The Magnitude of Malnutrition among Hospitalized Elderly Patients in University Malaya Medical Centre

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ABSTRACT: Malnutrition is a common, potentially serious and frequently undiagnosed condition among hospitalized elderly patients. It is important to determine the magnitude of malnutrition among hospitalized geriatric patients using anthropometric and biochemical indicators. This is a cross-sectional study involving the nutritional assessment of 181 subjects (98 women) aged 65 or older. These subjects were admitted to the Geriatric Ward, University Malaya Medical Centre within 72 hours of admission between April and August 2003. Subjects were assessed for anthropometric (body weight, height, mid upper arm circumference, and calf circumference), and biochemical (serum albumin, hemoglobin, total lymphocyte count and serum cholesterol) malnutrition. Although the majority of subjects had a normal Body Mass Index (BMI), 18.0% were underweight and 37.3% were overweight. 16.0% and 26.0% subjects had muscle wasting as assessed by low mid upper arm circumference (MUAC) and calf circumference (CC) respectively. Biochemical tests indicated that 41.4% subjects had hypoalbuminemia, 39.4% had anemia, and 23.4% had low total lymphocyte count. There were no subjects with low serum cholesterol values on admission. Since malnutrition is prevalent among hospitalized geriatric patients, there is a need to screen elderly patients during admission to ascertain who are at risk of malnutrition in order to improve their health, nutritional status and decrease the length of hospital stay.

Keywords: malnutrition, geriatric patients, anthropometric, biochemical assessment, hospitalized

Introduction

Malnutrition is a common occurrence in elderly patients (Walker and Beauchene, 1991; Volkert et al., 1998). This is due to several physiological, physical and psychological changes that are associated with aging (Suzana et al., 1999).

Several studies have shown that the prevalence of undernutrition in hospitalized elderly patients remain excessively high, reaching 30 – 55%, depending on the population and tools used (Covinsky et al., 1999; Persson et al., 2002; Correia and Campos, 2003; Mias et al., 2003). The occurrence of malnutrition in hospitalized elderly patients has been associated with longer hospitals stays higher morbidity and higher mortality rates especially among undernourished subjects (Persson et al., 2002; Mowe, 2002; Kyle et al., 2004). Adequate treatment has been shown to reduce mortality and complications (Walker and Beauchene, 1991; Milne et al., 2002; Persson et al., 2002; Visvanathan, 2003; Visvanathan et al., 2003). These findings emphasize the importance of detecting and treating malnutrition in hospitalized elderly patients.

A very recent Malaysian study of several local publicly funded shelter homes ('Rumah Seri Kenangan') had found that a large proportion of elderly subjects were underweight with 14.3% of subjects recording a body mass index (BMI) < 18.5 kg/m^2 and a further 18.2% recording a BMI between 18.5 and 20kg/m^2 (Visvanathan et al., 2005). Meanwhile, another study showed that almost 38.5% of elderly people residing in the rural areas of Malaysia were malnourished using a cut-off of 18.5kg/m^2 BMI as the definition of undernutrition (Suzana et al., 2002). For hospitalized elderly patients, Suzana et al. (2002) provided data to indicate that there was a significant reduction in body weight, biceps skinfold thickness, calf circumference (CC), mid upper arm circumference (MUAC), percentage of body fat and BMI in both elderly males and females during hospital stay in Universiti

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Published 30 June 2010

Kebangsaan Malaysia Medical Centre (PPUKM). These studies highlight the prevalence and the need to combat malnutrition among the Malaysian elderly population in both community and hospital setting.

Elderly people are vulnerable to the onset of disease (Prakash et al., 2004; Joshi et al., 2003), and diseases increase the risk of malnutrition (Hickson, 2006). It is now acknowledged that chronic diseases such as cancer, chronic obstructive pulmonary disease (COPD), cardiac failure, rheumatoid arthritis (RA), and renal failure can cause a state of nutritional depletion and eventually lead to malnutrition (Sridhar, 2003). Similarly, it is an established fact that deteriorated nutritional status can adversely affect the well-being of older persons, causing a decline in normal functioning and worsening of existing medical problems (Meydani, 2001). Malnourished older people are not only at risk of increased mortality; they are also at higher risk of multiple complications, including respiratory (Windsor and Hill, 1988) and cardiac complications (Heymsfield et al., 1978), infections (Felblinger, 2003; Lesourd, 2004), pressure ulcers (Horn et al., 2004; Baumgarten et al., 2006; Iizaka et al., 2009), immune dysfunction (Kaiser and Morley, (1994) and delayed wound healing (Wissing et al., 2001).

Since poor nutritional status significantly increases the risk of hospital admission and length of stay among the elderly (Feldblum et al., 2009), it is important to increase the awareness of medical practitioners in order to provide appropriate screening tools and management of nutritional problems. However, there is no single best parameter for measuring malnutrition. A full nutrition assessment is time and resource consuming, and this in turn may contribute towards inadequate nutrition assessment and nutritional care for elderly patients in many hospitals (Rasmussen et al., 1999; Kondrup et al., 2002). Thus, fast and simple screening method such as anthropometrical and biochemical measurements are commonly used as a comprehensive evaluation (Thorsdottir et al., 1999; Thorsdottir et al., 2001; Thorsdottir et al., 2005). In order to determine the viability and effectiveness of anthropometrical and biochemical measurements as sufficiently comprehensive evaluation of malnutrition, a study among hospitalized elderly patients in University Malaya Medical Centre (UMMC) was conducted.

Materials and Method

This cross sectional study was conducted between April and August 2003 among newly admitted geriatric patients aged 65 years and above in a Geriatric Ward at UMMC. The exclusion criteria were subjects who had been hospitalized at least a month prior to admission, had deformation of body parts, who were on a ventilator, who were mentally unstable or who were critically ill. Eligible subjects were identified daily from a patient admission list at the Geriatric Ward counter. Identified subjects were then visited in the wards to obtain their consent to participate in the study. The research was approved by the Medical Ethics Committee, UMMC (Ref: MEC: 209.12). The subjects' nutritional statuses were assessed using anthropometric and biochemical measurements. The necessary data were obtained within 72 hours of admission. Some of the data were obtained from the patients' medical record.

Measurement of the standing height was not possible in some elderly subjects. These individuals had severe kyphosis or were unable to stand straight. In addition, shortening of axial skeleton resulting from age-related osteoporosis, kyphoscoliosis, postural changes and degenerative disks changes may result in a decrease in height with aging will affect BMI readings (Kamel et al., 2000).

Therefore, in this study, the calculation from arm span was used to estimate height using a derivation equation developed by Suzana and Ng (2003). The subsequent estimated height was than used to calculate BMI. The anthropometric measurements were weight, arm span, BMI, MUAC, CC and triceps skin fold (TSF). Biochemical parameters were serum albumin, hemoglobin, total lymphocyte count and total cholesterol. Statistical Package for the Social Science (SPSS) version 10.0 was used for descriptive statistics and identifying patients with below-reference values for the different parameters.

Statistical analyses

Data was expressed as mean ± standard deviation of triplicate measurements. Data were analyzed using statistical software, SPSS version 15.0 for windows (SPSS Inc, Chicago, IL, USA). T-tests and one-way ANOVA were used to determine the differences for all nutrient contents in all samples. The level of significance was set at $p<0.05$.

Results

A total of 209 patients met the eligibility criteria but 181 patients participated in this study (response rate 86.6%). The reasons for non-response were either too tired (n=10) or had communication problems (n=18). Of the subjects, 45.9% were men, 37.6% were Malays, followed by 35.9% Chinese

and 26.5% Indians. The age ranged from 65 to 90 years (mean ± SD of 73.38 ± 6.20). The subjects were diagnosed to have cardiovascular disease (48.1%), followed by respiratory (16.6%), cancer (8.3%), urogenitory disease (6.1%), endocrine and metabolic related problems (6.1), gastrointestinal problems (5.0%), blood disorder (3.9%), musculoskeletal deficiencies (3.9%) and infection & parasitic disease (2.2%). The information is shown in **TABLE 1**.

TABLE 2 illustrates the anthropometric and biochemical characteristics of the patients at admission. Results indicated that women were lighter (p<0.0001), shorter (p<0.0001) and had lower CC (p<0.05), TSF (p<0.005) and hemoglobin (p< 0.005) as compared to men. In addition women had a greater percentage of body fat (p<0.0001) and total cholesterol (p<0.05) as compared to men.

The prevalence of malnutrition among subjects using anthropometric and biochemical indicators is shown in FIG. 1. A total of 16.0% and 26.0% subjects had muscle wasting as assessed by MUAC and CC, respectively. These measurements indicated that women had a greater prevalence of muscle wasting which were 16.3% and 26.3% compared to men at 15.7% and 25.6% (p<0.0001), respectively.

TABLE 1- Characteristics of 181 elderly patients admitted to Geriatric ward, UMMC

Characteristics	N (%)
Sex	
Men	83 (45.9)
Women	98 (54.1)
Age (year)	
65 – 74	108 (59.7)
≥ 75	73 (40.3)
Mean (±SD)	73.38 ± 6.20 years
Range	65-90 years
Ethnics	
Malay	68 (37.6)
Chinese	65 (35.9)
Indian	48 (26.5)
Diagnosis Primer	
Cardiovascular	87 (48.1)
Respiratory	30 (16.6)
Neoplasm	15 (8.3)
Urogenitory	11 (6.1)
Endocrine & Metabolic	11 (6.1)
Gastrointestinal	9 (5.0)
Blood	7 (3.9)
Musculoskeletal	7 (3.9)
Infection & parasitic	4 (2.2)

TABLE 2- Anthropometric and biochemical measurements of subjects (mean ± SD) on admission

Parameters (Unit)	Men (n = 83)	Women (n= 98)	Total (n = 181)
Weight (kg)	61.66 ± 15.39	51.39 ± 13.84[c]	56.53 ± 14.62
Estimated height from arm span (m)*	161.9 ± 0.05	148.6 ± 0.06[c]	155.3 ± 0.06
Mid Upper Arm Circumference (cm)	27.29 ± 4.53	26.92 ± 4.86	27.11 ± 4.70
Triceps (mm)	15.19 ± 6.98	18.68 ± 6.98[b]	16.94 ± 6.98
Calf circumference (cm)	32.00 ± 4.15	30.45 ± 4.56[a]	31.23 ± 4.36
Body Mass Index (kgm^{-2})	23.50 ± 5.52	23.09 ± 5.81	23.30 ± 5.67
% Body Fat (%)	28.09 ± 6.79	36.62 ± 5.83[c]	32.36 ± 6.31
Serum albumin (g/L)	33.11 ± 6.99 (n=79)	33.15 ± 6.29 (n=98)	33.14 ± 6.59 (n=177)
Haemoglobin (g/L)	12.98 ± 2.20	11.83 ± 2.15[b]	12.31 ± 2.41
Cholesterol (g/L)	4.76 ± 1.39 (n=75)	5.31 ± 1.44[a] (n=87)	5.06 ± 1.44 (n=162)
% Lymphocyte (%)	20.76 ± 11.35	21.41 ± 10.02	21.11 ± 10.62
White blood cell (x 10^9/L)	10.41 ± 4.80	9.82 ± 3.79	10.09 ± 4.28
Total Lymphocyte count (x 10^6/L)	1893.06 ± 929.27	1938.53 ± 982.03	1917.68 ± 955.83

[a] (p<0.05), [b](p<0.005), [c](p<0.0001)
Significance between both sexes (Mann-Whitney U Test)
* Suzana & Ng 2003
Men: Height = [0.681 x arm span (cm)] + 47.56
Women: Height = [0.851 x arm span (cm)] + 18.78

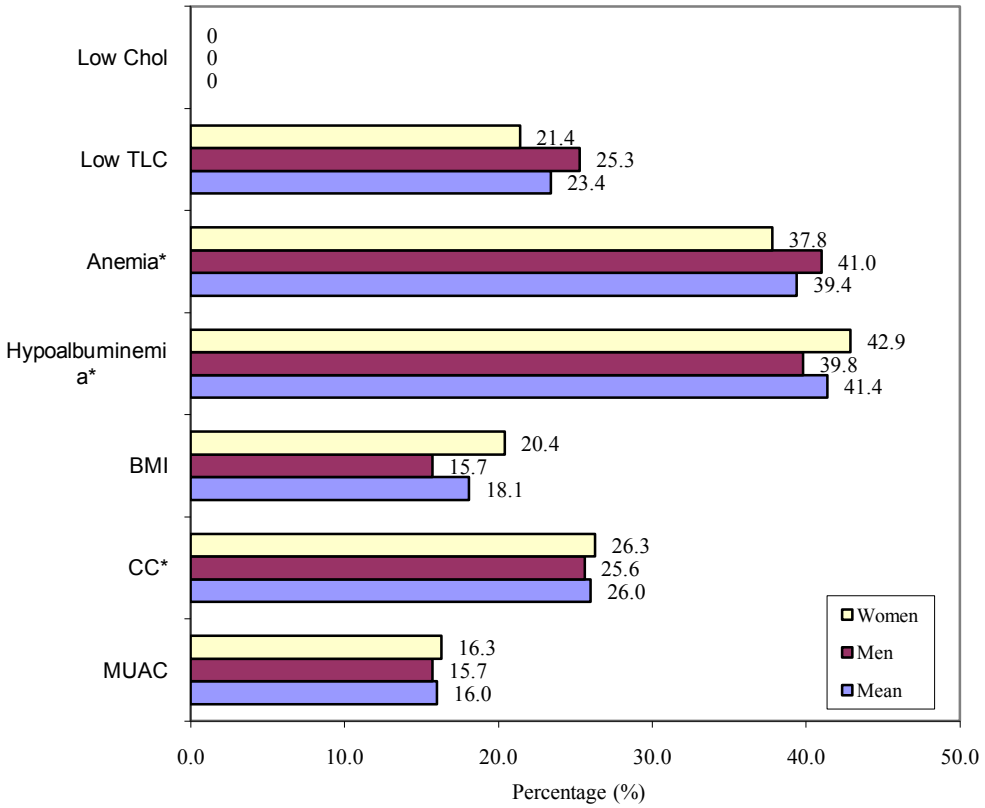

FIG. 1- Prevalence of malnutrition among the subjects using anthropometric and biochemical indicators
* (p<0.0001) significance between both sexes (Chi-square test)
Note: Low cholesterol (<1.6g/dl), Low total lymphocyte count (<1200x10^{6}L), Anemia (Haemoglobin <13g/dl –men, <12g/dl – women), Hypoalbuminemia (<35g/l), BMI (<18.5 kg/m^2), Calf circumference (<30.1 cm-men, <27.3 cm – women), MUAC (<23.0 cm-men, <22.0 cm- women)

BMI measurements also indicated that women had greater prevalence of malnutrition compared to men which were 20.4% and 15.6% respectively. Biochemical test indicated that 41.4% subjects had hypoalbuminemia and 39.4% were anemic. In addition, 23.4% of the subjects had low total lymphocyte count. There were no subjects with low serum cholesterol values on admission.

Discussion

The present study revealed that of the 181 geriatric patients, 55.2% were classified as malnourished. This classification was according to the BMI in which 18.0% were categorized as having CED I, II or III (BMI < 18.5kg/m^2); and 37.3% were either pre-obese, obese I or obese II (BMI > 24.9kg/m^2). The prevalence of overweight was higher than CED in our study as almost half of our subjects had cardiovascular disease (48.1%).

Excess body weight is an established independent risk factor for cardiovascular disease (Hubert et al., 1983; Kumanyika, 2000). Among patients with coronary heart disease, 70% to 88% are overweight (Brochu et al., 2000; Bader et al., 2001). Our findings herein are consistent with the local study conducted by Suzana et al. (2002). In that particular study, the prevalence of malnutrition in elderly inpatients according to the BMI was 48.9%, in which 10.9% had CED (BMI < 18.5kg/m^2) and 38% were overweight (BMI > 24.9kg/m^2). However, the prevalence of undernutrition (18.0%) in this study was much lower than what had been found in the literature. The undernutrition prevalence ranged from 29.7% to 65% (Johnson, 1991; Guigoz et al., 1996; Adrianaet al., 2006).

Conventional measurements of body weight and BMI do not provide sufficient information about distribution of body compartments (Guo et al., 1999). Weight stability might mask changes in the body compartments due to dehydration or fluid overloading in various conditions (Gallagher et al., 2000). BMI has been shown to be a poor indicator of body composition (Frankenfield et al., 2001). As such, for the purpose of this study anthropometric measures were used.

Anthropometric measures of body composition in our study i.e. MUAC, CC and TSF revealed that

16.0% and 26.0% of the subjects had muscle wasting. These anthropometric measurements of body composition specifically muscle mass and fat stores are very important in assessing the nutritional status of elderly patients as optimal body composition is a fundamental factor for physical, cognitive and medical conditions.[46]

Our study indicated that the nutritional status of women were slightly worse than that of men. This gender difference has been observed in the available literature in terms of food preference, intake pattern and risk profile for malnutrition (Bates et al., 1999; Quandt and Chao, 2000; Locher et al., 2005). Reasons for this disparity may be due to the biological difference between men and women and that women may be more susceptible to poor nutritional habits. Studies have also indicated that there are a number of fundamental metabolic differences between older males and females (Bates et al., 1999; Dionne et al., 1999). There is evidence to suggest that the interaction effects of age, education with income and/or other predictors like social support or depressive symptoms might be more complicated for women (Castel et al., 2006).

The condition is compounded with the presence of anemia. A high prevalence of anemia has been observed in hospitalized or institutionalized older individuals (Joosten et al., 1992; Inelmen et al., 1994; Smieja et al., 1996; Ramel et al., 2008) ranging from 24.0% to 52.4%. The prevalence of anemia in our patient group (39.4%) was thus consistent with the literature (Joosten et al., 1992; Inelmen et al., 1994; Smieja et al., 1996; Ramel et al., 2008).

For TLC, previous studies proposed that it decreases with progressive malnutrition and correlates with morbidity and mortality in hospitalized patients (Omran and Morley, 2000; Seiler, 2001). It has also been proposed that regardless of age, a decrease in TLC to less than 1500/mm^3 or less than 900/mm^3 reflects malnutrition or severe malnutrition, respectively (Omran and Morley, 2000; Seiler, 2001). However, Kuzuya et al. (2005) evidenced that TLC is not a suitable marker of malnutrition in the elderly. They suggested that TLC is correlated with aging in subjects between 65 and 90 years old, indicating that TLC appears to be reflective of age rather than of nutritional status.

Numerous age-related parameters and underlying diseases influence the nutritional status of elderly patients. The age-related changes include a reduction in the sensitivity of olfactory and gustatory receptors as well as alterations in the hormonal and neurotransmitter mediated regulation of hunger and satiety. The decrease in lean body mass and basal metabolic rate with age may also contribute to the development of a physiological anorexia of aging (Morley and Thomas, 1999).

Furthermore, various concomitants of old age may play a role in suppressing food intake. Physical disabilities e.g. restricted mobility, upper-extremity dysfunction, chewing problems or swallowing disorders also result in difficulties in shopping for food, preparing meals and eating. In older persons with confusion, dementia or depression poor appetite, forgetting to eat or refusal to eat may result in an inadequate dietary intake. Poverty as well as social isolation may further add to the problem. In hospitalized patients inadequate food intake may be a consequence of unattractive hospital food and surroundings, unjustified restrictive diets, or the lack of help for eating-dependent patients (Volkert, 2002).

Degenerative diseases such as cardiovascular and cerebrovascular disease, diabetes, osteoporosis and cancer, are diet affected and are among the most common diseases affecting older persons (WHO, 2009). Catabolic or hypermetabolic processes are characteristic features of many common diseases and may compromise the nutritional status of the elderly. In chronic diseases a subclinical inflammatory state is present.

This lead to an increased production of catabolic cytokines, increased rate of muscle catabolism, and depressed appetite (Roubenoff, 2000). Loss of muscle mass however, already physiologically occurring with age (sarcopenia), implies a decrease in metabolic reserves and results in a reduced ability to cope with the stress of a disease. Consequently, in older patients even minor stress of short duration can adversely affect their nutritional status (Vorkert, 2002).

Previous studies evidenced that up to 60% of geriatric patients in acute hospitals (Naber et al., 1997), long-term hospitals (Gilmore et al., 1995; Giner et al., 1996; Naber et al., 1997), and nursing homes (Rudman, 1995) have shown evidence of malnutrition on admission or develop nutrition deficits before discharge (Allison et al., 2000). In order to adequately manage the nutritional needs of these people, knowledge of their energy requirements are essential (Ritz, 2001). Gaillard et al. (2007) had analyzed the literature to determine the appropriate energy requirements for elderly people (Gaillard et al., 2007). They concluded that resting energy expenditure (REE), which could be used in conjunction with physical activity level (PAL) to calculate energy requirements, was approximately 20kcal/kg/day in sick elderly people.

This figure does not increase when compared to a group of healthy elderly. REE appears to be no longer affected by gender over the age of 60 years and minimal energy requirements can be set between 27 and 30kcal/kg/day in sick elderly people. The requirements are higher for underweight people (34–38kcal/kg/day).

Malnutrition can adversely affects the well-being of older persons, causing a decline in functional status and the worsening of existing medical problems (Omran and Morley, 2000). The functioning of the immune system is reduced (Chandra, 1997), and alterations in the structure and function of the gastrointestinal system occur (Reynolds et al., 1996). Impaired nutritional status also increases the incidence of sepsis in elderly surgery patients (Potter et al., 1995), increase the probability of mortality risk (Muhlethaler et al., 1995) and affects hospital costs (Tucker and Miguel, 1996).

Conclusion

Available literature clearly illustrates that poor nutritional status adversely affects health and recovery from illness or injury. Elderly patients constitute a nutritionally at high-risk group that should always be screened for the evidence of malnutrition. This is mainly to provide prompt nutritional interventions when such evidence is present. In this study, anthropometric and biochemical measurements were good indicators to assess malnutrition among hospitalized elderly patients. However, more studies are needed to examine the occurrence of malnutrition upon hospital-admission and hospital-acquired malnutrition among elderly patients.

Acknowledgements

We would like to express our gratitude and appreciation to all the health care providers and patients of Geriatric Ward, University Malaya Medical Centre for their contributions in this research. Great appreciation is extended to Miss Ngoh Hooi Jiun and Miss Tan Sze Lin for their technical assistance.

Conflict of interest and funding disclosure

The authors have no conflict of interest. This study was supported by grants from the Universiti Sains Malaysia (Fellowship scheme) and Universiti Kebangsaan Malaysia (UKM Grant, NN 10/02).

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