RESEARCH
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Nutritional Status Changes and Activities of Daily Living after Hip Fracture in Convalescent Rehabilitation Units: A Retrospective Observational Cohort Study from the Japan Rehabilitation Nutrition Database

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ABSTRACT

Background Several studies have suggested that malnutrition impedes functional recovery in patients with hip fracture, but there are few reports on improvement in nutritional status and return to activities of daily living (ADL) in these patients.

Objective This study was conducted to evaluate the relationship between change in nutritional status and recovery of ADL in malnourished patients after hip fracture and to identify predictors of functional recovery among the characteristic features of undernutrition.

Design This was a retrospective observational cohort study.

Participants/setting Data for patients aged ≥65 years with hip fracture and malnutrition (Mini Nutritional Assessment−Short Form [MNA-SF] score ≤7) at the time of admission to convalescent rehabilitation units were obtained from the Japan Rehabilitation Nutrition Database between November 2015 and August 2017.

Main outcome measures The main outcome measures were Functional Independence Measure (FIM) at discharge and the proportion of patients discharged home.

Statistical analyses performed Patients were divided into two groups based on MNA-SF scores at discharge: improvement in nutritional status (>7, IN group) and non-improvement in nutritional status (≤7, NN group). Clinical characteristics and outcomes were compared between the groups. Multivariable regression analysis was performed to adjust for confounders including age, sex, comorbidity, pre-fracture ADL level, and FIM score on admission.

Results Of 876 patients, 110 met the eligibility criteria (mean age, 85 years; 78.2% female); 77 of the patients were assigned to the IN group and 33 to the NN group. The patients in the IN group were younger and had higher FIM and MNA-SF scores on admission than those in the NN group. At discharge, the median FIM score was significantly higher in the IN group than in the NN group (110 vs 83, $P<0.001$). Multivariable analysis revealed a significant association between improvement in nutritional status and higher FIM score at discharge (B=7.377 [B=partial regression coefficient], $P=0.036$) but no association with discharge to home. Mobility, neuropsychological impairment, and weight loss subscores of MNA-SF were independently associated with discharge FIM score ($R^2=0.659$).

Conclusions In older patients with hip fracture and malnutrition, improvement in nutritional status was independently associated with improved performance of ADL during inpatient rehabilitation. Weight loss may be an important nutritional indicator for these patients.

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HIP FRACTURE IS A MAJOR TYPE OF FRAGILITY fracture in older adults, which has critical consequences in terms of increased risk of mortality, functional decline, and decreased quality of life.[1-5] The reported annual incidence of hip fracture varies among countries from 2 to 574 per 100,000 women and from 2 to 290 per 100,000 men.[1] The incidence of hip fracture in Japan is among the highest in the world,[4] raising the costs of public long-term care insurance.[5] Patients with a hip fracture often develop malnutrition: it affects 11% to 28% of these individuals. The mortality rate is higher and functional decline is worse in patients with hip fracture and malnutrition than

in those without malnutrition.[6-9] Therefore, optimal nutritional care may be crucial to improve prognosis and functional capacity in this population.

Given the adverse relationship between malnutrition and outcomes after hip fracture, many clinical trials have been conducted with the aim of improving prognosis and/or functional outcomes by nutritional intervention to improve nutritional status.[10-13] However, most studies to date have failed to demonstrate improvement in functional outcomes.[10,11] Furthermore, in two recent meta-analyses, no clear conclusion regarding the effect of nutritional intervention on functional status after a hip fracture was reached.[14,15] However, these studies included individuals with a wide spectrum of nutritional status and did not assess nutritional status with validated instruments, such as the Mini Nutritional Assessment (MNA).[16] Thus the negative findings might be attributed to different effects of nutritional intervention on nutritional status and functional capacity in patients with a wide range of nutritional statuses.

In a recent report, investigators described a positive relationship between the trajectory of nutritional status and cognitive function after hip fracture.[17] This finding may indicate that a change in nutritional status may be associated with functional recovery after hip fracture in undernourished patients as compared with non-malnourished patients or those at risk for malnutrition. However, it is unclear whether improvement in nutritional status is associated with improvement in activities of daily living (ADL) in these patients, which raises the hypothesis that improvement in nutritional status may be positively associated with better performance of ADL in malnourished patients undergoing rehabilitation after hip fracture. Therefore, this retrospective observational cohort study was conducted with the aim of evaluating the relationship between change in nutritional status and ability to perform ADL in malnourished patients who have sustained hip fracture and sought to identify the most powerful predictor of functional recovery among the characteristics of undernutrition such as decreased food intake and weight loss.

RESEARCH SNAPSHOT

Research Questions: Is a change in nutritional status associated with recovery of activities of daily living among malnourished patients after hip fracture? What characteristic of malnutrition is the most powerful predictor of functional recovery?

Key Findings: In a retrospective observational cohort study involving 110 older patients with malnutrition and hip fracture identified in the Japan Rehabilitation Nutrition Database, improvement in nutritional status confirmed by the Mini Nutritional Assessment—Short Form [MNA-SF] was independently associated with the Functional Independence Measure score at discharge (B=7.377 [B=partial regression coefficient], P=0.036). In addition, a higher weight loss score was independently associated with better return of function according to the subscore of the MNA-SF (B=3.985, P=0.037).

METHODS

In this retrospective observational cohort study, registry data that were entered into the Japan Rehabilitation Nutrition Database (JRND) from November 2015 to August 2017 were analyzed. The primary outcome was the Functional Independence Measure (FIM) score at discharge, and the secondary outcome was the proportion of patients who were discharged home. Patients were divided into two groups based on the Mini Nutritional Assessment—Short Form (MNA-SF) score at discharge: the improvement in nutritional status (IN) group and the non-improvement in nutritional status (NN) group.

JRND

The JRND was established in March 2016 by the Committee of JRND under the auspices of the Japanese Association of Rehabilitation Nutrition to investigate the effectiveness of rehabilitation nutrition.[18] Patients with stroke or hip fracture in convalescent rehabilitation units and patients with pneumonia in acute care hospitals are registered in the database. The JRND was constructed by using the Research Electronic Data Capture tool (REDCap).[19] Fifteen participating facilities were recruited and have contributed data for 876 patients who sustained hip fracture or had a stroke or pneumonia. Admission data for the following patient characteristics are recorded in the JRND: age, sex, diagnosis, Charlson comorbidity index,[20] pre-fracture public long-term care insurance (LTCI) certification, FIM score on admission, height, body weight, MNA-SF score, mean energy intake (kilocalories per day for a week), serum albumin level, and route of feeding. Discharge data are discharge destination, FIM and MNA-SF scores, and total duration rehabilitation therapy. Although procedures for estimating energy intake were not specified in this study, standard practice in Japan is for the food service dietitians to plan a menu of basic meals based on the *Standard Tables of Food Composition in Japan − 2015*, 7th revised edition,[21] by means of commercial meal planning software. Nursing staff or dietitians record a visual estimate of the percentage of each item that the patient ingested. Registered dietitians then convert these data to energy intake. Researchers registered with REDCap in each facility then enter the data into the JRND.

The LTCI is a mandatory public long-term care insurance system operating in Japan.[22] Convalescent ("kaifukuki") rehabilitation units aim to achieve maximum recovery of ADL in patients with disabilities and return them to their own homes. This is covered by public health insurance in Japan. Comprehensive rehabilitation is provided in the units by a multidisciplinary rehabilitation team.[23] For patients within the first 60 days of hip fracture, public health insurance covers individualized rehabilitation for up to 90 days for a maximum of 9 units (180 minutes) per day.

This study was approved by the ethics committee at Jikei University School of Medicine (approval number 27-150 [8035]). Because only anonymous clinical data are registered in the JRND, the participating facilities supplied information about the JRND to all patients and explained the opt-out option, which allows patients to withdraw from the registry at any time.

Inclusion and Exclusion Criteria

Eligibility criteria for this study were age ≥65 years, a hip fracture, and an MNA-SF score on admission of 0 to 7 points