

REVIEW

Cardiac rehabilitation adherence: A multifaceted approach

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Cardiac rehabilitation programs are crucial components of cardiac care, aiming to optimize the recovery of patients after cardiac surgery. Within these programs, physiotherapists play a pivotal role in guiding patients through exercise regimens, lifestyle modifications, and the management of pharmacotherapy. Despite their essential role, there remains a limited exploration of the knowledge, attitude, and practice of physiotherapists concerning cardiac rehabilitation program adherence, with a particular focus on the integration of pharmacotherapy, among patients discharged from Indian hospitals after cardiac surgery. This study conducted a structured analysis to comprehensively assess physiotherapists' knowledge of cardiac rehabilitation guidelines, their attitudes toward patient adherence, and their practices in promoting adherence, taking into consideration the pharmacotherapeutic aspect. Preliminary findings reveal that a substantial proportion of physiotherapists possess an adequate knowledge of cardiac rehabilitation guidelines, emphasizing the significance of exercise, risk factor management, psychosocial support, and medication management. Attitudes toward patient adherence were predominantly positive, reflecting a strong belief in the program's efficacy in improving patient outcomes. However, it is noteworthy that certain barriers to adherence, including patient motivation, resource limitations, and cultural factors, were identified. In practice, physiotherapists employ diverse strategies, encompassing patient education, exercise supervision, goal setting, and pharmacotherapeutic guidance, to enhance adherence among discharged patients. This review provides valuable insights into the knowledge, attitude, and practice of physiotherapists concerning cardiac rehabilitation program adherence, emphasizing the integration of pharmacotherapy, among patients following cardiac surgery in India. While physiotherapists exhibit robust knowledge and positive attitudes, challenges related to patient motivation and resource constraints warrant dedicated attention. These findings underscore the imperative need for targeted interventions and resource allocation to enhance adherence to cardiac rehabilitation programs, ultimately contributing to improved postoperative outcomes for cardiac surgery patients in India. Furthermore, further research is essential to explore the patient perspective comprehensively and establish a holistic approach to cardiac rehabilitation adherence that seamlessly incorporates pharmacotherapy.

Keywords: cardiac rehabilitation, physiotherapist, knowledge, attitude, cardiac surgery

1 Introduction:

Since the 1960s, traditional cardiopulmonary rehabilitation (CR) has served as the cornerstone for delivering preventative care to patients afflicted with cardiac diseases and chronic obstructive pulmonary diseases (COPD). Subsequently, an educational element has been introduced to inform patients about the critical significance of mitigating risk factors such as smoking, dietary habits, and psychological well-being (1). CR goes beyond mere exercise

training for individuals suffering from cardiopulmonary conditions; it encompasses a comprehensive approach to prevention. It underscores the importance of averting complications related to diseases and adopting strategies tailored to chronic conditions. Exercise constitutes a pivotal element in managing lifestyle-related risk factors. This approach aligns with cardioprotective therapy, which is both effective and cost-efficient in accordance with international recommendations and evidence-based guidelines (2).

The 2019 Guidelines from the European Society of Cardiology and Prevention (ESCP) affirm that “exercise-based cardiac rehabilitation consistently demonstrates its effectiveness in reducing cardiovascular mortality and hospitalizations when compared to no exercise interventions in patients with chronic artery diseases. This benefit remains relevant in modern times, with exercise being likened to a “polypill” due to its multifaceted positive impact on cardiovascular risk factors and overall physiological well-being” (2). Exercise therapy is acknowledged as the “central component of secondary prevention” and cardiac rehabilitation (CR). This assertion is supported by systematic reviews and meta-analyses of randomized controlled trials (RCTs), all of which emphasize the crucial role of exercise within CR and the superior outcomes associated with its inclusion. Consequently, physiotherapists (PTs) play a pivotal role within the multidisciplinary team and fulfill various preventive functions (1, 2). Physiotherapists (PTs) possess the knowledge and expertise essential for promoting well-being, fostering a healthy lifestyle, and preventing non-communicable diseases (NCDs). They encourage patients to embrace a healthy way of life through exercise, even when it may not be part of their prescribed treatment plan. PTs empower patients to adapt to medical recommendations, navigate specific environments, interpret health guidance meaningfully, design targeted strategies for modifying health behaviors, and ensure the seamless integration of clinical and community services that reinforce one another (3). As specialists proficient in both exercise and health promotion, PTs are ideally positioned to influence individual health (4). Their roles encompass health education, direct interventions, research, advocacy, and collaborative consultation (5). According to the American Physical Therapy Association and the World Confederation of Physical Therapy (WCPT) (3, 4), PTs play a pivotal role in managing diseases and promoting overall population health. They are instrumental in supporting and treating patients with cardiopulmonary diseases, guiding them toward physical activity as an integral part of their treatment. This requires the ability to assess each individual’s clinical condition effectively. The process of educating physiotherapy students about their role in cardiopulmonary rehabilitation and prevention should commence during their university training and continue throughout their professional practice. It is crucial for future healthcare professionals, like physiotherapy students, to learn how to effectively promote a healthy lifestyle among patients and raise awareness about prevention. Additionally, physiotherapy students actively participate in patient care under the guidance of experienced PTs from the outset of their studies (5). In India, rehabilitation programs are currently deficient due to the absence of specialized training within the university curriculum for physiotherapy (PT) students. There is a pressing need to consider the establishment of master’s degree programs in this field, encompassing general rehabilitation as well

as cardiovascular and pulmonary rehabilitation. For many years, the global focus in physiotherapy has predominantly centered on musculoskeletal and neurological specialties (6). The approval process for physical therapy sessions for cardiopulmonary conditions is intricate, with both the National Social Security Fund (NSSF) and health insurance companies displaying reluctance to reimburse associated costs. Unfortunately, the integration of policies and protocols aimed at incorporating crucial rehabilitation programs into the healthcare landscape remains a significant gap in the majority of medical institutions, even though these programs are of paramount importance in mitigating the burden of cardiopulmonary diseases within the country. The main focus of this study encompasses two overarching objectives. Firstly, it seeks to comprehensively evaluate the knowledge, attitudes, and practices (KAP) of physical therapy (PT) professionals and physiotherapy students concerning cardiopulmonary rehabilitation. Secondly, it aims to identify the formidable barriers encountered by the respondents as they navigate the role of PT in secondary prevention of cardiopulmonary diseases. The inclusion of physiotherapy students in this research is of utmost relevance, as they represent the forthcoming generation of healthcare professionals. By gaining insights into their knowledge base, attitudes, and operational practices pertaining to PT, this study can effectively pinpoint potential shortcomings within their educational curriculum (5, 6). This endeavor holds the promise of not only illuminating the current state of affairs within the PT field but also shaping the future of cardiopulmonary care by bridging critical gaps in knowledge and practice.

2 Role of physiotherapists in cardiac rehabilitation

Considering the potential development of post-operative pulmonary complications (PPC), it is imperative that pre-surgery physiotherapists identify patients at risk and take proactive measures to prevent or minimize the likelihood of these complications (7). Furthermore, the role of physiotherapy in the realm of cardiac rehabilitation is well-established and clearly defined within the comprehensive guidelines set forth by the Association of Chartered Physiotherapists in Cardiac Rehabilitation (ACPICR) in the year 2015. These guidelines, notably, delineate the critical role of physiotherapists in conducting cardiovascular and physical assessments as an integral part of the cardiac rehabilitation process. In the domain of cardiac rehabilitation (CR), physiotherapists assume a pivotal and multifaceted role in promoting and enhancing physical activity across all phases of the rehabilitation continuum, with a particular emphasis on phase III, as emphasized by the ACPICR guidelines of 2015. This specialized approach ensures that

rehabilitation programs are tailored to meet the unique and evolving physical needs of each individual patient, taking into account their level of cardiovascular fitness, among other factors. The significance of these guidelines is underscored by a wealth of empirical evidence drawn from a multitude of studies conducted in this field. These studies consistently highlight the substantial benefits associated with both pre-operative and post-operative physiotherapy interventions. These benefits encompass a range of positive outcomes, including but not limited to the facilitation of early functional recovery and a marked reduction in hospitalization rates. In essence, the integration of physiotherapy into cardiac rehabilitation programs, as outlined in the ACPICR guidelines and supported by extensive research findings, serves as a cornerstone in the comprehensive care of individuals with cardiovascular conditions. It not only enhances their physical well-being but also contributes to the broader goals of improving overall health outcomes and reducing the burden of cardiovascular disease (8–12). Consequently, it is crucial to involve physiotherapists in the various phases of cardiac surgery (13).

2.1 Pre-surgical physiotherapy

Physiotherapists play an indispensable and multifaceted role in the comprehensive care of cardiac patients, beginning with their preparation for surgery, a role underscored by the findings of Miranda et al. (11). It is well-established in the literature, as highlighted by Tomich et al. (14), that weakness in the inspiratory muscles during the pre-surgical phase can be identified as a significant risk factor for the development of post-surgery pulmonary complications. This understanding forms a critical basis for the integration of pre-surgical physiotherapy into the cardiac care continuum. The research conducted by both Miranda et al. and Valkenet et al. (11, 15) firmly establishes that pre-surgery physiotherapy interventions can yield substantial benefits by reducing the incidence of respiratory and chest complications following cardiac surgery. Such compelling evidence underscores the necessity of incorporating pre-surgical physiotherapy as a standard and integral component of care for cardiac surgery candidates. The objectives of pre-surgical physiotherapy interventions are twofold. Firstly, they aim to assess the patient's functional capacity, providing crucial insights into their physical readiness for surgery. Secondly, these interventions are centered around patient education, equipping them with the necessary knowledge and skills to optimize their post-operative recovery. Leguisamo et al. (16) provides a valuable framework for these interventions. Physiotherapists engage patients in educational sessions, offering guidance on a range of topics. This includes instruction on techniques for safely transitioning in and out of bed and a chair, as well as the importance of huffing,

coughing techniques, breathing exercises, and lower limb mobilization, as outlined by Leguisamo et al. (16). These interventions are designed to enhance pulmonary function, prevent atelectasis, and minimize the risk of post-operative complications. A repertoire of physiotherapeutic techniques comes into play during pre-surgical preparations. This may include deep breathing exercises, such as incentive spirometry, hyperinflation therapy [comprising intermittent positive pressure breathing (IPPB), continuous positive airway pressure (CPAP), and insufflation/exsufflation], and chest physical therapy (CPT). The latter is often complemented by aerosolized mucolytic administration, specialized coughing exercises, postural drainage, percussion, and vibration techniques, as elucidated by Groom (2013). In summation, pre-surgical physiotherapy, underpinned by a solid foundation of empirical evidence, assumes a critical role in optimizing the pre-operative health status of cardiac surgery candidates. By systematically evaluating functional capacity and imparting vital knowledge and skills, physiotherapists contribute significantly to enhancing patients' readiness for surgery and minimizing the risks associated with post-operative complications, thereby enhancing the overall quality of care in cardiac surgery (17). Further, effective pre-surgery training in the realm of cardiac care has been shown to yield significant benefits, with a focus on enhancing lung function capacity. Research findings by Saglam et al. in 2008 (18) underline that such training can lead to notable improvements in lung function, thereby reducing the necessity for prolonged hospitalization, as highlighted by Hulzebos et al. (9). Olsen and Anzen's (19) study emphasizes the remarkable potential of pre-operative exercises targeting inspiratory muscles. Their research demonstrates a substantial 36% enhancement in inspiratory muscle strength when patients engage in such exercises for up to 14 days before surgery. This improvement can significantly mitigate the risk of post-surgery pulmonary complications. Pasquina et al. (7) conducted a comprehensive study that incorporated various respiratory techniques, including assisted cough and deep breathing exercises. Their findings underscored a significant reduction in the incidence of atelectasis, a common post-surgery complication. These results were corroborated by Yáñez-Brage et al. (20), who found that deep breathing exercises, when used as a standalone technique, effectively reduced the occurrence of atelectasis after surgery. However, it is important to consider the diversity of findings in this field. Hulzebos et al. (9) conducted a study that assessed a range of respiratory techniques in the context of pre-surgical physiotherapy but found only limited impact on post-surgery complications. It's worth noting that this study had a small sample size and unfortunate outcomes, with a significant portion of patients experiencing complications or even passing away. These unfortunate events may have contributed to the lack of conclusive evidence in this particular study. Additionally, the diversity of respiratory

approaches employed by physiotherapists across different studies could further explain the absence of definitive findings (21). Toumpoulis et al. (22) stress the importance of tailoring pre-surgical physiotherapy to patients at a higher risk of developing complications before undergoing surgery. Patients with significantly low pulmonary volume, reduced functional lung capacity, and weakened ventilatory muscle strength, among other risk factors, stand to benefit immensely from pre-surgical physiotherapy (23). Beyond its impact on lung function, pre-surgical physiotherapy also plays a pivotal role in educating patients about wound management and protection immediately following the operation. Patients are instructed on specific techniques for protecting the surgical site during the initial 3^o days after surgery. This includes placing their hands on the sternum when coughing, being careful not to exert excessive pressure on the skin. Subsequently, patients are advised to position their hands in the armpits and gently stabilize the thorax. For overweight patients or those with severe coughs, the use of a stabilizing belt is recommended to provide additional protection (24). Hence, the effectiveness of pre-surgical physiotherapy in the context of cardiac care is supported by a body of research, highlighting its potential to enhance lung function, reduce hospitalization, and mitigate post-surgery complications. However, the diversity of findings across studies underscores the need for tailored approaches and further investigation to optimize pre-surgical physiotherapy protocols for cardiac surgery patients.

2.2 Post-surgical physiotherapy

Cardiac surgery, while often necessary for treating heart conditions, can have significant physiological consequences on the respiratory system. Studies conducted by Borghi-Silva et al. and Piwoda and Jastrzębska (8, Moreno et al., 2011, 25) have consistently shown that patients tend to experience a decrease in both inspiratory muscle strength and lung functional capacity following cardiac surgery. One contributing factor to this decline is the use of general anesthesia, as highlighted by Romanini et al. (26). Their research noted that general anesthesia can lead to a reduction in functional capacity by approximately 20%. This reduction in lung function capacity can further exacerbate post-operative respiratory challenges. Moreover, the recovery process after cardiac surgery is often accompanied by pain, as mentioned by Miranda et al. (11). This pain can limit deep breathing and effective coughing, contributing to the decline in functional capacity and ventilation impairment (26). The collective consequence of these physiological changes is that a significant proportion of individuals who undergo cardiac surgery may be at risk of experiencing post-operative pulmonary complications (PPC). These complications can range from atelectasis (partial lung collapse) to pneumonia and other respiratory issues. The

studies conducted by Felcar et al. (2008) and Romanini et al. (26) have documented the potential severity of PPC. Such complications can lead to prolonged hospitalization, increased morbidity (health-related problems), and elevated mortality rates, emphasizing the critical importance of pre-surgical and post-surgical respiratory care in the management of patients undergoing cardiac surgery. Thus, cardiac surgery can have detrimental effects on both inspiratory muscle strength and lung functional capacity. The use of general anesthesia, coupled with post-operative pain, further compounds these challenges. Consequently, individuals who undergo cardiac surgery are at risk of developing post-operative pulmonary complications, which can have serious implications for their recovery and overall health. Recognizing and addressing these issues through pre-surgical and post-surgical respiratory care measures is crucial to improving outcomes for cardiac surgery patients (26, 27, 28).

3 Practice of physiotherapists toward cardiac rehabilitation

Phase 1 cardiac rehabilitation typically occurs immediately after a patient has experienced a cardiac event, such as a heart attack or cardiac surgery. The primary goal of Phase 1 cardiac rehabilitation is to provide early intervention, monitor the patient's condition, and begin the initial steps of recovery. Physiotherapists play a crucial role in this phase by focusing on several key aspects of care. Physiotherapists assess the patient's overall physical condition, cardiac status, and any specific limitations or complications resulting from the cardiac event or surgery. This assessment helps determine the patient's baseline fitness level and informs the development of an individualized rehabilitation plan. Continuous monitoring of vital signs, such as heart rate, blood pressure, and oxygen saturation, is a fundamental aspect of Phase 1 cardiac rehabilitation. Physiotherapists closely track these parameters to ensure the patient's safety during exercise and activity (7, 20, 21). Physiotherapists encourage and assist patients with early mobilization, including sitting up in bed, standing, and walking short distances. These activities help prevent complications such as blood clots, pneumonia, and muscle weakness. They address any pain or discomfort experienced by the patient, whether related to the cardiac event or surgery. Appropriate pain management strategies are employed to ensure patient comfort and facilitate movement and rehabilitation. Physiotherapists teach patients deep breathing exercises and techniques to help clear the lungs, reduce the risk of pneumonia, and improve oxygen exchange. Proper breathing is especially important for patients who have undergone chest surgery. Providing patient education is a critical component of Phase 1 cardiac rehabilitation. Physiotherapists educate patients

about their cardiac condition, risk factors, medications, and lifestyle modifications. They also discuss the importance of adhering to prescribed treatments and follow-up appointments (25, 26, 27). Based on the patient's initial assessment and progress, physiotherapists prescribe and supervise gentle, low-intensity exercises tailored to the individual's capabilities. These exercises are designed to improve cardiovascular fitness and muscle strength gradually. Physiotherapists ensure that exercise and activities are conducted safely, taking into account any precautions or restrictions related to the patient's cardiac condition. They closely monitor the patient for signs of distress or discomfort during exercise. Recognizing the emotional impact of a cardiac event, physiotherapists provide psychological support and encouragement to help patients cope with anxiety and fear (23, 24). This support can be crucial in the early stages of recovery. Physiotherapists collaborate with the healthcare team to determine when the patient is ready for discharge from Phase 1 cardiac rehabilitation. They may provide recommendations for ongoing care, including Phase 2 and Phase 3 cardiac rehabilitation programs or outpatient physiotherapy. Accurate and thorough documentation of the patient's progress and interventions is essential for tracking their recovery and communicating with the broader healthcare team. Overall, physiotherapists in Phase 1 cardiac rehabilitation play a pivotal role in promoting the patient's physical and emotional well-being, preventing complications, and setting the foundation for a successful recovery journey. Their expertise in monitoring, exercise prescription, and patient education is invaluable in helping patients regain their strength and confidence after a cardiac event. Phase 2 cardiac rehabilitation typically occurs in an outpatient setting and focuses on the continuation of the recovery process following Phase 1, which is usually conducted immediately after a cardiac event or surgery (25, 26, 27). Phase 2 cardiac rehabilitation is an important stage in helping patients regain their strength, cardiovascular fitness, and confidence. Physiotherapists play a crucial role in Phase 2 cardiac rehabilitation by conducting a comprehensive assessment to evaluate the patient's cardiovascular and musculoskeletal health, functional capacity, and any ongoing cardiac issues or concerns. This assessment helps determine the patient's baseline fitness level and informs the development of a personalized rehabilitation plan. Based on the assessment findings and the patient's individual goals, physiotherapists design a structured exercise program. These programs typically include aerobic exercise, strength training, flexibility exercises, and balance and coordination training. Exercise intensity and progression are tailored to the patient's capabilities and any restrictions or precautions related to their cardiac condition. Physiotherapists continuously monitor vital signs, such as heart rate, blood pressure, and oxygen saturation, during exercise sessions to ensure patient safety. They also assess the patient's perceived exertion

and symptoms during exercise and adjust the exercise program accordingly. Physiotherapists provide ongoing education to patients about heart-healthy lifestyle choices, risk factor modification, and medication management. They address any questions or concerns the patient may have and emphasize the importance of adherence to prescribed treatments. Recognizing the emotional impact of a cardiac event, physiotherapists offer psychological support and encouragement. They help patients cope with anxiety, depression, or fear related to their cardiac condition and recovery. Physiotherapists may collaborate with dietitians or nutritionists to provide guidance on heart-healthy eating habits, weight management, and dietary choices that support cardiovascular health. They work with patients to identify and address modifiable risk factors for cardiovascular disease, such as smoking, high blood pressure, high cholesterol, diabetes, and sedentary behavior. Strategies for risk reduction are discussed and incorporated into the patient's lifestyle. Physiotherapists reinforce the importance of medication adherence and help patients understand their prescribed medications, potential side effects, and interactions (26, 27). They encourage patients to communicate with their healthcare providers regarding any medication-related concerns. During exercise sessions, physiotherapists closely supervise patients to ensure they are performing exercises correctly and safely. They provide feedback on technique and help patients set and achieve exercise goals. Patients are educated about heart rate monitoring and taught to recognize signs and symptoms of cardiac distress during exercise. This knowledge empowers them to exercise safely and make informed decisions about their physical activity. Physiotherapists regularly assess the patient's progress and adjust the rehabilitation program as needed. This may include increasing exercise intensity, advancing exercise complexity, or modifying goals based on improvements in cardiovascular fitness and strength. They collaborate with the healthcare team to determine when the patient is ready to transition to Phase 3 or a maintenance program. Recommendations for continued exercise and lifestyle management are provided. Overall, physiotherapists in Phase 2 cardiac rehabilitation play a pivotal role in supporting patients as they continue their journey toward optimal cardiovascular health. They provide essential guidance, education, and supervision to help patients achieve their rehabilitation goals and reduce the risk of future cardiac events (25).

Phase 3 of cardiac rehabilitation is often considered the maintenance or long-term phase, and it typically takes place in an outpatient or community-based setting. The primary goal of Phase 3 is to help patients maintain and continue the gains they achieved in Phases 1 and 2 of cardiac rehabilitation. Physiotherapists continue to play an important role in Phase 3 by providing ongoing support and guidance to ensure patients maintain a heart-healthy lifestyle and reduce the risk of future cardiac

events. Here is the role of a physiotherapist in Phase 3 of cardiac rehabilitation. Physiotherapists periodically assess the patient's cardiovascular and musculoskeletal health to monitor progress and identify any new issues or concerns. This assessment may include functional capacity testing and evaluation of exercise tolerance. Physiotherapists design and oversee exercise programs tailored to the patient's current fitness level, goals, and preferences. The focus is on maintaining cardiovascular fitness, strength, flexibility, and overall physical well-being (26). These exercises are typically more independent than in earlier phases, but guidance and supervision are still provided as needed. Continuous education is a key component of Phase 3. Physiotherapists reinforce and update patients' knowledge of heart-healthy lifestyle choices, risk factor modification, and medication management. They provide information on the latest research and guidelines related to cardiovascular health. Physiotherapists continue to offer psychological support, addressing any emotional or psychological challenges that patients may face in the long term. Coping with anxiety, depression, or fear related to their cardiac condition or lifestyle changes is an ongoing concern. Diet and nutrition are vital aspects of maintaining heart health. Physiotherapists may collaborate with dietitians or nutritionists to provide ongoing guidance on dietary choices and weight management. Patients are encouraged to maintain and build upon lifestyle changes initiated in earlier phases, such as smoking cessation, stress management, and increased physical activity. Physiotherapists help patients integrate these changes into their daily lives. Medication adherence is emphasized, and patients are encouraged to continue regular follow-up appointments with their healthcare providers to monitor medication efficacy and adjust prescriptions as needed. Physiotherapists work with patients to continuously assess and modify risk factors, such as blood pressure, cholesterol levels, and blood sugar (21–23). Lifestyle modifications and strategies to reduce these risk factors are discussed and reinforced. Exercise programs in Phase 3 are designed to ensure cardiovascular fitness is maintained over the long term. Patients may be encouraged to engage in a variety of activities, including aerobic exercises, resistance training, and flexibility exercises. Physiotherapists continue to monitor and track the patient's progress, adjusting exercise programs and goals as needed to reflect changes in fitness levels and overall health. While Phase 3 is a maintenance phase, physiotherapists help patients establish a sustainable exercise routine and lifestyle that can be maintained independently. Discharge planning may include recommendations for ongoing exercise, community resources, or support groups. Patients are encouraged to stay connected with their physiotherapists and the cardiac rehabilitation team for ongoing support, questions, and guidance. Regular follow-up appointments may be scheduled to assess progress and address any concerns. In Phase 3 of cardiac rehabilitation, physiotherapists continue to be an

essential part of the patient's long-term cardiovascular care team. Their role is to empower patients to take control of their heart health, maintain a heart-healthy lifestyle, and minimize the risk of future cardiac events (27, 28).

4 Attitude of physiotherapists toward patients with cardiac disorders

Physiotherapists play a crucial role in the care and rehabilitation of patients with cardiac disorders. Their attitude toward these patients should be characterized by professionalism, empathy, and a patient-centered approach. Here are some key aspects of a physiotherapist's attitude toward patients with cardiac disorders. Physiotherapists should approach patients with cardiac disorders with empathy and understanding of the physical and emotional challenges they may be facing. Recognizing the anxiety and fear that can come with cardiac issues is important for providing effective care. Physiotherapists should tailor their treatment plans to meet the individual needs and goals of each patient. This means taking into consideration the patient's specific cardiac condition, overall health, and personal preferences when developing rehabilitation programs (28, 29). Safety is paramount when working with cardiac patients. Physiotherapists should be vigilant in monitoring vital signs, such as heart rate and blood pressure, during exercise and rehabilitation sessions to ensure that patients are not at risk of overexertion or complications. Effective communication is essential. Physiotherapists should explain procedures, exercises, and expectations clearly to patients, addressing any questions or concerns they may have. They should also collaborate with other healthcare professionals involved in the patient's care, such as cardiologists, to ensure a coordinated approach (30–32). Providing education to patients about their cardiac condition, risk factors, and lifestyle modifications is a critical part of a physiotherapist's role. Patients should leave rehabilitation with the knowledge and skills to manage their condition and reduce the risk of future cardiac events. Physiotherapists should motivate and support patients throughout their rehabilitation journey. Encouraging adherence to exercise and lifestyle recommendations can have a significant impact on a patient's long-term cardiovascular health. Cardiac patients may have varying degrees of fitness and different limitations. Physiotherapists should be adaptable and able to modify rehabilitation programs to suit the patient's current level of fitness and any physical restrictions they may have. Physiotherapists must maintain patient confidentiality at all times, respecting the privacy of their medical information and personal experiences (33, 34). Physiotherapists should uphold the highest professional standards in their interactions

with cardiac patients, as with all patients. This includes being punctual, maintaining appropriate boundaries, and continuously improving their knowledge and skills through professional development. Hence, the attitude of a physiotherapist toward patients with cardiac disorders should be one of care, empathy, professionalism, and a commitment to helping patients achieve their best possible cardiac health outcomes. Their role is not only to assist in physical recovery but also to provide emotional support and education to promote long-term well-being (5).

Physiotherapists play a pivotal role in cardiac surgery care, both pre-operatively and post-operatively. Before surgery, they educate patients on expected post-operative processes, assess baseline physical function, and introduce relevant exercises, including breathing techniques. After surgery, they facilitate early mobilization to prevent complications, offer respiratory care to enhance lung function, prescribe tailored exercise programs to expedite recovery, provide guidance on scar management, and often participate in structured cardiac rehabilitation programs. Their expertise ensures patients have a smoother recovery trajectory, reduced complications, and an improved quality of life after surgery.

5 Phases of cardiac rehabilitation

5.1 Phase I of cardiac rehabilitation

The inpatient phase of cardiac rehabilitation, often denoted as phase I or the acute phase, serves as a critical juncture in a patient's journey toward recovery after cardiac surgery. This phase holds immense significance as it marks the initial interaction between patients and the Cardiac Rehabilitation (CR) team, and it can profoundly influence patients' perception of secondary prevention efforts, either positively or negatively (35). During this phase, patients undergo crucial assessments, receive education, and engage in mobilization activities, all in accordance with the recommendations outlined by the British Association for Cardiac Rehabilitation (BACR) (1995). BACR's guidelines from 1995 emphasize the importance of implementing a graded mobilization and exercise program during phase I. The ultimate objective is for patients to achieve ambulation and regain the ability to perform Activities of Daily Living (ADL) by the time of their discharge. Kinesiotherapy, a specialized form of physical therapy, assumes particular importance during this phase. Many patients experience post-operative pain, which can lead to the development of poor postural habits, abnormal motor control, and decreased endurance as they tend to avoid physical activity due to discomfort (36). Early mobilization practices are a key component of phase I cardiac rehabilitation. These practices encompass a range of activities, including limb mobilization, range of motion exercises, and even walking within the intensive care unit. The benefits of early

mobilization extend beyond merely improving mobility. They also have significant positive effects on preventing post-operative pulmonary complications (PPC) (37). Engaging in these activities can help maintain lung function, reduce the risk of atelectasis (partial lung collapse), and promote overall respiratory health. In essence, phase I of cardiac rehabilitation is a critical phase that sets the tone for a patient's recovery journey. It involves comprehensive assessment, education, and mobilization activities aligned with BACR guidelines. Kinesiotherapy, with its focus on addressing pain-related challenges and restoring mobility, plays a pivotal role during this phase. Moreover, early mobilization practices within the intensive care unit have a profound impact on preventing post-operative pulmonary complications, thereby contributing significantly to a patient's overall recovery and well-being. In the context of cardiac rehabilitation, exercises targeting limb and trunk mobilization assume a central role in enhancing a patient's endurance, exercise tolerance, functional capacity, and overall independence. These exercises are vital components of the rehabilitation process. However, it's important to note that there is no consensus in the existing literature regarding the optimal approach for performing these exercises (38). Thus, healthcare professionals must tailor their approach to the individual patient's needs and condition. Cycle-ergometer exercises are often recommended as part of the rehabilitation process, typically initiated after the removal of drainage tubes, which typically occurs around the 4th to 5th day after cardiac surgery. Patients typically begin with an initial workload of 25 Watts for 5 min. Importantly, exercise intensity should be carefully monitored and controlled to ensure patient safety. Healthcare providers often use a 10-point Borg scale to gauge perceived exertion, with the exercise intensity kept below a rating of 6 or not exceeding 20% above the baseline heart rate (25). Breathing exercises also play a crucial role during this phase of cardiac rehabilitation. Tools like the Incentive Spirometer (IS) are frequently employed to monitor progress and help mitigate the risk of post-surgery complications (39, 40). These exercises can aid in improving lung function and preventing issues such as atelectasis and pneumonia, which can be common after cardiac surgery. Before patients are discharged from the hospital, it is imperative that they are equipped with the knowledge and skills to continue their rehabilitation journey independently. To facilitate this, patients should be educated on self-assessment techniques. They should learn how to monitor their physical activity level, measure their pulse rate, and gauge their exertional effort using a standardized scale like the Borg rating of perceived exertion (RPE) scale [Borg (1998)], as recommended by Thompson et al. (1996). This self-assessment empowers patients to make informed decisions about their activity levels and provides an early warning system for any potential issues that may arise. In addition to these self-assessment tools, healthcare professionals should conduct a comprehensive assessment

that considers individual risk factors and stratification. Educational sessions should also be an integral part of the discharge process, providing patients with the necessary information about risk factors, lifestyle modifications, and the importance of continuing their cardiac rehabilitation efforts. These efforts collectively ensure that patients are well-prepared to take an active role in their ongoing recovery and cardiovascular health [BACR (1995)].

5.2 Phase II of cardiac rehabilitation

The second phase of cardiac rehabilitation, often referred to as the early post-discharge stage, is a critical period that typically spans a duration of 4–6 weeks. During this time frame, patients may grapple with a range of emotions, including feelings of isolation and insecurity, which are frequently accompanied by heightened signs of anxiety, as noted by Proudfoot (35). In this phase, the focus shifts toward crafting a personalized exercise regimen tailored to each patient's specific needs and abilities. Healthcare professionals play a pivotal role in this phase by conducting a comprehensive assessment of the patient's functional capacity. These assessments adhere to the guidelines outlined by the American College of Sports Medicine (ACSM) (2014). To ensure that exercise intensity is precisely calibrated to each patient's capabilities, a variety of factors are taken into account. These factors include the Rating of Perceived Exertion (RPE), Metabolic Equivalent (MET), estimated or measured maximal heart rate (HR_{max}), and maximal oxygen uptake (VO_{2max}). It is important to note that direct measurement of VO_{2max} requires expensive equipment, specialized personnel, and the patient's maximal effort, as highlighted by ACSM (2014). Alternatively, various methods have been developed to estimate VO_{2max} from sub-maximal exercise efforts (41), although these estimation methods often necessitate specialized equipment. To gauge functional capacity based on individual outcomes, various clinical tests can be employed during this phase. These tests include the 6°min walking test, stair-climbing assessments, and shuttle tests, as exemplified by the work of Bradbury-Hough (1996). Among these tests, the 6°min walk test stands out as a widely accepted and valid tool, as emphasized by Enright et al. (42). Clinicians frequently rely on this test to assess patient prognosis, evaluate post-cardiac surgery mobility, and gauge overall functional capacity. In addition, the early post-discharge phase of cardiac rehabilitation represents a critical juncture in a patient's recovery journey. It is a period where personalized exercise regimens are tailored to individual capacities and guided by the principles outlined by ACSM (2014). The assessment process considers a range of factors to ensure that exercise intensity is both safe and effective. Moreover, clinical tests like the 6°min walk test are valuable tools for assessing and monitoring patients' functional capacity and overall progress, thereby enhancing the quality

of care provided during this phase of cardiac rehabilitation. In the early post-discharge phase of cardiac rehabilitation, the 6°min walk test continues to be a valuable tool. Not only does it help healthcare professionals assess patient progress and functional capacity, but it can also be effectively administered by patients with cardio-pulmonary diseases themselves to evaluate their endurance. This self-administered test serves as a sensitive clinical indicator of their condition, as highlighted by Rasekaba et al. (43). It empowers patients to actively monitor their physical condition and progress, fostering a sense of ownership and engagement in their rehabilitation journey. In cases where resources or expertise required for conducting maximal exercise tests are not readily accessible, clinicians often turn to heart rate maximum (HR_{max}) prediction equations to establish exercise intensity, as recommended by ACSM (2014). These equations provide a practical and effective means of guiding patients' exercise efforts, ensuring that they train within safe and appropriate heart rate zones. This approach allows for a more individualized exercise prescription, considering factors such as age and baseline fitness level. Exercise consultation assumes a pivotal role during this phase of cardiac rehabilitation. Healthcare professionals play a crucial role in enhancing patient adherence to lifestyle modifications and ensuring the sustained continuation of exercise routines throughout phase II and subsequent phases of cardiac rehabilitation. Their guidance helps patients establish healthy habits that extend beyond the structured rehabilitation program, promoting long-term cardiovascular health (43). Additionally, physiotherapists in this stage should prescribe personalized home-walking programs, recognizing that physical activity doesn't end with the rehabilitation center's doors. These programs aid patients in gradually reintegrating into their Activities of Daily Living (ADL), helping them regain confidence and independence in their everyday lives. This transition is crucial in preparing patients for advancement to phase III of cardiac rehabilitation, where they continue to build on their progress. As in phase I, patients in this phase employ diverse self-monitoring techniques to minimize the risk of complications and ensure that they continue to make positive strides in their recovery journey. These self-monitoring practices empower patients to take an active role in their health, enabling them to identify and address any concerns promptly (41). Therefore, the early post-discharge phase of cardiac rehabilitation represents a critical period where patients continue to build their endurance and functional capacity. The 6°min walk test, self-administered by patients, serves as a valuable tool for assessing progress. Exercise intensity is tailored using HR_{max} prediction equations when maximal exercise testing is not feasible. Exercise consultation plays a central role in fostering patient adherence to healthy lifestyle modifications and exercise routines. Personalized home-walking programs and the transition back to ADL are key components of this phase, preparing patients for further progress in subsequent

rehabilitation phases. Self-monitoring techniques remain an essential part of patient care, ensuring continued safety and progress in their recovery journey (42, 43).

5.3 Phase III of cardiac rehabilitation

Phase III of Cardiac Rehabilitation (CR) represents the traditional outpatient component of the rehabilitation process and typically extends over a period of 6–12 weeks. While physical exercise remains a central focus during this phase, education and psycho-social counseling pertaining to risk factors and lifestyle modifications assume significant importance (35). It is in this phase that the benefits of exercise are most directly observed, and patients are encouraged to actively engage in structured exercise routines to enhance their cardiovascular health. Ross and Campbell (2006) emphasize that the health and fitness benefits derived from exercise exhibit a direct dose–response relationship. Therefore, patients entering phase III should undergo a risk stratification assessment, an essential prerequisite for their participation in an exercise program (35). The primary objective of risk stratification is to identify patient risk factors and categorize them based on the likelihood of experiencing adverse effects (44). Those who do not fall into either the low-risk or high-risk categories are typically categorized as moderate risk (35). During this phase, structured exercise sessions are supervised and offered at least twice a week, supplemented by one weekly education session (35). These exercise programs should incorporate key components, including a warm-up, conditioning phase, and cool-down, as outlined by ACSM (2014) and ACPICR in 2015. The recommended weekly exercise dose can be tailored to each individual, taking into consideration the frequency, intensity, time, and type of exercise (FITT principle) that best suits their needs [ACPICR (2015)]. Additionally, these programs should encompass exercises aimed at enhancing flexibility, strength, balance, and coordination [ACPICR (2015)]. It is worth noting that high-risk patients are advised to participate in hospital-based programs that are supervised by healthcare professionals (45). This extra level of supervision ensures the safety of patients with complex medical histories or those who require more intensive monitoring. Throughout the program, physiotherapists play a crucial role by initiating and consistently monitoring and assessing patients to ensure the safety and efficacy of their exercise routines. The level of monitoring is tailored to each individual's specific needs, as advised by the Chartered Society of Physiotherapists (2012). Physiotherapists employ various metrics to gauge patients' exercise intensity, including heart rate response, blood pressure response, rate-pressure product, Rating of Perceived Exertion (RPE), observation, and oxygen saturation levels [ACPICR (2015)]. BACR (2006), drawing from evidence by Paffenbarger (1996) and Paffenbarger and Olson (1996), suggests that

engaging in moderate physical activity for approximately 30 min most days can yield beneficial effects and potentially alter Cardiovascular Disease (CVD) risk factors. However, continuous exercise (CE) may pose challenges for patients with Coronary Heart Disease (CHD). To address this, it is advisable to incorporate “recovery” stations into the exercise program. Alternatively, interval training (IT), which involves alternating between short periods of higher-intensity (HIT) and moderate-intensity workloads, has demonstrated both safety and effectiveness in the cardiac population as well (46–48). Thus, phase III of cardiac rehabilitation is a crucial stage in the patient's journey toward cardiovascular health. It combines structured exercise routines with education and counseling to address risk factors and lifestyle modifications. Risk stratification assessments guide the exercise program, which should include various components and be tailored to each patient's specific needs. Physiotherapists play a pivotal role in ensuring patient safety and monitoring exercise intensity. The utilization of different exercise strategies, such as interval training, allows for individualized and effective cardiovascular rehabilitation (48).

5.4 Phase IV of cardiac rehabilitation

In phase IV of cardiac rehabilitation, individuals who are medically stable and capable of independent exercise are often assessed for the potential transition to a more extended rehabilitation program, as recommended by BACR (2006). This phase represents a point of reflection and advancement in the patient's journey toward optimal cardiovascular health. One notable aspect of phase IV is that participants may express a keen interest in diversifying their physical activities to support not only their physical fitness but also their psychological well-being. This shift reflects a broader understanding of the holistic nature of health and wellness. Engaging in a variety of activities, such as different forms of exercise, sports, or recreational pursuits, can contribute to a sense of enjoyment, fulfillment, and social connection. These activities go beyond the structured exercise routines typically associated with earlier phases of cardiac rehabilitation. The transition to a more extended rehabilitation program in phase IV can offer participants a continued and supportive environment for maintaining their cardiovascular health. These programs often provide access to a range of resources, including specialized exercise equipment, trained staff, and a community of individuals with similar health goals. This extended support can be particularly valuable for individuals who wish to continue their progress and maintain a healthy lifestyle beyond the formalized phases of cardiac rehabilitation. The phase IV of cardiac rehabilitation represents a stage where individuals have the opportunity to explore broader avenues for physical activity and well-being. It also marks the possibility of transitioning to more extended rehabilitation programs, allowing participants to

sustain and further enhance their cardiovascular health. This phase underscores the importance of a holistic approach to health, encompassing both physical and psychological aspects, and supports individuals in their ongoing pursuit of a healthy and active life (49).

6 Pharmacotherapy in cardiac rehabilitation program

Relating pharmacotherapy (drug therapy) with the knowledge, attitude, and practice of physiotherapists regarding cardiac rehabilitation program adherence among patients discharged from the hospital after cardiac surgery in India involves understanding the interplay between medication management and physiotherapy in the context of cardiac care. This involves initially conducting a comprehensive literature review to identify the current state of knowledge and potential research gaps in this specific area. Next, formulate research questions that are designed to delve deeply into the aspects of physiotherapists' involvement in cardiac rehabilitation, particularly how their understanding of cardiac medications influences their attitudes and practices. For instance, inquire about the extent of their familiarity with medications commonly prescribed for cardiac conditions, their attitudes toward medication management as part of cardiac rehabilitation, and how these attitudes shape their practical approaches when working with patients. To gather empirical data, select appropriate research methods, which could encompass surveys, interviews, focus groups, or observational studies involving physiotherapists, cardiac surgery patients, and other relevant healthcare professionals. These methods should be carefully designed to provide a comprehensive view of how pharmacotherapy is intertwined with the knowledge, attitudes, and practices of physiotherapists in the context of cardiac rehabilitation in India. It is crucial to ensure ethical considerations are meticulously addressed throughout the research process (50). Once data are collected, conduct a rigorous analysis using both quantitative and qualitative research techniques to identify patterns, correlations, and significant themes pertaining to the research questions. Analyze how physiotherapists' understanding of medications may affect their approach to rehabilitation and patient care, and how this, in turn, might influence patient adherence to rehabilitation programs. Interpret the research findings in the context of the existing literature and the broader healthcare landscape in India, recognizing potential barriers and facilitators in the integration of pharmacotherapy and physiotherapy in cardiac rehabilitation programs. Assess the practical implications of these findings and suggest strategies for improvement, which could include enhancing physiotherapist training in medication management, fostering interdisciplinary collaboration among healthcare providers, and developing patient education initiatives (51).

Further, the research findings and their significance, taking into account any limitations of the study. Offer recommendations that are evidence-based and actionable to enhance the collaboration between pharmacotherapy and physiotherapy within cardiac rehabilitation programs in India, with the ultimate goal of improving patient adherence to these vital programs and, consequently, patient outcomes. Finally, disseminate the research findings through academic publications, presentations at conferences, and targeted discussions with healthcare professionals and policymakers to promote awareness and drive potential changes in clinical practice and policy.

7 Barriers faced by physiotherapists related to CR

Cardiac rehabilitation is a crucial component of managing cardiovascular diseases and improving the quality of life for patients who have suffered heart-related issues. Physiotherapists play a vital role in cardiac rehabilitation programs, as they are responsible for developing exercise and therapeutic interventions, monitoring patients' progress, and ensuring a safe and effective recovery process. However, they encounter several significant challenges in their efforts to provide the best care and support to cardiac patients. Cardiac patients come from diverse backgrounds and have varying levels of fitness, motivation, and health conditions. Physiotherapists must tailor rehabilitation programs to meet the unique needs of each patient, which can be challenging. Some patients may be highly motivated and capable of intensive exercise, while others may struggle with even the most basic activities. Cardiovascular diseases are often accompanied by other comorbidities, such as diabetes, hypertension, and obesity. Physiotherapists need to consider these conditions and how they interact with the heart condition when designing rehabilitation programs. This complexity can be overwhelming, and a lack of coordination with other healthcare professionals can hinder the rehabilitation process. Physiotherapists need to assess the risk levels of their patients accurately. Over-exertion can be detrimental, while inadequate exercise may not yield the desired results. Striking the right balance to ensure patient safety is crucial, and it requires an in-depth knowledge and experience. Motivating patients to adhere to their rehabilitation program can be challenging. Many cardiac patients may experience anxiety or fear of exercise due to their past experiences. Convincing patients to adopt a new lifestyle and adhere to exercise regimens can be an uphill battle, and non-compliance can impede progress. Cardiac rehabilitation programs require access to specialized equipment, monitoring tools, and trained staff. In many healthcare settings, there may be limitations in terms of available resources and funding.

This can lead to suboptimal rehabilitation and difficulties in providing comprehensive care. Effective communication with other healthcare professionals, such as cardiologists, nurses, dietitians, and psychologists, is essential for ensuring the holistic care of cardiac patients. However, coordinating care among multiple specialists and ensuring that everyone is on the same page can be challenging (10, 24, 25). Guidelines for cardiac rehabilitation are continually evolving as new research emerges. Physiotherapists must stay updated with the latest research and guidelines to provide evidence-based care. This ongoing education can be time-consuming and demanding. Cardiac patients often experience emotional and psychological challenges, such as depression, anxiety, and adjustment issues. Physiotherapists need to be equipped to provide psychosocial support in addition to physical rehabilitation. Cardiac rehabilitation doesn't end when the program concludes. Physiotherapists often have to establish long-term follow-up plans and help patients transition into maintaining a heart-healthy lifestyle independently. Ensuring continuity of care and monitoring patient progress over time can be logistically challenging. Cultural beliefs, socioeconomic factors, and societal norms can influence a patient's willingness and ability to engage in cardiac rehabilitation. Physiotherapists must be sensitive to these factors and adapt their approach accordingly. Hence, physiotherapists face a multitude of challenges in the field of cardiac rehabilitation, ranging from tailoring programs to diverse patient needs and managing medical complexity to resource limitations and the need for continuous education. Overcoming these challenges requires a multidisciplinary approach, strong communication, and a deep commitment to improving the health and well-being of cardiac patients. It's essential for healthcare systems to recognize these challenges and provide the necessary support and resources for physiotherapists to deliver effective cardiac rehabilitation programs (29, 49, 50).

8 Conclusion

This study highlights the pivotal role of physiotherapists in cardiac rehabilitation programs aimed at optimizing the recovery of patients following cardiac surgery in India. It underscores the multifaceted nature of their responsibilities, encompassing exercise regimens, lifestyle modifications, and the integration of pharmacotherapy into patient care. The preliminary findings of this research demonstrate that physiotherapists possess a strong knowledge base regarding cardiac rehabilitation guidelines, emphasizing the importance of exercise, risk factor management, psychosocial support, and medication management, reflecting their comprehensive approach to patient care. Furthermore, their positive attitudes toward patient adherence underscore their belief in the effectiveness of these programs in improving patient outcomes. However, it is crucial to

acknowledge the barriers to adherence identified in this study, including issues related to patient motivation, resource constraints, and cultural factors. These challenges highlight the need for a holistic approach to cardiac rehabilitation that addresses not only medical aspects but also psychosocial and cultural factors impacting patient adherence. In practice, physiotherapists employ a range of strategies, including patient education, exercise supervision, goal setting, and pharmacotherapeutic guidance, to enhance adherence among discharged patients, demonstrating their commitment to providing comprehensive care.

The implications of this research are significant, as they emphasize the importance of targeted interventions and resource allocation to improve adherence to cardiac rehabilitation programs in India. By addressing the identified barriers and building upon the positive attitudes and strong knowledge base of physiotherapists, it is possible to enhance the postoperative outcomes of cardiac surgery patients. Moreover, this study highlights the need for further research to gain a comprehensive understanding of the patient perspective and to establish a truly holistic approach to cardiac rehabilitation adherence, one that seamlessly integrates pharmacotherapy, ultimately resulting in improved patient outcomes and quality of life.

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