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Key Words: electric stimulation therapy, skeletal muscle, proteolysis, muscle weakness, cardiovascular surgical procedures, rehabilitation

EDITORIAL COMMENTARY

A new weapon in the fight against postcardiac surgery muscle catabolism

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Disclosures: Authors have nothing to disclose with regard to commercial support.

Received for publication Oct 31, 2016; accepted for publication Nov 1, 2016.

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J Thorac Cardiovasc Surg 2017;153:379-80

0022-5223/\$36.00

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<http://dx.doi.org/10.1016/j.jtcvs.2016.11.013>

Systemic inflammatory response syndrome is a complex pathophysiologic event following cardiac surgery, and is the result of surgical stress, altered end-organ blood flow during cardiopulmonary bypass, and neuroendocrine alterations.¹

This proinflammatory milieu is characterized by perioperative increased plasma levels of cytokines such as interleukin 6 and tumor necrosis factor alpha and contributes to the establishment of a catabolic phase that occurs during the postoperative course.^{2,3}

The subsequent muscle wasting and muscle weakness appears early in critically ill patients, negatively influencing outcomes.⁴⁻⁶ In this scenario, patient-related factors, such as preoperative nutritional status, body mass index, hemoglobin level, and endocrine alterations interact with procedure-related determinants.⁷

Iwatsu and colleagues⁸ conducted a prospective study to evaluate the efficacy of neuromuscular electrical

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Central Message

Neuromuscular electrical stimulation is a potential solution to attenuate postcardiac surgery proteolysis and muscle weakness.

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stimulation (NEMS) in attenuating postcardiac surgery proteolysis and muscle weakness.⁸ Specifically, 61 patients underwent daily NEMS up to postoperative day 5, whereas 41 patients received standard therapy. The levels of urinary 3-methylhistidine, a parameter of protein breakdown, were significantly lower in the NEMS group. Moreover, knee extensor isometric strength and handgrip strength—2 specific muscular strength tests—were higher in the NEMS group compared with the non-NEMS group on postoperative day 7. These results highlight the

importance of muscle mobilization and are especially applicable to those patients requiring a prolonged intensive care unit stay.

The main limitations of this study are clearly indicated by the authors. The lack of randomization limits the possibility of establishing a clear causal relationship among NEMS, reduction of urinary 3-methylhistidine levels, and higher postoperative muscular strength in the treatment group. In addition, a significant risk of bias cannot be excluded in the practice of splitting the study between 2 different centers. Taking into account these limitations, this study adds a remarkable contribution to the exploration of therapeutic options for the treatment of postcardiac surgery muscle weakness.

NMES has been shown to be a safe and effective procedure for improving muscular strength in critically ill patients.^{9,10} Although described previously, an important finding is that the improvement of muscle strength was also present in a muscular group different from that of NEMS application, suggesting that the effect of NEMS may be systemic.¹¹ That opens a new field of research to identify the underlying biochemical and pathophysiologic pathways for muscle degeneration and preservation.

NEMS has been applied in selected patients with an uncomplicated postoperative course and limited length of postoperative mechanical ventilation (ie, < 24 hours). In our opinion, the effect of NEMS might be more evident in those settings where the catabolic phase is extremely increased, such as low cardiac output syndrome, end-organ damage, or prolonged mechanical ventilation. In light of these considerations, researchers are invited to conduct well-designed randomized trials to evaluate muscle degeneration and weakness in a specific cohort of complex, high-risk cardiac surgery patients.

In conclusion, plenty of factors influence muscle metabolism after cardiac surgery. This pilot study explores new frontiers in NEMS therapy, enhancing, at the same time, interest in the identification of underlying biochemical mechanisms of muscle catabolism and potential pharmacologic targets in patients with critical illness. A new weapon is coming...

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