

Abstract

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Title: Effect of Functional Electrical Stimulation-Assisted Ergometry on Muscle Cross-Sectional Diameter, Nitrogen and Fluid Balance in Critically Ill

Objectives: The aim of this thesis was to investigate the effect of functional electrical stimulation-assisted cycling ergometry (FES-CE) on cross-sectional diameter of the quadriceps femoris (QF) muscle of both lower extremities in critically ill patients. Another objective was to evaluate if the measured values are responding to the changes in muscle tissue or are caused by an oedema.

Methods: The intervention group received daily intensified physical therapy and FES-CE. We measured cross-sectional diameter of the QF muscle repeatedly by a diagnostic ultrasound. We recorded daily nitrogen balance to objectivize catabolism of muscle and fluid balance to objectivize amount of cumulative fluid.

Results: The total of 115 patients were evaluated. Average decrease of cross-sectional diameter of QF muscle in the intervention group was 0.020 ± 0.070 cm/day, in the control group it was 0.017 ± 0.084 cm/day ($p = 0.87$). We registered an opposite result from the eighth day onwards, the intervention group had average decrease 0.025 ± 0.047 cm/day and the control group 0.040 ± 0.076 cm/day ($p = 0.38$). The nitrogen intake was statistically significantly higher in the intervention group ($p = 0.029$). Average nitrogen balance in the intervention group was 0.56 ± 8.71 g nitrogen/day and in the control group $-1,34 \pm 9,36$ g/day in the first week ($p = 0.27$). Protein anabolism occurred more often within the first seven days in the intervention group. Nitrogen balance started to be stable from the eighth day

onwards, in the intervention group 2.41 ± 8.30 g nitrogen/day and in the control group 1.85 ± 11.58 g nitrogen/day ($p = 0.828$). Average fluid balance in the intervention group was 862.2 ± 1313.9 ml/day, in the control group 610.8 ± 1051.9 ml/day ($p = 0.26$). FES-CE seems to preserve muscle mass in the critically ill after the first week of admission to the ICU. The potential use of FES-CE as a rehabilitation tool in critically ill patients needs to be further investigated.

Keywords: ICU acquired weakness, muscle mass, nitrogen balance, fluid balance, functional electrical stimulation, diagnostic ultrasonography, functional electrical stimulation assisted cycling ergometry