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Prevalence of malnutrition and risk factors in geriatric patients of a convalescent and rehabilitation hospital

一所復康醫院內年老病人營養失調的患病率及危險因素

Objectives. To investigate the prevalence and risk factors of malnutrition in geriatric patients admitted to a convalescent and rehabilitation hospital.
Design. Cross-sectional study.
Setting. Regional hospital, Hong Kong.
Patients. A total of 120 patients (aged 60 years or older) referred to Tung Wah Eastern Hospital.
Main outcome measures. Anthropometric, biochemical, and haematological parameters were measured for nutritional assessment. Malnutrition was defined as a body mass index of lower than 18.5 kg/m^2 and serum albumin level of lower than 35 g/L. The clinical outcomes of patients were also recorded. The predictive value of the Chinese Mini Nutritional Assessment as a nutritional screening tool was assessed. Potential risk factors associated with malnutrition were evaluated according to established protocols.
Results. The mean age of patients was 80.3 years (standard deviation, 7.4 years), and the mean body mass index was 21.9 kg/m^2 (standard deviation, 4.4 kg/m^2). The prevalence of malnutrition was 16.7%. The age distribution of malnourished patients (mean, 86.2 years; standard deviation, 7.0 years; n=20) was significantly different to those nourished (mean, 79.1 years; standard deviation, 6.9 years; n=100) [P=0.0001]. Mortality was also higher in malnourished patients (25%) than nourished patients (4%) [P=0.001]. Based on the Chinese Mini Nutritional Assessment, 16.9% of patients were classified as malnourished (cut-off value, 18.5). The Chinese Mini Nutritional Assessment was useful as a screening tool to exclude patients who were not malnourished, ie it had a high negative predictive value (95%). Being totally dependent for the performance of activities of daily living, living in a home for the elderly, and being chair- or bed-bound posed a significantly increased risk of malnutrition. The presence of mental depression (geriatric depression scale score of 8 or higher), moderately or severely impaired cognitive function (abbreviated mental test score of lower than 7), or polypharmacy (five medications or more) did not significantly affect risk of malnutrition.
Conclusions. Malnutrition was common in the geriatric patients studied and was associated with an increased mortality. The Chinese Mini Nutritional Assessment was a useful screening tool to exclude malnutrition. Significant risk factors of malnutrition were total dependence, living in a home for the elderly, and being chair- or bed-bound.

目的：研究入住一所復康醫院的年老病人，其營養失調的患病率及危險因素。

Key words:
Aged;
Geriatric assessment;
Nutrition assessment;
Nutritional status;
Risk factors

關鍵詞：
年老者；
年老狀況評估；
營養狀況評估；
營養狀況；
危險因素

Hong Kong Med J 2005;11:234-42

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設計：橫斷面研究。
安排：地區醫院，香港。
患者：120 名年齡 60 歲或以上轉介到東華東院的病人。
主要結果測量：根據人體測量參數、生化學參數，以及血液學參數作營養評估。平均體重指數低於18.5 kg/m²及血清白蛋白水平低於 35 g/L 被定義為營養失調。本研究記錄病人的診斷結果，審估微型營養評定中文版作為篩選病人營養狀況的預測值，並根據已建立的程序評估與營養失調有關的潛在危險因素。
結果：病人的平均年齡為 80.3 歲（標準差為 7.4 歲），平均體重指數為 21.9 kg/m²（標準差為 4.4 kg/m²）。營養失調的比率為 16.7%。營養失調病人（n=20）的年齡分佈與營養充足的病人（n=100）相比有明顯不同（P=0.0001）；前者平均年齡為 86.2 歲（標準差為 7.0 歲），後者平均年齡為 79.1 歲（標準差為 6.9 歲）。營養失調病人（25%）的死亡率亦比營養充足的病人（4%）為高（P=0.001）。根據微型營養評定中文版，是次研究中 16.9% 的病人被劃分為營養失調（臨界值為 18.5）。微型營養評定中文版是一個有用的篩選工具，用以排除非營養失調患者，即有高的負預測值 (95%)。日常生活的活動完全依賴別人、入住於老人院和活動範圍只限於床椅上的病人，患營養失調的危機明顯增加。至於精神抑鬱(年老抑鬱數值分數達8或以上)、認知功能屬中度及嚴重受損（簡易智力測驗分數低於 7），或接受複方用藥（多於 5 種藥物）的情況，對病人的營養失調的危機均無明顯影響。
結論：營養失調對是次接受研究的年老病人而言是普遍現象，並與其高死亡率有關。微型營養評定中文版對區分營養失調的病人，是一個有用的篩選工具。日常生活上完全依賴別人、入住老人院，以及活動範圍只限於床椅上，均是造成病人營養失調的明顯危險因素。

Introduction

Malnutrition occurs when nutritional intake fails to meet nutritional requirements. A common factor in the elderly population that put them at risk is deterioration in sense of taste or smell and consequent poor appetite. Eating disturbances are also a feature of early cognitive change such as dementia. Age-related co-existing medical conditions, especially those associated with neurological disorders, can result in low food intake due to dysphagia or a reduced ability to self-feed. Polypharmacy in the elderly is common and may be an iatrogenic cause of malnutrition. A low food intake may be a side-effect of drugs such as digoxin and captopril, which are associated with nausea and loss of appetite and taste. Social isolation and financial deprivation are also recognised risk factors for malnutrition.[1]

Two major groups of malnutrition—protein energy malnutrition and vitamin/mineral deficiency—were recognised. A high prevalence of protein energy malnutrition in geriatric patients has been reported.[2] It is well documented that malnutrition increases the re-admission rate and cost of hospital care in terms of length of stay in hospital as well as mortality. The British Association for Parenteral and Enteral Nutrition recommended that medical professionals carry out simple nutritional screening for all patients on admission to hospital.[3] In addition, the Cochrane review of nutritional supplementation found that nutritional intervention could improve anthropometric and biochemical measures, and/or functional status.[4] An accurate screening tool to identify malnourished geriatric patients is a valuable means to improve patient care.

Mini Nutritional Assessment (MNA) is one of the tools designed specifically to screen for malnutrition in geriatric patients. It has a high predictive value for morbidity and mortality and consists of 18 assessment items divided into four parts: anthropometric, general, dietary, and self-assessment. Validation of a Chinese version of MNA (Chinese MNA) showed that it is a simple and valid screening tool for health care providers.[5]

The aims of the present study were three-fold: (1) to assess the prevalence of malnutrition using anthropometric and biochemical parameters; (2) to test the hypothesis that the Chinese MNA is not a useful screening tool for identifying malnutrition in hospitalised geriatric patients; and (3) to test the hypothesis that the risk of malnutrition is not increased by depressed mood, impaired cognitive function, functional impairment, polypharmacy, place of residence prior to admission, or mobility.

Methods

This was a cross-sectional study. Patients aged 60 years or older who were transferred to the geriatric wards of Tung Wah Eastern Hospital (TWEH) between 15 December 2002 and 31 March 2003 for convalescent and rehabilitative care were invited to participate. Patients previously stayed in the medical wards of

Table 1a. Methodology of anthropometric assessment

Anthropometric parameter*	Methodology
Height (nearest 1 cm)	Converted from knee height
Weight (0.1 kg)	Wearing patient's uniform and without shoes standing on an upright scale (Detecto; Webb City, Missouri, US); for bed-bound or chair-bound patients, a chair scale (Detecto) was used
Body mass index[6] (weight/squared height) [kg/m^2]	<18.5: malnourished 18.5-22.9: normal ≥23: overweight
Knee heel height[7,8] (nearest 1 cm)	Recorded at recumbent position with a knee height caliper; converted to body height using: (male) 2.24 x knee height + 51.16 (female) 2.46 x knee height - 0.12 x age + 46.11
Triceps skin fold (nearest 1 mm)	At the mid-point of non-dominant arm between the acromial process of the scapula and the olecranal process of the elbow using a Jamar skin fold caliper
Mid-arm circumference (nearest 1 cm)	The diameter of non-dominant arm was measured at the mid-point between acromial process of the scapula and olecranal process of the elbow using a measuring tape when the arm hanged loosely
Arm muscle circumference (AMC)[9] [nearest 1 cm]	Calculated from triceps skin fold using: Arm circumference (cm) - 0.314 x triceps skin fold (mm)
Corrected arm muscle area[9] (nearest 1 cm^2)	According to: (male) AMC^2 / (4 x 3.14) - 10 (female) AMC^2 / (4 x 3.14) - 6.5

* Measurement unit/resolution is shown in parenthesis

Pamela Youde Nethersole Eastern Hospital (PYNEH) where they had been admitted via the Accident and Emergency Department. Tung Wah Eastern Hospital is a regional hospital serving an estimated population of 850 000 in the Hong Kong East Cluster (HKEC). It is the main convalescent and rehabilitation hospital in HKEC and provides services in five specialties: medicine, geriatrics, rehabilitation, ophthalmology, and orthopaedic rehabilitation. The mean length of stay of patients was around 14 days. Exclusion criteria of the present study included:

(1) patients admitted to a geriatric ward via specialist out-patient clinics or government out-patient clinics;
(2) patients with limb amputation;
(3) patients with terminal cancer;
(4) patients re-admitted within the study period;
(5) patients (or their relatives) unable or unwilling to give written informed consent; and
(6) patients suffering from severe contractures that would not allow accurate measurement of body weight or knee height.

Baseline demographic data including age, sex, marital status, smoking status, alcohol consumption, and education levels were obtained on admission to the ward. Nutritional status was assessed using anthropometric, haematological, and biochemical data. Malnutrition was defined as a body mass index (BMI) of below 18.5 kg/m^2 for both sexes (reference range, 18.5-22.9 kg/m^2), and albumin level of less than 35 g/L (reference range, 35-50 g/L).[5] Clinical outcomes included mortality and length of hospital stay. Mortality was defined as death before discharge. Length of stay was defined as duration of hospitalisation at TWEH before discharge (including the duration of stay after transfer back to PYNEH) or death.

The modified Chinese MNA was used as a screening tool for malnutrition.[5] The maximum score of the Chinese MNA is 30 and the cut-off point is 18.5. The at-risk group had an MNA score between 18.5 and 23.5, while the nourished group had an MNA score above 23.5. These data were collected by a single investigator from patients within 48 hours of admission. Written consent was obtained from patients or their relatives. The research protocol had been previously approved by the Ethics and Research Committee of Tung Wah Group of Hospitals.

Anthropometric parameters were recorded and outlined in Table 1a.[6-9] Routine blood tests, including a complete blood picture with differential counts, liver and renal function tests were performed 1 day following patient admission to TWEH. Three biochemical and haematological parameters—albumin (g/L), haemoglobin (g/L), and lymphocyte count (x 10^9 /L)—were used for analysis. Risk factors associated with

Table 1b. Methodology of risk factor assessment

Risk factor	Methodology	Criteria
Depressed mood	Chinese version of geriatric depression scale[10]	≥8 points on a 15-point scale indicated depression
Impaired cognitive function	Chinese version of abbreviated mental test[11]	7-10: normal 4-6: moderate cognitive impairment <4: severe cognitive impairment
Functional status	Ability to perform daily activities including bathing, dressing, grooming, toileting, walking or transfer, and feeding	Partially dependent: self-reporting to need help with one or more tasks Totally dependent: unable to perform any task
Polypharmacy	Recorded on admission	Defined as those taking ≥5 drugs regularly
Residence before admission	Questionnaire	Classified as (i) living in an old-aged home, (ii) living with family, or (iii) living alone
Mobility	Recorded on admission	Classified as (i) walking unaided, (ii) walking with aid, (iii) chair-bound, or (iv) bed-bound

malnutrition that were investigated are outlined in Table 1b.[10,11]

Patients with a BMI of lower than 18.5 kg/m^2, albumin level of lower than 35 g/L, or at risk of malnutrition (as identified by MNA score) were referred to a hospital dietitian for dietary counselling. Patients considered overweight received advice on weight reduction.

Data were analysed using the Statistical Package for the Social Sciences (Windows version 11.5; SPSS Inc, Chicago [IL], United States). Student's *t* tests were used to compare the distribution between malnourished and nourished subjects (BMI/albumin level) of the anthropometric parameters, risk factors, and MNA scores (P=0.05). Chi squared test was used to determine any significant difference in distribution of age-groups between malnourished and nourished patients. One-way analysis of variance and Tukey post-hoc comparison tests were used to determine if there were significant differences in anthropometric parameters as well as the three biochemical and haematological parameters between the three age-groups: young-old (60-69 years), old (70-79 years), and old-old patients (≥80 years). Student's *t* tests were used to determine if significant differences existed between the sexes of the anthropometric, biochemical, and haematological parameters. The sensitivity and specificity of the Chinese MNA were analysed by 2×2 table. Student's *t* tests were also used for testing differences in geriatric depression scale (GDS) and abbreviated mental test (AMT) scores between malnourished and nourished subjects. The dichotomous distributions of risk factors between the malnourished and nourished subjects were subjected to risk estimation to report the odds ratio and confidence interval at 95%. Chi squared or Chi squared exact tests were used to determine the P values.

Table 2. Baseline demographic data of patients

Demographic data	Patients No. (%)
Age-group (years)	
Young-old (60-69)	9 (8)
Old (70-79)	46 (38)
Old-old (≥80)	65 (54)
Sex	
Female	61 (51)
Male	59 (49)
Marital status	
Single	4 (3)
Married	53 (44)
Widowed	63 (53)
Smoking status	
Non-smoker	59 (49)
Ex-smoker	46 (38)
Current smoker	15 (13)
Alcohol consumption	
Non-drinker	79 (66)
Ex-drinker	10 (8)
Social drinker	29 (24)
Chronic drinker	2 (2)
Education level	
Illiterate	54 (45)
Primary	47 (39)
Secondary	14 (12)
Tertiary	5 (4)

Results

Demographic data and outcomes

During the study period, 201 patients were transferred from PYNEH to the geriatric ward of TWEH. Informed consent to participate in the study was obtained from 108 patients. An additional 12 patients were recruited from a pilot study, giving a total of 120 patients (59 men, 61 women). The overall mean age was 80.3 years (standard deviation [SD], 7.4 years):

Table 3. Comparisons of the anthropometric, biochemical, and haematological parameters between malnourished and nourished patients

Parameter	Malnourished, n=20*	Nourished, n=100*	P value
Anthropometric			
Age (years)	86.2 ± 7.0	79.1 ± 6.9	0.0001
Body mass index (kg/m^2)	16.4 ± 1.5	23.0 ± 3.9	0.0001
Arm muscle circumference (cm)	17.0 ± 2.2	20.6 ± 2.9	0.0001
Corrected arm muscle area (cm^2)	15.4 ± 5.1	26.2 ± 9.4	0.0001
Triceps skin fold thickness (mm)	7.5 ± 2.8	17.3 ± 7.9	0.0001
Biochemical and haematological			
Albumin (g/L)	28.0 ± 4.0	36.0 ± 5.0	0.0001
Haemoglobin (g/L)	105 ± 14	118 ± 19	0.0031
Lymphocyte (x 10^9 /L)	1.3 ± 0.5	1.5 ± 0.8	0.149

* Data are shown in mean ± SD

Table 4a. Anthropometric, biochemical, and haematological parameters of patients by age-groups

Parameter*	Age-group†			P value‡
	Young-old, n=9	Old, n=46	Old-old, n=65	
Anthropometric				
Weight (kg)	59.8 ± 11.0	57.4 ± 11.4	48.0 ± 11.3	<0.001
Height (cm)	160.0 ± 5.5	154.8 ± 8.4	153.8 ± 9.1	0.134
Knee heel height (cm)	48.8 ± 2.4	47.3 ± 3.0	47.2 ± 3.2	0.320
BMI (kg/m^2)	23.4 ± 4.3	23.9 ± 4.1	20.2 ± 3.9	<0.001
Triceps skin fold thickness (mm)	17.4 ± 7.0	18.7 ± 9.2	13.4 ± 6.8	0.002
Mid-arm circumference (cm)	28.4 ± 3.4	26.4 ± 4.2	23.4 ± 4.0	<0.001
AMC (cm)	23.0 ± 3.1	20.6 ± 2.7	19.2 ± 3.0	<0.001
CAMA (cm^2)	33.4 ± 11.7	26.1 ± 8.5	21.9 ± 9.3	<0.001
Biochemical and haematological				
Albumin (g/L)	38.0 ± 6.6	34.5 ± 5.9	33.8 ± 5.1	0.111
Haemoglobin (g/L)	130 ± 12	117 ± 22	113 ± 16	0.034
Lymphocytes (x 10^9 /L)	1.7 ± 0.7	1.6 ± 0.8	1.4 ± 0.7	0.265

* BMI denotes body mass index, AMC arm muscle circumference, and CAMA corrected arm muscle area
† Data are shown in mean ± SD
‡ From analysis of variance

females were older than males (mean ± SD: 81.8 ± 7.9 vs 78.7 ± 6.5 years) but the difference was not statistically significant (P>0.05). More than half of the patients were widowed. Approximately a quarter of the patients were residents in old-aged homes, and a majority of institutionalised residents were aged 80 years or above (20 out of 31 institutionalised residents). Nearly half (45%) of the patients were illiterate. Other demographic data are summarised in Table 2.

Nine (7.5%) of the 120 patients died during the study period. The mortality rates were 25% in the malnourished group (n=20) and 4% in the nourished group (n=100). The difference was statistically significant (P=0.001), but the length of hospital stay (mean ± SD) was not (P=0.270): 32 ± 43 days for the malnourished patients (n=20) at TWEH, and 25 ± 27 days for the nourished patients (n=100).

Prevalence of malnutrition

Prevalence of malnutrition, based on a BMI of lower than 18.5 kg/m^2 and albumin level of lower than 35 g/L, was 16.7% (20/120). While 38.3% (46/120) of patients had a BMI of lower than 18.5 kg/m^2 and albumin level of lower than 35 g/L, 45% had a BMI of higher than 18.5 kg/m^2 and an albumin level of higher than 35 g/L (54/120). The anthropometric parameters and serum haemoglobin level were significantly lower in the malnourished group (Table 3).

Patients were divided into three age-groups: young-old (60-69 years), old (70-79 years), and old-old (≥80 years). More than half of the patients in this study belonged to old-old group. The distribution of malnourished and nourished subjects among the young-old, old, and old-old groups were 0/9, 3/43, and 17/48, respectively. Chi squared test showed that the distribution of malnourished subjects among age-groups was significantly different (P=0.01).

Weight, BMI, triceps skin fold thickness, mid-arm circumference, arm muscle circumference, and cor-

Table 4b. Differences between age-groups by post-hoc tests

Anthropometric parameter*	P value of post-hoc test		
	Young-old vs old	Old vs old-old	Young-old vs old-old
Weight	0.837	<0.001	0.012
Height	0.230	0.819	0.113
BMI	0.928	<0.001	0.073
Triceps skin fold thickness	0.888	0.002	0.323
Mid-arm circumference	0.363	0.001	0.363
AMC	0.062	<0.038	0.001
CAMA	0.077	0.049	0.002

* BMI denotes body mass index, AMC arm muscle circumference, and CAMA corrected arm muscle area

Table 5. Anthropometric, biochemical, and haematological parameters of patients by sex

Anthropometric parameter*	Female, n=61†	Male, n=59†	P value‡
Anthropometric			
Weight (kg)	49.4 ± 12.5	55.7 ±11.3	0.005
Height (cm)	148.0 ± 5.4	161.5 ± 5.6	<0.001
Knee heel height (cm)	45.4 ± 2.2	49.3 ± 2.5	<0.001
BMI (kg/m^2)	22.4 ± 4.9	21.3 ± 3.8	0.144
Triceps skin fold thickness (mm)	18.3 ± 9.2	13.0 ± 5.9	<0.001
Mid-arm circumference (cm)	24.8 ± 4.9	25.0 ± 3.7	0.740
AMC (cm)	19.0 ± 2.9	21.0 ± 2.9	<0.001
CAMA (cm^2)	23.1 ± 9.3	25.7 ± 9.9	0.131
Biochemical and haematological			
Albumin (g/L)	35.0 ± 6.0	34.0 ± 5.0	0.580
Haemoglobin (g/L)	115 ± 17	117 ± 21	0.414
Lymphocytes (x 10^9 /L)	1.6 ± 1.3	1.3 ± 0.6	0.017

* BMI denotes body mass index, AMC arm muscle circumference, and CAMA corrected arm muscle area
† Data are shown in mean ± SD
‡ From *t* test

rected arm muscle area were significantly different among the patients of the three age-groups. These parameters appeared to decrease with advancing age, but the differences between groups were not always significant as shown by post-hoc tests (Tables 4a and 4b). Nonetheless a significant difference in serum haemoglobin was observed between the young-old and old-old (P<0.05).

The BMI (mean and SD) of male patients was comparable with that of females, although males were significantly heavier and taller than females. Females had significantly thicker triceps skin fold thickness than males. When the three biochemical and haematological parameters were analysed, only the lymphocyte counts varied significantly between male and female patients (Table 5). Twelve of the 61 female patients and eight of 59 male patients were malnourished. Sex was not a predictive factor for malnutrition (P=0.369).

Chinese version of mini nutritional assessment

A nutritional assessment was completed using the Chinese MNA for 77 patients. Reasons for non-completion were absence of informed consent, inability to contact relatives or guardians, or deterioration in cognitive function.

According to the MNA, the incidence of malnutrition is 16.9% (n=13) in this study: an MNA score of 18.5 was used as the cut-off value, below which patients were considered at risk of malnutrition.[5] While 34 (44.2%) patients were considered at risk of malnutrition (MNA score, 18.5-23.5), the remaining 30 (38.9%) patients were adequately nourished. The malnourished patients had a mean MNA score of 15.4 (SD, 5.5), significantly lower than the nourished group of 22.5 (SD, 3.6) [P=0.0001]. The sensitivity of the Chinese MNA was 62.5% (5 true positive predictions/8 malnourished subjects), and the specificity was 88% (61 true negative predictions/69 nourished subjects). Its positive and negative predictive values were 38% (5 true positive predictions/13 positive predictions) and 95% (61 true negative predictions/64 negative predictions), respectively.

Risk factors predisposing to malnutrition

The GDS score for depressed mood and AMT score for cognitive function did not vary significantly between the malnourished and nourished subjects.

Other risk factors for malnutrition did not differ significantly between nourished and malnourished patients: depression (GDS ≥8), moderately or severely

Table 6. Dichotomous distribution of risk factors in malnourished and nourished subjects

Risk factor*	Distribution of risk factor		Odds ratio (95% confidence interval)	P value from Chi squared test
	Malnourished subjects (No. of patients/ total in group)	Nourished subjects (No. of patients/ total in group)		
Depression (GDS ≥8)	3/5	13/67	5.25 (0.96-28.76)	0.069†
Moderately or severely impaired cognitive function (AMT <7)	2/7	14/68	1.65 (0.35-7.75)	0.618†
Totally dependent (ADL)	12/20	16/100	4.93 (2.24-10.87)	<0.0001
Polypharmacy (>5)	5/20	29/100	0.843 (0.33-2.14)	0.793
Living alone	2/20	15/100	0.67 (0.17-2.64)	0.735†
Living in old-aged homes	9/20	22/100	2.90 (1.07-7.87)	0.0481
Chair- or bed-bound	13/20	24/100	4.17 (1.81-9.62)	0.002

* GDS denotes geriatric depression scale score, AMT abbreviated mental test score, and ADL activities of daily living
† Chi squared exact test

impaired cognitive function (AMT <7), polypharmacy (>5), and living alone. Nonetheless the distribution of subjects who were totally dependent, living in old-aged homes, and chair- or bed-bound was significantly different for each group (Table 6). Risk estimates of these three risk factors showed that the odds ratio of totally dependent subjects, old-aged home dwellers, and chair- or bed-bound subjects being malnourished were approximately 5, 3, and 4, respectively (Table 6).

Discussion

It has been estimated that in the United Kingdom, malnutrition in patients aged 65 years and above costs the health service £2 to 4 billion, mainly because of increased rates of hospital admission and prolonged hospital stay.[12] Malnutrition affects clinical outcome and may also prevent achieving the targets of geriatric rehabilitation. The United States Preventive Services Task Force and the American Academy of Family Physicians recommend that clinicians provide routine nutritional assessment and counselling to all patients,[13] yet a standardised nutritional assessment is not necessarily part of a comprehensive geriatric assessment.

As many as 40% to 60% of patients hospitalised for acute illness are malnourished,[14] yet this high prevalence is often underestimated by medical professionals.[15] There are three possible explanations: lack of training in nutritional assessment and monitoring of patients' nutritional status, the absence of a well-validated laboratory screening tool for malnutrition, and the lack of a consensus on what constitutes malnutrition.

The cohort of patients in this study had been transferred from PYNEH following management of an acute illness. This in itself may have affected the individual's BMI and albumin level. Under the present study conditions, the prevalence of malnutrition (based on BMI of <18.5 kg/m^2 and albumin level of <35 g/L) was 16.7%. This figure is comparable with the results of other recent studies—a study of institutionalised residents in Hong Kong[16] reported a 21.6% incidence of malnutrition while a study in Singapore of 658 patients treated over a 1-month period in general medical and surgical wards reported an incidence of 14.7% after screening patients using a subjective global assessment (SGA).[17] It has also been questioned whether the same BMI used for a Caucasian population is equally appropriate for an Asian one. A local study conducted by Woo et al[18] in 1988 showed that the normal range of BMI for men was 16 to 28 kg/m^2 and for women 15 to 31 kg/m^2. If a BMI of lower than 18.5 kg/m^2 had been used in this study, the prevalence of malnutrition would have been lower.

In this study, mortality was higher in malnourished patients: similar results were obtained by a study in North America.[19] The mean length of hospital stay in this study was 22.9 days, comparable with the 24.6 days quoted by a report of the Hospital Authority of Hong Kong on patients aged 75 years or over.[20]

Several other validated nutritional screening tools are available: SGA,[21] prognostic nutritional index (PNI),[22] and MNA. The SGA and PNI were initially validated in patients with gastro-intestinal problems and used to assess the risk of complications while in hospital. In clinical practice, MNA is a cost-effective, non-invasive, and user-friendly tool, able to be used by primary care physicians, nurses, residential care staff, and dietitians. It is reported to be highly sensitive (sensitivity=96%) and specific (specificity=98%), with a predictive value of up to 97%.[23] In addition to

using as a screening tool, it is useful for follow-up evaluation, nutritional intervention, and preoperative nutritional evaluation of elderly subjects.[24] The Chinese MNA as a nutritional screening tool was validated in Hong Kong in 2001.[5] Of the subjects assessed, 16.9% were classified as malnourished, 44.1% as at risk, and only 39% as 'normal'.[5] In this study, the sensitivity and specificity of MNA in the detection of malnutrition according to BMI and albumin level were 63% and 88%, respectively. The positive predictive value was only 38%, but the negative predictive value was as high as 95%. Therefore, the null hypothesis that the Chinese MNA is not a useful screening tool for malnutrition of hospitalised geriatric patients is rejected. The low sensitivity and low positive predictive value can be explained by the differences between study groups and clinical settings. In the initial validation study,[5] only institutionalised patients were assessed: they comprised only 26% of patients in this study. Further studies are required before it can be established whether the cut-off value of Chinese MNA should be adjusted for hospitalised patients. Another study established that the results obtained using a different version of the Chinese MNA were less reproducible among Hong Kong patients.[25] This may have been due to the unstable nature of the hospitalised subjects recruited, such as emotional instability during onset of disease. Nonetheless, preliminary analysis suggested that the Chinese MNA was a useful screening tool for malnutrition. In this study, it had a high negative predictive value, thus MNA may be used to confirm that the hospitalised patient is not malnourished.

Being totally dependent for performing general activities of daily living and being chair- or bed-bound related to the functional ability of patients and were predictors of malnutrition. The null hypothesis that the risk of malnutrition is not increased by mental depression (GDS ≥8), impaired cognitive function (AMT <7), polypharmacy (>5 medications), or place of residence prior to hospital admission (living alone) is accepted. The hypothesis that risk of malnutrition is not increased by functional impairment or mobility is rejected.

At least three previous studies have shown that compromised activities of daily living are a predictor of malnutrition.[1,26,27] In some instances the risk of malnutrition was doubled.[1] In this study, totally dependent patients were living in homes for the elderly or being looked after by full-time caretakers. In addition, more than half of the totally dependent patients required enteral feeding to ensure adequate nutrition. Chair- or bed-bound patients were also more dependent on others for care and feeding, thus predisposing them to a higher risk of malnutrition.

The 95% confidence interval of mental depression (GDS ≥8) as a risk factor in the present study was 0.96 to 29.76 with a P value of 0.069. This indicates that it was a borderline risk factor. Several other studies have nonetheless confirmed that severe depression was associated with a higher incidence of malnutrition. Such studies have involved patients with head and neck cancer, chronic haemodialysis patients, and patients with an advanced solid tumour.[28-30] A study of 250 older subjects living at home who received domiciliary care services also revealed that mental depression was a significant risk factor for malnutrition.[31] The findings of this study that mental depression was only a borderline risk factor should therefore be interpreted with caution.

Moderately or severely impaired cognitive function (AMT <7) was not a significant risk factor in the present study. Previous studies have used different tools to assess cognitive function and have yielded different results. In a study of 282 institutionalised elderly subjects living in Hong Kong, the risk of malnutrition in those suffering from dementia (according to the criteria of the AMT) was 10 times higher than in those who were not demented.[16] Another study of 627 elderly subjects who lived in European small towns showed that those with possible cognitive impairment were more than twice likely to be malnourished.[1] Cognitive impairment was diagnosed if a subject scored less than 24 by the Mini-Mental State Examination.

In the present study, polypharmacy did not affect risk of malnutrition. The effect of drugs on various functions, such as salivary secretion, food digestion, and metabolic balance, that may in turn affect nutritional status, was not assessed.

The findings of this study confirmed those of a study of 627 elderly in European small towns: living alone was not a significant risk factor of malnutrition.[1] Conditions that limit an individual's function and mobility are better indicators of malnutrition risk than living alone. Nevertheless, patients living in care homes for the elderly were at borderline risk (P=0.0481) of malnutrition.

Conclusion

The prevalence of malnutrition in geriatric patients

admitted to a convalescent and rehabilitation hospital was high (16.7%). Malnutrition was associated with increased mortality. The Chinese MNA had a high negative predictive value and was thus useful as a screening tool in clinical practice to identify the nourished patients. Patients who were totally dependent, lived in a care home for the elderly, or were chair- or bed-bound had a higher risk of malnutrition.

Acknowledgements

The authors would like to express appreciation for the assistance provided by Dr Kwok-hung Wong (Consultant of Department of Medicine and Rehabilitation), Dr Shing-chung Siu, (Consultant and Director of Diabetes Centre), and Ms Jamie Man-yue Leung (former Dietitian of Diabetes Centre, Tung Wah Eastern Hospital).

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