



Time influence of mechanical ventilation on functional independence in patients submitted to cardiac surgery: literature review

Influência do tempo de ventilação mecânica sobre a independência funcional em pacientes submetidos à cirurgia cardíaca: uma revisão da literatura

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Abstract

Introduction: Patients submitted to cardiovascular surgery present motor and respiratory complications mainly due to high surgery manipulation and the use of mechanical ventilation. Reducing the weaning start time and disconnecting patient's ventilation system prematurely can decrease the pulmonary complications and hospitalization time. Motor complications are the most relevant as they have a direct effect on functional independence provoked by immobility time. **Objectives:** Identify if mechanical ventilation time has an impact on functional capacity on patients submitted to cardiac surgery in order to contribute to the establishment of reliable evidence to practice through this patient's profile. **Materials and methods:**

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Original articles were analyzed, published between 2000 and 2014, which focused on the influence of mechanical ventilation time concerning the functional independence on patients submitted to cardiac surgery, contained in the following electronic database: Scielo, BIREME (LILACS), PubMed e CAPES. **Results:** It was observed that the length of stay in the intensive care unit in cardiac surgery was influenced directly by CPB, VM and pulmonary dysfunction. Functional independence was compromised in patients with longer duration of mechanical ventilation, postoperative pain and prolonged bed rest. It was also found that there is no consensus on the protocol for improved functional capacity. **Conclusion:** There is a functional decline in patients undergoing cardiac surgery, especially those at increased length of stay in mechanical ventilation, reflecting a direct and negative impact on their functional independence and quality of life.

Keywords: Cardiovascular surgery. Mechanical ventilation. Functional independence.

Resumo

Introdução: Os pacientes submetidos à cirurgia cardiovascular apresentam complicações motoras e respiratórias decorrentes principalmente de alta manipulação cirúrgica e do uso de ventilação mecânica. Pode-se diminuir a incidência de complicações pulmonares e o tempo de hospitalização reduzindo-se o tempo de início de desmame e desconectando o paciente precocemente do suporte ventilatório. As complicações motoras são as mais pertinentes, pois afetam diretamente a independência funcional pelo tempo de imobilismo. **Objetivos:** Identificar se existe impacto do tempo de ventilação mecânica sobre a capacidade funcional em pacientes submetidos à cirurgia cardíaca com a finalidade de contribuir com o estabelecimento de evidências confiáveis para as práticas nesse perfil de paciente. **Materiais e métodos:** Foram analisados artigos originais, publicados entre 2000 e 2014, que abordassem sobre a influência do tempo de ventilação mecânica sobre a independência funcional de pacientes submetidos à cirurgia cardíaca, contidas nas seguintes bases de dados eletrônicas: Scielo, BIREME (LILACS), PubMed e CAPES. **Resultados:** Observou-se que o tempo de permanência na unidade de terapia intensiva nas cirurgias cardíacas foi influenciado diretamente pelo tempo de CEC, VM e disfunção pulmonar. A independência funcional esteve comprometida em pacientes com maior tempo de VM, dor no pós-operatório e tempo prolongado de restrição ao leito. Também se verificou que não há consenso em relação ao protocolo para melhora da capacidade funcional. **Conclusão:** Existe uma declínio funcional nos pacientes submetidos a cirurgia cardíaca, principalmente naqueles em maior tempo de permanência na ventilação mecânica, refletindo de forma direta e negativa na sua independência funcional e qualidade de vida.

Palavras-chave: Cirurgia cardíaca. Ventilação mecânica. Independência funcional.

Introduction

The current cardiac surgery incidence has been increasing due to the population's daily habits, the consequence being the rise of cardiovascular diseases, mainly caused by obesity, sedentary lifestyle, smoking and systemic arterial hypertension. The physiological aging process exacerbates such factors. In Brazil's reality, these diseases occupy the leading causes of death and hospitalization, which corresponds to 32,6% of the determined cause of death (1).

Cardiovascular surgery involves high surgical manipulation, long duration, use of mechanical ventilation (MV), in addition of anesthesia, extra corporeal

circulation (ECC), and chest tubes. These factors contribute to the emergence of postoperative respiratory complications such as pneumonia, pleural effusion and atelectasis. The effects of these complications in lung function may increase morbidity and mortality (2,3).

According to Nogueira et al. (4), the incidence of postoperative complications is, however, a big challenge, and in a current scenario, few short-term possible solutions exists.

Even with modernization surgical procedures, several factors involved in heart surgery can compromise lung function, such as general anesthesia, surgical incision and cardiopulmonary bypass (CPB),

leading to functional loss, that will contribute with the limitation of daily life performance activities (3).

The invasive ventilation support is used by 39% of patients admitted to ICUs. Of these, 10% require prolonged mechanical ventilation, subject to complications associated to its use and the extended hospitalization stay (5).

Dependence on ventilatory support is directly related to morbidity occurrence, and increased length of stay in the ICU, consequently a rise in the length of hospital stay occurs. Patients undergoing prolonged MV are often deconditioned and limited from a kinetic-functional point of view.

In these, several factors contribute independently to neuromuscular abnormalities: the underlying disease; the severity and duration of organ failure; the adverse effects of medications used; and, in particular, prolonged immobilization. Critically ill patients, especially those requiring mechanical ventilation, often develop acute muscle weakness, resulting in increased hospitalization rates in the ICU, readmission, physical condition reduces over a prolonged period of time, and a reduction in quality of life (5-7).

As a result of the recognized possible postoperative complications, there is a need to measure the pre and postoperative functionality, to know the dynamic of therapeutic process and intervene when necessary, fallouts not allowing the establishment of functional limitation. During heart surgery recovery, motor functional capacity is one of the most relevant aspects as modification in patient's well-being provides alteration in other areas of life (8).

Functional independence is defined as the ability to do something with our own means. Mobility and functional capacity are related, in a way where the individual does not require assistance to its performance, e.g. independence implies motor and satisfactory cognitive conditions to perform tasks (1).

Consequently, we carried out a literature review in order to meet current and relevant information concerning the influence of prolonged mechanical ventilation and the impact on the level of functional independence in patients undergoing cardiac surgery.

Materials

Initially, electronic searches were conducted in MEDLINE databases (via PubMed), SciELO, LILACS

and Peter. Other databases were adjusted, using publications used as a reference such as Spanish, English and Portuguese, whose keywords were heart surgery, mechanical ventilation and functional independence.

The inclusion criteria were articles from 2000 to 2013 which focused on the influence of time in mechanical ventilation concerning the functional independence of patients submitted to cardiac surgery. Exclusion criteria for the study were articles that did not cover the topic, such as those who were unable to provide relevant results and studies that have maintained patients in mechanical ventilation.

The selection of studies was performed by two independent observers following three steps, the first, being title reading and excluding those that clearly did not meet the established criteria. Subsequent, the selected abstracts were analyzed and those who did not meet the inclusion criteria were excluded. The final step consisted in reading full articles. An active manual search of all selected studies were also performed, using the same criteria and procedures previously described.

The articles were analyzed through the different views on our topic seeking confrontation or agreement on it.

Results and Discussion

The polyneuropathy is a very common condition developed by critical patient in intensive care units undergoing MV for more than seven days, affecting about 25.3% of patients. This worrying finding is due to the fact of neuropathy being responsible for prolonging the VM and the permanence of the subject in the ICU (9).

The physiotherapy treatment in patients undergoing cardiac surgery aims to avoid the negative effects of prolonged bed rest, stimulate their return to activities and prevent pulmonary complications, as well as providing a base for home care (10).

Patients submitted to HS develop, mostly PO pulmonary dysfunction with significant reduction in lung volumes, damages in respiratory function, decreased lung compliance and rises the effort to inhale. These factors, associated with immobility, pain and fear, favor the adoption of a monotonous breathing pattern without performing sporadic sighs to the total lung capacity, promoting alveolar collapse (11).

The presence of functional decline is predictive of poor outcomes at hospital discharge and the strong correlation with prolonged hospitalization, increased mortality, increased costs and the need for home rehabilitation (12). Covinsky et al. (13), showed in a descriptive study, that functional decline experimented during hospitalization treatment for acute cases presented 35% for performing daily activities when compared to pre hospitalization data.

Kawasaki and D'Elboux (14) while analysing data, a functional loss of 25.9% was observed, which demonstrates the high impact of immobility, critical illness and bed restriction in such a highly complex unit. In this study we evaluated the functional independence through the measurement range of functional independence (FIM) in 28 elderly patients hospitalized in a medical ward at admission. Functional loss was observed at 11.97%, lower than the reduction found in this study in every five days of hospitalization, the discharge and one month following release.

In the study of Gnoatto et al. (15) the characterization of total MIF preoperatively, (97.8%) patients presented complete independence and (2.22%) dependence up to 25%. On the 2nd postoperative day (60%) patients presented dependence up to 50%, (38.9%) dependence up to 75% and (1.1%) patients with complete dependence, showing that none of the patients had functional independence in this period. On the 5th postoperative day (54.4%) patients presented dependence of up to 25%, (41.1%) complete independence and (4.4%) dependence up to 50%. In the preoperative period for the 2nd postoperative day, functional loss occurred in a total of 51.09% MIF; functional loss was also observed in MIF full motor and total cognitive FIM, being 63.85% and 17.78% respectively.

In regards to the same study, in relation to the dimensions of the pre MIF for the 2nd postoperative day: in self-care functional loss was greater in the Bathroom category (83.66%); the size transfers to higher functional loss presented in the category Transfer Toilet and Shower (77.85%); and in Locomotion category Locomotion — Stairs showed functional loss of 83.69%.

These percentages is justified by the fact that chest tube is still being used by the patient resulting in movement restriction, due to post-surgical medical guidelines and limited surgical deficit, but not by functional loss. Functional independence were not significant during the pre and 2nd postoperative day,

as there was functional loss; but were significant from the pre to the 5th postoperative day and also on the 2nd day to the 5th postoperative day, presenting an increase in the independence of ADLs.

In this sense Myles et al (16), observed in their study that cardiac surgery is crucial to functionality damage of these patients. The physiotherapy treatments bring metabolic exercise ends to reduce swelling and increase circulation, active exercises to maintain range of motion and gait training.

Borges et al. (7) observed in their study that the pain level had significant effect on functionality of patients undergoing cardiac surgery, both on the seventh postoperative day and at hospital discharge.

Chiang et al. (17), observed loss of peripheral muscle strength, deconditioning and decline in functional independence in mechanically ventilated patients for 14 days. They applied a physical training program for six weeks in a specialised unit in respiratory care acquiring gain in peripheral muscle strength in the arms and legs, increased days off the VM, as well as gains in functional independence measured by the FIM and Barthel score. Although Stiller (8), reports that there is still little information regarding the best type of activity to benefit critically ill patients during hospitalization and there are few published studies that explore the benefits, duration and frequency of exercise in ICU patients.

Thomsen et al. (18), reported that motor activities appear to be a significant predictor of weaning process and passive and active handlings determined as mobilization following transfer to ICU, can improve independent ambulation of the patient's pathophysiology. Although Burtin et al. (19) have demonstrated that the additional use of cycle ergometer on a daily basis to conventional physical therapy, led to an improvement in exercise capacity and self-perceived functional status at hospital discharge.

We have recently been given more attention to physical activity (beforehand) as a safe and feasible intervention in patients with neurological stability and cardio-respiratory (20,24). Early mobilization includes progressive therapeutic activities such as motor exercises in bed, bedside sedestation, standing position, chair transfer and walking. Immobility, physical deconditioning and muscle weakness are common problems in patients on MV. These complications can develop into physical deconditioning in the affected individual.

In the study by Nakamura et al. (21), with elderly patients submitted to heart surgery, a reduction in delirium index in the postoperative period with an earlier return to their homes was observed.

In another study, the hemodynamic impact of training with cycle ergometer in patients after cardiac surgery was evaluated. They said they only suffered a respiratory rate statistical variation. Confirming that the application of the cycle ergometer in patients after cardiac surgery is feasible and safe, and well accepted by patients (22).

In a study by Clavet et al. (23), one third of patients hospitalized for an extended period of time in a tertiary ICU, presented joint contractures and limited amplitude of the entire movement, that still lasted after two weeks of discharge. It is possible that the loss of functional independence identified is associated with decreased flexibility by muscle contractures, reduced muscle strength or other disabilities as a result from immobility.

An important factor raised by Morais et al. (3), is that patients who had a time of CPB exceeding 100 minutes showed a decrease in functionality evaluated behind the MIF.

The patient should be encouraged prematurely, through mobilization and positioning, always looking for functionality that should be emphasized from the beginning of hospitalization. Recalling that the patient should be seen as a whole, and immobility can directly affect the psychological state leading him to develop emotional disorders such as anxiety and depression that can indeed affect the functionality.

To Macchi et al. (25, 27) the implement of early ambulation favors a rapid recovery following surgical procedure enabling an earlier transfer of patient to rehabilitation services. Thus, the patient's walking capacity can be used as a treatment goal, as this parameter is more appropriate to the individual's functional capacity. Oliveira et al. (2) justify the significant negative correlation distance in the six-minute walk test covered with patient's period of hospital stay, suggesting that if the patient has a greater walking ability it also has a better functional capacity to discharge.

Conclusion

In our study, the functional decline was explicit in patients undergoing cardiac surgery, especially those

who spent additional time on mechanical ventilation, having a direct and negative reflection on their functional independence and quality of life.

The studies found showed the benefits of physical therapy applied in such patients, the main purpose being the decrease of duration in mechanical ventilation and hospitalization through early mobilization, thus, minor functional losses to the patient after discharge. However, we emphasize that there is still a need for studies in the area that address the technical and its impact on the functionality of patients and studies that address the functional issue as a risk factor in ICUs.

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