Enteral feeding in the elderly

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Abstract

Malnutrition is frequent in the elderly and it is commonly missed or ignored with deleterious consequences namely an increased morbidity and mortality in this age group. In this paper the authors describe and discuss the nutritional support by enteral feeding in the elderly highlighting indications, contraindications, nutrient requirements, the way of feeding and the complications of this method. The results obtained in 23 tube-fed hospitalized patients aged 65 to 90 years are also presented.

Key words: enteral feeding, nutritional support, malnutrition, elderly.

Introduction

Aging is an inevitable process that starts when growth and development end.[1] The form and rate of aging are dependent on several factors (genetic, economic, social, cultural and physiological factors), therefore the elderly constitute a very heterogeneous group.[2,3]

The increase in life expectancy observed in recent years with the consequent aging of the population, has led to hospitals serving a growing number of increasingly older patients.[4] These elderly patients, who often have cognitive and functional disorders that impair their ability to eat unaided, are at risk of developing nutritional deficiencies that may ultimately lead to malnutrition.[5] On the other hand, because nutrition plays an important role in the alteration of aging-conditioned physiological processes,[6,7,8] it is evident that the evaluation of the patient's nutritional condition, and the application of proper nutritional support, are important to prevent or correct the harmful consequences of malnutrition.[9] Enteral feeding is the most indicated method when the patients' gastrointestinal tract is working, but an adequate oral diet is not possible.[10,11]

The decision to start nutritional enteral support in elderly patients is not always easy. In a reversible clinical condition, such as pneumonia, for which a short-term support is expected, the decision is easier, but the same is not true when the conditions are expected to be long-lasting, or even irreversible.[12] The moral and ethical aspects of artificial nutritional support in elderly patients have been the subject of varied and sometimes heated debate [5,13-20] and will not be addressed in this article. However, before deciding for enteral feeding in the elderly patient, the potential benefits and risks should always be carefully considered, and the patient's opinion (where possible) or that of their family members, should be taken into account.[20]

Malnutrition

Malnutrition is a major problem in the elderly. Its prevalence ranges from 26% and 59% in hospitalized elderly patients, [21,22] affecting 17% to 65% of patients hospitalized for acute conditions.[2,23] Several factors can be related to its origin: depression, social isolation, dementia, disorders of the sense organs (sight, taste, and smell), decreased mobility, difficulty chewing, poor economic resources, chronic diseases, drug and food interactions, alcoholism, and anorexia.[24-27] However, despite the importance of its high prevalence, malnutrition is often underdiagnosed, or is ignored during the clinical evaluation.[24,25,28,29] In a prospective study involving hospitalized elderly patients, 39% had severe protein-energy malnutrition and 33% had moderate malnutrition; in none of the cases was malnutrition listed as a health problem, and in only 10% was nutritional intervention attempted.[30] The consequences of malnutrition in the elderly can be seen at several levels: changes in immune function

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with increased susceptibility to infections, changes in gastrointestinal function with altered intestinal absorption, changes in liver function with hypoalbuminaemia and increased risk of toxicity.[24] Together, these changes culminate in increased morbidity, length of hospitalization, and mortality.[35-39] It is well-established that correct nutritional support (natural or artificial) prevents or corrects many of the harmful consequences of malnutrition.[34] The assessment of the nutritional condition and early identification of elderly patients at risk of developing malnutrition are, therefore, imperative.

Nutritional assessment

Several methods have been proposed for assessing the nutritional condition of hospitalized elderly patients. They include clinical history and physical examination, anthropometry, serum protein count, immunological tests, skeletal muscle function tests and prognostic index.[2,24] They all have limitations inherent to their own method, and limitations that are specific of this age group, and no one method alone is sufficiently sensitive or specific to determine the severity of the malnutrition.[2,24,25,35,36,37,38,39] Conducting periodic nutritional assessment using several diagnostic methods is the best way to detect and assess the risk of malnutrition.[3,40,41]

Anthropometry

Aging causes changes in weight, height and body composition that should be taken into account when evaluating these parameters.[2,3,24,25,35,42,43]

The measurement of height through the knee-heel height test is an alternative method for patients, or for those suffering from static changes of the spine.[44,45,46]

The way weight evolves is predictive of morbidity and mortality, especially when weight loss is greater than 10% of the body weight within a period of less than 6 months.[3,24,35] BMI<24 kg/m^2 is also indicative of increased risk.[35]

The measurement of skinfolds (biceps, triceps, subscapular and suprailiac) and brachial and muscle circumference, and its comparison with the values considered normal for the age and gender, although subject to considerable errors, continue to be an easier form of assessment of nutritional condition.[2,24]

Laboratory parameters

The evaluation of visceral proteins is usually performed through the determination of serum albumin, transferrin, prealbumin and retinol-binding protein.[2,3,24,35,46,47] Although dependent on several factors, particularly hydration and liver function, serum albumin is still the main indicator of the nutritional condition and visceral protein compartment in the elderly, over the long term.[3,35]

The determination of total cholesterol, being stable in the elderly, is also predictive of morbidity and mortality in this age group.[3,35]

Immunological parameters

The total lymphocyte count is a very common indicator of the nutritional condition in the elderly.[25,35]

As the assessment of all parameters are sometimes impossible, some authors recommend that the combination of clinical history (with attention to weight gain), physical examination (with particular attention to loss of subcutaneous fat and muscle mass) and the determination of serum albumin (in the absence of liver disease, fluid retention or excessive losses) is sufficient for the detection of malnutrition in the elderly.[2,48]

Thus, when a need for nutritional support is identified in the evaluation of the nutritional condition, but it cannot be reasonably done through normal oral feeding (which is not uncommon in hospitalized elderly patients),[49] artificial nutritional support should be considered. The artificial nutritional support of choice is undeniably enteral feeding.

Enteral feeding: why?

"If the gut works, use it"

Enteral feeding is the most physiological feeding method and about 10 times cheaper than parenteral feeding. Its technique is simpler and it has a lower complication rate compared with the latter. On the other hand, and perhaps most importantly, enteral feeding prevents intestinal mucosal atrophy, prevents bacterial translocation and enables the use of nutrients that are not available from other sources.[2,11,50,51,52,53]

Role of the small intestine

The small intestine, in addition to its well-known functions of absorption and transport, plays an increasingly important role as a barrier to the passage of bacteria and toxins to the mesenteric lymph nodes and systemic circulation (a phenomenon

known as translocation) and as an organ involved in the immune response (both local and systemic), through the presence of lymphoid structures in its wall, which constitute about 70% to 80% of all the body's immune tissue.[11,32,54,55,56] The maintenance of the intestinal structure and function is dependent on complex interactions of various factors, for which the presence of nutrients in the lumen will assume the main role.[32,54,57] The presence of nutrients in the intestinal lumen has an important influence, both directly and indirectly, on intestinal function, such as providing nutritional substrate for the enterocyte, stimulating the secretion of gastrointestinal peptides, stimulating bowel motility, influencing the absorption of fluids and nutrients, and improving immune function.[11,32,33,54,58] Conversely, the local and systemic harmful effects caused by fasting[59] or malnutrition are well-known, manifested as intestinal mucosa atrophy and decreased enzyme activity,[55,57,60] dysfunction of the intestinal barrier with consequent bacterial translocation,[61,62,63,64,65] disturbances in the intestinal absorption and secretion,[55,66] disarrangement of bowel motility, immune dysfunction with immunosuppression and increased risk of systemic infections.[56] The importance of the specific actions of certain nutrients has led to the development of abundant research in the area of immunonutrition.

Immunonutrition

In the last decade, much research has been performed in respect to some nutrients with specific properties that can enhance the metabolic response to injury and infection, stimulate immune function and prevent the severe catabolism observed in some clinical conditions.[67,68] The main nutrients with known effects include glutamine, arginine, Omega 3 fatty acids, nucleotides and antioxidants.

Glutamine is the most abundant amino acid in the body and is the main fuel of enterocytes; it is also a precursor of glutathione in the intestine; maintains the intestinal structure and function, preventing atrophy; decreases translocation; and stimulates the immune system, reducing the incidence of infections and shortening hospitalization times.[50,67,68,69,70,71,72,73,74]

Arginine is a potent growth hormone, prolactin, insulin and glucagon secretagogue; it is also a precursor of nitric oxide, stimulates several immune functions in the intestine and at a systemic level, and improves wound healing.[50,67,68,69,71,75]

Omega 3 fatty acids reduce inflammatory response, enhance cell-mediated immune response, reduce the incidence of infections, improve survival and decrease hospitalization times.[50,67,68,71,75,76]

Nucleotides enhance the immune response and resistance to infections, and decrease intestinal mucosa atrophy, maintaining intestinal structure and functions.[50,68,71,75,76,77,78,79]

The importance of antioxidants (such as vitamins C and E, b-carotene and selenium) has been increased as the consequences of free radical formation are clarified.[50,67,68] Some experimental studies have shown the benefits of the use of antioxidants; however, their routine use cannot be recommended yet.[80]

Enteral feeding: indications in the elderly

The indications for enteral nutritional support in the elderly are, as in younger individuals, the inability to maintain an adequate nutritional condition through normal oral intake.[35] There are several situations that may eventually require enteral feeding in the elderly: mechanical causes, particularly the situations of upper obstruction (oral or oesophageal) due to neoplasms; dysphagia accompanying some clinical conditions, including stroke, dementia, coma, and traumatic brain injury; some chronic degenerative diseases that are accompanied by inability or refusal to eat (myasthenia gravis, multiple sclerosis, Parkinson's disease, cerebral palsy, and multi-organ failure); conditions of acute disease or trauma in which oral intake is seen to be inadequate.[35,81,82]

Enteral feeding: contraindications in the elderly

Due to the already mentioned advantages of enteral feeding, the contraindications are getting fewer, and relate mainly to the conditions of intestinal obstruction, gastrointestinal perforation and uncontrolled gastrointestinal bleeding.

As Seidner recently claimed: "If the gut works, use it, and if it doesn't, try anyway".[83]

Enteral feeding: when to start?

Prolonged fasting in the elderly (and also in younger individuals) causes a marked reduction in the size and exocrine function of the pancreas and intestine.[84] The combined effects of the disease and fasting are known to contribute to a rapid reduction in the epithelium of the gastrointestinal tract and its digestive functions.[35]

Evidence from studies in humans and animals show that early enteral feeding after trauma or acute diseases attenuates the hypermetabolic states, allows earlier achievement of a positive nitrogen balance,[85,86] decreases septic complications[87,88,89] and may prevent multiple organ failure syndrome.[90]

Due to all these factors, the gastrointestinal tract should be used to its optimal length, as early as possible, without any period of relative fasting; restoration of gastrointestinal function or return of appetite should not be awaited.[35]

Enteral feeding: assessing the needs in the elderly

Energy needs

In the elderly, basal metabolism decreases with the decrease in lean mass, whereas energy expenditure induced by food and exercise is similar to that of young adults.[91,92] On the other hand, elderly patients with malnutrition need more kilocalories per kilogram of body weight per day, compared with well-nourished elderly, or malnourished young individuals.[93] The use of the Harris-Benedict equation is used to calculate baseline energy needs in the elderly with an error margin of about 10% to 15%:[94]

$$BEN(F)\ (Kcal) = 66 + (13.7 \times W) + (5 \times H) - (6.8 \times A)$$
$$BEN(M)\ (Kcal) = 665 + (9.5 \times W) + (1.8 \times H) - (4.7 \times A)$$

where BEN is the baseline energy needs, W is the optimum weight, H is the height and A is age.[95]

In elderly patients with acute diseases or trauma, the multiplication of BEN by a 1.5 to 1.7 factor provides a good estimate of the total energy needs.[92] In a more practical form, the total energetic needs in the elderly are achieved with 30-35 kcal/kg (ideal weight)/day.[24,52]

Protein needs

In the elderly, the protein synthesis capacity is lower and protein renewal is higher.[44] While there is some evidence that elderly patients need higher amounts of protein (per kg of weight) to maintain a positive nitrogen balance,[96,97] it is known that this population has greater difficulty in metabolization and excretion of protein overloads[35] and some studies have shown that even values above 1.3 g protein/kg/day do not improve the anabolic response.[93] Therefore, 0.8 to 1.2 g protein/kg/day are recommended to adapt to clinical conditions.[3,24,25]

Lipid needs

Elderly patients generally have an increased fat mass.[24] Today, it is recommended that lipids constitute 25% to 35% of the total calories intaken[35], which enables us to provide an adequate amount of non-protein calories without an excess of glucids and at the same time, avoid a deficiency in essential fatty acids.[2]

Water needs

Changes in the thirst mechanism and a gradual deterioration in the renal function to which the elderly are subject put them at great risk of dehydration.[24,35] 30 ml/kg (ideal weight) per day is the recommended amount of water in combination, with monitoring of hydro-electrolytic parameters and volemia.[35,24]

Micronutrients

The absorption of some micronutrients is decreased in the elderly, but the needs are increased in some situations.[35] Although there are no specific recommendations for enteral feeding, the general guidelines have been followed[80] (suitable for most enteral formulas).[35,67] Vitamin K should be administered separately, once to twice a week.[67]

Enteral feeding: types of formula

There are currently several types of chemical diets for enteral feeding.

The classification of the various formulas takes into account the type of support they provide (full diets, supplements or modules), the form of presentation of their macronutrients (polymeric, oligomeric, monomeric), their protein content (normal protein content, high in protein), their calorie density (normal, high), etc. There are also formulas prepared for the special conditions which are often observed in the elderly, including renal insufficiency, liver insufficiency, diabetes, neoplasms, and high metabolic stress.

When choosing the most appropriate diet, several factors should be considered, including its composition, its sources of nutrients, its diet caloric density and osmolality, the presence or absence of certain nutrients, its safety, its price, and the type of administration.[10] Also, the diet should always be adjusted to the particular needs of the elderly patient. In general, it can be said that the elderly have good tolerance for

diets considered standard (polymeric, normal protein content, isocalorie), therefore other diets should be reserved for particular conditions.

Enteral feeding: access routes

The administration of enteral feeding through a nasogastric tube is the method most often used in geriatric units.[98] It is the method that is most similar to normal oral feeding. Its advantages include the fact that it is easy to perform, it is cheaper, and it allows intermittent administration.[10] It is the method of choice for elderly patients whose need for nutritional support is expected to be temporary (two to six weeks).[99] For greater comfort, small-diameter, preferably polyurethane tubes (8-14 FR) should be chosen. The main disadvantages of this method are the risk of bronchoaspiration (particularly high in elderly patients with altered state of consciousness and difficulty swallowing), occlusion of the tube and high rate of extubation.[49,100]

The administration of enteral feeding through a nasoenteral tube placed in the duodenum or jejunum may, at least from a theoretical point of view, reduce the risk of aspiration; however, some studies do not confirm this claim.[10,90,101] This method requires continuous administration, since the bowel does not tolerate bolus feeding well, or the rapid change in the rate of infusion.[10] Similarly to the nasogastric route, the nasoenteral route is not very suitable for long-term enteral feeding in the elderly patient.

Pharyngostomy, gastrostomy and jejunostomy are alternatives to the above methods for elderly patients who require nutritional support for a period longer than four to six weeks.[99,102] In the last decade, percutaneous endoscopic gastrostomy (PEG) was developed, which is a technique resulting in a low rate of complications that can be performed safely only in patients who are sedated. This method has almost completely replaced surgical gastrostomy, which can cause much higher morbidity and mortality,[3,102] and it is generally well-tolerated in the elderly.[98] It is more accepted and more effective in maintaining the state of nutrition and hydration (in the short term) compared with the nasogastric route[100] and is the technique of choice for prolonged or permanent nutritional support.[99,102,103,104] Percutaneous endoscopic jejunostomy (PEJ) is a variant of the PEG, and consists of the insertion, through the gastrostomy, of a small-diameter tube in fasting, in order to reduce the risk of aspiration.[99]

Enteral feeding: type of administration

The types of enteral feeding consist of intermittent, bolus or continuous feeding. Intermittent or bolus administrations are more similar to normal oral intake, but are more subject to complications, such as aspiration, abdominal distension and diarrhea.[24,105] They are easier to perform at home, and in the absence of an infusion pump.[99] Continuous administration with an infusion pump is well-tolerated, has fewer complications[105] and should always be chosen when the tube is inserted into the intestine, or when there is risk of aspiration or gastric intolerance. However, this is not a physiological type of administration, its limits mobility more, and it is more expensive.[82,99]

Enteral feeding: complications

Although this is undeniably the safest method of artificial nutritional support, enteral feeding may present complications (mechanical, metabolic, infectious, gastrointestinal), some of which can be potentially serious, so proper surveillance and monitoring are essential.

The mechanical complications relate to the problems associated with the insertion or maintenance of the tubes and include lesions of the nasopharynx, poor insertion of the tube, the occurrence of sinusitis, otitis, oesophagitis and cellulite, occlusion of the tubes, and extubation (the latter is closely related to states of agitation and occurs with high frequency among the elderly).[3,24,35,49]

Hyperglycaemia, hyperkalaemia, azotaemia, hypophosphataemia, hyperosmolar coma and hydro--electrolyte disequilibrium are the most common metabolic complications.[3,24,34,49] It should be emphasized that elderly patients are less able to tolerate these changes.[3]

Aspiration pneumonia is one of the most feared complications, because its prognosis is burdensome; it occurs with similar frequency with nasogastric and nasoenteral tubes.[10,49] Advanced age, history of pneumonia, history of previous episode of aspiration and current experience of oesophageal reflux confirmed by endoscopy are risk factors to be considered.[10,106]

The gastrointestinal complications include nausea, vomiting, abdominal pain and distension, malabsorption and diarrhea.[24] Diarrhea is a common complication of enteral feeding that often leads to its discontinuation or interruption.[99] Several factors

have been linked to its pathogenesis, including lactose intolerance, contamination of formulas, hyperosmolality, high rate of infusion, concurrent antibiotic therapy, and hypoalbuminaemia.[3,10] Recently, it has been proposed that a functional disorder of the colon is the origin of the diarrhoea observed in enteral feeding.[107] If confirmed, this new theory is likely to bring changes regarding the most suitable site for the infusion of enteral diets. Also the introduction of rapidly fermentable fiber sources gains importance in preventing the onset of diarrhea.[107]

Following this theoretical review, the authors present a study conducted at the Department of Medicine I of the HUC, with the aim of evaluating the results of enteral nutritional support in elderly patients hospitalized for diseases, who were unable to eat food in the normal oral way.

Material and methods

Sample characterization. For this study, from March 1995 to February 1996, 23 patients 65 years old or over who required total enteral feeding for a minimum period of five days were selected. The distribution by gender and age is shown in *Table I*. The various pathologies responsible for hospitalization are presented in *Table II*. *Table III* shows the main secondary diagnoses found in the patients.

Characteristics of enteral feeding (*Table IV*). All patients were inserted with a Freka nasogastric feeding tube (8 FR to 12 Fr diameter), and the formulas were administered continuously for 24 hours daily, with a rate of infusion adjusted by pump and adapted to the needs of each patient. The formulas used were chosen according to the requirements of the clinical conditions; 13 cases used the standard, isocaloric formulas, and all other cases used special formulas (high protein, high calories, suitable for diabetics, etc.). Enteral feeding was used until the patients were able to resume normal oral feeding or in cases of intolerance or irresolvable complications resulting from the application of this method.

Parameters Assessed (*Table V*). For all patients, anthropometric parameters were assessed (triceps skinfold, biceps skinfold, suprailiac skinfold, brachial circumference and brachial muscle circumference), as well as the biochemical parameters (total protein, albumin, prealbumin, trans-

TABLE I

Sample characteristics

Gender	No.	Age		
		Min	Max	Mean ± SD
Male	15	65	90	76.3 ± 7.1
Female	8	71	90	80.7 ± 7.6
Total	23	65	90	77.8 ± 7.4

TABLE II

Diagnosis on admission

Pneumonia	11
Urinary infection	4
Hydro-electrolytic disequilibrium	4
Chronic renal insufficiency	1
Septic shock	1
Heart insufficiency	1
Hepatic encephalopathy	1
TOTAL	23

TABLE III

Secondary diagnoses

Sequelae of stroke	9
Diabetes Type II	4
Diffuse cerebral dysfunction	3
Hepatic insufficiency	2
Heart insufficiency	2
COPD	2
TOTAL	23

TABLE IV

Characteristics of enteral feeding

Duration (days)			Kcal/day			Type of formula	
Min	Max	Mean ± SD	Min	Max	Mean ± SD	Standard	Other
5	30	12 ± 5.8	1000	2250	1716 ± 411	13	10

TABLE V

Parameters assessed

Anthropometric

Triceps skinfold, biceps skinfold, suprailiac skinfold, brachial circumference, brachial muscle circumference

Biochemical

Total protein, albumin, prealbumin, transferrin, apo A1, nitrogen balance, 24-hour creatinuria, total cholesterol, HDL cholesterol, triglycerides, phospholipids

Immunologic

Total and partial lymphocyte count, immunoglobulin, complement

TABLE VI

Anthropometric parameters

Parameter	1st assessment	2nd assessment	P
	Mean ± SD (mm)	Mean ± SD (mm)	
Triceps skinfold	8.2 ± 3.2	10.4 ± 4.7	NS
Biceps skinfold	4.8 ± 1.9	7.2 ± 4.3	NS
Suprailiac skinfold	7.1 ± 2.9	10.2 ± 8.2	NS
Brachial circumference	243 ± 30	262 ± 37	NS
Brachial muscle circumference	219 ± 18	229 ± 32	NS

TABLE VII

Biochemical parameters

Parameter	1st assessment	2nd assessment	P
	Mean ± SD (mm)	Mean ± SD (mm)	
Total protein (g/dL)	6.1 ± 0.7	5.7 ± 0.7	<0.05
Albumin (g/dL)	3.1 ± 0.5	2.8 ± 0.5	<0.05
Prealbumin (mg/dL)	0.10 ± 0.04	0.12 ± 0.05	NS
Transferrin (mg/dL)	1.09 ± 0.39	1.12 ± 0.21	NS
Apo A1 (mg/dL)	71.2 ± 22.3	84.7 ± 13.8	NS
24-hour creatinuria (mg)	972 ± 247	755 ± 194	NS
Nitrogen balance (g)	-0.43 ± 6.8	2.85 ± 5.6	NS
Total cholesterol (mg/dL)	131 ± 33	124 ± 34	NS
Triglyceride (mg/dL)	141 ± 62	116 ± 37	NS
HDL Cholesterol (mg/dL)	21 ± 9	21 ± 8	NS
Phospholipids (mg/dL)	142 ± 26	152 ± 29	NS

ferrin, apo A1, nitrogen balance, 24-hour creatinuria, total cholesterol, HDL cholesterol, triglycerides and phospholipids) and immunologic parameters (total and partial lymphocyte count, immunoglobulin and complement) on the day enteral feeding was begun and ended. Complications arising during the study period related to this method, and the final clinical outcome, were also evaluated.

Statistical analysis. Statistical analysis was performed by applying the Student t test for paired and independent samples.

Results

The results for the anthropometric parameters are shown in *Table VI*. An improvement in the skinfold and circumference values was observed, but statistical significance was not achieved. *Table VII* shows the evolution of the biochemical parameters assessed. A decrease in total serum protein and albumin was observed from the 1st to the 2nd assessment, while prealbumin, transferrin, and apo A1 increased insignificantly. The 24-hour creatinuria decreased from one assessment to the other, while nitrogen balance went from negative at the beginning of the nutritional support to positive at the time of the extubation. Again, these results were not statistically significant. The lipid count showed a decrease in total cholesterol and triglycerides, and an increase in phospholipids. *Table VIII* shows the results related to the immunological parameters assessed. A significant increase in the total lymphocyte count was observed, which was mainly due to an increase in T lymphocytes. No changes in serum immunoglobulins and complement were observed.

Major complications occurred during the administration of enteral feeding and related to this method are shown in *Table IX*. A high rate of extubation by the patients themselves was observed, which may be related to the altered

TABLE VIII

Immunological parameters

Parameter	1st assessment	2nd assessment	P
	Mean ± SD (mm)	Mean ± SD (mm)	
Total lymphocytes/ mm³	1357 ± 754	1554 ± 846	<0.05
Lymphocytes B4 / mm³	225 ± 168	184 ± 126	NS
Lymphocytes Pan T/ mm³	1080 ± 619	1245 ± 750	NS
Lymphocytes T4 / mm³	613 ± 370	654 ± 435	NS
Lymphocytes T8 / mm³	325 ± 280	405 ± 282	NS
IgA (g/L)	5.01 ± 1.78	5.18 ± 1.83	NS
IgG (g/L)	13.8 ± 5.3	14.9 ± 4.8	NS
IgM (g/L)	0.89 ± 0.35	0.87 ± 0.35	NS
C3 (g/L)	1.03 ± 0.26	1.05 ± 0.20	NS
C4 (g/L)	0.31 ± 0.14	0.27 ± 0.07	NS

TABLE IX

Complications

Complication	No. of patients	No. of times
Extubation	10 (43.5)	19
Diarrhea	7 (30.4)	18
Stasis	6 (26.1)	12
Aspiration pneumonia	2 (8.7)	2

TABLE X

Clinical outcome

Outcome	No. of patients	%
Improved	11	48.0
Death	8	34.8
Same	3	12.9
Worsened	1	4.3
TOTAL	23	100

states of consciousness experienced by many of them. The relatively low rate of diarrhea (classified as more than three defecations within 24 hours) was most likely due to the handling of formulas and the use of the infusion pump. Two patients had aspiration pneumonia.

The clinical outcomes of the 23 patients are shown in *Table X*. As it can be seen, eleven patients had their condition improved and were discharged after resolution of the clinical conditions which were the reason of their hospitalization. Of the eight deaths, only one was due to a complication of the enteral feeding (aspiration pneumonia). In three patients, the clinical condition did not improve and in one patient, it worsened.

Table XI shows the results of a comparative analysis between patients whose clinical conditions improved and whose conditions resulted in death. Age was found to be a determining factor for both groups. Among the biochemical parameters studied, patients who died had lower total protein values at the beginning of nutritional support. No differences were observed for the anthropometric parameters. The immunological parameters evaluated showed significant differences between both groups, both in relation to total lymphocyte count and in respect to some of its partial counts. Differences in the amount of calories provided daily to both groups were also observed.

Discussion and conclusions

This study reflects some of the major problems observed in hospitalized elderly patients. In fact, the analysis of this population found, in addition to advanced age, a high incidence of serious infectious diseases that complicated previous chronic neurological conditions, including all their consequences related to general condition and nutritional status. These patients' state of malnutrition, as observed in the nutritional parameters assessed, reflected, in most cases, difficulties in feeding without support at home, and no cases of acute malnutrition. The introduction of enteral feeding allowed some improvement in the parameters studied, both in the anthropometric parameters, and in biochemical and immunological determinations. The decrease in total protein and albumin is thought to be due to changes in the hydro-electrolyte equilibrium motivated by the

TABLE XI

Comparison between patients with improved outcome and deaths

Parameter	Death	Improved	P
Age	81,9 ± 7,4	74,2 ± 5,7	<0,05
Kcal/day	1496 ± 450	1884 ± 347	<0,05
Total protein (g/dl) - 1st assessment	5,52 ± 0,66	6,43 ± 0,61	<0,01
C3 (g/L) – 1st assessment	0.77 ± 0,28	1.14 ± 0,18	<0.01
Total lymphocytes/ mm3 - 2nd assessment	500 ± 200	1957 ± 645	<0.01
Lymphocytes Pan T/ mm3 - 1st assessment	559 ± 314	1387 ± 576	<0.05
Lymphocytes Pan T/ mm3 - 2nd assessment	359 ± 152	1640 ± 596	<0.01
Lymphocytes T4/ mm3 - 2nd assessment	175 ± 151	875 ± 366	<0.01
Lymphocytes T8/ mm3 - 2nd assessment	123 ± 101	505 ± 273	<0.05

enteral feeding, and not a worsening of the nutritional condition. The apparent improvement in the immune condition, particularly cellular immunity, reflected by an increase in T lymphocytes, was also an important aspect in this study because, as was observed, this parameter appeared to be related to the prognosis. As for the lack of statistical significance in most of the results, we believe that this was due to the severity of the clinical conditions, the patients' advanced level of malnutrition, and the short duration of the enteral nutritional support. The relatively low rates of complications observed and the favorable prognosis in half of the cases were, in our opinion, very positive and justify the use of enteral feeding in hospitalized elderly patients in cases where oral feeding is not possible.

In conclusion, elderly patients, for several reasons, are at high risk of malnutrition. Malnutrition in the elderly often goes unnoticed or is ignored, resulting in the disastrous consequences of increased morbidity and mortality. Failure to provide adequate oral nutritional support is a common problem in geriatric wards. In these situations, the early insertion of artificial nutritional support should be considered. Enteral feeding should always be the first choice, as it enables the patient to receive nourishment, maintains intestinal structure and functions, and stimulates the immune system. ■

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