THE PREVALENCE AND RISK FACTORS OF PROTEIN-ENERGY MALNUTRITION IN THREE DIFFERENT INSTITUTIONS FOR ELDERLY CHINESE IN HONG KONG

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Abstract: 282 Chinese elderly residents, aged 60 years and above, living for more than one year in a Long Stay Care Home (LSCH), a Care & Attention Home (C&AH), and infirm hospital (WCHH), were recruited into the nutritional survey during the period from June to August of 1998. Protein nutritional status was assessed using anthropometric and biochemical indices. Medical history taking and physical examination were carried out focusing on oral or non-oral feeding, comorbid medical conditions, physical function (simplified Barthel index), and cognitive function (abbreviated mental test). 61 out of the 282 elderly residents (21.6%) were found to have Protein Energy Malnutrition (PEM). The prevalence of PEM in men was 14.8% and in women was 26.3%. Data analysis using stepwise logistic regression showed that chronic lung disease (OR 23.1, 95% CI 4.7-114.3, p = 0.0001), dementia (OR 10.8, 95% CI 2.9-40.0, p = 0.0004), and feeding with gastric diet (OR 5.8, 95% CI 2.3-14.4, p = 0.0002) were significantly associated with PEM. Diabetes mellitus (OR 0.10, 95% CI 0.02-0.45, p = 0.0025) and women (OR 0.2, 95% CI 0.06-0.59, p = 0.004) were negatively related to the PEM. Conclusion: PEM is a common problem in institutionalised elderly in Hong Kong. Old persons who are cognitively compromised, in need of modified method of feeding, or with chronic lung diseases are at significant risk for PEM.

Key words: prevalence, elderly, Chinese, protein-energy malnutrition

Introduction

In 1996, the Hong Kong elderly population (aged 65 and over) was 629,555. By the year 2006, it is projected to rise to 761,900, a net increase of 21%. There will be concomitant increase in the old-old group (aged 75 and over) by 56%1-3. Based on current projection, the numbers of elderly requiring nursing care will also increase rapidly. Nutrition plays a pivotal role in maintaining health and delaying the slow, progressive decline that comes with normal ageing. Malnutrition is likely a common problem in elderly subjects3-4. A review of Caucasian literatures in nutrition yields surprisingly a large range of values of prevalence of malnutrition5-10. In Hong Kong, only few studies about nutritional assessment in institutionalised elderly Chinese were carried out years ago11-14. However, the prevalence of protein-energy malnutrition in long-term care facilities for elderly in Hong Kong is unknown. Many diseases or conditions can affect a person's nutritional status. Important influences on food intake in the elderly include medication use, psychological factors such as depression, impaired cognitive function, and physical factors including immobility, inability to feed oneself, and poor / ill-fitting dentures15-19. These are all prevalent among institutionalised elderly. As malnutrition is well known to be associated with higher morbidity, higher mortality, and poor quality of life, nutritional assessment and risk identification in an attempt to provide early nutrition intervention are important in health care services for institutionalised elderly in Hong Kong.

Objectives

The primary objective of the study is to ascertain the prevalence of protein-energy malnutrition (PEM) in the following three different groups of institutionalised elderly in Hong Kong:

i) Psychiatric patients (ambulatory and totally independent in activities of daily living).

ii) Mildly dependent patients (ambulatory and partially dependent in activities of daily living).

iii) Infirmary patients (extremely dependent in...
activities of daily living

The secondary objective is to identify risk factors associated with the occurrence of PEM among these subjects.

**Subjects an methods**

A cross-sectional study was conducted within the period from June to August of 1998 in the i) Yeung Sing Memorial Long Stay Care Home (LSCH) ii) Yu Chun Keung Memorial Care & Attention Home (C&AH), and iii) Wong Chuk Hang Hospital (WCHH).

There were 167 patients residing in the 170 beds LSCH that housed stable psychiatric patients of which almost all were chronic schizophrenics with a few being of mood disorders. They were ambulatory and independent in activities of daily living.

There were 200 beds in the C&AH that provided residence for the elderly who was ambulatory and required minimal assistance (mildly dependent) in the activities of daily living. A total of 195 residents lived in the setting at the period of survey.

There were 150 beds in the infirmary setting (WCHH) of which the elderly were bed-ridden and extremely dependent in activities of daily living. The 125 elders in this infirm setting were one of the three studied groups.

Residents who were aged 60 years or above and had lived in the setting for one year or more (inclusion criteria) were invited to take part in the study. Informed consents were obtained from the residents or their relatives. In the LSCH, 159 psychiatric patients met the inclusion criteria. 79 patients were recruited into the study (response rate 49.7%). In the C&AH, 177 residents met the inclusion criteria. 95 subjects were recruited into the study (response rate 53.7%). In the WCHH, 119 patients met the inclusion criteria. 108 subjects were recruited into the study (response rate 90.8%). The overall response rate was 62% (282 / 455 patients).

**Data Collection**

**Anthropometric measurements.** All anthropometric measurements were performed by a trained nurse. **Corrected arm muscle area (CAMA)** was calculated using measurements of triceps skin-fold thickness and the arm circumference\(^2\). Arm circumference was measured at the mid-point between the acromion and olecranon processes. Triceps skin-fold thickness was measured with the Lange Skin-fold Callipers at the same point. The average of three readings was used. Arm muscle circumference (AMC) and CAMA were derived from the following equations\(^2\):

\[
AMC(cm) = \text{Arm circumference (cm)} - 0.314 \times \text{triceps skin-fold thickness (mm)}
\]

Male: \(\text{CAMA(cm}^2) = (\text{AMC})^2 / 4\pi - 10 (\pi = 3.14)\)

Female: \(\text{CAMA(cm}^2) = (\text{AMC})^2 / 4\pi - 6.5\)

**Body mass index (BMI)** is defined as weight in kilograms divided by height in metres squared. The height of the bed-ridden residents could not be measured by conventional method. We used the fibula length measured from the fibular head to the lateral malleolus in centimeters converting into height in centimeters by the following validated multiple linear regression equation for Chinese\(^2\):

\[
\text{Height} (cm) = 153.1 - 0.26 \times \text{age (in years)} - 11 \times \text{sex} + 1.05 \times \text{fibula length (cm)}
\]

\[(\text{sex: male} = 1, \text{female} = 2)\]

**Biochemical measurements.** Twenty ml. of venous blood were taken for biochemical tests. The blood was sent to a single laboratory for serum prealbumin and transferrin concentrations. Measurement of the serum prealbumin and transferrin was by pre-calibrated analyser (Berkman Array 360). Serum albumin was measured using automated analyser.

**Clinical evaluation.** Clinical data were collected through a pre-designed patient proforma form.

The **Simplified Barthel index (SBI)** was used to assess the physical function of the activities of daily living\(^2\).

The **Abbreviated mental test (AMT)** was used to assess the cognitive function\(^2\).

**Definition of protein-energy malnutrition (PEM).** Serum protein concentrations and anthropometric indices have been found to be useful indicators of assessing protein status. As there has not been any validated nutritional assessment tool in elderly Chinese, we defined PEM as presence of one abnormal anthropometric measurement (BMI or CAMA) and one abnormal biochemical measurement (serum albumin, prealbumin, or transferrin) (Table 1). Normal reference range values of the anthropometric and biochemical measurements for elderly Chinese have not been established. We used cut-off values of normal BMI within 18.5 kg/m\(^2\) to 24.9 kg/m\(^2\) as normal\(^2\). The cut-off values for CAMA were based on a survey

| Table 1: Cut-off values used in defining abnormal measurements |
|------------------|------------------|
| **Anthropometric** | **Biochemical (serum)** |
| Body Mass Index (kg/m\(^2\)) | Albumin (g/L)  |
| <18.5 | <36.0 |
| Corrected Arm Muscle Area (cm\(^2\)) | Prealbumin (mg/L)  |
| <16.1 | <180.0 |
| **Transferrin (g/L)** | Transferrin (g/L) |
| <2.1 | <2.1 |
conducted by Woo et al. The normal values for the laboratory measurements were based on laboratory normal range values.

**Statistical analysis:** Results were analysed using the Statistical Package of Social Sciences (SPSS, version 6.0) programme. Stepwise logistic regression analysis was used to study the risk factors for PEM (dependent variable). Independent covariates including AMT, SBI, feeding pattern, number of medication use, status of co-morbidity (e.g. dementia, stroke, chronic lung disease, hypertension, diabetes mellitus) were entered into the model with controlling for sex and age. For statistical analysis, feeding was classified as regular diet, gastric diet and nasogastric tube feeding. SBI was re-grouped as total dependence (0 to 4), severe dependence (5 to 8), moderate dependence (9 to 11), and slight dependence to independence (12 to 20). AMT was re-grouped as severe cognitive impairment (0 to 3), moderate cognitive impairment (4 to 6) and normal (7 to 10).

**Results**
Totally 282 subjects (68 men and 11 women from LSCH, 34 men and 61 women from C&AH, and 13 men and 95 women from WCHH) were studied. Of the 282 studied subjects, 115 (40.8%) were men and 167 (59.2%) were women. Characteristic features of the three groups of elderly were shown in the Table 2. 91% from the LSCH group (totally independent), 79% from the C&AH group (mildly dependent), and 29% of the WCHH group (extremely dependent) had regular diet. 9% of the LSCH group, 21% of the C&AH group, and 52% of the WCHH group had gastric diet (puree meat and vegetables with rice) because of dental and chewing problems. 19% (21 out of 108 residents) of the WCHH group had fluid diet from milk products (naso-gastric tube dependent) due to chewing and swallowing problems.

The overall prevalence of PEM in the three studied groups was 21.6% (61 out of 282). The prevalence among men was 14.8% (17 out of 115) and among women was 26.3% (44 out of 167). The WCHH group had the highest prevalence (42.6%) of PEM among the three groups of patients (Table 3).

**Table 2: Characteristic features of the three studied groups of elderly**

<table>
<thead>
<tr>
<th>Gender</th>
<th>LSCH (N=79)</th>
<th>C&amp;AH (N=95)</th>
<th>WCHH (N=108)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male/Female (No)</td>
<td>68/11</td>
<td>34/61</td>
<td>13/95</td>
</tr>
<tr>
<td>Age (years), Mean (SD)</td>
<td>65.9 (3.4)</td>
<td>80.9 (8.4)</td>
<td>82.9 (7.8)</td>
</tr>
<tr>
<td>Abbreviated Mental Test, Mean (SD)</td>
<td>7.1 (2.9)</td>
<td>6.2 (2.6)</td>
<td>1.7 (2.7)</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²), Mean (SD)</td>
<td>23.2 (3.8)</td>
<td>24.3 (4.9)</td>
<td>20.5 (4.4)</td>
</tr>
<tr>
<td>Simplified Barthel Index, Mean (SD)</td>
<td>19.6 (1.2)</td>
<td>15.0 (4.6)</td>
<td>2.8 (3.9)</td>
</tr>
<tr>
<td>Feeding Pattern (%)</td>
<td>91.9:0:7</td>
<td>79:21:0</td>
<td>29:52:19</td>
</tr>
<tr>
<td>Normal: gastric: tube feed</td>
<td>32.4 (11.1)</td>
<td>30.6 (10.2)</td>
<td>23.9 (8.4)</td>
</tr>
<tr>
<td>Corrected-Arm Muscle Area (cm²), Mean (SD)</td>
<td>3.0 (1.0)</td>
<td>3.0 (2.2)</td>
<td>1.0 (1.2)</td>
</tr>
<tr>
<td>Number of drug/day, Mean (SD)</td>
<td>39.9 (4.5)</td>
<td>34.4 (3.9)</td>
<td>30.1 (4.3)</td>
</tr>
<tr>
<td>Serum Albumin (g/L), Mean (SD)</td>
<td>257.3 (62.1)</td>
<td>235.8 (69.6)</td>
<td>201.3 (61.1)</td>
</tr>
<tr>
<td>Serum Transferrin (g/L), Mean (SD)</td>
<td>2.3 (0.34)</td>
<td>2.1 (0.44)</td>
<td>1.9 (0.35)</td>
</tr>
</tbody>
</table>

**Table 4: Logistic regression predicting occurrence of protein-energy malnutrition (PEM) of the three groups of patients**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Odds ratio</th>
<th>95% C.I.</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic lung disease</td>
<td>23.1</td>
<td>4.7 to 114.3</td>
<td>0.0001</td>
</tr>
<tr>
<td>Dementia</td>
<td>10.8</td>
<td>2.9 to 40.0</td>
<td>0.0004</td>
</tr>
<tr>
<td>Gastric diet feeding</td>
<td>5.8</td>
<td>2.3 to 14.4</td>
<td>0.0002</td>
</tr>
<tr>
<td>Sex (female)</td>
<td>0.19</td>
<td>0.06 to 0.59</td>
<td>0.004</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>0.10</td>
<td>0.02 to 0.45</td>
<td>0.0025</td>
</tr>
</tbody>
</table>
Discussion

There is little information about the nutritional state of residents of long-term care institutions in Asian countries. Malnutrition, particularly protein-energy malnutrition, is likely to be a common problem. In our study, nutritional status of the three groups of institutionalised elderly Chinese was assessed. The results of the WCHH group could be representative of the patients placed into Hospital Authority infirmary beds. However, as the response rates of the other two institutions were about 50%, the results could, therefore, not represent the nutritional status of each group. The unsatisfactory response rates of these two groups of elders were entirely due to either lack of patients or their relatives’ consents, or that the patients had not lived in the institutions for more than one year.

Surprisingly, a large range of values of malnutrition in the elderly in some Caucasian literatures was found. Silver et al. estimated that as many as 15% of free-living elderly, 35% to 65% of older patients hospitalised for acute illness, and 25% to 60% of residents of long-term care facilities were malnourished. In another Caucasian study, even up to 85% of elderly in nursing home were found to be malnourished. The reason is that different criteria and methods can be used to define nutritional status. In our study, the prevalence of PEM in the WCHH group was significantly higher than the other two groups (Table 2). The characteristics of the WCHH patients were older age, poorer cognitive function and extreme dependence. The prevalence of male residents in each of the three groups was higher than that of the female elderly (Table 3). In the LSH (psychiatric) group, male elderly was predominant and no female elders met the PEM criteria (Table 2). In the C&AH group, the male PEM cases were either older or having more medical problems (i.e. chronic lung disease) than the other female ones. In the WCHH (infirm) group, female elders were predominant. However, the health status of the male elderly (WCHH) was generally poorer than that of the female ones (i.e. disability and poor cognitive function due to multiple episodes of stroke). This may account for the result of the logistic regression analysis showing that female subjects hadprotective effect of developing PEM.

Overseas study had demonstrated that dental and chewing problems were associated with higher prevalence of malnutrition. In our study, oral health status could not be accurately evaluated because dental professionals were not available in our institutionalised setting. We could not assess the swallowing status of the patients because speech therapist was not involved in our study. The problem was indirectly reflected by the nature of feeding pattern. Those with satisfactory oral condition and no problem of swallowing were put on normal diet. Those with acceptable oral / dental problem and apparently normal swallowing function were given gastric diet. Those with either unacceptable oral / dental problem, or swallowing problem were given non-oral feeding through nasogastric tube feeding. Our study showed that the group with “acceptable” oral / dental problem and apparently satisfactory swallowing function (i.e. gastric diet group) had higher risk of developing PEM.

Cognitively and physically impaired older persons are at significant risk for compromised nutritional status. It was interesting to understand why those orally fed subjects developed PEM within institutions. Our hospital dietitian had assessed the dietary intake of part of the studied subjects (randomly selected 95 subjects from the three groups) using the 24-hour food record method. The results (unpublished data) showed that daily calorie and protein intake were similar among the LSH and C&AH groups (about 1700 kcal and 75 grams), yet the WCHH group had lower daily calorie and protein intake (about 1500 kcal and 68 grams). Some of the studied subjects were found to have less than 1000 kcal of daily calorie and 36 grams of daily protein intake. Among the 61 PEM cases, 3.3% of the LSH group, 3.8% of the C&AH group and 74% of the WCHH group were on gastric diet. In our study, food was provided from our catering section. Food portioning was done by nurses. We postulated that the low energy and protein intake was due to problems in feeding rather than insufficient quantity provided.

Chronic lung disease in our study was defined as chronic obstructive airway disease, bronchiectasis, pulmonary tuberculosis, and pulmonary fibrosis. Those who required medical treatment for symptomatic relief were found to have lower nutritional indices. The reason could be that appetite was reduced due to the symptoms per se or the medications.

Despite our vigorous refinement on the study design, there were still a few limitations. Our study had not addressed the interaction of depression to our study. All subjects in the independent group were psychiatric patients and majority of the infirmary patients had moderate to severe impairment of cognitive function. Documentation of depression would be extremely difficult. There was also a lack of validated age-adjusted values for
anthropometric, biochemical and clinical criteria for PEM. Within the limitation, we had defined PEM based on the CAMA suggested by Woo et al, and laboratory reference used among normal population. Our results might differ from others if different criteria were used.

Conclusions

Infirmary institutionalised elderly are at the highest risk for protein-energy malnutrition. Patients who are cognitively compromised, with impaired oral health requiring modified method of feeding, or with chronic lung diseases are at significant risks for PEM. As malnutrition is well known to be associated with higher morbidity, higher mortality, and poor quality of life, there is a need to look into proper nutrition intervention for the individuals who are at particularly high risk. We recommend that nutritional status should be monitored among institutionalised subjects. Multidisciplinary approach to the malnourished elderly should involve dietitian, dentist and speech therapist.

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