Walking with ventilated intensive care patients

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ESPAÑOL

Caminar con pacientes ventilados en cuidado intensivo

Palabras clave

Ambulación, movilización, equipo, ventilación, caminar

Resumen

- Hay una creciente evidencia sobre los beneficios de la movilización temprana en pacientes ventilados.
- La movilización y aún la ambulación con pacientes ventilados es posible y segura. Esta mejora la rehabilitación y la calidad de vida del paciente ventilado.
- Caminar con pacientes ventilados une al equipo.

SUMMARY

- There is growing evidence of the benefits of early mobilisation of ventilated patients.
- Mobilisation and even walking with ventilated patients is feasible and safe. It improves the rehabilitation and quality of life of ventilated patients.
- Walking with ventilated patients connects the team.

INTRODUCTION

Mr Smith (pseudonym) is on the neurological intensive care unit. Because of his brain stem infarction, he has a massive swallowing disorder, aspiration pneumonia, and had to be intubated. For adequate oxygenation he requires an inspired oxygen (FiO_2) of 0.45, has a postive end expiratory pressure (PEEP) of 8 mbar and an oxygenation index of 188.

Mr Smith sits straight up in a chair, careful of his ventilation tubes. He is a little dizzy because of the infarction, has double vision and he needs some help with stability, but he largely manages alone. Finally, his wife arrives and he wants to sit and talk (she talks, he writes). We ask him if he minds the breathing tube, if he would like anything to help him sleep. He shrugs and writes that he is fine and continues talking with his wife. In between, he stands up, takes a few steps, sits down again. This makes us wonder why he is doing so well, with no sedation or need to lie down.

SEDATION

It is time for a paradigm shift. An oral tube is not an indication for deep sedation, like many nurses and physicians believe. On the contrary, in orally intubated patients the same high levels of anxiety, depression or complaints can be found as in patients with a tracheostomy (Saur et al. 2009). Nurses often think it would be easier with a tracheostomy tube. It is not, it is equally difficult.

Furthermore, we now know that immobility attracts considerable consequences: increased thrombosis; incidence of pressure ulcers; deterioration of almost all respiratory parameters with increasing risk of pneumonia; constipation; urinary incontinence; electrolyte shift and oedema; hormonal disturbances; changes in blood clotting; muscle and calcium removal and contractures; emotional and cognitive changes that culminate in sensory deprivation with degradation of cognitive performance and depression (Zegelin 2005; Brower 2009). All of these complications often lead to a prolonged intensive care stay, or prolonged weaning with some serious consequences, of which sepsis is only one of several.

Thus, critical illness polyneuropathy - a heavy long-lasting neuromuscular disorder - as well as post-traumatic stress disorder, is discussed in this context. Several questions are raised:

- Do we treat patients well if we assume that intensive care, ventilation and immobilisation must go together?
- Do we protect patients with really deep sedation?
- Is it correct to think that one should not consciously experience mechanically ventilation?

In recent years, in the United States, England and Australia, an interesting change in thinking has taken place. Ventilated patients are increasingly mobilised and finally walked, even just across the hall, with a portable monitor, ventilator and suction. The first surveys have shown positive effects.

LITERATURE REVIEW

Methods

A systematic literature search was conducted via PubMed in February 2010. The purpose was to find current studies about mobilising ventilated patients. Raising a limb is a form of mobilisation (Chiang et al. 2006), of course, but we searched for mobilisation including being out of bed with ventilation. The combined search terms included were: ICU, intensive care unit, critical care, mobili*, ambulat*, walk*, ventilat*, and respirator.

In summary we found 310 articles and then added the following limits: Clinical Trial, Meta-Analysis, Practice Guideline, Randomized Controlled Trial, Review, Case Reports, published in the last 5 years. This resulted in 51 articles whose abstracts were reviewed. Of these, 42 were excluded because they did not deal with mobilisation of ventilated patients. Choi et al.'s (2008) review, for example, included studies about mobility exercises, while the patient was still lying in bed, so this fine review has been excluded. A few of Chang's intensive care patients were successfully weaned and there was not a separation in this (excluded) study between weaned and ventilated patients (Chang et al. 2004). Other studies dealt with early mobilisation in the intensive care unit (ICU), but with extubated patients, and these were also excluded, also.

Nine articles were reviewed in full. Three of these were subsequently excluded, because they did not report a study; nevertheless one was found to be useful (Stiller 2007). Of the remaining six studies, review of the reference lists provided an additional three studies. Another study was discovered through personal contact (McWilliams & Pantelides 2008). (See Figure 1). Another study was found, but older than the defined time limit of five years (Zafiropulus 1994).

The studies are summarised in Table 1.

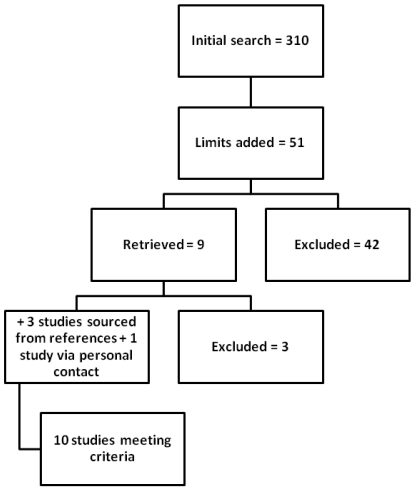

Figure 1. Literature search process

REVIEW

Bailey et al. (2007) from Salt Lake City showed that walking with ventilated patients is feasible and safe. The rate of adverse events (falling to his knees, blood pressure > 200 mmHg, SaO_2 < 80%) was less than 1% and none of the patients were accidentally extubated during an activity. The tubes were fixed with a typical ribbon. Thomson et al. (2008), working with Bailey, showed that the transfer to a respiratory intensive care unit (RICU), where early mobilisation is a priority, leads to early mobilisation. They suggested that patients should not suddenly stand up and walk because they were in a different department, rather it was because they were supported by a team that recognised the patient's potential.

Hopkins et al. (2007), from the Salt Lake City team, described the team process, and how to change the culture in the RICU. It took seven years to implement the approach of early mobilisation – with no increased costs, but increased staff satisfaction and reduced length of stay.

Morris et al. (2008) have worked on various ICUs with a mobility team (nurse, physiotherapist, and health care assistant) and supported patients' mobilisation. When compared to a standard group, these patients received more physiotherapy (80% vs. 47%, p < 0.001), were earlier out of bed (5 vs 11 days, p < 0.001) and had shorter time spent in the ICU (5.5 vs 6.9 days, p < 0.025) and the hospital (11.2 vs 14.5 days, p = 0.006). At the same rate of complications the mobilisation team caused no additional costs.

Despite significant methodological weaknesses in their study, McWilliams and Pantelides (2008) found that the staff was the main influence on mobilisation and retention. Patients who met the criteria for mobilisation but had not been mobilised due to lack of staff, however, had a significantly longer stay on the ICU of nine days compared to those who were mobilised. Zafiropoulos et al. (2004) showed that mobilising from lying to standing is haemodynamically safe and while ventilation parameters changed (minute volume, tidal volume, respiratory rate increased), oxygenation, as indicated by blood gas analysis, was not affected.

Schweickert et al. (2009) conducted an interesting study. During the daily sedation interruption in patients who were ventilated for less than 72 hours, but were expected to need a further 24 hours of respiratory assistance, a physiotherapy and occupational therapy mobilisation session was provided. This patient group showed, compared with a standard group, improved activities of daily living independence (59% vs 35%, p = 0.02), a shorter duration of delirium (2.0 vs 4.0 days, p = 0.02) and more ventilator-free days in the first month (23.5 vs 21.1 days, p = 0.05). There were 498 activities and only one adverse event (decrease in oxygen saturation less than 80%) and 19 (4%) discontinuations due to instability (mostly asynchrony with the respirator).

Three case reports described the benefits of mobilisation for single patients. Two reports described adult patients (Needham 2008; Perme et al. 2005), the latter describing a patient with a left ventricular assistance device, who had been successfully weaned after walking. A paediatric case report described a child who started walking with a respirator on the ICU and achieved a comparable development after discharge with a portable respirator (Dieperink et al. 2006).

Qualitative studies on the experience of our patients are currently unknown. There is a memorable quote from Needham (2008), who interviewed a ventilated patient about his walking experiences:

- Dr Needham: What did you think, when we discussed getting you out of bed while on a ventilator with a breathing tube in your mouth?
- Mr E: I thought it was wonderful. Anything to get me up and moving, and get me out of bed. Anything to get me off my back and on my feet – that is what I really wanted.
- Dr Needham: How did you feel to be awake, with a breathing tube in your mouth, on a ventilator, and walking laps around the medical intensive care unit?
- Mr E: It was wonderful. It was nice to get up and walk around. It was not uncomfortable. I enjoyed it. I think it had a very positive effect on me.

The first studies, which were performed with mixed populations of patients, suggest that walking with ventilated patients is feasible and safe and can have a positive influence on the ICU length of stay and the incidence of delirium. Also, walking can contribute significantly to the quality of life, motivation and wellbeing of patients.

However, walking when ventilated is not appropriate for all ICU patients. Various authors have described contraindications, which are summarised below.

Authors	Research question	Design	Sample	Results
Martin et al. (2005)	Does aggressive rehabilitation effect weaning and muscle strength?	Retrospective cohort analysis	49 bedridden patients at admission, mixed population in a ventilator rehabilitation centre	All patients could be weaned. Muscle strength increased
Perme et al. (2005)	Case report	Case report	Single patient: male adult with left venticular assist device	Patient could be weaned after several sessions of walking on a portable ventilator. Walking increased mobility and activity tolerance
Dieperink et al. (2006)	Case report	Case report	Single patient: child, ventilator dependent since birth	At 18 month portable CPAP was used to support psychomotor development. After being discharged home the child reached a 3-year comparable level of development
Bailey (2007)	Is walking with ventilated patients, feasible and safe?	Prospective observational study on a respiratory ICU	Mixed group (internal, surgery.): 103 adults with ventilation > 4 days. Activities: bedside sitting, sit in a chair, walking.	Yes, it is feasible and safe. 1449 activities took place, 249 activities were walking with orally intubated, ventilated patients. Rate of adverse events (falling to knees, blood pressure > 200, SaO_2 < 80%) < 1%; no accidental extubation
Hopkins et al. (2007)	How to transform an ICU to develop a culture of early mobility?	Implementation report of a respiratory ICU	Single respiratory ICU	Transforming process needed 7 years with no increased costs, but satisfied staff, more teamwork and patients reduced length of stay
Needham (2008)	Case report	Interview with a patient, after his ICU stay, who walked with a respirator in the ICU	Single patient	The male patient enjoyed the mobility. He felt it had a very positive effect on him. The oral tube was not a contraindication for awareness and mobility
Thomsom et al. (2008)	Does the mobilization of ventilated patients increase when they are transferred to a unit where mobility has a high priority?	Before and after observational study	As Bailey (2007)	After two days on the unit, the number of mobilisations increased three-fold
Morris et al. (2008)	Does earlier physiotherapy in the intensive care unit have an advantage for patients?	Prospective comparative study: mobility versus usual care. A mobility team screened patients after 48 hours ventilation and followed a protocol	Medical patients, 165 each group	Intervention group received more physiotherapy (80% versus 47%, $p < 0.001$), were previously out of bed (5 versus 11 days, $p < 0.001$), and had shorter time spent in ICU (5.5 versus 6.9 days, $p < 0.025$) and hospital (11.2 versus 14.5 days, $p = 0.006$).
McWilliams and Pantelides (2008)	Does physical therapy with early mobilisation have an impact on time spent in ICU?	Observational study of patients > 24 hours ventilation with early mobilisation ≤ 5 days	Mixed ICU, 65 patients	Patients who met the mobilisation criteria and had not been mobilised because of staff shortages, had an extended ICU stay (9 versus 4 days, $p < 0.001$)
Schweickert et al. 2009	Is the combination of a daily wake-up trial with early physiotherapy and occupational therapy effective?	Prospective, randomised comparative study in two hospitals	Medical patients with ventilation < 72 hours and expected ventilation > 24 hours. Intervention: n = 49, control group: n = 55	Intervention versus. control group: Activities of Daily Living independence (59% versus 35%, $p = 0.02$), duration of delirium (2.0 versus 4.0 days, $p = 0.02$), ventilator free days in 30 days (23.5 vs. 21.1 days, $p = 0.05$). 1/498 adverse event (O_2 saturation < 80%)

Table 1. Summary of studies

Contraindications

- Stroke
- Previous immobility
- Admitted for cardiopulmonary resuscitation
- Unstable cardiovascular disease
- Acute myocardial infarction or angina pectoris
- Severe chronic obstructive airways disease
- Body mass index > 45

Other contraindications are dependent on the patient population, for example increased intracranial pressure, opened chest or abdomen, unstable fractures, large femoral cannulation for more than 24 hours, and high-dose catecholamines.

Oxygenation index (pO_2/FiO_2) is not a contraindication provided it is < 150 or < 200, because the walking has no effect on the oxygenation, as demonstarted by Zafiropoulus et al. (2004). Similarly, hypercapnia is not relevant as long as no disturbance of consciousness predominates (Zafiropoulus et al. 2004).

Inclusion criteria for walking with ventilated patients indentified by Zafiropoulus et al. (2004) are:

- Intubated and ventilated
- Understanding of language
- Continuous postive airways pressure (CPAP) ≤ 12.5 cm H_2O
- Haemodynamically stable
- Can lift both legs while lying down
- Minimum 1 hour since last bolus of analgesia
- No physical therapy mobilisation in the last hour

Bailey (2007) notes that a FiO_2 ≤ 0.6 and PEEP ≤ 10 cm H_2O are inclusion criteria too; the FiO_2 or PEEP can be increased during mobilisation of patients with dyspnoea. Stiller (2007), a physical therapist, also observed that the environment must be suitable, for example, must be clear and free of obstruction and with adequate staff, and all tubes must be secured or removed from the patient.

What is needed to walk safely with ventilated patients?

To safely walk with ventilated patients it is important to consider both the environment and staffing needs, and the use of protocols.

Environment

- Bed, which allows mobilisation
- Rollator or similar tool
- Wheelchair that is always behind the patient
- Portable monitor, ventilator, suction (Needham et al. 2009)

Staff

- 2-3 persons (nursing, physical therapy, possibly relatives)
- One person takes care of ventilation and monitoring
- One person pushes a wheelchair behind the patient so that he can sit down if necessary
- One person assists the patient during walking.

Stiller (2007) points out that at least one person should be trained in mobilisation and communication with ventilated patients in order to adequately assist the patient.

Algorithms

Algorithms provide a means of support in everyday life if they are clearly formulated. On the basis of the available literature and personal experience we have developed an algorithm to walk with ventilated patients (see Figure 2). It should be noted that the evidence on which this is based is not particularly strong (grade II to III). This is due to the small number of studies and their methodological weaknesses. Thus, the use of this algorithm should be thoroughly discussed with all professions intending to use it.

Inclusion criteria

- Is the patient intubated and ventilated?
- Is the $FiO_2 \leq 0.6$ and PEEP ≤ 10?
- Does the patient understand the language?
- Is the patient hemodynamically stable?
- Can an angina or a heart attack be excluded?
- Is it minimally one hour since last analgesia bolus?
- No physiotherapy one hour before mobilisation

Prior to walking with a patient, the following checks should be made:

Contraindications

- Acute intracerebral hemorrhage or stroke
- Prior immobility
- Admitted for cardiopulmonary resuscitation
- Unstable cardiovascular disease
- BMI > 45
- Increased intracranial pressure
- Open chest or abdomen
- Unstable fractures
- Large-bore femoral cannulae (> 24 hours)
- High-dose catecholamines.

Meta-rules

- Light sedation preferable; that allows a daily wake-up and breathing trial
- Activity and mobilisation will be suspended for 24 hours if the patient has an acutely unstable event
- A mobilisation trial can be more effective than other physical challenging activities
- Teamplayers are more mobile than single heroes
- Mobility can often be initiated if the FiO_2 (+ 0.2) and PEEP (+2) are increased for short time
- The algorithm is evaluated twice a day

Checklist before commencing mobilisation

- Portable monitor, ventilator, and suction is available
- What infusions et cetera does the patient need while walking?
- Are all tubes securable?
- Can the equipment be transported?
- Is a mobilisation aid available for the patient?
- Is a wheelchair available?
- Are there 2-3 people for 20 minutes?

Phases of mobilisation (level achieved, duration, and characteristics will be documented)

- Passive movement (unconscious/deeply sedated)
- Sitting position in bed; aware, answers questions
- Free sitting in bed (or bedside); able to raise arms against gravity. (Passive transfers into a chair are possible from this point.)
- Standing; can lift legs against gravity
- Walking on the spot
- Active transfer into a chair
- Walking

Tolerance criteria

- Heart rate < 150
- Blood pressure > 90 and < 200 systolic
- O_2 saturation > 90
- If dyspnoeic: increase FiO_2 0.2 and increase PEEP +2

The goal is to gradually move closer to walking. To this end, the consideration of tolerance criteria is as important as the once-daily evaluation of how far the patient is able to mobilise.

Strategy

While the algorithm can be used on its own, we try to embed this activity in an overall plan. Other care concepts such as basal stimulation in nursing care or kinesthetics can be used in addition. The following various aspects help create a synergy:

- Patients, who are more lightly sedated are not exposed to stress as much as deeply sedated patients, and have fewer complications (Ely et al. 2003)
- Daily interruption of sedation (daily wake up trial) results in shortened ventilation time and ICU length of stay (Kress et al. 2000). These patients show also a trend toward lower post traumatic stress disorder (Kress et al. 2003).
- The combined wake up and breathing trial once a day leads to less sedation, time on mechanical ventilation, ICU days and better 1-year survival. Per seven patients treated one additional life can be saved (Girard et al. 2008).

It is clear that the algorithm steps should be integrated with ventilated patients in a professional sedation and ventilation strategy. If the daily interruption of sedation is not only combined with the spontaneous breathing trial on the machine with low pressure support, but also to a mobilisation trial, the effects can be very effective: wake up, breathe and mobilise (Schweickert et al, 2009).

Mobilisation, with the goal of walking, cannot be undertaken by

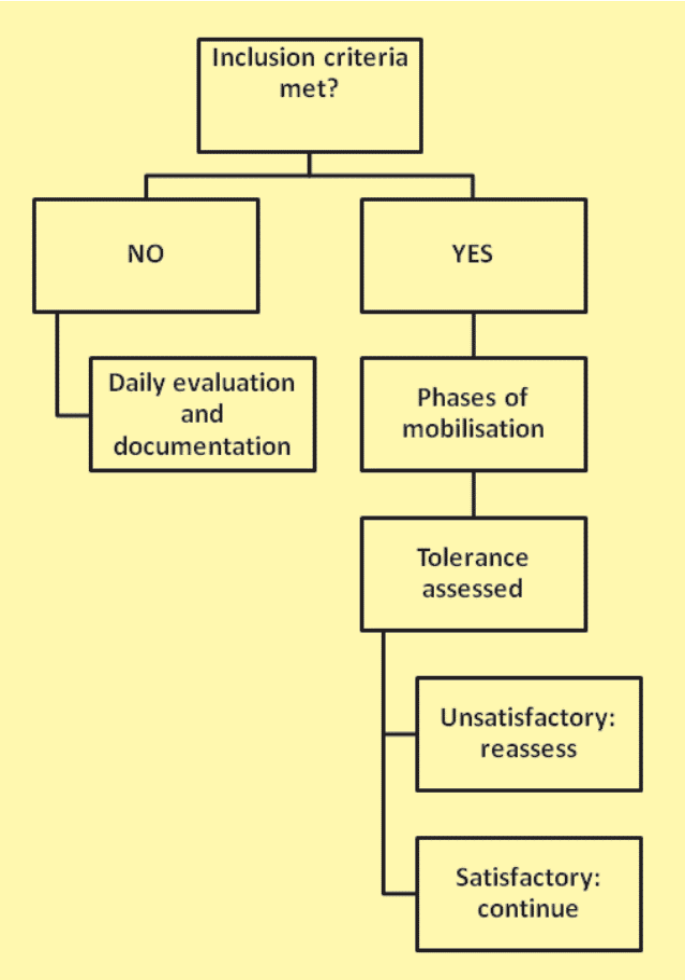

Figure 2. Algorithm: mobilisation of ventilated patients

Picture 1. Walking with a patient

nurses on their own, however nurses should coordinate all the relevant disciplines. The combined wake up, breathe and walk trial (see Picture 1) is suitable for medical assessment and is an ideal way into physio-occupational therapy, or integrated treatment. Close relatives who are, from the perspective of patients, the most important people, a respiratory therapist, pharmacists, and nutritionists on stand-by should all be involved in the team. Nurses should coordinate all of the professional groups involved and participate actively. In particular, the activities can be scheduled 24 hours in advance. Relatives should be invited to be involved: "Can you visit your husband tomorrow at 11:00; we would like to do another wake up and mobilisation trial?" The often-used restraints, as a self-extubation precaution, can be counteracted by the presence of relatives.

This type of interdisciplinary consultation allows the coordination of several patients and professional groups throughout the day. Or as Bailey et al. (2009) wrote:

- Linking long-term patient-focused care with cultural transformation in the ICU can improve patient outcome by unifying disciplines to achieve a common goal supported by shared values.

Nurses are able to connect these values and disciplines. This interdisciplinary collaboration does not stop with unsedated ventilated patients. We think that walking with ventilated patients meets with a primary task of care: patients feel comfortable and are encouraged to participate actively in life and also interact with their families.

Notes

There are some useful Internet video clips about mobilising and walking with ventilated patients:

- Transfer (Nydahl): www.youtube.com/watch?v=UMSbOiw0icQ
- Mobility (a how-to video): www.youtube.com/watch?v=LWUTF0sd5HI&feature=related
- Interview with a walking patient (Needham): http://video.yahoo.com/watch/2190081/6932798

Original article

This article is based on a lecture, by the first author (Nydahl) and was originally published in German in: Nydahl P, Flohr HJ, Rothaug O (2010): Gehen mit beatmeten Patienten. Pflegen Intensiv 1: 21-25.

Picture

Reproduced with the permission of D. Schuchardt and A. Drössler, Bad Berka, Germany.

Declaration of conflict

The second author (Flohr) is a nurse and product manager of Hill-ROM, a company that produces mobility supporting devices. The other authors neither depend on him or the company nor received any financial incentive.

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