RESEARCH PAPER

Nutritional status of patients who have fallen in an acute care setting

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Keywords
falls, nutritional status, malnutrition, subjective global assessment.

Abstract

Background Falls may result in injury, loss of independence and higher healthcare costs. The aim of this study was to examine the nutritional status of patients who had fallen in an acute care setting.

Methods Forty-nine patients who had experienced a fall while admitted at an Australian private hospital participated in the study (age: 71.2 (SD 14.1) years; 21 male: 28 female). Nutritional status was assessed using subjective global assessment. Protein and energy intake was determined by dietary history and analysed using Australian computerised food composition data.

Results According to subjective global assessment, 27 patients were well nourished and 22 malnourished (21 moderately, one severely malnourished). Well nourished fallers had significantly higher BMI (mean difference 3.7 kg/m^2, CI: 1.2-6.2), dietary protein (mean difference 19.8 g, CI: 2.0-37.5) and energy intake (mean difference 1751 kJ, CI: 332-3170) compared to malnourished fallers. There was no difference in severity of falls based on nutritional status, weight or BMI.

Conclusions There was a high prevalence of malnutrition and poor intake in this sample of patients who had fallen in hospital. Nutrition assessment and intervention for patients who have fallen in the acute care setting should be considered.

Conflict of interests, source of funding and authorship
The authors declar that they have no conflict of interests or sources of funding to declare.
JDB and EI were principal investigators and devised the study protocol, supervised the study, performed the statistical analysis and assisted in the interpretation and writing of the manuscript. JT, PH and JM performed data collection and assisted in the interpretation and the writing of the manuscript.

Introduction

Falls are the 14th leading cause of burden of disease in the world (Myers, 2003). Apart from potential adverse outcomes to fallers, there are substantial costs arising from increased length of stay; physician, hospital, rehabilitation and/or nursing home fees; medications; use of medical equipment/home modifications; and insurance administration/risk

of litigation (Australian Council for Safety and Quality in Health Care, 2005).

Clinical practice guidelines for assessment and prevention of falls in older people in the community, extended care or who attend primary or secondary care settings following a fall have been developed in the UK but do not include nutrition recommendations (Royal College of Nursing, 2005). Guidelines for preventing falls and harm from falls for Australian hospitals and residential aged care facilities list nutrition, weight and calcium intake as risk factors for falls, however, there is no clear and simple guidance on how to screen for nutritional risk (Australian Council for Safety and Quality in Health Care, 2005).

Although malnutrition is prevalent in the acute care setting (Stratton *et al.*, 2004; Banks *et al.*, 2007), the nutritional status of patients who have experienced a fall in hospital is not well documented. The aim of this study was to assess the nutritional status of patients who had fallen in an acute care setting and compare the differences between those who were well nourished and malnourished.

Materials and methods

Setting and subjects

The study was conducted within a tertiary, private 430-bed acute care facility. All patients who experienced a fall from July 2004 to March 2005 were eligible for inclusion in the study. Incident reports for patients experiencing a fall during hospitalization were completed by nursing staff within 24 h of the event and forwarded to the Quality Secretariat for inclusion in the falls incident register. The Quality Secretariat notified the Nutrition Services Department of fall events and patients were approached to participate in the study. The hospital's multidisciplinary ethics committee approved the study and written informed consent was obtained from each patient.

Measurement of nutritional status

Nutrition assessment was performed by dietitians trained in the use of the Subjective Global Assessment (SGA) (Detsky *et al.*, 1987). The SGA is a reliable and valid tool used to determine nutritional status based on a medical history and physical examination. Patients were classified as well nourished (SGA A), suspected or moderately malnourished (SGA B) or severely malnourished (SGA C).

A modified Burke diet history was recorded at the same time as the SGA assessment (Burke, 1947). Subjects were systematically asked about dietary intake during a typical 24-h period, then asked to account for variations (e.g. weekends and take away meals), and finally a checklist was used as a cross-check on the types and quantities of certain foods consumed during the week. Dietary intake (protein and energy) was determined using computerized Australian food composition data (Food Works Professional, Version 3.01, 2002; Xyris Software, Brisbane, Qld, Australia).

Measurement of nutritional risk

Nutritional risk was obtained using the Malnutrition Screening Tool (MST), which is a mandatory component of the Nursing Health Assessment completed within 24 h of admission (Ferguson *et al.*, 1999). Patients who scored ≥2 are considered at risk of malnutrition. The MST has a reported sensitivity of 93% and specificity of 93% when compared with SGA in 408 acute care patients with mixed diagnoses (Ferguson *et al.*, 1999).

Measurement of falls, falls risk and falls severity

The hospital uses the World Health Organisation definition of a fall that is 'an event which results in a person coming to rest inadvertently on the ground or floor or other lower level' (World Health Organisation, 2005). The number of days between admission and fall (including multiple falls) was recorded. Patient falls history was collected during assessment and falls risk on admission was obtained by review of patient medical records. Patient falls risk assessment is a mandatory component of the Nursing Health Assessment performed within 24 h of hospital admission and consists of eight indices: ≥80 years of age; history of falling or syncope; condition that affects cognitive ability; impaired balance, gait, mobility

including walking aids, drains, tubes/IV's; polypharmacy (≥four medications); altered elimination; sensory impairment and post-surgery/procedure. Falls risk status is assigned depending on the number of indices: no indicators are classified as 'low risk', one indicator 'high risk' and more than one indicator 'very high risk'.

Severity of falls was obtained from the hospital falls register. Falls severity was classified according to injuries sustained as a result of the fall – no injury, minor injury (lacerations, graze, bruise, skin tears, sprains, torn nail and sore shoulder), moderate injury (fracture) or severe injury (death).

Statistical analysis

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences, Version 12, 2003, Chicago, IL, USA). Continuous variables are presented as mean (SD) for normally distributed variables or median (range) for non-normally distributed variables. Categorical variables are presented as count (percentage). To compare well nourished and malnourished patients, independent sample *t*-tests or nonparametric Mann–Whitney test, were used as appropriate. Chi-squared analyses were performed for categorical variables. For the purpose of analysis, falls severity and nutritional status were reclassified as dichotomous variables [severity: no injury and injury (minor, moderate and severe); nutrition status: well nourished (SGA A) and malnourished (SGA B and C)] because of the small numbers in each of the original categories. Statistical significance was set at the conventional $P < 0.05$ level (two-tailed), however, results were also interpreted for clinical relevance.

Results

Subjects

Over the 9-month study period, 270 patients experienced a fall. A convenience sample of 64 patients was approached to participate in the study of which 49 (77%) consented. Reasons for the size of the convenience sample include delays in notification and patients being discharged prior to being notified of the fall. The mean age of participants was 71.2 (SD 14.1) years, with 21 females and 28 males. The majority of participants fell in rehabilitation ($n = 10$, 21%), orthopaedic ($n = 9$, 19%) and oncology ($n = 5$, 11%) wards. There was no significant difference in demographic characteristics between participants ($n = 49$) and non-participants ($n = 221$) in relation to age [71.2 (14.1) versus 71.6 (14.3) years; $P = 0.610$], gender (% male: % female; 43 : 57 versus 42 : 58; $P = 0.502$) or falls severity (% no injury: % injury 47 : 53 versus 57 : 43; $P = 0.135$).

Nutritional status

There was no significant difference in the median (range) number of days between the fall and nutrition assessment for well nourished and malnourished subjects [6 (1–18) versus 4 (0–18) days; $P = 0.756$]. According to SGA, 27 (55%) patients were well nourished and 22 (45%) malnourished (21 moderately and one severely malnourished). Age, nutritional indices, medications and past falls history are presented in Table 1. Well nourished fallers had significantly higher body mass index (BMI) [mean difference 3.7 kg m^{-2} (95% CI: 1.2–6.2)], dietary protein intake [mean difference 19.8 g (95% CI: 2.0–37.5)] and energy intake [mean difference 1751 kJ (95% CI: 332–3170)] compared with malnourished fallers. There was no significant difference in age ($P = 0.453$) between well nourished and malnourished hospital patients, but there was a trend towards the well nourished patients using more medications ($P = 0.054$).

Falls, falls risk and fall-related injuries

The 49 patients experienced 56 falls events (i.e. 43 patients fell once, five fell twice and one fell three times). There was no difference in the median (range) number of falls between well nourished and malnourished patients [1 (1–3) versus 1 (1–2) falls: $P = 0.235$] with well nourished patients experiencing 33 falls and malnourished patients 23 falls. Twenty-one patients reported previous falls history; 16 were well nourished and five were malnourished when assessed in hospital.

Table 1 Age, nutritionalindices, medications and falls history of 49 patients who experienced a fall during hospitalization

	Well nourished (SGA A) *n* = 27	Malnourished (SGA B + C) *n* = 22	*P*-value
Age (years)	69.8 ± 14.1	72.8 ± 14.1	0.453
Weight (kg)	75.4 ± 13.9	63.0 ± 12.8	0.002*
BMI (kg m^{-2})	25.9 ± 3.9	22.1 ± 3.4	0.003*
Protein (g)	77.2 ± 29.5	56.4 ± 30.4	0.022*
Energy (kJ)	6671 ± 2351	4949 ± 2466	0.018*
Medications (*n*)	9.7 ± 3.5	7.2 ± 5.1	0.054
Falls history (*n*)	16	5	0.014*
Malnutrition risk on admission (MST)			
Not at risk (0, 1)	21	6	< 0.001*
At risk (≥ 2)	6	16	
Falls risk on admission			
Low risk	1	1	0.465
High risk	6	2	
Very high risk	20	19	
Severity of fall (*n* = 56 falls events)			
No injury	16	11	0.609
Minor injury	16	11	
Missing data	2		

Continuous variables are presented as mean ± SD. Categorical variables are presented as counts (*n*).
SGA, Subjective Global Assessment; BMI, body mass index.
*Statistical significance is reported at $P < 0.05$ two-tailed level using independent *t*-tests for continuous variables and chi-squared analysis for categorical variable (falls history).

Falls risk assessment on admission and severity of falls are presented in Table 1. There was no difference in falls risk on admission or falls severity between well nourished and malnourished subjects. There was no significant difference in median (range) days between admission and fall between well nourished and malnourished subjects [9 (1–36) versus 7.5 (1–76) days: $P = 0.139$].

Discussion

Prevalence of malnutrition and comparison with other studies

This study reports that 22 (45%) of 49 patients who had fallen in an acute care setting were malnourished according to SGA. The prevalence of malnutrition in the acute care setting is reported between 12% and 42% in other Australian studies using SGA as the nutrition assessment method (Ferguson *et al.*, 1999; Middleton *et al.*, 2001; Lazarus and Hamlyn, 2005; Banks *et al.*, 2007). At the same private hospital, Ferguson *et al.* (1999) identified 17% of 450 patients to be malnourished at admission using SGA. Although the prevalence of malnutrition may increase during length of stay, the number of patients who were malnourished in this sample was higher than anticipated.

No studies were identified that have assessed nutritional status of subjects who have fallen in an acute care setting. In the rehabilitation or community setting suboptimal nutritional status as assessed by biochemical or anthropometric parameters has been documented in subjects who have experienced a fall. Comparison between studies is difficult because of the different nutrition assessment tools/parameters used and the various criteria used to define malnutrition or risk of malnutrition. On the basis of criteria of BMI < 22 kg m^{-2} together with mid-arm circumference (MAC) or triceps skinfold thickness (TSF) <15th percentile, Stolz *et al.* (2002) reported that 12.2% (11/90) of patients attending an Australian falls clinic were undernourished. Vellas *et al.* (1992) found that a number of biochemical (albumin, pre-albumin and retinol binding protein) and anthropometric parameters (BMI, MAC, TSF and calf circumference) were significantly lower in fallers admitted to a geriatric clinic. Using the Mini Nutrition Assessment (MNA), Visvanathan *et al.* (2003) found that 38.4% of 250 elderly recipients of domiciliary care services living at home were at risk of malnutrition and 4.8%

malnourished (42.2% not well nourished). In the subsequent 12 months, subjects classified as not well nourished at baseline were 1.65 times more likely to fall than those who were well nourished. However, the MNA has been found to overestimate malnutrition in comparison to SGA (Christensson *et al.*, 2002; Persson *et al.*, 2002) and the Visvanathan *et al.* (2003) study is consistent with recommendations that the SGA is the more useful tool in detecting established malnutrition and MNA in detecting those who need preventive nutritional measures (Christensson *et al.*, 2002).

Parameters such as low BMI (Tinetti *et al.*, 1995a,b; Royal College of Nursing, 2005) and grip strength (Nevitt *et al.*, 1991; Miller *et al.*, 2003) have been shown to be associated with injurious falls among the elderly living within the community. In this study, although there was a significant difference between BMI for the well nourished and malnourished groups, the mean BMI for the well nourished group was within the overweight range and the mean BMI for the malnourished group was within the well nourished range This is in agreement with another Australian study (Visvanathan *et al.*, 2003) that found BMI was within the normal range for subjects classified as not well nourished (24.6 ± 5.5 kg m^{-2}) and overweight (27.2 ± 4.5 kg m^{-2}) category for the nourished group. This may be reflective of the overall prevalence of overweight and obesity in the Australian population. Measurement of BMI as a key nutrition parameter as in the Stolz *et al.* (2002) study may not be a sensitive indicator of nutritional risk in the Australian setting. Although higher acceptable BMI ranges have been proposed for the elderly (22–29 kg m^{-2}), in this study, the mean BMI for the malnourished group was within this range. The data highlights the fact that malnourished patients are not necessarily the very thin and frail and may therefore be overlooked without appropriate nutrition screening and assessment.

A survey of the current practice of Australian falls clinics found that only one of 15 clinics included a dietitian as a core member of the multidisciplinary team and only four clinics included nutrition screening and/or assessment (Hill *et al.*, 2001). Recommendations from the survey included the need for improved communication and standardization of core procedures and assessment tools to facilitate best practice. As the results of this study indicate that fallers in the acute setting appear to be at greater nutritional risk than the general acute care population, there are clear opportunities for dietitians to participate as members of the multidisciplinary falls team by implementation of an appropriate nutrition assessment and intervention program.

Dietary intake

Intake of protein and energy was significantly lower in the malnourished group compared with the well nourished group, which was expected. As patients in the malnourished group were not meeting protein and energy requirements, it is likely that nutritional status would deteriorate further without dietetic intervention. Lumbers *et al.* (2001) reviewed the dietary intake of 75 elderly women admitted for fractured neck of femur compared to age-matched controls. Energy and protein intake was significantly lower in the fractured neck of femur group although there was no comparison of the group based on nutritional status.

Nutritional status and falls outcomes

There was no difference in severity of fall based on nutritional status as determined by SGA. Although this contrasts with the findings of Lumbers *et al.* (2001) who found that patients who sustained a moderate injury (hip fracture) had lower body weight and BMI than age-matched females, all injuries in this study were classified as minor. The study was underpowered to detect a clinically meaningful difference of 10% in the proportion of falls classified as no injury compared to minor injury between well nourished and malnourished groups, as 1050 patients would have been required to detect this difference with 90% power.

Limitations

This study had several potential limitations. There was a time delay between the fall event and the nutrition assessment due to delays in paperwork

reaching the Quality Secretariat and subsequent notification to Nutrition Services. Although nutritional status may have deteriorated during the time, it is unlikely that the global SGA rating would have been affected. The smaller than anticipated convenience sample was also due to the delay in notification as many patients had been discharged prior to the nutrition team being notified of the fall. This may have resulted in selection bias, however, there was no difference in the key parameters between participants in the study and the total eligible patient group.

In conclusion, there was a high prevalence of malnutrition as assessed by SGA and poor nutritional intake in this sample of acute care patients who had fallen during admission. Without appropriate nutrition intervention, inadequate intake is likely to further negatively impact on nutritional status. The incorporation of nutrition assessment and intervention program for patients who have fallen should be considered. Further research regarding the nutritional status of patients who have fallen in hospital and outcomes of nutrition intervention in this group is warranted.

Acknowledgments

Thank you to Sharon Rochester, Catherine Mortimer, Lisa Farlow, Cheryl Collins and Emma Speak for assistance with this project.

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