Functional recovery after critical illness

van der Schaaf, M.

Citation for published version (APA):
SUMMARY
Due to advances in medical treatment of critically ill patients, survival has considerably increased but new complications and disorders are increasingly recognized among critically ill patients. With this, interest has shifted from mortality to morbidity as outcome measure in survivors of critical illness. Critical illness is associated with a wide range of serious long-lasting impairments that interfere with optimal functional outcome. With this, it has been recognized that the intensive support of these patients needs to be continued after discharge from the intensive care unit (ICU). Nevertheless, specialized after care for ICU survivors to enhance functional recovery is scarcely available. A prerequisite for the development of adequate follow-up care for ICU patients is a thorough understanding of the long-term functional restrictions. This thesis focuses on functional recovery in patients after discharge from the ICU. The aim of this thesis is to describe the course of functional recovery according to the World Health Organization’s (WHO) framework; the International Classification of Functioning, Disability and Health (ICF); body functions, activities and participation, in patients who were treated for more than 48 hours in the ICU, during the first year after their critical illness. (chapter 1)

Chapter 2 describes a literature review on patients with critical illness polyneuropathy (CIP), the most common manifestation of neuromuscular abnormalities which may develop in critical illness. For this review, studies published until September 1999 reporting on outcomes on the ICF levels of body function, activities and participation, and, on quality of life (QoL) are summarized. The appendix of chapter 2 provides an update of the literature that was published after September 1999 (until May 2009) on functional outcome in patients with CIP or critical illness myopathy (CIM).

The original review comprised 9 reports on the functional outcome in patients with CIP. Due to the limited number of studies, the variation in follow-up and outcome measures, a quantitative analysis was not possible. Muscle weakness of the limbs, sensory deficits, reduced walking capacity, and dependency in the performance of daily activities (ADL) were reported on the ICF levels of body function and activities. No information was available on the recovery of patients with CIP with respect to participation and quality of life (QoL).

In the appendix of chapter 2, 7 additional articles published after 1999 on the functional outcome of 80 patients with CIP or CIM are summarized. The results of the studies in this update were in agreement with the original literature review. However, in addition to the original review, outcomes on the ICF level of participation and on QoL from our own observational study (chapter 3) could be included in this update of the literature.
In spite of the limited amount of literature on functional outcomes in patients with CIP or CIM, all studies agreed that functional recovery is prolonged and that attention should be paid to the high prevalence of long-term impairments in body functions, limitations in activities, restrictions in participation and reduced QoL in patients with CIP/CIM.

To obtain more insight in the natural history of functional recovery after a critical illness and to identify rehabilitation needs, we evaluated impairments in body functions, limitations in activities, restrictions in participation and reduced QoL in patients with CIP.

Chapter 3 describes the results of a prospective observational study and a cross-sectional study on the functional outcome in 16 patients with CIP at 6 and 12 months after discharge from the ICU. We found a high mortality (56%), and a wide variation in the course of recovery, and in the extent of physical and psychological sequelae. Although functional status improved in all patients with CIP, the majority suffered from persistent limitations in activities, restrictions in participation and reduced QoL one year after discharge from the ICU.

As the number of patients surviving a prolonged stay in the ICU is increasing as a consequence of the advances in medical techniques, attention should be paid to the quality of outcome of survivors of a critical illness.

Therefore, in chapter 4, 5, 6 and 7 the focus of research is expanded from patients with CIP to a larger population of ICU patients potentially at risk for poor functional outcome, i.e. patients who were mechanically ventilated for longer than 48 hours.

Chapter 4 describes the results of a cross-sectional study evaluating the functional status and its potential determinants, in 69 patients immediately after discharge from the ICU.

Between 3-7 days, grip-strength was found to be 50% lower than age- and gender corrected normative data, and 27% of the patients had indications for cognitive impairments (Mini Mental State Examination <24). Overall functional status was poor (median Barthel Index 6 of 20), with 67% percent of the patients being severely dependent, 15% moderate dependent, and 9% to some extent dependent on other people for basic activities of daily living. Seventy-three percent of the patients was not able to ambulate independently within the first week after discharge from the ICU (Functional Ambulation Category 0-3).

The duration of mechanical ventilation was associated with functional status immediately after discharge from the ICU, whereas age, QoL prior to ICU admission, and severity of illness on ICU admission were not.

In view of the severe impairments and restrictions in the performance of
basic activities of daily living (Barthel Index) after discharge from the ICU, we recommend that all patients ventilated for more than 48 hours in the ICU should be closely monitored, to initiate rehabilitation treatment early in patients showing a complicated or delayed functional recovery.

To develop optimal and adequate rehabilitation therapies for critically ill patients at risk for poor functional outcome, the impact from health condition on daily functioning, and potential prognostic factors for functional outcome were studied in Chapter 5.

Chapter 5 describes the results of a cross sectional study of a cohort of 746 patients who had been treated in the ICU for more than 48 hours. The aims were to describe the restrictions in daily functioning one year after discharge from the ICU, and to identify prognostic factors.

Fifty-four percent of the patients had restrictions in daily functioning (evaluated with the Sickness Impact Profile), with walking and social activities most frequently being restricted (30-60% of the patients). Symptoms of anxiety and depression were found in 14%, and post-traumatic stress disorder in 18%. Health related QoL (evaluated with the SF-36) was reduced compared to the health related QoL reported for the general Dutch population. Severity of illness at ICU admission and length of stay in the ICU were identified as prognostic factors for functional outcome, although they explained only 10%.

It was concluded from the high prevalence of long-lasting restrictions in physical, social and psychological functioning, that patients who had stayed in the ICU for at least 2 days, are to be considered a target population for rehabilitation medicine and allied health professions. However, the early identification of ICU patients most likely to develop long-term problems in functional status is not possible, on the basis of information regarding gender, age, admission diagnosis, severity of illness on admission, and LOS in the ICU.

In addition to the functional outcome after one year (Chapter 5), the course of physical and psychological recovery, and the prevalence of clinical sequelae complicating functional recovery during the first year following critical illness was studied in detail in Chapter 6.

Chapter 6 describes the results of a prospective observational study of 116 patients who were ventilated in the ICU for more than 48 hours. We assessed functional health status at 3, 6, and 12 months after discharge from the ICU using the Sickness Impact Profile (SIP68). The presence of ICU related sequelae, i.e. impairments in function, limitations in activities, and restrictions in participation, classified according to ICF, and the use of rehabilitation resources were evaluated after 3 and 12 months.

During the first year following critical illness there was an overall improve-
ment in functional health status, however and in agreement with our previous findings (chapter 5), two-thirds of the patients were still limited with respect to daily activities after one year.

With this, it seems that the high prevalence of impairments in neuromuscular and movement related body functions such as muscle weakness (50%), joint stiffness (40%), and balance problems (17%), contribute to the high prevalence of limitations in the ICF domain of mobility. In addition, the impairments in sensory functions and pain, such as impaired hearing (>40%), impaired vision (>30%), and pain (>20%), and in mental functions, such as reduced attention (73%), emotional instability (41%), sleeping problems (23%), and upsetting thoughts or memories about the ICU (23%), may also interfere with carrying out daily activities.

Although the presence of post traumatic stress disorder (PTSD) related symptoms was not measured with a validated PTSD questionnaire, the prevalence of hyperarousal, and of intrusive symptoms were high. Obviously, the wide range of impairments and activity limitations that were identified in this study may account for restrictions in participation such as taking part in recreational activities (50%) and problems with returning to work (>40%).

Finally, the majority of patients was found to receive physical therapy. However, with respect to the high prevalence of muscle weakness and joint stiffness after one year, it remains unclear whether the physical impairments of patients discharged from the ICU could be considered as more or less persistent, or that the physical therapy that was provided was insufficiently effective for these specific ICU related sequelae. In contrast, psychological and social problems after discharge from the ICU apparently often remained unrecognized, as a large proportion of patients with severe psychological or social problems had not received psychological treatment.

A carefully planned multidisciplinary rehabilitation program may help patients to improve functional independence and return to activities of daily living. To improve the outcome of ICU survivors, a multidisciplinary stepped care approach with different degrees of therapeutic intervention depending on patient’s needs is suggested.

In chapter 7 the course of physical and mental recovery in ICU patients is investigated and the prognostic value of physical functioning and mental health before admission to the ICU and 3 months after ICU discharge, on functional recovery after one year.

In a consecutive series of 38 ICU patients who were ventilated >48 hours, the Physical Functioning (PF) and Mental Health (MH) dimensions of the Medical Outcomes Study 36-item Short-Form General Health Survey (SF-36) were used as primary outcome measures to assess physical and mental
functioning at 3, 6 and 12 months after ICU discharge. The SF-36 dimensions PF and MH were also used as potential determinants to assess physical functioning and mental health before admission to the ICU. As secondary physical outcomes, grip-strength (digital hand-grip dynamometer) and walking speed (Six Minute Walking Test; 6-MWT) were measured between 3-7 days after discharge from the ICU, and after 3 and 12 months.

In agreement with chapter 6, we found a different time course for physical and mental recovery. Whereas physical functioning improved mental health did not change between 3 and 12 months after discharge from the ICU. Moreover, after 12 months, physical recovery was incomplete in the majority (62%) of the patients who had good physical function before ICU admission, while mental health was good in all patients with pre-ICU good mental health. PF before ICU admission and grip-strength and walking speed after 3-7 days to ICU discharge were not associated with PF 12 months after discharge (Table 6.4). PF and walking capacity 3 months after discharge were strongly associated with PF at 12 months. The PF score at 3 months explained 61% of the variance in the PF score at 12 months. Moderate associations were found between MH prior to ICU admission or MH 3 months after discharge, and MH 12 months after discharge.

The sensitivity of the PF cut-off value of 60 at 3 months for poor physical outcome was 100%. The positive predictive value (PPV) was 59%. The sensitivity for the MH cut-off value of 60 at 3 months after discharge was 50% and the PPV was 33%.

It was concluded that most improvements in physical functions and activities occur primarily within the first 6 months after discharge from the ICU, but remain below both the pre-ICU values and normative values 12 months after discharge. In contrast, mental health is already restored to pre-ICU values at 3 months after discharge. Most importantly, it seems possible to predict long-term restrictions, in particular physical functioning, 3 months after discharge from the ICU, which enables the identification of patients who may benefit from tailored rehabilitation services.

**Chapter 8**, the general discussion, critically reflects upon the results and on the methodological considerations of the studies in this thesis and the implications for future care and research are discussed.

This thesis shows that functional recovery is impaired in the majority of patients who have been treated in the ICU for more than 2 days. A high prevalence of impairments in body functions, limitations in activities and restrictions in participation were consistently found in a substantial proportion of ICU survivors during the first year after their critical illness.

The severity of impairments in neuromuscular, skeletal, cardiovascular,
respiratory, mental, and digestive functions, and the resulting limitations in activities and restrictions in participation, necessitate the development of appropriate multidisciplinary rehabilitation interventions for patients after discharge from the ICU. Randomized controlled trails to evaluate the effectiveness of rehabilitation interventions targeting specific ICU sequelae are needed to decide whether functional outcome of ICU survivors can be improved.