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Role of Physiotherapy in Cardiopulmonary Patients: An Essential Component of Comprehensive Care

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ABSTRACT

Cardiopulmonary diseases remain among the leading causes of morbidity, disability, and mortality worldwide, posing a substantial burden on healthcare systems and society. Although advances in medical management, pharmacological therapies, surgical techniques, and interventional procedures have significantly improved survival rates, many patients continue to experience persistent functional limitations, reduced exercise capacity, and impaired quality of life. Consequently, optimal recovery requires a comprehensive multidisciplinary approach in which physiotherapy plays a pivotal role. Cardiopulmonary physiotherapy encompasses evidence-based interventions such as exercise training, respiratory muscle training, airway clearance techniques, breathing exercises, early mobilization, and patient education, all of which contribute to improved exercise tolerance, respiratory mechanics, functional independence, symptom control, and overall health-related quality of life. These interventions also help reduce hospital length of stay, prevent complications, decrease hospital readmissions, and enhance long-term clinical outcomes. This review discusses the current evidence and evolving role of physiotherapy across the spectrum of cardiopulmonary conditions, including heart failure, coronary artery disease, chronic pulmonary diseases, postoperative cardiothoracic surgery, and critical care settings, highlighting its importance in optimizing patient recovery and promoting long-term health and functional well-being.

Keywords: Physiotherapy; Cardiac Rehabilitation; Pulmonary Rehabilitation; Heart Failure; Coronary Artery Disease; Cardiopulmonary Physiotherapy; Critical Care.

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INTRODUCTION

Cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide, accounting for nearly one-third of all global deaths annually.[1] Likewise, chronic respiratory diseases, including chronic obstructive pulmonary disease (COPD), bronchiectasis, asthma, and interstitial lung disease, are major contributors to morbidity, disability, and healthcare utilization worldwide.[2,3] Despite remarkable advances in pharmacological therapies, interventional cardiology, and cardiothoracic surgery, many patients continue to experience exercise intolerance, respiratory dysfunction, skeletal muscle weakness, reduced functional capacity, and impaired quality of life following acute or chronic cardiopulmonary conditions.[4,5] Optimal management of these conditions extends beyond medical treatment and requires a comprehensive multidisciplinary rehabilitation approach. Physiotherapy has emerged as a cornerstone of cardiopulmonary rehabilitation, aiming to restore functional capacity, improve respiratory and cardiovascular efficiency, and enhance overall health outcomes.[6] Evidence-based physiotherapy interventions include aerobic and resistance exercise training, respiratory muscle training, breathing exercises, airway clearance techniques, early mobilization, inspiratory muscle training, and patient education. These interventions improve exercise tolerance, pulmonary function, muscle strength, functional independence, and health-related quality of life while reducing dyspnea, postoperative complications, hospital length of stay, and readmission rates.[7-9] Physiotherapy plays an essential role across the continuum of care, from acute hospital management and intensive care units to outpatient rehabilitation and long-term community-based programs. Increasing evidence supports its effectiveness in patients with heart failure, coronary artery disease, chronic respiratory diseases, postoperative cardiothoracic surgery, and critically ill patients requiring prolonged hospitalization. This review summarizes the current evidence regarding physiotherapy interventions in cardiopulmonary diseases, highlighting their mechanisms, clinical applications, and contributions to improving functional recovery, patient outcomes, and long-term quality of life.

Physiological Basis of Cardiopulmonary Physiotherapy

Physical inactivity associated with cardiopulmonary diseases often results in physiological deconditioning, characterized by reduced skeletal muscle strength, impaired aerobic capacity, endothelial dysfunction, and diminished respiratory efficiency These changes contribute to exercise intolerance, fatigue, dyspnea, and reduced functional independence. Structured physiotherapy interventions are designed to counteract these adverse effects by improving cardiovascular conditioning, enhancing pulmonary ventilation, optimizing oxygen uptake and utilization, reducing the sensation of dyspnea, and strengthening peripheral skeletal muscles. In addition, early mobilization and progressive rehabilitation help prevent complications associated with prolonged immobilization, such as muscle atrophy, atelectasis, venous thromboembolism, and hospital-acquired weakness. Collectively, these physiological adaptations improve exercise tolerance, functional capacity, and overall quality of life while reducing hospital length of stay, healthcare utilization, and the risk of disease-related complications.[4,6]

Role in Cardiovascular Diseases

Coronary Artery Disease

Physiotherapy is a fundamental component of comprehensive cardiac rehabilitation for patients with coronary artery disease (CAD), particularly following myocardial infarction, percutaneous coronary intervention (PCI), and coronary artery bypass graft (CABG) surgery. Structured, supervised rehabilitation programs emphasize aerobic exercise as the cornerstone of treatment, complemented by resistance training, flexibility exercises, patient education, and lifestyle modification. Regular exercise improves exercise tolerance and cardiorespiratory fitness by enhancing myocardial efficiency, endothelial function, and peripheral oxygen utilization. Physiotherapy also contributes to the reduction of modifiable

cardiovascular risk factors through improved lipid profiles, better blood pressure control, weight management, and enhanced glycemic regulation. In addition, participation in cardiac rehabilitation has been shown to reduce recurrent cardiovascular events, hospital readmissions, and cardiovascular mortality while improving functional capacity and overall quality of life. Beyond its physical benefits, physiotherapy positively influences psychological well-being by reducing anxiety and depression, increasing self-confidence, and encouraging long-term adherence to healthy lifestyle behaviors. Consequently, structured aerobic exercise, delivered as part of a multidisciplinary cardiac rehabilitation program, remains the cornerstone of evidence-based management for patients with coronary artery disease.[4,5]

Heart Failure

Heart failure is characterized by reduced cardiac output, significant exercise intolerance, skeletal muscle dysfunction, and impaired functional capacity, all of which adversely affect patients' quality of life.[7,8] Physiotherapy plays a central role in the comprehensive management of heart failure through individualized rehabilitation programs that include aerobic exercise training, resistance training, inspiratory muscle training, and functional mobility exercises. Aerobic exercise improves cardiorespiratory fitness and exercise tolerance, while resistance training enhances muscle strength and endurance. Inspiratory muscle training strengthens respiratory muscles, reduces dyspnea, and improves ventilatory efficiency, whereas functional mobility exercises promote independence in activities of daily living. Collectively, these interventions improve functional capacity, reduce fatigue and symptom burden, enhance health-related quality of life, and decrease the risk of hospitalization. Current international clinical guidelines strongly recommend supervised exercise training as a safe and effective component of treatment for patients with stable heart failure, recognizing its substantial benefits in improving both clinical and functional outcomes.[6-8]

Pulmonary Hypertension

Historically, exercise was discouraged in pulmonary hypertension; however, carefully supervised physiotherapy programs have shown benefits.8

Post-Cardiac Surgery Rehabilitation

Physiotherapy is an essential component of postoperative rehabilitation following cardiac surgery, including coronary artery bypass grafting and valve replacement procedures.[5,6] Early physiotherapy interventions facilitate recovery by promoting early mobilization, preventing postoperative pulmonary complications such as atelectasis, improving lung expansion and pulmonary function, and enhancing overall functional capacity. Breathing exercises, incentive spirometry, deep breathing techniques, supported coughing, airway clearance strategies, and progressive ambulation are key components of postoperative care. These interventions help improve ventilation, facilitate secretion clearance, reduce pain-related respiratory impairment, and minimize the risk of complications associated with prolonged bed rest, including muscle weakness and venous thromboembolism. Early rehabilitation also accelerates recovery, shortens hospital length of stay, and promotes a faster return to daily activities, ultimately improving postoperative outcomes and quality of life.[5,6]

Table1. Physiotherapy Interventions in Cardiovascular Diseases

Disease	Physiotherapy Intervention	Major Benefits
Coronary Artery Disease	Aerobic exercise	Improved exercise capacity
Heart Failure	Aerobic + resistance training	Increased VO_2 peak
Pulmonary Hypertension	Supervised rehabilitation	Better functional class
Post-CABG	Early mobilization	Reduced complications
Valvular Heart Disease	Exercise prescription	Improved endurance

Role in Pulmonary Diseases

Chronic Obstructive Pulmonary Disease

Pulmonary rehabilitation is one of the most effective evidence-based, non-pharmacological interventions for patients with chronic obstructive pulmonary disease (COPD) and is recommended as a standard component of comprehensive disease management. Physiotherapy-based pulmonary rehabilitation significantly reduces dyspnea, improves exercise tolerance and functional capacity, decreases the frequency of exacerbations and hospital admissions, and enhances health-related quality of life. Comprehensive rehabilitation programs typically integrate aerobic exercise training, resistance and strength training, breathing exercises such as diaphragmatic and pursed-lip breathing, airway clearance techniques when indicated, and patient education on disease management, medication adherence, energy conservation, and smoking cessation. These interventions improve respiratory muscle function, optimize ventilation and oxygen utilization, reduce symptom burden, and promote greater independence in daily activities. Furthermore, pulmonary rehabilitation enhances patients' self-management skills, enabling them to better cope with symptoms, maintain physical activity, and achieve improved long-term clinical outcomes.[9-12]

Bronchiectasis and Cystic Fibrosis

Physiotherapy is a key component in the management of bronchiectasis and cystic fibrosis, with airway clearance techniques forming the cornerstone of treatment. Interventions such as the active cycle of breathing technique, postural drainage, positive expiratory pressure therapy, and chest physiotherapy facilitate mucus clearance, improve ventilation, reduce dyspnea, and decrease the frequency of respiratory infections and exacerbations. Regular physiotherapy also enhances exercise tolerance, preserves lung function, and improves quality of life.[9,13-16]

Interstitial Lung Disease

Patients with interstitial lung disease (ILD) often experience severe exercise intolerance, dyspnea, and reduced functional capacity due to progressive pulmonary fibrosis.[15,16] Pulmonary rehabilitation, including aerobic and resistance exercise training, breathing exercises, and patient education, has been shown to improve functional exercise capacity, reduce symptom burden, and enhance health-related quality of life.[17,18] Although pulmonary rehabilitation may not significantly improve lung function, it provides meaningful functional benefits and supports better daily activity and overall well-being.

Role in Critical Care and Intensive Care Units

Physiotherapy is an integral component of multidisciplinary care in intensive care units (ICUs), where critically ill patients are at high risk of muscle wasting, respiratory weakness, and prolonged functional disability. [11,12] Critical care physiotherapy includes early mobilization, airway clearance techniques, respiratory muscle training, therapeutic positioning, and interventions to prevent ventilator-associated complications. These evidence-based strategies help preserve muscle strength, improve pulmonary function, facilitate ventilator weaning, and prevent complications associated with prolonged immobilization. Early rehabilitation in critically ill patients has been shown to reduce the duration of mechanical ventilation, shorten ICU and hospital length of stay, and minimize long-term physical disability, thereby improving functional recovery and quality of life after hospital discharge.

Role of Point-of-Care Ultrasound (POCUS)

Point-of-care ultrasound (POCUS) is increasingly being incorporated into cardiopulmonary physiotherapy to support assessment, treatment planning, and monitoring of rehabilitation outcomes. Physiotherapists use POCUS to evaluate diaphragm function, monitor lung pathology, assess skeletal muscle mass and quality, and estimate fluid status in selected patients. These real-time assessments enable individualized rehabilitation, facilitate early

detection of physiological changes, and help monitor treatment response, thereby improving the safety and effectiveness of physiotherapy interventions.

Respiratory Physiotherapy Techniques

Respiratory physiotherapy comprises several evidence-based interventions aimed at improving ventilation, enhancing airway clearance, and strengthening respiratory muscles. Common breathing exercises include diaphragmatic breathing, segmental breathing, deep breathing exercises, and pursed-lip breathing, which improve lung expansion, reduce the work of breathing, and alleviate dyspnea. Airway clearance techniques, such as chest percussion, vibration, huffing, and assisted coughing, facilitate the mobilization and removal of pulmonary secretions, thereby improving ventilation and reducing the risk of respiratory infections. Inspiratory muscle training is another important intervention that enhances respiratory muscle strength and endurance and has demonstrated significant benefits in patients with chronic obstructive pulmonary disease (COPD), heart failure, and neuromuscular disorders.[19,20] Collectively, these techniques improve respiratory function, exercise tolerance, and health-related quality of life while reducing symptom burden.

Table 2. Physiotherapy Interventions in Respiratory Diseases

Outcome	Evidence
Increased VO_2 peak	Level I
Reduced hospital admissions	Level I
Improved QoL	Level I
Reduced dyspnea	Level I
Reduced mortality after MI	Level I

Exercise Prescription in Cardiopulmonary Rehabilitation

Exercise prescription in cardiopulmonary physiotherapy should be individualized based on a comprehensive assessment of the patient's clinical condition, functional capacity, comorbidities, and rehabilitation goals. A well-designed exercise program typically includes aerobic training, such as walking, cycling, or treadmill exercise, resistance training for upper and lower limb strengthening, flexibility exercises to maintain joint mobility, and balance training, particularly for older adults at increased risk of falls. Exercise intensity should be carefully prescribed and progressed according to the patient's symptoms, heart rate response, oxygen saturation, and perceived exertion to ensure safety and optimize clinical outcomes. Recent advances in cardiopulmonary rehabilitation have further enhanced the delivery of physiotherapy through tele-rehabilitation, home-based rehabilitation programs, wearable monitoring devices, artificial intelligence-assisted rehabilitation, point-of-care ultrasound-guided physiotherapy, and virtual reality-based rehabilitation. These innovations facilitate personalized care, remote monitoring, and improved patient engagement while expanding access to rehabilitation services, particularly in resource-limited and geographically underserved settings.[5]

Challenges in Developing Countries

Despite the well-established benefits of cardiopulmonary physiotherapy, its implementation remains limited in many developing countries. Major barriers include a shortage of trained physiotherapists, inadequate rehabilitation facilities, limited awareness among healthcare professionals and patients, financial constraints, and geographic barriers that restrict access to rehabilitation services. These challenges often result in delayed referrals and underutilization of physiotherapy interventions. Strengthening multidisciplinary collaboration, expanding rehabilitation infrastructure, increasing professional training, and integrating cardiopulmonary rehabilitation into routine clinical practice are essential to improve access, optimize patient outcomes, and reduce the burden of cardiopulmonary diseases.[1,5]

CONCLUSIONS

Physiotherapy is a cornerstone of comprehensive cardiopulmonary care, with strong evidence supporting its effectiveness in improving exercise capacity, respiratory function, functional independence, health-related quality of life, and overall clinical outcomes in patients with cardiovascular and pulmonary diseases.[9,10] As an integral component

of multidisciplinary rehabilitation, physiotherapy facilitates recovery, reduces complications and hospital readmissions, and promotes long-term disease management. With the growing emphasis on patient-centered care, greater integration of physiotherapy into routine clinical practice is essential. Expanding rehabilitation services, increasing the availability of trained physiotherapists, and adopting emerging technologies such as tele-rehabilitation, wearable monitoring, and point-of-care ultrasound will further improve the accessibility, quality, and effectiveness of cardiopulmonary rehabilitation in the future.

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