

Impact of Aquatic Therapy on Systemic Inflammation in Spinal Cord Injury Rehabilitation

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Abstract

This study investigates the effects of incorporating aquatic therapy into standard physiotherapy treatment on systemic inflammatory markers in patients with Spinal Cord Injury (SCI). A randomized controlled trial was conducted with SCI patients assigned to either a standard physiotherapy group or a combined aquatic therapy and physiotherapy group. Systemic inflammation was assessed by measuring levels of C-Reactive Protein (CRP) and Interleukin-6 (IL-6) before and after an 8-week intervention period. Results indicated that patients receiving combined aquatic therapy and standard physiotherapy experienced significant reductions in CRP and IL-6 levels compared to those receiving only standard physiotherapy. These findings suggest that aquatic therapy may enhance the anti-inflammatory effects of traditional physiotherapy, potentially improving overall rehabilitation outcomes for individuals with SCI.

Keywords: Spinal cord injury • Aquatic therapy • Systemic inflammation • Physiotherapy

Introduction

Spinal Cord Injury (SCI) often leads to a range of physical and functional impairments, including reduced mobility, muscle weakness and systemic inflammatory responses. Systemic inflammation is a common consequence of SCI and can contribute to secondary complications such as cardiovascular disease and impaired wound healing. Inflammation in SCI patients is frequently monitored using biomarkers such as C-Reactive Protein (CRP) and Interleukin-6 (IL-6), which are indicators of inflammatory activity in the body. Standard physiotherapy is a cornerstone of SCI rehabilitation, aiming to improve functional outcomes, reduce spasticity and enhance overall quality of life [1]. Recently, aquatic therapy has emerged as an adjunctive treatment due to its potential benefits, including reduced joint stress and enhanced muscle activation in a buoyant environment. Aquatic therapy has been shown to offer significant advantages in terms of improving range of motion, strength and cardiovascular fitness. Despite the growing interest in aquatic therapy, there is limited research on its effects on systemic inflammation in SCI patients. Understanding whether aquatic therapy can contribute to reducing systemic inflammatory markers when combined with standard physiotherapy could provide valuable insights into optimizing rehabilitation protocols. This study aims to address this gap by examining the impact of adding aquatic therapy to standard physiotherapy on systemic inflammatory markers, specifically CRP and IL-6, in individuals with SCI. The findings could inform clinical practice by highlighting potential benefits of integrating aquatic therapy into SCI rehabilitation programs, ultimately improving patient outcomes and quality of life [2].

Literature Review

Spinal Cord Injury (SCI) is associated with systemic inflammation, which contributes to various secondary complications and impairs overall recovery. Systemic inflammation in SCI patients is often marked by elevated levels of

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biomarkers such as C-Reactive Protein (CRP) and Interleukin-6 (IL-6). CRP is a general marker of inflammation and is elevated in response to acute and chronic inflammatory conditions. IL-6 is a cytokine that plays a crucial role in inflammation and immune response and its levels are often elevated in individuals with SCI. Chronic inflammation following SCI can exacerbate complications such as cardiovascular disease, pressure ulcers and metabolic disorders. Standard physiotherapy for SCI focuses on improving physical function, reducing spasticity and enhancing overall mobility and quality of life. This approach typically includes a combination of strength training, range of motion exercises and functional activities tailored to the individual's level of injury and functional abilities. While effective for improving physical outcomes, traditional physiotherapy may not directly address systemic inflammation or its associated complications [3].

Aquatic therapy has gained recognition as a beneficial adjunctive treatment in rehabilitation due to its unique properties. The buoyant environment of water reduces joint stress and provides resistance that can enhance muscle activation and cardiovascular conditioning. Research has demonstrated that aquatic therapy can improve range of motion, strength and overall functional outcomes in various patient populations, including those with musculoskeletal and neurological conditions. The impact of aquatic therapy on systemic inflammation is an emerging area of interest. Studies have indicated that aquatic exercise can lead to reductions in inflammatory markers and improve overall health outcomes. For example, research involving individuals with arthritis has shown that aquatic exercise can reduce levels of CRP and IL-6, suggesting an anti-inflammatory effect. However, the specific effects of aquatic therapy on systemic inflammation in SCI patients have not been extensively studied, highlighting a gap in the current literature [4].

Discussion

The findings of this study indicate that incorporating aquatic therapy into standard physiotherapy significantly impacts systemic inflammation in SCI patients. Specifically, the combination of aquatic therapy and physiotherapy resulted in notable reductions in CRP and IL-6 levels compared to standard physiotherapy alone. These results suggest that aquatic therapy may enhance the anti-inflammatory effects of traditional physiotherapy, potentially leading to improved overall rehabilitation outcomes. Aquatic therapy's effectiveness in reducing systemic inflammation could be attributed to several factors. The buoyancy of water reduces the mechanical stress on joints and tissues, which may decrease the inflammatory response associated with physical activity. Additionally, the hydrostatic pressure of water can enhance venous return and lymphatic drainage, further contributing to reduced inflammation. The combination of these physiological benefits may result in lower levels of

inflammatory biomarkers such as CRP and IL-6 [5].

The study's findings are consistent with previous research showing that aquatic exercise can reduce inflammatory markers in other populations. However, this study is among the first to specifically investigate the effects of aquatic therapy on systemic inflammation in SCI patients, addressing a significant gap in the literature. The improvements observed in inflammatory markers, alongside the benefits of standard physiotherapy, suggest that integrating aquatic therapy into SCI rehabilitation programs could offer a more comprehensive approach to managing both physical function and systemic inflammation. Despite the promising results, the study has limitations. The relatively short duration of the intervention and the absence of long-term follow-up may impact the sustainability of the observed effects. Additionally, the sample size and demographic characteristics of the participants may limit the generalizability of the findings. Future research should explore the long-term effects of aquatic therapy on inflammation and functional outcomes in SCI patients and assess its applicability to diverse populations and clinical settings [6].

Conclusion

This study provides evidence that adding aquatic therapy to standard physiotherapy can significantly reduce systemic inflammation in spinal cord injury patients. The reduction in CRP and IL-6 levels observed with the combined intervention suggests that aquatic therapy may enhance the anti-inflammatory effects of traditional physiotherapy, leading to improved rehabilitation outcomes. Integrating aquatic therapy into SCI rehabilitation protocols offers a promising approach to addressing both physical and systemic aspects of recovery. Future research should focus on the long-term benefits of aquatic therapy, exploring its effects on various inflammatory markers and functional outcomes over extended periods. Additionally, studies should investigate the potential of aquatic therapy in different patient populations and settings to refine and optimize rehabilitation strategies for individuals with SCI. Overall, this research highlights the value of incorporating innovative and evidence-based therapies into SCI rehabilitation programs to enhance patient outcomes and quality of life.

Acknowledgement

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Conflict of Interest

There are no conflicts of interest by author.

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