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Research Article

Assessment of Nutritional Status in Hospitalized Older Patients, and Association with Functional and other Outcomes

Anshu Sami[1], Danielle Ní Chróinín[2, 3*]

[1]Department of Medicine, South East Regional Hospital, NSW, Australia

[2]Department of Geriatric Medicine, Liverpool Hospital, NSW, Australia

[3]South Western Sydney Clinical School, UNSW Sydney, NSW, Australia

[*]**Corresponding author:** Danielle Ní Chróinín, Department of Geriatric Medicine, Liverpool Hospital, Locked Bag 7103, Liverpool BC NSW 1871, Australia, Tel: +61 (0)287386152; Email: dmmnic@umail.ucc.ie (or) danielle.nichroinin@health.nsw.gov.au

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Abstract

Background: Malnutrition may be associated with poor functional and clinical outcomes, but may be unrecognized. We sought to evaluate assessment of malnutrition and explore its relationship with functional and other outcomes in older in-patients.

Methods: We selected a random sample of 200 patients admitted under geriatric medicine in a tertiary hospital, and excluded those for whom medical records were unavailable. We assessed the use of the Malnutrition Screening Tool (MST), diagnosis of malnutrition, and their association with dependence in personal activities of daily living (PADL) at discharge (primary outcome) and other patient outcomes.

Results: In total, 188 patients were included. Over half (57.6%) were at risk of being malnourished per MST assessment (MST ≥2). Only 42.42% (42/99) underwent formal dietetic assessment; 73.81% were identified as malnourished (50% severely so), and this was commoner in males (OR 6.25, CI 1.15-33.33, p=0.03). Nutritional status was not associated with outcomes assessed.

Conclusions: Many patients at risk of malnutrition were sub-optimally assessed. Male sex was associated with malnutrition, but malnutrition was not associated with assessed outcomes. Further studies exploring malnutrition and clinical outcomes in hospital, are warranted.

Keywords: Older; Aged; Function; Hospitalizations; Malnutrition; Nutrition

1. Introduction

Malnutrition refers to deviation from a normal nutritional state, and in older people is typically defined as inadequate nutritional status, undernourishment due to poor dietary intake, poor appetite, muscle wasting and weight loss [1]. Evidence suggests malnutrition may be associated with poor functional and clinical outcomes, including institutionalization and mortality and may often be unrecognized [1]. The prevalence of malnutrition in acute care is estimated to be between 20% and 50%, compared to 10% and 30% in the community [3, 4]. Reasons for malnutrition are myriad-inadequate nutritional intake due to poor appetite, increased nutritional requirements from chronic disease, and malabsorption, as well as non-physiological factors [5]. The ability to regulate food intake in the older person may be both impaired and inadequate following acute illness [6]. Weight loss, which may accompany malnourishment in older patients, may be associated with sarcopenia [7], a well-established risk factor for falls and fractures, and predicts functional decline and physical disability. Malnutrition may be conceptualized as an intricate relationship between the underlying disease processes, dysfunctional metabolic pathways due to chronic and acute illness, limited accessibility to nutrients and increased loss of body muscle and fat [8].

Several studies have shown an association between nutrition and/or frailty and various functional outcomes in the acute and sub-acute setting, although there has been heterogeneity in the assessment tools utilized [9-11]. Furthermore, while malnutrition, frailty and physical disability may co-exist [12], the exact relationship between these states has not been well-clarified. The relationship between dietary modification and improved function is not clear-cut [13]. Although the recently published SHIELD study noted improvements in selected functional measures (leg strength, hand grip in females) in older adults randomized to dietary intervention [14], strong evidence in the acute hospital setting is lacking. Those in the clinical team who have high levels of patient contact are pivotally positioned within the multidisciplinary team to assess and guide nutritional screening, monitoring and care, as part of the holistic management of the older patient. While the rate of nutritional assessment in Australian hospitals has historically been as low as 5% [15] a subsequent review conducted in 2010 has shown a significant increase in malnutrition screening over the intervening decade [16].

In this study, we aimed to evaluate assessment of nutrition in hospital using the MST and SGA. We hypothesized that poorer nutritional status would be associated with reduced functional status at discharge (dependence in any personal activity of daily living [ADL], primary outcome), and with secondary outcomes including longer length of stay (LOS), 3-month readmission, and 6 month mortality following discharge. A pre-specified secondary aim was to identify whether patients from residential aged care facilities (RACFs) were at higher risk of malnutrition than community-dwelling elders.

2. Methods

In this retrospective observational study, older patients admitted (index admission) under geriatric medicine at a tertiary hospital in Australia over a 12 month period were potentially eligible for inclusion. In order to obtain a representative sample from the 1962 admissions over the year, 200 patients aged over 65 years were randomly selected from our database using a computer-generated randomization process (SAS, version 9.4; SAS Institute, Inc., Cary, NC, USA). From these, patients were excluded if medical records were

unavailable. As this was an observational study, data gathered as part of routine clinical care were obtained from the medical records. Medical records were utilized to collect data on patient demography, principal diagnosis, and comorbidities. Baseline frailty was recorded as that 1 month prior to admission, assessed retrospectively by the attending Specialist Geriatrician, and scored based on the 7-point CSHA Clinical Frailty Scale (CFS), with 'frail' status defined as CFS ≥5 [17]. Number and type of comorbidities were scored according to Charslon Comorbidity Index (CCI) [18]. Diagnosis of dementia was determined as per the treating geriatrician, based on DSM IV criteria.

In our hospital, as in many others, nurses caring for each individual patient assess and record anthropometric measures (patient height, weight, body mass index (BMI) in kg/m^2). It is recommended that all admitted adult patient be screened for malnutrition with the MST, as per local policy. In this, patients are questioned regarding recent unintentional weight loss, and recent food intake and/or appetite. A score of ≥2 (scale 0-7) is taken to indicate that a patient is at risk of malnutrition [19], and should prompt referral to the dietitian for assessment. As part of the evaluation of malnutrition, dietetic review will usually include use of the Subjective Global Assessment (SGA) scale, performed by dietitians. This classifies the individual patient into three categories-well nourished (A), mild-moderate malnutrition (B), and severe malnutrition (C) [20]. The primary outcome measure was dependence in any personal activity of daily living (PADL) at discharge, based on assessment by the Occupational Therapist.

Independence in both personal activities of daily living (PADL) and instrumental activities of daily living (IADL) were recorded both at admission and discharge. Secondary outcomes included long length of stay (LOS) defined as LOS in highest quartile, three-month readmission (to our tertiary hospital) and death by six months (identified from the hospital medical records). LOS was also analyzed as a continuous variable.

2.1 Statistical analyses

Comparisons between groups were performed using t-test, rank sum test Chi square analysis or Fisher's exact test as appropriate. The relationship between nutritional status and variables of interest were further investigated on univariate analysis with logistic regression. Logistic regression analysis was used for binary outcomes. Variables with an association with the outcome of interest on univariate analysis ($p<0.05$) were automatically included in the multivariable logistic regression model. Linear regression was utilized for continuous outcome variables. In all analyses, two-tailed P-values <0.05 were considered statistically significant. Statistical analyses were performed using Stata version 13.0, (StataCorp®, Texas, USA). This study was approved by the district Human Research Ethics Committee (LNR/16/LPOOL/209).

3. Results

Table 1 outlines the characteristics of patients studied. Amongst 200 patients identified through randomization, 188 (94%) were included (12 excluded due lack of available medical records). The median age of included subjects was 84 years (IQR 78-89), and those resident in RACFs were slightly older (86.5 versus 83 years, p=0.05). The most common active diagnoses were delirium, respiratory tract infection, and dementia with fall (Table 1). The cohort was frail, with a median CFS of 6 (IQR 5-7), and 87.57% were designated 'frail' (CFS ≥5).

3.1 Anthropomorphic data and nutritional screening outcomes

The median weight for included patients was 62kg (IQR 53-75kg), with a median BMI was 24kg/m^2 (IQR 20-

27kg/m^2). Almost one in five (19.82%, 22/111) had a BMI <20kg/m^2. There was no association between place of residence and BMI (p=0.19). MST was performed in 91.49% (n=172) patients. Over half (57.56%, 99/172) were identified as being at risk of malnutrition (MST score ≥2), 30.30% (n=30/99) were RACF residents while 69.70% were community dwellers (p=0.44). Patients with an MST score indicating that they were at risk of malnutrition were not older than those who had MST <2 (86 versus 82 years, p=0.13) There was no association between sex and MST score ≥2 (p=0.44).

3.2 Further dietetic review in those identified as at risk of malnutrition

Although 99 patients were identified as being at risk of malnutrition, with MST score ≥2, only 42.42% (42/99) underwent in-depth dietetic review. Of this subgroup, 73.81% (n=31/42) of these patients assessed by the dietitian were diagnosed as being malnourished, and half of these were noted to be severely malnourished. Amongst those who proceeded to more in-depth dietetic assessment, males were more often malnourished (OR 6.25, CI 1.15-33.33, p=0.03), while there was no association with age. There was no association between the CFS and either being at risk of malnutrition (MST ≥2) (OR 1.18 per unit increase, CI 0.91-1.54, p=0.20), or, in the subgroup undergoing dietetic review, malnourished status (OR 1.95 per unit increase in CFS, CI 0.77-4.94, p=0.77). Findings were similar- that is, no association seen- when a binary variable (frail versus non-frail) was used.

3.3 RACF residents

Compared to community-dwelling older persons, RACF residence was not associated with increased likelihood of being at risk of malnutrition using the MST (OR 1.33, 95% CI 0.67-2.63, p=0.42), nor in the subgroup who underwent dietetic assessment, of being malnourished (OR 0.67, 95% CI 0.10-4.27, p=0.67).

3.4 Primary outcome: Functional dependence at discharge

In terms of functional assessment and outcomes, a total of 55.48% (n=86) of patients were dependent in at least one PADL at admission. Unsurprisingly, rates of needing assistance with IADL were higher: 93.15% (136/188) at admission, 93.62% at discharge. No association was noted between being identified as at risk of malnutrition (MST ≥2) and dependence in PADL at discharge (OR 0.59, CI 0.25-1.38, p=0.22) (Table 2). Similarly, on subgroup analysis of the dietitian-assessed subgroup (N=42), malnourished status was not associated with dependence for PADL at discharge on univariate analysis (OR 1.31, CI 0.20-8.62, p=0.78).

3.5 Secondary outcomes

With regards to LOS, the overall median LOS stay was 9 days (IQR 5-17) (Table 1). There was no relationship between long LOS(LOS >17 days) and either being at risk of malnutrition (MST ≥2) (p=0.20, Table 2), or, in the subgroup undergoing dietetic review, malnourished status (p=0.74). Results were similar when LOS was analyzed as a continuous variable (p=0.53). Overall, 28.40% (28/169) were readmitted within 3 months of discharge. No association was noted between the MST score and likelihood of being readmitted within 3 months of discharge (OR 1.26, CI 0.63-2.51, p=0.52) (Table 2). In the subgroup who underwent dietetic assessment (N=42), malnourished status was not associated with increased likelihood of being admitted 3 months post discharge (OR 7.86, CI 0.87-71.06, p=0.067). In total, 11.11% 919/171) had died by 6 months. Patients identified as at risk of malnutrition (MST ≥2) did not have an increased likelihood of death by 6 months post-discharge (OR 1.19, CI 0.43-3.30, p=0.74) (Table 2). Likewise, in subgroup analysis of those undergoing formal dietetic review, malnourished status was not associated with dying at 6 months post discharge (OR 1.11, CI 0.07-16.50, p=0.94).

Categorical variables	**N**	**Proportion (%)**
Female sex	101	53.7
Domicile		
RACF resident	52	27.66
Community dwelling	136	72.34
Principal diagnosis		
Delirium	49	27.4
Respiratory tract infection	16	8.9
Dementia with fall	14	7.8
Cellulitis	6	3.6
Injury-skin subcutaneous	5	2.8
Infection-viral illness	5	2.8
Fracture- pelvis	5	2.8
Infection-urinary tract	4	2.2
Cardiac- failure	4	2.2
Fracture- other	4	2.2
Infection-septic shock	3	1.7
Diagnosis of Dementia§	112	61.5
Diagnosis of Delirium§	84	45.7
Dependence for in ADLs at admission		
PADL	86	55.5
IADL	136	93.1
Continuous/ordinal variables	**Median (IQR)**	**Range**
Age, years	84 (78-89)	63-98
Weight (mass), kg*	62 (53-75)	35-128
BMI**	24 (20-27)	14-43
Charlson comorbidity index	2 (1-4)	0-11
Length of stay	9 (5-17)	1-86

*data available for 137; **data available for 111

§ These diagnoses are not mutually exclusive (66 patients had both)

RACF=Residential Aged Care Facility, BMI=Body Mass Index, IQR=Inter-Quartile Range

Table 1: Patient characteristics (*n*=188 included patients). IQR=interquartile range.

Outcome	OR	95% CI	P value
Primary Outcome measure			
Dependence in PADL on discharge	0.59	0.25-1.38	0.22
Secondary Outcome measures			
Long LOS	1.6	0.78-3.27	0.2
Three-month readmission	1.26	0.63-2.51	0.52
Death by 6 months	1.19	0.43-3.30	0.74

Long LOS was defined as LOS in the highest quartile (>17 days). LOS=Length of stay, PADL=personal activities of daily living.

Table 2: Univariate analyses of potential association between being identified as at high risk of malnutrition on MST, and clinical outcomes.

4. Discussion

In an exploratory study of over 180 patients, we found that over half of patients were identified as being at risk of malnutrition using a validated standardized assessment tool. However, only a fraction of these went on to formal dietetic review. Of this subgroup, the majority were noted to indeed be malnourished, and half of these were noted to be severely malnourished. Community-dwellers were as vulnerable as those from RACFs in terms of malnutrition risk and diagnosis. One of the most important findings from our study is that while the vast majority underwent screening with the MST, still almost 1 in 10 patients did not. In aged care, the individual patient is not always able to give a detailed history, highlighting the importance of inter-party communication when patients are transferred between primary care or RACF and the hospital, and the need to engage family and carers in obtaining a collateral history. Furthermore, of those who were identified as at risk of malnutrition, fewer than half were seen by a dietitian. We did not collect data regarding barriers to best practice. It is plausible that equipment access issues (e.g. hoist scales), altered mental status, palliative status, competing priorities, and/or lack of education regarding need for further referral may all have contributed, alone or in combination. We did not explore whether the suboptimal rate of dietetic review represented lack of referral at a nursing and medical level, or lack of dietetic resources (where patient may have been referred, but not seen). In some patients, e.g. those dying, dietetic referral may not have been appropriate. Despite the lack of dietitian input, the management of malnutrition is multidisciplinary, and basic steps to improve nutritional status in at-risk patients- such as encouraging intake or instituting supplements, may have been undertaken in at risk individuals. And some patients may have been referred to community dietetics on discharge. Finally, patients may not understand or believe a diagnosis of malnutrition, highlighting the need to educate and engage patients in the diagnosis and management plan [21].

Previous studies have identified variable prevalence of malnutrition in older persons, depending on population and setting, and in fact, those in subacute or residential setting may be even more at risk than those in the acute hospital setting [2, 22-25]. Our cohort was generally frail, irrespective of residence, with a median CFS score of 6, perhaps explaining why we did not observe associations between nutritional status and either RACF residence or frailty and malnutrition, unlike a previous cross-sectional study, which had reported poorer nutritional status to be associated with frailty [26].

Furthermore, many of our patients (62%) had a diagnosis of dementia, and a common and well-known risk factor both for malnutrition and frailty. Interestingly, in our group, of those who progressed to dietetic review, males were more often noted to be malnourished. This is in contrast to findings from previous work in a group of 718 older Italians living in facilities and at home, where malnutrition, and malnutrition risk, were commoner in women, although women were possibly over-represented in this study [27]. However, the influence of gender on nutritional status may be complex, and in addition to sex-influenced factors such as comorbidity, baseline reserve, and cognitive status, hypotheses regarding psychosocial contributors could range from conventional gender roles giving women an advantage in preparing meals and improving intake, to financial status, to the presence of patriarchal structures where the male dominant figure may be better fed.

While we did not observe an association between poorer nutritional status and functional outcomes, we note that, firstly, many of our patients were quite dependent at both admission and discharge. It may be that acute illness exerts a bigger influence on functional status in the peri-hospitalization period in our cohort given the increased prevalence of frailty. Moreover, only a fraction of those identified as at risk of malnutrition went onto in-depth dietetic assessment, limiting our ability to truly delineate the relationship between a formal diagnosis of malnutrition and dependence in PADL. Finally, the measure we used (dependence in any PADL) may have been insufficiently sensitive to detect poorer function. While some authors have described an association between poorer nutritional status and more global measures of function or mobility [9, 10], others have specifically reported reduced performance on specific functional measures such as hand grip strength, leg strength, timed up and go and short physical performance battery test [11, 14]. Malnutrition is a complex syndrome, and reflects a complex interplay of biopsychosocial factors, which may variably influence mortality. Although we did not find an association between nutritional status and death by 6 months, existing literature indicates that there may be an association, with poorer nutritional status associated with mortality [2, 28, 29], even after adjusting for comorbidities, functional status and acute illness. Our numbers may have been underpowered to detect an association, or our follow up too short; we also note that 6 month follow up was only complete for 91% of the cohort.

Strengths of our study include the reporting of findings from a real-world in-patient setting, in a relatively large random sample of vulnerable older patients. By using a randomized sample, we minimized bias. We allowed for broad inclusion criteria, and did not exclude patients based on cognitive status, linguistic background, or residential status, as can be seen in some studies, making this representative of unselected older patients encountered in day to day practice. Furthermore, some of the seeming 'limitations' we encountered- such as suboptimal involvement of specialist dietitians- may be reflective of challenges in other busy hospital settings, and in fact represent one of the most important findings of this paper. We highlight that our findings must be interpreted in light of the study's limitations. Barriers to formal nutritional and/or dietetic assessment were not explored. The retrospective nature of the study meant that we relied on sometimes-limited documentation. Although the study was confined to our institution and generalizability of our findings may be limited, it nonetheless highlights the high rates of potential malnutrition, and difficulties encountered in ensuring optimal nutritional assessment and management which can occur in real-world practice.

5. Conclusion

The findings from our study highlight that current practice in the acute hospital setting may be subject to gaps in terms of both identification of malnutrition risk, and appropriate referral to specialist multidisciplinary services. Older in-patients appear to be at high risk of malnutrition, although the association with clinical outcomes such as function and mortality may be complex and subject to a complex interplay of influencing factors. A team approach to assessment and treatment is likely to best serve this vulnerable population in the acute hospital. In tandem with this, other opportunities for screening and management need to be considered, including in primary care and residential settings. Further research in the acute setting might concentrate on identification and solutions to existing barriers to best practice, and in-depth exploration of the interaction between nutrition, comorbidity, frailty and outcomes. This must include randomized controlled trials in specific settings, to address the impact of nutritional interventions in older frailer patients, in order to strengthen the evidence base for the care of our patients.

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Conflicts of Interest

No conflicts of interest to declare.

Authors' Contributions

AS and DN contributed to study conceptualization and design, data collection, statistical analysis, drafting, revision and finalization of the manuscript.

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