Three simple methods of detecting malnutrition on medical wards

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Malnutrition in hospital is often unrecognized. A nutrition team aims to teach simple methods of detecting malnutrition. On a single day all medical in-patients underwent a nutritional assessment. Eighty-four patients (43 men), median age 71 years (range 28–97), were assessed. The most common diagnoses were cardiac disease (26), stroke/dementia (12), non-malignant lung disease (9) and malignancy (6). A weight loss of more than 10% (%WL) was found in 17/65 (26%) and a body mass index (BMI) of less than 19 kg/m^2 in 13/69 (19%). A mid-arm muscle circumference (MAMC) less than the fifth percentile occurred in 16/83 (19%) patients. Percentage weight loss alone detected seven patients of whom four were overweight (BMI > 25 kg/m^2), BMI alone detected three patients, and MAMC alone eight patients of whom three could not be weighed and three had fluid retention. There was fluid retention in 35/84 (42%) patients of whom nine were malnourished (six detected by BMI and/or %WL, and three by MAMC alone). All three measurements were made in 64 patients, six (9%) of whom were detected as malnourished by all three methods.

Combining the three measurements 29/84 (35%) of patients were malnourished and only 28% of these patients had been assessed by a dietitian. BMI and %WL detect most patients but fluid retention may limit their accuracy. MAMC is useful in those who cannot be weighed or who have fluid retention.

INTRODUCTION

Malnutrition occurs when the intake and/or absorption of nutrients is less than the metabolic requirements; so an impairment of physiological function results. At its most extreme, death occurs in previously healthy subjects if starved for 2 months or more, or if more than $\frac{1}{3}$ of the original weight is lost[1]. Studley, in his classical paper in 1936, showed that there was a 33% mortality for patients undergoing peptic ulcer surgery if more than 20% body weight had been lost, compared to 4% if less than 20% body weight had been lost[2]. Malnutrition reduces skeletal and cardiac muscle function so making chest infections and cardiac failure more common[3,4]. The risk of chest infections is further increased by an impairment of immune function[5]. Reduced mobility increases the risk of deep venous thrombosis, pulmonary emboli and pressure sores[6]. While intellectual performance may be unchanged, general apathy, depression and reduced appetite make the situation worse[7,8]. In severe malnutrition, bacteria may cross the gut mucosa and give rise to an endotoxaemia which may contribute to multi-organ failure[9].

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Thus malnourished patients are more likely to require high-dependency nursing and stay longer in hospital than patients having similar problems but of normal weight[10–13].

The treatment of malnutrition would be expected to reduce: the incidence of pre- and post-operative complicatons; morbidity and mortality; the patient's cost per day and length of hospital admission. All these benefits have been reported when pre- and/or post-operative nutritional support is given to malnourished patients[14–20]. A study of elderly general medical patients has also shown a reduced mortality with dietary supplementation[21]. It is thus beneficial both for quality of care and for economic reasons to detect and treat malnutrition.

In January 1992 the King's Fund published *A Positive Approach to Nutrition as Treatment*. The report recommended that all hospitals have a nutrition team consisting of a clinician, dietitian, nurse and pharmacist. The team's roles include the education of medical and nursing staff in the detection, prevention and treatment of malnutrition[1].

This study aimed to determine the prevalence of malnutrition on medical wards using three simple methods, and to see how many malnourished patients had been assessed by a dietitian. The methods used were: percentage weight loss in the preceding 3 months (%WL), body mass index (BMI) (both were recommended measurements in the King's Fund report[1]), and mid-arm muscle circumference

(MAMC). The study also aimed to compare the three methods and determine if they were affected by fluid retention.

METHODS

On a single day, all medical in-patients underwent a nutritional assessment. Age, sex, diagnosis and weight 3 months previously were recorded. It was noted if a patient had been, or was about to be, assessed by a dietitian. Weight, height, triceps skinfold thickness and mid-arm circumference were measured. A clinical examination for fluid retention was performed (sacral or pedal oedema, basal crepitations or a raised jugular venous pressure).

Calculations

$$\%WL: \frac{\text{previous weight (kg)} - \text{current weight (kg)} \times 100}{\text{previous weight (kg)}}$$

$$BMI\ (kg/m^2): \frac{\text{current weight (kg)}}{\text{height (m)}^2}$$

$$MAMC\ (cm): \text{mid-arm circumference (cm)} - 3.14 \times \text{triceps skinfold thickness (cm)}$$

The mid-arm circumference (mid-way between the tip of the acromion and olecranon processes) and the triceps skinfold measurements were carried out by one observer on the relaxed non-dominant arm. The triceps skinfold measurement was the mean of three measurements. The normal range used for MAMC is that of Symreng[22].

RESULTS

Patient details

The patients studied were all on acute medical wards. This excluded care-of-the-elderly wards (subsequent to this study care of the elderly and general medicine wards have become integrated).

Eighty-four patients (43 men), median age 71 years (range 28–97), were assessed. The median age for the women (78 years, range 35–93) was greater than for men (64 years, range 28–97; $P<0.01$). The most common diagnoses were cardiac disease (26), stroke/dementia (12), non-malignant lung disease (9) and malignancy (6).

Height and weight measurements

Fifty-nine of the 84 patients (70%) 'knew' their height. Height could be measured in 55 of the 84 patients (65%). Forty patients 'knew' their height and had their height measured; 34 of these (85%) stated their height to within 5 cm of their measured height. Thus, if it is not possible to measure a patient's height, the patient's stated height may be used. In 14 of the 84 patients (17%), although height could not be measured, BMI was calculated from their stated height.

Weight was measured in 69 of the 84 patients (82%). For reasons of poor mobility 15 patients (18%) could not be weighed. Seventy-four of the 84 patients (88%) 'knew' their weight 3 months previously.

Percentage weight loss

Of 65 patients who could be weighed and who knew their weight 3 months previously, a %WL of more than 10% had occurred in 17 (26%; Table 1). Four of seven patients, detected as malnourished by %WL but not by other methods were overweight ($BMI > 25\ kg/m^2$).

Body mass index

Of 69 patients in whom height and weight could be measured, a body mass index (BMI) of less than $19\ kg/m^2$ was found in 13 (19%; Table 1). Only three patients were detected as malnourished by BMI alone. Nine were detected by both %WL and BMI (six of these were malnourished by all three methods) and one patient by BMI and MAMC.

Overweight/obese

Twenty-seven of 69 patients (39%) in whom BMI could be calculated had a BMI of more than $25\ kg/m^2$. Twelve of these (17%) were obese (BMI of more than $30\ kg/m^2$).

Mid-arm muscle circumference

Triceps skinfold thickness and mid-arm circumference were measured in all but one patient, thus MAMC was calculated in 83 (99%). A MAMC less than the fifth percentile and within the reference age range[22] detected 16 of 83 patients (19%) to be malnourished (Table 1). Only eight of these

Table 1 **Number of medical in-patients assessed as malnourished using three methods on a single day, and the number of malnourished patients assessed by a dietitian**

	Assessed n (% of all patients)	*Malnourished n (% of those assessed)*	*Assessed by dietitian n (% of those malnourished)*
%WL	65 (77)	17 (26)	4 (24)
BMI	69 (82)	13 (19)	5 (38)
MAMC	83 (99)	16 (19)	6 (38)
All methods	84 (100)	29 (35)*	8 (28)

*By one or more parameters.
Patients considered malnourished if: BMI < 19 kg/m2, %WL > 10%, MAMC < 5th percentile.
BMI=Body mass index; %WL=Percentage weight loss; MAMC=mid-arm muscle circumference

patients had been detected by BMI and/or %WL (six by all three methods, one by %WL and one by BMI). Of the eight detected by MAMC alone, three could not be weighed and three had fluid retention.

Fluid retention

There was fluid retention in 35 of the 84 patients (42%) of whom eight of 35 (23%) were detected as malnourished by one or more methods (one by all three methods, 2/28 by %WL alone, 2/28 by BMI alone and 3/35 by MAMC alone). One of those detected by MAMC alone could not be weighed.

Comparison of the three methods

In 64 patients BMI, %WL and MAMC were all determined (Figure 1). Six patients (9%) were detected as malnourished by all three methods. %WL detected the most patients as malnourished (17/64, 27%). Four of seven detected by %WL alone were clinically overweight (BMI > 25 kg/m^2). Two patients were detected by BMI alone. The two patients detected by MAMC alone both had fluid retention.

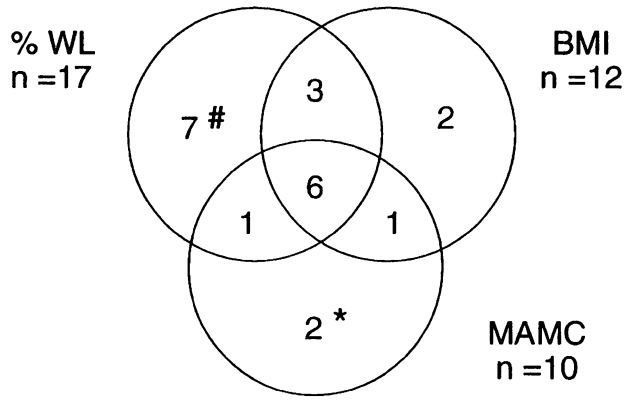

Figure 1 **Venn diagram showing the number of patients detected as malnourished by the three methods, in 64 patients in whom percentage weight loss (%WL), body mass index (BMI) and mid-arm muscle circumference (MAMC) could be determined. #=four patients were overweight (BMI > 25 kg/m^2). *=two had excess fluid**

DISCUSSION

This paper shows that, using %WL, BMI and MAMC, the prevalence of malnutrition on general medical wards was 35%. Most of these patients had not been recognized as malnourished (only 28% of the malnourished patients had been assessed by a dietitian). No one diagnostic group predominated. This high prevalence of malnutrition is comparable to previous reports on medical[23,24] and surgical wards[24–27]. It is alarming that the prevalence of undetected hospital malnutrition has not declined during the last 20 years.

Although there is considerable overlap between the techniques for detecting malnutrition, each has advantages and drawbacks. Both %WL and BMI depend upon patients being mobile enough to be weighed on accurate scales. Only 82% of our patients could be weighed. The %WL relies upon patients 'knowing' their previous weight and then not over or under estimating it. The %WL detects as malnourished many patients who are or who have been overweight, but because they have unintentionally lost weight quickly, they have lost mainly lean body mass[28]. These patients, who may also be detected by MAMC, need nutritional support but they are rarely recognized.

A measured height is ideal for the BMI calculation, but if the patient knows his or her height, it is usually accurate enough to be used in the BMI calculation. As most general medical patients are elderly, inaccuracies in height measurement may occur due to a kyphosis. In this situation a measure of arm span may be appropriate[29,30].

While MAMC is a time-consuming and observer-dependent measurement it can be performed on almost all patients. It is most suitable for those who cannot be weighed, or for very oedematous patients in whom %WL and BMI may be misleadingly normal. The published reference ranges of MAMC vary for each sex and age group[22,31,32]. The commonly quoted survey of Americans by Bishop *et al.* did not include those older than 74 years[31], while that of Burr and Phillips of people in South Wales did not include those of less than 65 years[32]. For our normal range, we chose to use the data of Symreng[22], derived from a European population of all ages over 20 years. From our data a MAMC of less than 19 cm in women and less than 21 cm in men of all ages would have detected most of the patients found to be malnourished in this study by %WL and BMI results. These numbers are similar to those of Morgan *et al.* who found the fifth percentile for MAMC in active elderly people of either sex to be 20.2 cm[33].

If patients are asked their usual weight 3 months ago and if their height and weight are measured, %WL and BMI can be determined in about 80% of medical in-patients. Any patient with a %WL more than 10% or a BMI less than 19 kg/m^2 may be considered malnourished[1]. If a patient cannot be weighed or has fluid retention, MAMC may be determined; a result of less than the fifth percentile provides evidence of malnutrition. All patients detected as malnourished should ideally be assessed by a dietitian, who will determine why malnutrition has occurred if this has not already been done by medical and nursing staff. Reasons for malnutrition include: reduced energy intake (e.g. anorexia, poor dentition or dysphagia); increased energy requirements (e.g. trauma, sepsis or burns); or malabsorption. The dietitian will attend to predisposing factors and give appropriate nutrient supplements.

This paper concerns the detection of patients who are already malnourished. In hospital there is a second group of patients who are not malnourished but are at a high risk of becoming so. To optimize hospital nutritional care, both patient groups need be identified: those malnourished by %WL, BMI and MAMC, and those at risk of becoming malnourished by a nursing assessment that identifies the factors that predispose to malnutrition. A policy of performing nutritional assessments on all hospital in-patients will increase the workload of nursing staff and dietitians. However, it is beneficial, as malnourished and patients at risk of becoming malnourished will be treated earlier and so should have a shorter hospital stay with fewer complications.

Following discharge from hospital, malnourished patients may be followed up by community dietitians and general practitioners if the reasons for malnutrition persist and/or if the nutritional status is not improving. All obese patients in hospital should be given advice on a healthy-eating weight-reducing diet that is appropriate for any underlying medical conditions. Medical and/or dietetic follow-up of obese patients may be offered to those who are most motivated to lose weight. Follow-up care of malnourished and obese patients may reduce the need for future hospital admissions.

An improvement in the detection and prevention of hospital malnutrition may occur as more hospitals form nutrition teams (in 1988 less than a third of hospitals within the UK had a nutrition team[34]). A nutrition team is responsible for teaching medical and nursing staff about nutritional assessments. Attention to the nutritional status of medical patients by means of the three simple techniques outlined in this study should improve the quality of care given to patients.

These data, showing a high prevalence of undetected malnutrition in hospital, in conjunction with data on inappropriate parenteral feeding, helped persuade the hospital management to finance a nutrition team: a full-time clinical nurse specialist has been appointed.

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