Amino Acids (2005) 29: 263–266
DOI 10.1007/s00726-005-0217-6

Amino Acids
Printed in Austria

Plasma levels of amino acids in elderly long term care residents with oropharyngeal dysphagia: Comparison of hand-oral with tube-enteral-fed patients

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Received April 15, 2005
Accepted May 18, 2005
Published online August 10, 2005;

Summary. *Background*: Dysphagia and eating difficulties are highly prevalent in long term care patients. Evaluation of their nutritional status is complicated by comorbidity, frailty and individual patterns of feeding. In previous studies we found vitamin deficiencies (folic acid B6 and B12) in orally fed elderly in early stages of oropharyngeal dysphagia despite satisfactory nutritional parameters (BMI, albumin and hemoglobin). The aim of this study is to evaluate the plasma amino acids levels in these hand-oral fed elderly patients with dysphagia.

Methods: Plasma amino acids were measured in 15 orally fed elderly patients in early functional outcome swallowing scale (FOSS), stage 2, and compared with those of 15 matched nasogastric-tube-fed counterparts.

Results: The plasma levels of all measured amino acids, ratio of essential to nonessential, levels of conditionally essential and the immune-enhancing amino acids were similar in both groups and within the normal range of our laboratory. The traditional nutritional parameters were also similar in both groups and within the normal range.

Conclusions: Plasma levels of amino acids in elderly patients in early stage of FOSS are satisfactory, supporting the view that their protein intake is adequate. Further studies should concentrate on patients in advanced stages of FOSS.

Keywords: Plasma amino acids – Oropharyngeal dysphagia – Tube feeding

Introduction

Elderly nursing home residents are heterogeneous with respect to their eating ability. It varies from normal oral intake, through several degrees of dysphagia to tube enteral feeding (TEF). Dysphagia is highly prevalent in long term care (LTC) elderly patients reaching up to 70% of this population (O'Laughlin and Shanley, 1998; Layne et al., 1989).

Proper feeding is further complicated by factors such as poor cooperation, understaffing and insufficiently motivated personnel (Kayser-Jones et al., 1999; Steele et al., 1997; Kayser-Jones, 2002). With time, in many patients, dysphagia worsens, cooperation diminishes and eating is increasingly difficult, inefficient and even dangerous, bringing the issue of TEF into consideration (Gillick, 2000; Mitchell et al., 2000). Although this procedure does not eliminate the risk of aspiration pneumonia it does ensure the intake of food and fluids. The decision to initiate tube feeding, involves medical, emotional and ethical issues that confront both, medical staff and patients' families (Lubart et al., 2004). The medical reasons for TEF are based upon swallowing ability, anthropometric measurements (BMI), and nutritional parameters, mainly albumin. The reliability of albumin as indicator for proper nutrition has been recently questioned (O'Keefe and Dicker, 1988; Jones et al., 1997; Covinsky et al., 2000). The body mass index has also been found inadequate as nutritional indicator in eating disorders (Marcos et al., 1993). The nutritional evaluation of patients with dysphagia is complicated by comorbidity, polypharmacy and individual patterns of feeding. The existence of an increasing number of TEF patients in same LTC departments, whose feeding and ingestion of nutrients are under control, allows us to compare the impact of the eating/feeding status and quality on several nutritional parameters.

In previous studies we found that compared with those on TEF the orally fed elderly patients with dysphagia, showed nutritional deficits such as low levels of vitamin B12, B6 and folic acid (Leibovitz et al., 2002). In an additional study we found low CD4 lymphocyte counts and CD4/CD8 ratio in the orally fed with dysphagia (Leibovitz et al., 2004). These deficits were found in

patients with apparently normal nutritional parameters, (BMI and albumin). Protein calorie malnutrition (PCM) is highly prevalent in nursing homes affecting up to 85% of these patients (Pasvogel, 2003). Low levels of some amino acids were found to reflect this deficit (Polge et al., 1997). Early identification and treatment of PCM can reduce complications and mortality (Brugler, 2001).

The aim of the present study was to examine the levels of the plasma amino acids in the orally fed patients with dysphagia as compared with TEF patients who receive optimal formulations. Particular interest was paid to the levels of essential vs nonessential, conditionally essential and those of immune-enhancing amino acids (arginine, glutamine) in these groups.

Our studies use of the functional outcome swallowing scale (FOSS) (Salassa, 1999) to categorize patients with dysphagia according to the severity of their condition.

Patients and methods

Subjects were screened from among the 168 patients of the skilled nursing division of a geriatric hospital. The study group comprised all 15 elderly nursing home patients on oral feeding with swallowing difficulties, categorized as stage 2 by the FOSS. The control group included 15 patients on naso gastric tube feeding for at least two months, matched by age, gender and Charlson comorbidity index (Charlson et al., 1987). Only patients in stable medical condition for at least one month were included. Excluded from both groups were patients with advanced cancer, pressure sores, chronic liver disease and renal insufficiency. All patients received a balanced diet, closely supervised by a clinical dietitian, which included all nutritional constituents according to guidelines for the recommended daily allowance. For the orally fed patients the intake of nutrients was determined by tray inspection performed by the ward dietitian who was present during at least one daily meal and by nursing food record. Calculations were done manually, based on tables of food, minerals and vitamins issued by the nutritional division of the Health Ministry. Patients on NGT feeding received Osmolite or Jevity (Abbot Laboratories Columbus, OH).

Blood samples where drawn in the early morning hours (06:30–07:30) after overnight fasting. After blood separation, plasma was stored at -20° until the chemical analysis was performed.

The plasmas with added internal standard, were deproteinised with 35% sulphosalicylic acid, centrifuged and filtered through a $0.2\,\mu$ filter. The filtrate was used for the analysis.

The instrument used was Biochrom 20 plus dedicated Amino acid analyzer (Pharmacia Biotech Ltd Cambridge, England). Separation of the amino acids is achieved on a ion exchange column. The resin used is a sulphonated polystyrene cross linked with divinylbenzene. Final separation is achieved by alteration in the column temperature changing the buffer pH, and the alterations in the time that the buffer is pumped.

Once separation has been achieved the eluted amino acid is reached with ninhydrin and the colour is read photometrically at 570 nm and 440 nm. The digital signal corresponding to the colour is read by the computer, integrated, and compared to known standards and the concentration of each is then measured. The Data Handling software that is used to collect and process the data is the EZChrom ELITE tm CLIENT/SERVER Chromatography Software (Scientific Software INC, Pleasanton, CA).

Normal values of healthy persons (all ages) were obtained from data bank of the chemical laboratories of Sheeba Medical Center.

The method used to assess the plasma amino acids profile did not allow a reliable measurement of free tryptophan.

Statistical analysis was performed using the student t test by the SPSS software.

Results

Demographic and clinical characteristics of both groups are presented in Table 1. No significant differences were observed for these data.

The results of the plasma amino acids analyses are presented in Table 2. There was no significant difference between the plasma amino acid level of the study group and that of the control group. Likewise there were no signifcant differences for the groups of essential/nonessential, branched and immune enhancing amino acids.

The mean levels of all amino acid in both groups were in the range of the normal reference limits of our laboratory.

Discussion

The levels of all plasma amino acids in the LTC elderly patients were found to be in the normal ranges and there are no differences between those with oropharyngeal dysphagia as compared to those on NGT feeding.

These findings suggest that the protein intake is similar and satisfactory in both groups. Of particular interest and importance are the normal levels of the conditionally

Table 1. Demographic, dietary and clinical data

	Oral feeding	NGT feeding
No.	15	15
Age	78.8 ± 10.2	80.1 ± 6.2
Female/Male	9/6	9/6
Charlson Index	3.3	3.0
Stroke	10	9
Hypertension	7	9
Dementia	12	14
IHD	7	6
DM	6	4
BMI	24.3 ± 3.9	25.1 ± 4.5
Nutrition		
Calories	1560 ± 350	1625 ± 277
Protein (g/day)	58 ± 14	64 ± 13
Fat (g/day)	57 ± 18	64 ± 17
Laboratory data		
Serum albumin (g/dl)	3.3 ± 0.4	3.2 ± 0.5
Hemoglobin (g/dl)	12.2 ± 1.5	11.8 ± 1.6

IHD, Ischemic Heart Disease
DM, Diabetes Mellitus
BMI, Body Mass Index

Table 2. Amino acid levels in elderly patients with dysphagia

	Oral feeding	NGT feeding	Normal range
Alanine	272 ± 86	331 ± 128	(177–583)
Arginine	61 ± 24	57 ± 35	(15–128)
Asparagine	53 ± 14	49 ± 12	(35–74)
Aspartate	11 ± 9	14 ± 15	(1–25)
Citrulline	38 ± 14	40 ± 25	(12–55)
Cysteine	6 ± 6	6 ± 4	(5–82)
Glutamate	89 ± 48	78 ± 47	(10–131)
Glutamine	470 ± 99	424 ± 100	(205–756)
Glycine	274 ± 94	232 ± 99	(150–490)
Histidine	57 ± 14	55 ± 13	(32–107)
Isoleucine	59 ± 15	52 ± 8	(30–108)
Leucine	103 ± 29	95 ± 16	(72–200)
Lysine	171 ± 40	171 ± 55	(135–243)
Methionine	17 ± 4	19 ± 7	(10–42)
Ornithine	93 ± 19	73 ± 26	(48–195)
Phenylalanine	54 ± 12	53 ± 18	(35–85)
Serine	112 ± 27	77 ± 42	(58–141)
Taurine	68 ± 30	68 ± 32	(51–210)
Threonine	114 ± 37	97 ± 31	(60–225)
Tyrosine	54 ± 10	57 ± 13	(34–112)
Valine	167 ± 35	170 ± 25	(119–336)
bcaa	329 ± 75	317 ± 46	
eaa	685 ± 143	656 ± 113	
neaa	1618 ± 298	1529 ± 383	
eaa/neaa	0.4271 ± 0.0676	0.4412 ± 0.0647	
imeaa	625 ± 116	554 ± 139	

bcaa, branched amino acids; *eaa*, essential amino acids; *neaa*, non eaa; *imeaa*, immunoenhancing amino acids
All values are in micromol/L

amino acid, arginine involved in wound repair (Wilmore, 2004), and taurine, considered the main brain osmoregulator whose levels were found insufficient in a previous report (Cho et al., 1990). Unlike our previous studies which showed deficient nutritional parameters in FOSS 2 patients, this study suggests that their protein intake is sufficient. Our results also suggest that in this group of stable elderly patients with dysphagia, plasma albumin and BMI do reflect an adequate level of plasma amino acids.

Data on the plasma amino acid levels and ageing are scanty (Pitkanen et al., 2003; Rudman et al., 1989; Ravaglia et al., 2004). Among the very few reports regarding this matter in frail elderly only one mentioned tube-fed subjects as a distinct group (Rudman et al., 1989). That study suggests that intake of essential amino acids may often be suboptimal in either independent or institutionalized persons. A recent study reports some abnormalities in aromatic and basic amino acids (Ravaglia et al., 2004).

Our study is the first to examine the level of plasma amino acids in relation to the eating/feeding status as expressed by the FOSS. This is a relatively small group of patients. Nonetheless the results indicate a satisfactory nutritional status from the point of view of protein intake in this vulnerable subgroup of patients. Further studies should concentrate on patients in more severe stages of the FOSS.

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