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Rassegna - Review

Nutritional management of stroke patients

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ABSTRACT: Stroke has a significant impact on public health in Italy as well as in most industrialized countries due to its high incidence, prevalence and subsequent disability rate. While appropriate diagnostic tools and pharmacological agents have proven effective in the management of this disease, the unequivocal demonstration of the usefulness of nutrition therapy in stroke patients is lacking. Since stroke patients are nutritionally vulnerable, nutrition management is expected to play a major role in the therapy of hospitalized and home care stroke patients. In both cases, stroke patients can experience one or more disabilities, which influence eating habits and dietary intake; in addition, more than half the stroke patients need feeding support when discharged from hospital to home or to other long-term care settings. We review the techniques for assessing the nutritional status of stroke patients and the strategies for managing dysphagia and feeding patients, as well as the different types of feasible nutrition therapy. In addition, clinical and radiological options for the diagnosis of dysphagia are examined. Studies concerning the nutrition treatment of stroke patients demonstrate several methodological problems including no generally accepted malnutrition definition, stroke patient heterogeneity and the availability of a wide range of outcome variables. The data regarding nutritional treatment in stroke patients remains inconclusive; therefore, long-term randomized controlled studies are needed to evaluate better the effects of defined nutritional intervention programs on determining clinically relevant outcomes. (RINPE 2004; 22: 205-26)

KEY WORDS: Nutritional status, Malnutrition, Stroke, Dysphagia, Nutritional plan

PAROLE CHIAVE: Stato Nutrizionale, Malnutrizione, Ictus, Disfagia, Supporto nutrizionale

INTRODUCTION

In Italy, stroke is the third major cause of death after cardiovascular diseases and tumors. It causes 10-12% of deaths every year, and represents the main cause of disability. Stroke incidence increases progressively with age, reaching the highest values among individuals ≥85 yrs old; 75% of all strokes affect those >65 yrs (1). There are >130,000 new stroke cases every year and owing to the progressive ageing of the population, in 2008 this will be >170,000 new stroke cases per year if there is no reduction in the incidence rate.

While stroke incidence has been stable in recent years, post-stroke death and disability are decreasing. To date, mortality in the first month is 30% and 40% of survivors have serious residual disability (1).

In both acute and chronic stages, stroke patients experience complex disabilities that influence eating and dietary intake (2-4). Different functional impairments relating to arm movement, posture, lip closure, chewing and swallowing abilities, perception, attention and sensation, contribute to eating disabilities (5). Dysphagia occurrence rate is 13-71% and poor appetite and food intake occur in 60% of patients (5-7). A loss in sight can

result in the oversight or spillage of food; depression reduces the desire to eat and has a deleterious influence on recovery in activities of daily living (8). Reliance on other people for feeding assistance increases the risk of inadequate intake. These multiple obstacles can be compounded further by the psychological effects of dealing with eating disabilities in an environment where meals are consumed in front of others (8).

Stroke patients are nutritionally vulnerable and dietary issues are important factors to consider in their management in hospital and at home. Overnutrition and protein energy malnutrition (PEM) are frequent in stroke patients (Tab. I) and both conditions have been documented.

Prospective and case-control studies report that obesity, particularly abdominal obesity is an independent risk factor for ischemic stroke (9). Therefore, its presence in patients is likely to be pre-existing. The prevalence of being overweight in stroke patients, reported by different studies varied from 16-30.4% (9-12), probably due to patient selection. However, only six out of the sixteen studies listed looked at overweight.

PEM affects 8-30% of stroke patients on admission and deteriorates thereafter; this figure is reported as tripled on admission to rehabilitation units (Tab. I) (4, 11, 13-18). In addition, more than half (67-80%) the stroke patients need feeding support at the time of discharge to home or to other care settings from an acute-care hospital (19, 20).

Malnutrition is a risk factor for complications, increased mortality, length of hospitalization and related cost (21); a strong association has been demonstrated between malnutrition and poor clinical outcomes across a wide range of diagnostic groups, including stroke, through a variety of mechanisms (4, 22). The question of whether nutritional support can modify these deleterious effects has been addressed with differing diagnostic groups and nutritional support strategies (23, 24), but to date limited work has been carried out with stroke patients.

A recent study evaluated evidence-based guidelines for nutrition support following acute stroke. The authors selected 24 guidelines for nutritional screening, assessment and management of stroke patients; improvements in compliance to 15 guidelines were associated with a significant reduction in infective episodes, but no change in the Barthel index, body mass index (BMI), length of stay and discharge destination (10).

This paper reviews the techniques for nutritional assessment, swallowing screening and referral for swallowing assessment, nutritional needs and support in stroke patients.

The literature search strategy focused on: Screening and assessment of nutritional status; Screening, assessment and management of dysphagia; Nutrition support techniques.

Electronic databases searched were Medline, the Cochrane Library and the Worldwide Web using all available inclusion dates to May 2004; citations of pertinent publications were checked for further references.

a) Nutritional status of stroke patients

The ultimate goal in the assessment of nutritional status is to help the patient to attain or maintain a sufficient intake of energy and nutrients; therefore, reducing the risk of adverse outcomes associated with poor nutrition and promoting an optimal health level.

Dietary insufficiency of nutrients, first, leads to reduced levels in tissue and body fluids, secondly, to reduced functional levels in tissues and diminished activity in nutrient-dependent enzymes and, finally, to functional impairment and the appearance of clinical symptoms and signs.

Until recently, there was no generally agreed screening system aimed at detecting undernourished patients or patients who could benefit clinically from nutritional support. No single test used alone can offer adequate sensitivity or specificity in the detection of poor nutritional status; tests are used most effectively in combination or serially. Anthropometric and biochemical measurements, as well as physical examination, medical and dietary histories, are useful in assessing nutritional status.

The methods used to identify malnutrition in stroke patients, can be grouped into three main categories (Tab. I):

1. Simple bedside methods using clinical assessment;
2. Anthropometry, possibly in combination with laboratory tests or other tests or bioelectrical impedance analysis (BIA);
3. Nutritional risk screening tools, using anthropometry and clinical and dietary assessment.

The criteria used were not specific to stroke patients and different cut-off points for anthropometric measures were used.

In the first case, a simple bedside categorization of nutritional status was performed by healthcare professionals to identify patients with low BMI and abnormal anthropometric values; based on this, stroke patients were classified as undernourished, normal or overweight. The subjective nature of this method lends itself to potential bias; nevertheless, it has been reported as having reasonable inter-observer reliability. In the second case, malnutrition was assessed when at least one or up to three different nutritional measures were below the normal range, but the reference ranges with which mea-

TABLE I - PREVALENCE OF MALNUTRITION IN STROKE PATIENTS AND OUTCOME RELATED TO NUTRITIONAL STATUS

Author	Setting and time of assessment	Patients (n)	Category of nutrition assessment	Measures of nutritional status	Criteria of nutrition assessment	Prevalence of malnutrition	MAIN FINDINGS
Unosson et al 1994, Sweden	Acute care hospital At admission and discharge	50	2) Anthropometry, in combination with blood tests, other tests and BIA	a) IBW, TSF, MUAC b) serum albumin, prealbumin, antitrypsin c) delayed hypersensitivity d) LBM from BIA e) functional status	Undernutrition three or more nutritional measures below normal values (at least 1 from each group)	Undernutrition 8%	Low serum albumin and anergy were common among stroke patients with severely impaired neurological function. Immobility leads to loss of body cell mass
Finestone et al 1995, Canada	Rehabilitation service At admission and after 1 month, 2 months and follow-up to 4 months	49	2) Anthropometry, in combination with blood tests	a) IBW, BMI, weight loss, AMC, sum of subcutaneous skin-folds b) serum albumin, transferrin, prealbumin, total lymphocyte count	Undernutrition Two or more nutritional measures below normal values (BMI <20 kg/m^2; IBW <90%; weight loss >7.5% in 3 months, serum albumin <3.5 g/dL)	Undernutrition 49% at admission; 34% after 1 month; 22% after 2 months; 19% at follow-up	Significant predictors of malnutrition on admission to the rehabilitation service included: 1) use of tube feeding on the acute service and a history of prior stroke and diabetes; 2) advanced age at 1 month, weight loss and lack of community care at follow-up
Davalos et al 1996, Spain	Acute care hospital At admission and after 1 week	104	2) Anthropometry, in combination with blood tests	a) TSF, MUAC b) serum albumin	Undernutrition TSF or MUAC <10th centile or serum albumin <3.5 g/dL	Undernutrition 16.3% at inclusion 26,4% after the first week	Undernourished patients showed higher stress reaction. Malnutrition was associated with higher frequency of respiratory and urinary infections and bedsores, worse outcome and prolonged length of hospital stay
Axelsson et al 1998, Sweden	Acute care hospital At admission and weekly until discharge	100	2) Anthropometry, in combination with blood tests	a) IBW, TSF, MUAC b) serum albumin, transferrin, prealbumin	Undernutrition Two or more nutritional measures below normal values of healthy reference population	Undernutrition 16%	Malnutrition was associated with infections, male sex, use of cardiovascular drugs and advanced age
Gariballa et al 1998a, UK	Acute care hospital At admission, after 2 and 4 weeks	201	2) Anthropometry, in combination with blood tests	a) BMI, BSF, TSF, MUAC b) serum albumin, transferrin, iron, vitamin B12, folate	Undernutrition BMI <20 kg/m^2 TSF <25th centile MUAC <25th centile; serum albumin <3.5g/dL	Undernutrition at admission 31% BMI; 49% TSF; 12% MAC; 19% serum albumin;	1) Baseline and in-hospital poor nutritional status were associated with poor clinical outcome. 2) In stroke patients,

TABLE I - continued

Author	Setting and time of assessment	Patients (n)	Category of nutrition assessment	Measures of nutritional status	Criteria of nutrition assessment	Prevalence of malnutrition	MAIN FINDINGS
						after 2 and 4 weeks significant deterioration in all measures of nutritional status	a 1 g/L lower serum albumin concentration on admission to hospital was associated with 1.13-fold increase in risk of death at 3 month
Gariballa et al 1998 b, UK	Acute care hospital At admission, after 2 and 4 weeks	225	2) Anthropometry, in combination with blood tests	a) BMI, BSF, TSF, MUAC, AMC b) serum albumin, transferrin, iron	Undernutrition BMI <20 kg/m^2 TSF <25th centile MUAC <25th centile serum albumin <3.5g/dL	Undernutrition: at admission 19% serum albumin; after 2 and 4 weeks significant deterioration in all nutritional measures	1) Stroke patients with low serum albumin had a grater risk of poor functional outcome and infective complications during hospitalization 2) serum albumin concentration was a good predictor of death at 3 months after acute stroke
Choi-Kwon et al 1998; Korea	Acute care hospital At admission	88	2) Anthropometry, in combination with blood tests	a) BMI, TSF, SSF, ASF, TBF, LBM from BIA b) TLC, hemoglobin, serum albumin	Undernutrition more than one biochemical indicator and at least two anthropometric indicators below the lower limit of reference value Obesity: more than three anthropometric indicators above the upper limit of reference value	Undernutrition 62% in hemorrhagic stroke 25% in ischemic stroke Overnutrition 10% in hemorrhagic stroke 24% in ischemic stroke	1) A considerable proportion of stroke patients were already undernourished in the acute stage. 2) Obesity, particularly abdominal obesity tends to be more frequent in patients with ischemic stroke than in those with hemorrhagic stroke or controls
Westergren et al 2001a, Sweden	Medical clinic or geriatric rehabilitation ward At admission, after 2 weeks, 1 and 3 month	24	2) Anthropometry, in combination with blood tests	a) BMI ,IBW , weight loss, TSF, MUAC b) serum albumin	Undernutrition BMI <20 kg/m^2 or IBW ≤80% or weight loss >5% (since admission) and at least one of the following measures below normal values: TSF or MUAC or serum albumin	Undernutrition 8.3% at admission 8% after 2 weeks 29% and 33% after 1 and 3 month	The increase in the prevalence of malnutrition over time may be due to: 1) stroke severity increase the risk of malnutrition despite of nutritional interventions; 2) the monitoring and efforts to increase nutritional intake were not sufficient; 3) the level of alertness/energy in dysphagic stroke patients was

TABLE I - continued

Author	Setting and time of assessment	Patients (n)	Category of nutrition assessment	Measures of nutritional status	Criteria of nutrition assessment	Prevalence of malnutrition	MAIN FINDINGS
							important for the ability to eat and swallow and the development of complications over time
Westergren et al 2001b, Sweden	Rehabilitation service	162	3) Nutritional risk screening tools	a) SGA	Undernutrition SGA B, C or D	Undernutrition 32%	Patients who needed assisted eating were at risk of becoming or were already undernourished. The strongest eating variables for predicting nutritional status were alertness, swallowing difficulties, eats three-quarters or less of food served, and aberrant eating speed. Nutritional status could in turn significantly predict pressure ulcers.
FOOD Trial Collaboration 2003, UK	Acute care hospital At admission (within 7 days of the stroke)	2955	1) Simple bed-side methods using clinical assessment or 2) Anthropometry, in combination with blood tests	a) Simple bedside method performed by clinician (in 60% of patients included) or b) a fuller assessment of nutritional status (weight, height, dietary history, blood tests)	Patients were categorized as under-nutrition, normal, overweight on the basis of the clinical judgment	Undernutrition 9% Overnutrition 16%	Undernourished patients were more likely to develop infections and gastrointestinal bleeding. Undernutrition immediately after stroke is associated with reduced survival, functional ability and quality of life 6 months later.
CeSAR 2003, Italy, (unpublished data)	Rehabilitation service At admission and after 2 and 4 weeks	65	2) Anthropometry, in combination with blood tests	a) Body weight, TSF, MUAC b) serum albumin	Undernutrition BMI <20 kg/m^2 Overnutrition BMI >30 kg/m^2	Undernutrition 7.7% Overnutrition 20%	30% of patients had a dietary intake <75% of energy needs
Perry L 2003, UK	Acute care hospital At admission (within 3-5 days of the stroke)	a) 200 b) 200	2) Anthropometry 3) Nutritional Risk Screening Tools	a) Nutrition Risk Score (NRS) b) BMI c) Assessment of dietary intake	Undernutrition BMI <20 kg/m^2 Overnutrition BMI >26 kg/m^2	Undernutrition Sample a) 24.3% Sample b) 19.2% Overnutrition Sample a) 30.1%	Implementation of evidence based guidelines for nutritional support following acute stroke using a multifaceted strategy was associated with

TABLE I - continued

Author	Setting and time of assessment	Patients (n)	Category of nutrition assessment	Measures of nutritional status	Criteria of nutrition assessment	Prevalence of malnutrition	MAIN FINDINGS
						Sample b) 30.4%	improvement in selected patient outcome
Suk SH 2003, NY	Acute care hospital At admission or medical record or self-reported	576	2) Anthropometry	a) BMI, WHR	Overnutrition BMI >30 kg/m^2	Overnutrition 21%	Abdominal obesity is a stronger risk factor than BMI for ischemic stroke in all ethnic groups
Sotillo C 2003, Spain	Geriatric rehabilitation ward	25	2) Anthropometry, in combination with BIA	a) Body weight, MUAC, BSF, TSF, SSF LBM from BIA	Not reported	Not reported	Comparison of older people recovering from cerebrovascular accident and healthy older subjects shows the benefits of physical exercise in compensating for changes in body composition as a result of immobility during convalescence
Davis JP 2004, Australia	Acute care hospital At admission	185	2) Blood tests 3) Nutritional risk screening tools	a) SGA b) serum albumin	Undernutrition SGA A or B serum albumin <3.5g/dL	Undernutrition 16% SGA; 16.2% serum albumin	Premorbid undernutrition, assessed using SGA, may increase the risk of mortality and poor outcome 1 month after stroke Undernutrition assessed by serum albumin was associated only with mortality
Perry L 2004, UK	Post-stroke patients living at home or institutionalized 6 months post-stroke	206	2) Anthropometry 3) Nutritional risk screening tools	a) Nutrition risk score (NRS) b) BMI c) Assessment of dietary intake (24-h recall)	Undernutrition NRS <normal values BMI <20 kg/m^2 Overnutrition BMI >30 kg/m^2	Undernutrition 6.8% and 5.3% at moderate and high nutritional risk on the basis of NRS score; 15.5% BMI Overnutrition 13.9% BMI	79% and 25% of the group had a reported energy and protein intake not meeting national recommendations. Interventions on nutrition and eating disabilities might achieve improvements in post-stroke survivors' perceived quality of life

In grey are reported data obtained from rehabilitation services

AMC: arm muscle circumference; ASF: abdominal skin-fold thickness; BMI: body mass index; BSF: biceps skin-fold thickness; IBW: ideal body weight; LBM: lean body mass; MUAC: mid upper arm circumference; SGA: subjective global assessment; TSF: triceps skin-fold thickness; WHR: waist/hip ratio.

surements are compared (i.e. healthy reference population) can influence the reported extent of malnutrition. In the last case, nutritional risk screenings methods such as subjective global assessment (SGA) and nutritional risk score (NRS), were used to detect malnutrition and classified stroke patients as well nourished, moderately undernourished or severely undernourished. It is suggested that the use of validated nutritional risk screenings must be a routine part of medical treatment in different categories of high risk patients, but currently no validated tools exist for stroke patients. A recent review concerning the methodology of nutritional screening and assessment tools (25), indicated that insufficient details were given regarding their intended use and derivation method and that effectiveness was not adequately assessed.

Anthropometric measures and indices

Regardless of the method used for nutritional assessment, anthropometry is the key technique. BMI categories can be used to identify the risk of chronic protein-energy malnutrition in adults (Tab. II), but simple assessments of height and weight in estimating BMI can be difficult in bedridden stroke patients, and surrogate measures for height are frequently used. Weight measurements in non-ambulatory patients require specialized equipment such as wheelchair balance or a bed scale. When stature cannot be measured because of the stroke patient's inability to stand, supine height (13) or knee height (18) have been used as alternative parameters. Height is then predicted using several equations such as the following (26):

Males 64.19 - (0.04 x age) + (0.02 x knee height)
Females 84.88 - (0.24 x age) + (1.83 x knee height)

Demi-span is also considered as a surrogate measure for height (10, 17). Several prediction equations have also been developed for demi-span, depending on the population. However, in clinical practice height is obtained simply by doubling the longer of the two demi-span measurements. (4, 10, 12, 17).

The use of BMI in combination with other anthropometric measurements and with the assessment of weight loss are more useful and accurate; particularly clinically relevant is the involuntary weight loss or percentage weight loss (Tab. III).

Skinfold measurements, particularly in the triceps area, have been used in the clinical setting to estimate energy reserves in subcutaneous tissue (27). Combined measurements of triceps skinfold and mid-upper arm circumference have been applied successfully to classify patients according to relative arm muscle estimates. Skinfold measurements and mid-upper arm circumference can be useful for assessing long-term changes in subcutaneous adipose tissue stores and derived muscle area in patients, such as stroke patients, who have chronic or long-term conditions or who are being renourished by artificial nutrition (AN) over months or years. Nutritional risk classification based on these parameters requires reference data that are not available for all populations (28, 29). In addition, the validity of these measurements for estimating body composition in very obese and healthy muscled individuals is questionable because of the technical difficulties in performing measurements.

Abdominal circumference is preferable to skinfold thickness in obese patients because of the technical problems associated with taking skinfold measurements. The waist-hip circumference ratio (WHR) has been used to assess adipose tissue distribution. WHR has been reported to be strongly associated with visceral fat, although waist circumference alone could be a better visceral fat deposition predictor than WHR.

Bioelectrical impedance analysis (BIA)

BIA is considered a precise, rapid, safe and non-invasive field method for assessing body composition. Com-

TABLE II - CATEGORIES OF BMI FOR IDENTIFYING RISK OF MALNUTRITION IN ADULTS

BMI Category (kg/m^2)	Interpretation
<16	Severe malnutrition
16-16.9	Moderate malnutrition
17-18.4	Mild malnutrition
18.5-19.9	Malnutrition possible
20 -25	Malnutrition unlikely (low risk)
25-30	↑ risk of complications associated with overnutrition
>30	Moderate (30-35), high (35-40) and very high risk (>40) of obesity-related complications

TABLE III - INVOLUNTARY WEIGHT LOSS ASSOCIATED WITH INCREASED RISK OF MALNUTRITION IN PATIENTS

Involuntary weight loss	Time period
1-2%	1 week
5%	1 month
>5%	3 months
>10%	6 months

Source: Stratton et al (2003).

pared to skinfold measurements field it has a similar prediction accuracy in estimating FFM, but the advantage of requiring less training and experience in taking accurate measurements (30). The ability of BIA to determine changes in body composition is particularly important for clinical use. BIA has been used for evaluating and monitoring the nutritional status of stroke patients (11, 13, 31).

Laboratory data

Laboratory monitoring of nutritional status provides information on both somatic and visceral (non-muscle) compartments of the body. The somatic compartment is composed of skeletal muscle and adipose tissue. Creatinine-height index and urinary 3-methylhistidine are biochemical methods used in addition to anthropometry, to estimate somatic protein stores. The visceral compartment includes the organs and structural components of the body. Serum albumin, transferrin, transthyretin (or prealbumin) and retinol-binding protein are laboratory indices commonly used to assess protein status.

Most studies included serum albumin as a measure of nutritional status. Gariballa et al (4, 18) reported that among several nutrition markers, serum albumin was the only marker significantly related to outcomes (mortality or poor functional outcome). Davalos et al (14) showed a tendency for nutrition (assessed by serum albumin) to be associated with stress response, stroke severity and swallowing difficulties. Dziedzic et al (32) reported that stroke patients with poor outcomes had significantly lower serum albumin values than patients with non-poor outcomes.

However, it is difficult to distinguish between changes in serum albumin induced by nutrition and those induced by the disease process. Although baseline serum albumin measurements could be unaffected by the acute stress response after stroke, serial measures introduce stress response and stroke severity as potential confounders (3). However, certain nutrition deficiencies that affect stroke patients can be overlooked, such as micronutrients and antioxidants. The use of lymphocyte counts could prove useful, as immune function is highly affected by these deficiencies.

TABLE IV - PREVALENCE OF SELF-REPORTED EATING DISABILITIES IN POST-STROKE PATIENTS AT 6 MONTHS (N=206)

Upper limb motor/sensory impairment	75%
Functionally useless arm	18%
Visual/perceptual deficits	26%
Communication deficits	27%
Lip closure difficulties	10%
Chewing difficulties	18%
Swallowing difficulties (dysphagia)	19%
Poor mealtime attention	2.5%
Postural instability	0.5%

Source: Perry and McLaren 2003

Nutritional risk screening tools

The evaluation of nutritional risk involves preliminary screening and assessment. The purpose of nutritional screening is to identify quickly individuals who are malnourished or at nutritional risk and determine whether a more detailed assessment is warranted. Nutritional assessment can use a combination of anthropometric measures with a variety of biochemical (for example, albumin, prealbumin and transferrin) or immunological (for example, total lymphocyte count) parameters. Recently, ESPEN has published guidelines for nutritional screening (33) based on integrated evaluation between impaired nutritional status and disorder severity.

The guidelines recommend that patients should be screened on admission to hospital or other institutions, particularly if they are disabled; if the patient is not at risk, he could need to be re-screened at specific intervals; if the patient is at risk it is necessary to activate a nutrition program; if the patient is not at risk, but metabolic or functional problems are predominant, or if there is doubt as to whether the patient is at risk, a second nutritional assessment level should be contemplated.

The criteria for initial screening are BMI <20.5; weight loss within the last 3 months; reduced dietary intake in the last week; and patient severely ill (for example, in intensive therapy). In the case of meeting any of the criteria, a second more in-depth assessment is warranted.

b) Eating disability in stroke patients

An eating disability can be defined as the result of any physical or mental condition that modifies the individual's ability to eat; and therefore, affects food choices, preparation and consumption. A dependency in eating can be related to all the conditions/diseases that lead to an impairment in mobility (i.e. the presence of upper extremity dysfunctions) and cognition, to an abnormal oral status and/or to impaired swallowing (dysphagia).

Stroke can produce a wide range of eating problems and impairments; Table IV lists the eating disabilities that can be still present 6 months after the stroke. Furthermore, in older patients a number of other factors related to ageing can contribute to the occurrence of eating disabilities: biological changes such as impaired vision, impaired hearing and reduced sensory perception

can interfere with consuming meals. Chronic degenerative diseases often result in physical impairments; physical changes can influence the ability to purchase food, prepare meals, open packages, use eating utensils, etc. Finally, the loss of independent functioning related to ageing contributes to the individual's need for assistance and has the potential to deteriorate the quality of life (QoL).

In the acute stroke stage, patients experience various impairments that affect feeding ability. The reported frequency of eating problems varies from 20-50%, the most common disabilities are impaired arm movements and posture, while alterations in chewing, oral food preparation and swallowing are also common (15, 34, 35). Interestingly, a significant negative association was found recently in these cases between eating problems and energy or protein intake (34).

On the other hand, eating problems persist beyond hospitalization in a consistent proportion of individuals. However, a recent study (7) which excluded the most disabled patients, showed that 66% of stroke survivors experienced mild or moderate difficulties in eating, while the number of eating problems occurring in the same patient varied widely (20, 36). A high prevalence of dependence on eating was also observed in patients living in nursing homes (20). It should be remembered that, beyond their nutritional consequences, eating activities were considered by patients as important social, psychological and functional aspects of life (36); and therefore, eating disabilities are associated with a worse QoL (12).

Specifically, regarding meal-related activities, in the post-stroke period around half the patients do not cook, around half do not shop, and 17-40% cannot eat independently and need help with feeding (37). The most common eating disabilities are upper limb motor/sensory impairment, posture impairment and visual/perceptual/attention impairment (36), while alterations in lip closure, chewing and swallowing occurred in 10-20% of patients (19). Dysphagia was still reported in 10% of survivors at 4-5 yrs after stroke (37), whereas Daniels et al (38) indicated that dysphagia occurred in 55% of stroke patients. However, dysphagia is a common occurrence after stroke it increases morbidity and can persist for a long time in some patients. Several authors referred that post-stroke dysphagia leads to chest infection, malnutrition, persistent disability, prolonged hospitalization and higher mortality (39, 40). Smithard et al (41) examined the relationships between dysphagia and both outcome and complications in 121 stroke patients and demonstrated that dysphagia was a significant mortality predictor. In a recent study, Wang et al (42) indicated that acute stroke patients with dysphagia have a relative risk for 1-yr mortality of 7.2 (confidence interval 3.8-13.7).

Assessment of dysphagia

There are several assessment options for dysphagic patients different bedside swallowing assessments (BSA), videofluoroscopy (VFS), pulse oxymetry during swallowing and others. VFS is considered the "gold standard" (43), because it shows anatomic details and allows a dynamic deglutition study, but it has several limitations: patients need to be able to sit, it is time consuming and costly, it exposes the patient to x-ray absorption and has an unclear relationship with prospective clinical outcome.

There are various bedside tests (40, 44-46): generally they are safe, simple to perform and repeatable, but there is no agreement about their sensitivity, specificity and reliability. BSA usually consists of an evaluation of wakefulness and alertness levels, of sitting posture, cough, drooling, lip closure and swallowing different volumes of water (47).

Fiberoptic endoscopy is another valid technique to assess dysphagia (48, 49). It obtains anatomic and dynamic details and can be performed at the bedside, but, as for VFS, its reliability is not unanimously reported and the relationship with outcomes is unclear.

Various studies have compared the validity and the statistical properties of these different techniques to establish their best application in clinical practice (50). Smithard et al (41), found that in patients classified at risk for swallowing by BSA, there was a significantly higher number of deaths, chest infections and institutionalization at discharge and the length of hospitalization compared to non-risk patients. Daniels et al (51) identified six significant aspiration risk predictors by VFS (abnormal volitional cough, abnormal gag reflex, dysphonia, dysarthria, cough after swallow and voice alteration after swallow) and found that the presence of two of these six factors could significantly differentiate patients with moderate to severe dysphagia from patients with mild or normal swallowing. Mann et al (52) in comparing VFS to BSA following acute stroke, found a positive predictive power of 92% in the clinical assessment, in highlighting evidence of dysphagia compared to VFS, but the positive predictive power to detect aspiration was only 41% (high prevalence of false positive). Leder and Espinosa (53), comparing fiberoptic endoscopy with BSA, observed a good sensitivity (86%), but a low positive predictive power (50%) for clinical tests, with an overestimation of aspiration risk in patients without it.

Collins and Backheit (54) found good sensitivity (72.7%) and accuracy (81.5%) of O_2 saturation during deglutition, compared to VFS: in this setting a reduction in >2% of resting O_2 saturation was considered signifi-

cant. From their data, a positive predictive power of 80% was calculated for O_2 saturation as a predictive factor of aspiration. Recently, Smith et al (55) reported similar results: they found a positive predictive power of 95% when O_2 desaturation was combined with BSA compared to VFS in assessing the risk of penetration and/or sub-glottic aspiration. Lim et al comparing O_2 desaturation with fiberoptic endoscopy, found a sensitivity of 79% in detecting the aspiration risk, but this increased to 100% when O_2 desaturation was combined with BSA (56).

Smith Hammond et al (57) compared VFS and measurements of aerodynamic parameters of cough and sound pressure level; they found a significant correlation between aspiration severity, as assessed by VFS, and sound pressure level, expulsive phase rise time, expulsive phase peak flow, cough volume acceleration and stroke severity. This equipment is unavailable in the majority of hospital facilities; and therefore, its practical usefulness is doubtful.

Analysis of eating difficulties

Westergren et al (5) considered the problem according to three aspects: ingestion (i.e. the ability to sit, manipulating food, and the transport of food to the mouth); deglutition (i.e. mouth activity, manipulating food in the mouth and swallowing difficulties); energy (i.e. eating less than three-quarters of food served, reduced alertness and excessive eating time). They found that patients with fewer eating difficulties had a reduced length of stay in rehabilitation facilities and a better prognosis in terms of independent living after stroke. In the same study, it was observed that alertness, swallowing difficulties, amount of food eaten and eating speed were the strongest predictive nutritional status factors. Again the same authors demonstrated that eating difficulties were related to nutritional status and this in turn, together with the activities of daily living, age and gender, was related to the risk of developing pressure ulcers (58). Preliminary data from the FOOD trial, an ongoing study that compares different feeding routes and regimes in stroke patients, demonstrates that poor nutritional status at admission is related to more frequent dependent living at discharge, more frequent discharge to a nursing facility and a higher risk of death (59). Recently, Perry and McLaren evaluated two groups of 200 stroke patients before and after having implemented guidelines for nutrition screening, for assessment, referral and management (10). They did not find any difference in the Barthel index efficiency and effectiveness (activity index of daily living) between the two groups, but they pointed out a reduction in the time spent without nutrition on admission and a reduction in the incidence of septic complications in the group evaluated according to the guidelines, and encouraged a systematic approach to nutritional screening of these patients. The importance of an accurate intervention was demonstrated in another study by Westergren et al who divided 24 dysphagic stroke patients into three subgroups according to their ability to complete a meal (60). These groups were treated differently according to their difficulty and at the end of the trial, they observed a significant reduction in the number of patients requiring non-oral feeding or adaptive feeding strategies compared to baseline.

c) Nutritional needs

Nutritionally, stroke is an evolutive process beginning in the acute disease phase and continuing during rehabilitation through to resolution of the dysphagia or through AN procedures. This multiphase process is influenced by patient age, complications, location and extension of the brain lesion. Clinical nutrition strategies are different in the dependent patient, in the presence of dysphagia and in rehabilitation.

Nutritional needs should be estimated repeatedly, since they are probably different at different stages. In the acute phase, the patient is unable to cover energy and nutrient needs due to the neurological deficit, and fluctuating vital parameters. A careful modulation of fluids is necessary for antiedema therapy. The first few days are critical: approximately 25% of stroke patients worsen during the first 24-48 h, and 10% worsen further after 96 h (61).

Few studies, and in a limited number of patients, have measured energy requirements during acute metabolic response to brain injury. Finestone and Greene-Finestone (62) concluded that in stroke patients, baseline resting energy expenditure (REE) were approximately 30% higher than those predicted for normal healthy subjects. Recently, measurements performed by indirect calorimetry, indicated 7-8% higher REE then those predicted using the classic Harris-Benedict equation, suggesting a lack of hypermetabolic response (63). Other studies, have reported high interleukin-6 and interleukin-2 levels (64), and recently in patients at day 2-5, Sanchez-Moreno et al found reduced plasma vitamin C levels and an increment in various inflammation markers and acute phase response (C-reactive protein, tumor necrosis factor-alpha, beta interleukin, intercellular adhesion molecule (icam-1), prostaglandins) (65).

Theoretically, energy needs should be measured by indirect calorimetry. Alternatively, energy requirements can be estimated using a factorial method: the basal metabolic rate (BMR), predicted with classic equations,

should be multiplied by factors depending on the physical activity level and on the disease. No stroke specific correction has been identified, but plus 10% could be considered in addition to the value calculated through prediction equations (63).

A further 20% increment should be considered for bedridden or chair bound patients and 30% for those totally independent. Body temperature is critical: approximately 50% of stroke patients develop hyperthermia 2 days after the acute event (66) and nutrient requirements increase. The most common causes of fever in stroke patients are infections, dehydration and stimulation of the central temperature regulation system.

In the early disease phase, in well nourished or in overweight patients, it is more appropriate to provide 25 Kcal/kg/body weight a day, with a gradual increase until the metabolic requirements are satisfied. In stressed critical patients, nitrogen losses are often high in the first week of the disease. Immobility and the neurological damage leading to muscle hypotrophy explain the negative nitrogen balance with high protein breakdown (67, 68). A nitrogen balance study showed that the urea/creatinine ratio doubled in 4-10 days from the brain injury (69).

The overall protein requirements in the acute or long-term post-stroke period are not well described. However, it is possible to extrapolate from data related to other chronic diseases or guidelines for nutritional care in hospital (Council of Europe, 2003) (22). Recommended minimum protein intake is approximately 1 g/kg of actual body weight (in individuals with normal BMI) or desirable body weight (in obesity or underweight) and up to 1.2-1.5 g/kg day in the presence of hypercatabolic conditions or bed sores (70, 71). In severe malnutrition, protein requirements must be tailored to the individual patient. Once protein requirements have been met, the proportion of carbohydrates and lipids can vary between 50 and 65% and between 20 and 30% of total energy, respectively (71). If the patient is partially able to eat, support with oral nutrition supplements compatible with dysphagia can be considered as a simple and effective procedure to improve nutritional status and prognosis (70).

In the acute post-stroke phase, bone and muscle catabolism takes place. Osteopenia develops in the hemiplegic limbs with negative calcium balance and reduced vitamin D levels (72-74). A negative zinc balance has also been observed in obligatory recumbent patients (72).

There is evidence supporting the occurrence of an oxidative stress condition in the brain during ischemia. Antioxidants (vitamin A, C and E) are reduced immediately after a cerebrovascular accident and increase over the following days (3, 75).

The risk of dehydration in stroke patients is often not appreciated; this is particularly true for dysphagic patients receiving all nutrition orally. A minimal fluid intake of 1500 ml is suggested in patients between 50-80 kg, but fluid requirements are increased above normal in the presence of fever, diarrhea, vomiting and during the administration of hyperosmolar formulas (62). Careful monitoring of body weight, fever and gastrointestinal losses must be observed, with a daily recording of plasmatic osmolarity, diuresis, creatinine, and blood and urine electrolytes.

d) Dietary management of stroke patients

The dietary management of stroke patients requires the evaluation of not only of nutritional status but also of self-feeding skills with the dietician identifying the foods that the patient tolerates (76, 77). A multidisciplinary approach is needed in which each member of the team can offer an important contribution to develop a specific nutrition plan that meets the individual's needs (78).

Dietary management of eating disabilities in stroke patients

As indicated above, stroke survivors experience a wide range of swallowing disabilities. In these patients, the major goal of dietary treatment is to prevent and treat malnutrition by providing an adequate intake of energy, nutrients and fluids, and to present foods and liquids in a safely tolerated consistency (according to the needs and clinical conditions of the patients) (76, 78, 79). Different indications are given for lip closure impairment, impairment in chewing and oral preparation phase and pharyngeal phase.

Lip closure impairment

Lip closure impairment, i.e. the inability to close the lips, causes drooling, dropping food from the mouth and failing to clear food from utensils.

Dietary intervention in these patients requires (78, 79) the evaluation of the most appropriate food consistency (whole, chopped, ground or pureed foods); the provision of appropriate eating utensils, i.e. cups with lids, to facilitate independence in eating; the use of thickening agents to help the patient retain food or beverages in the mouth. Patients should also be encouraged to take smaller amounts of food for each bite.

Impairment in chewing and oral preparation phase

Stroke can prevent individuals from chewing, gathering food with the tongue and passing it to the back of the mouth for swallowing. Patients with impaired chewing and in the oral preparation phase are at increased

risk of choking due to incomplete food mastication. Therefore, dietary intervention focuses, first, on modifying food consistency (78, 79). As matter of fact, an appropriate diet consistency and moisture food content should promote oral transport. To reduce the risk of choking, pureed or ground foods should be preferred (see below) and the use of thickeners should be considered to improve food retention and transit.

Pharyngeal phase

The dysphagia diet is commonly used for patients with impairment in the pharyngeal swallowing phase (when the involuntary swallowing reflex is triggered and the bolus passes through the pharynx to the oesophagus). In addition to providing adequate energy and nutrient intakes, the primary goal of the dysphagia diet is to prevent foods from penetrating the airways. The diet is highly individualized and progressive, and can change in relation to the individual's improvement in swallowing ability (76, 77). Evaluating the characteristics of both solid foods and liquids is a common and rational dietary practice: depending on the impairment level, solid foods and liquids need to be modified for texture, consistency, density, viscosity, temperature and taste (76, 80). Furthermore, since patients with dysphagia typically have more difficulties with liquids than solids, thickeners are often added to liquids, especially when dysphagia is more severe. Therefore, in general, pureed or ground foods should be offered, liquids should be thickened and dry, crunchy foods should be avoided.

Several problems persist in defining and standardizing dysphagia diets. The American Dietetic Association (76) identifies a four-level dysphagia diet plan: (1) pureed diet; (2) ground/minced diet; (3) soft/easy to chew diet; (4) modified general diet. In brief, the *pureed diet* (level 1) consists of thick, smooth and homogeneous texture foods. Foods have a "spoon-thick" or pudding-like consistency, while no coarse textures, nuts, raw fruits or raw vegetables are allowed. All beverages and water are modified to the recommended consistency with a thickening agent. Due to the severity of swallowing problems, a supplementation is often needed to meet dietary goals.

If the patient can tolerate a minimum amount of food easy to chew, diet consistency can improve and evolve to a *ground/minced diet* (level 2) including soft-bite pasta or rice, milk, yoghurt with soft fruit, cottage, soft or grated cheese, soft poached or soft scrambled eggs, ground meats, mashed potatoes, mashed or minced vegetables or fruits; ground meat and fish could be cooked with gravy or broth to moisten.

The next step is the *soft/easy to chew diet* (level 3), which consists of soft food items prepared without blending or pureeing. The foods have a soft texture with no tough skins, and are minced or cut into small pieces, according to the patient's tolerance. As in the other diets, beverages and water should be thickened. This diet is designed to provide an adequate quantity of nutrients according to dietary goals.

Finally, patients who largely improve their swallowing ability can progress to a *modified general diet* (level 4), including soft food cut into bigger pieces. Soft textures that do not require grinding or chopping are used. No nuts, crisp, or deep-fried foods are allowed.

Another reference document for the dietary treatment of dysphagia was recently published by a multi-disciplinary task force (81). This paper aimed to establish standard terminology and applications of dietary texture modification, and was developed by a panel of dieticians, speech-language pathologists, and a food scientist (81, 82). The National Dysphagia Diet (NDD) requires specification of both the diet consistency and liquid viscosity. Foods were classified according to eight textural properties and placed in four different levels dysphagia pureed, dysphagia mechanically altered, dysphagia advanced and regular. The first three levels are recommended in different dysphagia stages: from each level the patient can progress to the next one and finally to the regular diet (any solid textures). In addition, four frequently used terms were chosen to label liquid viscosity levels: thin, nectar-like, honey-like and spoon-thick. Although much work remains to be done, NDD represents a template on which clinical work and scientific research can be implemented.

The studies concerning the dietary treatment of dysphagia underline that the risk of dehydration is often under appreciated in patients with dysphagia, especially if they receive their nutrition orally (76, 77). Liquids can pose particular problems for swallowing; and therefore, as mentioned previously, special attention should be given to the use of thickening agents, which could be needed to modify liquid consistency in any stage of the dietary treatment of dysphagia. The ideal thickening agent should be cheap, tasteless, odorless and should be used both for cold and for hot food. A wide range of commercial thickeners is available. These products can usually be obtained through community pharmacies and should be used according to the manufacturer's instructions. Common food thickeners are unflavored/flavored gelatine, instant cereal, pureed thick vegetables, pureed fruits or applesauce and potato flakes.

Finally, caregivers' attitudes toward patients can also ameliorate mealtime performance. The appropriate assistance level and prompting should be offered: patients, who receive too much assistance, can gradually lose the

ability to eat by themselves, whereas patients benefit from an environment where they are encouraged to use their abilities to their best. Compensatory strategies are also effective in preventing dysphagia complications, including:
– A proper position with the individual sitting upright with the shoulders slightly forward and feet flat on the floor or firmly supported.
– Proper eating/feeding techniques, such as tucking the chin and turning the head to assist closure of the airways; encouraging lip closure during chewing and swallowing, etc.
– A pleasant dining atmosphere during mealtimes, and sufficient time allowed for eating.

e) Artificial nutrition for stroke patients

AN in stroke patients is mainly aimed at preventing PEM, but it could have a role in reducing mortality, since the malnutrition degree at the time of the stroke is significantly correlated with the complication rate, functional rehabilitation and mortality (14, 83). The enteral route must be preferred, unless major functional or anatomic intestinal defects coexist. Parenteral nutrition is generally contraindicated, since intestinal function is preserved in stroke patients.

Timing

Although there is no available data to indicate the adequate timing of AN for dysphagic patients in the early post-stroke period, a practical algorithm should consider the presence of malnutrition. While for malnourished patients it is indicated to start AN early (24-72 h) after stroke, to minimize the PEM risks, for normally nourished patients AN initiation can be delayed for a maximum of 7 days, during which recovery from dysphagia could occur (84, 85). Enteral nutrition (EN) in this period should be administered via a feeding tube (FT). Small bore FT (ED 5-12 F) are cost-effective and relatively safe for enteral feedings for up to 6-8 weeks. In many patients with only temporary inability for per os intake, the decision for the evaluation and placement of percutaneous endoscopic gastrostomy (PEG) is often inappropriately made when a small-bore nasogastric FT can provide adequate nutrition support. In patients with an anticipated need for supplemental enteral feeding of <8 weeks, PEG tube feeding does not offer any substantial medical benefit in comparison with nasoenteric tube feeding. For agitated patients with an anticipated requirement for supplemental enteral feeding for >2 weeks PEG tubes are generally better tolerated than the nasogastric tube (NGT), although there is still a significant risk of extubation if appropriate safety measures are not put in place (i.e. abdominal binder and soft restraints) (86).

The aspiration risk is high in patients with cerebrovascular accidents, being higher (28 vs. 6%) in those fed via an NGT than in those bearing a PEG (87). Postpyloric EN is advisable in patients with gastro-oesophageal reflux at aspiration risk (88). This can be achieved by either positioning the distal end of the FT in the duodenum after the ligament of Treitz, or by placing a percutaneous endoscopic jejunostomy (PEJ) or by infusing EN into the jejunum using the PEG access (PEG/J). EN should be continued until dysphagia recovers, allowing oral nutritional intake sufficient to cover at least 75% of the estimated nutritional needs.

In patients with persisting dysphagia 15 days after stroke, and in whom it is anticipated that dysphagia will last for >2 months, PEG (or PEJ, if the aspiration risk is high) placement is indicated. According to the patient's general condition, home enteral nutrition (HEN) via PEG is then initiated.

PEG is a well known, widespread, easy to manage technique, suitable for long-term EN in chronic stroke patients (86). Appropriate indication for PEG placement in chronic stroke patients is essentially the neurologic etiology of dysphagia without obstruction (87, 88). Contraindications for PEG placement are gastrointestinal failure, inability to perform gastroscopy, severe coagulopathy, active gastric/duodenal ulcer and lack of informed consent. This latter aspect represents a critical issue for PEG placement in non-competent post-stroke patients, when consent is provided by the next of kin, posing a number of relevant ethical problems (70, 86).

Major PEG-related complications are respiratory failure, gastrointestinal bleeding, intestinal perforation and peritonitis, abdominal abscess, necrotizing fasciitis, sepsis, wall hematoma and peristomal infection. Other complications are migration, occlusion, rupture, GE reflux, aspiration pneumonia, diarrhea and stipsis (88, 89). Table V reports an algorithm for PEG positioning in patients with neurological deficits (86).

Effect of AN on outcome in stroke patients

Nutritional rehabilitation in post-stroke patients is a critical issue, which should not be underestimated to avoid an overindication of long-term AN treatments (90). Unlike chronic degenerative neurological diseases, where nutritional rehabilitation occurs in 3.6-10% of patients, post-stroke patients demonstrate a rather modest, but significant (13-18.5%), nutritional rehabilitation (70, 90, 91) after a mean time of 8.5 months (and up to 3.7 yrs). Forty percent of patients are still on HEN 6 yrs af-

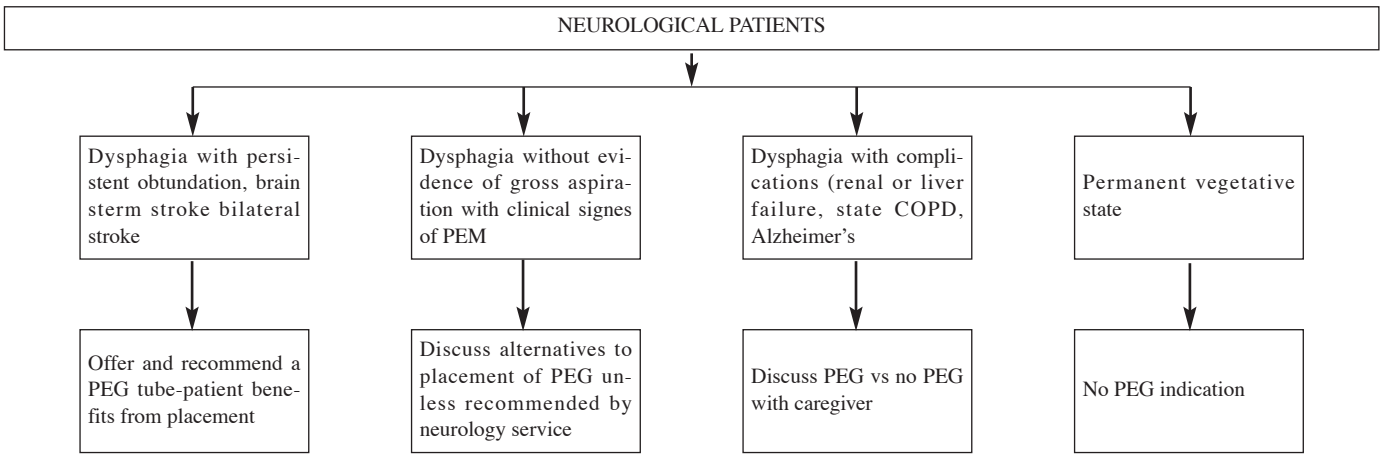
ter stroke (Tab. VI, Fig. 1) (90).

The effects of AN on mortality in post-stroke patients are far from being fully clarified, but evidence exists suggesting that the nutritional status at the moment of stroke has an effect on survival (92), low serum albumin concentrations are a strong and independent predictor of death following acute stroke (17, 24). The data from the British Artificial Nutrition Society (BANS) database suggest greater mortality in older stroke patients during Home Enteral Tube Feeding (HETF), and indicated that the overall mortality during HETF rose curvilinearly over time with an overall mortality of 14% at 3 months and 30% at 12 months, being almost doubled in patients managed in nursing homes compared with those in their own home (91).

Observations from two northern Italian HAN units reported a 40% survival rate in stroke patients at 7 yrs (70), while Norton et al (87) reported significantly lower 6-week mortality in acute stroke patients fed via PEG with respect to those fed via NGT (12 vs. 57%, respectively, $p<0.05$). Moreover, PEG-fed patients showed an overall improvement in nutritional state compared with the nasogastric group, as suggested by serum albumin concentrations (4, 92). These data indicate superiority in gastrostomy feeding over nasogastric feeding after acute dysphagic stroke.

Data concerning the QoL in stroke patients on AN are scant and do not provide precise conclusions. Loeser (93) et al assessed QoL and nutrition status in a group of 155 PEG-fed HEN patients. Of these, 65 patients had neurological disorders (six competent and 59 non-competent), 30 of which were post-stroke patients. The two essential findings of this study were that malnutrition in stroke patients was associated with a reduction in health-related QoL and that nutritional status and certain QoL aspects can improve within 4 months of HEN. This was seen both in competent and non-competent patients.

TABLE V - ALGORITHM FOR PEG PLACEMENT



Modified from Angus and Burakoff, 2003.

TABLE VI - FUNCTIONAL REHABILITATION IN NEUROLOGICAL DISORDERS
(Modified from Palmo et al, 2002)

	Stroke	**Degenerative**	**ALS**	**Head trauma**
BANS British Registry (% pts resuming oral nutrition; n=8014 neurological pts)	12.9%	Mult scler. 3.6% Parkinson's: 4.3% Dementia: 8.1%	1.1%	8.5%
Turin/Ivrea (% pts resuming oral nutrition; n=410 neurological pts)	18.5%	9.8%	0%	13.3%
Lenght of HEN (days to oral nutrition resumption (Turin/Ivrea) (Median-range)	260 (10-1346)	206 (12-1186)	nd	223 (34-328)

f) Role of nutrition in *continuum care*

As stroke patients move back to the community, there is a need for an integrated continuum of seamless, coordinated medical and supportive services named as *continuum care*.

The *continuum care* model is a system of settings, services, providers and care levels in which health, medical, social and supportive services are provided in the appropriate care setting (94).

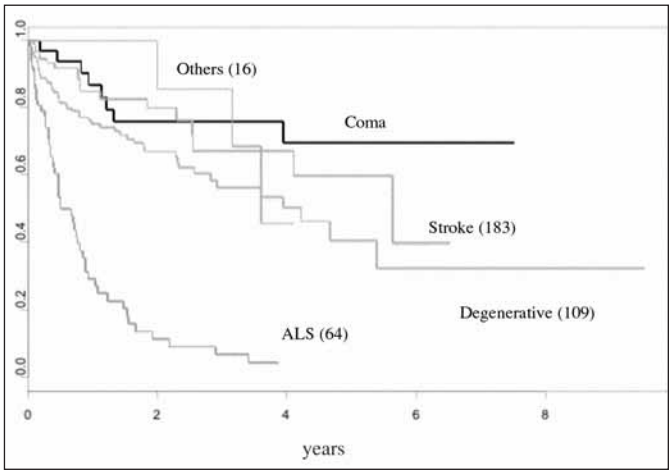


Fig. 1 - *Survival in neurological patients (410) on HEN. (Modified from Palmo et al, 2002)*

The main goals of *nutritional continuum care* include the necessity of enhancing patient QoL, of promoting health and functional independence, and the need to reduce risk and complications through medical nutrition therapy.

Within the circle of *nutritional care* of stroke patients, the major goals should be: to meet the nutrient and energy needs; to prevent and or to treat malnutrition; to plan an individual intervention; to manage temporary or permanent feeding problems; to schedule customized support (such as medical foods or AN).

In Italy, the current framework of assistance facilities available for stroke patients and in general for all disabled people, is based on two separate systems: home care and institutional settings (1, 95).

Home care involves a wide range of services, both social and medical, such as home help, home meals, nursing, home visiting general practitioners and rehabilitation assistance.

Integrated home care provides all the above services plus multidisciplinary medical assistance.

A dependent disabled person has several care setting options: a minimum care facility is the nursing home, where all basic social support is provided, the disabled person with low care needs can have residential assistance. In this setting, they have the use of medical assistance in a temporary, permanent, daily or continuous way.

The third option is medical residential facility, which

TABLE VII - NUTRITIONAL SERVICES AVAILABLE IN DIFFERENT SETTINGS

	Individual health status					
	Good to excellent/home	**Moderately ill or disabled/home**	**Chronically ill/home**	**Acutely ill/home**	**Acutely ill/hospital**	**Chronically ill**
Health services	Medical practitioners Social centers Health maintenance organization	Home health care	Adult day care	Ambulatory care center	Hospital	Rehabilitation center or extended care facility RSA
Available nutrition services	-Congregate meals -Ticket for food	-Home meals	-Home meals	-Home meals	-Moderate to extensive clinical nutrition care -Meals	-Consulting nutrition services -Meals
Optimal nutrition services	Nutrition services -Screening -Education -Meals/foodservice management	-Assessment, monitoring and evaluation -Counseling -Training -Clinical nutrition services				

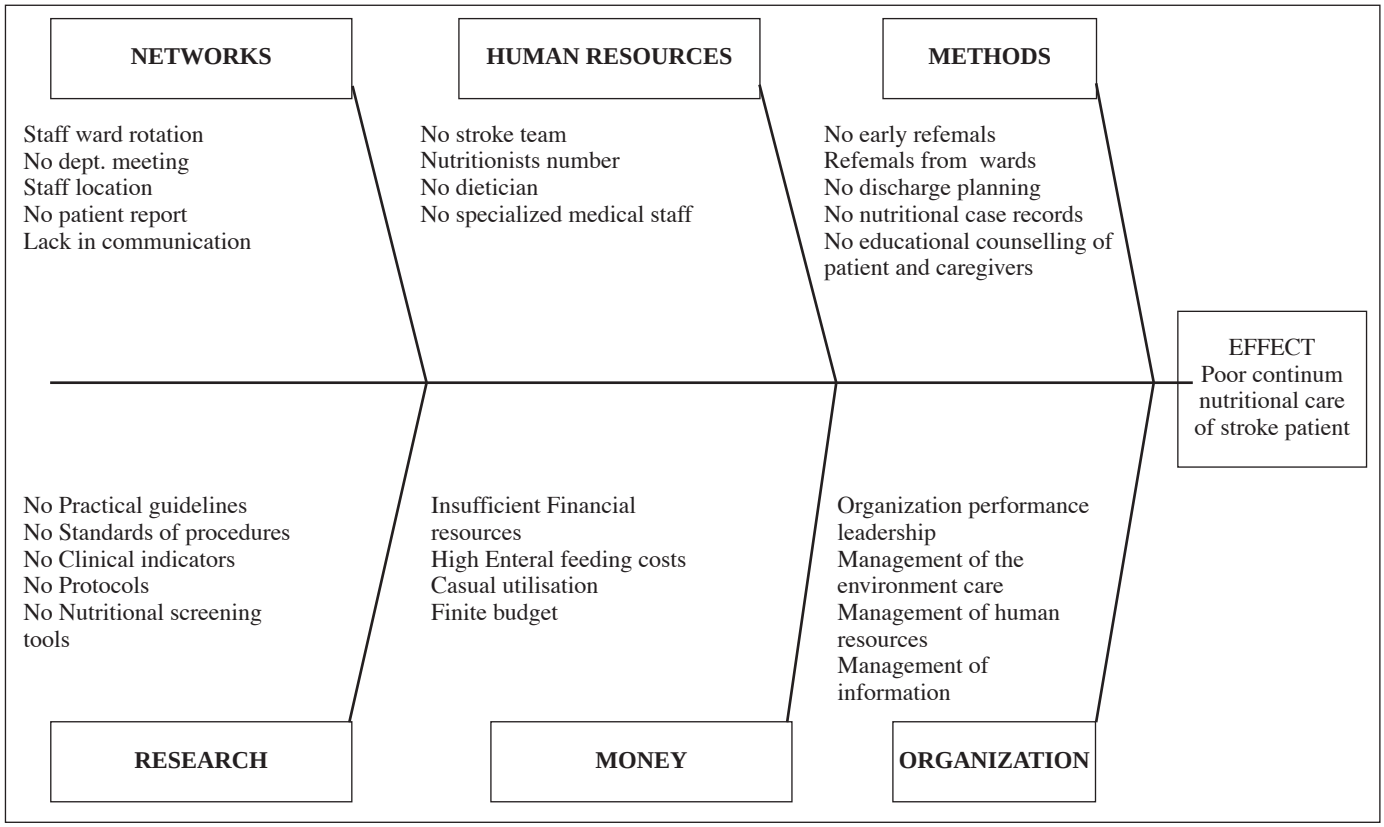


Fig. 2 - *Causes and effect "Fishbone" diagram (Modified from Patch et al. 1999)*

provides a wider range of medical support. It hosts disabled people with higher dependency levels, who cannot be assisted at home.

The last option is intermediate assistance, which provides social and medical services and support that is always customized to the individual's needs.

Table VII shows the nutritional and dietetic services supplied in different settings. These services vary nationwide and are usually charged on a sliding scale or a combination of public and private funds. Despite the acknowledged links between nutrition and health among stroke patients, few of the existing mechanisms of providing community-based health and supportive services to the patient include a nutrition service component.

Currently, a well-coordinated delivery system of medical and supportive services, across acute, home, community and long-term care sites does not exist. The lack of a coordinated delivery system has complications for providing stroke patients with appropriate food and nutrition services. Figure 2 shows a "fishbone" cause and effect diagram, which analyzes the possible barriers leading to poor nutritional continuum care (96).

Nutritional care is optimally provided by an interdisciplinary team of health professionals: different competencies should collaborate to reach the same objective, with a clear definition of separate roles and responsibilities (97-100). The nutrition and dietetic staff is involved in nutritional assessment and monitoring, in evaluating energy and nutrient needs. They recommend special diets or adjustments to food textures, but the entire multidisciplinary team is responsible for comprehensive screening assessment, and planning health care and treatment.

The physicians diagnose disease conditions that can influence nutritional status and select models for nutrition intervention. Nurses provide direct care and identify emerging problems with appetite, ability of self-feeding and compliance to the diet. The physical therapists recommend motion and coordination exercises to facilitate functional self-feeding. They address cognitive issues to ensure a safe feeding practice. The occupational therapists assess the patient's potential for eating reha-

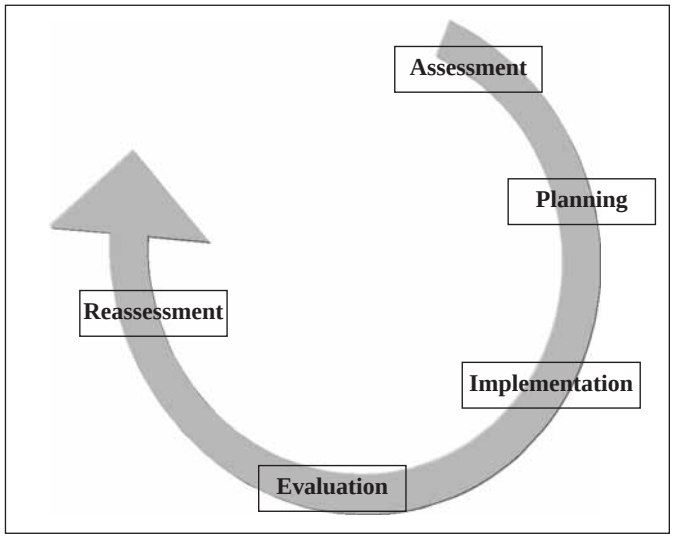


Fig. 3 - *Care planning process.*

bilitation, introducing compensatory techniques, providing advice on positioning, and the use of adaptive tableware and utensils. The speech pathologists assess the nature and extent of the swallowing deficit, and determine the patient's reflexes and levels of inabilities.

In *continuum care* social services play a central role in coordinating the patient with the social and medical agencies available. For example, checking that the patient and his family receive adequate training for home care (101). Finally, the patient and his family play an important role; the patient's involvement is essential in collecting information about nutritional status and food preferences; the family collaborates in providing help with eating and emotional support.

The care planning process

Care plans are implemented in all areas of the health care continuum and promote an integrated approach involving patient, facility staff, the patient's family and caregivers (100, 102).

The care planning process can be represented by a spiral where it is possible to identify five principle stages: assessment, planning, implementation, evaluation and reassessment (Fig. 3).

The goal in care planning is to develop a course of action designed to maintain or return the patient to the best possible state of health. The assessment stage comprises mainly of nutritional status evaluation. Nutritional assessment should identify individuals who are malnourished or at nutritional risk.

Nutritional assessment, in rehabilitation, or generally in all medical residential facilities, is performed with a comprehensive approach that defines nutritional status using medical, nutrition and medication histories (including feeding and eating skills), physical examination, anthropometrical measurements and laboratory values.

For outpatients at low malnutrition risk, a nutritional status evaluation is recommended, by regularly measuring body weight and food intake. In home care, for a medical practitioner, nutritional screening tools can be an easy predictive instrument to use in evaluating malnutrition.

Based on the assessment and findings from the team (including the patient and/or family) an intervention plan is developed and it includes specific nutrition goals to be addressed across the continuum of care.

Therefore, during the planning stage the major objectives are: formulating problems and needs statement; developing measurable goals; selecting intervention approaches.

The care plan coordinates appropriate treatments and maintains the continuity of care through periodic review and modification.

The planning stage also includes the system of the available methods to encourage individual independence in self-feeding and the evaluation of the degree of help and assistance needed.

The purpose of the implementation stage is to verify that the procedures are running efficiently, for example, timing, sequencing and repetition. The last two stages in care planning "evaluation and reassessment" are necessary to estimate and debate the goals reached, the applied procedures and the patient's nutritional outcomes. It is necessary to reconsider the objectives, the approaches and the time frame and to analyze the possible nutrition related problems and triggers. It is essential to identify deficiencies in the plan and to guide staff in correcting them.

CONCLUSIONS

A high percentage of stroke patients in acute and post-acute phases suffer from advanced and complex problems in eating, feeding and nutrition; a significant number of stroke patients are undernourished on admission and their nutritional status deteriorates further while in hospital. Moreover, in stroke patients, undernutrition or poor nutritional status is associated with increasing morbidity and mortality.

Stroke patients are likely to suffer unnecessary complications unless attention focuses on identifying their nutritional needs and appropriate interventions are planned. Unfortunately, nutrition in hospital is often overlooked, and in routine clinical practice, it is not easy

to assess stroke patients' nutritional status.

The conclusions that can be currently drawn are summarized in the following points.

- A clinical goal in the management of stroke patients should be to prevent or to identify and treat malnutrition and lating disabilities. The clinical nutritionist/dietician have an important role in the acute phase and in continuing rehabilitation following discharge from hospital. Regular follow-up and reassessment is vital to ensure the maintenance of optimal nutritional status.
- Currently, there is no "gold standard" for determining nutritional status because there is no universally accepted definition of undernutrition and all current assessment parameters are affected by age-related changes, disability, illness and injury. Combinations of more variables are accepted for evaluating nutritional status, but anthropometric measures are basic. Anthropometric indices are useful and simple to obtain. The main difficulty is the definition of normal ranges and reference values, especially in elderly and in immobile stroke patients. Serum albumin should also be included as a nutritional status measure.
- The literature review does not provide a conclusion concerning the best technique for screening dysphagia. Further studies are needed to improve the accuracy of clinical tests to reduce the risk of inappropriately feeding patients who are at risk of aspiration, or failing to feed patients who are not at risk.
- Further studies are needed for metabolic demands, stress responses and specific dietary needs of stroke patients. Nutritional support can reduce the length of hospitalization, morbidity and mortality, but further research is needed to determine the optimal timing, route, and composition of nutritional therapy.
- Coverage of micronutrient needs could require the design of higher density diets or the provision of enriched food supplements. Antioxidants can be particularly important in the acute phase, and throughout rehabilitation.
- Dietary management of eating disabilities should be individualized, according to a well-defined dietary plan, to meet the individual's nutrient requirements and swallowing capacity. Depending on the impairment level, solid foods and liquids need to be considered separately and modified for texture, consistency, density, viscosity, temperature and taste.
- A better understanding of the extent to which the management of dysphagia affects energy and nutrient intake, is needed. Further research is essential to define better the nutrition treatment of stroke survivors, and further work should be done especially concerning randomized controlled trials aimed at evaluating clinical outcomes such as malnutrition, dehydration, QoL and aspiration pneumonia.
- AN in stroke has been only recently recognized as a real therapy, and its use is rapidly increasing and should be considered a life-saving therapeutic procedure in non-terminally ill dysphagic patients. Data on the outcome of patients with disabilities on HEN are still scant and do not provide precise recommendations, however, stricter cooperation between neurologists and nutrition caregivers is warranted to allow the development of rational guidelines for AN use in stroke disability. An appropriate and adequately timed AN intervention could help to prevent malnutrition and improve, at least temporarily, the QoL of some patient groups as well as that of their families.
- Critical issues concerning AN in stroke disability still exist regarding the effect on mortality, on QoL, the ethical aspects in non-competent patients and the workload for caregivers.
- A full multidisciplinary team is needed to provide nutritional care to stroke patients. Institutional and community based health and social programs and settings should be integrated with optimal nutritional services in the daily work practice. Screening, education and a proper foodservice management should be introduced in all settings, as well as careful nutritional evaluation and monitoring wherever stroke patients need more assistance.

RIASSUNTO

In Italia e nei paesi industrializzati, l'ictus rappresenta una delle principali cause di mortalità e disabilità; nonostante numerosi studi abbiano dimostrato l'efficacia di protocolli diagnostici e terapeutici, allo stato attuale non sono definite né le caratteristiche né l'efficacia di protocolli nutrizionali per la gestione del paziente affetto da ictus.

Tuttavia i soggetti affetti da ictus presentano un elevato rischio di compromissione dello stato nutrizionale ed i fattori nutrizionali rivestono particolare importanza, durante l'ospedalizzazione e dopo la dimissione. Sia nella fase acuta che durante il periodo riabilitativo differenti tipi di disabilità possono compromettere l'assunzione dietetica e la coperta dei fabbisogni nutrizionali e circa il 50% dei pazienti post-ictus necessitano di assistenza nell'alimentazione al momento dell'ingresso nella struttura riabilitativa o al rientro al proprio domicilio.

Nel presente articolo sono presentati i metodi utilizzati in letteratura per la valutazione dello stato nutrizionale del paziente affetto da ictus, le strategie nutrizionali utilizzate per il trattamento della disfagia, i metodi utilizzati per la valutazione della disfagia, nonché le opzioni per il trattamento nutrizionale con nutrizione artificiale.

In tale ambito, numerosi sono i problemi metodologici presenti, tra cui la mancanza di una definizione universalmente accettata di malnutrizione e l'eterogeneità dei pazienti affetti da ictus. Le evidenze riguardo il trattamento nutrizionale del paziente affetto da ictus non sono ancora definite e sono necessari RCT che valutino gli effetti di specifici programmi di intervento nutrizionale sulla prognosi dell'ictus.

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