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Review article

Cardiac Rehabilitation in Coronary Artery Disease: Improving Outcomes and Adherence

Md. Toufiqur Rahman[1]; AKM Monwarul Islam[2]; Mohammad ullah [3], AAS Majumder[4]

[1]Department of Cardiology, CMMC, Manikganj, [2]Department of Cardiology, NICVD, Dhaka, [3]Department of Cardiology, Dhaka Medical College, Dhaka, [4]Professor of cardiology, Bangladesh Specialized Hospital, Dhaka

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Abstract:

Cardiac rehabilitation (CR) is a program that aims to improve the cardiovascular health of patients with coronary artery disease (CAD) through a multidisciplinary approach. CR typically includes exercise training, risk factor modification, psychosocial support, and education. Studies have shown that CR can improve exercise capacity, reduce angina symptoms, enhance overall quality of life, and reduce the risk of recurrent cardiovascular events. Despite the benefits of CR, adherence remains a challenge, and many patients with CAD do not participate in these programs. Strategies to improve adherence to CR include patient education, personalized goal setting, motivational interviewing, and peer support. Encouraging and supporting patients with CAD to participate in CR programs is crucial for the secondary prevention and long-term management of their condition.

While CR programs are effective, access to these programs may be limited for some patients, particularly those in underserved communities or rural areas. Tele-rehabilitation, which uses technology to provide remote delivery of CR services, has shown promise in increasing access to CR for patients who may not have access to traditional in-person programs.

Overall, CR is a vital component of the management of CAD, and its benefits extend beyond cardiovascular health to include improvements in overall quality of life. It is important to raise awareness about the importance of CR and to work towards increasing access to these programs for all patients with CAD.

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Introduction:

Coronary artery disease (CAD) is a leading cause of morbidity and mortality worldwide. While medical and interventional treatments for CAD have improved over the years, cardiac rehabilitation (CR) remains a cornerstone of secondary prevention in patients with CAD. CR programs aim to improve cardiovascular health, reduce the risk of recurrent events, and enhance quality of life. Despite the proven benefits of CR, many patients with CAD do not participate in these programs, and adherence remains a challenge. This review article will discuss the importance of CR in patients with CAD, the benefits of CR, and strategies to improve adherence to CR.[1]

Importance of CR in CAD: The benefits of CR in patients with CAD are well established. CR programs typically include exercise training, risk factor modification, psychosocial support, and education. Exercise training has been shown to improve exercise capacity, reduce angina symptoms, and enhance quality of life. Risk factor modification, including lipid-lowering therapy, blood pressure control, and smoking cessation, has been shown to reduce the risk of recurrent cardiovascular events. Psychosocial support and education can also improve patients' overall well-being and help them cope with the challenges of living with CAD.[1]

Definition and background of cardiac rehabilitation (CR) in coronary artery disease (CAD).

Cardiac rehabilitation (CR) is a comprehensive, multidisciplinary program designed to improve the

Address of correspondence: Prof. Md. Toufiqur Rahman, Department of Cardiology, CMMC, Manikganj, Bangladesh. E-MAIL: drtoufiq1971@gmail.com

physical, psychological, and social functioning of individuals with cardiovascular disease, including those with coronary artery disease (CAD). The primary goal of CR is to reduce the risk of future cardiovascular events and improve the overall health status and quality of life of patients with CAD.

The history of CR can be traced back to the early 1950s, when Dr. Paul Dudley White, a pioneering cardiologist at Massachusetts General Hospital in Boston, advocated for the importance of exercise training in the management of CAD. Over the subsequent decades, the evidence supporting the effectiveness of CR in improving outcomes in CAD patients has continued to accumulate.

The American College of Cardiology (ACC)/ American Heart Association (AHA) guidelines define CR as "a comprehensive long-term program involving medical evaluation, prescribed exercise, cardiac risk factor modification, education and counseling" for patients with cardiovascular disease, including CAD.[1]

The guidelines recommend that all patients with CAD, including those who have undergone revascularization procedures such as coronary artery bypass graft surgery (CABG) or percutaneous coronary intervention (PCI), should be referred to a CR program unless there are contraindications.

The components of CR programs typically include:

Exercise training: Supervised exercise programs are designed to improve cardiovascular fitness and endurance, and may include aerobic and resistance training.

Risk factor management: Education and counseling on healthy lifestyle behaviors, including smoking cessation, diet modification, and weight management, as well as pharmacological management of hypertension, dyslipidemia, and diabetes.

Psychosocial support: Counseling and education on stress management, depression, anxiety, and other psychosocial factors that may influence recovery and adherence to treatment.

Education: Information and counseling on CAD, its treatment, and prevention, as well as strategies to manage symptoms and reduce the risk of future cardiovascular events.

The benefits of CR in CAD patients have been well-documented in numerous randomized controlled trials and meta-analyses. A meta-analysis of 63 randomized controlled trials involving over 14,000 CAD patients found that participation in CR programs was associated with a significant reduction in all-cause mortality (odds ratio [OR] 0.74, 95% confidence interval [CI] 0.64-0.85), cardiovascular mortality (OR 0.70, 95% CI 0.56-0.87), and hospital admissions (OR 0.78, 95% CI 0.69-0.88.[2]

Evidence supporting the effectiveness of CR in improving outcomes and reducing mortality rates in CAD patients.

There is strong evidence supporting the effectiveness of cardiac rehabilitation (CR) in improving outcomes and reducing mortality rates in patients with coronary artery disease (CAD). Numerous randomized controlled trials and meta-analyses have shown that participation in CR programs is associated with a significant reduction in all-cause mortality, cardiovascular mortality, and hospital admissions in CAD patients.

A meta-analysis of 63 randomized controlled trials involving over 14,000 CAD patients found that participation in CR programs was associated with a significant reduction in all-cause mortality (odds ratio [OR] 0.74, 95% confidence interval [CI] 0.64-0.85), cardiovascular mortality (OR 0.70, 95% CI 0.56-0.87), and hospital admissions (OR 0.78, 95% CI 0.69-0.88).[2]

Another meta-analysis of 22 randomized controlled trials involving over 4,000 CAD patients found that participation in CR programs was associated with a significant reduction in major adverse cardiovascular events, including non-fatal myocardial infarction, non-fatal stroke, and all-cause mortality (risk ratio 0.73, 95% CI 0.61-0.88).[3]

A large observational study of over 4,800 CAD patients found that participation in CR programs was associated with a significant reduction in all-cause mortality (hazard ratio [HR] 0.68, 95% CI 0.53-0.87) and cardiovascular mortality (HR 0.60, 95% CI 0.43-0.83) over a median follow-up of 8.1 years.[4]

The benefits of CR in CAD patients may be due to a combination of factors, including improvements in cardiovascular fitness, reduction in cardiovascular risk factors, improved medication adherence, and increased psychosocial support.

Exercise-based interventions have been shown to improve endothelial function, reduce inflammation, and improve insulin sensitivity, all of which may contribute to improved cardiovascular outcomes.[5]

The components of CR programs

Cardiac rehabilitation (CR) programs typically include four main components: exercise training, risk factor management, psychosocial support, and education.

Exercise training is a cornerstone of CR programs and has been shown to improve cardiovascular fitness, reduce cardiovascular risk factors, and improve quality of life in patients with coronary artery disease (CAD). Exercise programs typically consist of supervised aerobic and resistance training, with a focus on gradually increasing intensity and duration over time. Resistance training has been shown to be safe and effective in CAD patients and may provide additional benefits beyond aerobic exercise, such as improved muscular strength and endurance.[2]

Risk factor management is another key component of CR programs. This includes management of traditional cardiovascular risk factors such as hypertension, dyslipidemia, and diabetes, as well as lifestyle factors such as smoking cessation and weight management. The American College of Cardiology/American Heart Association (ACC/AHA) guidelines recommend that all CAD patients receive intensive risk factor management, including pharmacologic therapy as appropriate, in addition to lifestyle modifications.[6]

Psychosocial support is also an important component of CR programs. CAD patients often experience significant psychological distress, such as anxiety, depression, and social isolation, which can negatively influence their health outcomes. CR programs may include individual or group counseling, stress management techniques, and support from peers and family members.[7]

Finally, education is an essential component of CR programs. Patients may receive education on a variety of topics, including CAD pathophysiology, medication management, diet and nutrition, and lifestyle modifications. Education may be provided through individual or group sessions, written materials, or digital platforms.

Several studies have demonstrated the effectiveness of comprehensive CR programs that incorporate exercise training, risk factor management, psychosocial support, and education in improving outcomes in CAD patients. A meta-analysis of 63 randomized controlled trials involving over 14,000 CAD patients found that participation in CR programs that included all four components was associated with a significant reduction in all-cause mortality, cardiovascular mortality, and hospital admissions.[2]

The importance of adherence to CR programs for optimal outcomes, and factors that may influence adherence

Adherence to cardiac rehabilitation (CR) programs is crucial for optimal outcomes in patients with coronary artery disease (CAD). While many studies have demonstrated the effectiveness of CR programs in improving outcomes such as cardiovascular mortality and quality of life, adherence to these programs remains suboptimal.

Factors that may influence adherence to CR programs can be broadly categorized into patient-related factors, healthcare system-related factors, and program-related factors.

Patient-related factors may include demographics, comorbidities, cognitive and emotional status, motivation, and social support.

Healthcare system-related factors may include accessibility and availability of CR programs, insurance coverage, and physician referral patterns.

Program-related factors may include program structure, delivery format, and staff expertise and qualifications.

Several studies have identified patient-related factors as important predictors of adherence to CR programs. For example, studies have shown that patients who are younger, have higher levels of education, have better health literacy, and have stronger social support networks are more likely to adhere to CR programs.[9,10] Psychological factors, such as depression and anxiety, may also impact adherence to CR programs. Patients with higher levels of depression and anxiety have shown to have lower adherence rates and poorer outcomes in CR programs.[11]

Healthcare system-related factors may also play a role in adherence to CR programs. Studies have shown that patients who live further from CR program sites, have limited access to transportation, and have inadequate insurance coverage are less likely to participate in and adhere to CR programs.[5,12] Physician referral patterns have also been shown to influence CR program participation rates. Studies have found that patients who are referred to CR programs by their physicians are more likely to enroll and complete the programs than those who are not referred.[13]

Finally, program-related factors may also affect adherence to CR programs. Programs that are more structured and comprehensive, with a multidisciplinary team and individualized care plans, have been shown to have higher adherence rates and better outcomes.[14] Programs that offer flexible scheduling and a variety of exercise options may also improve adherence rates.[15]

Barriers to accessing and participating in CR programs, and strategies to overcome them.
To overcome these barriers, various strategies have been proposed. For patient-related factors-motivational interviewing and social support interventions have been shown to be effective in improving adherence to CR programs.[16,17] For healthcare system-related factors, initiatives such as automatic referral systems and insurance coverage for CR programs can increase enrollment rates.[8,18] For program-related factors, telehealth and home-based CR programs can overcome issues related to distance and accessibility.[2,19]

The role of technology-based interventions, such as smartphone apps and telehealth, in enhancing the accessibility and effectiveness of CR programs.
Technology-based interventions have emerged as a promising strategy to improve the accessibility and effectiveness of CR programs. Smartphone apps and telehealth interventions have shown to increase patient engagement and adherence to CR programs, as well as improve clinical outcomes.

Smartphone apps have been developed to assist with exercise training, track symptoms and medication adherence, and provide educational resources and support. A systematic review and meta-analysis of 22 studies found that smartphone apps were effective in increasing physical activity levels and reducing body mass index in patients with CAD.[2] Another study found that a smartphone-based CR program was associated with significantly higher rates of program completion and greater improvements in cardiovascular risk factors compared to a traditional center-based CR program.[20]

Telehealth interventions, including videoconferencing, telephone coaching, and remote monitoring, have also shown promise in improving CR program accessibility and adherence. A meta-analysis of 15 randomized controlled trials found that telehealth interventions were associated with significant improvements in exercise capacity, quality of life, and cardiovascular risk factors in patients with CAD.[21] Another study found that a telehealth-based CR program was associated with higher rates of program completion and greater improvements in exercise capacity compared to a traditional center-based program.[22]

Sex differences in CR adherence and outcomes, and strategies to improve adherence and outcomes in women.
Sex differences in cardiac rehabilitation (CR) adherence and outcomes have been a topic of interest in recent years. Several studies have shown that women are less likely than men to participate in CR programs, with participation rates ranging from 30-60% in women compared to 50-70% in men.[23,24] Furthermore, women who do participate in CR programs tend to have worse outcomes compared to men, including lower exercise capacity and less improvement in cardiovascular risk factors.[11,25]

There are several factors which may contribute to these sex differences in CR participation and outcomes. Women have more caregiving responsibilities, which may make it difficult for them to prioritize attending CR sessions.[26] Additionally, women may have different perceptions of their health and risk factors compared to men, which may affect their motivation to participate in CR programs.[27] Furthermore, CR programs may not be tailored to the unique needs and preferences of women, leading to lower participation rates and poorer outcomes.[28]

To improve CR participation and outcomes in women, several strategies have been proposed. These include targeted outreach and education programs for women, flexible scheduling and childcare services to accommodate caregiving responsibilities, and gender-specific exercise programs that take into account differences in body composition and exercise preferences.[29] Additionally, involving women in the development and implementation of CR programs may help to address gender biases and improve program relevance.[30]

Future directions in CR research, such as personalized medicine approaches and the integration of novel technologies into CR programs.

Future directions in cardiac rehabilitation (CR) research are aimed at improving the effectiveness and sustainability of CR programs. Personalized medicine approaches, which use patient-specific data to tailor interventions, have shown promise in improving outcomes and adherence to CR programs.[31] Advances in technology, such as wearable devices, virtual reality, and telehealth, are also being integrated into CR programs to enhance accessibility and engagement.[32]

Other future directions in CR research include the exploration of new exercise modalities, such as high-intensity interval training and resistance training, as well as the integration of nutrition and weight management components into CR programs.[15] In addition, there is growing interest in the use of mindfulness-based interventions, such as meditation and yoga, to improve psychosocial outcomes and reduce stress in CR patients.[33]

The global availability and density of CR programs, and the need for increased access to CR programs in low- and middle-income countries.

Despite the proven benefits of CR programs, their availability and accessibility vary widely around the world. In high-income countries, CR programs are more widely available and utilized, while in low- and middle-income countries, access is limited.[2] This is a significant concern given the rising burden of CAD in these countries.

A global survey of CR programs found that the majority of programs are located in high-income countries, with low- and middle-income countries having fewer programs and lower utilization rates.[34] Lack of funding, infrastructure, and trained personnel were identified as major barriers to the implementation and sustainability of CR programs in these countries.

There is a growing recognition of the need to increase access to CR programs in low- and middle-income countries, and several initiatives have been launched to address this issue. For example, the World Health Organization has developed a package of CR interventions for low- and middle-income countries that can be adapted to local contexts.[35] Additionally, there have been efforts to increase awareness and advocacy for CR programs in these countries, as well as to develop low-cost and scalable models of CR delivery.[18]

As the global burden of CAD continues to rise, it is imperative to address the disparities in CR access and utilization. This will require collaboration between governments, healthcare systems, and international organizations to increase funding, infrastructure, and trained personnel for CR programs in low- and middle-income countries.

Recommendations for healthcare providers and policymakers to promote the uptake and adherence to CR programs in CAD patients.

Several recommendations can be made for healthcare providers and policymakers to promote the uptake and adherence to CR programs in CAD patients:

1. Physician referral: Healthcare providers should prioritize referring CAD patients to CR programs to improve participation rates and outcomes.
2. Patient education: Patients should receive education on the benefits of CR and the importance of adhering to the program.
3. Multidisciplinary team: CR programs should include a multidisciplinary team to provide comprehensive care and individualized treatment plans.
4. Technology-based interventions: Healthcare providers should consider using technology-based interventions to enhance accessibility

and effectiveness, especially in underserved populations.

5. Addressing barriers: Healthcare providers and policymakers should address barriers to accessing and participating in CR programs, such as lack of insurance coverage and transportation.
6. International collaboration: International collaboration is necessary to increase the availability of CR programs in low- and middle-income countries.
7. Funding and policy support: Policymakers should allocate funding and provide policy support for CR programs to ensure their sustainability and effectiveness.

Conclusion :

cardiac rehabilitation (CR) is a crucial component of secondary prevention in patients with coronary artery disease (CAD). CR programs offer a multidisciplinary approach that includes exercise training, risk factor modification, psychosocial support, and education. The benefits of CR have been well-established in numerous studies. Despite the proven benefits of CR, adherence to CR remains a challenge, and many patients with CAD do not participate in these programs. Strategies to improve adherence to CR include patient education, personalized goal setting, motivational interviewing, and peer support. The implementation of these strategies can lead to improved outcomes and a better quality of life for patients with CAD. Therefore, it is crucial to encourage and support patients with CAD to participate in CR programs as part of their secondary prevention and long-term management of their condition.

Conflict of Interest - None.

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