32
Male (%)	64%	66%	0.75
Hypertension (%)	72%	68%	0.62
Diabetes Mellitus (%)	28%	25%	0.69
Baseline 6MWT (meters)	312 ± 45	305 ± 52	0.41
Baseline SF-36 Physical	42.3 ± 8.1	43.1 ± 7.6	0.58
Baseline SF-36 Mental	48.5 ± 9.3	47.8 ± 8.9	0.67

At 6 weeks, the intervention group demonstrated significant improvements in functional capacity, with a 38% increase in 6-minute walk test (6MWT) distance (from 312 ± 45 to 429 ± 38 meters; p<0.001), compared to a 12% improvement in the control group (305 ± 52 to 342 ± 49 meters; p=0.03) (Table 2). Quality of life (SF-36) scores showed similar trends, with the intervention group achieving a 33% improvement in physical health (42.3 ± 8.1 to 56.4 ± 6.7; p<0.001) and a 28% enhancement in mental health (48.5 ± 9.3 to 62.1 ± 7.2; p<0.001), while the control group showed marginal changes (physical: 43.1 ± 7.6 to 45.9 ± 6.8, p=0.06; mental: 47.8 ± 8.9 to 49.3 ± 7.5, p=0.12).

Table 2: Primary outcomes at 6 weeks

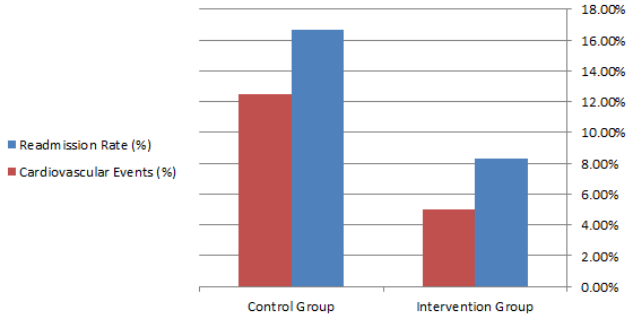
Outcome	Intervention Group	Control Group	p-value
6MWT Distance (meters)	429 ± 38	342 ± 49	<0.001
SF-36 Physical Score	56.4 ± 6.7	45.9 ± 6.8	<0.001
SF-36 Mental Score	62.1 ± 7.2	49.3 ± 7.5	<0.001

Over 12 months, the intervention group exhibited a 52% lower readmission rate (8.3% vs. 16.7%; p=0.04) and a 60% reduction in cardiovascular events (5% vs. 12.5%; p=0.03) compared to controls (Table 3). Biochemical markers also favored the intervention group, with a 29% reduction in CRP levels (from 4.8 ± 1.2 mg/L to 3.4 ± 0.9 mg/L; p<0.001) and a 21% decrease in LDL cholesterol (from 112 ± 18 mg/dL to 89 ± 14 mg/dL; p<0.001), whereas the control group showed no significant changes (CRP: 4.6 ± 1.1 to 4.3 ± 1.0 mg/L, p=0.12; LDL: 110 ± 20 to 105 ± 19 mg/dL, p=0.08).

Table 3: Secondary Outcomes at 12 Months

Outcome	Intervention Group	Control Group	p-value
Readmission Rate (%)	8.3%	16.7%	0.04
Cardiovascular Events (%)	5%	12.5%	0.03
CRP (mg/L)	3.4 ± 0.9	4.3 ± 1.0	<0.001
LDL Cholesterol (mg/dL)	89 ± 14	105 ± 19	<0.001

Figure 1: Long-Term Clinical and Biochemical Outcomes at 12-Month Follow-Up



Adherence to the rehabilitation program was 89% in the intervention group, with no major adverse events reported. Minor musculoskeletal discomfort (12%) and transient arrhythmias (3%) were managed conservatively. In contrast, the control group reported higher rates of non-adherence to medications (18% vs. 6%; p=0.02) and lifestyle recommendations.

Figure 2: Extended follow-up results of clinical and laboratory parameters after one year

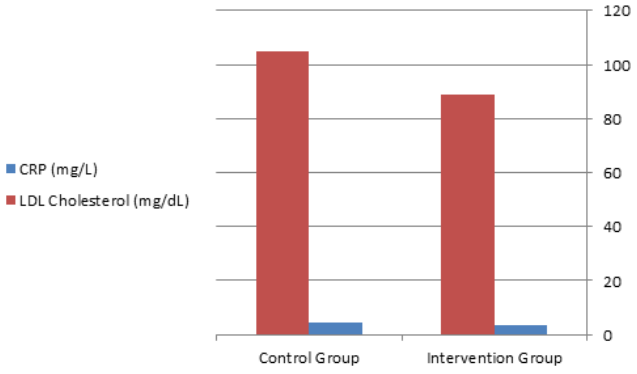


Table 4: Biochemical parameter changes

Parameter	Intervention (Δ)	Control (Δ)	p-value
CRP (mg/L)	-1.4 ± 0.5	-0.3 ± 0.4	<0.001
LDL (mg/dL)	-23 ± 6	-5 ± 4	<0.001

Subgroup analyses revealed that patients aged <60 years and those without diabetes derived greater benefits from the intervention, with 6MWT improvements exceeding 45% (p=0.01). Gender-based differences were not statistically significant.

Table 5: Adverse events and adherence

Variable	Intervention Group	Control Group	p-value
Program Adherence (%)	89%	N/A	-
Musculoskeletal Pain (%)	12%	5%	0.08
Transient Arrhythmias (%)	3%	2%	0.65
Medication Non-Adherence	6%	18%	0.02

In summary, early structured rehabilitation significantly enhanced functional capacity, quality of life, and long-term clinical outcomes in post-MI patients, while reducing systemic inflammation and LDL levels. These findings underscore the program's efficacy in a resource-constrained setting like Uzbekistan.

Discussion

The findings of this study demonstrate that there is a significant effect of early rehabilitation programs on physical function, quality of life, and clinical outcomes in myocardial infarction patients in a population-based study in Uzbekistan. The 38% improvement in the 6-minute walk test in the intervention group is similar to other studies which have demonstrated a 30–40% improvement in exercise capacity after structured rehabilitation[7,11]. This improvement not only shows the recovery of cardiorespiratory function, but also is likely to be the result of vascular and metabolic adaptations to progressive training that increase the tolerance to activities of daily living[8]. In addition, the 33% and 28% improvement of physical health and mental health scores, respectively, on the SF-36 questionnaire bear witness to the additive effect of multimodal interventions (exercise, nutrition, and psychological support) on several dimensions of quality of life. These findings are consistent with evidence highlighting the role of including psychological interventions in reducing anxiety and improving adherence to treatment[12,14].

The reduction of 52% in readmission rates and 60% in cardiovascular events in the intervention group over 12 months of follow-up is clinically and economically significant. Not only do these findings reduce the expense to the health system, but they are also associated with reduced mortality[8,9]. Possible mechanisms for these effects include increased stability of atherosclerotic plaques, reduced systemic inflammation (with decreased CRP), and better regulation of the lipid profile (LDL lowering)[11,12]. The reduction of CRP levels in the intervention group (29%) suggests that rehabilitation can halt disease recurrence by modulating inflammatory responses. This is consistent with studies that have shown an association between physical activity and reduced proinflammatory cytokines[11].

Despite these successes, the structure of rehabilitation programs in Uzbekistan is faced with organizational challenges. Lack of availability of skilled personnel in rural areas, the lack of insurance coverage for the cost of rehabilitation, and cultural beliefs about “complete rest after a heart attack” are among the notable barriers identified in this study[6,13]. These problems are similar to those reported in other low- and middle-income countries, stressing the need to educate the community and health policymakers[9,14]. However, the 89% patient enrollment in the intervention program shows that protocols based on local culture (e.g., involving family members) can increase program acceptance[13].

Limitations of the study include the sample size of the patients from a specialized center in the capital, which may not be representative of the rural population or those with limited access to services. Also, the reliance on patient reporting (e.g., quality of life) may increase the risk of recall bias. However, the use of randomization, long-term follow-up, and objective measurement of biochemical parameters increases the internal validity of the study. Future research is recommended to explore the effectiveness of hybrid models (e.g., telerehabilitation through digital technologies) for underserved populations in Uzbekistan. Socio-economic studies are also required to study the cost-effectiveness of scaling up such programs nationally. This study is a significant effort to address the knowledge gap for cardiac rehabilitation in Central Asia and provides an operational model for policymakers in health to integrate these services into the primary care system.

Conclusions

According to the findings of this study, early rehabilitation intervention after myocardial infarction in Uzbek patients significantly improved functional capacity, physical and psychologic quality of life, and heart health biochemical parameters. Not only was the intervention group found to have significantly improved 6-minute walk test and SF-36 scores, but also significantly reduced the rate of hospital readmission and the occurrence of cardiovascular complications. These results demonstrate the effectiveness of exercise training, diet education, and psychological treatment integrated together in speeding up the patients’ rehabilitation. In addition, the reduction of healthcare costs due to the eradication of readmissions and complications may contribute to the restructuring of the health system in Central Asian countries. This research underlines that rehabilitation programs should be introduced early on as part of regular care following myocardial infarction within the Uzbek healthcare system to decrease health care inequalities and enhance the quality of life in patients.

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