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REVIEW

Physiotherapy in critically ill patients

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Abstract Prolonged stay in Intensive Care Unit (ICU) can cause muscle weakness, physic deconditioning, recurrent symptoms, mood alterations and poor quality of life.

Physiotherapy is probably the only treatment likely to increase in the short- and long-ter care of the patients admitted to these units. Recovery of physical and respiratory function coming off mechanical ventilation, prevention of the effects of bed-rest and improvement the health status are the clinical objectives of a physiotherapy program in medical and surgic areas. To manage these patients, integrated programs dealing with both whole-body physio therapy and pulmonary care are needed.

There is still limited scientific evidence to support such a comprehensive approach to critically ill patients; therefore we need randomised studies with solid clinical short- and lon term outcome measures.

PALAVRAS-CHAVE
Reabilitação;
Ventilação mecânica;
Fisioterapia;
Desmame

Fisioterapia em pacientes gravemente doentes

Resumo Uma estadia prolongada na Unidade de Cuidados Intensivos (UCI) pode caus fraqueza muscular, descondicionamento físico, sintomas recorrentes, alterações de humor má qualidade de vida.

A fisioterapia é, provavelmente, o único tratamento com potencial para aumentar nos cuid dos a curto e longo prazo aos pacientes internados nestas unidades. A recuperação das funçõ físicas e respiratórias, retirar a ventilação mecânica, prevenção de efeitos do repouso na car e melhoria do estado de saúde são objectivos clínicos de um programa de fisioterapia nas áre médicas e cirúrgicas. Para tratar estes pacientes, são necessários programas integrados q englobem tanto a fisioterapia global como os cuidados respiratórios necessários.

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A evidência científica para apoiar esta abordagem abrangente para todos os doentes crític ainda limitada; portanto, são necessários estudos aleatorizados com medidas de resultad curto e longo prazo.

Advances in the management of critically ill patients admitted to intensive (ICU) or respiratory intermediate intensive care units (RIICU) have improved hospital mortality and morbidity, leading to a growing population of patients with partial or complete dependence on mechanical ventilation and other ICU therapies.[1–3]

Clinical consequences of prolonged mechanical ventilation

Prolonged Hospital stay and difficulty with or lack of response to therapies can often cause severe complications such as muscle weakness, physical deconditioning, recurrent symptoms, mood alterations and poor quality of life.[4,5] Patients needing prolonged mechanical ventilation, may suffer from ''chronic critical illness'' involving myopathy related weakness, neuropathy, loss of lean body mass, increased adiposity, and anasarca.[4–6] This syndrome may contribute to low target organ hormone levels and impaired anabolism,[5,7] increased prevalence of difficult-to-eradicate infections,[8] coma or protracted or permanent delirium,[9] skin wounds, edema, incontinence, and prolonged immobility.[10,11]The role and workload of physical therapists in an ICU is different in different European countries,[12] but common to all is a growing need for physiotherapy programs in the short- and long-term care of patients admitted to ICUs or RIICU.[13–16] The recovery of physical and respiratory functions, discontinuation of mechanical ventilation, prevention of the effects of bed-rest and improvement in health status are proven clinical results of a physiotherapy program in these medical and surgical areas.[17–20]

The aims of any physical therapy program in critically ill patients is to apply advanced cost-effective therapeutic tools to decrease complications and the patient's ventila dependency and in this way decrease risks of complicat associated with bed-rest, to improve residual function prevent the need for new hospitalisations and to imp the health status and quality of life. Physical therap a part of the overall care of patients undergoing card upper abdominal, and thoracic surgery, may prevent treat respiratory complications such as secretion re tion, atelectasis, and pneumonia by means of diffe techniques. Early physical therapy may prevent diffi weaning, limited mobility and ventilator dependency (Table 1).

Table 1 Physiotherapy techniques in the ICU.

Mobilisation
Postures
Passive limb exercise
Active limb exercise
Continuous rotational therapy
Muscle training
Respiratory muscle training
Peripheral muscle training
Neuromuscular electrical stimulation
Airway Secretions Management
Manual hyperinflation
Percussion and vibrations
In-exsufflation
Intrapulmonary percussive ventilation

Treatment of muscle weakness and related complications

Mobilisation

Prolonged immobility is a main cause of muscle weak in patients admitted to ICU, conversely early physiot apy has an important role in the recovery of these patie Early physical activity is feasible and is a safe inter tion following the initial cardio-respiratory and neurolog stabilisation.[23,24] Early mobilisation and muscle training improve functional outcomes, cognitive and respiratory ditions in these critically ill patients,[24] reducing the risk venous stasis and deep vein thrombosis.[25] Postures, pas or active limb movements and Continuous Rotational T apy (CRT) are considered the principal strategies to mob patients.

Postures

Prone position has been shown to result in short-term in oxygenation, in improvement of ventilation and perfu mismatch and of the residual lung capacity.[26–29] Impr ments in lung function and atelectasis have been also sh in patients with unilateral disease when positioned on t side, lying with the affected lung uppermost.[30,31] Des their physiological rationale,[17] these easy techniques still not widely used and it is still unclear whether reported physiological improvements can be associated improvements of stronger clinical outcomes like mortal

Passive and active limb exercise

Passive, active assisted, or active resisted limb movem are aimed at maintaining the range of motion of the jo at improving soft-tissue length and muscle strength, decreasing the risk of thromboembolism.[32]

Fig. 1 Early bed cycling in ICU.

Quadriceps force and functional status was the same in patients undergoing the addition of early mobilisation to standard physiotherapy compared to standard physiotherapy alone. However, the total distance they walked, the isometric quadriceps force and the perceived functional well-being were significantly better with early mobilisation.[33] A gradual mobility protocol for both upper and lower limbs resulted in feasibility, safety and decreased hospital length of stay in acute patients requiring mechanical ventilation.[34] Supported arm training in addition to normal physiotherapy[35] gave similar positive results in patients recently weaned from mechanical ventilation in a RIICU (Fig. 1).

Continuous rotational therapy

This refers to specialised beds used to turn patients continuously along the longitudinal axis up to an angle of 60° onto each side, with preset degree and speed of rotation. This treatment can prevent sequential airways closure, and pulmonary atelectasis, reduce the incidence rate of lower respiratory tract infection and pneumonia, the duration of endotracheal intubation and the length of hospital stay.[36–40]

Muscle training

It is well known that muscle mass and its ability to perform aerobic exercise invariably declines with inactivity.[41] In critically complex patients, skeletal muscle training aims to strengthen, thus potentially increasing the patient's ability to perform Activities of Daily Life (ADL). In these patients, a tailored training program seems to be very effective in speeding weaning, in improving hospital survival, and in reducing risks associated to hospital-stay.[42]

Respiratory muscle training

Respiratory muscle weakness, imbalance between muscle strength and the load of the respiratory system and cardiovascular impairment are major determinants of weaning failure in ventilated patients. In ICU patients these factors and the excessive use of controlled mechanical ventilation, may lead to rapid diaphragmatic atrophy and dysfunction. Nevertheless, the rationale for respiratory muscle traini in ICU is still controversial. Indeed, the diaphragm of CO patients is as valid as that of a healthy person in generati pressure at comparable lung volumes,[44] showing an adapti change toward the slow-to-fast characteristics (resistan to fatigue) of the muscle fibres due to increased operation lung volume.[45]

There has been a debate in recent literature about t potential role of Inspiratory Muscle Training as a compone of pulmonary rehabilitation in severely disabled COPD a in neuromuscular patients,[46,47] which is aimed at improvi their strength and reducing the load perception of the resp ratory system. Studies on ICU ventilatory-dependent CO patients have also shown that respiratory muscles traini may be associated with a favourable weaning outcome.[48]

Peripheral muscle training

Prolonged inactivity is more likely to cause skeletal mu cle dysfunction and atrophy in antigravity muscles, wi reduced capacity to perform aerobic exercise.[41,50] severely disabled patients peripheral muscle training (bo passive and active training lifting weights or pushing again a resistance with the limbs), produces specific gain strength and recovery of ADL, although the evidence effects after an episode of acute respiratory failure is n specified.[51] We have found that selective arm training add to the benefits (exercise tolerance and perception of dys noea) of standard physiotherapy.[35]

Neuromuscular electrical stimulation

Neuromuscular electrical stimulation (NMES) can indu changes in muscle function without any form of ventilato stress in severely ill patients who are unable to perfor any activity.[52] However, no clinical studies have yet clear demonstrated the additional effect of NMES on exercise to erance when compared with conventional training. NM can be easily used in the ICU, applied to lower limb muscl of patients lying in bed. Patients with COPD[53,54] or with co gestive heart failure[55] are more likely to benefit. NMES h been also considered as a means of preventing ICU polyne romyopathy, a frequent complication in the critically patients.[56]

Airway secretions

Increase of bronchial secretions (either due to muco-cilia dysfunction or to muscular weakness) may affect respir tory flow and increase the risk of nosocomial pneumonia Chest physiotherapy should prevent such complications improving ventilation and gas exchange, and by redu ing airway resistance and the work of breathing.[15] Sever manually assisted techniques (manual hyperinflation, pe cussions/vibrations) and mechanical devices (in-exsufflato are often applied to facilitate removal of excess of muc (Table 1).

Manual hyperinflation

This respiratory technique is aimed at preventing pulmonary collapse (or re-expanding collapsed alveoli), improving oxygenation and lung compliance, and facilitating the movement of secretions toward the central airways.[57] Manual hyperinflation does not have a standard practice; the possible physiological side effects of delivered air volume, flow rates and airway pressure must be carefully considered, especially in patients under mechanical ventilation.[58–60] Increase in air volume with this technique can be obtained both manually or with assisted mechanical ventilation, each producing similar benefits in clearing excessive mucus.[61,62]

Percussion and vibrations

Manual percussion and vibrations (clapping a selected area and then compressing the chest during the expiratory phase) are commonly used to increase airway clearance and are often associated with postural drainage. Currently, in critical ventilated patients with a normal cough competence, increase of mucus clearance is achieved without a significant change of blood gases and lung compliance.[15,63,64]

In-exsufflation

The mechanical in-exsufflator promotes removal of excessive mucus by inflating the airways with a large air volume that rapidly is exsufflated by a negative pressure, thus simulating the physiological mechanism of cough.[65–67] The safety and the clinical advantage (avoidance of tracheostomy and/or endotracheal intubation) of this device when compared with conventional chest physiotherapy in hospitalised neuromuscular patients with recent upper respiratory tract infection has been shown.[68,69] The usefulness of these techniques in allowing for extubation in patients judged as needing tracheostomy has been recently outlined.[70]

Intrapulmonary percussive ventilation

Intrapulmonary Percussive Ventilation creates a percussive effect in the airways thus facilitating mucus clearance through direct high-frequency oscillatory ventilation which is able to help the alveolar recruitment.[71] This effect has been successfully shown during both acute and chronic phases in patients with respiratory distress,[72] neuromuscular disease,[73] and pulmonary atelectasis with or without consolidation.[74] In hospitalised COPD patients with respiratory acidosis, this technique has been shown to prevent the deterioration of the acute episode, thus avoiding endo-tracheal intubation.[75] In tracheostomised patients recently weaned from mechanical ventilation the addition of Intrapulmonary Percussive Ventilation to standard chest physiotherapy was associated with an improvement of oxygenation and expiratory muscle performance thus leading to a substantial reduction in the risk of pneumonia.[76]

Conclusion

Due to the increasing number of ICU admissions and global risk of complications and mortality over the follow years,[3,77] comprehensive programs including physiotapy should be implemented to speed-up the patie functional recovery and to prevent the complication prolonged immobilisation especially in ventilator-depend or difficult- to wean patients.[18,78] To manage the mult and complex problems of these patients, integrated grams dealing with both whole-body physical therapy pulmonary care are needed.[13,14]

There is still limited scientific evidence to support su comprehensive approach to all critically ill patients; th fore we need randomised studies with solid clinical sh and long-term outcome measures.

Conflicts of interest

The authors have no conflicts of interest to declare.

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