

# *Chronic Critical Patient: A challenge for modern Critical Care Medicine*

## Kronično kritično bolestan pacijent: Izazov za modernu medicinu

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*Narrative review*

Pregledni rad



## Abstract

**Introduction:** Chronic critical patients need long term care and multidisciplinary approach.

**Aim:** To show clinical features of chronic critical illness and possible solutions for long term care.

**Materials and methods:** Electronic searches of literature using words related to *critical illness, chronic disease, physiotherapy*.

**Results:** Most of critically ill patients need prolonged mechanical ventilation and/or tracheostomy. Aggressive intensive care treatment, advanced age and comorbidities are major risk factors for development of chronic critical illness. Chronic critical illness except prolonged mechanical ventilation and/or tracheostomy includes severe complications in almost all organs and organ systems (severe neuromyopathy, metabolic disorders, generalized oedema, pressure sores, recurrent infections, hormonal changes, emotional changes, etc.). Prolonged specialized care is associated with high costs for medical equipment and consumable medical supplies. Also, prolonged critical care is a burden for their families due to economic and emotional issues.

**Conclusion:** Chronic critical illness becomes a real problem in the all developed world including Croatia. Multidisciplinary approach is a cornerstone of the care for the chronic critical ill patient and respiratory physiotherapist should be a team leader in that team. Regular early physiotherapy can improve final outcome and decrease the number of complications. National service for prolonged critical care treatment out of acute hospitals and clear guidelines might improve the care for these patients. Long term home treatment is the best way of care, so it is very important to involve family members early at the beginning of intensive care treatment, educate and train them for the taking care of sick family member. Ensuring financial, medical and technical support to the family is important also.

**Key words:** critical illness, chronic disease, physiotherapy

## Sažetak

**Uvod:** Kronično kritičan pacijent zahtijeva dugotrajnu zdravstvenu skrb i multidisciplinarni pristup.

**Cilj:** Prikazati kliničke značajke kronične kritične bolesti i moguća rješenja za dugoročnu skrb.

**Materijali i metode:** Elektronsko pretraživanje literature koristeći ključne riječi „kritične bolesti, kronične bolesti, fizioterapija“.

**Rezultati:** Većini kritično bolesnih pacijenata potrebna je dugotrajna mehanička ventilacija i/ili traheotomija. Agresivni tretman intenzivne njege, poodmakla dob i prateće bolesti glavni su faktori rizika za razvoj kronične kritične bolesti. Kronična kritična bolest osim

dulje mehaničke ventilacije i/ili traheotomije uključuje ozbiljne komplikacije u gotovo svim organima i organskim sustavima (poput teške neuromiopatiije, metaboličkih poremećaja, generaliziranih edema, dekubitusa, rekurentnih infekcija, hormonalnih promjena, emocionalnih promjena, itd). Dugotrajna specijalizirana skrb povezana je s visokim troškovima medicinske opreme i potrošnog sanitetskog materijala. Isto tako, produžena skrb kronično kritično bolesnih pacijenata teret je za njihove obitelji, zbog ekonomskih i emocionalnih problema.

**Zaključak:** Kronična kritična bolesti postaje pravi problem u svim razvijenim zemljama, uključujući Hrvatsku. Multidisciplinarni pristup je kamen temeljac skrbi za kronično kritične pacijente pri čemu bi respiratorni fizioterapeut trebao biti vođa tima. Rani početak fizioterapije može poboljšati konačni ishod i smanjiti broj komplikacija. Nacionalna služba za produženo liječenje kronično kritično bolesnih pacijenata izvan bolnice i jasne smjernice mogu poboljšati skrb za ove pacijente. Dugoročno kućno liječenje najbolji je način zaštite, tako da je vrlo važno uključiti članove obitelji na početku liječenja u jedinicama intenzivne njege, educirati i osposobiti ih za brigu o bolesnom članu obitelji. Osiguranje financijske, medicinske i tehničke potpore obitelji je također važna.

**Ključne riječi:** kritične bolesti, kronične bolesti, fizioterapija

## Introduction

Majority of patients who are admitted to Intensive care facility survive acute critical illness and are discharged from the hospital. Unfortunately, there are around 5-10% of critically ill patients who need long term intensive care treatment, and most of them need prolonged mechanical ventilation.<sup>1</sup> The term „chronically critically ill“ was first time described 30 years ago by Girard and Raffin who described a group of patients who survived acute critical illness, did not recover completely and remained dependent on long-term intensive care treatment.<sup>2</sup> Advances in modern critical care medicine and aggressive medical treatment lead to the increased number of patients who survive acute critical illness and consequently lead to the increased number of chronic critical patients. Increasing number of elderly people who have significant comorbidities also influences on the percent of chronic critical patients. It is estimated that there are more than 100,000 such patients in the United States at any point in time and the costs exceed \$20 billion each year.<sup>3</sup> Prolonged specialized care is associated with high costs for medical equipment (ventilator, oxygen concentrator, pulse oxymeter, special beds, mattresses) and consumable medical supplies (catheters, tubes, wipes, filters). Chronic critical patient is not only an issue for the health care system, it is burden for their families (emotional changes, increased home expenses, family members have to be include in 24/7 care, etc.).

There are different definitions of chronic critical illness in the literature (Table 1.), but the main characteristics in majority of them are respiratory failure and dependence on long-term mechanical ventilation and/or tracheostomy.

For most of them prolonged ICU stay is also important. It is well known that the chronic critical illness now includes changes in several organs and organ systems and it is described in the literature as the Chronic critical illness syndrome.<sup>3</sup> Due to its complexity, a long-term treatment, medical and nursing care for these patients are the real challenge for health care system.

The aim of this article is to show clinical features of chronic critical illness, possible solutions for long term care of these patients. The main focus in article is multi-disciplinary approach in order to improve medical care and quality of life.

## Materials and methods

Searches were conducted of MEDLINE, CINAHL, EMBASE, PEDro, the COCHRANE Library and the PubMed databases for relevant articles using words related to critical illness, chronic disease, weaning, physiotherapy.

## RESULTS AND DISCUSSION CLINICAL FEATURES OF CHRONIC CRITICAL ILLNESS

A clinical course of each acute critical disease is described in Figure 1. Typical subject who become the chronic critical patient is elderly person with a few chronic comorbidities. During acute critical illness (medical, neurological, surgical, or trauma) this patient usually suffers from septic episodes, infections or other acute disorders. All these severe acute comorbidities negatively influence on a recovery from acute illness and undoubtedly contribute to developing of chronic critical illness. As we mentioned earlier, most important clinical

**Table 1.** Most common used definitions of Chronic critical illness

AUTHOR	YEAR OF PUBLICATION	TYPE OF STUDY, NUMBER OF INCLUDED PATIENTS	DEFINITION
<sup>4</sup> Zilberberg	2008.	Model study, no human subjects included	Prolonged acute mechanical ventilation of $\geq 96$ h
<sup>5</sup> Scheinhorn	2007.	Multicentre, observational study, 1419 patients	Prolonged ventilator-dependent respiratory failure
<sup>6</sup> MacIntyre	2005.	Report	Prolonged mechanical ventilation is the need for mechanical ventilation for 21 consecutive d and 6 h/d
<sup>7</sup> Daly	2005.	Randomized, controlled trial, 334 patients	Patients requiring mechanical ventilation for $\geq 72$ h who survive to discharge from the index hospitalization
<sup>8</sup> Nelson	2004.	Prospective cohort study, 50 patients	A syndrome of significant derangements of metabolism and of neuroendocrine, neuropsychiatric, and immunologic functions defined by performance of tracheotomy for failure to wean from mechanical ventilation
<sup>9</sup> Nierman	2002.	Prospective observational study, 274 patients	Patients who survive a critical illness but are left with significant functional impairments and dependency on intense nursing care and advanced technology
<sup>10</sup> Carson	2001.	Retrospective inception cohort study, 182 patients	Patients who require continued care and prolonged mechanical ventilation in an *ICU for weeks to months
<sup>11</sup> Nasraway	2000.	Retrospective cohort study, 97 patients	A small subset of the *ICU patients who because of underlying illness or complications suffer a prolonged and complicated *ICU course; severely weakened survivors of acute illness often ventilator dependent or renal dialysis dependent
<sup>12,13</sup> Douglas	2003.	Prospective longitudinal descriptive study, 135 patients	Patients who require long-term ventilation and intensive nursing care after receiving medical therapy for primary disease

\*ICU-intensive care unit

feature of this illness is prolonged dependency on mechanical ventilation and/or tracheostomy, from a few days up to months and even years.<sup>10,12,13</sup> Most of these patients need a long-term ICU treatment due to severity of primary disease and different comorbidities like heart failure, COPD, end stage respiratory disease, diabetes or advanced age.

Long-term immobility and malnutrition lead to severe myopathy and muscle weakness. Muscle atrophy and fatigue is an important clinical problem because acquired skeletal muscle weakness can increase the duration of hospitalization, result in exercise limitation, and contribute to a poor quality of life.<sup>14</sup> Critical myopathy is the main reason of difficulties for weaning from mechanical ventilation.<sup>15</sup> Poor, limited and irregular physiotherapy plays an important role as well. Artificial respiratory support through endotracheal tube or tracheostomy along with a poor cough, swallowing problems and a bed dependency lead to more often respiratory tract infections and septic episodes. It is well known that patients in the intensive care setting very often have impaired airway clearance what is a major risk factor for respiratory complications. Endotracheal intubation prevents the patient from closing the glottis, which is necessary for effective coughing and clearing secretions from airways and predispose to development of ventilator-associated pneumonia (VAP). Ventilator-associated pneumonia is a form of nosocomial pneumonia that occurs in patients receiving mechanical ventilation for longer than 48 hours. VAP is associated with increases in morbidity and mortality, hospital length of stay, and costs.

Furthermore, prolonged mechanical ventilation results in weakness and atrophy of the diaphragm in critically ill patients, an entity termed as ventilator-induced diaphragmatic dysfunction (VIDD).<sup>16</sup> VIDD along with dysfunction of other respiratory muscles is one of the reasons for failed weaning from mechanical ventilation. Volume overloading, increased capillary leak, poor nutritional status and hypoalbuminaemia make this group of patients predisposed for development of generalized oedema. Loss of muscle tissue and hypoproteinaemia attributed to immobility, oedema, poor skin quality, poor peripheral blood circulation and urinary or/and stool incontinence make these patients especially sensitive to skin breakdown, pressure sores and ulcers which are often infected. Multiresistant microorganisms are most common cause of infections among chronically critically ill (CCI) patients. Recurrent infections are significant problem for CCI and main reason for repeated admissions in the hospital and often require the treatment with expensive intravenous antibiotics. Despite the good medical and nursing care, patients suffer from pain, thirst, dyspnoea, anxiety, depression and inability to speak. Changes of a quality and a level of consciousness may also be present.<sup>17</sup> Furthermore, the complex endocrine changes are the components of chronic critical illness too. Changes of hormonal release and pulsatility from pituitary gland leads to decrease production of almost all hormones (thyroid hormones, corticosteroids, antidiuretic hormones). Hormonal dysregulation along with nutrients deficiency influences on increased catabolism and decreased anabolism.<sup>3,18,19</sup>

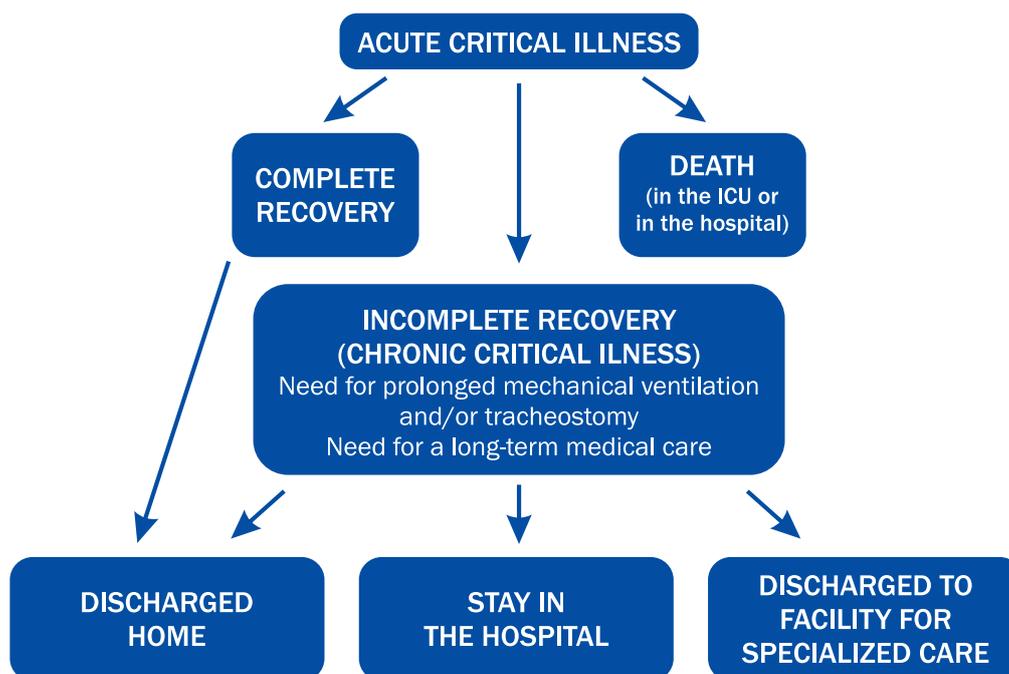


Figure 1. Clinical course of acute critical disease

## CHRONIC CRITICAL PATIENTS: ISSUES IN CROATIA

There are around 100 invasive mechanically ventilated (IMV) patients and 50 noninvasive ventilated (NIV) patients at home ventilation in Croatia. Mostly IMV patients are children with spinal atrophy, adults with amyotrophic lateral sclerosis and NIV patients with kyphoscoliosis or severe chronic obstructive pulmonary disease (COPD).

Unfortunately, there is no home care provider for ventilatory dependent patient in Croatia and if patient's family is not able to take care for prolonged mechanically ventilated patient he/she stays in acute intensive care unit which is the most expensive option. The costs of home ventilated patient are around 400 euros per month, which include consumable medical supplies (catheters, tubes, wipes, filters) and around 8500 euros for medical equipment (ventilator, oxygen concentrator, pulse oxymeter). Those costs are covered by Croatian national health insurance.

As aforementioned number and capacity of chronic care institutions are insufficient and limited so majority of adult patients who require prolonged mechanical ventilation are stationed in ICU. Rare families are able to take care of them at home or are able to pay accommodation in private facilities. Accommodation of mechanically ventilated patient in private institutions costs around 1000 euros per month. This costs are only for nursing care while all the medical equipment is provided by Croatian national health insurance. By the rules of national health insurance company, in acute care hospitals prolonged mechanical ventilation is defined with ventilation duration of more than 96 hours. The insurance company does not recognize the category of chronic critical patient, and the insurer expects that ICU stay for patients on mechanical ventilation will not last more than 47 days. Nowadays, insurance company is paying 14,000 euros per patient from 96th hour of mechanical ventilation to day 47 regardless of number of days and real expenses. If the patient require to be hospitalized for more than 47 days insurance company will pay for 30 more days (prolonged treatment). Until recently, all time spend in ICU after day 77. was not payed to the hospital at all. Nowadays, from day 47. to the end of hospitalization, in case patient is all the time on ventilator, hospitals get payed 130 euros per day. Insurance company is calculating costs of hospital care using DTS (diagnostic-therapeutic procedures) calculator, and not the real expenses. It is important to emphasize that medical staff work is never taken into account. The aforementioned amount of money payed for prolonged mechanically ventilated patients is a result of a sole decision of insurance company management. So they are paying the same amount of money for patient being on mechanical ventilator for 97 hours as well as for patient being on mechanical ventilator for 47 days.

Overall, in majority of prolonged mechanically ventilated patients real expenses of ICU stay exceeds the payment made by insurance company. The absurd fact is that a few minutes of noninvasive ventilation are better payed than less than 96 hours of invasive mechanical ventilation. For noninvasive ventilation, despite of its duration, hospitals get payed around 2200 euros overall. Chronic critical patient on prolonged mechanical ventilation is not an exception in Croatian ICU. Because it is almost impossible to transfer them to other facilities majority of this patients spent the rest of their life in ICU. This produces a great psychological burden on already burned out ICU staff.

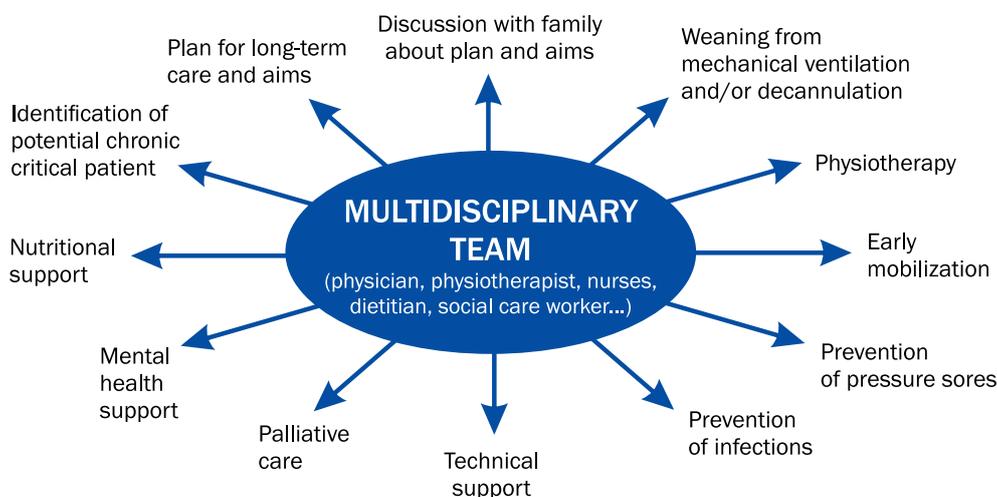
## CORNERSTONES OF MEDICAL TREATMENT AND NURSING CARE

Patients who are more likely to develop a chronic critical illness should be recognized as early as possible during the treatment of acute critical event. ICU treatment has to be limited on a short, necessary period and patient who develops chronic critical condition should be in an acceptable health condition for discharge from the ICU. Presence of ongoing infection, hemodynamic instability, oxygenation and ventilation problems and unsolved surgical condition are contraindications for ICU discharge.

Multidisciplinary approach is a cornerstone of the care for the chronic critical ill patient. Critical care physicians, nurses, physiotherapists, psychologists, dietitians, social care workers have own role and responsibility before and after discharging of patients from the critical care setting. Respiratory physiotherapist should be a team leader and coordinator among the members of this team. It is very important to involve family members early at the beginning, educate and train them for the taking care of sick family member. Medical and technical support to the family should be available 24 hours 7 days a week. Ensuring a good palliative care and solving of each technical issue before discharging of patient at home are essential too. As we mentioned earlier, chronic critical illness is characterized by several clinical changes requiring specific treatment<sup>18</sup>. Treatment aims and options are summarized in Figure 2.

## ROLE OF PHYSIOTHERAPY IN CRITICAL CARE SETTING

Implementation of physiotherapy in critically ill patients, even at very early stages of critical illnesses, has been demonstrated to be safe and feasible and to provide short-term physiological benefits. Early physiotherapy has been shown to be a potential strategy to prevent or minimize the neuromuscular complications related to critical illness.<sup>20</sup> Although randomized-controlled trials are limited, several studies have reported an improve-



**Figure 2.** Treatment aims and options

ment in muscle strength, functional status, weaning outcomes and reduced ICU and hospital length of stay.<sup>21-23</sup> Also, physiotherapy may have a significant impact on the evolution of critical illness complications and improve pulmonary and functional outcomes.<sup>21,24</sup>

As it was mentioned earlier, respiratory complications are major problem during treatment of critically ill patient. Interventions to prevent VAP begin at the time of intubation and should be continued until extubation. Routine turning of patients a minimum of every 2 hours can increase pulmonary drainage and decrease the risk for VAP. Positioning patients in a semi-recumbent position with the head of the bed elevated 30° to 45° prevents reflux and aspiration of bacteria from the stomach into the airways.<sup>25</sup> Despite the many reports and reviews on VAP, little emphasis is placed on airway clearance. Chest physiotherapy such as vibration or percussion in ventilated patients is associated with a reduction in VAP.<sup>24</sup> Those techniques have no influence on volume of collected secretion and on SpO<sub>2</sub> but percussion performed by palm-cups is very effective in increasing dynamic lung compliance.<sup>26</sup> Respiratory muscle dysfunction is one of the reason for failed weaning from mechanical ventilation so strength training and endurance training should be considered for patients with respiratory muscle weakness.<sup>27</sup>

## Conclusion

The growing population of chronic critically ill patients in Croatia and other developed countries represents a great burden for health care system. A few steps should be done with the aim of increasing of quality of care for chronic critical patients. Healthcare authorities have to create a quality planned service and guidelines for treatment and care for chronic critical ill patients on national level. Improvement of care in acute hospitals, hospital wards for prolonged care and improvement of community care are very important. ICU treatment should be as short as possible and patients should be discharged to the ward as soon as possible. Quality physiotherapy and rehabilitation during the ICU stay certainly helps in weaning from mechanical ventilation and reducing the number of complications, especially respiratory infections. Organisation of specialized step-down wards for prolonged care and especially „home base“ treatment of chronic critical patients are the main challenges for health care system. A few specialized facilities for long term treatment of ventilatory dependent patients should be organized across the country. However, the best environment for long term treatment of this group of patients is their own home. All technical support should be ensured at all times. Considering a 24/7 care and consequently the heavy economic burden for patients' families it is necessary to give a regular financial support to home caregivers. Organisation of palliative care centres which can give medical and psychological support to the chronic critical patients and their families is also important.

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