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REVIEW

Early mobilization: Why, what for and how?

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Abstract Early mobilization strategies in the intensive care unit may result in the prevention and reduction of polyneuromyopathy in the critical patient, improved quality of life, shortened ICU and hospital stay, and lesser mortality during hospitalization. However, it is well known that factors such as the protocol used, the population included in the studies, the timing of the strategy, the severity of the patients and different barriers directly influence the outcomes. This study examines the main protocols described in the literature and their associated results. The main techniques used were kinesitherapy, transfer and locomotion training, as well as neuromuscular electrical stimulation and cycle ergometry. Although two trials and a meta-analysis found no positive results with mobilization, programs that focus on specific populations, such as patients with weakness due to immobility and with preserved neuromuscular excitability can derive more positive effects from such treatment.

PALABRAS CLAVE
Unidad de cuidados intensivos;
Fisioterapia;
Movilización precoz

La movilización temprana: ¿Por qué, para qué y cómo?

Resumen Las estrategias de movilización precoz en la unidad de cuidados intensivos pueden asociarse a la prevención y una reducción de la polineuromipatía del paciente crítico, una mejora de la calidad de vida del paciente y la reducción tanto del período de ingreso en la UCI

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y el hospital como de la mortalidad durante la hospitalización. Sin embargo, se sabe que los resultados se ven afectados por factores como el protocolo utilizado, la población incluida en los estudios, el momento en que se comienza a aplicar la estrategia, la gravedad de los pacientes y distintos tipos de barreras. Este estudio informa sobre los principales protocolos empleados en la literatura científica, así como sus resultados. Las principales técnicas empleadas fueron la quinesioterapia, la formación sobre traslados y locomoción, la estimulación neuromuscular eléctrica y el uso de bicicletas ergométricas. Si bien en dos ensayos y un metaanálisis no se han observado resultados positivos con la movilización, los programas que se centran en poblaciones objetivo específicas, como aquellas formadas por pacientes con debilidad debido a la inmovilidad y excitabilidad neuromuscular preservada, pueden lograr resultados más positivos con el tratamiento.

Interventions in early mobilization are beneficial for patients with critical illness because they reduce muscle weakness acquired in the intensive care unit (ICU). Adequate knowledge of the population that is at risk of developing muscular disorders is extremely important, and the two main evident risks are mechanical ventilation for extended periods and immobility.[1] Thus, it is clear that there is a need for the physiotherapy team to evaluate the possible risks of deleterious effects related to mechanical ventilation and immobility of critically ill patients at the ICU, such as loss of strength and muscle mass.

The main changes experienced by critical patients with muscle weakness at cellular and molecular level are reduced excitability of the muscle membrane, altering the link between protein production and degradation resulting in increased protein degradation, increased free radicals and decreased antioxidant defense plus oxidative stress, which results in an increased inflammatory status seen by raising further the interleukins and possible mechanisms involving growth and differentiation factor 15 (GDF-15), transforming growth factor-β (TGF-β).[2–4]

Unfortunately, molecular mechanisms underlying the muscle atrophy of intensive care unit-acquired weakness (ICUAW) are poorly understood. Jiroutková et al.[5] hypothesized that bioenergetics failure of skeletal muscle may contribute to the development of ICU-acquired weakness and conducted a study with the aim to determine whether mitochondrial dysfunction persists until the protracted phase of critical illness. The authors demonstrated that mitochondrial dysfunction in the quadriceps muscle of patients with protracted critical illness compared to metabolically healthy age-matched control patients undergoing hip replacement surgery. There was approximately 50% reduction in the capacity for aerobic ATP synthesis per milligram of muscle wet weight, in correlation with significant reductions in functional subunits of complexes III and IV.

When accounting for the activity of citrate synthase, which we used as a marker of mitochondrial content, there was no difference in global mitochondrial functional indices. Bloch et al. investigated GDF-15 and microRNA expression in patients with ICUAW and to elucidate possible mechanisms by which they cause in vivo and in vitro muscle atrophy and shows that GDF-15 may increase sensitivity to TGF-β signaling by suppressing the expression of muscle microRNAs, thereby promoting muscle atrophy in ICUAW. This study identifies both GDF-15 and associated microRNA as potential therapeutic targets.[6]

In the literature is possible to find different early mobilization protocols presenting variations related to the progression of exercises and even their start time. Other tools have been incorporated into the early mobilization protocols such as neuromuscular electrical stimulation (NMES), the cycle ergometer, and the orthostatic board. According to Conolly et al.,[7] early mobilization and electrostimulation are presented as the most effective alternatives for short-term outcomes.[8–10] Interestingly, Stefanou et al.[11] proposed a study for exploring the NMES-induced effects on mobilization of endothelial progenitor cells (EPCs) in septic ICU patients. Patients were randomized to one of the two 30-min NMES protocols of different characteristics, a high-frequency (75 Hz, 6 s on − 21 s off), or medium-frequency (45 Hz, 5 s on − 12 s off) protocol both applied at maximally tolerated intensity and blood was sampled before and immediately after the NMES sessions. The authors demonstrated that NMES acutely mobilized EPCs in severe ICU patients and these effects did not depend on NMES protocol or sepsis severity status.

The beneficial effects of the different early mobilization strategies are associated with the prevention and reduction of polyneuropathy and myopathy of the critical patient, improvement of the patients' quality of life, reduction of ICU stay and hospitalization, and mortality during hospitalization. Other associated outcomes are the reduction of mechanical ventilation time and weaning, and the preservation of peripheral and respiratory muscle strength.

Even passive mobilization strategies demonstrate significant beneficial effects at cellular level, as demonstrated by Llano-Diez et al.,[12] which evaluated the effects of a specific intervention aiming at reducing mechanical silencing in sedated and mechanically ventilated ICU patients. The authors evaluated muscle gene/protein expression, post-translational modifications, muscle membrane excitability, muscle mass measurements, and contractile properties at the single muscle fiber level were explored in seven deeply sedated and mechanically ventilated ICU patients subjected to unilateral passive mechanical loading for 10 h per day and

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