CRITICAL CARE

COMMENTARY

Have we found the prevention for intensive care unit-acquired paresis?

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See related research by Routsi *et al.*, http://ccforum.com/content/14/2/R74

Abstract

Several recent reports have highlighted the utility of transcutaneous electrical muscle stimulation to preserve muscle mass and strength in ICU patients. Specifically, Serafim Nanas and colleagues report a significant reduction in the odds of ICU-acquired weakness with its use. Whether these findings are relevant to all patients with acute respiratory failure remains to be seen. As critical care studies attempt to study the outcome of physical recovery, significant additional data need to be provided in order for the results to be reported in the appropriate context. Future studies need to be performed in a setting where secondary injuries like sedation and immobilization are quantified so any benefit can be weighed against other interventions available.

Have we found the prevention for ICU-acquired paresis? In the previous issue of *Critical Care*, Serafim Nanas and colleagues [1] presented a report of the use of transcutaneous electrical muscle stimulation (TEMS) in critically ill patients. Its simple application less than 1 hour a day resulted in improved global strength upon recovery. The odds of developing ICU-acquired paresis were reduced by almost 80%. Importantly, there is precedent that this simple technology improves strength in other patient groups with at least partial immobilization [2] and the effect may be systemic [3].

Unfortunately, despite the magnitude of the observed effect in this patient population, many important questions remain unanswered. First, why would electrical stimulation of only the lower extremities impact overall strength? While systemic effects of TEMS have been observed in the form of improved microcirculation [3], is this enough to improve global strength in non-stimulated muscle groups? Severe sepsis, a disease long associated with a high rate of critical illness polyneuromyopathy, may actually lead to electrically unexcitable muscles [4,5]. This particular study appears to have a relative minority of patients experiencing sepsis at ICU admission, leading to questions about its efficacy in this population. Along these lines, the dose of electricity required to activate muscles in this study were not reported and several patients were not included in the analysis because they received no TEMS. Was this because capture could not be achieved or were they simply missed? For this specific question we await the results of studies focusing on the use of TEMS in sepsis patients (ClinicalTrials.gov identifier NCT01071343). Is it possible that TEMS at the doses used is mentally alerting? This is an intriguing idea given that patients in the TEMS group in this study were less often excluded due to coma (11 in the TEMS group versus 22 in the control group) and therefore unable to be examined for strength. If this were true, it could explain why control patients could possibly remain in the ICU longer than their TEMS counterparts as the duration of time patients spend in coma is highly associated with the development of ICU-acquired weakness and muscle atrophy [6].

Additionally, what muscles should be targeted? Most recent studies of physical therapy interventions in the ICU have focused on ambulation [7,8]. However, respiratory muscle strength may be a more relevant target in respiratory failure patients. Extrapolating from outpatient studies might suggest that a global approach to muscle training is important to achieve improved respiratory muscle strength [9]. Is it feasible to think that TEMS can be applied to both upper and lower extremities?

In fact, this article and the interpretation of its results raise significant issues as to the essential data that need to be reported in studies of critically ill patients designed to measure physical strength as their outcome. This is a very different outcome than survival. Typical outcomes for interventions in severe sepsis patients have been survival or organ failure resolution [10,11]. However, in

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studies of physical function other variables have to be accounted for. What is the baseline physical function of these ICU patients prior to their acute illness? How were sedative agents handled? What were the baseline physical therapy practices of the base ICU and, therefore, the control group? In many ways the example given to us by William Schweickert and colleagues [12] should serve as a guide for future researchers in this area of critical care research. In their study of structured physical therapy in ventilated patients, baseline functional status was determined and their intervention was applied in the context of rigorous sedation interruption ensuring that excess 'immobilization days' were minimized. Similar to the studies of mechanical ventilation and weaning that require the standardization of multiple non-ventilator practices, future attempts to test interventions to preserve neuromuscular function in critically ill patients must account for these and other important co-factors.

While many questions remain regarding TEMS, there is little doubt that the present study represents an exciting new advance in our thinking on the ability to prevent severe neuromuscular injury in ICU patients. Much of our ability to include TEMS in the discussion of future therapies can be attributed to the multiple studies by Dr Nanas and colleagues. However, while TEMS is likely to play a role in the future, that role needs further definition. The time for universal adoption is not upon us, but thoughtful application of these devices in future multi-centered studies could help to clarify the role of TEMS. Until then a concerted effort to avoid over-sedation and provide the best physical therapy to all of our patients needs to be the priority.

Abbreviations

TEMS = transcutaneous electrical muscle stimulation.

Competing interests

The author declares that they have no competing interests.

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