

The Association between Nutritional Status using the Mini Nutritional Assessment and the severity of Pressure Ulcer in Elderly Hospitalized Patients at King Abdul-Aziz Medical City in Riyadh

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ABSTRACT

Introduction: Pressure Ulcer (PU) is a localized injury to the skin and/or underlying tissue. Malnutrition correlates with PU and is one of the main factors for PU development. Mini Nutritional Assessment (MNA) has been designed and validated by previous workers to provide a single, rapid assessment of nutritional status in elderly patients, which classified patients into normal nutritional status, at risk of malnutrition, or malnourished.

Objectives: Investigate the relationship between nutritional status and PU and the possibility of using the MNA to predict pressure ulcer outcomes. The main aim is to investigate the relationship between nutritional status using MNA and PU in elderly hospitalized patients at King Abdul-Aziz Medical City in Riyadh (KAMC).

Methods: The study is a cross sectional study using pre-post test which included thirty five elderly patients newly diagnosed with PU admitted at KAMC. Nutritional status and PU was assessed at baseline and after two months at the end. Anthropometric measurements were taken and blood samples collected to analyze albumin, blood urea nitrogen (BUN), creatinine, before and after two months.

Results: The results showed that 88.6% of PU patients were malnourished or at risk of malnutrition at baseline using the MNA test, and there was a reduction in the MNA score with the severity of PU. The MNA score was significantly increased at post study, and 54.3% of the subjects were healed completely from PU at the end. The results showed that all patients classified as normal nutritional status were completely healed from PU, 79% of at risk of malnutrition were completely healed, while only 24% of malnourished were completely healed. The result showed that there was a significant negative correlation between MNA score and age. There were significant positive correlations between MNA score and BMI, CC, MAC and albumin at baseline.

Conclusion: To conclude, the results indicated that the severity of PU in elderly subjects is affected by nutritional status using MNA score. Thus, optimizing diet may help in treating and reducing the severity of PU in elderly subjects. This should be an integral part of any PU management.

Key words: Mini Nutritional Assessment, Pressure ulcer, Malnutrition, Elderly

Introduction

In recent years, there has been a sharp increase in the number of older persons worldwide [1] and more older people are alive nowadays than at any time in the past [2]. The proportion of the population aged 60 and over, is also growing each year. By the year 2025, the world will host 1.2 billion people aged 60 and over and that is expected to rise to 1.9 billion in 2050 [3]. The same trend is also predicted in the Eastern Mediterranean Region; while the proportion of the elderly population to total population was 5.8 % in 2000 it is expected to reach 8.7 % by the year 2025 and 15 % by 2050 [4].

The proportion of people who are 60 years of age and older in the Saudi population is 5.2% [5]. The proportion of elderly subjects is expected to increase to 8.6% by 2025 and 18.6% by the year 2050 [6].

Pressure ulcer (PU) is a localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction [7]. The prevalence of multiple illnesses among the elderly people is usually increasing. Many workers predict that this could lead to a considerable increase in PU [8].

PU occurs in both hospital and community settings, often in the elderly and/or immobile people with severe acute illness and in those with neurological deficits. An increasing elderly population with growing number of multiple illnesses is being seen in western society [9].

Malnutrition correlates to PU. Patients with PU or who are vulnerable to PU have a significantly lower energy intake than other patients not suffering from PU [10-11]. Malnutrition is one of the well-known factors for PU development in hospitals and nursing homes [12-13].

The Mini Nutritional Assessment (MNA) has recently been designed and validated to provide a single, rapid assessment of nutritional status in elderly patients in outpatient clinics, hospitals, and nursing homes. It has been translated into several languages and validated in many clinics around the world [14]. The MNA provides a simple, noninvasive, and well-validated nutrition screening tool that can quickly and easily identify older adults who are at risk of malnutrition. It is targeted at those living in the community, long-term care facilities, or nursing homes and those who require social services and those coming to acute care units. The MNA has been used and validated in all these above mentioned settings. In both medical practice and clinical research, the reliability, ease of use, and effectiveness of the MNA have made it widely acceptable for nutrition screening and assessment of elderly people [14-15]. The MNA has become a vital component of comprehensive geriatric assessment [14].

In this study, the association between nutritional status using the MNA and the severity of PU in elderly hospitalized patients at King Abdul-Aziz Medical City (KAMC) in Riyadh was studied. According to the best of our Knowledge, we haven't found any published study investigate the association between MNA score and the severity of PU. The results will draw attention on the possibility of using the MNA score to predict PU outcome.

Rationale and Objective

Nutritional status has been correlated with the development and healing of PU. Thus, the association between MNA and the severity of PU in elderly patients would draw attention to the possibility of using the MNA to predict PU outcome. Therefore, the main aim is to investigate the relationship between MNA score and PU in elderly hospitalized patients at KAMC in Riyadh.

Methodology

Study design and site

The study was a cross sectional study using pre post test, in which nutritional status and PU were assessed at admission (baseline) and after two months of including the elderly patients newly diagnosed with PU, admitted at KAMC in Riyadh, Kingdom of Saudi Arabia.

This study was approved from three scientific committees; Deanship of postgraduate at King Saud University, King Abdullah International Medical Research Center (KAIMRC), and King Abdulaziz City for Science and Technology (KACST) and was funded by KACST.

Study sample and objects

All elderly (≥ 60 years old) patients newly diagnosed with PU admitted at geriatric unit and/or long term care units (Wards 22, 23, 24 and 25) at KAMC in Riyadh are included in the study. Forty four newly admitted elderly patients were the study sample for a period of ten months (from May 2011 to March 2012) in which 9 patients passed away. Thirty five patients continued in this study in which 15 subjects were female and 20 subjects were male and their mean age was 79.2 years \pm 11.3.

Stages and healing of pressure ulcer

PU status was assessed at the next day of admission by a thorough visual skin assessment conducted by wound team with a large practice specializing in the diagnosis and treatment of PU. Wounds team consists of a dermatologist, plastic surgeon, wound care nurse and elderly care nurse. On the basis of the skin assessment, wounds team recorded the characteristics (including stage) of all PUs observed. Patients were also categorized based on the presence and stage of PU.

The PU was assessed using the staging system of National Pressure Ulcer Advisory Panel (www.npuap.org) [7] at baseline. This scale is used widely for clinical evaluation of PU and it has been recommended to guide the assessment of PU [7].

To assess the healing status of PU after two months at the end of the study we didn't use the PU score to measure the improvement of PU status but we used the healing classification (completely healed and not completely healed).

Nutritional status

Nutritional status of elderly PU patients was screened and assessed at admission and after two months at the end of the study at KAMC in Riyadh. Dietitians in KAMC in Riyadh assess weight status for each individual to determine weight history and significant weight loss from usual body weight, assess ability to eat independently, and assess adequacy of total food and fluid intake.

Mini Nutritional Assessment (MNA)

Nutritional status of elderly patients was assessed using the MNA. MNA were mostly filled in by watchers of patients (relatives or hospital caregivers) and some were done by the patients.

The MNA scale (0-30 points) consisting of 18 point-weighted questions, is composed of anthropometric measurements, global assessment, dietary questionnaires and subjective assessment. The answers were given a maximum of 30 points. Depending on the score of the test, elderly subjects involved in the study were classified into the following categories: well-nourished [MNA points 24-30], at risk of malnutrition [MNA points 17-23.5], and malnourished [MNA < 17 points] [16].

Anthropometric measurement

Measurements of weight and height were measured by the nurses at time of admission and after two months at the end of the study. Midarm circumference (MAC) and Calf circumference (CC) were measured by the researcher on the next day of admission and after two months at the end of the study.

Measurements of weight (to the nearest 0.1 kg) and height (to the nearest 0.1 cm) were made using a portable scale and a portable stadiometer, respectively. Knee height was used to estimate the stature of a person who could not stand, or for a person with an obvious spinal curvature. The following equation was used to estimate the stature from knee height; Stature for elderly = [(2.02 knee height) - (0.24 age)]. BMI was calculated by dividing the weight in kilograms by the square of the stature in meters (kg/m²). MAC was taken on the front of the non-dominant upper arm by measuring the halfway distance between the inferior aspect of the acromion and the olecranon. MAC was measured to the nearest 0.1 cm using a flexible non-elastic tape. CC was taken while the elderly patient was laid supine, and the left knee and ankle were bent to a 90° angle. CC measurement was taken with an insertion measuring tape. The loop of the tape is moved up and down the calf to locate the largest diameter, and the measurement was recorded to the nearest 0.1cm [17].

Biochemical indicators

Blood samples were collected by nurses at 9 a.m. and processed for serum albumin, urea nitrogen (BUN), and creatinine. A total of 5 ml of blood was drawn from each subject. Blood samples were then centrifuged at 3500 r.p.m for 10 minutes in a refrigerated centrifuge to separate serum samples from the cells. Serum samples were stored at 22° C in plastic tubes until analysis. All samples were measured at central lab of KAMC in Riyadh.

BUN concentration was measured by urease and creatinine concentration was measured by kinetic alkaline pictrate methods. Serum albumin was determined by the spectrophotometric bromocresol green method. The following values were considered normal: albumin >35g/L; BUN 3.0 to 7.0mmol/L; serum creatinine 40 to 110µmol/L [18].

Nutritional Management for PU:

The nutritional status for elderly subjects with PU was screen and assess at admission. They refer all individuals with PUs to dietitians in KAMC in Riyadh for early assessment and intervention of nutritional problems.

Dietitians in KAMC in Riyadh provide sufficient calories (30 kcal to 40 kcal per kg of body weight per day or Harris-Benedict times stress factor (1.2 for stage 1 and stage 2 ulcer, 1.5 for stage 3 and stage 4 PU). They adjust calorie based on weight loss, weight gain, or level of obesity. They provide adequate protein for positive nitrogen balance of individuals with PU (1.2g to 1.5g of protein/kg bw/d (stage 1 and stage 2 PU), 1.5g to 2.0g of protein/kg bw/d (stage 3 and stage 4 PU)). However the hospital does not use any standard nutritional assessment specialized for elderly such as MNA, subjective global nutritional assessment, or malnutrition universal screening test to evaluate nutritional status for elderly patients

Results

The mean body weight, BMI, CC, and MAC were higher at post study compared to baseline (Table 1). Albumin value at post study was higher than at baseline (Table 1). The results show that there were no statistical differences in the other biochemical measurements. The mean of MNA score was 12.4. However, at post study, the mean of MNA score was increased significantly to 15.8 (Table 1 - next page).

The results show that 57.2% of elderly patients were in stages 3 and 4 of PU at baseline, when they were admitted to hospital. There were 54.3% healed completely at the end of two months; 45.7% were not completely healed (Table 2 - next page).

Correlation between Pressure Ulcer Score and Mini Nutritional Assessment Score at baseline

The results show that there is a significant negative correlation between PU score and MNA score (Table 3 - page 7).

Classification of nutritional status of subjects

Based on the MNA Score, it was found that 88.6% of the patients were malnourished or at risk of malnutrition at baseline. The percentage of the subjects classified as malnourished at baseline decreased from 74.3% to about 48.6% at post study (Table 4 - page 7).

Classification of nutritional status

The results show that most (69%) of malnourished patients are at stage 4 and stage 3 of PU score at baseline (Table 5).

The results show that all patients classified as normal nutritional status were healed, 79% of at risk of malnutrition were healed and only 24% of malnourished subjects were completely healed (Table 5).

Table 1: Anthropometric, biochemical measurements, and MNA score of subjects at baseline and post study

Parameter	M ±SD		P Value*
	Baseline	Post study	
Body weight (kg)	57.6±15.9	58.3±15.7	0.001
BMI (kg/m ²)	22.2±5.4	22.5±5.3	0.002
CC (cm)	30.3±2.2	30.4±2.1	0.003
MAC (cm)	21.3±1.8	21.5±1.9	0.002
Albumin (g/l)	28.9 ± 4.10	31.6 ± 3.70	0.0001
BUN (mmol/l)	11.0 ± 7.70	10.9 ± 8.50	0.975
Creatinine (µmol/l)	93.0 ± 71.8	92.6 ± 76.8	0.949
MNA score	12.4 ± 6.5	15.8 ± 7.2	< 0.0001

*Paired t test; P < 0.05 considered statistically significant. M: mean. SD: standard deviation.

BMI: body mass index, CC: calf circumference, MAC: mid-arm circumference, BUN: blood urea nitrogen, MNA: Mini Nutritional Assessment.

Table 2: Classification of pressure ulcer status (healing status) of subjects at post study according to pressure ulcer stage at baseline

PU stage (baseline)	PU status (post study)		
	Completely healed N(%)	Not completely healed N(%)	Total N(%)
Stage 1	3(75)	1(25)	4(11.4)
Stage 2	10(90.9)	1(9.1)	11(31.4)
Stage 3	5(62.5)	3(37.5)	8(22.9)
Stage 4	1(8.33)	11(91.7)	12(34.3)
Total	19(54.3)	16(45.7)	35(100)

PU: Pressure Ulcer. N: number of cases. (%): percent.

Table 3: Correlation between Pressure Ulcer Score and Mini Nutritional Assessment Score at baseline

Correlation between pressure ulcer score and mini nutritional assessment score	R	P Value
	-0.403	0.016

R: Pearson correlation; P < 0.05 considered statistically significant

Table 4: Classification of nutritional status of subjects at baseline and post study

Classification of nutritional status	Baseline	Post study	P value
	N (%)	N (%)	
Normal nutritional status	4 (11.4)	4 (11.4)	0.005
At risk of malnutrition	5 (14.3)	14 (40.0)	
Malnourished	26 (74.3)	17 (48.6)	

N: number of cases. (%): percent. *Paired t test; P < 0.05 considered statistically significant.

Table 5: Classification of nutritional status in relation to pressure ulcer stages at baseline

Classification of nutritional status	PU stages (baseline)				PU status (post study)	
	Stage 1 N(%)	Stage 2 N(%)	Stage 3 N(%)	Stage 4 N(%)	Completely healed N (%)	Not completely healed N (%)
Normal nutritional status	1(25)	2(50)	1(25)	0 (0.0)	4 (100)	0 (0.0)
At risk of malnutrition	1(20)	3(60)	1(20)	0 (0.0)	11 (79)	3 (21)
Malnourished	2(8)	6(23)	6(23)	12(46)	4 (24)	13(76)

PU: Pressure Ulcer. N: number of cases. (%): percent.

Mini nutritional assessment score and albumin

The results show that there was a reduction in the MNA score and serum albumin with the severity of PU (Table 6 - next page).

The results show that completely healed patients had higher MNA score and albumin than not completely healed (Table 7 - next page).

Table 6: Comparison between MNA score and PU stages and between albumin and PU stages at baseline

PU Stages (baseline)	MNA score (baseline) M ± SD	Albumin (baseline) M ± SD
Stage 1	20.00 ± 5.07 ^a	33.0 ± 1.0 ^a
Stage 2	14.68 ± 5.7 ^{ab}	30.9 ± 2.3 ^a
Stage 3	11.90 ± 7.5 ^{bc}	28.9 ± 4.3 ^{bc}
Stage 4	09.30 ± 4.7 ^c	28.9 ± 3.8 ^{bc}

PU: Pressure Ulcer, MNA: Mini Nutritional Assessment. M: mean. SD: standard deviation. Means with different letter superscript are differ significantly. Oneway Anova Test-Post Hoc Tests; P < 0.05 considered statistically significant.

Table 7: Comparison between MNA score and PU status and between albumin and PU stages at post study

PU status (post study)	MNA score (post study) M ± SD	Albumin (post study) M ± SD
Completely healed	19.97 ± 5.3 ^a	33.2 ± 3.8 ^a
Not completely healed	11.133 ± 5.7 ^b	29.6 ± 2.44 ^b

PU: Pressure Ulcer. MNA: Mini Nutritional Assessment. M: mean. SD: standard deviation. Means with different letter superscript are differ significantly. Oneway Anova Test-Post Hoc Tests; P < 0.05 considered statistically significant.

Classification of nutritional status and albumin

The results show that there was a reduction in the serum albumin in all MNA groups and malnourished patients had lower serum albumin level (Table 8).

Table 8: Classification of nutritional status in relation to albumin at baseline

Classification of nutritional status	Albumin (baseline) M ± SD	Albumin (post study) M ± SD
Normal nutritional status	34.00 ± 1.15 ^a	36.50 ± 1.9 ^a
At risk of malnutrition	32.00 ± 2.80 ^a	31.70 ± 3.7 ^b
Malnourished	27.48 ± 3.60 ^b	30.30 ± 3.2 ^b

M: mean. SD: standard deviation. Means with different letter superscript are differ significantly. Oneway Anova Test-Post Hoc Tests; P < 0.05 considered statistically significant.

Albumin and age

The results show that serum albumin had significant negative correlation with advancing age and positive correlation with BMI in PU elderly patients (Table 9).

Table 9: Correlation of albumin with age and BMI at baseline

Parameters	Albumin	
	R	P value
Age	-0.422	0.013
BMI	0.394	0.021

BMI: body mass index.

R :Pearson correlation;

P < 0.05 considered statistically significant.

Correlation between mini nutritional assessment score and age, anthropometric and biochemical measurements

The results show that there were significant negative correlations between MNA score and age and between MNA score and BUN at baseline. There were significant positive correlations between MNA score and BMI, CC, MAC and albumin at baseline (Table 10). No significant correlation was found between MNA score and creatinine.

Table 10: Correlation between mini nutritional assessment score and various parameters at baseline

Parameters	MNA score	
	R	P value
Age	-0.518	0.002
BMI	0.420	0.014
CC	0.396	0.021
MAC	0.401	0.019
Albumin	0.507	0.002
BUN	-0.358	0.038
Creatinine	-0.005	0.976

MNA: mini nutritional assessment. BMI: body mass index, CC: calf circumference, MAC: mid-arm circumference, BUN: blood urea nitrogen. R: Pearson correlation; P < 0.05 considered statistically significant.

The correlation between MNA score and these parameters were tested at post study and we found the same results as at the baseline except BUN in which there is no significant correlation found with MNA score at post study (data not shown).

Discussion and Conclusions

In the present study, we investigate the nutritional status of elderly subjects using the MNA score in PU patients at KAMC in Riyadh.

The results show that there was a reduction in the MNA score with the severity of PU which may indicate that PU is affected by nutritional status (Table 6). This is accompanied by improvements in MNA score in which 34.6% of malnourished patients at baseline moved to at risk of malnutrition at post study (Table 4). The results show that all patients classified as normal nutritional status were completely healed, 79% of at risk of malnutrition were completely healed, and only 24% of malnourished were completely healed (Table 5). This may indicate that nutritional intervention in addition to other medical care has a role in improving PU status of the elderly subjects at KAMC in Riyadh.

Wissing and Unosson (1999) showed that in free-living elders with leg ulcers of any cause, (46%) and (3%) were at risk of malnutrition and malnourished, respectively [19]. Other studies show that more than 80% of PU elderly patients were classified as at risk of malnutrition or malnourished using MNA score [18-20]. This was consistent with our study in which 88.6% of PU patients were malnourished or at risk of malnutrition at baseline (Table 4). Because malnutrition is one of the main factors of developing PU, it is not a surprise in our study that about 88% of the subjects were at risk of malnutrition or malnourished.

Hudgens et al (2004) show that subjects classified as well nourished had a median stage 2 PU, whereas those classified as at risk and malnourished had a median stage 3 and stage 4, respectively [20]. In our study the median stage of subjects classified as well nourished or at risk of malnutrition is stage 2 PU, whereas those classified as malnourished had a median stage 3. This is accompanied by a significant negative correlation between MNA score and PU score in our study. This may be an indication that MNA test can be used to predict the severity of PU.

Wissing et al (2001) show that MNA score increased over time in healed PU subjects. This suggests that improving MNA score is an indication of an enhanced wound healing process[21]. This was consistent with our study in which the MNA score was significantly increased at post study compared to baseline (Table 1), and 54.3% of the subjects were healed completely (Table 2).

Fifty percent to 70% of PU healed completely after nonsurgical intervention has been applied [22]. Berlowitz and Wilking (1990) show that 40% of PU patients completely healed during a 6-week follow-up period [23]. In addition they show that nutritional intervention and medical care resulted in healing of 65% of stage II ulcers, 14% of stage III ulcers, and 0% of stage IV ulcers over a 6-week follow up period [23]. This was consistent with our study (see Table 2).

Hudgens et al (2004) show that serum albumin was low in all 3 MNA groups in PU patients who lived in an elders nursing home [20]. In another study patients with MNA \geq 17 usually

have a low albumin level [14]. This is consistent with our study in which serum albumin was below normal range in all 3 MNA groups (Table 8). Previous studies demonstrated that serum albumin levels were lower in patients with PU compared with those without PU [24], and was able to predict PU development with adequate validity [25]. This is consistent with Bonnefoy et al's (1995) study, that found that wound severity can be influenced by albumin levels in patients with PU [26]. In our study, the results show that there was a reduction in the serum albumin level with the severity of PU which indicates that PU may be affected by nutritional status (Table 6). Furthermore the decrease in the level of serum albumin could be due to inflammation that is associated with PU. This is because albumin is one of the negative acute phase proteins that decrease with inflammation.

Serum albumin level has been traditionally considered as a marker for PU healing [27] and also may be associated with PU healing [28]. This is consistent with our study in which the results show that completely healed patients have higher serum albumin level than those not completely healed (Table 7).

MNA score correlated with albumin level in elderly patients [29-30]. In a residential home for the elderly, Salva et al (1996) found that levels of serum albumin level were highly correlated with the MNA score [31]. In our study the MNA score correlates positively with serum albumin level (Table 10).

The result shows that the MNA score correlated positively with BMI, CC, and MAC (Table 10). This was consistent with Langkamp Henken et al's (2005) study in which they found that the MNA score correlated positively with anthropometric measures including BMI, MAC and CC [18]. In a previous study show that levels of BMI were highly correlated with the MNA score [31].

Shahin et al's (2010) study show a significant relationship between the presence of PU in hospitals and undesired weight loss [32], and weight loss were highly correlated with the MNA score [31]. In our study, we found a significant increase in BMI at post study (Table 1). This increase in BMI may play a role in the healing process of PU.

Desneves et al (2005) found that PU patients who received high caloric diet and supplementation of vitamins and minerals noted a 2.5 fold greater improvement in healing than PU patients who received regular diet [33]. A study conducted by Wilson and his colleagues (2002) indicate that individuals who consumed oral nutritional supplements (protein, calories, fat, vitamins, minerals and/or amino acids) between meals accelerate the healing of PU [34]. In a study of 12 enterally fed patients with PU, the group who received 1.8 g/kg of protein had a greater decrease in PU surface area than the group receiving 1.2 g/kg of protein (the current recommended daily allowance) [35]. This was consistent with our study (MNA questionnaires) that there was increase in food intake (protein, vegetables and fruits, and fluids). This was accompanied by improvement of PU status in which 54.3 % were completely healed and 45.7% were not completely healed (Table 2).

Using MNA, the subjects who consume at least one serving of dairy products (such as milk, cheese, yoghurt) per day and two or more serving of legumes or eggs per week and meat, fish or poultry every day increased from 48.6% at baseline to 62.9% at post study. This increase in protein intake may have a role in the increase in albumin level at post study and in the healing process of PU.

To conclude, the results indicate that the severity of PU in elderly patients is affected by nutritional status using MNA score. Diet may help in treating and reducing the severity of PU in elderly subjects as shown by the increase in protein intake and by the increase in BMI and in the concentration of albumin level, which is commonly used as indication of the nutritional status.

Recommendations

Serial assessments of elderly PU patients using the MNA are recommended so that we can monitor the effectiveness of nutrition interventions.

Performing nutritional screening and assessment is important, but nutrition intervention should be adapted when patients are identified as malnourished or at risk of malnutrition.

Nutrition assessments and interventions must be documented so that the entire healthcare team is aware of the patient's nutrition goals.

There was minimal information and limited studies in the area of what nutritional intervention should be implemented to reduce the risk of developing malnutrition in PU patients, further studies are needed in this area.

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