Physiotherapy and Mobilization

Prospective observation of physical activity in critically ill patients who were intubated for more than 48 hours ☆,☆☆,★,★★

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ABSTRACT

Purpose: Critical illness can result in impaired physical function. Increased physical activity, additional to rehabilitation, has demonstrated improved functional independence at hospital discharge. The purpose of this study was to measure patterns of physical activity in a group of critically ill patients.

Methods: This was a single-center, open, observational behavioral mapping study performed in a quaternary intensive care unit (ICU) in Melbourne, Australia. Observations were collected every 10 minutes for 8 hours between 8:00 AM and 5:00 PM with the highest level of physical activity, patient location, and persons present at the bedside recorded.

Results: Two thousand fifty observations were collected across 8 days. Patients spent more than 7 hours in bed (median [interquartile range] of 100% [69%-100%]) participating in little or no activity for approximately 7 hours of the day (median [interquartile range] 96% [76%-96%]). Outside rehabilitation, no activities associated with ambulation were undertaken. Patients who were ventilated at the time of observation compared with those who were not were less likely to be out of bed (98% reduction in odds). Patients spent up to 30% of their time alone.

Conclusion: Outside rehabilitation, patients in ICU are inactive and spend approximately one-third of the 8-hour day alone. Strategies to increase physical activity levels in ICU are required.

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1. Introduction

Studies of rehabilitation for survivors of critical illness have failed to show sustained improvement in physical function beyond hospital discharge [1,2]. The timing and/or the dose of intervention provided may have impacted these results with the time spent in rehabilitation representing a small percentage of a patient's day. Schweickert et al [3] provided the earliest (within 48 hours of intubation) and largest dose of rehabilitation (26 ± 14 minutes for patients on mechanical ventilation and 28 ± 11 minutes for patients who are spontaneously breathing) to date with reported improvements in physical function at hospital discharge but no measurement beyond. It could be

hypothesized, similar to ward patients, that additional physical activity either targeted or incidental as well as prescribed rehabilitation [4] may improve physical function for patients who are critically ill. Currently, little is known about the patterns of physical activity undertaken by patients in intensive care unit (ICU).

Point prevalence and observational data [5-7] suggest that critically ill patients are relatively immobile. However, these study designs typically capture a single data point or the highest level of function over the course of a 24-hour period, which limits our understanding of the patterns of physical activity of critically ill patients. Furthermore, these studies do not provide detail about how physical activity levels are influenced by ventilatory status, sedation state, or level of cooperation; and we hypothesize that these may significantly influence patient activity in this population.

Behavioral mapping, a structured observational method using intermittent sampling, has been used to prospectively determine levels of physical activity in other patient populations [8,9] and was suited to this study. During mapping, information regarding the location where activity is performed, who is with the patient, and the therapy provided are also acquired.

Therefore we aimed to (1) prospectively quantify the amount, location, and type of physical activity undertaken by critically ill patients between 8:00 AM and 5:00 PM on a single day; (2) quantify the effect of ventilatory status, sedation state, and length of ICU stay at the time of observation on physical activity levels; and (3) describe who is present at the bedside throughout the course of the day.

2. Materials and methods

2.1. Study design and setting

This was a single-center, open, observational behavioral mapping study of critically ill patients performed between October 2012 and February 2013 in a 24-bed quaternary ICU in Melbourne, Australia. The study was approved, and informed consent waived by the Austin Health Human Research Ethics Committee (HREC 04519). Because of the observational nature of the study, participant consent was deemed unnecessary. This study is reported in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology statement for the reporting of observational cohort studies (http://www.strobe-statement.org).

2.2. Participants

Patients were included if they had been mechanically ventilated for at least 48 hours and were deemed by the treating intensive care specialist likely to remain in the ICU for a further 24 hours. Patients were excluded if death was imminent, treatment likely to be withdrawn in the ensuing 24 hours, or were admitted with a severe neurologic insult resulting in tetraplegia.

2.3. Study size

A theory-based, purposive sampling approach was taken for this study. The frequent sampling associated with behavioral mapping means that a representative sample of 41 cases was adequate to provide baseline activity data in an acutely ill population [10].

2.4. Behavioral mapping procedure

Observation was conducted between Monday and Friday by a single observer (JWR) [9]. A mapping day was feasible if a minimum of 3 eligible patients were available for observation. Patients were observed for 1 minute every 10 minutes except for 4 randomly scheduled 10-minute breaks, between 8:00 AM and 5:00 PM, which was considered to be the most active part of the patient's day [5]. At each time point, the observer recorded the highest level of physical activity, patient location, and persons present. If the curtains were drawn, patients were not observed. The route through the ICU remained consistent across days. Observations were recorded on 8 individual nonconsecutive days.

Physical therapists providing an intervention to patients on observation days completed records of the amount and type of therapy provided in each treatment session.

To minimize the effects of observing practice on standard care, therapists and nursing staff were told that the study aimed to provide information about the structure and current care processes in intensive care.

2.5. Classification of observed level of physical activity

At each observation, patient activity could be classified into 1 or more of 13 motor activities. These activities were prospectively grouped into 4 prespecified activity categories judged by 3 intensive care physiotherapists with a mean of 12 years' experience in ICU to represent the expected clinical progression of physical activity in ICU (Table 1).

2.6. People in attendance and location of activity

People in attendance were classified into 8 categories: alone; family or visitors; nursing staff; medical staff; support staff; physical therapists; all other allied health; and other, for example, patient service attendants. To be classified in attendance, individuals were required to be at the patient's bedside. Patient location was categorized into 3 categories; in bed, out of bed, and off the unit.

Table 1
Observed activity and activity classification scales

Observed activity	Activity level
No active motor	No or minimal activity
Incidental nonpurposeful movement	No or minimal activity
Purposeful movement	No or minimal activity
In seated position in bed	No or minimal activity
Hoist transfer	No or minimal activity
Seated position in chair	Low intensity
Sitting over side of the bed	Low intensity
Standing	Moderate intensity
Transfer feet on floor	Moderate intensity
Marching on the spot	Moderate intensity
Exercise using arms and legs	High intensity
Mobilizing away from bed	High intensity
Walk	High intensity

2.7. Additional data

Demographic data of interest included age, sex, and severity of illness (Acute Physiological and Chronic Health Evaluation 2 score [APACHE II] and sequential organ failure assessment [SOFA] scores). If an arterial line was not present, oxygen saturation as measured by pulse oximetry was substituted [11]. The use of sedative agents, presence of delirium (Confusion Assessment Method ICU [CAM-ICU], sedation and agitation (Riker score [12]), and the use of neuromuscular blocking agents were also recorded. The CAM-ICU and Riker scores were completed at the start of the observation day by the investigator (JWR) and repeated if a change in patient state occurred.

2.8. Data management and statistical analysis

Descriptive statistics were used to describe the patient sample. Aggregate percentages of individual patient observations were calculated for the observed highest level of activity as well as location and people present. The median and interquartile range of the aggregate percentages were then calculated for the whole group data. In addition to whole group activity, separate data for ventilated and nonventilated patients (at the time of observation) are presented, with further classification of patients according to sedation state defined by Riker scores [12]. The time spent in each category was estimated by multiplying the aggregate percentages of individual participants by 480 minutes (8 hours). This value is an approximation but included because of the exploratory nature of this article. To account for the nested nature of the observations, random-effects logistic regression with the group variable being the subject was used to calculate odds ratios (ORs). Odds ratios and 95% confidence intervals (CIs) were calculated to determine the relationship between patient location and ventilatory status, physical activity classification, and ventilatory status and between physical activity classification and sedation state. All data were analyzed using SPPS for Windows statistical software package (version 18; SPSS Incorporated, Chicago IL) and Stata 13IC (Stata, College Station, TX).

3. Results

In total, 2050 observations were recorded over a 4-month period on 8 observational days. One thousand one hundred fifty observations were carried out on patients who were mechanically ventilated and 900 on patients no longer requiring mechanical ventilation. These data were generated from direct observation of 41 patients. Twenty-three (56%) of the patients were mechanically ventilated on the day of observation. Patient characteristics are presented in Table 2. The flow of patients eligible for observation is presented in the Figure. On the days of observation, patients had spent a median (interquartile range [IQR]) duration of 9 (6-16) days in ICU. No patient required rescue therapies, and only 2 patients required greater than 10 μg/min of noradrenaline with the maximum dose being 17 μg/min. One patient was restricted to