

Effect Ergometer Use in Critically Ill Patients in Intensive Care Unit

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Abstract

Introduction

During the hospital stay in an intensive care unit (ICU), the immobility of the bed leads to a clinical disorder, which may prolong the stay of patients in this environment, triggering certain damage to musculoskeletal system, may pass over a long period, or even after his discharge. The use of a cycle ergometer in critically ill patients can be of great value in the recovery, improvement of physical condition and this individual residence time at this location, as well as an optimization of the acquired disorders.

Objective

Enclose the benefits of using the cycle ergometer in critically ill patients in the ICU.

Methods

This study was conducted from May to September 2014 in the virtual library BIREME, LILACS, PUBMED, MEDLINE and SciELO, using the key words: cycle ergometer, Motor Physical

Therapy Early, Motor Physical Therapy in ICU and critical patient. They included 29 articles to be considered relevant to the topic. Of these, 10 studies have directly proposed data. Twenty-one of them are in English and the other eight are in Portuguese.

Results

Ten studies have relevance to this review.

Conclusion

The evaluated studies claim that their use is safe and effective, will come to present favourable results for reversal of muscle weakness, improvement of peripheral and respiratory muscle strength, functionality level rise and could reduce the weaning time.

Introduction

Intensive care unit (ICU) is a structured place to give advanced life support and treatment of critically ill patients. It is known that prolonged stay in the ICU will trigger damage to various organs and body systems. Over time these sites have become space of high concentration of sick, and advanced technologies have been created for such. However, the incidence of complications arising from the deleterious effects of immobility in the ICU contributes to the potential for decline, increased welfare costs, reduced quality of life and survival after discharge [1].

The advance of treatment techniques increased comorbidities related to longer survival of the most seriously ill patients, the European Respiratory Therapy Society Task Force advises early initiation of passive and active exercise in hospitalized critically ill patients, demonstrating that early rehabilitation is safe and possible to be held as soon as the patient is admitted to the ICU. They advocate that conducts as further use of ergometer and others are between physiotherapist domain [2].

Studies show the evidence that critically ill patients after discharge to present a persistent fatigue and muscle weakness due to their prolonged stay in the ICU due to its routines. Physical training is an essential component of the rehabilitation program this unit, the ergometer can be cited as a method to be included in this program, using still sheltered will some health center, however widely used in clinics and outpatient settings, to assist in rehabilitation of patients with various diseases, few studies cite or evaluate its use in a more complex environment like a UTI [3].

The cycle ergometer is a stationary unit, which performs cyclical rotations, which allows the realization of assets, liabilities and resistance exercises, being possible to perform the exercise in both lower limbs (LL) and upper limb (UL) for sedated patients or not. With this enables the patient to participate in physical therapy activity can bring benefits, assisting in the rehabilitation process, reduced hospital stay and improving the reintegration of these patients to their quality of life and activities of daily living (ADLs) [4].

According to France *et al.*, [5] in the Task Force on the Physical therapy in critically ill patients of the Association of Critical Care Medicine (AMIB); The ergometer can produce a change in heart and respiratory rate, blood pressure, and oxygen saturation. On the assumption that the patient is a whole, then we understand that these changes is a fact to be studied before the application of this instrument in the patient, and becomes very important the proper use of it, so there are benefits to same.

Due to the limited number of jobs related to this intervention as important and proven placed the literature, encouraging the creation of new protocols for the safety of this approach, explains the importance of this study in order to clarify the use of a cycle ergometer at the critical patient an intensive care unit trying to analyze the outcome provided by the use of this instrument in these environments. Given the importance of this therapy in prevention and treatment, this literature review aimed to define the benefits of using the cycle ergometer in critically ill patients in the ICU.

Methods

This study consisted of a literature review on the effect of using the cycle ergometer in critically ill patients in the ICU. The survey was conducted using electronic databases: LILACS, Medicine®, MEDLINE, SciELO, PudMed were retrospectively consulted articles since 1994. The survey was conducted from May to October 2014. For the search the following words were used key: ergometer (ergometer); Early physical therapy (physical therapy Early); physical therapy in intensive care units (physical therapy in the intensive care unit); critical patient (patient critical).

The inclusion was limited to articles in English and Portuguese, that addressed the use of a cycle ergometer in critically ill patients in the ICU, with year of publication between 1994 and 2014; included only intervention articles. Original articles that did not provide access altogether were excluded.

The selection of items was initiated by the use of keywords; followed by selection of articles by the titles, to privilege the use of a cycle ergometer in patients in an ICU; in the next stage selected pre articles, abstracts were read, including studies that fits the above described inclusion criteria.

The articles identified by the search strategy were evaluated independently and blindly by two researchers (authors), strictly observing the inclusion criteria: full text, publication time (since 1994), target population (critical patients in ICU), intervention (active or passive use of a cycle ergometer in the lower limbs and / or upper limbs), type of study (without delimitation) in languages (English and Portuguese). Such strategies have been taken in order to maximize the results of research, since it was found scarce in the literature. They are expressed in the table to make teaching more reading the data found.

Results

The search resulted in 96 articles being obtained and analyzed 29 because they are considered relevant to the topic. Of these, 10 have proposed data directly. Twenty-one of them is in English and the other eight are in Portuguese. After analyzing abstracts were selected 29 articles. After the analysis, ten works presented inclusion criteria, participating in the study (Figure 01).

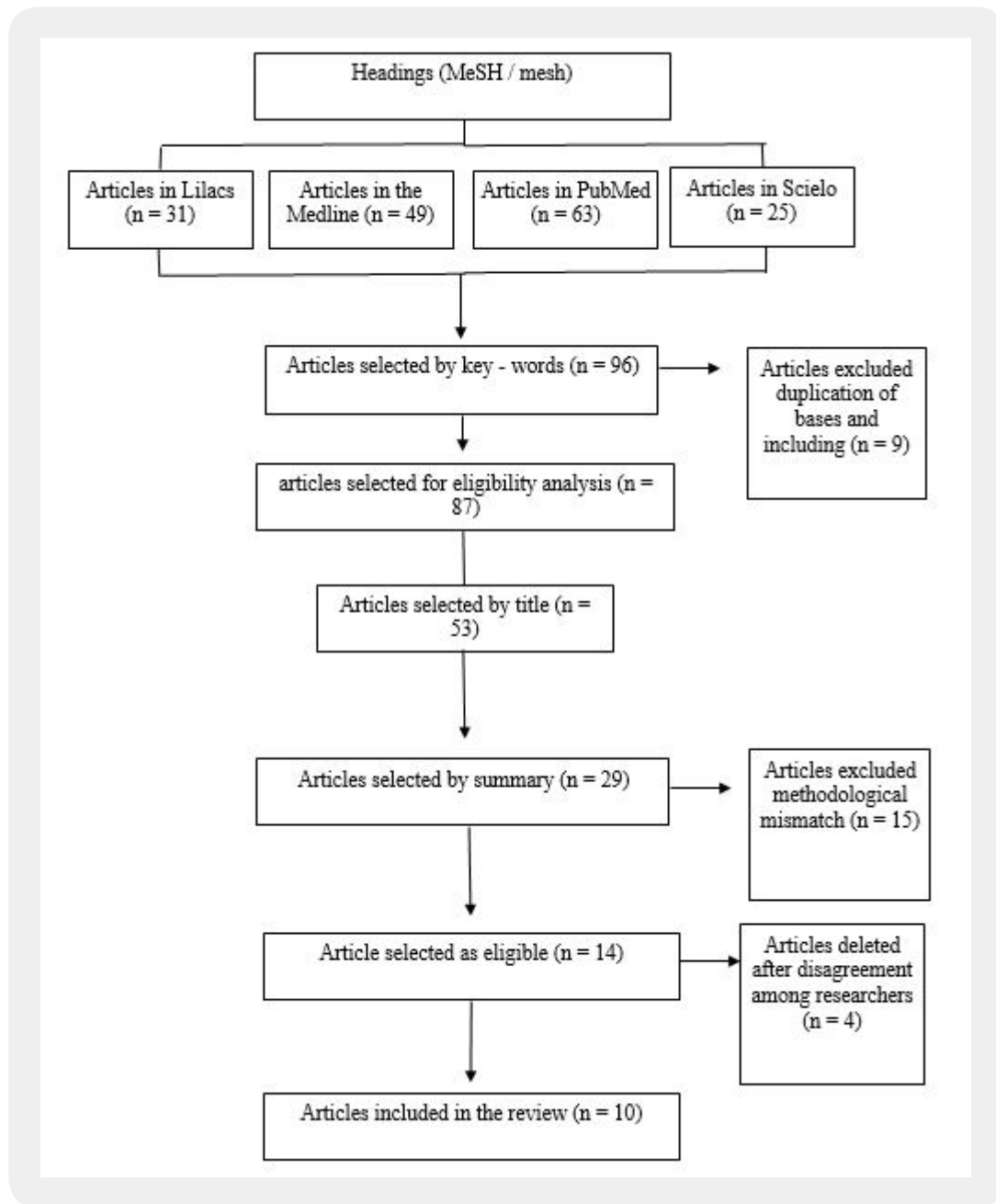


Figure 1: Flowchart of Articles selection of steps for review

Table 01 shows the description of the items, followed by autoterres, study design, a sample intervention protocol, key variables and the results obtained after treatment using the cycle ergometer in critically ill patients.

Table 01. Effect of Cycle ergometer use in patients in the ICU.

Authors / Year	Study Design	Sample	Intervention protocol	key variables	denouement
Pires-Neto et al. / 2013	Number of cases	38 pts.	ergometer actively in LL (no resistance) for a 20 min period. It was established a rhythm, but they were asked to pedal as fast as possible.	Variables in HR, RR and Borg.	Is a viable activity to be performed in collaborative hspas ICU with a high degree of tolerance, showed the average increase in HR was 3%, the RF was 20%, and Borg, it was reported moderate dyspnea.
Pires-Neto et al. / 2013	Number of cases	19 pts.	ergometer liability in LL with frequency of 30 revolutions per min. performed for 20 min.	There was no hemodynamically significant changes, resp variables. or met.	In this study, this exercise was carried out earlier considered safe.
Das et al. / 2012	clinical trial, randomized controlled.	02 groups of 14 pts.	Physiotherapy conventional ergometer passively in LL + 02 times a day, for 20 min.	Changes in MIP, MEP, FM ins. And peripheral.	There was no reduction in the duration of MV and ICU stay, however, progressed with a gain of FM ins. and peripheral, and 50% of them were discharged from the ICU with more functionality.
Burtin et al. / 2009	randomized clinical trial.	02 groups of 45 pts.	Conventional Therapy + Additionally, use of LL ergometer with an average duration of 20 minutes. 01 once daily.	SF-36, 6MWT, Berg scale, quadriceps strength, weaning time / ICU stay and mortality.	There ↑ quadriceps strength, improved functionality and status PCT functional perceived by itself in the intervention group.
Vitacca et al. / 2006	descriptive prospective study.	08 pts	02 tests in the cycle ergometer, the incremental min. in min. It was added a filler, performed with the other 50% of the peak load was reached in only incremental, and ends when patient reported exhaustion.	Both resulted in higher VC and FC, lower pressure resp muscles. and worsening of dyspnea.	Done this way this exercise causes an increase in RF output and respiratory muscle pressure. Dyspnea induced by exercise.
Porta et al. / 2005	A prospective, randomized and controlled.	02 groups of 25 pts.	+ daily conventional physiotherapy sessions UL cycle ergometer for 20 min. with increasing load in accordance with dyspnea.	↑ MIP and improves the sensation of dyspnea	The training in upper limb is feasible in these patients and improves muscle function ins. Basal.
Martin et al. / 2005	retrospective analysis	49 pts	Physiotherapy conventional ergometer + performed 05 times per week with a duration ranging from 30 to 60 min.	Not applicable	This correlated directly with the strength gain in upper limbs. For each point gain in the FM range (Medical Research Council) had a reduction in 07 days at weaning time.
Feliciano et al. / 2003	clinical trial, randomized controlled	02 groups of 14 pts.	Conventional Therapy for LL + passively during ergometer 20 min. (No resistance) of 05 days.	↑ significant MIP after the study period in the intervention group.	There was no reduction in VM and length of stay in UTI. But the patients had a gain of FM ins. and peripheral.
Nava / 1998	Prospective Randomized Study	80 pts	Physiotherapy conventional ergometer LL + passively during 01 hours per day.	↑ MIP	Improvement in lung function in both. Autonomy for ambulation with better performance, significant improvement in MIP sensation of dyspnea and exercise tolerance, in the intervention group.
Griffiths et al. / 1995	randomized controlled study	05 pts.	Ergometer LL passively continuously for 03 periods of 03 hours per day.	there was a slight gain fiber, and relatively minor loss of protein in the intervention member.	Decreased loss of muscle mass. It is compared by perimetry.

Pcts- patients; Lower limbs lower limbs; min- minutes; HR- heart rate; FR respiratory rate; Uti- intensive care unit; respiratory Resp-; metabolic Met; PImáx- maximal inspiratory pressure; PEmáx- expiratory pressure; Ins inspiratory; VM-ventilation; FM-muscle strength; SF-36- Medical Outcome Study 36- item short health survey; TC-6-minute walk test; ↑ - increase; VC tidal volume; UL upper limbs.

Discussion

According to the literature, 20% of the articles [10,11] performed their studies using the cycle ergometer of upper limbs, however other cycle ergometer 80% used LL [6-9,12-15]. where 60% of them have made the use of this equipment passively, [7-9,13-15] while the other 40% actively used [6,10-12].

Pires-Neto *et al.* [6], aimed to analyze hemodynamic changes and verifying the tolerance of patients to perform this type of activity. Another study, Pires-Neto *et al.* [7] aimed to assess respiratory hemodynamic and metabolic effects of a cycling exercise performed within 72 hours VM. And Porta *et al.* [11] conducted their study with the purpose of verifying whether the addition of the ergometer of the overall UL physical therapy is applicable and result in benefits to the patient weaned VM during the period from 48 to 96 hours. We conclude that the method is beneficial to the patient, bringing their improved respiratory mechanics.

Studies Dantas *et al.* [8] and Feliciano *et al.* [13] evaluated the effects of an early mobilization protocol, wherein the ergometer 30 was included in steps 40 and 50. While Nava [14] compared the effects of early pulmonary rehabilitation with the progressive ambulation. In that carries out a training program, with a 07-week trial, consisting of 04 different steps with increasing difficulties, which was included in the Cycle Ergometer steps 30 and 40. There was no significant difference in respect of the application protocols, as the They all made gains in inspiratory muscle strength and peripheral.

In the study by Burtin *et al.* [9] investigated whether, daily exercise sessions using a cycle ergometer, still in bed, was safe and effective in preventing or mitigating the loss of functional exercise performance, functional status and quadriceps strength. Already Martin *et al.* [12] assessed the prevalence and magnitude of muscle weakness and the impact of rehabilitation in chronically ventilated patients admitted to a unit of multidisciplinary rehabilitation. Both found a gain significant muscle strength in patients who underwent the procedure.

Already Vitacca *et al.* [10] and Griffiths *et al.* [15] evaluated the effects of using the cycle ergometer in patients in an ICU. However, Vitacca *et al.* [10] two tests carried out in this equipment in one of them, every minute was added a load and the patient was taken to exhaustion. While the study of Griffiths *et al.* [15] performed an activity in the patient's lower limbs where one member was subjected to the intervention and the contralateral was kept as control. The results were divergent, whereas in the study Vitacca *et al.* [10] with their patients had an increased respiratory rate, and dyspnea, the study of Griffiths *et al.* [15] showed an improvement in muscle performance LL.

The study Pires-Neto *et al.* [7] showed that the use of this equipment passively was not associated with significant changes in hemodynamic, metabolic and respiratory variables. Hemodynamic and metabolic effects of therapy in patients under VM has been widely investigated [16]. Horiuchi *et al.* [17] investigated the cause for the increased metabolic and hemodynamic responses during the therapy supported VM. They hypothesized that the increased metabolic demand even during small movements of physical therapy to the many different ways it was similar to the response the resulting exercises increase muscle activity, while the increase in hemodynamic responses would be more likely caused by the stress response associated the increase of sympathetic tone, there is a discrepancy between studies.

However, in another study Neto-Pires *et al.* [6], in which there was little cardiorespiratory changes, corroborate the research Lamb *et al.* [18], which found that the exercise carried out with the active cycle ergometer, implies small increase in heart rate (HR), systolic artery pressure (SBP), diastolic blood pressure (DBP), statistically increasing the respiratory frequency. This increase in RF is grounded in the literature as a response to physical activity. Most studies were conducted in patients with COPD, in which the FR increases and, in some cases, there is a positive relationship between the RF and the perception of effort [19].

The musculoskeletal impairment caused by immobility in a bed is varied, providing significant limitation with consequent loss of innervation and decline in muscle mass [20]. In studies Burtin *et al.* [9] Martin *et al.* [12] and Griffiths *et al.* [15], there was a gain of muscle strength in some of the members, with a gain of post-discharge functionality. Das *et al.* AND. [8], Porta *et al.* [11] and Feliciano *et al.* [13] further presents gain and peripheral inspiratory muscle strength. Nava *et al.* [14] further concludes that the conduit increases exercise tolerance, reducing muscle fatigue.

The literature suggests that early mobilization in the ICU is an essential factor for the recovery of these patients because, in addition to entailed physical wear in this environment, immobility still come to contribute to prolonged hospitalization, resulting in weaning delay fan and development pressure ulcers [21]. None of the authors reported losses determined using the cycle ergometer in the ICU, demonstrating the feasibility of this approach. Bailey *et al.* [22] evaluated the safety and feasibility of rehabilitation in the ICU, showed that less than 1% of the activities correlated with adverse effects simple, uncomplicated.

Regarding the cost-effective, Hopkins *et al.* [23] reported that cultural change within an ICU aimed at early mobilization does not require increased spending. Martin [12] further states that for each point gain in the FM range (Medical Research Council) had a reduction in 07 days at weaning time. If there is a divergence in results Feliciano *et al.* [13] wherein showed no reduction in hospitalization time.

The therapeutic exercise is considered a key element in the most therapeutic care plans when performed in a safe and prudent manner comes to be of great value in hospitals [24]. In the study Vitacca *et al.* [10] patients were induced a dyspnea caused by exercise, the result was not so good, since studies in which the time was defined as the Nava [14] where there was a significant improvement in MIP sensation of dyspnea and exercise tolerance, you can see an optimization of the patient. This may not have happened with the previous study, probably because the author has done so that the patients were taken will exhaust.

The acquired weakness assisting a critically ill patient has to be a common problem, Parry *et al.* [25] primary, makes use of a cycle ergometer LL where a member is performed only ergometer while the other is increased one electrostimulation, we have not yet found the results of this study, but it resembles the study of Griffiths *et al.* [15] also made use of this instrument using a member as a control and the other as intervention, which resulted in preventing atrophy muscle fibers in critically ill patients.

This review has measured that the use of Cycle Ergometer is feasible and safe, and has been employed in diverse populations. In search of a more concrete evidence, was examined in the literature, effects of using cycle ergometer in critically ill patients admitted to an ICU, but few studies have evaluated the use of this equipment in these individuals, [28] however in the last two decades this equipment has been increasingly used in this medium, and its effectiveness has been proven. With that, he has gained ground, and increasingly being included in physical therapy protocols, and well employed in multidisciplinary environment [29].

Conclusions

Given the above, it is concluded that the use of a cycle ergometer in critically ill patients in an ICU comes will present favorable results for reversal of muscle weakness, improved respiratory and peripheral muscle strength, functionality level increase, can reduce the time weaning, although whether or not accompanied by hemodynamic changes, the use of this equipment is well accepted by patients. Although most of the evaluated studies suggest its use as safe and effective, its diversity protocols points to the need for more randomized, controlled, with larger samples and better standardization in the addition of this treatment.

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