

Early mobilization of the critically ill patient: Literature systematic review

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Abstract

Introduction: The immobility and prolonged bed rest, to which the critically ill patient admitted to the intensive care unit is subjected, are harmful and have potential adverse effects, especially on the musculoskeletal system and, consequently, on motor functionality.

Objectives: To characterize the impact of early mobilization on the critical patient admitted to an intensive care unit.

Method: Systematic review of the literature that used the PI[C]OD methodology to compile the research question, which led to the search in the EBSCOHost search engine, in the CINAHL Complete and MEDLINE Complete databases, for the identification of studies published between 2016 and 2019. Four systematic reviews of the literature and three randomized controlled trials were selected. This review considered the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) re-

commendation. Levels of evidence were secured by the levels of evidence from The Joanna Briggs Institute and methodological quality was analyzed using the Critical Appraisal Skills Program.

Results: Most of the articles included in this review point to the benefits of early mobilization in intensive care units, mainly for the improvement of motor functionality and functional capacity, and only one revision, due to the poor quality of the articles included, is inconclusive to the benefits of this intervention in this population.

Conclusions: Early mobilization is a feasible, beneficial, and safe intervention for the critical patient admitted to an intensive care unit. However, due to the lack of studies on the subject and the limitations of the studies analyzed, it is suggested that more quantitative studies, with more representative samples, be carried out.

Key words: Early ambulation, critically ill, critical illness, intensive care, Intensive Care Units.

Introduction

Intensive care units are contexts where, in general, care delivery is promoted for critical patient support and monitoring, with vital or threatened vital functions, in order to provide adequate diagnostic and therapeutic measures aimed at improving the

outcomes. (1) To achieve this objective, these units are worthy of human resources, physical and technological factors that enable the treatment of people with pathological situations of increasing complexity (2) and enable a promotion of care that goes to the state of the art. (3)

The patient admitted to an intensive care unit usually experiences a situation of greater or lesser criticality, with frequent and severe instability, requiring vigilance and intensive treatment, and it is often that this patient is subject to considerable risks of mortality and morbidity. (3)

Today, thanks to the latest technological and scientific advances in the field of intensive medicine, it has been observed that intensive care units are increasingly less the end point of critical illness. (4,5) However, despite this increase in survival as a consequence of these advances in the area of intensive care, it is recognized an increase in physical and psychological morbidity after the experi-

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ence of the critical situation (6,7) and after the experience of invasive mechanical ventilation. (8) During admission to intensive care, many patients are subjected to the implementation of therapies which, because of the discomfort they can induce, are often responsible for increasing the anxiety of the person in critical situation, which leads, most of the time, to the need to administer therapy that promotes comfort, relaxation and sedation, which contributes to these patients being subjected to long periods of immobility and prolonged rest in the bed. (9)

The bed rest model for the critical patient was introduced in the 19th century, with the aim of minimizing metabolic requirements and allowing the focus of treatment to be rest for recovery promotion. (5) Significant negative effects associated with prolonged bed rest are currently recognized for the patient admitted to intensive care, especially for the patient undergoing invasive mechanical ventilation. Nevertheless, although these deleterious effects are widely documented and it is argued that their undervaluation is pernicious, it remains to be seen that prolonged bed rest continues to be used in the treatment of the critical patient submitted to invasive mechanical ventilation, in such a way that these days it is still allowed that these people continue to remain immobile and subjected to sedation for days, sometimes even weeks. (2,7,10,11)

As direct consequences of immobility and prolonged bed rest for the musculoskeletal system and for motor, loss of muscle mass, bone density and other potentially adverse effects are identified, such as decreased joint amplitude, as early as the first week of intensive care. (5) However, it is recognized that immobility and prolonged rest in the bed contribute negatively to other body systems, such as cardiovascular, respiratory, neuromuscular disorders and for non-physical disorders, such as changes in the state of consciousness, anxiety and delirium. (12)

Mobility contributes to the proper functioning of all body systems, namely the musculoskeletal system. (10) Finding an appropriate balance between prolonged bed rest and mobilization may be important for improving outcomes and it is assumed that early patient mobilization in intensive care, particularly of the patient undergoing invasive mechanical ventilation, contribute to the improvement of motor function, to increase functional independence and to prevent the adverse effects of immobility. (10)

Method

It consists of a systematic review of the literature that included the development of the research question, research in scientific databases, analysis and interpretation of selected articles, synthesis and presentation of results.

For the selection of articles and formulation of the research question, the methodology PI [C] OD was used, being (P) the target population, (I) the type of intervention, (C) comparisons, (OD) the type of study. The following question was elaborated to answer the objective outlined and that served as the guiding thread for this systematic review of the literature: Is early mobilization (I) a beneficial and safe intervention (O) for the critical patient admitted to an intensive care unit (P)?

The research strategy included the search of articles published in the English language, carried out by two authors, between January 2016 and March 2019, via the EBSCOHost search engine, in the databases CINAHL Complete, MEDLINE Complete.

The research included the descriptors Critical Illness, Critical Care, Intensive Care Units, Early Ambulation and Early Mobilization. The descriptors were connected with the Boolean operators "AND" and "OR" in the following arrangement: "Critical Illness" OR "Intensive Care Units" OR "Critical Care" AND "Early Ambulation" OR "Early Mobilization". All the descriptors used were extracted from the Medical Subject Headings (MeSH) and the vocabulary Descriptors in Health Sciences (DeCS).

Inclusion criteria defined for selection of studies comprised: (1) critical patients admitted to intensive care units; (2) patients aged 18 or over; (3) interventions implemented based on early mobilization/rehabilitation. Articles with methodologies that focus on the object of study, from academic journals with analysis by specialists and with available references, were privileged. In the exclusion criteria, all articles with ambiguous methodology, repeated in both databases, without correlation with the object of study, or presenting conflicts of interest.

The initial research identified 451 articles, and 102 duplications were identified. The evaluation of the remaining articles, carried out by three authors independently, was carried out in three phases, namely: the selection phase of articles for analysis after reading the titles, which allowed the identification of 44 articles; the reading and interpretation phase of abstracts of all selected

abled the identification of 17 articles with potential interest for the review; and the last phase, which consisted of the full reading of all articles, after which, after applying the inclusion and analysis criteria to the levels of evidence and methodological quality, seven articles were selected, covering four systematic reviews of the literature and three randomized controlled trials. After the full analysis of the articles by the six authors, the decision to include them in this review was unanimous not only because they all respond to the research question, but also by the level of evidence demonstrated (**Figure 1**).

The levels of evidence from the studies selected for this systematic review were evaluated based on the levels of evidence from The Joanna Briggs Institute. The methodological quality was analyzed using the Critical Appraisal Skills Program for systematic reviews of the literature and for randomized controlled trials, which allows the classification of studies at two levels: level A for studies with good methodological quality and reduced bias; level B for studies with satisfactory methodological quality, but with increased bias potential. The levels of evidence and the methodological quality are presented in **Table 1**.

Results

One chose to present the results in a table format (**Table 2**) with a view to facilitating and simplifying the interpretation of these results by analyzing the articles included in this systematic literature review.

Discussion

The analysis of the articles included in this systematic review of the literature led the authors to consider that early mobilization in intensive care units is an achievable, beneficial and safe intervention for the critical patient.

With regard to the feasibility of this intervention, it can be seen that, in intensive care units, difficulties are often identified for its implementation, mainly due to the particularities of critical illness. (13) Nevertheless, due to the associated benefits, mobilization programs should be encouraged and implemented as soon as possible after admission in these contexts, and their teams should promote the formulation of algorithms that allow the timely execution of exercises. (13)

The majority of articles testify to the safety of early mobilization in intensive care units, especially when it is progressively implemented. (13-16)

Concerning the benefits of early mobilization for the critical patient admitted to an intensive care unit, most of the articles support benefits in terms of motor functionality and functional capacity. (15-18) However, some articles distinguish benefits in terms of muscle strength, walking distance, (19) in the reduction of the time of invasive mechanical ventilation and the length of stay in intensive care (17,18) and is related to the perception of better quality of life. (19)

Despite the results of this systematic review of the literature, there are several limitations that the authors recognize and feel forced to mention. In the systematic reviews of the literature, there are articles with low methodological quality, with samples of small dimensions and frankly heterogeneous. (13,14,17) In randomized controlled trials, the greatest limitation identified was the inability to delineate a double-blind strategy. (15,18) These limitations considerably increase the risk of bias, and the results of this review should be observed with caution.

Conclusion

The critical patient, particularly the patient undergoing invasive mechanical ventilation, is associated with a certain hemodynamic vulnerability, among other constraints, that interfere with the implementation of early mobilization strategies. (20) However, the evidence suggests that early mobilization of the critical patient is a safe intervention, (13,14) fact that has been proven for more than a decade, since the first study on patient mobilization in intensive care. (21) In addition, the frequency with which adverse events associated with early mobilization are reported is quite low, which certifies that this is a safe intervention that can be instituted early, even in people undergoing invasive mechanical ventilation. (2,7,8,15,21-23)

In general, it is agreed that early mobilization in intensive care is a beneficial intervention for the critical patient. (13,14) The benefits that are most evident are in the improvement of motor function and functional capacity. (15-18) However, this intervention may also contribute to the reduction of the time of invasive mechanical ventilation and to the reduction of the length of stay in intensive care. (17,18)

It is imperative to rethink the culture of immobility and prolonged rest in the bed of critical patients. Although the evidence supports the implementation of early mobilization strategies in this population, the authors of this review are unanimous in

considering that further studies are needed to demonstrate the benefits of early mobilization of critically ill patients admitted to intensive care, especially for critical patient subgroups subject to the implementation and implementation of advanced therapies and supports, such as invasive mechanical ventilation, renal replacement therapy or extracorporeal membrane oxygenation.

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Statement of conflicts of interest

The authors declare an absence of conflict of interest.

Table 1. Classification of the articles by levels of evidence and methodological quality

Title	Level of evidence	Methodological quality
Systematic review of early exercise in intensive care: A qualitative approach	1.b - Systematic review of randomized clinical trials and other study designs	Level A
Rehabilitation and early mobilization in the critical patient: Systematic review	1.b - Systematic review of randomized clinical trials and other study designs	Level A
Safety criteria to start early mobilization in intensive care units: Systematic review	1.b - Systematic review of randomized clinical trials and other study designs	Level B
Early intervention (mobilization or active exercise) for critically ill adults in the intensive care unit	1.b - Systematic review of randomized clinical trials and other study designs	Level B
Early, goal-directed mobilization in the surgical intensive care unit: A randomised controlled trial	1.c - Randomized controlled trial	Level A
A Binational Multicenter Pilot Feasibility Randomized Controlled Trial of Early Goal-Directed Mobilization in the ICU	1.c - Randomized controlled trial	Level A
Earlier and enhanced rehabilitation of mechanically ventilated patients in critical care: A feasibility randomised controlled trial	1.c - Randomized controlled trial	Level A

Table 2. Synoptic of the studies included in the review

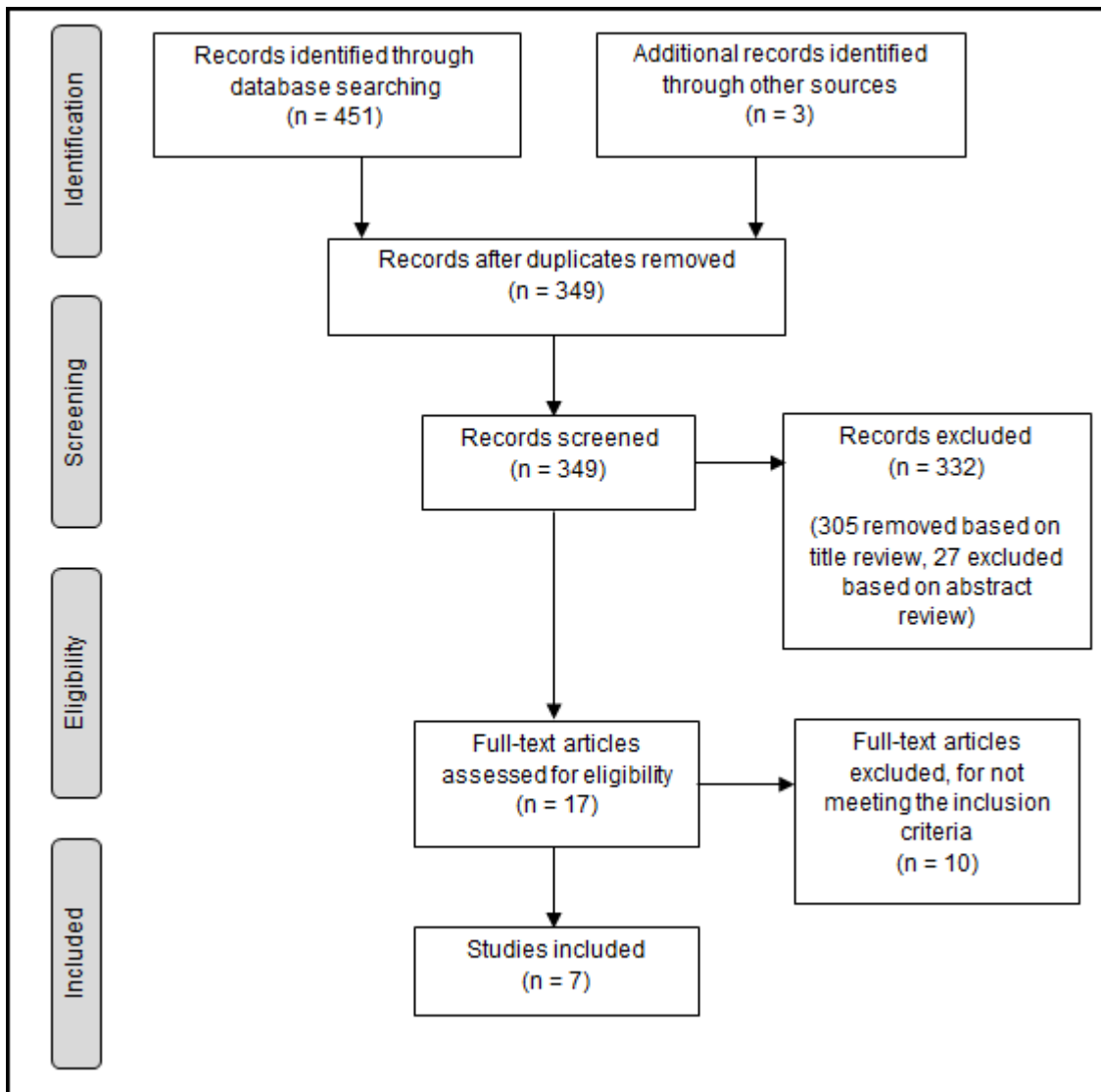
Authors, date	Research population/sample	Interventions, phenomena of interest	Results/authors' conclusions	Limitations of the study
Laurent, et al, 2016. (13)	22 studies (n=2301): 19 randomized controlled trials, 2 controlled case studies, 1 retrospective study	The objectives of most studies included analysis of the safety and efficacy of early mobilization. Interventions included: joint mobilization exercises, muscle strengthening exercises, bed mobilization activities, transfers, walking, cycle ergometer. Methods of safety analysis and efficacy of early mobilization included: occurrence of polyneuropathy, microcirculation parameters, respiratory muscle strength and endurance, diameter of the rectus femoris and vastus medialis muscles, distance traveled (6-minute walking test), state functional (MIF Scale, Barthel Index) and quality of life	Early mobilization in intensive care units is feasible and safe. Although there are technical difficulties associated with critical illness, exercise programs in these settings should be encouraged and implemented at an early stage. All professionals should play an important role in the daily performance of critical patient exercises. It is suggested that the teams of intensive care units should formulate algorithms that promote the performance of exercises in a timely manner, always considering critical illness and sedation levels	The study included three studies with poor methodological quality. The populations used in the studies were, in most of the studies, very heterogeneous and of small size. Participant follow-up losses were significant
Conceição, et al, 2017. (14)	37 studies (n=6641): 6 randomized controlled trials, 8 retrospective studies, 1 prospective study, 1 partially prospective and retrospective study, 13 case-series, 8 studies with other research designs	In the majority of the studies the interventions implemented included mobilizations in the bed, sitting in bed, standing and walking. The safety of interventions was assessed using the identification of adverse events, although in 15 studies there was no reference to adverse events. The most commonly reported events include: decreased peripheral oxygen saturation, tachypnea, altered heart rate, postural hypotension, clinical devices	The early mobilization of the critical patient is a safe intervention. The variables and parameters used for the safety evaluation of critical patient mobilization interventions mentioned by the authors of this review should be adopted for practice, in order to guide their implementation and to allow a safe progression	The search strategy used to include as many articles as possible enables a high risk of bias. In some of the articles information was limited. There was great heterogeneity between the samples and a great divergence in methods and results

Arias-Fernandez, et al, 2018. (15)	11 studies (n=913): 8 randomized controlled trials, 2 controlled case studies, 1 cross-over test	In most of the studies, the participants in the control group underwent the implementation of general care and in some studies the implementation of passive and/or active mobilizations. Experimental groups were submitted to general care, passive and active mobilizations, and in addition to: resistance training exercises, sitting, lifting, walking, transfers, balance training, cycle ergometer (3 studies), electrostimulation (2 studies), occupational therapy (1 study) and respiratory physiotherapy (2 studies)	The early mobilization of the critical patient is associated with an increase in functional capacity, muscle strength, walking distance, decreased mechanical ventilation time and perception of better quality of life. In studies that included electrostimulation, there was no improvement in muscle strength at discharge	Only three of the included studies have high methodological quality
Doiron, et al, 2018. (16)	4 randomized controlled trials (n=690)	In three of the included studies, the participants in the experimental group underwent range of motion exercises, bed mobilization activities, transfers and ambulation. In the fourth study, participants in the experimental group underwent upper limb exercises	The quality of the studies is not enough to prove that the early mobilization of the critical patient admitted to an intensive care unit is a beneficial intervention	The authors identify in all studies a significant risk of bias as the studies were not double-blind for participants and caregivers and two of the four studies were not double-blind for the investigators. The description of the intervention, with respect to type, dose to intensity and frequency, was scarce

Schaller, et al, 2016. (17)	200 participants, aged 18 years or over, underwent invasive mechanical ventilation for a minimum period of 48 hours, in which maintenance of this ventilatory strategy was anticipated for a period of at least 24 hours	The sample was randomly divided into control group (n=96) and experimental group (n=104). All participants remained sedated and underwent a strategy of daily discontinuation of sedation, daily assessment of the state of consciousness and delirium and pain. The level of intensive care was similar for both groups. Control group: standard mobilization, according to established protocols. Experimental group: the mobilization strategy was defined daily and adhered to a previously established mobilization algorithm that included five levels (level 0: without mobilization; level 1: passive bed mobilization exercises; level 2: sit down; level 3: stand up; level 4: ambulation)	Goal-oriented early mobilization contributes to improving patient mobility during admission to a care unit, reducing length of hospital stay in intensive care, and improving motor functionality upon hospital discharge	The impossibility of generalizing the results obtained for critical non-surgical patients and those not undergoing invasive mechanical ventilation
Hodgson, et al, 2016. (18)	50 participants, aged 18 years or above, who anticipated invasive mechanical ventilation for a minimum period of 24 hours	The sample was randomly divided into a control group (n=21) and an experimental group (n=29). Both groups underwent daily cardiovascular and respiratory evaluation. Control group: implementation of standard care. Experimental group: daily implementation of a mobilization exercise session, lasting 30 to 60 minutes. The intensity of the mobilization was established to maximize the participant's active participation for as long as possible. Exercises implemented included: bed active exercises, balance exercises, sit, stand up and stand, walk	Data was obtained from 47 participants. Seven days after division of the groups, participants in the experimental group had a longer duration of physical activity (mean of 20 minutes/day) compared to participants in the control group (mean of seven minutes/day). At the hospital discharge date, participants in the experimental group had higher levels of motor activity. There were no significant adverse events. The early implementation of a mobilization program is a feasible, safe intervention and contributes to increasing the duration and level of physical activity of the person in intensive care unit	The inability to perform a blind design study. The sample used is dimensionless for statistical significance and does not allow clinically relevant differences to be detected

<p>McWilliams, et al, 2018. (19)</p>	<p>103 participants, aged 16 years or over, underwent invasive mechanical ventilation for a minimum period of four days in which maintenance of this ventilatory strategy was anticipated for a period of at least 24 hours</p>	<p>The sample was randomly divided into control group (n=50) and experimental group (n=52). Control group: standard care that included mobilization initiated the first 24 hours of intensive care admission in five weekly sessions of 30 to 45 minutes. Experimental group: personalized mobilization, initiated at the first 24 hours of admission to intensive care, with weekly objectives, carried out by a specialist in mobilization of critical patients</p>	<p>The implementation of an early mobilization strategy in intensive care is possible and contributes to improving the mobility of the person admitted to intensive care</p>	<p>The inability to conduct a blinded study and the potential risk of bias</p>
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Figure 1. PRISMA diagram for the presentation of the research methodology



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