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# Functional evolution of critically ill patients undergoing an early rehabilitation protocol

*Evolução funcional de pacientes graves submetidos a um protocolo de reabilitação precoce*

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## ABSTRACT

**Objective:** Evaluation of the functional outcomes of patients undergoing an early rehabilitation protocol for critically ill patients from admission to discharge from the intensive care unit.

**Methods:** A retrospective cross-sectional study was conducted that included 463 adult patients with clinical and/or surgical diagnosis undergoing an early rehabilitation protocol. The overall muscle strength was evaluated at admission to the intensive care unit using the Medical Research Council scale. Patients were allocated to one of four intervention plans according to the Medical Research Council score, the suitability of the plan's parameters, and the increasing scale of the plan expressing improved functional status. Uncooperative patients were allocated to intervention plans based on their functional status. The overall muscle strength and/or functional status were reevaluated upon discharge from the intensive care unit by comparison between the Intervention Plans upon admission ($Plan_{initial}$) and discharge ($Plan_{final}$). Patients were classified into three groups according to the improvement of their functional status or not: responsive 1 ($Plan_{final} > Plan_{initial}$), responsive 2 ($Plan_{final} = Plan_{initial}$) and unresponsive ($Plan_{final} < Plan_{initial}$).

**Results:** In total, 432 (93.3%) of 463 patients undergoing the protocol responded positively to the intervention strategy, showing maintenance and/or improvement of the initial functional status. Clinical patients classified as unresponsive were older (74.3 ± 15.1 years of age; p = 0.03) and had longer lengths of intensive care unit (11.6 ± 14.2 days; p = 0.047) and hospital (34.5 ± 34.1 days; p = 0.002) stays.

**Conclusion:** The maintenance and/or improvement of the admission functional status were associated with shorter lengths of intensive care unit and hospital stays. The results suggest that the type of diagnosis, clinical or surgical, fails to define the positive response to an early rehabilitation protocol.

**Keywords:** Rehabilitation; Early ambulation; Exercise; Critical care; Practice guideline; Intensive care units

**Conflicts of interest:** None.

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## INTRODUCTION

Technological advances and developments in the care of critically ill patients have significantly contributed to reduce mortality and to increase the survival of those patients in recent years, triggering a growing interest in understanding morbidities and the adverse effects resulting from immobilization.[1,2] Several

studies have shown that the occurrence of disorders resulting from prolonged bed-rest periods may begin within 72 hours of admission to the intensive care unit (ICU), and their consequences may persist for up to five years after hospital discharge,[1,3-6] reducing the long-term quality of life and generating higher incidences of depression and anxiety, in addition to the socioeconomic impact.[7-9]

The early rehabilitation of critically ill patients has proven a feasible and safe approach that may promote improved physical function, greater independence in Activities of Daily Living (ADL) and an accelerated process of the return to pre-morbidity activities, with reduced symptoms of fatigue and dyspnea.[6,9-14] In addition to those benefits, early rehabilitation has also been associated with other relevant clinical outcomes, including preventing the incidence of ICU-acquired muscle weakness, reducing the time of weaning from mechanical ventilation (MV), the length of hospital stay and costs.[15-18]

Although the benefits from the early rehabilitation of critically ill patients are unquestionable, evidence suggests that many interventions are not routinely used in clinical practice. The lack of uniformity in the development of protocols and guidelines, cultural barriers to the practice of early mobilization, shortage of material and human resources, and the lack of preparation of multidisciplinary teams have been recognized as the main factors hindering the implementation of early rehabilitation protocols.[12,19,20] The paradox between what is known and what is practiced is reported in the literature as a phenomenon of deficient knowledge transfer and application,[21] and a task force has been widely employed towards promoting advances in the clinical applicability of scientific paradigms through the implementation of ICU protocols and care models.[22]

Accordingly, an early rehabilitation protocol for critically ill patients was prepared in our institution towards preventing and treating complications resulting from the immobility of patients admitted to the ICU. That protocol was prepared based on the guidelines from the European Respiratory Society (ERS) and the European Society of Intensive Care Medicine (ESICM)[10] for physical therapy approaches to critically ill patients. Our objective in the present study was to evaluate the functional outcomes of patients undergoing an early rehabilitation protocol from admission to discharge from the ICU using a flowchart identifying patients with risk factors for the development of muscle weakness and systematizing the care model in intervention plans, according to individual evaluations of functional deficit.

## METHODS

### Study site

This cross-sectional study was conducted at the adult ICU of the *Hospital Sírio-Libanês* in São Paulo (SP, Brazil) and was approved by the Research Ethics Committee of the institution (opinion number 108.252); because this study was retrospective, the informed consent form was waived. The ICU of the hospital consists of 40 beds for different clinical specialties. The ICU care model includes a professional physical therapist as a member of the multidisciplinary team, which is a key strategy for ensuring the quality of round-the-clock care provided to patients, without reducing the professional staff on weekends. The management dynamics of the Department of Physical Therapy of the institution promotes a ratio of one physical therapist for every five to six patients under physical therapy care in six-hour shifts. The minimum time of each session is 30 minutes; sessions may reach up to 60 minutes of total care, depending on the clinical conditions and needs of each patient. The respiratory and musculoskeletal approach is always provided by the same physical therapist at each appointment.

The implementation of the early rehabilitation protocol for critically ill patients occurred from June to July 2011, and all 51 physical therapists working at the ICU participated in standardized theoretical and practical training courses conducted by the training and development section of the Department of Rehabilitation of the institution. The training courses included conducting practical workshops primarily focusing on the use of technological resources recommended in the protocol and the theoretical content described in the document (flowcharts, patient selection and therapeutic strategies, recommendations, and guidelines for patients and their relatives). The monitoring of protocol application occurred from August to December 2011, using a data collection chart for quality indicators.

### Subjects

Data were retrospectively collected from the medical records of patients meeting the inclusion criteria and admitted to the ICU from January 2012 to January 2013. Adult patients (older than 18 years of age) of both genders and showing at least one risk factor for the development of ICU-acquired muscle weakness (mechanical ventilation > 72 hours, sepsis/septic shock, use of sedation > 72 hours, use of corticoids and/or neuromuscular blockers and

immobility defined as bed rest > 50% of the time excluding the sleep period) were included in the study.[23] Patients who remained hospitalized at the ICU for a time period < 48 hours, who progressed to in-hospital death, who had medical records with loss of study data, who had prior neurological and/or orthopedic deficits, who had referrals for palliative care, or who exhibited contraindications for the protocol throughout the ICU stay were excluded from the study.

### Intervention plans

The protocol included some contraindication criteria for the application of intervention plans, which were assessed daily by the physical therapist: hemoglobin < 7, temperature > 38°C, insufficient cardiovascular and/or ventilatory reserve capacity (blood oxygen saturation - $SpO_2$ < 90% with fraction of inspired oxygen - $FiO_2$ > 0.60, use of accessory muscles of ventilation, presence of paradoxical breathing, respiratory rate - RR > 35ipm), platelets < 20,000 cells/$mm^3$, presence of limiting symptoms of pain or fatigue, unstable intracranial pressure (ICP) > 20mmHg, episodes of seizures and/or lumbar puncture in the last 24 hours, and/or patients with extubation scheduled on that day.[10,24] Patients were included in the daily care immediately after reversing the contraindications criteria, which were continually reevaluated throughout hospitalization.

ICU inpatients without contraindications for the protocol were evaluated by the physical therapist using the daily monitoring chart, through which patients with risk factors for the development of acquired muscle weakness were identified. Following that monitoring, the patients were evaluated regarding the level of awareness and overall peripheral muscle strength, which was measured using the Medical Research Council (MRC) scale to score patients able to cooperate with the evaluation.[7] The MRC score may range from zero (tetraplegia) to 60 (normal muscle strength), with results from the evaluation of six motions (wrist extension, elbow flexion, shoulder abduction, ankle dorsiflexion, knee extension and hip flexion) assessed bilaterally. The patients were allocated to one of four intervention plans, according to the MRC score (Plan I: MRC 0 - 23; Plan II: MRC 24 - 35; Plan III: MRC 36 - 47; Plan IV: MRC 48 - 60). Patients uncooperative with the MRC evaluation were allocated to intervention plans based on their functional status[25] (Plan I: bedridden and sedated patients unable to cooperate with the therapy; Plan II: bedridden patients, albeit able to cooperate with the therapy and perform assisted bedside sedestation with minimal support; Plan III: patients able to perform orthostatism and tolerate ambulation training with assistance for limited distances; Plan IV: patients able to walk and tolerate progressive ambulation training) (Figure S1 of electronic supplementary material).

Thus, interventions used in each plan were based on the MRC score or functional status of each individual and are outlined in table S1 of the electronic supplementary material.[15] Patients and relatives were informed about the therapeutic program objectives, the expected risks and benefits and the selected therapeutic strategies.

Neuromuscular electrical stimulation of the vastus lateralis and medialis muscles was considered for patients included in Training Plans I and II,[26,27] with the following parameters: frequency: 20 or 50Hz (resistance versus strength training, respectively); pulse: 300 - 400ms; cycle: five-second stimulus with 10 seconds of rest; intensity: maximum tolerated by the patient or 50% above the maximum intensity able to produce a tetanic contraction in unresponsive patients;[28] and stimulus time: the maximum time tolerated by the patient without signs of muscle fatigue, aiming at a 30-minute training session. The electrodes were placed in the vastus lateralis muscle (placed along the muscle fibers, one immediately above the patella and another two palms above along the anterior superior iliac crest) and vastus medialis muscle (placed along the muscle fibers, one immediately above the patella obliquely and another two palms above, in the direction of the groin).

Active exercise on a stationary bicycle was considered for patients classified in Training Plans III and IV with prolonged hospitalization forecast greater than seven days and should be performed once daily until discharge. Exercise was initiated with no load for the maximum period tolerated by the patient without signs of intolerance (perceived individual exertion from four to six points in the modified Borg scale, heart rate - HR > 70% age-predicted maximum; HR drop > 20%; systolic pressure > 180mmHg; drop > 20% systolic or diastolic pressure; $SpO_2$ < 90%; and clinical signs or symptoms of cardiopulmonary overload),[29] aiming for a time period of 20 minutes of exercise. The increase in load was initiated when the patient was able to perform the exercise without load for at least 20 minutes and was performed gradually, according to the tolerance of the patient.

### Criteria for responsive versus unresponsive patients

The overall peripheral muscle strength and/or functional status were reevaluated daily until discharge from the ICU and by comparison between the Intervention Plans at admission ($Plan_{initial}$) and discharge from the ICU ($Plan_{final}$). Patients were classified into three groups, according to the response assessed from the early rehabilitation protocol (modification of intervention plans throughout hospitalization): "responsive 1" (patients who were in a higher Intervention Plan at discharge from the ICU than at admission), "responsive 2" (patients who remained in the same Intervention Plan from admission to discharge from the ICU) and "unresponsive" (patients who were in a lower Intervention Plan at discharge from the ICU than at admission).

### Statistical analysis

The Statistical Package for the Social Science® (SPSS®, Chicago, Illinois, United States), version 15.0, was used for statistical analyses. An initial descriptive analysis was performed to observe the distribution of variables. The results are outlined in tables of simple and relative frequencies (percentages) for categorical variables and with calculations of central tendencies and dispersion measurements for quantitative variables. The chi-squared association test (or Fisher's exact test) was performed to assess the association between categorical explanatory variables and the response to the early rehabilitation protocol. The Kruskal-Wallis nonparametric test was used with the Tukey's post hoc Honest Significant Difference (HSD) test to assess the difference between the means of quantitative variables in the three groups (responsive 1 and 2 versus unresponsive). The Mann-Whitney test was used to compare the length of stay at the ICU and hospital between clinical and surgical patients. A 5% alpha error was used for all statistical tests, i.e., the results were considered statistically significant when $p < 0.05$.

## RESULTS

A total of 2,097 patients were admitted to the ICU of our hospital in the period from January 2012 to January 2013. Four hundred sixty-three (463) patients of that total underwent the early rehabilitation protocol for critically ill patients and met the inclusion criteria. The main causes of exclusion from the study were ICU admission for less than 48 hours (30.3%), loss of data in the analysis of medical records (22.6%), in-hospital death (21.7%), absence of risk factors for the development of muscle weakness (13.6%) and presence of contraindications for the protocol throughout the ICU stay (11.8%; Figure 1).

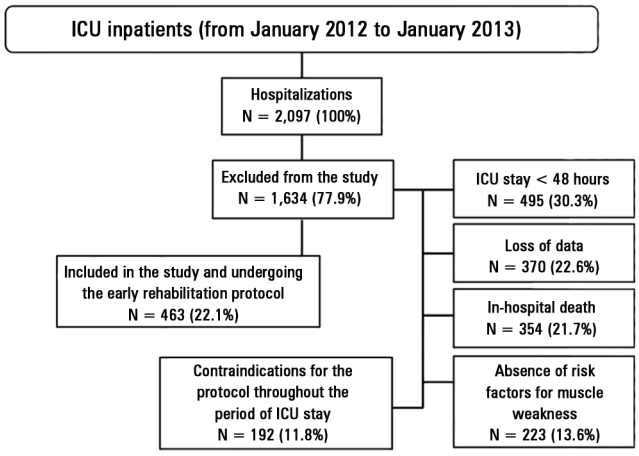


**Figure 1 -** Flowchart of patient inclusion in the study. ICU - intensive care unit.

The mean age of patients included in the study was 67.9 ± 16.1 years, and male subjects comprised 57.2% of the sample (n = 265). Regarding the main diagnosis of the cause of ICU admission, the percentage of individuals with a clinical diagnosis was 47.1% (n = 218), and the percentage with surgical diagnosis was 52.9% (n = 245). The demographic and clinical characteristics of the patients included in the study and groups responsive 1 and 2 and unresponsive are outlined in detail in table 1.

A total of 71.7% patients were allocated to Intervention Plan IV and 10.8% to Intervention Plan I upon ICU admission. The same analysis was performed upon discharge from the ICU, and a significant decrease ($p = 0.001$) of the percentage of patients allocated to Intervention Plan I (3.9%) was observed, associated with a gradual increase in the ratio of patients allocated to the other Intervention Plans (Figure 2). No adverse events occurred when applying the intervention plans.

Eighty-three (17.9%) of a total of 463 patients undergoing the early rehabilitation protocol responded positively to the intervention strategy proposed by the protocol, showing improvement in their Intervention Plan at discharge from the ICU compared to admission (responsive 1). A total of 349 patients (75.4%) maintained their Intervention Plans throughout their entire ICU stay,

**Table 1 -** Clinical and demographic characteristics of patients

| Variable | Total sample (N = 463) | Responsive 1 and 2 (N = 432) | Unresponsive (N = 31) |
|---|---|---|---|
| Age (years) | 67.9 ± 16.1 | 67.5 ± 16.07 | 74.32 ± 15.14* |
| Gender (F:M) | 198:265 | 12:19 | 186:146 |
| Medical diagnosis | | | |
| Clinical | 47.1 | 47.0 | 51.6 |
| Surgical | 52.9 | 53.0 | 48.4 |
| APACHE IV score | 38.2 ± 13.8 | 37.77 ± 18.83 | 44.54 ± 11.95* |
| Primary diagnosis on ICU admission | | | |
| Cancer | 125 (27.0) | 115 (26.6) | 10 (32.2) |
| Sepsis/septic shock | 68 (14.7) | 64 (14.8) | 4 (12.9) |
| Heart disease | 45 (9.7) | 42 (9.7) | 3 (9.7) |
| Exacerbated COPD | 24 (5.2) | 22 (5.1) | 2 (6.4) |
| AFR | 23 (5.0) | 21 (4.9) | 2 (6.4) |
| Infections/infectious diseases | 16 (3.5) | 15 (3.5) | 1 (3.2) |
| Kidney failure | 6 (1.3) | 5 (1.2) | 1 (3.2) |
| Thoracic surgery | 62 (13.4) | 56 (13.0) | 6 (19.3) |
| Abdominal surgery | 141 (30.5) | 130 (30.1) | 11 (35.5) |
| Various surgeries | 42 (9.1) | 39 (9.0) | 3 (9.7) |
| Others | 59 (12.7) | 54 (12.5) | 5 (16.1) |
| Use of invasive MV | 12.1 | 11.34 | 22.6 |
| Time of invasive MV (days) | 5.4 ± 5.7 | 4.7 ± 5.1 | 10.3 ± 7.3* |
| Use of sedation | 13.2 | 12.0 | 22.6 |
| Time of sedation (days) | 5.6 ± 5.8 | 5.0 ± 5.0 | 11.6 ± 8.6* |
| Use of VAD | 61.5 | 63 | 48.4 |
| Time of VAD (days) | 4.3 ± 4.1 | 4.1 ± 3.8 | 8.4 ± 6.5* |
| Use of continuous analgesia | 14.9 | 14.8 | 16.1 |
| Time of continuous analgesia (days) | 2.8 ± 1.4 | 2.8 ± 1.38 | 2.4 ± 0.9 |
| Use of intermittent analgesia | 68.9 | 74.2 | 68.5 |
| ICU stay (days) | 5.5 ± 5.7 | 5.26 ± 5.07 | 8.5 ± 10.9* |
| Hospital stay (days) | 20.5 ± 28.5 | 19.6 ± 27.9 | 32.81 ± 33.98* |

F - female; M - male; APACHE - Acute Physiology and Chronic Health Evaluation; COPD - chronic obstructive pulmonary disease; AFR - acute respiratory failure; MV - mechanical ventilation; VAD - vasoactive drugs; ICU - intensive care unit. The results are expressed as numbers (%) or means ± standard deviations. *$p < 0.05$ compared to responsive 1 and 2.

thus preventing functional loss (responsive 2). Lastly, 31 patients (6.7%) showed worsening of their Intervention Plan during the ICU stay and were considered unresponsive.

Patients classified as unresponsive had a higher mean age (74.3 ± 15.1 years; p = 0.03) compared to the responsive 1 and 2 groups (69.3 ± 16.1 years and 67.0 ± 16.1 years, respectively). Surgical diagnosis was more common among patients from the responsive 1 (79.5%) and responsive 2 (56.2%) groups, while clinical diagnosis was more common in the unresponsive group (51.6%). The inter-group analyses of the lengths of ICU and hospital stay were stratified according to surgical and clinical patients because the ratios of these variables differed between groups.

The mean lengths of ICU and hospital stays in the overall sample included in the study were 5.5 ± 5.7 and 20.5 ± 28.5 days, respectively. The unresponsive group experienced longer ICU stay (11.6 ± 14.2 days) than the responsive 1 (6.7 ± 5.8 days) and responsive 2 (5.9 ± 6.0 days; p = 0.047) groups among patients with clinical diagnosis. No significant difference in length of ICU stay occurred between the responsive 1 and responsive 2 groups ($p > 0.05$). The unresponsive group experienced a noticeably longer length of hospital stay (34.5 ± 34.1 days) than the responsive 2 group (19.5 ± 24.5; p = 0.002;

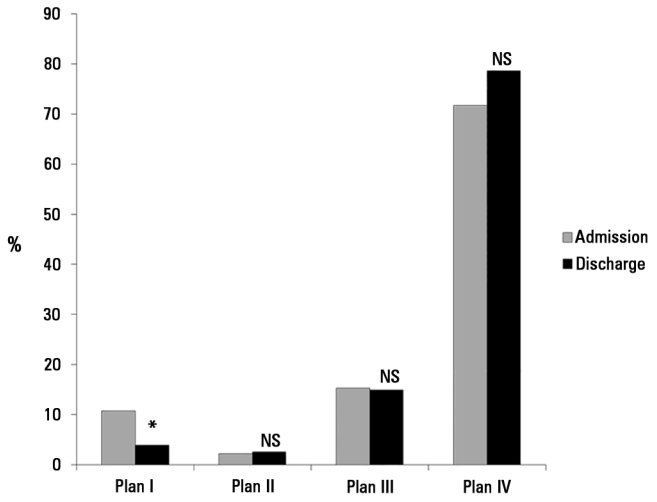


**Figure 2 -** Ratio s of patients allocated to the intervention plans of the early rehabilitation protocol upon admission to and discharge from the ICU. NS - non-significant compared to admission to the ICU ($p > 0.05$). * Significant difference compared to ICU admission ($p = 0.001$).

Table 2). No significant differences in length of ICU stay were observed between groups among surgical patients (p = 0.23). However, the length of hospital stay was significantly longer in the unresponsive group (31.0 ± 35.0 days; p = 0.02) than in the responsive 1 (23.8 ± 34.5 days) and responsive 2 (15.8 ± 13.7 days) groups (Table 2).

The comparison of patients with clinical (n = 218) and surgical (n = 245) diagnoses revealed that surgical patients were younger than clinical patients (66.0 ± 15.9 years and 70.1 ± 16.0 years, respectively; p = 0.002). Patients with surgical diagnosis had shorter lengths of ICU (4.6 ± 4.1 days and 6.5 ± 7.0 days; p < 0.001) and hospital (17.8 ± 19.9 days and 23.5 ± 35.6 days; p = 0.04) stays than clinical patients. However, no association occurred between the initial diagnosis and the response to the early rehabilitation protocol.

## DISCUSSION

Our results revealed a high prevalence (93.3%) of individuals considered responsive to the early rehabilitation protocol. Notably, responsive patients belonged to younger age groups and had higher rates of surgical diagnoses. Lastly, unresponsive clinical patients progressed with distinctly longer ICU and hospital stays.

A total of 71.7% of patients included in the study were allocated to Intervention Plan IV upon ICU admission, showing improved prior functional status. Patients undergoing an early mobilization protocol in the study by Feliciano et al.[9] had MRC scores compatible with Intervention Plans III and IV (49.29 ± 11.02) and showed significant improvement in the final MRC scores when compared to the control group undergoing conventional in-bed mobilization. Our results indicate a significant decrease in the rate of patients allocated to Intervention Plan I (from 10.8% to 3.9%), associated with a gradual increase in the ratio of patients allocated to the other intervention Plans. This finding indicates an improvement from the initial functional status, with reduced rates of patients exclusively bedridden following the intervention, suggesting that applying an early rehabilitation program effectively prevented and improved the functional status of most patients. No adverse events occurred when applying the intervention plans, an observation that is compatible with the results from other studies, which have already reported reaching functional benefits safely when using similar methods to those used in our protocol.[12,14,30]

The present study showed that 93.3% of patients included in the study responded positively to the intervention strategy proposed in the protocol, with improved Intervention Plans upon discharge from the ICU compared to ICU admission (responsive 1) and/or

**Table 2 -** Lengths of intensive care unit and hospital stays of patients responsive and unresponsive to the early rehabilitation protocol

| Groups | ICU stay (days) | p value | Hospital stay (days) | p value |
|---|---|---|---|---|
| Clinical patients (N = 218) | | | | |
| Responsive 1 (N = 50) | 6.7 ± 5.8 | | 32.3 ± 56.8 | |
| Responsive 2 (N = 152) | 5.9 ± 6.0 | 0.047 | 19.5 ± 24.5[†] | 0.002 |
| Unresponsive (N = 16) | 11.6 ± 14.2*# | | 34.5 ± 34.1# | |
| Surgical patients (N = 245) | | | | |
| Responsive 1 (N = 33) | 5.5 ± 4.9 | | 23.8 ± 34.5 | |
| Responsive 2 (N = 197) | 4.4 ± 3.9 | 0.23 | 15.8 ± 13.7[†] | 0.02 |
| Unresponsive (N = 15) | 5.3 ± 4.0 | | 31.0 ± 35.0*# | |

ICU - intensive care unit. [†] Significant differences (responsive 1 versus responsive 2); * significant difference (unresponsive versus responsive 1); # significant difference (unresponsive versus responsive 2).

Plan maintenance (responsive 2). However, the mean ages of those patients were significantly lower (66.3 ± 16.1 and 67.0 ± 16.1 years, respectively) when compared to the mean of the unresponsive group (74.3 ± 15.1 years), which corresponded to 6.7% of patients included in the study. Both older age and higher Acute Physiology and Chronic Health Evaluation II (APACHE II) score are known to significantly affect the musculoskeletal system, resulting in increased difficulty in functional recovery,[9] which may explain the worse outcome observed among patients from the oldest age group.

The clinical patients from the unresponsive group had longer ICU (11.6 ± 14.2 days) and hospital (34.5 ± 34.1 days) stays than the other patients, and the responsive 2 group had a significantly shorter hospital stay (19.5 ± 24.5 days; p = 0.002). The shorter hospital stay observed among clinical patients from group responsive 2 most likely resulted from the fact that 88% of patients from that group had a functional status compatible with Intervention Plan IV upon admission and, therefore, better prognosis. The surgical patients from the unresponsive groups also had a longer hospital stay (31.0 ± 35.0 days) than the other responsive patients. Previous studies have already shown the existence of associations between early rehabilitation protocols and lengths of ICU and hospital stay. A recent study showed that introducing a rehabilitation team focused on early intervention for critically ill patients promoted a significant increase in the mobility of those patients upon discharge from the ICU, associated with a reduced length of stay at that unit (14.8%).[17] Another study conducted by Lord et al.[18] reported that implementing an early rehabilitation program resulted in an 18.5 to 21.8% reduction in the length of stay of critically ill patients.

Although all patients included in this study underwent the same early rehabilitation protocol, the differences observed in the lengths of ICU and hospital stay may be related to other heterogeneous characteristics between groups. The clinical diagnosis was more common (51.6%) among patients from the unresponsive group, whilst the responsive 1 and responsive 2 groups predominantly had surgical diagnoses (79.5 and 56.2%, respectively). Surgical patients had a younger mean age (66.0 ± 15.9 versus 70.1 ± 16.0 years; p = 0.002) and shorter ICU (4.6 ± 4.1 days versus 6.5 ± 7.0 days; p < 0.001) and hospital (17.8 ± 19.9 days versus 23.5 ± 35.6 days; p = 0.04) stays than clinical patients when compared separately regarding diagnosis. Such characteristics most likely favored the responsive 1 and 2 groups over the unresponsive group, contributing to an improved response to treatment and a lower prevalence of loss of muscle strength, as evaluated using the MRC score during hospitalization.

The clinical diagnosis may be associated with prolonged ICU and hospital stays, given the older mean age observed in this group, which may explain the higher incidence of chronic diseases compared to younger patients. Furthermore, clinical diagnoses may be more associated with exposure to factors compromising the muscle function and performance of patients undergoing intensive therapy. The need for intubation and mechanical ventilation of patients with respiratory failure (a leading cause of ICU admission)[9] may extend the bedridden period and ICU stay, especially the prolonged use of mechanical ventilation[31] and the common need to use sedation capable of leading to reduced mobilization and worsened muscle weakness[32] or neuromuscular blocking agents, strongly associated with the occurrence of polyneuropathy among critically ill patients.[33] The increased proteolysis resulting from the occurrence of sepsis/septic shock and systemic inflammatory response syndrome induces ICU-acquired muscle weakness, also extending the time period of mechanical ventilation and lengthening the hospital stay.[34]

Several factors may be associated with the responsiveness to the early rehabilitation protocol of critically ill patients, which may have undoubtedly affected the clinical functional prognosis and length of stay of unresponsive patients. The present study showed that unresponsive patients also have a higher severity-of-disease score (APACHE IV) and longer requirements for invasive mechanical ventilation and the use of sedation and vasoactive drugs. However, the identification of such factors was not the aim of this study. Therefore, further studies are needed to identify which clinical factors are associated with the positive and negative responses to early rehabilitation protocols.

Some limitations could be identified in the present study: its retrospective design limited the inclusion of some patients admitted to the ICU during the period assessed because of loss of data; the application of the protocol was individualized and adapted to the possibilities and restrictions of each patient and, therefore, the application of each resource composing the protocol was not evaluated quantitatively; and the exposure to risk factors for immobilization and the development of polyneuropathy among critically ill patients were not evaluated. Furthermore, all patients who died were excluded from the study, which increases the prevalence of responsive patients because the more critically ill patients would tend to be less responsive. The absence of

those variables limited the association of our results with the possible causes. Therefore, further studies are needed to identify the effects of those factors on the functional prognosis of patients.

## CONCLUSION

Our results confirm a high prevalence of patients considered responsive to the early rehabilitation protocol. Furthermore, clinical patients responsive to the protocol had lower lengths of stay at the intensive care unit and hospital, while responsive surgical patients had a shorter length of hospital stay. Clinical or surgical diagnoses are apparently not decisive for positive responses to the early rehabilitation protocol. Further studies are needed to assess which factors are decisive for a positive response to an early rehabilitation protocol.


## RESUMO

**Objetivo:** Avaliar a evolução funcional dos pacientes submetidos a um protocolo de reabilitação precoce do paciente grave da admissão até a alta da unidade de terapia intensiva.

**Métodos:** Foi conduzido um estudo transversal retrospectivo, incluindo 463 pacientes adultos com diagnóstico clínico e/ou cirúrgico, submetidos a um protocolo de reabilitação precoce. A força muscular global foi avaliada na admissão da unidade de terapia intensiva por meio da escala *Medical Research Council*. De acordo com a pontuação da *Medical Research Council* os pacientes foram alocados em um dos quatro planos de intervenção, de acordo com a adequação ou não desses parâmetros, com a escala crescente do plano significando melhor status funcional. Os pacientes não colaborativos foram alocados nos planos de intervenção, conforme seu status funcional. A força muscular global e/ou o status funcional foram reavaliados na alta da unidade de terapia. Por meio do comparativo entre o plano de Intervenção na admissão ($Plano_{inicial}$) e na alta ($Plano_{final}$). Os pacientes foram categorizados em três grupos, de acordo com a melhora ou não do status funcional: respondedores 1 ($Plano_{final} > Plano_{inicial}$), respondedores 2 ($Plano_{final} = Plano_{inicial}$) e não respondedores ($Plano_{final} < Plano_{inicial}$).

**Resultados:** Dos 463 pacientes submetidos ao protocolo, 432 (93,3%) pacientes responderam positivamente à estratégia de intervenção, apresentando manutenção e/ou melhora do status funcional inicial. Os pacientes clínicos classificados como não respondedores apresentaram idade superior (74,3 ± 15,1 anos; p = 0,03) e maior tempo de internação na unidade de terapia intensiva (11,6 ± 14,2 dias; p = 0,047) e no hospital (34,5 ± 34,1 dias; p = 0,002).

**Conclusão:** A manutenção e/ou melhora do status funcional admissional esteve associada com menor tempo de internação na unidade de terapia intensiva e hospitalar. Os resultados sugerem que o tipo de diagnóstico, clínico ou cirúrgico, não é definidor da resposta positiva ao protocolo de reabilitação precoce.


**Descritores:** Reabilitação; Deambulação precoce; Exercício; Cuidados críticos; Guia de prática clínica; Unidades de terapia intensiva

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