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Original article

Hospital acquired malnutrition in orally fed geriatric patients: what's the role of a hospital dietetics and food service?

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Summary. *Background:* The malnutrition delays recovery from illness and prolongs the hospitalization and its costs. It frequently occurs during hospitalization because of the low intake of patients. The aim of the study was to identify the key barriers to adequate dietary intake of geriatric patients. *Methods:* A two day survey among hospital in-patients of an Italian geriatric hospital - INRCA (Ancona) – was performed in October 2015. Two structured questionnaires were used to collect data on clinical, functional and nutritional status of 75 orally fed patients (84.5±6.9 years) as well as on their intake, food preferences and reasons for non eating. The Harris-Benedict formula corrected for age, disease and physical activity was used to assess patients' energy needs, a reference range from 1.0 to 1.5 g of proteins/body weight to assess their protein needs. Nutritional values of food served were compared to values of food consumed and patients' needs. Patients' preferences and reasons for non eating were analyzed. *Results:* Three main diets were found: standard diet, diet for dysphagia and low glycemic diet. Discordance between food provided, patients' needs and their intake was found for all diets and, in particular, for the diet for dysphagia. Very low intakes were registered. Patients' preferences were focused on first courses, primary pasta and soups and on homogenized fruit. Insufficient assistance during meals was the most common reason for not consuming everything offered. *Conclusions:* Hospital dietetics and the organization of the food provision service for geriatric patients should better match both patients' preferences and their impairments.

Key words: hospital dietetics, geriatrics, food intake

Introduction

The protein-energy malnutrition is a condition that may result from reduced nutrient intake, impaired absorption and assimilation, increased energy expenditure or combination of these (1). In industrialized countries, the protein-energy undernutrition i.e. the energy and/or protein insufficiency is particularly frequent in hospitals and is associated with disease and older age. It is quite difficult to define precisely the prevalence of malnutrition among patients (PTS) upon hospital admission. It is so because the scientific community still haven't reach an agreement on proper tools and cut off values to use for the diagnosis of malnutrition and, consequently, within each study the malnutrition is diagnosed by different methodological approaches. Moreover, it is very frequent that the moment of the screening or assessment is not clearly specified. It has been estimated, however, that from 40% up to 80% of geriatric PTS are undernourished already at the moment of hospital admission (2-5). It has been also demonstrated that the nutritional status of almost 70% of in-PTS worsens during first 10

days of hospitalization and that in some 60%-70% of cases the malnutrition never gets recognized by hospital staff (6). During hospitalization, the malnutrition may occur as a side effect of underlying diseases, treatments, medications and diagnostic procedures. It is also frequently caused by inadequate intake because of sadness, loneliness and worries of PTS, their non self sufficiency on meals, the insufficient time for meal consumption or, more simply, because of the inadequacy of hospital diets to meet PTS' specific needs and preferences (7). Independently from its causes, the consequences of malnutrition are always fearful. The malnutrition compromises the immune response and increases the risk of infections and infection-related complication, it slows down the wound-healing process, it delays recovery from illness, it prolongs hospitalization and it increasis its costs. It also increases the risk of death (8-10).

In this study we analyzed the dietary intake of PTS hospitalized at an Italian geriatric hospital (INRCA, Ancona). A two-day survey was carried out to gather data on clinical, functional and nutritional status and on intake of geriatric hospital in-PTS who were at INRCA hospital on 9th October 2015, independently from the day of the recovery. Nutritional values of food served were compared to PTS' needs and their intake.

Methods

Settings and sample

The Unit of Clinical Nutrition and Medical Direction of the geriatric hospital of INRCA- Ancona promoted in 2015 a two day survey of dietary intake among PTS hospitalized at INRCA hospital. After obtaining the Ethical Committee approval, PTS were invited to participate in the study. Both short and long stay PTS were invited to participate. PTS from the emergency room were excluded from the study. All PTS gave their informed consent for the collection and processing of their data for scientific purposes.

Data collection

Two specific questionnaires were developed and submitted to PTS and their caregivers. One questionnaire was designed to collect following data: social history (date of birth, gender), functional status (immobilization, pressure ulcers, swallowing and mastication difficulties), clinical conditions (underlying diseases, pluripathologies), nutritional status (history of weight loss), and nourishment during a hospitalization (diets and feeding routes). The malnutrition screening was performed by Malnutrition Universal Screening Tool – MUST (11, 12). PTS' anthropometric data were gathered by hospital staff. PTS were weighted and their height was measured by height rod. Bedridden PTS were weighed by bed scale and special weighing set complete with digital scale and support spreader bar. Their heights were estimated from the ulna height. On the same day, blood samples of PTS were collected by nurses and measurements of serum albumin (Alb), serum prealbumin (Pab) and C-reactive protein (CRP) were carried out in the hospital analyses laboratory. Another questionnaire was designed to collect data on PTS' intake, on their food preferences and on reasons for non eating. The intake of PTS was determined by a recall method and by observation of intake. During a two days survey, PTS and caregivers were interviewed by physicians, dieticians and nurses on intake of meals and snacks, 3 times per day. Both the assumption of the food delivered from the kitchen and the extra food and supplements were assessed. To reduce measurement error in the estimation of food intake, rigorous and systematic monitoring of portion sizes and the plate leftovers was performed during the study period by dieticians (13). The food preferences were investigated using a five point hedonic score. Information on catering, on different typologies of hospital diets prescribed to PTS and on their detailed composition were provided by hospital dietician.

Data analyses

Descriptive statistics were used to describe PTS characteristics. Continuous variables were expressed as mean values ± standard deviation and median values (min-max). Categorical variables were expressed as relative frequencies. This data was submitted to analyses through the Statistical Package for Social Sciences (SPSS) version 19.0. The individual intake of energy and protein was calculated, based on quantities of meals consumed, through the Winfood software. The Harris-Benedict formula corrected for age, disease

and physical activity was used to assess PTS' energy needs (14). Following the indications from PROT-AGE Study Group position paper and ESPEN recommendations, the reference range from 1.0 to 1.5 g of proteins/body weight was used to assess PTS' protein needs (15, 16). According to these indications, the protein requirement is calculated based on the degree of hypertacatabolism and the severity of protein deficiency. For PTS with hypertacatabolism and sever protein deficit, and if there are no contraindications represented by kidney impairment, the protein requirement reaches 1.5 g protein/kg body weight/day. Nutritional values of food served and consumed were compared to PTS' needs. Answers provided by PTS on reasons for non eating were analyzed and expressed as relative frequencies.

Results

Data on 75 orally fed PTS (mean age 84.5±6.9, 41% M, 59% F) were collected and analyzed. PTS who were not orally fed – overall 14 PTS (6.7% nothing by mouth, 9.0% tube fed) - were excluded from the study. General characteristics of PTS whose nutritional needs and intakes were analyzed are shown in Table 1. Almost 50% of PTS enrolled belong to the category of the oldest old (> 85 years). According to the MUST,

Table 1. Characteristics of patients enrolled in the study

GENDER*	41.33% M; 58.67% F
AGE (years)**	84.51±6.87
CARE SPECIALISATION*	
Acute	58.67%
Surgical	13.33%
Intensive	6.67%
Long term	21.33%
ORIGIN*	
Home	70.66%
Nursing home	2.67%
Other hospitals/other hospital units	26.67%
PREVIOUS HOSPITALIZATIONS*	41.67% Yes; 58.33% No
DURATION OF HOSPITALIZATION ON THE DAY OF THE STUDY (days)***	7 (1; 70)
MAIN DISEASES*	
Neurologic	32.00%
Chronic renal insufficiency	24.00%
Heart failure	56.00%
Diabetes mellitus (DM)	33.33%
Cancer	14.67%
Chronic obstructive pulmonary disease (COPD)	20.00%
Anorexia	8.00%
PLURIPA THOLOGIES*	89.33% Yes; 10.67% No
PRESSURE ULCERS ON ADMISSION*	12.00% Yes; 88.00% No
BEDRIDDEN*	38.67% Yes; 61.33% No
EDENTULISM*	52.70% Yes, 47.30% No
BODY MASS INDEX (BMI) (kg/m2) **	24.94±4.70
UNINTENTIONAL LOSS OF WEIGHT (ULW) > 5% of usual body weight*	18.67% Yes; 52.00% No;29.33% Doesn'tknow
ALBUMIN (ALB) (g/dI) **	3.35±0.52
PREALBUMIN (pAB) (rng/dl)**	13.33±5.38
C REACTIVE PROTEIN (CRP) (rng/dl)***	1.5 (0.02; 23.07)
Malnutrition Universal Screening Tool (MUST)*	
Low risk	44.00%
Medium risk	8.00%
High risk	22.67%
Missing answers	25.33%

22.7% of PTS were at high risk for malnutrition on the day of the study. For 25.3% of PTS it wasn't possible to collect all data necessary for the assessment of the MUST given that PTS and caregivers weren't able to provide the information on PTS' Unintentional Loss of Weight (ULW) in the previous 6 months.

The hospital was using a traditional cook-serve catering with a food prepared and cooked on site and distributed at the appropriate temperature to the wards. PTS meals were delivered by a food service assistants and ward assistants. Cutlery wasn't provided by hospital and PTS used their own cutlery. Approximately 50% of PTS needed assistance during meals. They were sometimes assisted by volunteers but most of the feeding assistance was provided by visitors (family members and external caregivers). The mean reported time available for each main meal was 30-40 minutes. A 2000 kcal standard diet (18% proteins, 28 % fat, 54% carbohydrate) represented 46.8% of diets administered. It was followed by different types of diets varying in texture and consistency for PTS with difficulties with chewing and swallowing (overall 33.0% of diets whereas the most frequent was the diet for dysphagia which represented 21.0% of total) and by the low glycemic diet (21.0%). A diet for dysphagia was a 2000 kcal diet (15% proteins, 42% fat, 43% carbohydrates) while the low glycemic diet was providing 1600 kcal (19% proteins, 30% fat, 52% carbohydrates). No nutritionally fortified versions of foods and beverages were found. The episodes of providing the external food by caregivers were registered.

As it is shown in table 2, a high discordance between food provided, PTS' needs and their intake was found with reference to all main diets. The food provided exceeded PTS' needs for standard diet and diet for dysphagia while the average intake was lower than PTS's requirements with reference to all diets (Table 3).

Overall, lunch was the most important meal whereas the first course consisting of pasta, rice, supper and similar, was the favourite dish (80% of PTS with standard diet and 75% of PTS with low glycemic diet consumed ≥ ¾ of the first dish for the lunch) followed by the second course (65% of PTS with standard diet and 55% of PTS with glycemic diet consumed ≥ ¾ of the second dish for the lunch). The great preference of the first course was registered also with reference to the dinner. Very low intake was registered among PTS consuming diet for dysphagia during the lunch whereas only 40% of subjects were consuming ≥ ¾ of the first dish and only 35% were consuming ≥ ¾ of the second dish. The situation was even worse with reference to the dinner when only 29% of dysphagic PTS consumed ≥ ¾ of the second dish. More than 40% of these PTS argued that the homogenized fish and meat have quite or very unpleasant taste. This food, together with yoghurt which was served to all PTS for the breakfast, was identified as the less welcome by

Table 2. Information on energy and proteins provided, needed and assumed for three main diets administered: standard diet, diet for dysphagia and low glycemic diet

	STANDARD DIET	DIET FOR DYSPHAGIA	LOW GLYCEMIC DIET
FOOD PROVIDED			
Energy intake (Kca/day)*	2040.00±46.67	1961.70±18.38	1679.00±133.08
Protein intake (gr/day)*	89.90±0.99	62.27±4.24	87.00±12.09
RECOMMENDED NEED			
Energy intake (Kca/day)*	1626.06±307.41	1562.94±259.01	1844.86±224.22
Protein intake (gr/day)*	78.06±16.70	79.12±15.62	95.18±14.86
PTS.INTAKE			
Energy intake (Kca/day)*	1249.12±442.85	998.28±629.35	1249. 13±425.28
Protein intake (gr/day)*	57 .23±23.48	30.86±20.83	63.36±26.76
P-value**			
Energy intake	0.0004	0.0043	0.0007
Proteins	0.0015	0.0000	0.0156

Table 3. Frequencies of patients who didn't meet their energy and protein needs for three main diets administered: standard diet, diet for dysphagia and low glycemic diet

	ENERGY NEEDS	PROTEIN NEEDS
STANDARD DIET	67.65%	44.12%
LOW GYLICEMIC DIET	83.40%	62.86%
DIET FOR DYSPHAGIA	62.75%	81.25%

all categories of PTS. PTS' preferences were focused on first courses, primary pasta and soups. The homogenized fruit, which was served as a dessert, was also highly appreciated by all PTS.

When asked to specify the reasons for non eating, PTS mostly answer that they don't appreciate the taste and consistence of the food served (Table 4). Pasta was overcooked according to 11.2% PTS while the vegetables were insufficiently cooked according to another 11.3% of subjects. Other PTS didn't appreciate the food served because it was tasteless (6.0%), too hot (11.1%) or because the menus were too repetitive (6.1%). Some PTS have complained that the breakfast and lunch were served too closely so that they were not hungry at lunch, other didn't have enough time to finish dishes (17.6%). Only 6.2% of PTS answered explicitly that they were depressed and didn't care about eating. An important number of PTS fasted because of medical tests and analyses (almost 28.4%). However, the main problem was the insufficient assistance provided to PTS during the meals (17).

Discussion

It dates back to more than 100 years ago the issue of the "Journal of the American Medical Association" reporting the observations expressed by dr. Horace D. Arnold during a symposium on hospital management on the role of hospital dietetics. It was already in 1912 that Dr. Arnold asserted how, in numerous cases, the success of hospitalization is far more dependent upon a correct dietary than upon any other element of treatment. Therefore, he argued, it is a sine qua non that the dietary be adapted quantitatively and qualitatively to the PTS under treatment but, also, that a diet shall not only be satisfactory to the physician but equally so to the PTS (18). Numerous studies have been carried out since than on nutritional status of PTS upon and during hospitalization and on impact of malnutrition on the outcomes of hospitalizations. It has been demonstrated that, independently from the moment of its occurrence, malnutrition, and in particular the under nutrition, compromises the immune response of PTS, increases the risk of infections, slows down the

Table 4. Patients' judgment of hospital diets and food provision service

	Relative Frequencies
The meals are sufficient	Yes 95.45%; No 4.55%
The meals served have a good taste	Yes 70.41 %; No 29.59%
The food has good appearance	Yes 77.22%; No 22.78%
The hospital menu is sufficiently variegated	Yes 80.70%; No 19.30%
The meals are administered at proper time	Yes 91.24%; No 8.76%
A time for meal consumption is sufficient	Yes 82.40%; No 17.60%
The food is served at proper serving temperature	Yes 88.92%; No 11.08%
The privacy during meals is guaranteed	Yes 89.60%; No 10.40%
I often fast because of medical tests and analyses	Yes 28.42%; No 71.58%
I am sufficiently assisted during meals by the hospital staff	Yes 63.13%; No 36.87%

wound-healing process and recovery from illness and, as a result, increases the costs of hospitalization. But although the optimal nutritional intake forms an essential part of therapeutic treatment of malnutrition, very few studies describe the food intakes of hospitalized patients. Given that the understanding of hospital dietetics and its adequacy to satisfy PTS' needs and preferences represents the fundamental information for the management of the risk of malnutrition of orally fed PTS during hospitalization time, before the last call for tenders for the assignation of hospital catering, the Clinical Nutrition Unit and Sanitary Direction of the geriatric hospital INRCA (Ancona) promoted a two day survey on food intake of orally fed PTS and on their food preferences (19-21). The aim was to assess in what measure the characteristics of the hospital service respect the peculiarities of geriatric PTS and to identify the key elements on which to intervene to ensure an adequate intake of PTS. Our results showed that the quantities of calories and proteins provided exceeded PTS' needs. This finding is also consistent with results of studies on hospital dietetics and PTSs' intake performed previously in other countries (22). Patients' intake was even lower than their needs. Differently from other studied where the highest food consumption was registered at breakfast, in our study, the highest food consumption was observed at lunch with the high preference for first plates. Only for low glycemic diet a high food consumption at breakfast was observed. The lowest consumption of food and the lowest coverage of protein needs was registered for PTS receiving diet for dysphagia. This finding is also consistent with results of some previous studies (23). Insufficient food intake was mostly attributed to causes other than disease. Therefore, numerous suggestions for the reorganization of the service were made (24). Improvement of a diet for dysphagia was identified as a priority action. To reach this aim, different nutrition - food fortification and enriching diet strategies may be adopted (25). Food provision of the meals should also be reorganized. To avoid the failure to comply with dietary indications provided by physicians, more assistance on mealtime should be provided to PTS who are bedridden, edentulous, with enabling pathologies. What is more, the assistance should be provided by professionals. Non professional caregivers who were providing most of the assistance were frequently administering some extra food or liquids which may be even dangerous for PTS. Numerous cases of the provision of the food different than that prescribed and provided by hospital (brought from home or from restaurants) were registered. In fact, PTS consuming more kcal and proteins than prescribed were also registered for all categories of diets. Feeding aids such as adapted cutlery and crockery for PTS with different physical disabilities should become mandatory in geriatric hospitals.

Some potential limitations of this study have to be mentioned. As it is known, in this study the energy requirements of PTS were not measured by indirect calorimetry or other objective measures but were estimated by prediction equations. To predict the energy requirements we used the Harris Benedict formula which is the most commonly used formula both historically and internationally. Still, it has to be mentioned that there is a lack of strong and consistent evidence supporting standardized predictive equations. With reference to Harris Benedict formula it has been argued that the individual variance in basal metabolic rates may be as high as 10% and that the use of activity and injury factors may even accentuate this error. It has also been noted that this forma may overestimate requirements when compared with indirect calorimetry. With reference to protein requirements, they have been collated from the available evidence-based guidelines and literature. It has to be noted that many of these equations are based on 'expert opinion' or have limited supporting evidence (26, 27). What is more, a proper nutrition doesn't concern exclusively the energy and protein needs but also the micronutrients and fluids. In this study, low intake of liquids was registered but the exact quantities of liquids assumed were not reported. The levels of vitamins and minerals assumed were not analyzed at all. It would be therefore interesting to face these arguments in future studies.

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