

Post Intensive Care Syndrome(PICS) and Physiotherapy Management



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Abstract

Post Intensive Care Syndrome (PICS) is a complex condition that encompasses a range of physical, cognitive, and psychological impairments experienced by individuals after critical illness and intensive care unit (ICU) stay. The long-term consequences of PICS can significantly impact the quality of life and functional independence of survivors. Physiotherapy management has emerged as a crucial component in addressing the physical impairments associated with PICS and promoting recovery. This review aims to provide an overview of the current evidence on physiotherapy interventions for PICS. The review explores various aspects of physiotherapy management, including early mobilization, strength training, balance and coordination exercises, gait training, and functional rehabilitation. The effectiveness of these interventions in improving muscle strength, respiratory function, gait speed, balance, and activities of daily living is discussed based on available research studies. The review also highlights the challenges and considerations in implementing physiotherapy interventions for PICS, such as the optimal timing and intensity of interventions, interdisciplinary coordination, and resource limitations. Furthermore, it emphasizes the importance of patient-centered care and shared decision-making in developing individualized treatment plans that consider the unique needs and preferences of each patient.

Keywords: Post Intensive Care Syndrome; Cognitive; Intensive Care Unit; Physiotherapy; Respiratory Function

Abbreviations: PICS: Post Intensive Care Syndrome; ICU: Intensive Care Unit; PTSD: Post-Traumatic Stress Disorder; ICUAW: ICU-Acquired Muscle Weakness; CIM: Critical Illness Myopathy; MRC: Medical Research Council; HGS: Hand Grip Strength; 6MWD: 6-Minute Walk Distance; ADLS: Activities of Daily Living

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Overview of Post Intensive Care Syndrome (PICS)

A number of technological and scientific developments have been observed in the intensive care field in recent years. In spite of the increasing age and burden of diseases, disease severity these developments have resulted in a decrease in the death rate [1]. However, there is an increasing population of survivors and discharge who are dealing with various long-term effects of critical illness. Advanced age and pre-existing comorbidities can increase vulnerability to PICS, and certain ICU interventions and procedures, such as central venous catheterization or tracheostomy. The severity and duration of critical illness, inflammatory response, along with prolonged mechanical ventilation, immobility during the ICU stay contributes to muscle weakness and functional decline, while delirium is an independent risk factor associated with PICS. The use of sedatives, opioids, and other medications can impact cognitive function and mobility [1,2].

Post-intensive care syndrome (PICS) is a constellation of physical, cognitive, and psychological impairments that occur in patients who have survived a critical illness and stay in the ICU [2]. PICS affects a significant proportion of ICU survivors, with reported prevalence rates ranging from 30% to 80% [3]. The syndrome can have profound and long-lasting effects on patients' overall well-being, functionality, and quality of life. Physical impairments commonly observed in PICS include generalized muscle weakness, reduced exercise capacity, and impaired physical functioning [4]. These deficits can persist for months or even years after ICU discharge, limiting patients' ability to perform daily activities and increasing their dependence on caregivers [5]. Such physical limitations can also hinder patients' ability to return to work or engage in meaningful social interactions, further impacting their quality of life. In addition to physical impairments, cognitive dysfunction is a significant component of PICS. ICU survivors often experience difficulties with attention, concentration, memory, and executive functions [6]. These cognitive deficits can interfere

with patients' ability to resume their previous roles, engage in complex tasks, and affect their overall cognitive well-being. Furthermore, PICS encompasses psychological impairments such as anxiety, depression, and post-traumatic stress disorder (PTSD). The experience of a critical illness and ICU stay can be traumatic for patients, leading to psychological distress and persistent emotional symptoms [7]. The prevalence of these psychological disorders in PICS patients is substantial, with estimates ranging from 20% to 60% [8].

Physiotherapy Interventions for Physical Impairments

The physical components of PICS are very diverse. Patient with PICS experience respiratory dysfunction, respiratory and limb muscle weakness, reduced exercise capacity, and difficulty resuming activity of daily, driving, and employment [9].

The condition is caused by weakness [ICU-acquired muscle weakness (ICUAW)]. In this case, muscle weakness is defined as a symmetrical decrease in the strength of the patients' skeletal muscles that cannot be attributed to another cause. The development of muscle weakness is a consequence of critical diseases; it is classified as critical illness polyneuropathy, critical illness myopathy(CIM), and both critical illness neuromyopathy [10]. The prolonged bed rest and inflammatory cytokines that are often encountered in intensive care patients reduce the rate of proteolysis and catabolism. As muscle weakness progresses with neuropathy, neuronal mitochondrial dysfunction and demyelination mechanisms may be triggered by microvascular ischemia [11,12].

Several studies have demonstrated a decline in knee and ankle muscle strength at 3, 6, and 12 months after critical illness [12]. According to one study, this reduction in muscle strength corresponded with a decrease in muscle mass and was accompanied by impaired rate of force development and endurance, which persisted for up to 12 months after critical illness. Further, grip strength is strikingly diminished, similar to that of limbs [13,14]. Barotrauma and respiratory muscle dysfunction develop in the lung due to long-term use of mechanical ventilator [15,16]. The findings of one study indicate that approximately two-thirds of those admitted to intensive care have abnormal pulmonary function tests within six months of admission, which is consistent with a restrictive model of pulmonary impairment. In a meta-analysis study that included 15 randomized controlled trials, physical symptoms associated with PICS lasting up to 1 year were reported [11].

Another notable loss is observed in the 6-minute walk distance(6MWD). The reductions in the 6MWD, persist for up to 12 months in survivors of intensive care treatment. Muscle strength, as assessed by the Medical Research Council (MRC) sum score, upon ICU discharge, has been identified as a predictor for hand grip strength (HGS), 6MWD, and self-reported physical functioning

even five years later [17]. Considering these significant functional capacity losses, monitoring muscle strength and functional capacity by physiotherapists in intensive care patients is crucial for enhancing daily life activities and improving quality of life.

Assessment of Physical Impairments in PICS

Physiotherapy evaluation and physical examination are essential components in the management of PICS patients. Through a comprehensive assessment, including the evaluation of respiratory function, musculoskeletal system, cardiovascular fitness, and balance and coordination, physiotherapists can identify specific impairments and functional limitations that require targeted interventions.

Respiratory function assessment

Assesing spirometric function, lung mechanics, diffusion capacity test, respiratory muscle strength, and breathing pattern can help identify respiratory impairments and guide appropriate interventions such as breathing exercises, airway clearance techniques, and pulmonary rehabilitation [18,19].

Musculoskeletal System assessments

Evaluating muscle strength, joint range of motion, and muscle tone can identify deficits in muscle performance and mobility. This information helps determine the need for interventions such as strengthening exercises, manual therapy techniques, and mobilization protocols [20,21]. One common method used to assess muscle strength is manual muscle testing, which involves evaluating the strength of six muscle groups on both sides of the body and calculating the MRC Sum Score. A score below 48 on the MRC Sum Score is considered significant in identifying ICU-acquired weakness. Muscle strength can also be assessed over time using manual muscle testing with the MRC scale or through the use of a handheld dynamometer [22].

Exercise Capacity and Functional Mobility assessments

The 6-Minute Walk Test (6MWT) has been extensively validated in survivors of critical illness and has shown to be a reliable predictor of future outcomes such as mortality, hospitalization, and health-related quality of life. Studies have indicated that a change in walking distance of 20 to 30 meters in the 6MWT is considered clinically meaningful for survivors of ARDS [23]. This implies that improvements or declines in walking distance beyond this threshold can have significant implications for the patient's overall prognosis and functional status. As an alternative to the 6DYT physiotherapists may prefer the 4-minute walk test and the 2-minute walk test. Physiotherapists should consider the patient's profile and clinical conditions when deciding which test to use. After a critical illness, gait speed, which is a measure of physical functioning, is significantly reduced. This decline in gait speed has been observed in survivors of ARDS and is closely associated with lean muscle mass [24].

Falls have been noted to occur more frequently in the subgroup of survivors of intensive care who are older, require inotropic support, and experience longer hospital stays [25]. The evaluation of static and dynamic balance is of paramount importance, considering the concomitant risk of falls. The Berg Balance Scale is a reliable and valid tool to assess balance and predict functional outcomes. It consists of 14 items that evaluate various aspects of balance and postural control [26]. Assessing the ability to perform activities of daily living (ADLs) is crucial in evaluating functional independence. The Barthel Index is a widely used assessment tool that measures independence in ADLs. It provides valuable information about an individual's level of dependence and guides treatment planning [27].

Physiotherapy Intervention of PICS

Physiotherapy plays a crucial role in addressing physical impairments in patients with PICS. Several interventions have been implemented to improve physical function and reduce disability in this population. This section will discuss the key physiotherapy interventions, including early mobilization, strength training, balance and coordination exercises, gait training, and functional rehabilitation, along with the supporting evidence.

i. Early mobilization: Early mobilization involves initiating physical activity and movement as early as possible during the ICU stay. It includes activities such as sitting on the edge of the bed, standing, walking, and active range of motion exercises. Early mobilization has been shown to improve muscle strength, functional outcomes, and reduce the duration of ICU and hospital stays [28,29]. Early mobilization has also been associated with decreased incidence of delirium and ventilator-associated pneumonia [29,30].

ii. Strength Training: Strength training focuses on improving muscle strength and endurance. Resistance exercises, such as weightlifting, elastic band exercises, and bodyweight exercises, are commonly used. Studies have demonstrated that strength training can enhance muscle strength, physical function, and activities of daily living (ADLs) in PICS patients [31,32].

iii. Balance and Coordination Exercises: Balance and coordination exercises aim to improve postural stability, coordination, and proprioception. These exercises include standing balance activities, weight shifting, single-leg stance exercises, and specific coordination drills. Evidence suggests that balance and coordination training can enhance balance, reduce falls, and improve functional mobility in PICS patients [33,34].

iv. Gait Training: Gait training includes exercises to improve stride length, step symmetry, and gait speed. Gait training has been shown to improve walking capacity, balance, and overall

functional mobility in PICS patients [35,36].

v. Functional Rehabilitation: Functional rehabilitation aims to improve patients' ability to perform activities of daily living and instrumental activities of daily living. It involves task-specific training and functional activities relevant to the patient's daily life. Functional rehabilitation programs have demonstrated improvements in functional independence, quality of life, and community reintegration in PICS patients [37,38].

Due to the heterogeneity of PICS and patient-specific factors, individualized treatment plans are crucial for optimizing outcomes. Severity of PICS, comorbidities, functional baseline, and patient goals should be considered when tailoring interventions. Regular assessments of physical function, psychological well-being, and cognitive abilities should guide the development of personalized treatment plans [39,40]. Regular reassessment and modification of treatment strategies based on patient progress are essential for ensuring optimal outcomes.

Conclusion

Physiotherapy management plays a crucial role in addressing the physical impairments associated with Post-Intensive Care Syndrome (PICS). Through a multidimensional approach, including early mobilization, strength training, balance and coordination exercises, gait training, and functional rehabilitation, physiotherapy interventions have demonstrated effectiveness in improving physical function and reducing disability in PICS patients. The evidence supports the positive impact of physiotherapy on muscle strength, respiratory function, gait speed, balance, and daily activities. However, challenges exist in determining the optimal timing and intensity of interventions, as well as in implementing these strategies in clinical practice. Variations in patient acuity, resource limitations, and interdisciplinary coordination require careful consideration. To overcome these challenges, early screening for PICS risk, interdisciplinary collaboration, standardized protocols, and resource optimization are recommended. Furthermore, incorporating technology-based solutions, such as tele-rehabilitation, may enhance accessibility and continuity of care. Patient-centered care and shared decision-making should guide the development of individualized treatment plans, considering the unique needs and preferences of each patient.

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