Age and Ageing 2001; **30:** 221–226

Does the Mini Nutritional Assessment predict hospitalization outcomes in older people?

MARIE-CLAIRE VAN NES, FRANÇOIS R. HERRMANN, GABRIEL GOLD, JEAN-PIERRE MICHEL, RENÉ RIZZOLI

Department of Geriatric Medicine, University Hospitals, Geneva, Switzerland

Address correspondence to: G. Gold, Hôpital de Gériatrie, Route de Mon Idée, CH-1226 Thônex, Switzerland. Fax: (+41) 22 305 6115. Email: Gabriel.Gold@hcuge.ch

Abstract

Background: the Mini Nutritional Assessment is a validated clinical tool for the assessment of nutritional status in older people. Moderate to severe malnutrition is common in elderly patients in hospital and is associated with a poor outcome.
Objectives: to determine whether the Mini Nutritional Assessment can predict the outcome of hospital stay in older individuals.
Setting: a tertiary-care geriatric hospital.
Methods: we evaluated nutritional status using the Mini Nutritional Assessment in 1319 patients (mean age 84.2, 70% women) admitted between February 1996 and January 1998; 1145 complete assessments were available for analysis. The assessment was carried out on admission and studied in relation to length of stay and in-hospital mortality for all patients, and discharge to a nursing home for those living at home before admission.
Results: Mini Nutritional Assessment scores averaged 19.9 ± 3.8 (mean $\pm$ SD) with a range of 8.0–27.5, and a median of 20.5. A score below 17, corresponding to malnutrition, was associated with an almost threefold increase in mortality and in the rate of discharge to a nursing home; this contrasted with a score above 24, which indicates satisfactory nutritional status (11.3% *vs* 3.7%; $P < 0.01$ and 20.3% *vs* 7.7%; $P < 0.001$, respectively). Length of stay was longer in the low scoring group (42.0 days *vs* 30.5 days; $P < 0.0002$).
Conclusion: Poor nutritional status as measured by the Mini Nutritional Assessment was associated with increased in-hospital mortality, a higher rate of discharge to nursing homes and a longer length of stay.

Keywords: *aged, hospitalization outcome, length of stay, Mini Nutritional Assessment, mortality, nutritional status*

Introduction

Moderate to severe malnutrition is particularly common in elderly hospital patients [1–4]. As has been demonstrated in surgery wards, there is an association between malnutrition and important hospital stay outcomes such as mortality [5], length of stay [6–7], readmission rate [8–10] and discharge destination [11–12]. In these studies, the assessment of nutritional status was mainly based on serum albumin levels or isolated anthropometrical measurements, which are particularly prone to confounding factors.

Clinical assessment tools have only recently been developed, but are not yet widely used [13–15]. One of them, the Mini Nutritional Assessment (MNA) is a simple clinical scale for the evaluation of the nutritional status of frail elderly subjects. It has been validated in older people by comparing it with a clinical assessment performed by expert geriatric nutritionists [16, 17]. It is a cheap and easy way of screening aged individuals in order to detect those who are at risk of developing complications caused by malnutrition. However, its ability at predicting the outcome of hospital stay in older people has not been tested.

To address this issue, we analysed the relationship between outcome and the MNA prospectively collected over a 2-year period in a general geriatric hospital.

Subjects and methods

Subjects

The study population consisted of a convenience sample of 1319 patients admitted to the Geneva Hospital of Geriatric Medicine (a tertiary-care facility) between February 1996 and January 1998. The analysis includes the 1145 of this group who had a complete MNA on admission. This represents 24% of the 4677 admissions to the hospital during the study period.

Nutritional assessment

The MNA is composed of 18 items, including anthropometrical measurements (weight, height and weight loss), a global assessment (six questions related to lifestyle, medication and mobility), a dietary questionnaire (eight questions related to the number of meals, food and fluid intake) and a subjective assessment (self-perception of health and nutrition). The maximum score is 30 points, the risk for malnutrition increasing with lower scores. We used the MNA score to classify patients as well-nourished (a score of 24–30), at risk for malnutrition (a score of 17–23.5) or malnourished (a score of <17) [16–18].

The MNA was administered by the physician in charge of the patient—except for the dietary questionnaire, which was completed by the dieticians. Inter-rater reliability, tested on a subgroup of patients, was high for MNA scores ($\kappa=0.8$) and perfect for the categorical nutritional status classification described above ($\kappa=1.0$).

Outcome

We studied length of stay and in-hospital mortality in the 1145 patients with a complete MNA. We analysed numbers discharged to nursing homes only for patients living at home before admission ($n=908$). We also compared outcomes in the study population with those in the other 3532 people who were admitted during the same period, but whose nutritional status was not assessed with the MNA, or who had an incomplete MNA record. We also assessed the predictive value of each individual MNA item.

Statistical analysis

We analysed frequencies using the χ^2 test. Means were compared using analysis of variance when the continuous variables were normally distributed; otherwise, groups were compared using a Kruskall–Wallis test. We used linear regression to evaluate the relation between MNA scores and age. Bonferroni's correction for multiple comparisons was applied when assessing the relationship between outcomes and the 18 individual items of the MNA; thus the P threshold value was set to 0.0028 for theses analyses (corresponding to 0.05 divided by 18).

Results

Patients in the groups with and without an available complete MNA were similar in terms of sex distribution, age, marital status and percentage discharged to nursing home. However, there were more hospital deaths and a slightly shorter length of stay in the group without an MNA (Table 1).

MNA scores averaged 19.9 ± 3.8 (SD) and ranged from a minimum of 8.0 to a maximum of 27.5, with a median at 20.5. There was no relation with age or sex. There was a strong relationship between mortality and MNA scores, with a threefold increase in death rate in malnourished individuals (MNA score <17) compared with the well-nourished group (MNA $\geqslant 24$). The median length of stay was also closely related to the MNA, and increased from 30.5 days in those with a score $\geqslant 24$ to 42.0 days in those with a score <17 (Table 2).

Among the 908 patients living at home before admission, 32 (20.3%) of 158 with a score <17 were discharged to a nursing home compared with 99 (18.3%) of 542 with a score of 17–23.5 and 16 (7.7%) of 208 with a score $\geqslant 24$ ($P<0.001$).

Interestingly, individual MNA items were not similarly associated with hospitalization outcomes. Mid-arm and calf circumference measurements were associated with an increased risk of in-hospital death, while neuropsychological problems and the ability to live independently were associated with a higher rate of nursing home transfer, and five items were related to a longer length of stay (Table 3).

Discussion

We report a striking increase in mortality, a greater likelihood of discharge to nursing home and a prolonged hospital stay in individuals with a low MNA score based on a large data set of hospitalized elderly patients. Our findings are consistent with nutritional evaluations of elderly people at home, which also show significantly increased mortality in subjects with a low MNA score [19].

Our study has some limitations. The MNA was not completed for every patient admitted, and there was no randomization between patients who underwent the MNA and those who did not. Mortality was higher in the latter group. This suggests that sicker patients were not submitted to the MNA, as malnutrition was probably clinically evident, thus obviating the need for a screening procedure. However, patients who did have a MNA were similar in many respects to those who did not, and we believe it is unlikely that our results are due to selection bias alone.

Table 1. Characteristics and main outcomes of patients with and without a Mini Nutritional Assessment performed

		Mini Nutritional Assessment		
	All	Yes	No	*P*
No. of patients	4677	1145	3532	
Age, years				
Mean (SD)	84.2 (6.9)	84.1 (6.7)	84.2 (6.9)	0.59
Median	85.1	85.0	85.2	
Length of stay, days				
Mean (SD)	46.6 (42.7)	48.8 (41.3)	45.9 (43.1)	0.045
Median	34	36	33	
No. (and %)				
Women	3240	803 (70.1)	2437 (69.0)	0.69
Married	1294	316 (27.6)	978 (27.7)	0.95
Died in hospital	513	80 (7.0)	433 (12.3)	<0.001
Discharged to nursing home	602	147 (12.8)	455 (12.9)	0.104

Table 2. Prevalence (%) of specific outcomes according to Mini Nutritional Assessment categories

	Mini Nutritional Assessment score				
	<17 ($n=213$)	17–23.5 ($n=688$)	$\geqslant 24$ ($n=244$)	All ($n=1145$)	*P* value
In-hospital death, %	11.3	6.8	3.7	80	<0.01
Length of stay, days					
Mean (SD)	52.8 (43.7)	50.4 (42.0)	40.7 (36.1)	48.8 (41.3)	<0.001
Median	42.0	36.5	30.5	36	

Table 3. Relationship between hospitalization outcomes and individual Mini Nutritional Assessment items

	Outcome						
	Death (80/1145)		Nursing-home transfer (147/908)		Length of stay, days ($n=1145$)		
Item	%	*P* value	%	*P* value	Mean	SD	*P* value
Anthropometric assessment							
Body mass index, kg/m^2		0.010		0.026			0.035
<19	12.9		17.6		49.0	35.8	
$\geqslant 19, <21$	9.2		24.8		55.2	48.0	
$\geqslant 21, <23$	6.9		18.5		53.2	46.4	
$\geqslant 23$	5.3		13.5		46.0	39.0	
Mid-arm circumference, cm		0.000[a]		0.806			0.003
<21	11.7		18.3		59.4	50.3	
$\geqslant 21, \leqslant 22$	12.8		15.7		49.2	38.9	
>22	5.1		15.9		46.9	39.8	
Calf circumference, cm		0.001[a]		0.047			0.003[a]
<31	9.7		19.0		53.0	43.8	
$\geqslant 31$	4.7		14.1		45.6	39.1	
Weight loss during last 3 months		0.634		0.067			0.015
>3 kg	8.8		23.9		56.7	53.1	
Does not know	7.4		17.0		50.6	42.9	
1–3 kg	7.1		17.9		43.3	33.4	
None	5.4		11.7		43.7	34.5	
General assessment							
Lives independently		0.029		0.000[a]			0.001[a]
No	9.9		24.4		55.7	47.0	
Yes	6.0		13.6		46.5	39.0	
Takes >3 drugs a day		0.012		0.008			0.580
No	4.6		20.2		47.9	41.1	
Yes	8.5		13.6		49.3	41.5	

Table 3. (*Continued*)

	Outcome						
	Death (80/1145)		Nursing-home transfer (147/908)		Length of stay, days (n=1145)		
Item	%	*P* value	%	*P* value	Mean	SD	*P* value
Stress or acute disease		0.140		0.488			0.881
No	6.1		16.8		48.6	41.5	
Yes	8.4		15.1		49.0	41.1	
Mobility		0.059		0.059			0.002[a]
Bed- or chair-bound	11.8		24.1		58.6	45.9	
Does not go out	7.6		19.4		51.9	43.0	
Goes out	5.9		13.6		45.7	39.4	
Neuropsychological problems		0.960		0.000[a]			0.000[a]
Severe dementia/depression	6.3		32.6		52.6	42.5	
Mild dementia	7.2		22.9		55.2	48.3	
None	6.9		9.8		43.9	34.8	
Pressure sores		0.321		0.506			0.001[a]
No	6.8		15.9		47.6	40.3	
Yes	9.5		18.9		62.1	49.2	
Dietary assessment							
No. of meals per day		0.336		0.182			0.500
1	6.5		22.7		52.9	41.5	
2	5.1		15.8		48.1	41.3	
3	7.8		15.3		48.4	41.3	
Eats D, L/E, M/F/P every day		0.234		0.220			0.840
Yes to 0 or 1	10.8		21.2		49.8	36.6	
Yes to 2	6.2		17.7		47.8	39.7	
Yes to all	6.8		14.6		49.2	42.9	
Eats fruits or vegetables twice a day		0.323		0.085			0.140
No	5.8		19.6		51.7	42.2	
Yes	7.4		14.9		47.7	41.0	
Loss of appetite		0.087		0.087			0.762
Severe	13.1		14.3		46.1	39.1	
Moderate	8.0		15.8		47.8	36.8	
None	6.1		16.5		49.3	43.0	
Daily fluid consumption, cups		0.813		0.137			0.025
<3	7.9		15.7		55.1	43.9	
3–5	6.5		18.5		50.5	43.1	
>5	7.3		13.4		45.1	38.1	
Mode of feeding		0.037		0.037			0.200
Needs assistance	5.7		18.2		54.1	60.2	
Self-fed with difficulty	13.0		22.2		54.7	40.7	
Self-fed without difficulty	6.4		15.5		48.0	40.6	
Self-assessment							
Self-assessed malnutrition		0.110		0.571			0.081
Major	6.1		20.7		34.1	26.3	
Moderate/does not know	9.9		17.9		51.1	37.5	
None	6.1		15.5		48.6	42.8	
Health status compared with peers		0.248		0.239			0.678
Not as good	6.5		14.8		48.3	39.7	
Does not know	9.9		21.2		47.6	39.1	
As good	6.8		16.4		50.2	43.7	
Better	3.1		10.7		44.4	39.2	

D, dairy products; L/E, legumes or eggs; M/F/P, meat, fish or poultry.
[a]Significant after Bonferroni's correction for multiple comparisons.

Nutritional status affects major systems, including the immune defences, gait and balance [20] and cognitive function [21], and is a risk factor for infections, falls, delirium and adverse drug reactions. However, it is often difficult to distinguish the effects of malnutrition on health outcomes and mortality from those of associated co-morbidities and functional limitations [22]. In a recently studied nursing-home population, the MNA

correlated with mental health and medication use but not with activities of daily living scores; whether this is also true in hospitalized older patients is unclear [23].

Our data do not allow us to determine the relative contribution of malnutrition and of non-nutritional factors to poor clinical outcomes in patients with a low MNA score. However, intervention studies have shown that nutritional support can shorten hospital stay and improve outcomes in older hip fracture patients, suggesting that nutritional status *per se* may be an important determinant of patient outcome in certain hospitalized populations [24, 25].

Nutritional evaluation is a key component of comprehensive geriatric assessment [15, 26, 27]. The MNA is a validated tool that does not rely on laboratory tests. It can easily be administered by any health professional. In our experience, nutritional status as measured by the MNA was closely associated with outcomes in older hospitalized populations. Patients with a low MNA score were more likely to die, to be discharged to a nursing home, and to have a longer length of stay. Whether the MNA would be able to identify correctly patients likely to benefit from nutritional support, and consequently to have a more favourable outcome, deserves further investigation.

Key points

- A low Mini Nutritional Assessment score, indicative of malnutrition, is common in hospitalized elderly patients.
- The Mini Nutritional Assessment score can predict hospital stay outcomes in older patients.
- A low Mini Nutritional Assessment score is associated with a striking increase in mortality, prolonged length of stay and a greater likelihood of discharge to nursing home.

Acknowledgements

We thank the dieticians of the Department of Geriatric Medicine of the University Hospitals of Geneva for collecting the data.

References

1. Covinski K, Martin G, Beyth RJ *et al.* The relationship between clinical assessments and nutritional status and adverse outcomes in older hospitalized patients. J Am Geriatr Soc 1999; 47: 532–8.

2. Sullivan DH, Sun S, Walls RC. Protein-energy undernutrition among elderly hospitalized patients. J Am Med Assoc 1999; 281: 2013–19.

3. Burns JT, Jensen GL. Malnutrition among geriatric patients admitted to medical and surgical services in a tertiary care hospital: frequency, recognition, and associated disposition and reimbursement outcomes. Nutrition 1995; 11: 245–9.

4. Constans T, Bacq Y, Brechot JF *et al.* Protein-energy malnutrition in elderly medical patients. J Am Geriatr Soc 1992; 40: 263–8.

5. Burness R, Horne G, Purdi G. Albumin levels and mortality in patients with hip fractures. N Z Med J 1996; 109: 56–7.

6. Anderson MD, Collins G, Davis G *et al.* Malnutrition and length of stay: a relationship? Henry Ford Hosp Med J 1985; 33: 190–3.

7. Bernstein LH. Relationship of nutritional markers to length of hospital stay. Nutrition 1995; 11: 205–9.

8. Sullivan DH. Risk factors for early hospital readmission in a select population of geriatric rehabilitation patients: the significance of nutritional status. J Am Geriatr Soc 1992; 40: 792–8.

9. Herrmann FR, Safran C, Levkoff SD, Minaker KL. Serum albumin level on admission as a predictor of death, length of stay and readmission. Arch Intern Med 1992; 152: 125–30.

10. Friedmann JM, Jensen GL, Smiciklas-Wright H, McCamish MA. Predicting early nonelective hospital readmission in nutritionally compromised older adults. Am J Clin Nutr 1997; 65: 1714–20.

11. Potter J, Klipstein K, Reilly JJ, Roberts M. The nutritional status and clinical course of acute admissions to a geriatric unit. Age Ageing 1995; 24: 131–6.

12. Chima CS, Barco K, Dewitt ML *et al.* Relationship of nutritional status to length of stay, hospital costs and discharge status of patients hospitalized in the medicine service. J Am Diet Assoc 1997; 97: 975–8.

13. Detsky AS, Baker JP, Mendelson RA *et al.* Evaluating the accuracy of nutritional assessment techniques applied to hospitalized patients. Methodology and comparison. J Parent Enter Nutr 1984; 8: 153–9.

14. Hirsch S, de Obaldia N, Peterman M *et al.* Subjective global assessment of nutritional status: further validation. Nutrition 1991; 7: 35–8.

15. Antonelli Incalzi R, Landi F, Cipriani L *et al.* Nutritional assessment: a primary component of multidimensional geriatric assessment in the acute care setting. J Am Geriatr Soc 1996; 44: 166–74.

16. Guigoz Y, Vellas B, Garry PJ. Mini Nutritional Assessment: a practical assessment tool for grading the nutritional status of elderly patients. Facts and Research in Gerontology. Paris: Serdi Publishing, 1994; 15–59.

17. Vellas B, Guigoz Y, Garry PJ *et al.* The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. Nutrition 1999; 15: 116–22.

18. Lauque S, Arnaud-Battandier F, Mansourian R *et al.* Protein-energy oral supplementation in malnourished nursing-home residents. A controlled trial. Age Ageing 2000; 29: 51–6.

19. Beck AM, Ovesen L, Osler M. The Mini Nutritional Assessment (MNA) and the Determine your Nutritional

Health Checklist (NSI checklist) as predictors of morbidity and mortality in an elderly Danish population. Br J Nutr 1999; 81: 31–6.

20. Vellas BJ, Baumgartner RN, Garry PJ, Albarede JL. The roles of nutrition and body composition in falls, gait, and balance disorders in the elderly. In Morley JE, Glick Z, Rubenstein LZ eds. Geriatric Nutrition. New York: Raven Press, 1995; 343–7.

21. Rosenberg IH, Miller JW. Nutritional factors in physical and cognitive functions of elderly people. Am J Clin Nutr 1992; 55: 1237S–43S.

22. Sullivan DH. The role of nutrition in increased morbidity and mortality. Clin Geriatr Med 1995; 11: 661–74.

23. Saletti A, Lindgren EY, Johansson L, Cederholm T. Nutritional status according to mini nutritional assessment in an institutionalized elderly population in Sweden. Gerontology 2000; 46: 139–45.

24. Schurch MA, Rizzoli R, Slosman D *et al.* Protein supplements increase serum insulin-like growth factor I levels and attenuate proximal femur bone loss in patients with recent hip fracture. A randomized, double-blind, placebo-controlled trial. Ann Intern Med 1998; 128: 801–9.

25. Chevalley T, Rizzoli R, Nydegger V *et al.* Effects of calcium supplements on femoral bone mineral density and vertebral fracture rate in vitamin-D-replete elderly patients. Osteoporosis Int 1994; 4: 245–52.

26. Rubenstein LZ, Harker J, Guigoz Y, Vellas B. Comprehensive Geriatric Assessment (CGA) and the MNA: an overview of CGA, Nutritional Assessment, and Development of a shortened version of the MNA. In Vellas B, Garry PJ, Guigoz Y eds. Mini Nutritional Assessment (MNA): research and practice in the elderly. Basel: Karger, 1999; 101–16.

27. Vellas BJ, Guigoz Y. Nutritional assessment as part of the geriatric evaluation. In Rubenstein LZ, Wieland D, Bernabei R eds. Geriatric Assessment Technology: the state of the art. Milan: Kurtis, 1995; 179–84.

Received 20 July 2000; accepted in revised form 23 November 2001