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# Role of LTACH in Chronic Critical Illness in the Elderly

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Thiruvoipati Nanda Kumar

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## Abstract

Long-term acute care hospitals (LTACH) have become an integral part of the health care continuum since they were established in the USA in 1999. Many elderly patients admitted to intensive care units (ICUs) survive an acute episode of illness but do not recover fully and develop chronic critical illness (CCI). These patients have been stabilized in short-term acute care hospitals with completion of diagnostic workup and transferred to LTACHs. Elderly patients who have CCI form an important group of patients admitted to LTACHs. LTACHs are organized to provide multidisciplinary management that includes complex medical therapies such as ventilator weaning and dialysis, intravenous therapies like total parental nutrition, complex wound care and rehabilitative services, including physical, occupational and speech therapies. Consistent with high disease burden of comorbidities and poor outcome in the subset of patients with CCI, palliative care should become an essential component of the post-acute care continuum (PACC). LTACHs play a pivotal role in transitioning these patients across the PACC. Details regarding the organization of LTACHs, management of patients with special reference to CCI and perspectives for future advances are discussed in this chapter.

**Keywords:** long-term acute care hospital (LTACH), chronic critical illness (CCI), post-acute care continuum (PACC), elderly, ventilator, outcomes

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## 1. Introduction

Advances in medicine and intensive care have led to many elderly patients surviving acute phase of illness, leading to a state of chronic critical illness (CCI) requiring specialized treatments for a prolonged period of time [1–3]. Since their creation in the USA in 1999, long-term acute care hospitals (LTACHs) have become an integral part of the post-acute health care continuum (PACC), serving medically complex patients for a period initially envisaged as more than 25

days [1, 4]. While LTACHs typically admitted patients who were difficult to wean from mechanical ventilation, they now cater to a wider range of patients with complex medical conditions in the setting of chronic comorbidities like congestive heart failure, end-stage renal disease, diabetes mellitus type II and chronic difficult to heal wounds. Elderly patients with chronic critical illness are an important and challenging subset of patients admitted to the long-term acute care hospitals, after stabilization in intensive care units (ICUs) in short-term acute care hospitals (STACH) [5].

Chronic critical illness is a devastating condition resulting many times from respiratory failure with difficulty to liberate from mechanical ventilation and characterized by prolonged debility, multi-organ dysfunction, physical and cognitive impairments [2]. A course complicated by intercurrent illnesses, poor outcomes, and high mortality is a hallmark of chronic critical illness in the elderly. LTACHs are organized to provide such multidisciplinary specialized care. Being the first destination in post-acute care, long-term acute care hospitals play an important role in defining the aggressiveness and level of care and arranging appropriate transition of care, as these patients still remain with significant comorbidities and cognitive and functional impairments.

This chapter deals with details regarding the organization of LTACHs and management of chronic critically ill patients, including incorporation of palliative care approaches. Defining aggressiveness of care, directives regarding cardio-pulmonary resuscitation and discharge disposition to the next level of care are addressed. These issues will need further refinement as advances in medicine including pharmaco-therapeutics, genomic health and outcomes research enhance our understanding that can be incorporated into our decision making.

## **2. LTACH: organization and services**

Patients admitted to acute hospitals and intensive care units suffer a wide variety of acute severe illnesses such as sepsis, respiratory failure with sepsis, pneumonia, chronic obstructive pulmonary disease (COPD), cardiac, neurological, hepatic, renal, gastrointestinal, oncological illnesses, trauma, post-operative states, etc. While they survive the acute phase, recovery is incomplete, and they require complex specialized inpatient management for prolonged period of time. About 10% of patients with acute respiratory failure become chronically critically ill [5]. LTACHs have come to be established to provide such level of specialized multidisciplinary care at a cost lower than that of intensive care units. Coordination of expertise specially geared to treat such patients with complex comorbidities is accomplished by a multidisciplinary team. Patients requiring weaning from prolonged mechanical ventilation and those with conditions requiring inpatient care for about 25 days are usually admitted to the LTACHs. Among the elderly population, many suffer from acute illnesses including sepsis, severe pneumonia, endocarditis, vascular events, post-operative complications, trauma in the setting of chronic disease burden such as congestive heart failure (CHF), COPD, end-stage renal disease (ESRD) on dialysis, immunocompromised states, malnutrition, neurological and musculoskeletal impairments. These patients have completed diagnostic workup and require comprehensive

medical management that may include mechanical ventilation, dialysis, intravenous therapies for antibiotics, total parental nutrition, complex wound care management including excisional debridement, and rehabilitative services including physical, occupational therapies. They do not, however, require the level of monitoring and diagnostic services available in intensive care units, and can be provided at a lower cost in LTACHs.

High-intensity monitoring and treatment targeted at their acute illness and decompensation with meticulous attention to other chronic illnesses is required to lead to improved outcomes in terms of medical management and improvements in functional capacity. LTACHs provide an opportunity to discharge patients at an early stage from intensive care units [6]. While the need for 25 days of stay was a main determinant for LTACH admissions in the past, experience gained so far in terms of quality of care, outcomes and cost are leading to refinements in the patient selection criteria.

There are two types of locations for long-term acute care hospitals. Some are freestanding, separate hospitals while others operate as a specialized unit within the hospital called “hospital in hospital” set-up. Freestanding hospitals are developed to provide a full gamut of services and multidisciplinary coordination. They have enough bed strength to support provision of those services. Hospital within hospital units provide benefits in facilitating early transition to the next level of care while having the advantage of acute hospital ancillary services and other consultative services at the doorstep. Short-term acute hospital operations are benefited by freeing of ICU beds, better utilization of the available space by leasing to LTACHs and providing ancillary diagnostic services [7].

### **2.1. Criteria for LTACH admissions**

The majority of LTACH admissions are Medicare beneficiaries. The following criteria have to be met for admission to LTACHs: Patients must be screened prior to admission regarding their appropriateness for admission to LTACH in terms of their medical complexity and requirement of inpatient services for a longer period and should be validated within 48 hours of admission [1, 6].

- (a) Daily physician visits and review of progress with availability of necessary consulting physicians at the bedside on a timely basis.
- (b) Regular review and evaluation of the need for continued care in the LTACH with appropriate discharge disposition if the patient does not meet criteria for care in LTACH.
- (c) An individual treatment plan must be formulated for each patient by the interdisciplinary health care team including physicians.
- (d) An average length of stay more than 25 days was required for all Medicare patients. There is a welcome shift in emphasizing the need for complexity of medical care with a multidisciplinary team approach rather than adherence to 25-day length of stay as the main criteria. Adjustments in financial reimbursements will however follow.

As the criteria for requirement of average length of stay undergoes revision, financial reimbursements may be impacted. But greater number of medically complex patients that would

benefit from the intensity of care and multidisciplinary approach offered in LTACHs could be cared for and have better outcomes. The heterogeneity of patient population and the smaller number of patients admitted to LTACHs make it difficult to study the outcomes comprehensively. But continued attention to quality metrics and refinements is essential. The quality metrics measured and reported include ventilator weaning, wound healing and prevention of pressure ulcers, avoidance of STACH readmissions, catheter-related blood stream infections, mortality and patient safety indicators [7].

As the treatment progresses in LTACHs, the interdisciplinary team plays an important role in consolidating the progress materialized and charting a course for further transition to home or appropriate venue of care, establishing future advance directives on appropriate level of care and coordination of post-acute services. The above characteristics of LTACHs and the delineation of services provided make them an obvious venue for treating chronic critically ill elderly patients who survive catastrophic severe illnesses.

### **3. Chronic critical illness**

While advances in critical care have resulted in improved survival from acute illness, it has led to a large group of patients who are chronically critically ill.

These patients have difficulty weaning from mechanical ventilation, require high-intensity therapeutic, rehabilitative services, and suffer from chronic debility and cognitive and physical decline punctuated by intercurrent illnesses. The number of these patients is increasing and constitutes about 10% of patients with respiratory failure admitted to intensive care units with mechanical ventilation. Protracted recovery period and poor outcomes are a hallmark of this group. More than 50% of such patients are above 65 years. There is a 50% mortality at the end of first year and only 10% are living at home at the end of one year, albeit with some impairment [2, 4, 5]. The incidence of chronic critical illness has doubled with each decade consistent with the increase of aging population and availability of critical care services. The overall annual health care cost of chronic critical illness has exceeded 20 billion dollars in the United States and is steadily increasing [2, 6].

The clinical phenotype is easily recognizable at the bedside by the constellation of clinical features and context. But the heterogeneity of clinical conditions that lead to chronic critical illness as well as varied presentations render difficulties in arriving at a precise clinical definition.

#### **3.1. Defining features of chronic critical illness**

While a strict definition is elusive, patients considered to have the syndrome of chronic critical illness in various studies have included [2, 4–6]:

- (1) Respiratory criteria in the setting of
- (2) Chronic pathophysiological state

**(1) Respiratory criteria:**

- (a)** Respiratory failure with a difficulty to wean requiring prolonged mechanical ventilation for at least 21 consecutive days for at least 6 hours a day. Patients requiring mechanical ventilation for at least 96 hours and an ICU length of stay for at least 21 days.
- (b)** Patients with mechanical ventilation for at least 96 hours with a tracheostomy placement when done for a condition other than head, neck or face disease. Tracheostomy placement indicates a clinical judgment that patient survived from acute episode with no impending signs of death but unable to liberate from mechanical ventilation. Tracheostomy placement is considered a turning point in the progression of course from acute to chronic critical illness [3, 5].
- (c)** Patients who required at least ten days of mechanical ventilation and not expected to die or be liberated from mechanical ventilation in the next 72 hours were also considered to have chronic critical illness in some studies.
- (d)** Patients with respiratory failure transferred to LTACHs are generally considered to have entered the stage of chronic critical illness, as the initial purpose of creation of LTACHs was to serve patients that require prolonged services.

**(2) Chronic pathophysiological state:**

The patients that progress to chronic critical illness form a variety of conditions have a chronic pathophysiological state with persistent inflammation that seems to diminish the physiological reserves and impairs repair [2, 4, 8]. It comprises elements of multi-organ dysfunction encompassing various systems as follows:

- Cardiac
- Renal
- Hepatic
- Endocrinopathy with hormonal dysregulation including loss of pulsatile anterior pituitary hormone secretion, stress hyperglycemia,
- Severe functional decline associated with axonal neuropathy
- Decreased muscle mass with increased adiposity
- Anasarca with hypoproteinemia
- Increased susceptibility to infections and sepsis with resistant organisms
- Encephalopathy manifesting as varying degrees of delirium and cognitive impairment
- Wounds escalated by immobilization including nutritional deficiency, incontinence, infection.
- Malnutrition



### 3.2. Limitations in the use of respiratory failure in defining chronic critical illness

- (a) Patients who are medically complex requiring prolonged medical management share pathophysiological features characteristic of chronic critical illness but do not need intubation with mechanical ventilation or tracheostomy. Examples of such patients include those with severe COPD and respiratory failure requiring high flow oxygen and non-invasive ventilation for prolonged periods, patients requiring longer term inotropes, left ventricular assist devices, and those elderly patients with sepsis and chronic comorbidities [5]. This group includes patients who survived medical or surgical illness that did not require mechanical ventilation but required prolonged inpatient care and form a significant population of patients admitted to LTACHs. These patients are considered to have chronic critical illness.
- (b) Patients requiring mechanical ventilation for neuro-degenerative disorders or myopathic conditions without the comorbid burden pathognomonic of chronic critical illness. Examples are amyotrophic lateral sclerosis and muscular dystrophies. Such patients do not share the pathophysiological substrate and are not considered to have chronic critical illness.

## 4. Clinical features: course and outcomes of chronic critical illness

The clinical picture of elderly patient with chronic critical illness is characterized by recovery from acute critical illness with ventilator dependence, debility, delirium, severe functional decline, in the setting of multiple comorbidities and immunocompromised states. Accordingly, they have ongoing complex medical therapies continued from short-term acute hospitals or intensive care units that include mechanical ventilation, dialysis, intravenous therapies for antibiotics or total parental nutrition or complex wound care. The course is complicated by infections, sepsis and intercurrent illnesses involving other organ systems. While many patients are unable to express their symptoms due to their physical and mental conditions, they suffer from significant symptoms both physical and psychological. These include pain, dyspnea, anxiety, unsatisfied hunger and thirst. The other signs and symptoms are related to the precipitating acute illness, preexisting comorbidities, intercurrent illness and complications during the course of treatment [3]. Hence, they encompass multiple organ systems and vary from patient to patient due to the heterogeneity of these conditions [3, 9]. Following is a list of conditions involving patients with chronic critical illness:

- Respiratory: complications associated with ventilation, decannulation, atelectasis, pneumonia, acute COPD exacerbation.
- Cardiac: CHF, cardiomyopathy, cardiac arrhythmias, acute coronary syndromes.
- Renal: acute kidney injury, chronic kidney disease, complications of dialysis.
- Neuromuscular: axonal polyneuropathy, myopathy.

- Neuropsychological: delirium, restlessness, anxiety, psychomotor agitation, post-traumatic stress disorder.
- Gastrointestinal: hemorrhage, ileus, diarrhea, complications of parenteral and enteral nutrition, *Clostridium difficile colitis*.
- Infections: pneumonia, bacteremia without definite source, catheter-related blood stream infections, gram-negative infections, methicillin-resistant staphylococcal aureus, vancomycin-resistant enterococci and other multi-drug-resistant organisms. *C. difficile colitis*.
- Metabolic/nutritional: malnutrition, anasarca, decreased lean body mass, increased adiposity, stress hyperglycemia, hypothalamic pituitary adrenal hormonal dysregulation, increased bone resorption, vitamin D deficiency and electrolyte imbalance [4].

The above-mentioned conditions require strict attention in terms of management and prevention. However, improving the general condition, well-being and emotional state of the patient by diligent attention to nutrition, exercise and mobility, fluid electrolyte balance, emotional support, sleep and avoidance of drug side effects and toxicities should be the corner stone of management of these patients [2, 10].

## 5. Clinical course and outcome

Consistent with the complexity and multiplicity of problems involved with the care of chronically critically ill elderly patients, the course is complicated by heavy symptom burden, poor outcomes and extensive resource utilization. About 10% of patients who require mechanical ventilation in the ICUs become chronically critically ill. While generalizations of outcome are difficult due to the heterogeneity of patient conditions and features of different venues, about 30–50% are weaned from mechanical ventilation [2]. The duration of time taken for ventilator liberation varies depending on the diagnosis and condition of patients from 16 to 37 days [2]. Patients who cannot be weaned in 60 days are unlikely to wean. A significant number of patients with chronic critical illness successfully weaned from ventilator continue to have poor prognosis and are burdened by comorbid conditions with multi-organ dysfunction, intercurrent illnesses, immunocompromised states with poor functional status and cognitive impairment. There is a high risk of death in three months and 50% of patients are dead by the end of one year. Only 10% of patients are living at home after one year [3, 11].

Elderly patients with multi-organ dysfunction in general have poor prognosis [12]. It is not age alone, but advancing age with comorbidities and limitations in functional status adversely affect survival and prognosis.

*Pro Vent score* was developed as a prognostic model to predict mortality. Four factors are taken into consideration: (1) age above 50 years, (2) platelet count less than 150,000 microliters, (3) need for vasopressors and (4) need for dialysis are calculated on the twenty first day of mechanical ventilation. The presence of all four factors was associated with 100% mortality at one year [4, 5, 13]. The absence of all four factors was associated with 80% survival at one year.



Physical and cognitive impairments are severe in chronically critically ill in elderly compared to acute phase. Understanding outcomes, modulating treatment and decisions regarding aggressiveness of care should focus not only on mortality but also on effects on functional status and quality of life.

### **5.1. Venues of care: LTACH and beyond**

LTACHs have been in existence since 1999 to serve the needs of medically complex patients that require prolonged hospitalization [6]. Patients requiring liberation from mechanical ventilation constituted an important group of patients admitted to LTACHs. Patients are transferred from short-term acute hospitals to provide care adapted to the special needs of chronically critically ill patients at a low-cost environment [6]. STACHs were able to discharge patients to LTACHs earlier. This enables STACHs to utilize ICU beds for other patients who are in need for acute critical care illness. In LTACHs, results are often optimized in an environment of multidisciplinary approach geared to treat this group of patients with lower levels of monitoring and cost [14]. LTACHs are not uniformly distributed in different states within the USA, and there is a geographical conglomeration in some states while absence of LTACHS in other areas [4, 5, 7]. Such patients are treated by extended length of stay in the ICUs and transferred to other venues in due course. At the end of optimizing treatment based on cardio-pulmonary and functional status, patients are discharged to lower levels of care. Depending on their care requirements, they are discharged to home with adequate care giver support and home health services, assisted living facilities, skilled nursing facilities and inpatient rehabilitation facilities. The majority of these patients were living at home prior to their acute critical illness that culminated in chronic critical illness [3]. Patients and families have to grapple with complexities of adapting to a completely different discharge disposition. Movement to and from between different venues of acute and post-acute care is an important feature in chronically critically ill elderly [4]. Costs of health care are increasing, estimated to have crossed 20 billion annually, while the number of patients with chronic critical illness is also increasing.

### **5.2. Decision making including aspects of palliative care**

Physicians and members of health care team should have a clear understanding and knowledge of outcomes. Attempts to understand patient wishes and preferences regarding cardio-pulmonary resuscitation and lifesaving therapies should be made earlier in the course [3]. Symptom relief and palliative care should play an important role [4]. Understanding and explaining principles of palliative care to families are important to root out the misconception that palliative care is giving up. It is striving for the best quality of life appropriate to the condition with full understanding of the risks and benefits involved in chosen therapies. Physicians and members of the health care team should be knowledgeable and recognize that chronic critical illness is a separate pathophysiological entity with different clinical connotations and outcome compared to acute phase of illness. This highlights the need to chart a different course in CCI compared to those with acute critical illness [4]. Individual therapeutic decisions should however align with the patient's overall wishes and goals. Education of health care providers is of paramount importance in improving understanding and decision making

by patients and family members who carry a heavy burden [15]. Families need information regarding estimates of survival, functional impairments and needs of care giving. In the proportion of patients who only survive to suffer and die over several months, early institution of do not resuscitate status and palliative measures are meaningful if consistent with patient's wishes.

## 6. Perspectives for the future

Measures to improve better understanding and treatment of acute critical illnesses like sepsis, acute respiratory distress syndrome and acute kidney injury will decrease chronic critical illness [8].

Improvements in antibiotic stewardship, prevention of nosocomial infections, catheter-associated blood stream infections and new therapies now under investigational phase for *C. difficile colitis* will all play an important role.

Knowledge of chronic critical illness is not widely apparent among the spectrum of health care providers. With increasing aging population, availability and utilization of critical care services worldwide, chronic critical illness should become part of curriculum in medical education [11]. Knowledge of palliative care and adequate deployment where needed should be encouraged.

Although LTACHs are established in the USA, the experiences and perspectives gained in LTACHs could be adapted to suit different locations worldwide.

Genetic studies hold further promise in being able to understand longevity, susceptibility and therapeutic response to certain infections and diseases that may be heritable [16, 17]. Individuals may have targeted therapies appropriate to their genetic studies. Identification of specific biochemical markers in chronic critical illness may play a role in stratification of patients with chronic critical illness.

Increased use of non-invasive ventilation at early stages to prevent endotracheal intubation may decrease complications and the number of patients progressing to chronic critical illness. Improvements to non-invasive ventilation like delivery via helmet interface may enhance tolerability, compliance and effectiveness with diminished air leak.

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## Author details

Thiruvoipati Nanda Kumar

Address all correspondence to: nanadakumar.th@gmail.com

Vibra Hospital of Northern California, University of California at Davis, Redding, CA, USA

Family Practice Residency Program, Dignity Health, Redding, CA, USA

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