UNIVERSITY OF WEST ATTICA
SCHOOL OF HEALTH AND CARE SCIENCES
DEPARTMENT OF PHYSIOTHERAPY

PhD Thesis Summary

Title: The effect of an active mobilization program on the incidence of Intensive Care Unit neuromuscular syndrome

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SUMMARY

INTRODUCTION: Every year, millions of critically ill patients around the world are treated in intensive care units (ICUs). Hospitalization in the ICU can last from days to months, depending on the reason for admission and the patient's response to the treatment administered.

During hospitalization, initial treatment focuses on treating the underlying disease, stabilizing vital organ function, and restoring life-threatening physiological disorders. In order to achieve the above goals, the use of mechanical ventilation and other invasive diagnostic and therapeutic methods is considered necessary, which requires an initial period of sedation and analgesia. All of the above usually result in a prolonged period of immobility and lack of physical activity.

However, immobility and lack of physical activity are not without complications. Many studies have shown the damage caused by prolonged immobility and the resulting lack of physical activity to the muscular system, both in healthy and sick individuals. More specifically, these studies have shown that immobility results in a short period of time, a reduction in muscle mass and muscle strength as well as aerobic capacity and muscle endurance, resulting in impaired muscle function and contractility. The above negative effects of immobility on muscle function appear within a few hours or days.

Taking all of the above into account, the devastating consequences of the necessary and imposed initial period of sedation and immobility of severely ill patients become understandable. These consequences are reinforced by the effects of the critical illness itself.

With regard to the damaging effect on muscle tissue, the systemic inflammation that characterises critical illness has a synergistic effect with prolonged immobility. The changes caused by critical illness in muscle tissue are both structural and functional. Due to the oxidative stress caused by critical illness, through the increased circulation of inflammatory mediators (TNF-α, IL-1β, IL-6, GDF-15, TGF-β) and free oxygen radicals, there is reduced protein synthesis and increased proteolytic activity through increased activation of protease systems. During the first ten days of hospitalization, the muscle architecture changes. The size of muscle fibers decreases, mainly due to the destruction of thick myosin filaments, the concentration of the non-contractile component of the muscle (connective tissue) increases, and microhaemorrhages develop.

As far as nerve tissue is concerned, the damage caused by critical illness to peripheral nerves is both structural and functional. More specifically, due to the cytokine-mediated (TNF-α, IL-1) of systemic inflammation, microcirculation is disrupted and vascular permeability increases in the epineurium and endoneurium, resulting in the development of endoneurial oedema, extravasation of activated white blood cells and the entry of toxic agents into the nerve. Inadequate capillary circulation results in disruption of the supply of oxygen and nutrients to the nerve cell axons, intraneural oedema impedes energy transfer along the nerve axons, while the effect of toxic agents causes mitochondrial dysfunction and insufficient energy production within the nerve cells. The above mechanisms ultimately result in the degeneration and death of nerve axons. Finally, the oxidative stress caused by pro-inflammatory cytokines

disrupts the transfer of energy potential along nerve axons, resulting in low-frequency and low-intensity nerve impulses reaching the muscle fiber membrane, which, combined with the reduced ability of the membrane to be stimulated, causes functional denervation of the muscles.

The pathophysiological disorders described above collectively lead to the onset of the clinical syndrome known as 'ICU-acquired weaknes or ICU neuromuscular syndrome. ICU-acquired weakness is defined as a condition in which, after the removal of sedation, there is clinical weakness of the skeletal muscles of the limbs, for which no other cause can be found other than the critical illness itself and hospitalization in the ICU. Clinical examination reveals diffuse symmetrical weaknes of the limbs, ranging from mild weakness to flaccid paralysis or even quadriplegia. Another important clinical feature is weakness of the respiratory muscles, particularly the diaphragm, resulting in the inability to wean from mechanical ventilation.

In order to minimise the complications of critical illness on the neuromuscular system, it is necessary to take measures very early during hospitalization. One of these measures, perhaps the most important, is the early initiation of mobilization and physical rehabilitation of severely ill patients.

PURPOSE: Based on the above, the present study aims to investigate the effect of implementing an active mobilization programme on the occurrence of neuromuscular syndrome in the Intensive Care Unit (ICU).

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