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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

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Abstract The Task Force reviewed and discussed the available literature on the effectiveness of physiotherapy for acute and chronic critically ill adult patients. Evidence from randomized controlled trials or meta-analyses was limited and most of the recommendations were level C (evidence from uncontrolled or nonrandomized trials, or from observational studies) and D (expert opinion). However, the following evidence-based targets for physiotherapy were identified: deconditioning, impaired airway clearance, atelectasis, intubation avoidance, and weaning failure. Discrepancies and lack of data on the efficacy of physiotherapy in

clinical trials support the need to identify guidelines for physiotherapy assessments, in particular to identify patient characteristics that enable treatments to be prescribed and modified on an individual basis. There is a need to standardize pathways for clinical decision-making and education, to define the professional profile of physiotherapists, and increase the awareness of the benefits of prevention and treatment of immobility and deconditioning for critically ill adult patients.

Introduction

Critical illness can last from hours to months, depending on the underlying pathophysiology and response to treatment. It carries high morbidity and mortality rates, and the associated care is a major determinant of healthcare costs. The evolution of intensive care medicine and integrated team management has greatly improved the survival of critically ill patients [26, 69]. In view of the high costs associated with ICU, every attempt should continue to be made to prevent complications and appropriately treat the primary underlying pathophysiology to minimize length of stay in ICU. There are common complications particularly associated with a prolonged ICU stay, including deconditioning, muscle weakness, dyspnea, depression and anxiety, and reduced health-related quality of life [17, 41, 70]. Chronic critical illness is associated with prolonged immobility and intensive care unit (ICU) stay [29] and accounts for 5–10% of ICU stays, a proportion that appears to be increasing [13]. Because of these detrimental sequelae of long-term bed rest, there is a need for rehabilitation throughout the critical illness [16, 38, 66, 73, 114] and thereafter [49], to address these effects. The amount of rehabilita-

tion performed in ICUs is often inadequate [20] and, as a rule, is better organized in weaning centers [66, 73].

Physiotherapy in the management of patients with critical illness

Physiotherapists are involved in the management of patients with acute, subacute and chronic respiratory conditions and in the prevention and treatment of the sequelae of immobility and recumbency [47, 77]. Their role varies across units, hospitals, and countries [77], with respect to patient referral, roles, treatment goals and selection of interventions [47, 77]. Due to a lack of substantive evidence, an earlier review could not draw firm conclusions on the effectiveness of physiotherapy for critically ill patients [98]. The purpose of this document is to critically review the evidence currently available for the use of physiotherapy in the *adult* critically ill patient and to make recommendations for assessment and monitoring and best practice in three relevant clinical areas:

- Deconditioning and related complications
- Respiratory conditions (retained airway secretions, atelectasis, pneumonia, acute lung injury, inhalation injury, postoperative pulmonary complications, chest trauma, intubation avoidance and weaning failure)
- Emotional problems and communication

The Task Force members met twice face to face and agreed on the identified areas and the working procedures (see details in ESM). Details of the effectiveness of physiotherapy in specific pulmonary conditions, implications for staffing and suggestions for future research are discussed in the ESM.

Conditions and physiotherapy interventions

Assessment and monitoring

Physiotherapy assessment of critically ill patients is less driven by medical diagnosis, instead focusing on deficiencies at a physiological and functional level [39]. This leads to identification of problems and the prescription of one or more interventions. Physiotherapists should be able to prioritize, and identify aims and parameters of treatments, ensuring that these are both therapeutic and safe by appropriate monitoring of vital functions [22, 100]. Accurate and valid assessment of respiratory conditions, and of deconditioning and related problems, is of paramount importance for physiotherapists. While these areas should be assessed with previously validated measures, such measures are often not available or applicable in an ICU setting (e.g., outcomes for functional performance such as the Functional Independence Measure, the Berg Balance scale and SF-36 may be inapplicable for acutely ill ICU patients yet be successfully used to monitor the progress of patients in long-term weaning facilities) [16]. In addition, physiotherapists can contribute to the patient's

overall well-being by providing emotional support and enhancing communication. Fig. 1 outlines the etiology of respiratory insufficiency and failure (see also ESM), and may serve as a framework for the respiratory assessment and treatment. Assessment of muscle and neurological function is difficult in the ICU [81], but physiotherapists can reveal undetected injuries [92]. Detailed descriptions of assessment are given elsewhere [100].

Recommendations:

- Assessment prior to treatment should determine the underlying problem amenable to physiotherapy and which, if any, intervention(s) are appropriate (level D).
- Appropriate monitoring of vital functions should be used and acted upon to help ensure that physiotherapy interventions are both therapeutic and safe (level D).

Physical deconditioning and related complications

Due to the nature of critical illness and the modalities used to manage it, prolonged bed rest, with well-known adverse physiologic effects, seems

to be the rule in the ICU (see ESM for details). Rehabilitation has the potential to restore lost function but is traditionally not started until after ICU discharge. Critically ill patients are often viewed as 'too sick' to tolerate physical activity in the early phase of their illness and their immobilization is frequently 'inevitably' prolonged. This will enhance deconditioning and might further complicate the clinical course [21]. Early mobilization was shown 30 years ago to reduce the time to wean from mechanical ventilation and is the basis for functional recovery [103, 104]. Recently more attention has been given to (early) physical activity as a safe and feasible intervention after the initial cardio-respiratory and neurological stabilization [6, 71]. In the ICU setting, the prescription of exercise is mostly based on clinical condition and response to treatment. Reducing the active muscle mass (or even passive motion or electrical muscle stimulation), the duration of the exercise and/or the number of repetitions will result in lower metabolic demands. Patients with hemodynamic instability, or those on high FiO₂ and high levels of ventilatory support, are not candidates for aggressive mobilization. The risk of moving a critically ill patient should be weighed against the risks entailed by immobility and recumbency [50, 108]. No adverse effects of physical activity on the inflammatory status of critically ill patients have been demonstrated [109]. Fig. 2 outlines the steps involved in safe mobilization of critically ill patients [100]. In the following paragraphs several specific treatment modalities will be discussed.

Positioning can be used to increase gravitational stress and associated fluid shifts, through head tilt and other positions that approximate the upright position. The upright position increases lung volumes and gas exchange [15], stimulates autonomic activity, and can reduce cardiac stress from compression [57]. *Mobilization* has been part of the physiotherapy

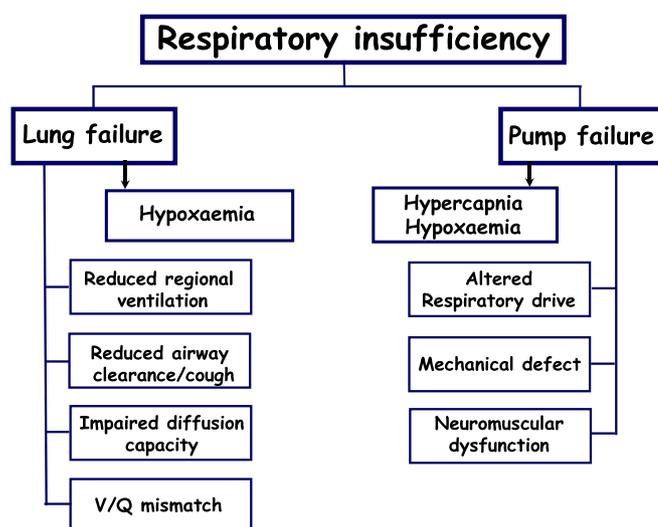
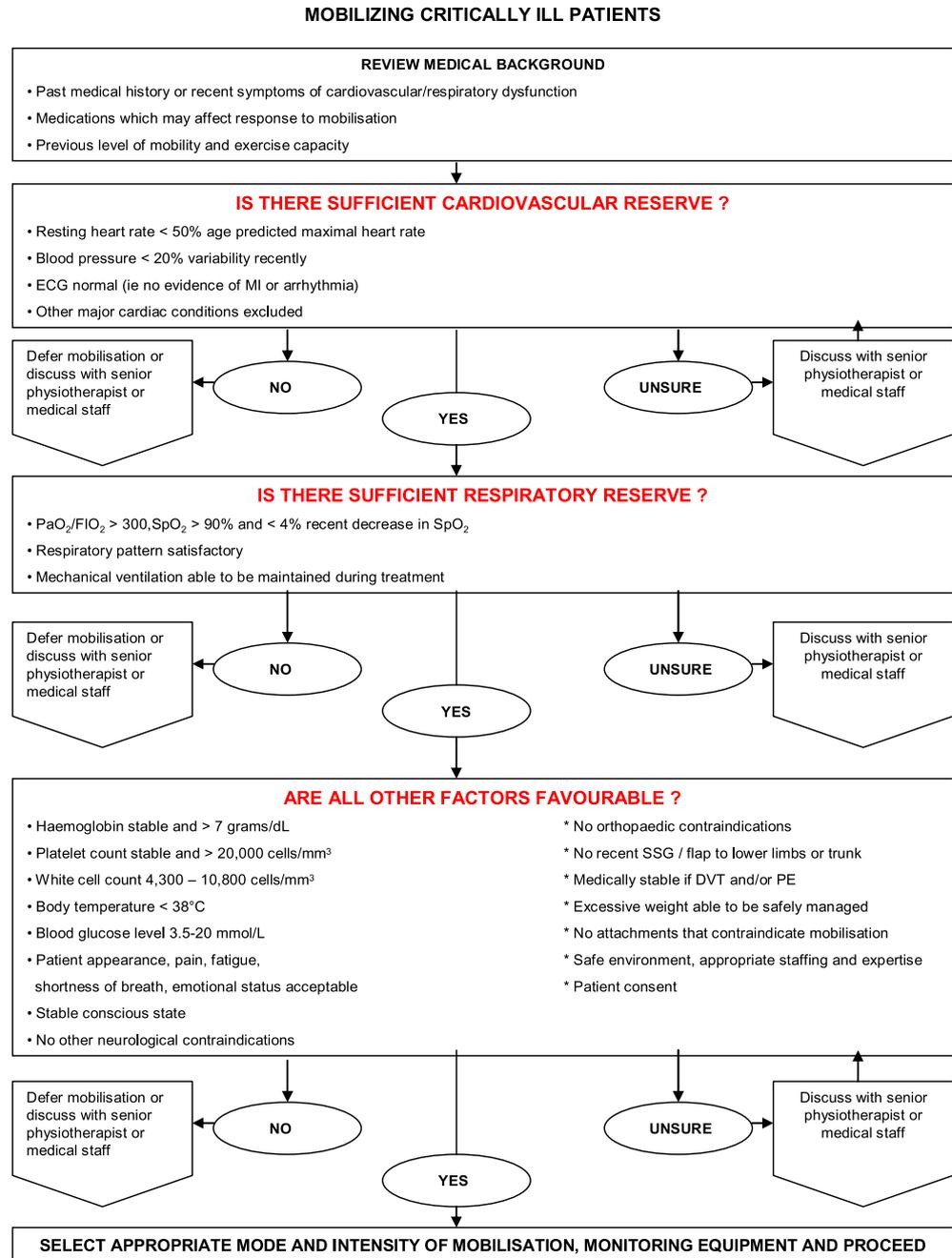


Fig. 1 Model of respiratory insufficiency (adapted from [90])

Fig. 2 Overview of safety issues before mobilizing critically ill patients. (Reproduced from: Stiller K, Phillips A (2003) Safety aspects of mobilising acutely ill inpatients. *Physiother Theory Pract* 19(4):239–257; with permission of Taylor & Francis Group, LLC, <http://www.taylorandfrancis.com> [100])



management of acutely ill patients for several decades [23]. Mobilization refers to physical activity sufficient to elicit acute physiological effects that enhance ventilation, central and peripheral perfusion, circulation, muscle metabolism and alertness and are countermeasures for venous stasis and deep vein thrombosis [79].

Strategies – in approximate order of intensity – include passive and active turning and moving in bed, active-assisted and active exercise, use of cycling pedals in bed, sitting over the edge of the bed, standing, stepping in place, transferring from the bed or chair, chair exercises and walking. These activities are safe

and feasible in the early phase of ICU admission [6]. Walking and standing aids (e.g., modified walking frames, tilt tables) are safe and feasible to facilitate the mobilization of critically ill patients [15, 112, 113]. In patients with spinal cord injury abdominal belts improve vital capacity [34] and increase the exercise

ability. Non-invasive ventilation during mobilization may improve exercise tolerance for non-intubated patients, similar to that demonstrated in patients with severe COPD [106].

Aerobic training and muscle strengthening, in addition to routine mobilization, improved walking distance more than mobilization alone in ventilated patients with chronic critical illness [73]. A recent randomized controlled trial (RCT) showed that a 6-week upper and lower limb training program improved limb muscle strength, increased ventilator-free time and improved functional outcomes in patients requiring long-term mechanical ventilation compared to a control group [16]. These results are in line with a retrospective analysis of patients on long-term mechanical ventilation who participated in whole-body training and respiratory muscle training [66]. In patients recently weaned from mechanical ventilation, the addition of upper-limb exercise enhanced the effects of chest physiotherapy on exercise endurance and dyspnea [82]. Recent technological developments have resulted in equipment for active or passive leg cycling during bed rest. This allows early application of leg cycling in critically ill patients, potentially improving functional status [11].

Low-resistance multiple repetitions of *resistive muscle training* can augment muscle mass, force generation and oxidative enzymes. This in turn can improve O₂ extraction and efficiency of muscle O₂ kinetics. Applying these physiological responses to the ICU scenario, ICU patients should be given sets of repetitions (3 sets of 8–10 repetitions at 50–70% of 1 repetition maximum, RM) [52] to perform daily within their tolerance, commensurate with their goals. In patients unable to perform voluntary muscle contractions, *neuromuscular electrical stimulation* (NMES) has been used to prevent disuse muscle atrophy. In patients with lower limb fractures and cast immobilization for 6 weeks, daily NMES for at least

1 h reduced the decrease in cross-sectional area of the quadriceps and enhanced normal muscle protein synthesis [33]. In ICU patients, NMES of the quadriceps, in addition to active limb mobilization, enhanced muscle strength and hastened independent transfer from bed to chair [114].

Passive stretching or range-of-motion exercise may have a particularly important role in the management of patients who are unable to move spontaneously. Passive movement has been shown to enhance ventilation in neurological patients in high-dependency units [14]. Evidence for using continuous dynamic stretching is based on the observation, in other patient groups, that continuous passive motion (CPM) prevents contractures and promotes function [91]. CPM has been assessed in patients with critical illness subjected to prolonged inactivity [38]. Three hours of CPM per day reduced fiber atrophy and protein loss, compared with passive stretching for 5 min twice daily [38].

For patients who cannot be actively mobilized and are at high risk for soft tissue contracture (e.g., following severe burns or trauma, and in some neurological conditions), *splinting* may be indicated. In burns patients, fixing the position of joints has been shown to reduce muscle and skin contraction [55]. The ideal duration of the intervention is unknown. Many facilities use a ‘2 h on, 2 h off’ schedule, but this is not supported by data [85]. In patients with neurological dysfunction, splinting may reduce muscle tone [42].

Recommendations:

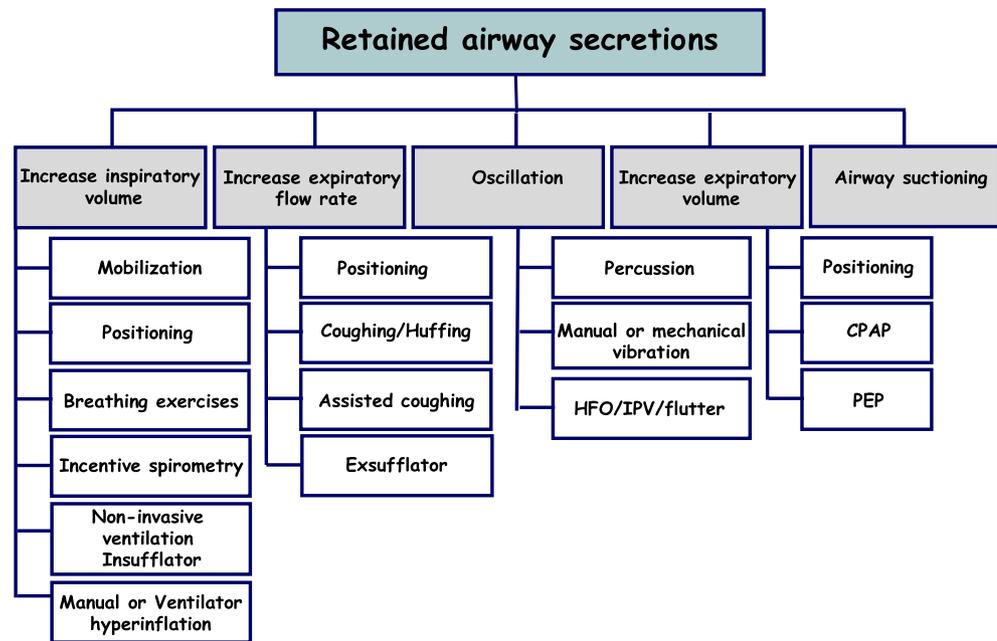
- Active or passive mobilization and muscle training should be instituted early (level C).
- Positioning, splinting, passive mobilization and muscle stretching should be used to preserve joint mobility and skeletal muscle length in patients unable to move spontaneously (level C).

- NMES may be instituted, where equipment is available, in patients who are unable to move spontaneously and at high risk of musculo-skeletal dysfunction (level C).
- Techniques, such as positioning, passive movement and transfers, should be administered jointly with the nursing staff (level D).
- The physiotherapist should be responsible for implementing mobilization plans and exercise prescription, and make recommendations for progression of these in conjunction with other team members (level D).

Respiratory conditions

Respiratory dysfunction is one of the most common causes of critical illness necessitating ICU admission. Failure of either of the two primary components of the respiratory system (i.e., the gas-exchange membrane and the ventilatory pump.. [90] (Fig. 2; see ESM, Table S2), can result in a need for mechanical ventilation to maintain adequate gas exchange and to assume some, if not all, of the work of breathing. The aims of physiotherapy in respiratory dysfunction are to improve global and/or regional ventilation and lung compliance, to reduce airway resistance and the work of breathing, and to clear airway secretions. Body positioning and mobilization are potent options for treatment that may optimize oxygenation by improving ventilation, V/Q matching, using gravity dependency to augment alveolar recruitment, and lung perfusion. Evidence for interventions used to clear retained airway secretions will be discussed generally. The ESM describes the evidence for interventions in specific pathophysiological problems and diagnoses, i.e. atelectasis, pneumonia, acute lung injury, acute respiratory distress syndrome, inhalation injury, postoperative pulmonary complications and chest trauma.

Fig. 3 Pathways and treatment modalities for increasing airway clearance (*PEP*, positive expiratory pressure; *CPAP*, continuous positive airway pressure; *HFO*, high-frequency oscillation; *IPV*, intrapulmonary percussive ventilation; *NIV*, non-invasive ventilation; *IPPB*, intermittent positive pressure breathing)



Retained airway secretions

As different mechanisms can be responsible for reducing airway clearance, it is important firstly to identify the problem and then to select the intervention(s) that may be appropriate (Fig. 3).

Non-intubated patient: Interventions aimed at *increasing inspiratory volume* (see Fig. 3) affect lung expansion, regional ventilation, airway resistance and pulmonary compliance. Interventions aimed at *increasing expiratory flow* include *forced expirations (both active and passive)*. Actively, these can be with an open glottis (a huff), or with a closed glottis (a cough). *Manually assisted cough*, using thoracic or abdominal compression, may be indicated for patients with expiratory muscle weakness or fatigue (e.g., neuromuscular conditions) [96]. All forced expiratory techniques rely on an adequate inspiratory volume and may need to be accompanied by interventions to increase inspiratory volume, if reduced inspiratory volume is contributing to an ineffective cough. The *mechanical in-exsufflator* can be used to deliver an inspiratory pressure followed by a high negative

expiratory force, via a mouthpiece or facemask. This increases tidal volume and augments expiratory flow and thus is indicated when the patient is unable to clear secretions. Although not widely used, it has been successfully applied in the management of non-intubated patients with retained secretions secondary to respiratory muscle weakness (e.g., muscular dystrophy) [35]. *Airway suctioning* is, dependent on local agreements, practiced by doctors, nurses and physiotherapists and is used solely to clear central secretions that are considered a primary problem when other techniques are ineffective. Detailed descriptions of airway suctioning techniques and the risks associated with these techniques are given elsewhere [4].

Recommendations for the non-intubated patient:

- Interventions for increasing inspiratory volume should be used if reduced inspiratory volume is contributing to ineffective forced expiration (level B).
- Interventions for increasing expiratory flow should be used to assist airway clearance if reduced

expiratory force is contributing to ineffective forced expiration (level B).

- Manually assisted cough techniques and/or in-exsufflation should be applied in the management of non-intubated patients with retained secretions secondary to respiratory muscle weakness (level B).
- Oro-nasal suctioning should be used only when other methods fail to clear secretions (level D).
- Nasal suctioning should be used with extreme caution in patients with anticoagulation, bony or soft tissue injuries or after recent surgery of the upper airways (level D).

Intubated and ventilated patients: *Body positioning* and *mobilization* may optimize airway secretion clearance and oxygenation by improving ventilation, alveolar recruitment and V/Q matching. *Manual hyperinflation* (MHI) or ventilator hyperinflation, positive end-expiratory pressure (PEEP) ventilation and *airway suctioning* may assist in secretion clearance [7]. The aims of *MHI* are to prevent pulmonary atelectasis, re-expand collapsed alveoli, im-

prove oxygenation, improve lung compliance, and facilitate movement of airway secretions towards the central airways [43, 68]. The head-down position may enhance the effects of MHI on sputum volume and compliance [8]. MHI involves a slow deep inspiration with manual resuscitator bag, an inspiratory hold, and then a quick release of the bag to enhance expiratory flow and mimic a forced expiration. MHI can precipitate marked hemodynamic changes associated with a decreased cardiac output, which result from large fluctuations in intra-thoracic pressure [95]. As with other forms of ventilatory assistance, damage to the lung can occur if inflation is forced or PEEP is lost during the technique. A pressure of 40 cmH₂O has been recommended as an upper limit [84]. Similarly, there is a risk of hypo- as well as hyperventilation. MHI can also increase intracranial pressure (ICP) and mean arterial pressure, which has implications for patients with brain injury. These increases are usually limited, however, such that cerebral perfusion pressure remains stable [78]. *Airway suctioning* may have detrimental side effects [110] although reassurance, sedation, and pre-oxygenation of the patient may minimize these effects [61]. Suction can be performed via an *in-line closed suctioning system* or an *open system*. The in-line system does not appear to decrease the incidence of ventilator-associated pneumonia (VAP) [25, 59] or the duration of mechanical ventilation, length of ICU stay or mortality [59], but it does increase costs. Closed suctioning may be less effective than open suctioning for secretion clearance during pressure-support ventilation [58]. The routine *instillation of normal saline* during airway suctioning has potential adverse effects on oxygen saturation and cardiovascular stability, and variable results in terms of increasing sputum yield [1, 9]. *Chest wall compression* prior to endotracheal suctioning did not improve airway secretion removal, oxygena-

tion, or ventilation after endotracheal suctioning in an *unselected* population of mechanically ventilated patients [105].

Recommendations for the intubated patient:

- Body positioning and mobilization can be used to enhance airway secretion clearance (level C).
- Manual or ventilator hyperinflation and suctioning are indicated for airway secretion clearance (level B).
- MHI should be used judiciously in patients at risk of barotrauma and volutrauma or who are hemodynamically unstable (level B).
- Care must be taken to ensure that over- or under-ventilation does not occur with MHI (level B).
- Airway pressures must be maintained within safe limits (e.g., by incorporating a pressure manometer into the MHI circuit) (level D).
- Reassurance, sedation, and pre-oxygenation should be used to minimize detrimental effects of airway suctioning (level D).
- Open system suctioning can be used for most ventilated patients (level B).

- Neither suctioning nor instillation of normal saline should be performed *routinely* (level C).

Respiratory insufficiency – intubation avoidance

Complications of endotracheal intubation and mechanical ventilation are common, and weaning from mechanical ventilation can be challenging, so where appropriate and possible, physiotherapy is aimed at avoiding intubation. Of paramount importance is whether the respiratory failure is due to lung failure, pump failure, or both (Fig. 2; see ESM Table S2), as the problems and strategies will vary accordingly. Imbalance between respiratory muscle (pump) workload and muscle (pump) capacity can result in respiratory insufficiency (Fig. 4) and is a major cause of need for ventilatory support. Physiotherapy may help decrease ventilatory load, e.g., by reducing atelectasis [62, 99] or removing airway secretions [60, 99]. Conditions contributing to the need for ventilatory support or weaning failure are described in the ESM (Table S3).

Problems related to the work of breathing and efficiency of ventilation, along with progressive debility, are the primary focuses of physiotherapy in the management of respiratory insufficiency and the avoidance of

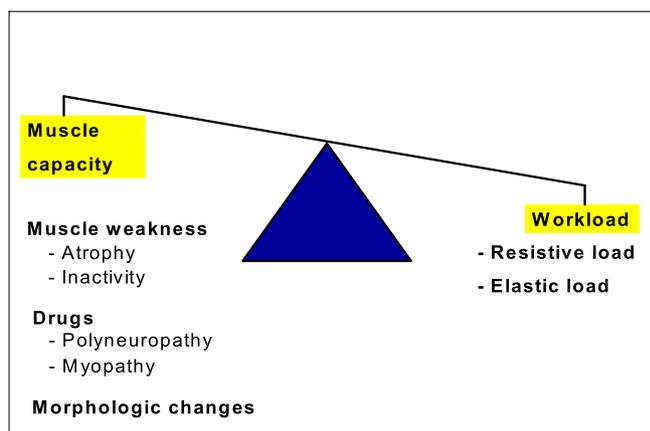


Fig. 4 Factors contributing to respiratory insufficiency, failure and ventilator dependence

intubation. *Positioning* can reduce the work of breathing and improve the efficiency of ventilation. Improvements have been documented (see ESM) for patients with unilateral lung disease when they are positioned on their side with the affected lung uppermost [45]. For those with, or at risk of, reduced FRC, supported upright sitting, with the help of pillows if necessary, may be beneficial [46]. In lung failure, CPAP has produced favorable outcomes in adults with ARDS [36] and in patients with *Pneumocystis carinii* pneumonia [37], and may prevent re-intubation [24]. NIV has been used for postoperative support [2] and for COPD patients with CAP [18], as well as in some patients with acute lung injury [89], to avoid intubation. When pump dysfunction is present, NIV can reduce breathlessness [10], reduce rates of intubation [83], reduce mortality from exacerbations of COPD [83], and is cost effective [80]. Both CPAP and NIV can reduce the need for intubation in acute cardiogenic pulmonary edema [67].

Recommendations:

- Body positioning should be used to optimize ventilatory pump mechanics in patients with respiratory insufficiency (level C).
- CPAP and NIV should be considered for the management of acute cardiogenic pulmonary edema (level A).
- NIV should be used as the first line of treatment in pump failure due to exacerbations of COPD, providing immediate intubation is not warranted (level A).
- NIV may be used in selected patients with pump failure due to acute respiratory complications from musculo-skeletal chest wall dysfunction or neuromuscular weakness (level A).
- NIV/CPAP can be used in selected patients with type 1 acute respiratory failure, e.g., inhalation injury, trauma and some pneumonias (level C).

Weaning failure

Only a small proportion of patients fail to wean from mechanical ventilation, but they require a disproportionate amount of resources. *Therapist-driven protocol (TDP)* was shown to reduce the duration of mechanical ventilation and ICU cost [27, 51]. However, a recent study showed that protocol-directed weaning may be unnecessary in an ICU with generous physician staffing and structured rounds [54]. A *spontaneous breathing trial (SBT)* can be used to assess readiness for extubation with the performance of serial measurements, such as tidal volume, respiratory rate, maximal inspiratory airway pressure, and the rapid shallow breathing index [63, 111]. Early detection of worsening clinical signs such as distress, airway obstruction and paradoxical chest wall motion ensures that serious problems are prevented. Airway patency and protection (i.e., an effective cough mechanism) should be assessed prior to commencement of weaning. *Peak cough flow* is a useful parameter to predict successful weaning in patients with neuromuscular disease or spinal cord injury when extubation is anticipated [5]. An “*airway care score*” has been developed based on the quality of the patient’s cough during airway suctioning, the absence of ‘excessive’ secretions and the frequency of airway suctioning [12, 27].

NIV can facilitate weaning [74] and reduce ICU costs [102], and physiotherapists can play a major role in its application [53, 77]. NIV is effective in preventing post-extubation failure in patients at risk [75, 97]. Respiratory muscle weakness is often observed in patients with weaning failure [56]. Since inactivity (‘ventilator-induced diaphragm dysfunction’, VDI) is suggested as an important cause of respiratory muscle failure [31], and intermittent loading of the respiratory muscles has been shown to attenuate respiratory muscle deconditioning [32], *inspiratory muscle training* might be beneficial

in patients with weaning failure. Uncontrolled trials [3, 64] and one RCT [65] observed an improvement in inspiratory muscle function and a reduction in duration of mechanical ventilation and weaning time with intermittent inspiratory muscle training. Finally, *biofeedback* to display the breathing pattern has been shown to enhance weaning [44]. *Voice and touch* may be used to augment weaning success either by stimulation to improve ventilatory drive or by reducing anxiety [40]. Environmental influences, such as ambulating with a portable ventilator, have been shown to benefit attitudes and outlooks in long-term ventilator-dependent patients [28].

Recommendations:

- Therapist-driven weaning protocols and SBTs can be implemented dependent on physician staffing in the ICU (level A).
- Therapist-driven protocols for weaning should be adhered to if in existence (level A).
- In patients with respiratory muscle weakness and weaning failure respiratory muscle training should be considered (level C).
- NIV may be used as a weaning strategy in a selected population of hypercapnic patients (level A).
- Patients at risk of post-extubation ventilatory failure should be identified and considered for NIV (level B).
- During the early post-extubation phase, assisted coughing maneuvers or nasal endotracheal suctioning should be performed as necessary (level C).
- Physiotherapists can assist in patient management post-decannulation (level D).

Emotional problems and communication

Critically ill patients may experience feelings of anxiety, alienation and

panic, particularly if nursed in an ICU or high-dependency unit [76, 101]. Those on mechanical ventilation may experience additional distress from the endotracheal tube [30]. These emotions may lead to post-traumatic stress disorder in some patients after discharge [48]. Anxiety also adversely affects recovery if not assessed and treated [72]. Promoting a restful environment conducive to relaxation and sleep is a daily challenge in critical care [87]. Physiotherapists can make a valuable contribution to the psychological well-being and education of the critically ill patient [94]. *Relaxation interventions* can reduce anxiety and panic, promote sleep, and, in turn, reduce the severity of pain and dyspnea. *Body positioning and repositioning* are useful means of achieving relaxation and reduce symptoms. Breathlessness can respond favorably to positioning [93]. *Therapeutic touch* has been reported to promote relaxation and comfort in critically ill patients, which in turn may enhance sleep [86]. Physiotherapists, by virtue of their hands-on treatment provided to ICU patients, have an opportunity to provide such therapeutic touch. *Massage* may be useful in enhancing relaxation and reducing anxiety and pain in acute and critical care [88]. *Communication* is central to patient satisfaction and physical and emotional well-being [94]. The development of post-traumatic stress disorder has been associated with the inability to communicate effectively. Informed consent is a means of empowering the patient when highly vulnerable [19]. *Education* is designed to help the

patient understand their condition and care and appreciate their own role in pain control, e.g., patient-controlled analgesia, wound support during movement or airway clearance, and strategies such as body positioning for comfort [107].

Recommendations:

- Physiotherapists should ensure treatment sessions address discomfort and anxiety as well as physiological problems (level D).
- Physiotherapists should ensure patient education is included in treatment sessions (level D).
- Physiotherapists can consider massage as an intervention for anxiety management and sleep promotion (level C).
- Physiotherapists should include appropriate use of therapeutic touch in all treatments they provide (level D).

Summary

Physiotherapists are members of the interdisciplinary healthcare team for the management of critically ill patients. For the purpose of this review, several important areas for physiotherapy in critical illness were identified: physical deconditioning, neuromuscular and musculoskeletal complications; prevention and treatment of respiratory conditions; and emotional problems and communication. The following problems were identified as evidence-based targets for physiotherapy: deconditioning, muscle weakness, joint stiffness,

retained airway secretions, atelectasis and avoidance of intubation and weaning failure. Appropriately prescribed physiotherapy may improve outcomes and reduce the risks associated with intensive care, as well as minimize costs.

The lack of systematic reviews and RCTs to support or reject physiotherapy interventions was recognized by the Task Force, as most recommendations were level C and D. However, evidence-based medicine in the ICU is not restricted to RCTs and meta-analyses. Other forms of evidence, including expert opinion and physiologic evidence, are also valid in terms of providing a basis for practice and identifying areas where further research is needed to strengthen and advance this evidence base.

Discrepancies regarding the efficacy of physiotherapy in clinical trials support the need to identify indications for interventions based on an individual's needs, rather than being condition dependent, and to establish sound principles for the prescription of specific interventions to achieve the desired outcome. However, there is a need to standardize pathways for clinical decision-making and education, and define the professional profile of ICU physiotherapists in more detail. Patients in the ICU have multiple problems that change rapidly in response to the course of illness and to medical management. Rather than standardized treatment approaches for various conditions, the goal is to extract principles of practice that can guide the physiotherapist's assessment, evaluation and prescription of interventions and their frequent modification for each patient in the ICU.

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