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The German Validation Study of the Surgical Intensive Care Unit Optimal Mobility Score☆,☆☆

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ABSTRACT

Purpose: Immobilization of critically ill patients leads to muscle weakness, which translates to increased costs of care and long-term functional disability. We tested the validity of a German Surgical Intensive Care Unit (ICU) Optimal Mobilization Score (SOMS) in 2 different cohorts (neurocritical and nonneurocritical care patients).
Materials and Methods: Physical therapists estimated the patients' mobilization capacity by using the German version of the SOMS the morning after admission. We tested the prognostic value of the prediction for ICU and hospital length of stay (LOS) as well as for mortality, and built a model to account for other known predictors of these outcomes in the 2 cohorts.
Results: A total of 128 patients were included in the analysis, 48 of these were neurocritical care patients. The SOMS predicted mortality and ICU and hospital LOS. Neurocritical care patients stayed significantly longer in the ICU (median 12 vs 4 days, $P < .001$) and in the hospital (25 vs 17 days, $P = .02$). The SOMS predicted ICU and hospital LOS. It predicted mortality only in nonneurocritical patients.
Conclusions: The German SOMS assessed by physical therapists on the day after ICU admission predicts ICU and hospital LOS, and mortality. Our data suggest that the association between early mobilization and mortality is more complex in neurocritical care patients.

1. Introduction

Physical therapy is an integral part of a multidisciplinary approach in the treatment for patients in the intensive care unit (ICU) [1]. Previous data indicate that early mobilization in the medical ICU is able to shorten delirium [2], ventilation days [2], and ICU and hospital length of stay (LOS) [3,4], and resulted in a better functional outcome [2,3,5,6].

However, in surgical ICUs (SICUs), where data are limited, barriers to early mobilization are numerous, for example, open wounds, drains, unstable fractures, surgical wound pain, or the necessity of medical interventions such as dialysis [7,8].

To evaluate the effectiveness of early goal-directed mobilization compared with standard physical therapy on SICUs, the international, multicenter Surgical ICU Optimal Mobilization Score (SOMS) trial [9] was initiated. Early goal-directed physical therapy is facilitated using the SOMS using a specific algorithm for mobilization [7,9]. The SOMS is a simple "0" to "4" score ranging from "no activity" to "ambulation" which has been validated in English before [10]. In this study, we created a German version of the SOMS and validated it at our university hospital similar as described before [10]. In addition, we tested if there is a difference in the validity of the SOMS in our SICU patients subdivided in nonneurocritical and neurocritical care subgroup.

2. Methods

2.1. Study population and setting

The single-center prospective study was approved by the ethics committee of the "Fakultät für Medizin der Technischen Universität München" on September 5, 2013 (5938/13), prior to patients'

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enrollment. The study is listed under the acronym GEVASOMS (German Validation Study of the Surgical ICU Optimal Mobility Score) at the German Clinical Trial Register (GermanCTR, DRKS00004873) registered on September 30, 2013, with the Universal Trial Number (U1111-1141-5311).

Patients were included if admitted to our interdisciplinary SICU, older than 18 years, and expected to stay in the SICU for at least 24 hours. Furthermore, their Barthel Index score [11] had to be greater than 70, obtained by a proxy describing the patient's function 2 weeks before admission. Patients were excluded if they took part in another clinical trial at the same time.

The study was performed at our interdisciplinary SICU of an academic medical center (Klinikum rechts der Isar, Technische Universität München, Munich, Germany) between 11th November 2013 and 26th February 2014. The ICU is a 22-bed unit that primarily admits patients after complex trauma, vascular, thoracic, or general surgery, as well as neurocritical care patients. It is staffed 24 hours with intensive care specialists, anesthesiology, or surgery residents in 2 shifts. During night and weekend hours, 1 intensive care specialist is on-call and at least 2 residents (1 at least anesthesiologist resident) are continuously present on the SICU. Critical care nurses are working in 3 shifts, 1 nurse for 2 patients. Physical therapy is available daily for all patients during the week and limited to 6 patients daily during the weekend.

2.2. Data collection

Each patient admitted to the SICU was screened regarding inclusion and exclusion criteria. If eligible, patient demographics and characteristics (age, sex, Barthel Index, admission diagnoses, and comorbidity index) were assessed and recorded. All patients were categorized in 2 subgroups: (1) patients without neurologic disorder (nonneurocritical care group) and (2) patients with neurologic disorder (neurocritical care group). If the patient was admitted to the ICU with an acute neurologic or neurosurgical illness requiring intensive care therapy [12], the patient was assigned to the subgroup "neurocritical care." The morning after admission, laboratory data (serum sodium, creatinine, glucose pH, Pao_2, $Paco_2$, and Fio_2) were obtained, and the Acute Physiology and Chronic Health Evaluation (APACHE II) score [13] and the presence of delirium (using the Confusion Assessment Method for the ICU) [14] were recorded as well. After discharge from the hospital, the following variables were collected: duration of mechanical ventilation in the SICU, SICU LOS, and hospital LOS.

2.3. Surgical ICU Optimal Mobilization Score

The SOMS has been described and validated previously [10]. It can be used to simply describe the patients' mobilization capacity and provides an algorithm for its advancement. The SOMS ranges from 0 to 4: SOMS 0, no mobility; SOMS 1, passive range of motion exercises in the bed; SOMS 2, patient is able to sit up in the bed greater than 45° or in a chair; SOMS 3, ability to stand with our without assistance; and SOMS 4, patient able to ambulate. We translated the SOMS into German by 2 German native speakers with high English proficiency. From these translations, a consensus was created. An English native speaker with high German proficiency translated the consensus draft back into English. All translators approved the final version of the translation based on this process (for German translation, see Supplementary Material). The SOMS level was assessed for each patient daily by the physical therapist (PT). These measures were defined as the predicted SOMS level with respect to level of mobility to be accomplished during the day. The PTs had a copy of the SOMS and recorded the predicted SOMS on a prepared sheet, which was disposed into a box on the ICU. In addition, the nurses of the morning and afternoon shift responsible for the patient as well as one of the intensivist on duty, independently from each other, assessed the predicted SOMS each morning (midday for the afternoon nurse) and the achieved SOMS at the end of the shift.

2.4. Data analysis

To validate the German version of the SOMS score, our primary hypothesis was that the German version of the SOMS taken on the day after ICU admission is associated with SICU LOS. Secondary hypotheses were that the German version of the SOMS is associated with hospital LOS and in-hospital mortality. We further tested if there were differences if the score was used for neurocritical care patients.

In the univariate analysis, we identified variables associated with our outcome measures. The following independent variables were included in the initial analysis: "neurocritical care," APACHE II, SOMS, comorbidity index, age, renal failure (defined as serum creatinine >1.0 and >1.2 mg/dL for women and men, respectively), and hypernatremia (serum sodium >144 mmol/L). Zero-truncated Poisson regression was used to identify independent predictors for SICU and hospital LOS, and logistic regression was used for in-hospital mortality. For the multivariate model, we included all variables statistically significant in the univariate model to a P level of .05. In the next step, factors were excluded from the multivariate model in a stepwise backward fashion starting with the factor with the highest P value in the multivariate model creation as long as the respective P value was at least .1. This was repeated until there was no factor in the multivariate model left with a P value at least 0.1. The main factors SOMS and neurocritical care, however, always remained in the model regardless of their P value. For LOS group comparison, Mann-Whitney test was used; for mortality comparison, log-rank test was used. The SOMS interrater reliability (IRR) was tested by comparison of the SOMS of each caregiver group compared with the SOMS of the other professionals, and the achieved SOMS was defined by the study team using all available information [10].

Similar to the study by Kasotakis et al [10], we conducted c statistics to compare the performance of APACHE 2 and SOMS in predicting mortality. The predictive performance of APACHE 2 and SOMS for mortality was presented in the form of receiver operating characteristic (ROC) curves. The areas the ROC curves were used as a measure for the discriminative power of the 2 prediction scores.

Data were analyzed using STATA 14 (Stata, College Station, Tex).

3. Results

Between November 11, 2013, and April 10, 2014, 309 SICU patients were screened. After admission to our SICU, 131 patients were enrolled in the study. Three patients were excluded because they did not fulfill

Table 1
Admission diagnosis

Patients with neurologic disorder	46	(36%)
Subarachnoid hemorrhage	13	(10%)
Intracerebral hemorrhage	6	(5%)
Stroke	6	(5%)
Postoperative after brain surgery	5	(4%)
Subdural hemorrhage	5	(4%)
Head trauma	4	(3%)
Status epilepticus	2	(2%)
Dens fracture	2	(2%)
Epidural hemorrhage	1	(1%)
Myasthenia gravis	1	(1%)
Meningoencephalitis	1	(1%)
Patients without neurologic disorder	82	(64%)
Postoperative after visceral surgery	29	(23%)
Postoperative aortic aneurysm repair	16	(13%)
Sepsis	11	(9%)
Postoperative after ENT surgery	5	(4%)
Acute renal failure	4	(3%)
Acute respiratory distress syndrome	4	(3%)
Polytrauma without head trauma	3	(2%)
Postoperative after lung surgery	3	(2%)
Postoperative after peripheral vascular surgery	3	(2%)
Acute heart failure	2	(2%)
Pulmonary embolism	2	(2%)
All patients	128	(100%)