European Journal of Oncology Nursing 16 (2012) 26–33

Contents lists available at ScienceDirect

European Journal of Oncology Nursing

journal homepage: www.elsevier.com/locate/ejon

Impact of walking ability and physical condition on fatigue and anxiety in hematopoietic stem cell transplantation recipients immediately before hospital discharge

Akiko Tonosaki [1]

St Luke's College of Nursing, Tokyo, Japan

Keywords:
Hematopoietic Stem Cell Transplantation
Fatigue
Anxiety
Muscle endurance
Knee extension strength
Ankle plantar flexion strength
Ankle dorsiflexion strength
Step-count
Food intake

A B S T R A C T

Purpose: This study analyzed the influence of walking ability and physical condition on fatigue and anxiety at hospital discharge in patients receiving hematopoietic stem cell transplantation (HSCT).
Method: A total of 25 subjects were assessed after receiving HSCT until discharge. The Japanese Cancer Fatigue Scale and the State-Trait Anxiety Inventory were used to assess fatigue and anxiety. Relationships of fatigue and anxiety status respective to walking ability variables: leg muscle strength (knee extension, ankle plantar flexion and ankle dorsiflexion strength) and average number of daily steps, and physical condition variables (food intake, febrile days, body mass index, and serum albumin) were examined with correlations and stepwise multiple regression analysis.
Results: Subjects with later achievement of adequate food intake after HSCT ($\beta = 0.62$) and weaker knee extension strength per body mass at discharge ($\beta = -0.42$) reported higher fatigue (adjusted $R^2 = 0.53$, $p = 0.00$). Knee extension strength per body mass at discharge was correlated with an average step-count from 51 to 80 days after HSCT ($r = 0.51$, $p = 0.01$). In subjects whose Body Mass Index was above 23.5, weaker ankle dorsiflexion strength per body mass prior to transplantation reported higher fatigue at discharge (adjusted $R^2 = 0.97$, $p = 0.00$). Subjects with later achievement of food intake after HSCT ($\beta = 0.59$) and more days with fever reported higher anxiety (adjusted $R^2 = 0.47$, $p = 0.00$).
Conclusion: Post-HSCT fatigue was affected by a delay in adequate food intake and diminished muscle strength. The results of this study show the importance of encouraging walking for maintaining muscle endurance.

Introduction

While hematopoietic stem cell transplants (HSCTs) produce a high cure rate for hematological disease, it is also an aggressive therapy that creates physical, social, psychological and emotional stress for patients (Bevans et al., 2006; 2008; Pidala et al., 2009; Heinonen et al., 2005; Hjermstad et al., 2004; Syrjala et al., 2004; Lee et al., 2002). Molassiotis (1999) discovered that patients who received HSCT in a previous six-month period showed that their tiredness and lack of energy could be predicted by the combined effects of difficulty concentrating and overall psycho-social adjustment. Moreover, the impact of graft-versus host disease (GvHD), a major complication of HSCT, has great clinical relevance and negatively impacts global QOL, and increasing such symptoms as: fatigue, gastrointestinal side effects and worries/anxiety (Pallua et al., 2010). Therefore, efforts to mitigate against debilitating side effects must be of paramount concern to health professionals.

The National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology for cancer-related fatigue (CRF) (Mock et al., 2007) recently recommended physical exercise for cancer patients to reduce deconditioning and CRF that results from physical inactivity, loss of appetite and such feelings as depression and anxiety (Mustian et al., 2007). Physical exercise is defined as planned or structured activity where energy output exceeds input and physical activity is defined as simply any bodily movement produced by skeletal muscles that results in energy expenditure (Caspersen et al., 1985). Therefore, when patients receive HSCT, reverse isolation is required to prevent infections and patients must stay in a laminar-air flow (LAF) room, which drastically reduces their physical activity, in particular lower leg muscles. Consequently, it was documented that their daily step-counts remarkably decreased (Tonosaki, 2004).

The relationship between walking (daily steps) and muscle strength is important to understand. A study of older people

E-mail address: tonosakia@adm.ncn.ac.jp.
[1] Present Address: National College of Nursing, 1-2-1 Umezono, Kiyose, Tokyo 204-8575, Japan.

1462-3889/$ – see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ejon.2011.01.012

(Yamasaki et al., 1998) reported a strong correlation between declines in walking ability and declines in knee extension, ankle plantar flexion, and ankle dorsiflexion, which were used as three measures of leg muscle strength. Biomechanics describes walking in terms of force and motion in relation to muscle and bone activity.

The biomechanical elements for walking ability are essentially antigravity, equilibrium, and stepping mechanisms (Dimitrijevic and Larsson, 1981). The walking motion is composed of speed, stability, efficiency and endurance (Shimada et al., 2008). In the process of walking, the heel first strikes the ground with the foot in the dorsiflexed position, and the triceps surae muscle then controls the dorsiflexion of the ankle joint to lift the heel from the ground and move to the planter flexion position, in effect kicking the ground rearward and thus providing the force for forward progress. Weakening of this muscle results in a shortened stride and reduced walking speed (Uematsu and Kaneko, 1997). As walking distance lengthens, walking ability becomes more a matter of walking endurance, or the degree to which the repeated kicking can be maintained, rather than instantaneous muscle contraction strength (Kaitani et al., 1999; Shibata et al., 2002). The rectus femoris muscle during knee extension is a particularly important for muscle endurance in long-distance walking (Kaitani et al., 1999). Finally, muscle endurance of lower leg muscle against gravity (i.e., body weight) is an important factor for walking ability. Walking ability has shown a positive correlation with physical fitness in daily living (Oida, 1998; Yamasaki et al., 1998; Ono and Ryushi, 2001).

Caspersen et al. (1985) defines being physically fit as "the ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies" (p128). As the period of patient inactivity following HSCT is quite long, maintaining muscle endurance to optimize walking motion is considered as an essential factor for being physically fit in the recovery phase. But there were no prior studies about measuring lower muscle strength of patients receiving HSCT. Being physically fit is also considered as coping well with anxiety and/or depression. This is an extremely important issue for when health situations lead to immobility and the ensuing muscle disuse. The specific aim of this study was to examine the relationships among walking ability, physical condition, fatigue and anxiety after hospital admission and prior to the initial HSCT and before hospital discharge from the initial HSCT for a hematological disease.

Method

Design and sample

This was a descriptive correlational study of a cohort of subjects with measurements over time. The participants in this study were a convenience sample recruited from patients who satisfied the eligibility criteria of the research hospital, The Institute of Medical Science, The University of Tokyo. For eligibility, it was required that the participant be: (a) at least 18 years of age; (b) capable of speaking and reading Japanese; (c) scheduled for initial HSCT as a hematological disease patient; and (d) willing to undergo muscle strength measurements, keep a dairy of their step-counts and complete questionnaires. Exclusion criteria were: (a) thrombocytopenia (platelets $<30 \times 10^9$/L); (b) heart failure or systolic blood pressure 180 mmHg or higher; and (c) functional impairment or bone metastasis precluding leg muscle strength measurement. The patients' primary physician determined their eligibility for participation in the study. Of the 66 eligible patients who were recruited to participate from November 2002 to January 2006, six did not consent leaving 60 (90.9%) enrolled in the study. However 44 (73.3%) actually began the study as 16 were excluded from the baseline assessment because they were unable to provide a record of their step-counts. At points after the baseline assessment, nine patients died and 10 were too ill to continue. Therefore 25 (56.8%) subjects completed the study. A schematic of the patient recruitment, enrollment, and attrition details are presented in Fig. 1.

Measures

The patients walking ability was assessed in terms of changes in leg muscle strength as measured by knee extension strength, ankle plantar flexion strength, and ankle dorsiflexion strength, as well as daily step-count, from before HSCT to the time of hospital discharge. Since physical symptoms caused by transplantation may also affect fatigue and anxiety levels, the patients' physical condition throughout the same period was also assessed, in terms of days with fever, food intake amount and serum albumin level.

Leg muscle strength (muscle force, knee extension and ankle strength)

To measure leg muscle force, a hand-held-dynamometer (HDD) was used. HDD(Isoforce GT-300 and GT-100, OG Giken Co., Ltd.,

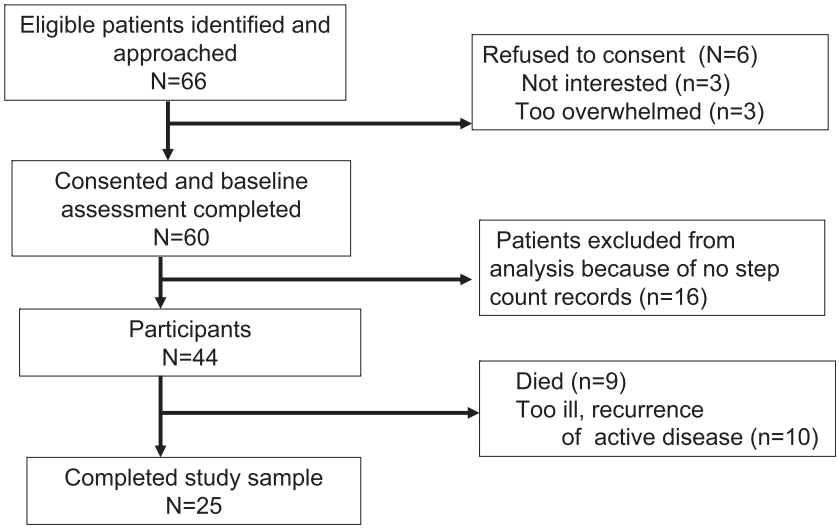

Fig. 1. Patients recruitment, enrollment, and attrition.