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Research paper

# Changes in nutritional status and associated factors in a geriatric post-hip fracture assessment

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ABSTRACT

*Aim:* To examine changes in nutritional status and to identify factors associated with poor nutritional status in a comprehensive geriatric assessment after hip fracture.
*Methods:* Nutritional status according to the Mini Nutritional Assessment Short Form (MNA-SF) was assessed in 585 hip fracture patients aged 65 years and over at baseline and six months postoperatively at our geriatric outpatient clinic. Poor nutritional status was defined as being malnourished or at risk of malnutrition according to the MNA-SF. Logistic regression analyses were used.
*Results:* At baseline, 39%, and at follow-up, 59% of patients had poor nutritional status. After adjusting for age, higher age, American Society of Anesthesiologists (ASA)-grade 3, taking 4–10 medications, prefracture diagnosis of memory disorder, non-independent mobility, not living in own home and poor nutritional status at baseline were prognostic factors for poor nutritional status. In the geriatric assessment, MMSE $<$ 24, difficulties in basic activities of daily living, depressive mood, longer time on Timed Up and Go (TUG) and weakened grip strength were associated with poor nutritional status. In multivariate analyses, prefracture memory disorder, MNA-SF at baseline and depressive mood, TUG and grip strength in the outpatient assessment continued to be associated with poor nutritional status at follow-up.
*Conclusions:* Cognition and mood require attention in the nutritional care of hip fracture patients. The strong association of poor nutritional status with impaired mobility and grip strength implies an association between protein-energy malnutrition and sarcopenia. Both muscle strength and nutrition need to be addressed in comprehensive hip fracture care and rehabilitation.


## 1. Introduction

The prevalence of malnutrition is very high in older populations. This has been demonstrated in many healthcare settings, hospitals and among community dwelling older people [1–4]. The incidence of hip fracture is currently high and expected to increase, especially in women, due to population aging [5]. Malnutrition is one significant risk factor for falls and fractures [6]. Food intake is often insufficient during recovery from the hip fracture operation, impairing the nutritional status further [7]. Patients with protein-energy malnutrition have a higher postoperative complication rate, which means longer expensive hospital stay, and also higher morbidity and mortality [4,7–9]. Altogether individuals with malnutrition are more likely to experience poor quality of life [1,10]. Identifying patients likely to benefit from nutritional support could reduce morbidity and mortality and also save costs.

Nutritional screening is important in order to identify at-risk patients. There is no gold standard for assessing nutritional status. The short form of the Mini Nutritional Assessment (MNA-SF) is one of the most frequently used nutritional instruments to assess nutritional status in older hip fracture patients. Both malnutrition and risk of malnutrition as assessed by the MNA-SF have recently been proven to predict major negative outcomes in older hip fracture population [3].

So far, only very few studies have examined changes in nutritional status in older populations over time [11,12]. To the best of our knowledge, no population-based observational studies have been presented following up changes in nutritional status in older hip fracture patients. The aim of the present study was to follow up nutritional status as measured by the MNA-SF [13] from the time of the hip fracture to the comprehensive geriatric

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outpatient assessment, to which all the hip fracture patients in our hospital were invited, according to our local care pathway, 4–6 months after the fracture. In particular, we aimed to identify prefracture prognostic indicators of poor nutritional status and factors associated with poor nutritional status as assessed at the outpatient clinic.

## 2. Material and methods

### 2.1. Study population and design

The study includes all 1025 consecutive patients aged over 65 who suffered their first hip fracture between January 2010 and December 2014. Pathological fractures were excluded. Of the patients 88% were operated on within 48 hours of admission to our hospital. The mean length of stay in the hospital was six days. Seinäjoki Central Hospital, Finland is the only hospital in the Southern Ostrobothnia region providing acute surgical care. The population of the hospital district is approximately 200,000 and all hip fractures are treated there.

The nurses on the orthopaedic ward were instructed to give daily nutritional supplements rich in energy (300 kcal) and protein (20 g) twice a day to all hip fracture patients in addition to meals (breakfast, lunch, dinner and evening snack) enriched with energy and protein. It was recommended to continue this in the primary care hospitals where patients were transferred for rehabilitation.

### 2.2. Data collection

The baseline data were collected during the perioperative hospital stay mainly by a single geriatric nurse interviewing the patients or their representatives and by extracting it from hospital records. In addition, data were collected during the visit to the geriatric outpatient clinic in the comprehensive assessment in a median time of six months (Inter Quartile Range [IQR] 4–6 months) after the fracture. A physiotherapist's examination preceded the geriatric assessment. All the patients or their caregivers gave informed consent and the study design was approved by the ethics committee of our hospital district. The dates of death for mortality follow-up were extracted from the electronic patient files. The mortality data were complete.

### 2.3. Variables

In order to assess the nutritional status MNA-SF was used in the perioperative period on the orthopaedic ward and again at the outpatient clinic. To measure the body mass index (BMI), the patients' height and weight were monitored as reported by the patients or caregivers or extracted from the patient files and, if not available, as estimated by the nurses on the orthopaedic ward. At the outpatient clinic, the patients were measured and weighed. The MNA-SF consists of six sections: appetite or eating problems, recent weight loss, mobility impairment, acute illness/stress, dementia or depression and BMI. Its scores are 0–7 points malnourished, 8–11 points at risk of malnutrition and 12–14 points normal nutritional status [13]. For the purposes of our study, poor nutritional status was defined as being at risk of malnutrition or being malnourished according to the MNA-SF.

The preoperative American Society of Anesthesiologists (ASA) risk scores were used to assess general health at the time of the fracture. There are five classes:

- healthy person;
- mild systemic disease;
- severe systemic disease;
- severe systemic disease that is a constant threat to life;
- a moribund person who is not expected to survive without the operation [14].

The ASA scores were categorized into three groups: 1–2, 3 or 4–5.

A possible diagnosis of memory disorder was elicited at the time of the fracture and defined as a clinical diagnosis confirmed by a specialist in geriatric medicine or in neurology.

The baseline independent mobility was defined as being able to move independently without personal assistance. Living in an institution was defined as residing in a health centre hospital or residential care home providing 24-hour care.

In the comprehensive geriatric assessment (CGA), the Geriatric Depression Scale (GDS-15) was used to measure the individual's mood [15]. The GDS-15 consists of 15 questions with higher scores indicating more symptoms of depression, a cut-off score of six meaning depressive mood. Cognition was assessed by the Mini Mental State Examination (MMSE), where a score of less than 24 points out of 30 was considered to indicate cognitive impairment [16]. Difficulties in the basic activities of daily living (ADLs) were defined as having difficulties in at least one out of the six basic activities of daily living [17] and difficulties in instrumental activities of daily living (IADL) one out of the eight IADLs [18]. The patients' regular medications were categorized as less than 4, 4–10 or more than 10 regular daily medications.

Physical functioning tests were conducted by a physiotherapist. Grip strength was measured using the Jamar Dynamometer on both the right and left hands. In men, grip strength less than 26 kg and in women less than 16 kg in the stronger hand was defined as weakened [19]. The Timed Up and Go test (TUG) requires patients to stand up from a chair, walk a short distance, turn around, return and sit down again [20]. It assesses both mobility and fall risk. In addition to measuring the median time, the performance on the TUG was categorized as normal (1 point), slightly abnormal (2–4 points) or markedly abnormal (5 points) as evaluated by mainly the same physiotherapist. Three or more points mean risk of falling. The Elderly Mobility Scale (EMS) was used to evaluate an individual's mobility problems in seven functional activities including bed mobility, transfers and bodily reaction to perturbation, speed of going from sitting to standing and walking speed [21]. The tasks give 0–4 points, total 20. Scores over 14 are taken to mean independent in basic ADLs.

### 2.4. Statistical analysis

Distributions of the basic characteristics at baseline between the well-nourished, those at risk of malnutrition and the malnourished are described in Table 1. Differences in the distribution of age, gender, ASA scores, BMI, MNA, type of hip fracture, regular medications and length of stay in hospital, mobility and living arrangements between groups were analysed by independent samples Kruskall-Wallis test or Pearson Chi$^2$ test. Due to the skew distributions, continuous variables were described by medians, with ranges and modelled by non-parametric tests.

Age-adjusted prognostic factors of poor nutritional status at baseline and in the CGA after six months' follow-up were calculated by logistic regression. The results were shown as prevalence odds ratios (POR) or incidence odds ratios (IOR) with 95% confidence intervals (CI). Finally, multivariate analyses including all the factors examined as enter and forward and backward stepwise models were conducted.

Statistical analyses were performed with IBM SPSS Statistics for Windows®, version 20.0.0 (IBM Corp. Released 2011, Amonk, NY). The $P$-value $< 0.05$ was considered statistically significant.