Association of Nutrition Status and Rehabilitation Outcome in the Disuse Syndrome: a Retrospective Cohort Study

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Background: To determine whether nutrition is associated with rehabilitation outcome in the disuse syndrome.

Methods: A retrospective cohort study was performed in 223 inpatients admitted to a university hospital who were diagnosed by physicians in the rehabilitation department as having the disuse syndrome, and subsequently prescribed physical therapy. Malnutrition was defined as a body mass index < 18.5 kg/m², hemoglobin level < 10.0 g/dl, serum albumin level < 3.0 g/dl, or total lymphocyte count < 1200 cells/mm³. Rehabilitation outcome was defined as whether or not the ADL score improved during rehabilitation. Nutritional status was assessed at referral using the Onodera’s prognostic nutritional index (PNI).

Results: The study cohort included 136 men and 87 women (mean age 67.5 years; median duration between admission and referral 17 days; median rehabilitation duration 32 days). A total of 202 patients (91%) were defined as being malnourished. Mean PNI was 32.9. With the ADL score improving in 135 patients (61%) during rehabilitation. Rehabilitation outcome was better in patients with normal nutrition compared to malnourished patients (relative risk: 0.72, p = 0.04). Patients with a hemoglobin level > 10.0 g/dl (relative risk: 0.69, p = 0.001), total lymphocyte count > 1200 cells/mm³ (relative risk: 0.78, p = 0.03), or PNI > 35.0 (relative risk: 0.74, p = 0.01) had a better rehabilitation outcome. Logistic regression analysis showed that hemoglobin level was associated independently with rehabilitation outcome (odds ratio 2.34, p = 0.005).

Conclusions: Malnutrition is common in patients with the disuse syndrome. Patients with low hemoglobin level and PNI at referral are more likely to have a poor rehabilitation outcome.

Key Words: deconditioning, disuse syndrome, nutrition assessment, malnutrition, rehabilitation

INTRODUCTION

The disuse syndrome is a constellation of signs and symptoms that occur as a consequence of physical inactivity resulting from moderate to severe disease or impairments, including forced rest. Several concepts have been proposed to explain the consequences of inactivity and disuse and include the disuse syndrome, deconditioning, hospital-associated deconditioning and debility. These concepts resemble each other in some respect. A review article of hospital-associated deconditioning noted that this appeared to be a relatively common problem, with older adults being the most frequently affected. Okawa et al conceptualized the disuse syndrome model as a gradual decline or stepwise downhill in functioning. Using these criteria they classified 226 of 542 patients (41.4%) with functional decline as having the disuse syndrome. On the basis of these figures, the disuse syndrome represents a relatively important condition in rehabilitation medicine.

Malnutrition often occurs in disabled patients. Rehabilitation outcome has been shown to be poor in malnourished patients with stroke, chronic heart failure, chronic obstructive pulmonary disease, and a variety of other diseases. It has therefore been suggested the relationship between nutritional supplementation and rehabilitation from hospital-associated deconditioning is an important area of research.

In an acute rehabilitation setting, obese patients with deconditioning show higher increases in functional independence measure (FIM) scores compared to either patients with a body mass index (BMI) in the normal range, or underweight, deconditioned patients (BMI<18.5). This latter group has the smallest increase in FIM motor score. As there is evidence that serum albumin is not a suitable marker of body composition–related nutritional status in elderly patients, and that hemoglobin may be affected by several conditions not related to nutritional status, it is necessary to measure both anthropometric and laboratory data in order to obtain accurate assessment of nutrition.

No previous studies have assessed nutritional status in patients with the disuse syndrome using both anthropometrical and laboratory data. The purpose of this study was therefore to determine whether or not nutrition was associated with rehabilitation outcome in patients with the disuse syndrome.

MATERIALS AND METHODS

Data was collected from subjects in our cohort study entitled “Development of diagnostic criteria and disorder degree evaluation for disuse syndrome”. This clinical cohort study was performed in the university hospital (715 beds) with 15.0 day length of stay (LOS). Subjects were registered from consecutive inpatient diagnosed with the disuse syndrome by physicians at the rehabilitation department.

This study was consisted of 2 periods. First study was performed to evaluate risk factors of disuse syndrome between June 2006 and March 2007. Second study was performed to develop diagnostic criteria of disuse syndrome between August 2008 and October 2008. Because of absence of the criteria or guideline for diagnosing disuse syndrome, physicians diagnosed the disuse syndrome by some period of inactivity or bed rest, some functional decline due to inactivity or bed rest, and symptoms of muscle weakness, joint contracture, orthostatic hypotension, tachycardia, pressure sore, physical intolerance, decline of activities of daily living, or psychological signs.

This retrospective cohort study was performed using the data of 225 registered subjects of above mentioned study. Inclusion criteria for this study were a diagnosis of the disuse syndrome and age older than 20 yrs. There were no exclusion criteria. Finally, 223 subjects were selected for this study. All patients were prescribed physical therapy 5 times a week including range of motion exercise, resistance training, ADL exercise, and ambulation exercise. Each session of physical therapy was one or two units (One rehabilitation unit equated to 20 minutes of therapy). A few patients were also prescribed occupational therapy including functional occupational therapy, ADL exercise, cognitive training, and speech therapy including dysphagia rehabilitation.

Malnutrition was defined as a BMI<18.5 and/or moderately impaired biochemical measurements (hemoglobin<10.0 g/dl, serum albumin<3.0 g/dl, or...
The study included 136 men and 87 women, with a mean age of 67.5 years (Table 1). Common causative diseases of the disuse syndrome included cardiovascular (53 cases) and gastroenterological diseases (37 cases). The median duration between admission and referral was 17 days, median rehabilitation duration was 32 days, median LOS was 53.5 days, and mean rehabilitation unit per week was 7.3 units.

Mean BMI was within the normal range, whereas mean hemoglobin and serum albumin level and mean TLC were below the normal range, indicating moderately impaired malnutrition (Table 2). Mean PNI was 32.9. During rehabilitation, 135 patients (61%) had an improvement in Barthel Index score. Two hundred and two patients (91%) were defined as being malnourished, with 56 patients (25%) being underweight (BMI<18.5), and 163 patients (73%) hypoalbuminemic (Table 3). The rehabilitation outcome of patients with normal nutrition was better than that of malnourished patients. Patients with a hemoglobin level >10.0, TLC >1200, and PNI >35.0 had a better rehabilitation outcome. Age, sex, serum albumin, and BMI were not significantly different between the normal nutrition and malnourished groups.

Logistic regression analysis using age, sex, hemoglobin, and TLC as the covariates showed the university hospital, with informed consent being obtained from all participants prior to enrollment in the study.

RESULTS

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Logistic regression analysis using age, sex, hemoglobin, and TLC as the covariates showed the
hemoglobin level (odds ratio: 2.34, 95% CI 1.29-4.25, p = 0.005) was an independent determinant of rehabilitation outcome (Table 4).

**DISCUSSION**

Many patients with the disuse syndrome are not underweight, although 91% of the patients in this study were found to be malnourished on the basis of biochemical measurements. These measurements were abnormal in the majority of patients. We observed that a common characteristic in patients with the disuse syndrome was being malnourished but not underweight. The causes of malnutrition in the disuse syndrome may be severe morbidity associated with inflammatory condition and/or physical stress of causative diseases and inappropriate nutritional management.

The median LOS in patients with the disuse syndrome was considerably longer than the mean LOS measured at the university hospital. This indicates that many of the patients with the disuse syndrome were severely impaired, and that discharge planning of these patients was complicated.

Malnourished patients with the disuse syndrome generally had poor rehabilitation outcomes. Similar results may be found with other diseases and disabilities. As nutritional status is associated with rehabilitation outcome, a combination of both rehabilitation therapy and appropriate nutritional management may be associated with a better outcome. Salisbury et al reported that it is possible to increase
the frequency of both physiotherapy and dietetic visits after critical illness, with resulting improvement in physical and nutritional outcomes. Sarcopenia is closely related to the disuse syndrome. Sarcopenia is a syndrome characterized by progressive and generalized loss of skeletal muscle mass and strength. Primary sarcopenia is considered to be age-related when no other cause is evident, other than ageing itself. Many patients with the disuse syndrome are also elderly and may complicate the diagnosis of age-related sarcopenia.

Secondary sarcopenia should be considered when one or more other causes are evident, such as activity-related sarcopenia, disease-related sarcopenia, or nutrition-related sarcopenia. Activity-related sarcopenia can result from bed rest, a sedentary lifestyle, deconditioning, or zero-gravity conditions. The presence of the disuse syndrome and disuse muscle atrophy equates to activity-related sarcopenia. Disease-related sarcopenia is associated with advanced organ failure (heart, lung, liver, kidney, and brain), inflammatory diseases, and malignancy (cancer). These disorders are often the causative disease of the disuse syndrome at admission. Nutrition-related sarcopenia results from inadequate dietary intake of energy and/or protein that occurs with malabsorption, gastrointestinal diseases or use of medications that cause anorexia. The majority of patients with the disuse syndrome are malnourished, which may complicate the diagnosis of nutrition-related sarcopenia.

Patients with the disuse syndrome and muscle atrophy may also complicate the diagnosis of not only activity-related sarcopenia, but also age-, disease-, and nutrition-related sarcopenia. In these cases, resistance training is not sufficient to improve muscle mass and strength and all patients with the disuse syndrome should undergo nutritional care management.

There were some limitations in this study. First, nutritional assessment was carried out using anthropometric and laboratory data, despite these being unvalidated methods. Validated methods like the Subjective Global Assessment or Mini Nutritional Assessment are better tools for assessing nutrition. Second, as there are no validated criteria for the disuse syndrome, its diagnosis may be different between physicians in rehabilitation departments. Finally, these results may not be applicable to patients with the disuse syndrome admitted to acute care general hospitals, because as patients admitted to the university hospital are more likely to be younger than inpatients of acute care general hospitals.

CONCLUSION
Malnutrition is common in patients with the disuse syndrome. Patients with low hemoglobin levels and PNI at referral are more likely to have a poor rehabilitation outcome. Malnutrition may be associated with poor rehabilitation outcome in patients with disuse syndrome.

References


