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Motor physical therapy in hospitalized patients in an intensive care unit: a systematic review

Fisioterapia motora em pacientes internados na unidade de terapia intensiva: uma revisão sistemática

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ABSTRACT

Objective: To analyze the outcomes achieved by motor physical therapy in critically ill patients admitted to intensive care units.

Methods: A systematic literature review was performed, and clinical trials published between 2002 and 2011 were included in the study. The search involved the LILACS, SciELO, MedLine, EMBASE and Cochrane databases, using the keywords "intensive care unit", "physiotherapy", "physical therapy", "mobility", "mobilization" and "randomized controlled trials." Two researchers screened the articles independently and included works that addressed the effect of physical therapy on critically ill patients.

Results: From an initial analysis of 67 potentially relevant articles, only 8 met the selection criteria and addressed the outcomes of electrostimulation, cycle ergometry and kinesiotherapy techniques. The sample sizes ranged from 8 to 101 subjects, with mean ages between 52 and 79 years. All patients were undergoing invasive mechanical ventilation. Among the analyzed articles, 6 reported significant benefits of motor physical therapy, such as improvement in peripheral muscle strength, respiratory capacity and functionality, in critically ill patients.

Conclusion: With this systematic review, it is possible to conclude that motor physical therapy is a feasible and safe therapy for critically ill patients and can minimize the deleterious effects of prolonged immobilization. Approaches involving electrostimulation, cycle ergometry and kinesiotherapy showed positive responses in patients under intensive care. Available evidence regarding the impact of motor physical therapy on length of stay in intensive care units and on mortality is still scarce, and further study in this area is warranted.

Keywords: Intensive care units, Intensive care, Early deambulation; Exercise therapy; Muscular atrophy

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INTRODUCTION

The care provided by health professionals is aimed to restore the clinical condition of patients and return them to their normal lives and quality of life. However, critically ill patients with unstable conditions, poor prognosis and high risk of death, represent a different challenge; the goal of care in such cases focuses on maintaining the patient's life, often with no estimate for discharge.[1] Immobility, physical deconditioning and muscle weakness often become problems that are associated with greater disability and prolonged rehabilitation.[2]

Muscular weakness in critically ill patients presents in a diffuse and symmetrical form, involving appendicular and axial striated skeletal musculature. The

proximal muscle groups are generally more affected than distal muscles, with variable involvement of deep tendon reflexes and sensory-motor innervation.[3] Polyneuropathy is quite common in critically ill patients undergoing mechanical ventilation (MV) in intensive care units (ICU) for more than 7 days; it affects 25.3% of patients.[4] This finding is important because neuropathy is responsible for prolonging the duration of mechanical ventilation and the patient's length of stay in the ICU.[5]

There are several factors that may contribute to the occurrence of neuropathy in critically ill patients. Chief among them are advanced age in females, diabetes mellitus, metabolic abnormalities, hyponatremia, hyperuremia, hyperglycemia, prolonged use of medications (such as corticosteroids, sedatives and neuromuscular blockers), dysfunction of two or more organs, MV, long stays in the ICU and immobility.[6,7] The diagnosis of neuropathic disorders is complex and is hampered by patients' level of consciousness, which in many cases is reduced due to sedation and which makes them unable to cooperate in testing and evaluation. It thus becomes necessary to use complementary tests to complete the clinical diagnosis.[6]

There is currently no effective therapy available for the treatment of neuropathy in critically ill patients. However, using a multidisciplinary approach, there are indications that physical therapy is an effective aid to patient recovery. Healthcare professionals in this context must go beyond "just treating" and use prophylactic measures to prevent musculoskeletal complications in the patient. To ensure a better functional status of individuals suffering from critical illness neuropathy, it is important to adopt a multi-therapeutic approach, including tight glycemic control, appropriate nutrition, early mobilization, superficial sedation, precautionary use of steroids and neuromuscular blocking agents.[6-9]

Recent studies show that more attention has been paid to early mobilization of the critically ill patient, as it is an intervention that is considered safe and feasible following cardiorespiratory and neurological stabilization and that rarely causes adverse reactions. Early mobilization is used by many physiotherapists and should be applied daily to critically ill but stable patients in the ICU, including those who are bedridden and unconscious (under MV), those who are conscious and those who are able to walk independently.[9,10] However, despite evidence showing that early mobilization of the patient reduces the deleterious effects of immobility and thereby provides a better clinical outcome for individuals, some healthcare professionals remain reluctant to mobilize patients under MV and ultimately restrict them to inactivity.[11-14] Some hospitals choose to start such therapy only after the patient is discharged from the ICU, as many professionals are unaware that critically ill patients are not necessarily "too sick" to tolerate exercise in the initial treatment phase.[13-15]

In keeping with the above reasoning, studies indicate improvement in critically ill patients undergoing early motor physical therapy. Positive indicators promoted by the motor approach include improvement in functional status, faster recovery of the ability to leave bed and deambulate and shorter hospital stay.[9,10]

Some researchers argue that not all risks associated with early mobilization are well defined and that, despite the fact that benefits of physical therapy in critically ill patients have been found in some scientific studies, there are few randomized controlled studies involving a representative sample size.[14,15] There is also still some disagreement in the scientific literature about the best type of activity, the optimum treatment duration and the frequency of activity for critically ill patients during their hospitalization.

No meta-analyses or systematic literature reviews were found in the Cochrane library that demonstrate the benefit of motor physical therapy in critically ill adult patients being treated in an intensive care setting. Thus, this study aims to conduct a systematic review of the literature to clarify the outcomes provided by the completion of motor physical therapy in critically ill adult patients being treated in ICUs.

METHODS

Identification and selection criteria

A search for articles involving the required clinical outcome was performed on the following databases: Latin American and Caribbean Health Sciences Literature (Literatura Latino-Americana e do Caribe em Ciências da Saúde - LILACS), Scientific Electronic Library Online (SciELO), Medical Literature Analysis and Retrieval System Online (MedLine/PubMed), Biomedical Answers (EMBASE) and the Cochrane Library. Articles were obtained using the following keywords: "intensive care unit", "physiotherapy", "physical therapy", "mobility", "mobilization" and "randomized controlled trials", employing the Boolean descriptors "and", "not" and "and not". Additional studies were identified through a manual search of references obtained from these articles.

The reference search was limited to articles written in Portuguese, English or Spanish and published in the last 10 years (2002-2011). In the final analysis, only those trials that addressed the application of motor physical therapy to critically ill patients were included. Letters, abs-

tracts, dissertations, theses and case reports were excluded, as were studies using animal models.

Evaluation of study validity

The titles and abstracts of articles identified by the search strategy were blindly assessed by two independent researchers. Studies that met the inclusion criteria were evaluated using the Physiotherapy Evidence Database (PEDro) scale.[16] This instrument was developed by the Australian Physiotherapy Association and is recognized worldwide. It aims to quantify the quality of publications that include randomized and controlled clinical trials, thereby acting as a guide to the merit of each publication and facilitating the rapid identification of studies containing sufficient information for professional practice.

The PEDro scale assesses tests using 11 pre-established items. The first item is an additional criterion and represents the external validity ("potential for generalization" or "applicability") of the trial; it is not included in the total score. The other items examine two aspects of the article's quality: internal validity (items 2-9) and whether the article contains sufficient statistical information for the results to be interpreted (items 10 and 11). These items are rated as "applicable" or "not applicable", generating a total score ranging from 0 to 10 points.[17]

To ascertain the methodological quality and rigor of the selected articles, they were analyzed and classified as "high quality" when they achieved a score of ≥ 4 points on the PEDro scale and as "low quality" when they achieved a score of < 4 on that scale.[18]

It should be noted that the PEDro score was not used as a criterion for inclusion or exclusion of items but as an indicator of the quality of scientific evidence in the studies that were included.

RESULTS

After analysis by two researchers, 59 articles were excluded either because they were duplicated across databases or because they did not possess the appropriate methodological design for inclusion. Only eight trials that met the methodological criteria stipulated for the desired outcome were included in the final selection, as shown by the flowchart in figure 1.

Table 1 contains information on the PEDro scores obtained by the randomized clinical trials. As indicated, all studies had eligibility criteria, conducted intergroup comparisons, and used both point measures and measures of variability. No study had "blinding" of subjects and therapists, and assessors were "blind" in four stu-
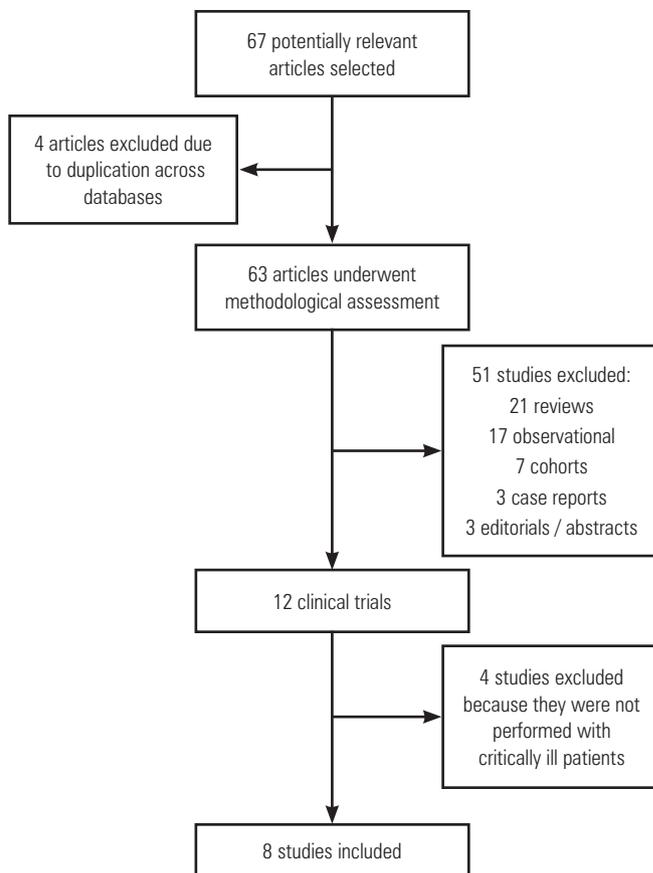

Figure 1 - Flowchart of article search strategy.

Table 1 - Classification of randomized clinical trials

PEDro scale	Zanotti et al.[19]	Gerovasili et al.[20]	Gruther et al.[21]	Poulsen et al.[22]	Porta et al.[23]	Burtin et al.[24]	Chiang et al.[25]	Schweickert et al.[26]
1. Eligibility criteria were specified	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Subjects were randomly allocated to groups	1	1	1	1	1	1	0	1
3. Allocation was concealed	0	0	0	0	0	1	0	1
4. Groups were similar at baseline	1	1	1	1	1	0	1	1
5. "Blinding" of all subjects	0	0	0	0	0	0	0	0
6. "Blinding" of all therapists	0	0	0	0	0	0	0	0
7. "Blinding" of all assessors	0	1	0	1	0	0	1	1
8. Appropriate monitoring	0	0	0	1	0	0	0	1
9. Intention to treat analysis	0	0	0	0	1	0	0	1
10. Intergroup comparisons	1	1	1	1	1	1	1	1
11. Point measures and measures of variability	1	1	1	1	1	1	1	1
Total score	4/10	5/10	4/10	6/10	5/10	4/10	4/10	8/10

According to the PEDro* scale, with 1 representing items covered and 0 representing items not covered. *Data source: http://www.pedro.org.au.[16]

dies (50%). Another relevant fact is that, in seven studies (87.5%), there was initial similarity between the groups. Using PEDro scale classification, 100% of the studies scored ≥ 4 points and were classified as "high quality" according to the criteria of Van Peppen et al.[18]

Of the eight included studies, four[19-22] dealt with the use of electrostimulation, two[23,24] used cycle ergometer exercises, and two[25,26] used motor kinesiotherapy with upper- and lower-limb exercises, functionality, training in basic and instrumental activities of daily living, changes in decubitus, balance, orthostasis and deambulation (Chart 1). The sample size varied between 8 and 101 subjects of both genders, with ages ranging from 52 to 79 years, who were subjected to IMV. Group homogeneity was included in most studies; the only exception was the study by Burtin et al.[24]

Chart 1 - Characteristics of selected randomized controlled clinical trials published between 2002 and 2011 that address motor physical therapy in critically ill patients

Author	Sample (N) EG	CG	Characteristics of the sample	Intervention	Intervention time	Key variables evaluated	Significant outcomes
Zanotti et al.[19]	12	12	Chronic COPD under IMV, bedridden more than 30 days, with severe peripheral atrophy	EG: active exercises (maximum 30 minutes) and electrostimulation in LL (30 minutes); CG: only active exercises	5 times a week for 4 weeks	Peripheral MS and days needed to transfer from bed to chair	Increase in MS in both groups, but higher in the EG; the EG was able to transfer from bed to chair in fewer days
Gerovasili et al.[20]	13	13	Patients in the ICU, under IMV, with APACHE II (admission) ≥ 13	EG: daily sessions of electrostimulation in LL (55 minutes); CG: Unspecified	Daily electrostimulation from the 2nd to the 9th day of hospitalization	Muscle diameter by ultrasound	Decrease in the diameter of the femoral quadriceps muscle in both groups; however, the decrease was lower in EG
Gruther et al.[21]	16	17	ICU patients, stratified into 2 groups: early and late	EG: early (30-60 minutes) (internment <1 week) and late (internment > 2 weeks) electrostimulation in quadriceps; CG: placebo	Daily session, 5 times a week for 4 weeks	Muscular diameter of the femoral quadriceps by means of ultrasonography	Muscle thickness decreased in both groups of early electrostimulation. The group that received late electrostimulation showed increased muscle mass
Poulsen et al.[22]		8	Patients admitted to the ICU with septic shock, under IMV	Unilateral electrostimulation (60 minutes) with the contralateral thigh serving as a paired control + routine physiotherapy	7 consecutive days	Evaluation of muscle mass by computed tomography of the thigh	There were no differences between baseline and post-electrostimulation values in the volume of muscle mass between the stimulated and non-stimulated sides
Porta et al.[23]	25	25	Intermediate ICU patients under prolonged IMV, with weaning > 48 hours and < 96 hours	EG: General physiotherapy (45 minutes) + UL cycle ergometer (20 minutes); CG: only general physiotherapy	15 total sessions, held daily	Incremental and endurance tests; perception of dyspnea and fatigue	Improvement in incremental test and endurance test, when compared to controls. Decrease in the perception of dyspnea in both groups. Reduction in the perception of fatigue in EG
Burtin et al.[24]	26	32	Patients with probable need to stay in the ICU for more than 7 days	EG: LL cycle ergometer for 20 minutes + physical therapy (motor and respiratory); CG: only conventional physiotherapy	5 times a week	SF-36, 6MWT, Berg scale, scale of categories of functional ambulation, quadriceps strength, time of weaning, length of stay in ICU and hospital and mortality	Increase in distance covered in 6MWD, in the SF-36 scores, and in quadriceps strength. No significant differences in the Berg scale, the length of stay in ICU and hospital or mortality
Chiang et al.[25]	17	15	Patients on IMV > 14 days, hospitalized in a respiratory care unit	EG: physical training program (strengthening of limbs, functional activities, walking); CG: only verbal encouragement	5 times a week for 6 weeks	Peripheral MS (dynamometry) and respiratory (compound gauge), Barthel Index, FIM, and 2-minute walk test	Increase in peripheral and respiratory MS in EG and decline in CG. Increased functionality in EG. Increased time away from IMV. Ultimately, 53% of EG were able to deambulate and 0% CG
Schweickert et al.[26]	46	55	ICU patients under IMV < 72 hours and pre-admission functional independence (Barthel index ≥ 70)	EG: motor physical therapy and OT since early inclusion in the study; CG: therapy only after medical clearance	Daily session from study enrollment until recovery of the initial functionality, or discharge	FIM, Barthel index, number of ADLs performed independently, unassisted walking distance, muscle strength (MRC), grip strength, functional milestones	The CG group did not receive therapy during the IMV. Improved functionality and increase in distance walked in EG. EG came out of bed earlier, stood up, moved to the chair and walked before CG

COPD - chronic obstructive pulmonary disease; IMV - invasive mechanical ventilation; EG - experimental group; LL - lower limbs; CG - control group; MS - muscular strength; ICU - intensive care unit; APACHE II - Acute Physiology and Chronic Health Evaluation; UL - upper limbs, SF-36 - Medical Outcomes Study 36-Item Short-Form Health Survey; 6MWT - 6-minute walk test; FIM - functional independence measure; OT - occupational therapy; ADL -activities of daily living; MRC - Medical Research Council.

Clinical trials involving electrostimulation varied in the modulation of the apparatus and time of technique application. One was performed late,[19] two were performed early[20,22] and one used both early and late electrostimulation[21] (Chart 2). In the two studies using a cycle ergometer, one used a late form of the technique on the upper limbs of patients,[23] and the other used an early form of the technique on the lower limbs,[24] as was the case with trials that used motor kinesiotherapy.[25,26]

Chart 2 - Characteristics of electrostimulation in the clinical trials analyzed

Modulation of electrostimulation	Zanotti et al.[19]	Gerovasili et al.[20]	Gruther et al.[21]	Poulsen et al.[22]
Frequency (Hz)	35	45	50	35
Pulse Width (ms)	0.35	0.40	0.35	0.30
Intensity	Unspecified	Visible contraction	Visible contraction	Visible contraction
Session duration (minutes)	30	55	30-60	60
Stimulated muscle group	Quadriceps and gluteus	Quadriceps and peroneus longus	Quadriceps	Quadriceps

Of the eight studies, six showed significant benefits of motor physical therapy to critically ill patients,[9,21,23-26] with improvements in peripheral muscle strength, breathing, exercise capacity and functionality and increased time away from MV. Only two studies[24,26] evaluated the length of the hospital stay, the duration of MV/weaning and mortality after 1 year. Burtin et al.[24] found no differences in weaning time, length of ICU stay or clinical outcome after 1 year. The study by Schweickert et al.[26] found a significant reduction in the duration of MV for the group that underwent motor physical therapy ($p<0.05$), but no differences were found in the other two outcome variables.

DISCUSSION

Neuropathies and prolonged immobility are common causes of muscle weakness in critically ill patients. Physical therapy plays an important role in the clinical recovery of these individuals and produces functional benefits. In the present study, which aimed to analyze different outcomes of motor physical therapy in critically ill patients being treated in ICUs, a beneficial response to physical therapy was observed and substantiated by methodological and statistical corroborative evidence from published clinical trials.[16]

All items included in this study were considered "high quality", as they achieved a score ≥ 4 on the PE-Dro scale.[18] However, it is important to note that scores on this scale should not be used to compare the quality of clinical studies because in some areas of physical therapy practice, it is not possible to satisfy all scale items, such as "blinding" of both subjects and examiners. As observed in some of the studies discussed in this review, the impossibility of meeting PEDro scale criteria is a function of the technique employed rather than a methodological bias generated by the researchers.

The studies included in this review demonstrated that the performance of motor physical therapy (electrostimulation, exercises on a cycle ergometer and classic motor kinesiotherapy) in critically ill patients represents a safe intervention that is feasible and well tolerated by patients.[19,22,24,26] Severe adverse reactions are uncommon, the need to discontinue therapy is minimal (only approximately 4%) and is commonly associated with asynchrony between the patient and the mechanical ventilator.[24-26] In this context, one must consider that aggressive mobilization is not recommended in patients with hemodynamic and respiratory instability, and the care team would need to decide on the feasibility of moving a critically ill patient at an early stage. There is a need to consider not only the risks arising from such mobilization but also the severe deleterious effects caused by prolonged immobility of the patient in bed. For instance, loss of muscle mass tends to increase exponentially with time spent in the hospital (with peak muscle loss occurring during the first 2 weeks of immobilization, further justifying the importance of adopting an early approach to physical therapy).[7,8]

Among the activities performed in motor physical therapy in the ICU are changes in decubitus and lying position, passive mobilization, actively assisted exercises and free activity, use of a cycle ergometer, electrostimulation, training activities for daily living and functionality, sitting up, orthostasis, static walking, transfer from bed to chair and deambulation.[7] All of these activities were represented among the clinical trials included in the present review.

It should be noted that patients were subjected to invasive MV. Neuromuscular abnormalities are commonly acquired in the ICU by this patient population because prolonged MV is considered an independent risk factor for the development of severe muscle weakness and promotes impairment of patient functional performance.[25] A prospective cohort study conducted in four hospitals detected severe muscle weakness in 25% of critically ill patients undergoing MV for more

than one week.[4] Chiang et al.[25] demonstrated a strong correlation between increased time away from the MV and the functional performance of the patient.

The use of sedation and MV are often considered obstacles to rehabilitation programs in ICUs, as many professionals are still afraid to mobilize patients on MV and ultimately restrict those patients to inactivity.[11,23] Nevertheless, techniques that do not require patient cooperation, such as neuromuscular electrostimulation, should be considered. Such techniques tend to promote peripheral and cortical activation when applied to peripheral muscles.[27] Electrostimulation, cycle ergometry and kinesiotherapy will be discussed in more detail below.

Electrostimulation

Among the studies using electrostimulation, the most satisfactory results were obtained when the technique was introduced later to increase muscle mass in chronic and debilitated patients.[19,21] Zanotti et al.[19] compared electrostimulation to a protocol of active appendicular exercises in patients with severe chronic obstructive pulmonary disease who were bedridden and under prolonged MV. It was found that the group receiving electrostimulation achieved a significantly greater increase in muscle strength compared to the control group.

The double-blind clinical trial performed by Gruther et al.[21] evaluated the effect of electrostimulation in two groups of patients. The first group was stimulated early to prevent loss of muscle mass, and the second was stimulated late to reverse the muscle atrophy of patients undergoing a long ICU stay. Both groups were divided into intervention and control subgroups. A significant decrease of muscular layer thickness was observed in both subgroups of the early-intervention group, demonstrating that electrostimulation did not prevent the loss of muscle mass. In the group receiving late electrostimulation, the intervention subgroup showed a significant increase in muscle mass compared to control subjects.

Studies evaluating the effect of early electrostimulation for the prevention of muscle atrophy demonstrated that electrostimulation during the first days of hospitalization of critically ill patients was unable to prevent the loss of muscle mass.[20,22] In the study conducted by Gerovasili et al.,[20] the decrease in muscle mass was significantly lower in the intervention group; however, the baseline muscle thickness was greater in the control group than in the intervention group, which reduced the direct comparability between the groups and may

explain why the absolute muscle loss was significantly higher in the control group. Immobilization, even for a short period of time, promotes a catabolic state in the muscle, resulting in significant loss of muscle mass and decreased strength.[28] This effect occurs more sharply during the first 3 weeks of hospitalization/immobilization,[8] and it may explain why electrostimulation did not affect the loss of muscle mass when applied early in critically ill patients.

In the analyzed trials, the loss of mass in the quadriceps muscle in the first weeks of ICU internment ranged from 16 to 40% and was unaffected by daily application of electrostimulation.[21,22] The correlation between electrostimulation intensity and disease severity shows that the excitability of muscle tissue may have been affected by the severity of disease; the most serious diseases may lead to muscular membrane disorders that impair muscle excitability and increase catabolism, thereby accentuating the loss of muscle mass and potentially affecting the anabolic stimulation by electrostimulation.[22]

It is important to consider that the diversity encountered among electrostimulation protocols and assessment methods limits direct comparisons between studies. There is no consensus as to the optimal modulation required to promote strong contractions with minimum fatigue.[22]

Exercise on a cycle ergometer

Among the reviewed studies that used a cycle ergometer, one employed the technique at a later stage on upper limbs and another used it at an early stage on lower limbs. Both studies demonstrated positive outcomes in individuals who underwent cycle ergometer training, showing an increase in exercise capacity and muscle strength of lower limbs.[23,24]

Porta et al.[23] demonstrated that the addition of upper-limb cycle ergometer exercises to conventional physical therapy in patients on prolonged MV increased exercise capacity and reduced the sensation of muscle fatigue and perception of dyspnea. In the population studied, baseline respiratory muscle strength was associated with a higher probability of improvement in exercise capacity, demonstrating the benefits of early intervention in critically ill patients admitted to ICUs.

The study by Burtin et al.[24] investigated whether early implementation of daily exercise for lower limbs on a cycle ergometer would be effective in preventing or mitigating the loss of functional performance, functional status and quadriceps strength. The authors

observed a significant increase in exercise capacity, self-perceived functional status and quadriceps strength of subjects who underwent physical therapy when compared to control subjects. The data also showed that muscle strength is positively correlated with patient self-perception of functional status and the distance walked at discharge, with the best independent walking distance achieved by the group that used the cycle ergometer.[24] This finding is of great importance, as independent walking is considered an important goal for patients before returning home.[9]

In combination, the reviewed studies show that cycle ergometer exercise, whether applied to the upper or lower limbs or performed early or late, promoted improvements in exercise capacity and muscle strength in the study population. It should be noted that these exercises were performed simultaneously with conventional motor physical therapy, thus demonstrating that this form of exercise can be used in a complementary way to improve the functional performance of patients in the ICU.

Motor kinesiotherapy

Chiang et al.[25] evaluated the application of a 6-week physical training program that included limb strengthening and functional and deambulation activities of patients under prolonged MV. The authors found a significant increase of muscle strength and respiratory function in patients undergoing physical therapy treatment. In contrast, peripheral and respiratory muscle strength worsened in control group subjects over the course of the 6 weeks, suggesting that immobilization is an important cause of muscle weakness in patients requiring prolonged MV. They also showed that motor functionality of the patients decreased in the both the intervention and control groups, demonstrating that immobility of critically ill patients has serious functional consequences. However, after applying the physical training program, functional scores significantly increased in the physical therapy group. Deambulation was of particular note because none of the subjects were initially able to walk, and yet 53% of subjects were able to walk independently by the end of the intervention.[25]

It is known that ICU internment leads to a sharp decline in patient quality of life. Studies indicate that quality of life, physical capacity, general health and social health of patients is incompletely recovered even 6 months after discharge.[27-29] The work of van der Schaaf et al.,[30] which assessed the state of patients within the first week of ICU discharge, showed that they have poor functional status, with the majority of subjects (67%) totally dependent in daily domestic activities and 30% having cognitive problems. In the present review, the studies of Chiang et al.[25] and Schweickert et al.[26] showed cognitive function improvements in patients undergoing motor physical therapy. In the study by Chiang et al.,[25] all subjects undergoing physiotherapy showed improvement in cognitive scores. In the study by Schweickert et al.,[26] physiotherapy reduced the time patients spent in the ICU with delirium. These studies show that motor physical therapy in critically ill patients not only promotes functional benefits but also stimulates cognitive activation.

Schweickert et al.[26] investigated the effect of daily interruption of sedation with early physiotherapy on the functionality of critically ill patients subjected to MV compared to a control group. The return to a state of functional independence at discharge was significantly higher in the intervention group; age, absence of sepsis and early physiotherapy were all associated with the successful acquisition of functionality.

Garnacho-Montero et al.[5] established in their study that the polyneuropathy of critically ill patients significantly increases the duration of MV and is considered an independent risk factor for the failure to "wean" (p <0.001). Prolonged MV is considered a risk factor for developing severe muscle weakness and consequent loss in functional performance.[4,25] MV creates muscle weakness and decreases function, making it difficult to wean patients. Such individuals remain immobilized and mechanically ventilated for longer, thus generating a vicious cycle that can be minimized with the implementation of motor physical therapy. Motor activity in critically ill patients promotes improvements in respiratory muscle strength and increased time away from MV, thereby reducing the overall duration of MV.[25,26]

In the study by Martin et al.,[3] a significant correlation was found between the muscle strength of upper limbs and the time of weaning from MV, suggesting that patients undergoing prolonged MV suffer significant overall muscle weakness that limits their ability to wean and to perform the activities of daily life. There is therefore evidence that upper-limb muscle strength is a simple but significant predictor of weaning time.

The results of our review allow us to conclude that the early performance of motor activity in critically ill patients is an important approach, as delaying the start of physical therapy can cause severe muscle weakness and deconditioning, thereby limiting functional activities, prolonging the duration of MV and limiting the final level of performance that a patient can achieve.

CONCLUSIONS

The methodological analysis conducted in the present study showed that several studies address the effect of physical therapy in critically ill patients, but there are few clinical trials consisting of two randomly distributed independent groups.

Motor physical therapy has proven to be a feasible and safe therapy that can minimize the deleterious effects of prolonged immobilization in bed. The most commonly used approaches for critically ill patients involve the techniques of electrostimulation, cycle ergometry and kinesiotherapy, all of which produce positive responses in patients under intensive care. Currently available evidence about the impact of motor physical therapy on length of stay in intensive care units and mortality is still scarce, and further study in this area is warranted.

RESUMO

Objetivo: Analisar os desfechos propiciados pela fisioterapia motora em pacientes críticos assistidos em unidade de terapia intensiva.

Métodos: Por meio de uma revisão sistemática da literatura, foram admitidos ensaios clínicos publicados entre 2002 e 2011. A busca envolveu as bases de dados LILACS, SciELO, MedLine, EMBASE e Cochrane, usando os descritores "*intensive care unit*", "*physiotherapy*", "*physical therapy*", "*mobility*", "*mobilization*" e "*randomized controlled trials*". Dois pesquisadores independentes realizaram a triagem dos artigos, tendo incluído trabalhos que abordassem a ação da fisioterapia em pacientes críticos.

Resultados: De uma análise inicial de 67 artigos potencialmente relevantes, apenas 8 contemplaram os critérios de seleção e abordaram os desfechos provenientes das técnicas de eletroestimulação, cicloergômetro e cinesioterapia. O tamanho amostral variou de 8 a 101 sujeitos, com média de idade entre 52 e 79 anos. Todos os pacientes estavam sob ventilação mecânica invasiva. Dos artigos analisados, seis indicaram benefícios significativos da fisioterapia motora em pacientes críticos, como melhora na força muscular periférica, capacidade respiratória e na funcionalidade.

Conclusão: Por meio desta revisão sistemática, foi possível concluir que a fisioterapia motora consiste em uma terapia segura e viável em pacientes críticos, podendo minimizar os efeitos deletérios da imobilização prolongada. A abordagem envolvendo eletroestimulação, cicloergômetro e cinesioterapia motora mostrou respostas positivas no paciente sob terapia intensiva. O nível de evidencia atualmente disponível a cerca do impacto da ação da fisioterapia motora sobre tempo de permanência na unidade de terapia intensiva e mortalidade ainda é baixo sendo necessários novos estudos.

Descritores: Unidades de terapia intensiva; Cuidados intensivos; Deambulação precoce; Terapia por exercício; Atrofia muscular

REFERENCES

1. Valentin A. The importance of risk reduction in critically ill patients. Curr Opin Crit Care. 2010;16(5):482-6.
2. Schweickert WD, Hall J. ICU-acquired weakness. Chest. 2007;131(5):1541-9.
3. Martin UJ, Hincapie L, Nimchuk M, Gaughan J, Criner GJ. Impact of whole-body rehabilitation in patients receiving chronic mechanical ventilation. Crit Care Med. 2005;33(10):2259-65.
4. De Jonghe B, Sharshar T, Lefaucheur JP, Authier FJ, Durand-Zaleski I, Boussarsar M, Cerf C, Renaud E, Mesrati F, Carlet J, Raphaël JC, Outin H, Bastuji-Garin S; Groupe de Réflexion et d'Etude des Neuromyopathies en Réanimation. Paresis acquired in the intensive care unit: a prospective multicenter study. JAMA. 2002;288(22):2859-67.
5. Garnacho-Montero J, Amaya-Villar R, García-Garmendía JL, Madrazo-Osuna J, Ortiz-Leyba C. Effect of critical illness polyneuropathy on the withdrawal from mechanical ventilation and the length of stay in septic patients. Crit Care Med. 2005;33(2):349-54.
6. Canineu RFB, Cabral MM, Guimarães HP, Lopes RD, Saes LSV, Lopes AC. Polineuropatia no paciente crítico: um diagnóstico comum em medicina intensiva? Rev Bras Ter Intensiva. 2006;18(3):307-10.
7. Gosselink R, Bott J, Johnson M, Dean E, Nava S, Norrenberg M, et al. Physiotherapy for adult patients with critical illness: recommendations of the European Respiratory Society and European Society of Intensive Care Medicine Task Force on Physiotherapy for Critically Ill Patients. Intensive Care Med. 2008;34(7):1188-99.
8. Gruther W, Benesch T, Zorn C, Paternostro-Sluga T, Quittan M, Fialka-Moser V, et al. Muscle wasting in intensive care patients: ultrasound observation of the M. quadriceps femoris muscle layer. J Rehabil Med. 2008;40(3):185-9.
9. Bailey P, Thomsen GE, Spuhler VJ, Blair R, Jewkes J, Bezdjian L, et al. Early activity is feasible and safe in respiratory failure patients. Crit Care Med. 2007;35(1):139-45.
10. Morris PE, Goad A, Thompson C, Taylor K, Harry B, Passmore L, et al. Early intensive care unit mobility therapy in treatment of acute respiratory failure. Crit Care Med. 2008;36(8):2238-43.
11. Skinner EH, Berney S, Warrillow S, Denehy L. Rehabilitation and exercise prescription in Australian intensive care units. Physiotherapy. 2008;94(3):220-9.
12. Nozawa E, Sarmento GJ, Vega JM, Costa D, Silva JE, Feltrim MI. Perfil de fisioterapeutas brasileiros que atuam em unidades de terapia intensiva. Fisioter Pesqui. 2008;15(2):177-82.
13. Stockley RC, Hughes J, Morrison J, Rooney J. An investigation of the use of passive movements in the intensive care by UK physiotherapists. Physiotherapy. 2010;96(3):228-33.
14. Borges VM, Oliveira LRC, Peixoto E, Carvalho NAA. Fisioterapia motora em pacientes adultos em terapia intensiva. Rev Bras Ter Intensiva. 2009;21(4):446-52.
15. Bailey PP, Miller RR 3rd, Clemmer TP. Culture of early mobility in mechanically ventilated patients. Crit Care Med. 2009;37(10 Suppl):S429-35.
16. Physiotherapy Evidence Database (PEDro) [Internet]. [cited 2011 Sept 7] Available from: http://www.pedro.org.au.
17. Maher CG, Sherrington C, Herbert RD, Moseley AM, Elkins M. Reliability of the PEDro scale for rating quality of randomized controlled trials. Phys Ther. 2003;83(8):713-21.

18. Van Peppen RP, Kwakkel G, Wood-Dauphinee S, Hendriks HJ, Van der Wees PJ, Dekker J. The impact of physical therapy on functional outcomes after stroke: what's the evidence? Clin Rehabil. 2004;18(8):833-62.

19. Zanotti E, Felicetti G, Maini M, Fracchia C. Peripheral muscle strength training in bed-bound patients with COPD receiving mechanical ventilation: effect of electrical stimulation. Chest. 2003;124(1):292-6.

20. Gerovasili V, Stefanidis K, Vitzilaios K, Karatzanos E, Politis P, Koroneos A, et al. Electrical muscle stimulation preserves the muscle mass of critically ill patients: a randomized study. Crit Care. 2009;13(5):R161.

21. Gruther W, Kainberger F, Fialka-Moser V, Paternostro-Sluga T, Quittan M, Spiss C, et al. Effects of neuromuscular electrical stimulation on muscle Layer thickness of knee extensor muscles in intensive care unit patients: a pilot study. J Rehabil Med. 2010;42(6):593-7.

22. Poulsen JB, Møller K, Jensen CV, Weisdorf S, Kehlet H, Perner A. Effect of transcutaneous electrical muscle stimulation on muscle volume in patients with septic shock. Crit Care Med. 2011;39(3):456-61.

23. Porta R, Vitacca M, Gilè LS, Clini E, Bianchi L, Zanotti E, Ambrosino N. Supported arm training in patients recently weaned from mechanical ventilation. Chest. 2005;128(4):2511-20.

24. Burtin C, Clerckx B, Robbeets C, Ferdinande P, Langer D, Troosters T, et al. Early exercise in critically ill patients enhances short-term functional recovery. Crit Care Med. 2009;37(9):2499-505.

25. Chiang LL, Wang LY, Wu CP, Wu HD, Wu YT. Effects of physical training on functional status in patients with prolonged mechanical ventilation. Phys Ther. 2006;86(9):1271-81.

26. Schweickert WD, Pohlman MC, Pohlman AS, Nigos C, Pawlik AJ, Esbrook CL, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial. Lancet. 2009;373(9678):1874-82.

27. Han BS, Jang SH, Chang Y, Byun WM, Lim SK, Kang DS. Functional magnetic resonance image finding of cortical activation by neuromuscular electrical stimulation on wrist extensor muscles. Am J Phys Med Rehabil. 2003;82(1):17-20.

28. Berg HE, Eiken O, Miklavcic L, Mekjavic IB. Hip, thigh and calf muscle atrophy and bone loss after 5-week bedrest inactivity. Eur J Appl Physiol. 2007;99(3):283-9.

29. Hofhuis JG, Spronk PE, van Stel HF, Schrijvers GJ, Rommes JH, Bakker J. The impact of critical illness on perceived health-related quality of life during ICU treatment, hospital stay, and after hospital discharge: a long-term follow-up study. Chest. 2008;133(2):377-85.

30. van der Schaaf M, Dettling DS, Beelen A, Lucas C, Dongelmans DA, Nollet F. Poor functional status immediately after discharge from an intensive care unit. Disabil Rehabil. 2008;30(23):1812-8.