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The Surgical Optimal Mobility Score predicts mortality and length of stay in an Italian population of medical, surgical, and neurologic intensive care unit patients

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ABSTRACT

Purpose: We validated the Italian version of Surgical Optimal Mobility Score (SOMS) and evaluated its ability to predict intensive care unit (ICU) and hospital length of stay (LOS), and hospital mortality in a mixed population of ICU patients.
Materials and Methods: We applied the Italian version of SOMS in a consecutive series of prospectively enrolled, adult ICU patients. Surgical Optimal Mobility Score level was assessed twice a day by ICU nurses and twice a week by an expert mobility team. Zero-truncated Poisson regression was used to identify predictors for ICU and hospital LOS, and logistic regression for hospital mortality. All models were adjusted for potential confounders.
Results: Of 98 patients recruited, 19 (19.4%) died in hospital, of whom 17 without and 2 with improved mobility level achieved during the ICU stay. SOMS improvement was independently associated with lower hospital mortality (odds ratio, 0.07; 95% confidence interval [CI], 0.01-0.42) but increased hospital LOS (odds ratio, 1.21; 95% CI: 1.10-1.33). A higher first-morning SOMS on ICU admission, indicating better mobility, was associated with lower ICU and hospital LOS (rate ratios, 0.89 [95% CI, 0.80-0.99] and 0.84 [95% CI, 0.79-0.89], respectively).
Conclusions: The first-morning SOMS on ICU admission predicted ICU and hospital LOS in a mixed population of ICU patients. SOMS improvement was associated with reduced hospital mortality but increased hospital LOS, suggesting the need of optimizing hospital trajectories after ICU discharge.

1. Introduction

Early mobilization during the intensive care unit (ICU) stay has been advocated to mitigate the effects of muscle weakness [1–5]. Early rehabilitation includes a spectrum of interventions ranging from passive motion exercises to ambulation and to the use of novel technologies such as cycle ergometry and transcutaneous electrical muscle stimulation [6]. Although some patients are unable to progress through all the different steps of mobilization, even minimal motor activities can reduce muscle weakness and wasting.

The beneficial effects of early mobilization in the medical ICU have been reported in several studies [1,2]. Although not free of risks [3,5,7], its safety profile is reported to be good with low rates of complications even in patients who are traditionally not mobilized, such as those with femoral vein or artery catheters [8–10]. Different strategies have been proposed to modify potential barriers to early mobilization, such as changing vascular catheter location, careful scheduling of procedures, and improved sedation management [11,12].

The Surgical Optimal Mobility Score (SOMS), a 5-point numerical rating scale to guide goal-directed early mobilization therapy, has been demonstrated to be a predictor of mortality as well as ICU and hospital length of stay (LOS) in a surgical ICU population [13]. In their original study, Kasotakis and colleagues [13] studied the reliability of SOMS score in 113 functionally independent surgical ICU patients by comparing SOMS assigned by nurses with those assigned by an expert mobility team (EMT), and they found an excellent agreement between the 2. The

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authors also found that higher SOMS scores, indicating better mobility, were associated with lower mortality and hospital and ICU LOS.

In this prospective cohort study, we assessed if SOMS can predict ICU and hospital LOS and hospital mortality in an Italian population of adult medical, surgical, and neurologic ICU patients. We also evaluated the interrater reliability of the Italian version of SOMS and the safety of SOMS-guided mobilization in this mixed ICU population.

2. Materials and methods

The SOMS is an algorithm for goal-directed early mobilization in the ICU. It contains a numerical rating scale from 0 to 4 to quantify the patient's mobilization capacity. SOMS 0 indicates that no mobilization should be considered, because it is deemed to be futile, for patients in terminal unstable clinical condition such as those with intracranial hypertension or severe systemic hemodynamic and respiratory insufficiency. SOMS 1 indicates that the patient can receive passive range of motion exercise while in bed, and SOMS 2 indicates that the patient can be sitting up in bed. SOMS 3 indicates that the patient is able to stand with or without assistance, and SOMS 4 is assigned to patients able to ambulate [13].

2.1. Development of the Italian version of the SOMS

As a first step to use SOMS in our ICU, we provided an Italian translation of the original English version following the recommendations for a comprehensive multistep process for translating, adapting, and cross-validating instruments (Supplementary Fig. 1) [14]. Two qualified medical doctors whose native language was Italian, fluent in English, and with knowledge in early rehabilitation in the ICU independently translated into Italian the original version of the SOMS score, the associated instructions, and the drawings' text. Thereafter, a consensus meeting was held to agree on a fully comprehensible and accurate Italian translation consistent with the original English text. The draft was back translated into English and compared with the original to develop the final Italian translation.

2.2. Study design and setting

The study was a prospective observational study conducted at the general and neurologic ICU of the Department of Anesthesia, Critical Care and Emergency of the Spedali Civili of Brescia, a large regional university-affiliated hospital. The ICU has 10 beds, 6 general and 4 neurologic. The daytime staffing of the unit consists of 1 medical coordinator, 1 attending physician, 2 residents (fourth- and fifth-year residents of the School of Specialty in Anesthesia and Critical Care Medicine), and 6 critical care nurses. The night shift team consists of 1 attending physician, 1 resident, and 4 nurses. Physical therapists are not dedicated exclusively to the ICU and provide general and respiratory physical therapy for 5 days a week based on a physiatrist-activated written protocol.

The study was approved by the local Ethics Committee (Comitato Etico Provinciale di Brescia; June 17, 2013; Reference No. 1383). Detailed written information was provided to the patients and family members about the study, and written informed consent to participate to the study was obtained from the patient whenever possible. In case of altered consciousness, the ethics committee waived the requirement for consent, because in Italy relatives are not regarded as legal representatives of the patient in the absence of a formal designation. Written informed consent was subsequently requested from all surviving patients as soon as they regained their mental competency. The study was conducted according to the principles expressed in the Declaration of Helsinki.

Patients were eligible if they were 18 years or older and were expected to stay in the ICU for at least 72 hours. Patients were defined as medical, surgical, or neurologic (patient's class) according to the reason for ICU admission. Patients with predicted ICU stay of less than 72 hours, admitted for postsurgery monitoring, or with unstable spine or in terminal condition were excluded.

2.3. Patient management

All patients were managed following the early-goal directed therapy guidelines [15] and a goal-directed sedation protocol aimed at minimizing the use of sedatives through daily interruption [16]. In nonneurologic patients, daily interruption of sedation was part of the "Awakening and Breathing Coordination, Delirium monitoring/management, and Early exercise/mobility" (ABCDE) bundle. SOMS assessment of the level of mobility anticipated to be accomplished during the morning shift was performed at fixed times (see Study Procedures) and not necessarily after awakening. However, the morning shift nurse integrated the entire information obtained from the night shift nurse with the actual patient's condition in order to assign SOMS scores on a solid clinical base [17].

Critically ill neurologic patients had continuous monitoring of cerebral hemodynamics, including intracranial pressure, cerebral perfusion pressure, and cerebrovascular autoregulation monitoring, according to predefined protocol [18]. For multimodal data acquisition, we used the Intensive Care Monitoring software system (ICM+; University of Cambridge, Cambridge, UK) running on bedside laptop computers [18]. Neurologic severity was graded according to the Glasgow Coma Scale [19] and the Full Outline of UnResponsiveness scale [20]. Continuous sedation and analgesia with propofol and fentanyl was gradually reduced and then interrupted if the neurologic condition, the systemic and cerebral hemodynamics, and brain computed tomographic findings stabilized according to the neurointensivist in charge. Initial repeated interruptions of sedation up to 3 times a day were followed by definitive interruption if the patient could tolerate it with no excessive stress reactions. This practice of early interruption of sedation has been in place for several years in our unit and has been demonstrated to be safe also by other centers [21].

2.4. Staff training

From April to June 2013, all ICU nurses were trained by study members to apply the SOMS in simulated cases and during routine care. The ICU staff was also provided with written instructions for proper SOMS scoring, and they were involved in 3 educational meetings devoted to present the potential benefits of early mobilization in the ICU. From July 2013 to October 2013, we prospectively recruited a consecutive series of critically ill patients admitted to our ICU.

2.5. Study procedures

Study investigators screened all ICU admissions daily in the morning to identify those patients fulfilling the inclusion criteria. The early mobilization program was started on the day after enrollment.

The SOMS level was assessed twice a day for each patient by 2 nurses during the morning shift at least 30 minutes after handover from the night shift nurse (*morning SOMS*) and then after the lunch break (*afternoon SOMS*). The 2 nurses' evaluations were separated from one another by a maximum of 30 minutes to minimize the effect of clinical fluctuation. The *morning SOMS level* was defined as the level of mobility anticipated to be accomplished during the morning shift. The level of mobilization effectively reached was defined as *achieved SOMS*. All nurses performed the assessments independently and were blinded to the other's assessment both in the morning and afternoon sessions. In addition, the nurses also recorded any barrier or complication (see next section) related to mobilization [22]. An EMT including an intensivist and a rehabilitation physician assessed the patients twice a week on Tuesday and Thursday morning to predict mobilization capacity using their expertise and the SOMS algorithm. The team,