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EARLY MOBILIZATION FOR THE PATIENT SUBMITTED TO INVASIVE MECHANICAL VENTILATION

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ABSTRACT

Objective: to evaluate the effectiveness of an early joint mobilization program that includes the implementation of therapeutic exercises of joint mobilization to maintain or improve the articular range of the person undergoing invasive mechanical ventilation subject to long periods of immobility and bedrest.

Method: a quantitative, descriptive and cross-sectional pilot study, applied to people undergoing mechanical ventilation, with an accidental sample of three people. The manual goniometry method was used to evaluate joint amplitude. Descriptive statistics were used to analyze the results obtained.

Results: the maintenance or improvement of joint amplitude of all the joints selected for the early joint mobilization program of all people included in the sample was confirmed.

Conclusion: the effectiveness of the early joint mobilization program for the person submitted to invasive mechanical ventilation is demonstrated. It was concluded that the joint mobilization therapeutic exercises contribute to the prevention of joint contractures associated with immobility and prolonged rest in the bed of the person undergoing mechanical ventilation. However, due to the small sample size, further studies are suggested to confirm the effectiveness of these interventions in this population.

Keywords: Rehabilitation Nursing; early mobilization; mechanical ventilation.

INTRODUCTION

In the last decades there has been a significant increase in the number of people admitted to intensive care units in Portugal[1]. The vast majority of these people experience a critical situation of greater or lesser criticality, with frequent and severe instability, which requires surveillance, monitoring and intensive treatment, evidencing invasive mechanical ventilation as one of the most frequently used treatment modalities. Thanks to the latest technological and scientific advances in the field of intensive medicine, especially in improving the capacity to support vital functions and increasing the effectiveness of new treatments, there is an increase in survival in this population[1,2], even in people in critical situations with high complexity pathological situations[3]. Nevertheless, after the experience of invasive mechanical ventilation, especially when accompanied by prolonged rest periods in the bed and of circumstantial or induced immobility, an increase in the physical and psychological morbidity in this population is recognized[4-6].

The negative effects of bed rest and immobility for motor function are well documented, especially for the musculoskeletal system, with some authors pointing to the beginning of the development of pathophysiological mechanisms that lead to a decrease in joint amplitude of the person in a critical situation in the first four days of immobility, in the context of admission to an intensive care unit[7-9]. In a review article that sought to understand the impact of prolonged bed rest on the musculoskeletal system in critically ill people, the authors concluded that bedrest, when associated with immobility, induces rapid muscle and bone density loss and other adverse effects such as decreased joint amplitude in the first week of intensive care hospitalization[2]. In general, the reduction of joint amplitude is advocated as a consequence of immobility during the first two weeks after admission to intensive care[10,11]. However, for a number of reasons, it is still permissible for the person undergoing invasive mechanical ventilation to be subjected to long periods of immobility[3,6,7,12].

Joint contractures, a term often used to describe the decrease in joint amplitude of the movable joints, are a common adverse effect of prolonged bed rest and immobility, which may result from decreased joint extensibility and/or increased tissue stiffness that constitute it, such as periarticular structures or muscles[10,13]. The person undergoing invasive mechanical ventilation, subject to prolonged rest periods in the bed and immobility, is predisposed to decrease the amplitude of their joints, especially of the mobile joints[10]. However, in addition to the deleterious effects to the musculoskeletal system associated with the development of joint contractures in critically ill people, such as motor function changes, some studies point to an increase in mortality associated with the development of joint contractures in this population[14]. The most vulnerable joints for the development of contractures in the critically ill person undergoing invasive mechanical ventilation are the shoulder, hip, knee and ankle joints[8].

Rehabilitation is a multidisciplinary specialty aimed at improving functional potential, promoting independence and maximizing a person's satisfaction and self-esteem, with acute or chronic illness[15]. The specialist nurse in rehabilitation nursing is a professional endowed with skills that enable the design, implementation, monitoring and evaluation of differentiated rehabilitation nursing plans, namely in the area of motor functional reeducation[15]. Thanks to this body of knowledge and specific procedures, the specialist nurse in rehabilitation nursing can develop their interventions in most of the contexts of care practice, namely in intensive care units, and implement them in people in critical situations submitted to invasive mechanical ventilation and subjected to prolonged bedrest periods, with risk of impaired motor functionalities[15].

Objective

To evaluate the effectiveness of a precocious joint mobilization program, which includes the implementation of therapeutic joint mobilization exercises, to maintain or improve the articular range of the person undergoing invasive mechanical ventilation subject to long periods of immobility and bedrest.

METHOD

A pilot study involving the use of a quantitative, descriptive and cross-sectional case study methodology carried out in a Multipurpose Intensive Care Unit of a health institution in the south of Portugal between November 2016 and January 2017.

The sample included individuals submitted to invasive mechanical ventilation and subjected to long periods of immobility and bedrest. The following inclusion criteria were used to integrate this sample: invasive mechanical ventilation for a minimum period of fourteen days; length of hospitalization that enables the implementation of an early articulation mobilization program by a nurse specialist in rehabilitation nursing from the first forty-eight hours after admission up to fourteen days of hospitalization.

An accidental sample was used that, in light of the eight-week temporal limitations for the development of this project, and of meeting the inclusion criteria, it includes only three people. The sample is made up of two female and one male person, aged between forty-eight and seventy-five years of age. All participants were submitted to invasive mechanical ventilation from the first forty-eight hours after admission to intensive care until the 14 days of hospitalization.

The early joint mobilization program involved the implementation of joint mobilization exercises from the first forty-eight hours until two weeks of admission (fourteen days of hospitalization) and included the following procedures:

1 .Evaluation of the person focused on the following parameters: assessment of the state of consciousness; assessment of vital parameters; assessment of the sedation-agitation level; evaluation of the range of neck movements, shoulder, elbow, wrist, hip, knee and ankle joints, in all possible amplitudes, prior to the implementation of the joint mobilization program.

2 .Joint mobilization program consisting of the early implementation of joint mobilization therapeutic exercises (passive mobilization exercises, active mobilization exercises and active-assisted mobilization exercises) in the selected joints. During the implementation of the program the number of exercises in each joint movement was gradually increased, from a series of eight mobilizations to the three series of twelve mobilizations.

3 .Assessment of articular joint range in all possible ranges, after the implementation of the joint mobilization program.

The instruments used were the Glasgow Coma Scale, the Richmond Agitation and Sedation Scale, for assessing the state of consciousness and the level of sedation-agitation, and the manual goniometry for joint amplitude assessment.

In order to assess joint amplitude, an instrument was used to record the data obtained, which was submitted to two judges. They examined the data collection instrument and evaluated whether each item reported to the domain under study. The opinions were convergent and both considered that the items to assess articular amplitude applied in full to the content under study[16], from which it was concluded that this instrument offered guarantees, in terms of content validity.

The obtained data was recorded in tables and analyzed using descriptive statistics to obtain the difference between the joint amplitude evaluated before the implementation of the early joint mobilization and the joint amplitude program, evaluated after the implementation of the program. Prior to the completion of this study, efforts were made with the institution and participants and their families to ensure respect for ethical principles. In this sense, the Board of Directors of the health institution involved was asked for authorization, as well as the opinion of the ethics committee of the University of Évora, in the area of health and well-being approved and whose document is registered with number 17004. For in addition, the participants or their relatives, having been duly informed and given confidentiality and anonymity, have signed a declaration of informed consent in accordance with the provisions of the Declaration of Helsinki and the Oviedo Convention.

RESULTS

At the end of the study, the complete implementation of the early joint mobilization program was confirmed for the selected sample, which corresponded to a total of forty-one sessions of the early joint mobilization program.

The articular range evaluation of the therapeutic exercise's target articulations of articular mobilization, before and after the daily realization of the early articular mobilization program, made the comparison of the results of the joint amplitude evaluation of each joint possible, in each person after the development of the program. This comparison of results enabled confirming the maintenance or improvement of joint amplitude in all possible joint movements of all the selected joints for the program, and there was no decrease in amplitude in any of the joint movements.

During the study, there were some difficulties in assessing joint amplitude and in the implementation of joint mobilization therapeutic exercises in some joint movements, namely:

1 .Person 1: neck (extension);

2 .Person 2: neck (extension), right shoulder (extension), left shoulder (extension), right hip (flexion, extension, adduction, adduction, medial rotation, lateral rotation), right knee (flexion, extension);

3 .Person 3: neck (flexion, extension, right axial rotation, left axial rotation, right tilt, left tilt), right hip (extension).

These difficulties, justified by safety precautions, were needed by the clinical condition of the persons included in the sample.

The joint mobilization therapeutic exercises that were implemented in the three individuals included in the sample only included passive mobilization exercises. The selection of this type of exercises was made due to the integration capacity of the person in the early joint mobilization program, which in all subjects included in the study, confirmed the need to implement exercises in which the movement is produced solely by an external force, in this case by the specialist nurse in rehabilitation nursing, and in which the movement is restricted to the range of movements. This integration capacity was evaluated using the Glasgow Coma Scale for assessing the level of consciousness and the Richmond Agitation and Sedation Scale for assessing the level of sedation and restlessness. At the start of the program the female participants presented the lowest levels of

consciousness and sedation and restlessness, and the male participant, although presenting adequate levels of consciousness and sedation and restlessness, presented a change in the motor function which made it impossible for the autonomous execution of therapeutic exercises.

During the implementation of the joint mobilization therapeutic exercise's sessions, the gradual increase of the number of exercises was carried out, that is to say, a series of eight mobilizations up to three series of twelve mobilizations.

The time required for the implementation of the motor functional re-education program ranged from sixty to ninety minutes, which corresponded to an average time of approximately seventy-seven minutes.

In all early joint mobilization sessions implemented during the study, the only adverse event identified was the change in arterial curve morphology during the implementation of exercises in the wrist joint, the joint closest to the arterial catheter insertion site. It should be noted, however, that this adverse event was always self-limiting, since whenever the wrist mobilizations were suspended, the arterial curve recovered its normal morphology.

DISCUSSION

With this study, it was possible to confirm that in all the study's participants the maintenance or increase of the amplitude in all the possible joint movements for the target joints was verified. It should be noted that, in most joints, joint amplitude increased. The only two joint movements in which joint amplitude was maintained were the elongation movements of the elbow and knee joints, which in all evaluations presented an amplitude equal to the maximum articular amplitude described for these articular amplitudes, considering a range maximum for elbow extension of 150 degrees and maximum amplitude for knee extension from zero to -5 degrees[17].

The results obtained with this study are in line with the results of other studies and demonstrate that rehabilitation and therapeutic exercises of joint mobilization prevent the installation of joint contractures[7,18,19], that is, maintain or improve the articular amplitude of the person submitted to invasive mechanical ventilation, directly contributing to the prevention of the deleterious effects of prolonged immobility and prolonged bedrest[13,18,20].

As with other authors, because of the absence of adverse events, the results obtained in this study confirm that the implementation of the joint mobilization therapeutic exercises, by the specialist nurse in rehabilitation nursing, to the person undergoing invasive mechanical ventilation is a feasible and safe intervention[1,5,6,13,20-24].

The accomplishment of this study certifies that the early rehabilitation of the person submitted to invasive mechanical ventilation, immediately after the beginning of this ventilator support, improves the results[4,12] and confirms that passive mobilization exercises contribute to the reduction and prevention of complications associated with immobility, especially adhesions or joint contractures, maintaining the mobility of the mobile joints[18,19]. However, despite the results obtained with this study, considering the conclusions of some recent publications, which conclude that the evidence of the benefits of passive mobilization exercises for the prevention of joint contractures is unclear[13,25], it is suggested that one carries out further investigations proving the efficacy of these interventions for the maintenance or improvement of the joint range, namely of the person undergoing invasive mechanical ventilation subject to prolonged periods of immobility and bedrest.

CONCLUSIONS

This study confirms the effectiveness of the early joint mobilization program for the person undergoing invasive mechanical ventilation. However, this study also certifies that the early implementation of joint mobilization therapeutic exercises is an achievable and beneficial intervention that contributes directly to the prevention of complications associated with immobility and prolonged bedrest, namely to prevent the reduction of joint amplitude.

It is assumed that the consistency of the results obtained is limited, given the limitations of the study, namely the temporal conditioning that led to a reduced sample, with implications on the external validity of the study. It is suggested that one carries out further studies on the implementation of joint mobilization therapeutic exercises to the person undergoing invasive mechanical ventilation, not only to evaluate the effectiveness of the implementation of these interventions to prevent the reduction of joint amplitude, but also to recognize the duration, intensity and frequency with which these interventions should be implemented in this specific population.

REFERENCES

1. Azevedo P, Gomes B. Effects of early mobilization in the functional rehabilitation of critically Ill patients: a systematic review. Referência. 2015 June; 4(5):129-38. Doi: 10.12707/RIV14035

2. Parry SM, Puthucheary ZA. The impact of extended bed rest on the musculoskeletal system in the critical care environment. Extrem Physiol Med. 2015 Oct; 4:16. Doi: 10.1186/s13728-015-0036-7

3. Schober A, Thornton K. Early mobilization in the intensive care unit. Curr Anesthesiol Rep. 2013; 3(2):73-8. Doi: 10.1007/s40140-013-0013-x

4. McWilliams D, Weblin J, Atkins G, Bion J, Williams J, Elliott C, et al. Enhancing rehabilitation of mechanically ventilated patients in the intensive care unit: a quality improvement project. J Crit Care. 2015 Feb; 30(1):13-8. Doi: 10.1016/j.jcrc.2014.09.018

5. Ntoumenopoulos G. Rehabilitation during mechanical ventilation: review of the recent literature. Intensive Crit Care Nurs. 2015 June; 31(3):125-32. Doi: 10.1016/j.iccn.2015.02.001

6. Schmidt UH, Knecht L, MacIntyre NR. Should early mobilization be routine in mechanically ventilated patients? Respir Care. 2016 June; 61(6):867-75. Doi: 10.4187/respcare.04566

7. Dammeyer J, Dickinson S, Packard D, Baldwin N, Ricklemann C. Building a protocol to guide mobility in the ICU. Crit Care Nurs Q. 2013 Jan/Mar; 36(1):37-49. Doi: 10.1097/CNQ.0b013e3182750acd

8. Dellaripa P, Giansiracusa D, Liu N, Strongwater S. Rheumatologic and collagen vascular disorders in the intensive care unit. In: Irwin and Rippe's Intensive Care Medicine. 5nd ed. Philadelphia: Lippincott Williams & Wilkins; 2003. p. 208-24.

9. Ordem dos Enfermeiros, organizadores. Guia Orientador de Boas Práticas – Cuidados à pessoa com alterações da mobilidade – posicionamentos, transferências e treino de deambulação [Internet]. Lisboa: Ordem dos Enfermeiros; 2013 [cited on 10 Jan, 2018]. Available from: http://www.ordemenfermeiros.pt/publicacoes/documents/gobp_mobilidade_vf_site.pdf

10. Clavet H, Hébert PC, Fergusson D, Doucette S, Trudel G. Joint contracture following prolonged stay in the intensive care unit. CMAJ. 2008 Mar; 178(6):691-7. Doi: 10.1503/cmaj.071056

11. Offenbächer M, Sauer S, Rieß J, Müller M, Grill E, Daubner A, et al. Contractures with special reference in elderly: definition ad risk factors: a systematic review with practical implications. Disabil Rehabil. 2014; 36(7):529-38. Doi:10.3109/09638288.2013.800596

12. Hashem MD, Nelliot A, Needham DM. Early mobilization and rehabilitation in the ICU: moving back to the future. Respir Care. 2016 July; 61(7):971-9. Doi: 10.4187/respcare.04741

13. Prabhu R, Swaminathan N, Harvey L. Passive movements for the treatment and prevention of contractures. Cochrane Database Syst Rev. 2013 Dec; 12: CD009331. Doi: 10.1002/14651858.CD009331.pub2

14. Clavet H, Doucette S, Trudel G. Joint contractures in the intensive care unit: quality of life and function 3.3 years after hospital discharge. Disabil Rehabil. 2015; 37(3):207-13. Doi: 10.1503/cmaj.071056

15. Ordem dos Enfermeiros. Regulamento n.º 125/2011 de 18 de Fevereiro de 2011, da Ordem dos Enfermeiros [Internet]. Lisboa: Ordem dos Enfermeiros; 2011 [cited on 10 Jan, 2018]. Available from: http://www.ordemenfermeiros.pt/legislacao/Documents/LegislacaoOE/Regulamento%20125_2011_CompetenciasEspecifEnfreabilitacao.pdf

16. Fortin MF, Côté J, Filion F. Fundamentos e etapas do processo de investigação. Lisboa: Lusodidacta; 2009.

17.Pina J. Anatomia humana da locomoção. Lousã: Lindel Edições Técnicas; 2010.

18. Kisner C, Colby L. Exercícios terapêuticos, fundamentos e técnicas. São Paulo: Manole; 2005.

19. Kisner C, Colby L. Therapeutic Exercise. Foundations and Techniques. Philadelphia: F. A. Davis Company; 2007.

20. Denehy L, Lanphere J, Needham D. Ten reasons why ICU patients should be mobilized early. Intensive Care Med. 2017 Jan; 43(1):86-90. Doi: 10.1007/s00134-016-4513-2

21. Cameron S, Ball I, Cepinskas G, Choong K, Doherty TJ, Ellis CG, et al. Mobilization in the critical care unit: a review of adult and pediatric literature. J Crit Care. 2015 Aug; 30(4): 664-72. Doi: 10.1016/j.jcrc.2015.03.032

22. Hodgson C, Berney S, Harrold M, Saxena M, Bellomo R. Clinical review: early patient mobilization in the ICU. Crit Care. 2013 Feb; 17(1):1-7. Doi: 10.1186/cc11820

23. Hodgson C, Bailey M, Bellomo R, Berney S, Buhr H, Denehy L, et al. A binational multicenter pilot feasibility randomized controlled trial of early goal-directed mobilization in the ICU. Crit Care Med. 2016 June; 44(6): 1145-52. Doi: 10.1097/CCM.0000000000001643

24. Taito S, Shime N, Ota K, Yasuda H. Early mobilization of mechanically ventilated patients in the intensive care unit. J Intensive Care. 2016 July; 4:50. Doi: 10.1186/s40560-016-0179-7

25. Saal S, Beutner K, Bogunski J, Obermüller K, Müller M, Grill E, et al. Interventions for the prevention and treatment of disability due to acquired joint contractures in older people: a systematic review. Age Ageing. 2017 May; 46(3):373-82. Doi: 10.1093/ageing/afx026

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