Diet and Nutrition in Dementia and Cognitive Decline

Edited by
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Chapter 110

The Mini-Nutritional Assessment and Cognitive Impairment in Older People

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LIST OF ABBREVIATIONS

AD Alzheimer's disease
ADL activities of daily living
BMI body mass index
ELSA study Etude Longitudinale de Suivi de la Maladie d'Alzheimer
MD mixed dementia
MCI mild cognitive impairment
MMSE Mini-Mental State Examination
MNA mini-nutritional assessment
MNA-SF MNA short form
MPI Multidimensional Prognostic Index
NutriAlz the health and nutrition promotion program for patients with dementia
REAL.FR study French network on Alzheimer's disease
VaD vascular dementia

INTRODUCTION

Malnutrition is a major health problem in older adults worldwide, including in industrialized countries [1,2]. This leads to many complications, influencing negatively the quality of life [3] and increasing morbidity and mortality rates [4], with a profound impact on healthcare systems. Moreover, poor nutritional status is associated with several geriatric syndromes [5] including cognitive impairment [6], which represents one of the main causes of disability in older age [7] with very high costs. Despite its prevalence in the elderly, malnutrition is also often misdiagnosed, unrecognized, and untreated in older people, particularly in those with cognitive decline. This is in part because of the frailty of these subjects, and in part because cognitive decline frequently contributes further to difficulties in assessment of nutritional status (difficulties in obtaining correct and accurate information). Furthermore, medical teams and other health care professionals are often insufficiently aware of the importance of nutritional screening or assessment in older people with cognitive decline.

The early detection of malnutrition and the risk of malnutrition remains an important strategy for improving the care of older people. Therefore, in the past two decades, many researchers tried to find a tool for identifying older people with poor nutritional status or at high risk of malnutrition.

Among the various nutritional screening tools developed as rapid, easily administered, and mass screening tools, the mini-nutritional assessment (MNA) [8–10], a comprehensive tool developed and described by Vellas and colleagues in the 1990s, has become the best validated and most widely utilized screening test specifically developed to quickly identify malnutrition in frail older people [11]. It can be easily used both in full (MNA) [8–10,12] and/or in short form (MNA-SF) [13] to assess the nutritional status also in subjects with dementia or mild cognitive decline and to identify those who could benefit from early nutritional intervention. The MNA administrated in its two-step procedure, including a nutritional screening (MNA-SF) and an assessment for subjects at risk of malnutrition (full MNA), appeared to be a good, feasible, and reliable tool for predicting malnutrition in frail older people with deep or mild cognitive decline, if the test is completed with the help of family or caregivers [10,14]. Therefore, it should be included in the comprehensive geriatric assessment (CGA) of older subjects with cognitive decline, as already reported for general older people [15,16].

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TABLE 110.1 Validity of the Three Versions of the MNA

Version	Sensitivity	Specificity	Positive Predictive Value
Original full MNA (version 1)	96% [9]	98% [9]	97% [9]
MNA-SF (version 2)	97.9% [13]	100% [13]	99% [13]
Newest MNA-SF (version 3)	89% [18]	82% [18]	Youden Index [18] = 0.70

MNA PROCEDURE

Currently, several screening instruments are utilized for evaluating malnutrition in older people, together with clinical diagnostic tests, anthropometry, bioelectrical impedance analysis, or biochemical markers. The MNA is a rapid assessment tool designed and validated to quickly assess the nutritional status in healthy and frail older people as part of a CGA [8–12,14–16]. Up to now it has been translated in over 20 languages, and it is internationally used in several geriatric settings (free living, home care, institutionalized, and hospitalized), both in clinical practice and in clinical research. The MNA was originally developed in the 1990s by the Centre for Internal Medicine and Clinical Gerontology of Toulouse (France), together with the Clinical Nutrition Program at the University of New Mexico (United States) and the Nestlè Research Centre in Lausanne (Switzerland). As claimed by its developers, it was designed to represent "a reliable scale, usable by a generalist assessor, inexpensive and well acceptable to patients, with clearly defined thresholds and minimal opportunity for bias dependent on data collector" [10,14]. The MNA two-step procedure, including a nutritional screening (MNA-SF), which takes less than 5 min, and an assessment for patients at risk of malnutrition (full MNA), which can be completed in approximately 10–15 min, represent a reproducible and inexpensive tool, with high sensitivity (96%), specificity (98%), positive predictive value (97%), and a level of reliability equal to 0.89 [9,17] (Table 110.1).

The MNA procedure evolved over the years via three steps:

1. The original version of the MNA (full MNA or version 1) [8–12,14], validated in the 1990s for a thorough nutritional evaluation, measures 18 items grouped in four sections (Table 110.2). Different sections of MNA assess different components of nutritional status: (1) MNA-1 = anthropometric measurements (4 items), including weight and height to calculate body mass index (BMI), arm and calf circumferences, and weight loss (score: 0–8 points); (2) MNA-2 = general assessment (6 items), including residential status, psychological problems, mobility, medications, and skin ulcers (score: 0–9 points); (3) MNA-3 = assessment of dietetic habits (6 items), including number of meals, food and fluid intake, and autonomy of feeding (score: 0–9 points); (4) MNA-4 = subjective assessment (2 items), including self-perception quality of health and nutrition (score: 0–4 points). Each item has a numerical value and contributes to the final score, which has a maximum of 30 points. The MNA score is used to classify subjects as well nourished (score of 24–30), at risk for malnutrition (score of 17–23.5), or malnourished (score less than 17), according to the original cut-off point of the MNA full test [9,14].
2. The MNA two-step procedure, which incorporated within the full MNA the short form of MNA (MNA-SF, or version 2) [13], was validated in 2001 for screening of malnutrition in low-risk patients. It comprises BMI measurement and the assessment of five other MNA items including questions related to food intake, weight loss, mobility, psychological stress, and neuropsychological problems such as dementia or depression (Table 110.2), with a maximum score of 14 (step 1—screening). The MNA-SF can distinguish subjects well nourished (score of 12–14), requiring no further investigation from those at risk for malnutrition (score of 8–11), or malnourished (score less than 8), in which diagnostic confirmation by completing the full MNA is required (step 2—assessment), with a similar validity and accuracy of the full MNA (Table 110.1).
3. The revised MNA-SF (newest MNA-SF, or version 3) [18] was validated as a stand-alone tool in 2009, including the same six MNA-SF questions, with the option to substitute calf circumference if BMI is not available.

MNA AND DEMENTIA

From 1995 to 2005, many authors investigated the relationship between the nutritional status measured by the MNA and different grades of cognitive impairment in several geriatric settings (free living, home care, institutionalized, and hospitalized). Cognitively impaired older subjects were generally characterized not only by weight loss or food disorders [19], but also by MNA scores indicative of risk of malnutrition or malnutrition, even in the absence of significant differences in BMI [20].

TABLE 110.2 The MNA 18 Items [8–14] Grouped in Four Sections

MNA-1 Anthropometric measurements	**Weight loss during the past 3 months[a]**
	0 = weight loss greater than 3 kg (6.6 lbs)
	1 = does not know
	2 = weight loss between 1 and 3 kg (2.2 and 6.6 lb)
	3 = no weight loss
	Body Mass Index (BMI) (weight in kg)/(height in m^2)[a]
	0 = BMI less than 19
	1 = BMI 19 to less than 21
	2 = BMI 21 to less than 23
	3 = BMI 23 or greater
	Mid-arm circumference (MAC) in cm
	0.0 = MAC less than 21
	0.5 = MAC 21 to 22
	1.0 = MAC 22 or greater
	Calf circumference (CC) in cm
	0 = CC less than 31
	1 = CC 31 or greater
MNA-2 General assessment	**Mobility[a]**
	0 = bed or chair bound
	1 = able to get out bed/chair but does not go out
	2 = goes out
	Has suffered psychological stress or acute disease in the past 3 months?[a]
	0 = yes 2 = no
	Neuropsychological problems[a]
	0 = severe dementia or depression
	1 = mild dementia
	2 = no psychological problems
	Lives independently (not in nursing home or hospital)
	1 = yes 0 = no
	Takes more than 3 prescription drugs per day
	0 = yes 1 = no
	Pressure sores or skin ulcers
	0 = yes 1 = no
MNA-3 Assessment of dietetic habits	**Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?[a]**
	0 = severe decrease in food intake

(Continued)

TABLE 110.2 (Continued)

	1 = moderate decrease in food intake
	2 = no decrease in food intake
	How many full meals does the patient eat daily?
	0 = 1 meal
	1 = 2 meals
	2 = 3 meals
	Selected consumption markers for protein intake
	– **at least one serving of dairy products (milk, cheese, yogurt) per day: yes or no** – **two or more servings of legumes or eggs per week: yes or no** – **meat, fish, or poultry every day: yes or no**
	0.0 = if 0 or 1 yes
	0.5 = if 2 yes
	1.0 = if 3 yes
	Consumes two or more servings of fruit or vegetables per day?
	0 = no 1 = yes
	How much fluid (water, juice, coffee, tea, milk...) is consumed per day?
	0.0 = less than 3 cups
	0.5 = 3 to 5 cups
	1.0 = more than 5 cups
	Mode of feeding
	0 = unable to eat without assistance
	1 = self-fed with some difficulty
	2 = self-fed without any problem
MNA-4 Subjective assessment	**Self view of nutritional status**
	0 = views self as being malnourished
	1 = is uncertain of nutritional status
	2 = views self as having no nutritional problem
	In comparison with other people of same age, how does the patient consider his/her health status?
	0.0 = not as good
	0.5 = does not know
	1.0 = as good
	2.0 = better
SCREENING SCORE (MNA-SF)[a]:	
12 to 14 points: normal nutritional status 8 to 11 points: at risk of malnutrition Less than 8 points: malnourished	
For a more in-depth assessment, continue with the remaining 12 MNA items	
ASSESSMENT SCORE (FULL MNA):	
24 to 30 points: normal nutritional status 17 to 23.5 points: at risk of malnutrition Less than 17 points: malnourished	

[a]*Item included in the nutritional screening MNA-SF.*

The Etude Longitudinale de Suivì de la Maladie d'Alzheimer (ELSA study), a longitudinal study on a population of patients with Alzheimer's disease (AD) living in the community, has followed patients with AD since 1994. The ELSA study found a mean MNA score = 24 ± 2.3, with 6% of subjects having an MNA score ≤17 (malnourished), 37% between 17 and 23.5 (at risk of malnutrition), and 57% of them an MNA of >23.5 (well nourished) [21]. The MNA tool seemed to be useful in following nutritional status of these AD subjects, showing the decrease in MNA score over a 1-year period of follow-up significantly related to weight loss and/or eating behavior.

However, the prevalence of malnutrition described in 16 studies mainly conducted in Western Europe including 3,313 cognitively impaired older subjects who were screened using the MNA was variable, ranging between 0% and 74% (Table 110.3) [4,6,22–35]. As already described by Guigoz [14], this large variability about the prevalence of the MNA categories in subjects with dementia results mainly from the different levels of cognitive impairment and levels of dependence and health status among the different settings (Figure 110.1).

In line with the increasing number of reports, the presence of malnutrition assessed by MNA among patients suffering from dementia seems strictly related to patients' age and duration of disease, severity of cognitive impairment and disability, aggravation of psychological and behavioral symptoms, and the stress of caregivers [19,21,30,36]. In particular, in a sample of 143 AD patients with a mean Mini-Mental State Examination (MMSE) score of <13 was found a mean MNA score of 19.9 [20], while in a prospective study of 395 AD patients with mean MMSE score >17 was found a mean MNA score of 24.8 [37]. Moreover, in a recent cross-sectional study comprising community-dwelling older persons and their family caregivers, the MNA score of older people with dementia was strongly and inversely associated with the activities of daily living (ADL) score and was strongly and positively associated with the MNA score of the family caregiver, confirming the value of investigating nutritional deficiencies in dementia within the caregiving dyad and suggesting that the functional status of older people with dementia and the nutritional status of family caregivers should be carefully assessed [24].

One-year follow-up of older AD patients living at home reported that lower nutritional status assessed by the MNA is also related to a higher risk of institutionalization [32] or hospitalization in an acute-emergency ward [38].

Data from the prospective longitudinal study conducted by the French network on Alzheimer's disease (the REAL.FR study) on 677 older community-dwelling AD patients revealed that the patients living alone were at increased risk of malnutrition, representing a subpopulation with specific needs requiring great attention [26].

According to previous findings, reporting nutritional status did not vary in patients with various dementia diagnoses [39], several studies also indicated that nutritional status assessed by MNA did not vary in cognitively impaired patients with AD, vascular dementia (VaD), mixed dementia (MD), and other types of dementias, showing a high percentage of malnutrition in all subgroups of demented patients, particularly evident in subjects with deeper cognitive impairment [6,25,40]. However, interesting data from the health and nutrition promotion program for patients with dementia (NutriAlz), a cluster-randomized clinical trial conducted in the region of Catalonia (Spain) that compared a health and nutrition promotion program versus usual care in a cohort of community-dwelling elderly subjects with dementia, have recently shown that malnutrition was more frequent in Lewy bodies dementia than in other types of cognitive impairments [22]. Further studies will be needed to adequately clarify this topic.

With regard to the single sections of MNA, novel findings reporting lower MNA-3 and MNA-4 subscores in patients with dementia suggest that some components of nutritional profile such us dietary habits (MNA-3) and subjective assessment of self-perceived quality of health and nutrition (MNA-4) could be very important variables to be considered in the multidimensional evaluation of cognitive impairment subjects, although the relation between cognitive decline and nutritional status is complex and reciprocal [23].

In agreement with previous studies that showed a possible impact of malnutrition on cognitive decline and also that poor nutritional habits seem to be linked to disease progression in very mild AD [41], recent studies confirmed in AD subjects at risk of malnutrition a rapid cognitive decline greater than those well nourished [19].

The identification of a significant association between MNA score and grade of cognitive impairment allowed health care professionals to use this tool to evaluate the efficacy of several therapeutic interventions. Recent data confirmed the effectiveness of the MNA in the follow-up of AD patients treated with acetylcholinesterase inhibitors or atypical antipsychotic drugs [42,43]. The MNA also seemed useful in monitoring nutritional status of cognitively impaired subjects receiving specific nutritional support and in confirming its efficacy in improving the nutritional and health status, as recently demonstrated by several research groups including the NutriAlz program [44]. Finally, recent findings from a multicenter trial (2011) highlighted the potential benefits of a medical food called Souvenaid not only on nutritional status but also on specific cognitive areas [45]. Further intervention studies will undoubtedly be informative in this regard.

TABLE 110.3 Nutritional Status According to the MNA

Author	Setting	Subjects[a]	Age[b]	Nutritional Status (%)		
				MN[c]	AR[d]	WN[e]
Roquè et al. [22]	Community dwelling	940	79.0 ± 7.3	5	43	52
Orsitto [23]	Hospitalized	78	78.9 ± 6.0	62	30	8
Rullier et al. [24]	Community dwelling	56	80.7 ± 6.5	23	59	18
Camina Martin et al. [25]	Institutionalized	83	81	41	56	3
Kagansky et al. [4]	Hospitalized	107	83.5 ± 5.4	74	20	6
Nourhashemi et al. [26]	Living at home	528	76 ± 6	0	26	74
Suominen et al. [27]	Nursing home	23	69–89	13	87	0
Arellano et al. [28]	Convalescence unit	63	80.8 ± 8	62	36	2
Holm et al. [29]	Living at home	59	74	14	63	24
Brocker et al. [30]	Community dwelling	479	77 ± 7	5	35	61
Magri et al. [6]	Alzheimer section	174	80.2 ± 8	36	48	17
Fallon et al. [31]	Community dwelling	123	75 ± 7	2	33	64
Andrieu et al. [32]	Living at home	318	75	1	19	80
Riviere et al. [33]	Living at home	100	76 ± 12	6	36	58
De Mendonca Lima et al. [34]	Day hospital	133	75 ± 7	14	54	32
Lauque et al. [35]	Nursing home	51	86 ± 7.5	41	45	14

Categories—malnourished, at risk of malnutrition or well nourished—in sixteen studies. Mainly conducted in Western Europe including 3,313 cognitively impaired older subjects from different geriatric settings (free living, home care, institutionalized, or hospitalized).

[a]*Number of subjects of sample study is reported.*

[b]*Years (mean values ± standard deviation) are reported.*

[c]*MN = malnourished (MNA < 17).*

[d]*AR = at risk of malnutrition (MNA between 17 and 23.5).*

[e]*WN = well nourished (MNA ≥ 24).*

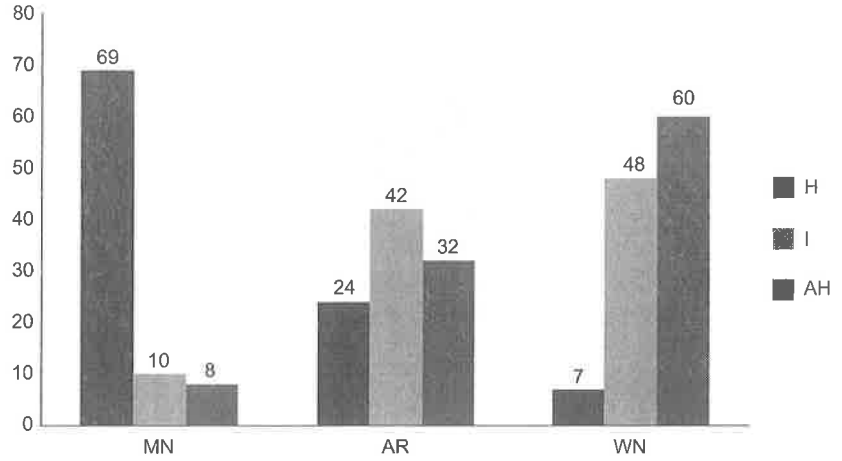

FIGURE 110.1 Prevalence of MNA categories in subjects with dementia among different geriatric settings [4,6,22–35]. Mean frequencies (%) are reported. MN = malnourished (MNA < 17); AR = at risk of malnutrition (MNA between 17 and 23.5); WN = well nourished (MNA ≥ 24); H = hospitalized; I = institutionalized; AH = living at home.

APPLICATIONS TO OTHER AREAS OF COGNITIVE DECLINE: MNA AND PRECLINICAL PHASE OF DEMENTIA

Recently the attention of researchers has focused on the preclinical phase of dementia, particularly in mild cognitive impairment (MCI). According to the Petersen criteria described in 1999, the MCI is defined as a transitional and heterogeneous clinical syndrome that lies between normal aging and early dementia, which refers to non-demented aged persons with memory or cognitive impairment and no significant disability. MCI has as its hallmark cognitive decline greater than that expected for age and educational level and has been shown to have a high risk of progression to dementia.

In agreement with previous data indicating a high percentage of malnutrition in patients with different grades of cognitive impairment, some authors also showed a high prevalence of malnutrition assessed by MNA in older patients with MCI admitted to an acute geriatric ward (44% of malnourished, 47% at risk of malnutrition, and 9% of well nourished) [46] or living in elderly homes (11% of malnourished, 41% at risk of malnutrition, and 48% of well nourished) [47], as shown in Figure 110.2. With regard to the single sections of MNA, the further evidence in cognitively impaired subjects that MNA-3 (dietary habits) and MNA-4 (subjective assessment of self-perceived quality of health and nutrition) scores were significantly lower, not only in subjects with dementia but also in those with MCI, is of potential clinical value might suggest that these two components of MNA could represent significant predictors of cognitive decline in older people and emphasizes the importance of early identification of nutritional status among subjects with MCI (Figure 110.3) [23].

Moreover, as already indicated for malnourished subjects with dementia, also those with MCI showed a significant improvement both in the MNA score and in several measures of cognitive function, highlighting the utility of a nutritional support, as well as a specific diet integration in the control of nutritional and cognitive deficit of these subjects [43]. Further intervention studies will certainly be informative in this regard.

MNA AND PROGNOSTIC EVALUATION

The prognostic definition of cognitively impaired older subjects suffering from malnutrition or at risk of malnutrition is a crucial point for physicians, patients, and their families and plays a key role in the decision analyses of care processes, including the organization of social health care systems, the support to families, caregivers, and patients, as well as the choice of appropriate treatment [48]. Some previous data indicated that malnutrition assessed by MNA or MNA-SF is a factor independently associated with poor prognosis and mortality [49]. Particularly, interesting data from hospitalized older patients showed that not only total MNA score but also all MNA subscores were significantly lower in those who died during hospitalization, underlining the usefulness and the prognostic value of all sections of MNA [4].

However, mortality in frail older subjects results from a combination of various factors (i.e., clinical, psychological, environmental) requiring multidimensional evaluation. Among the prognostic tools described for predicting mortality in

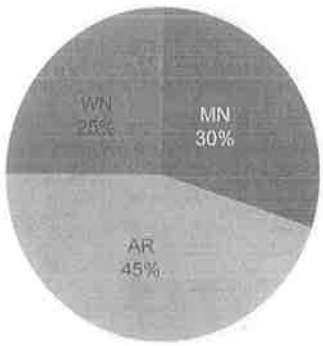

FIGURE 110.2 Prevalence of MNA categories in older subjects with mild cognitive impairment [46,47]. Mean frequencies (%) are reported. MN = malnourished (MNA < 17); AR = at risk of malnutrition (MNA between 17 and 23.5); WN = well nourished (MNA ≥ 24).

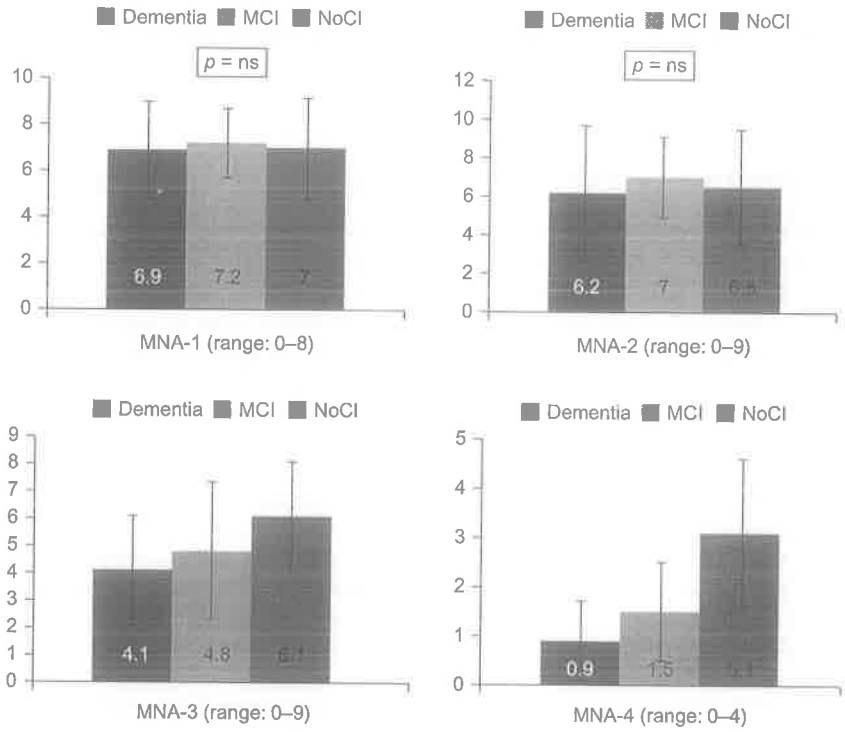

FIGURE 110.3 MNA subscores and cognitive levels [23]. Mean values and standard deviation are showed. MCI = mild cognitive impairment. NoCI = normal cognition. MNA-1 = anthropometric measurements. MNA-2 = general assessment. MNA-3 = assessment of dietetic habits. MNA-4 = subjective assessment. MNA-3: dementia versus NoCI, $P < 0{\cdot}001$; MCI versus NoCI, $P < 0.001$. MNA-4: dementia versus MCI, $P < 0.05$; dementia versus NoCI, $P < 0.001$; MCI versus NoCI, $P < 0.001$.

patients with cognitive decline, the Multidimensional Prognostic Index (MPI) for 1-year mortality calculated from information collected in a standardized CGA, including a nutritional assessment by MNA, was developed and validated by Pilotto and colleagues [50]. As recently reported by the above-mentioned author, MPI was sensitive and effective in predicting short- and long-term mortality risk also in older patients with cognitive decline admitted to a geriatric hospital ward [50].

In conclusion, the MNA used alone or incorporated in various multidimensional assessment tools such as the MPI, might be useful in identifying older malnourished demented patients at different risk of mortality who probably need a different intensity of clinical interventions. These findings warrant confirmation in larger, controlled studies.

PRACTICAL ISSUE: GUIDE OF MNA PROCEDURE

As already detailed by Guigoz and colleagues for general older people [10,14], the MNA two-step procedure score (MNA-SF and MNA) can also be used with cognitively impaired subjects for classification as well nourished, at risk for malnutrition, or malnourished. Particularly in these subjects, the test must be completed with the help of family or caregivers [10,14].

Well-Nourished Subjects

As described by its developers, if the MNA-SF score is ≥12 points or the full MNA score is ≥24, subjects can be classified as well nourished, requiring no further investigations. Subjects or their caregivers should be informed about the importance of continuing good dietary habits, and the MNA screening or assessment should be administrated at the next visit to detect any changes [14].

Subjects At Risk of Malnutrition

If the MNA-SF score is <12 points, subjects may be at risk of malnutrition, requiring diagnostic confirmation by completing the full MNA assessment. If the full MNA score is ≥24, subjects result as well nourished, requiring no further investigations; an MNA score between 17 and 23.5 confirms that the subjects are at risk of malnutrition [14]. At this stage, starting with early nutritional intervention is crucial in order to obtain a good prognosis. Therefore, health care professionals should carefully analyze the risk factors together with subjects or their caregiver (e.g., poor dentition, number of meals per day, domestic conditions, drug intake, family status, skin lesions) to undertake those strategies to treat the above-mentioned conditions, as reducing drugs that are interfering with the subject's appetite, congregating or regularly delivering meals, determining eating disorders, arranging domestic help, or suggesting to the caregiver the need for varying the diet. At this point, the MNA assessment should be administered every 3–6 months to evaluate the effectiveness of interventions and the nutritional status of the subjects.

Malnourished Subjects

Finally, as described by Guigoz [14], if the full MNA score is <17 points, subjects can be classified as malnourished, requiring further diagnostic investigations such as laboratory tests (i.e., serum albumin, prealbumin, transferrin, cholesterol, retinol, alpha-tocopherol, 25-OH cholecalciferol, zinc, hemoglobin) in order to confirm the diagnosis. At this stage, subjects are cognitively compromised, and the solution to the problem is often difficult. Therefore, with the consent of the family, a complex and multidisciplinary intervention is necessary, including frequent follow-up visits.

MNA LIMITATIONS

The MNA was designed to be a rapid comprehensive tool to assess the nutritional status of older people. However, some limiting factors to its use have been described in the following special conditions or disease states:

- High-risk patients, those receiving total parenteral nutrition, tube feeding, or oral liquid supplementation, may have difficulties answering MNA-3 questions. Therefore, they should be monitored by a dietitian or trained nutrition support professional.
- The MNA is not useful in determining specific vitamin or mineral deficiencies, such as folate, vitamin B12, iron, zinc, vitamin D. Thus, specific laboratory test investigations are mandatory if the above-mentioned deficiencies are suspected [14].
- The accuracy of anthropometric measurements (height, weight, BMI) can be reduced in bedridden patients, as well as in those who have undergone amputation. BMI may be unreliable in the presence of confounding factors such as edema or ascites. Furthermore, reliable measurement of height can be difficult in patients with alterations of the spine, vertebral compression, and postural changes. In addition, measuring arm and calf circumferences can be difficult and inaccurate due to the loss of muscle or skin tone of older people.

CONCLUSIONS

The prevalence of malnutrition is very high in older people with deep or mild cognitive decline. This underlines the importance of evaluating nutritional status in cognitively impaired subjects because malnutrition co-occurs with other diseases and may negatively influence the prognosis and quality of life of subjects and their caregivers [3,30].

In the past nearly two decades (1999–2013), many studies in the Western world have investigated the nutritional status of cognitively impaired older people by using multidimensional assessment tools such as the MNA [4,6,22–35,46,47]. In particular, this test administered in its two-step procedure (MNA-SF and/or MNA) appeared to be a good, feasible, and reliable tool to quickly identify malnutrition or risk of malnutrition in frail older people, including those with deep or mild cognitive decline [10,14]. In these subjects, the test should be completed with the help of the family or caregivers. The MNA, both for its versatility and for its high level of specificity and sensitivity, is being used increasingly in clinical practice, and there is a large and growing number of studies in a variety of settings of cognitively impaired patients examining its associations with outcomes such as functional or cognitive decline, frailty, and mortality.

In conclusion, the multidimensional approach to subjects with cognitive impairment, including the MNA, appeared to be a useful tool in early characterizing of malnutrition, planning prevention strategies in frail elderly, and helping to understand the factors that may contribute to developing cognitive decline. Therefore, the MNA should be routinely used, particularly in cognitively impaired subjects, in which nutritional status represents an important prognostic factor [15,16,49,50].

SUMMARY POINTS

- The MNA administered in its two-step procedure, including a nutritional screening (MNA-SF) and an assessment for subjects at risk of malnutrition (full MNA), appeared to be a good, feasible, and reliable tool to identify malnutrition or risk of malnutrition in frail older people with deep or mild cognitive decline.
- In cognitively impaired subjects, the MNA procedure should always be completed with the help of the family or caregiver.
- Because of its validity, high sensitivity, and specificity, MNA should be included in the CGA of all subjects with cognitive impairment.
- In more than 3,000 cognitively impaired older subjects who were screened using the MNA, the prevalence of malnutrition was variable, ranging between 0% and 74%, depending on the different levels of cognitive impairment and the different settings (hospitalized, community dwelling, institutionalized, living at home).
- MNA scores among the patients suffering from dementia seemed strictly related with the patients' age and duration of disease, severity of cognitive impairment and disability, aggravation of psychological and behavioral symptoms, and the stress of caregivers.
- With regard to the single sections of MNA, novel findings reporting lower MNA-3 and MNA-4 subscores in patients with dementia and MCI suggest that some components of nutritional profile could represent significant predictors of cognitive decline in older people and emphasize the importance of early identification of nutritional status among cognitively impaired subjects.
- The MNA also seemed useful in monitoring nutritional status of cognitively impaired subjects receiving specific nutritional support.
- With regard to the prognostic evaluation, the MNA used alone or incorporated in various multidimensional assessment tools such as MPI might be useful in identifying older malnourished demented patients at different risk of mortality who probably need a different intensity of clinical interventions.

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