Nutritional Support in Neurological Diseases

Module 25.3
Nutritional Support in Stroke

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Learning Objectives

- Know the most frequent reasons for malnutrition in a stroke patient;
- Know the compulsory assessment leading to decision of nutritional support;
- Know the respective indications of oral and enteral feeding, and the best enteral feeding route according to the clinical situation;
- Know the outcome of a stroke patient receiving enteral nutrition.

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Key Messages

- Strokes are extremely prevalent, and their incidence is rising;
- Stroke patients are often malnourished, and dysphagia worsens malnutrition and patients’ outcome;
- Only malnourished patients need nutritional support;
- Half of dysphagic stroke patients receiving artificial nutrition do not survive to 6 months and of those surviving, 65% have severe disability;
- Enteral nutrition will be provided through a nasogastric tube, and gastrostomy will be advised after one month.
1. Introduction: Definition and Prevalence

There are two main categories of cerebrovascular accident (CVA) or stroke: those caused by arterial blockage (thrombosis or embolism), representing about 85% of strokes, and those caused by arterial haemorrhage. Cerebral thrombosis and cerebral embolism are caused by blood clots that block an artery leading to part of the brain. The resulting death of brain tissue is called cerebral infarction. Strokes caused by bleeding are referred to as cerebral and subarachnoid haemorrhages. Even though subarachnoid haemorrhages account for the lowest percentage of strokes, it is more frequently fatal. Although strokes occur suddenly, the risk has often been building for years. Some important manageable risk factors for stroke are hypertension, cigarette smoking, heart disease, diabetes, transient ischemic attacks, lack of exercise, alcohol, diet, obesity, drug use, and stress. The risk of stroke increases with age and the incidence of stroke is increasing proportionately with the increase in older individuals. For every decade after age 55, the risk of stroke doubles. In the European Union, Iceland, Norway and Switzerland an estimated 1.1 million new stroke events occur each year and currently 6 million subjects live in these countries having survived a stroke; according to population projections from the United Nations the number of new stroke events will increase to 1.5 million per year in 2025 in these countries (1). At 5 years, the excess risk of death in prevalent cases is 1.6 (1.2 to 2.0) (2). Stroke ranks in the world as the second leading cause of death behind heart disease, fifth in low income countries, first in middle income countries and second in high income countries (3). It also represents the major cause of disability in adults. Approximately one-third of individuals who recover from their first stroke will have another stroke within 5 years. Recurrent stroke is a major contributor to disability and death. The total annual costs of stroke in Europe range from € 5,400 (prevalent cases) to € 21,000 (incident cases), with a global cost of 64 billion euros (4).

2. Nutritional Aspects of Stroke

2.1 Pathophysiology

Stroke favours malnutrition through reduced food intake (mainly) and increased energy expenditure. It also favours muscle wasting and disability (sarcopenia) (5).

2.1.1 Pre-existing Malnutrition

6% to 62% of stroke patients are already malnourished on admission (6), more frequently in subarachnoid haemorrhage than in cerebral infarction patients, in older patients, in patients with diabetes, heart or kidney failure. Hypoalbuminemia is associated with more severe strokes (7).

2.1.2 Dysphagia

Dysphagia can be defined as any disruption in the swallowing process. It is responsible for both poor airway protection and the inability to cover the nutritional needs by mouth. Between 24% and 53% of stroke patients present with dysphagia on diagnosis (8). It increases by a factor 2.4 the risk of being malnourished (8). Hemispheric and brainstem strokes are both associated with dysphagia, but unilateral hemispheric strokes cause severe dysphagia less frequently. Limitations in the ability to swallow food and liquid may reflect an altered level of consciousness, physical weakness, or incoordination in the swallowing mechanism. In the acute stroke population, dysphagia is independently associated with stroke severity (9). It is responsible for aspiration pneumonia (second cause of death in these patients), malnutrition and dehydration in stroke patients (10). Dysphagia usually resolves in a few weeks; a study of 357 conscious patients with a single-hemisphere stroke reported a prevalence of dysphagia of 29% on admission, 16% at one week, 2% at one month and 0.4% at six months (11).
2.1.3 Other Causes of Reduced Food Intake
The willingness or ability to self-feed is frequently reduced: anorexia can be the result of post-stroke depression, and there can also be cognitive deficits, visual neglect, olfactory impairment, upper extremity paresis, and apraxia (12). As a result, stroke patients consume between 74 and 86% of their energy and protein requirements during the first 2-3 weeks following stroke (13, 14). Impaired gastric emptying may induce nausea and vomiting and further reduce food intake.

2.1.4 Hypermetabolism
Increased energy expenditure is common in subarachnoid haemorrhage patients (15), but is not an usual feature of cerebral infarction (16). Infectious complications may increase resting energy expenditure.

2.2 Consequences
Several studies have showed malnutrition at admission and at one week to be associated with one-month mortality, poor functional status, poor outcome, and with dependence at one and six months (17-21). Other well-known consequences of malnutrition have been reported in stroke patients: prolonged length of stay (22), bedsores, increased infectious complications.

3. Swallowing Therapy
Dysphagia may be treated by swallowing therapy. Besides behavioral interventions, performed by speech language therapists, which comprise swallowing exercises/therapy along with dietary modification, swallowing therapy may include acupuncture, drug therapy (nifedipine), neuromuscular electrical stimulation, pharyngeal electrical stimulation, physical stimulation (thermal, tactile), transcranial direct current stimulation and transcranial magnetic stimulation. A Cochrane systematic review did find any significant effect on case fatality or combined death or dependency. Dysphagia at end-of-trial was reduced by acupuncture (number of studies (t) = 4, numbers of participants (n) = 256; OR 0.24; 95% CI 0.13 to 0.46; P < 0.0001; I² = 0%) and behavioral interventions (t = 5; n = 423; OR 0.52; 95% CI 0.30 to 0.88; P = 0.01; I² = 22%) (23).

4. Nutritional Support
Nutritional support for the stroke patient is intended to prevent malnutrition and maintain or restore nutritional status according to the goals of care.

4.1 Route

4.1.1 Oral
In neurological dysphagia, nutritional therapy depends on the type and extent of the swallowing disorder. Oral nutritional therapy may range from normal food to mushy meals (modified consistency), thickened liquids of different consistencies. There is a wide range of nutritional supplements available, of varying consistency (liquid, puddings) and formulae (milk, fruit juice-based), presented as Tetabricks™, bottles or cups. Variations in consistency allow to select the most appropriate texture for dysphagic patients. The actual intake needs to be checked, though, as it has been showed that dysphagic patients on a texture-modified diet eat less than their non-dysphagic counterparts (24). In some cases, total restriction of oral intake may be necessary. When oral intake is contraindicated, enteral tube feeding is required until the patient can swallow safely. A Cochrane systematic review found nutritional supplementation to be associated with reduced pressure sores (t = 2; n = 4125; OR 0.56; 95% CI 0.32 to 0.96; P = 0.03; I² = 0%), and, by definition, increased energy intake (t = 3; n = 174; MD 430.18 kcal/day;
95% CI 141.61 to 718.75; \( P = 0.003; \) I² = 91%) and protein intake (\( t = 3; n = 174; \) MD 17.28 g/day; 95% CI 1.99 to 32.56; \( P = 0.03; \) I² = 92%) (23).

### 4.1.2 Enteral

A US survey reported, out of 164,408 stroke admissions across 1,540 acute care hospitals, feeding tube insertions in 8.8% of patients (25). Half of dysphagic stroke patients receiving artificial nutrition do not survive to 6 months and of those surviving, 65% have severe disability (26).

Nasogastric tubes are easily sited by nursing staff, do not routinely require X-ray screening, are minimally invasive, are low in cost and have no appreciable complication rate (27). Authors of a randomised controlled trial of 146 acute stroke patients found that the nasogastric nutrition group had a better nutritional status and reduced nosocomial infection and mortality rates after 21 days compared with patients in the family managed nutrition group (28).

Nasogastric tubes do not worsen dysphagia (29). However, they can be easily dislodged or removed, either intentionally or inadvertently. There are many reasons why this may occur, including impractical siting of adhesive dressing, inadvertent pulling during washing, dressing or movement of patients, and ejection during vomiting, as well as patients intentionally removing them. Nasogastric tube displacement has been reported to occur in 58–100% of patients (30) The use of a nasal loop to secure the nasogastric tube may help reduce the need for tube reinsertion (31). A systematic review reports that although looped NGT versus conventional NGT feeding do not differ for end-of-trial case fatality or death or dependency, feed delivery was higher with looped NGT (\( t = 1; n = 104; \) MD 18.00%; 95% CI 6.66 to 29.34; \( P = 0.002 \)) (23).

Percutaneous endoscopic gastrostomy (PEG) is a popular alternative to nasogastric tube when EN is prolonged. Norton et al. randomized 30 patients with dysphagia to be fed either via a nasogastric tube or a gastrostomy tube. The 6-week mortality was 57% vs 12% respectively (\( p<0.05 \)). One reason for the difference may be the smaller proportion of prescribed feed received (78 % vs 100%) (32). Sanders et al reported an improvement in activities of daily living in 25 stroke patients (mean age 80 years) with enteral nutrition (EN) via PEG (PEG placement on average 14 days after stroke) (33).

In a retrospective multivariate analysis of 77 patients with severe dysphagia from an acute-subacute hemispheric infarction, a higher severity of the stroke, translating into a higher initial NIHSS score (OR, 1.15; 90% CI, 1.02–1.290; \( P = .04 \)) and the presence of bihemispheric infarcts (OR, 4.67; 90% CI, 1.59–13.76; \( P = .019 \)) were significantly associated with PEG placement (34).

The most important trial to date is the FOOD (Feed Or Ordinary Diet) 17-country trial, which enrolled in 5033 patients admitted with a recent stroke between 1996 and 2003 (Table 1) (35). Surprisingly negative results may be a consequence of the low percentage of malnourished patients in these studies (8%), the lack of information on the amount of EN administered and the absence of compliance check.
Table 1
Main results from the FOOD trial. From (35).

<table>
<thead>
<tr>
<th>Trial</th>
<th>Description</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4023 patients who could swallow within 30 days of admission</td>
<td>Results in the supplemented group:</td>
</tr>
<tr>
<td></td>
<td>Normal hospital diet vs. normal hospital diet + supplements (540 kcal, 20 g protein)</td>
<td>- reduction in risk of death: 0.7% (NS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- increase in risk of death or poor outcome: 0.7% (NS)</td>
</tr>
<tr>
<td>2</td>
<td>859 dysphagic patients within 7 days of admission</td>
<td>Results in the early enteral nutrition group:</td>
</tr>
<tr>
<td></td>
<td>Early enteral nutrition vs enteral nutrition avoided for at least one week</td>
<td>- reduction in risk of death: 5.8% (p=0.09)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- reduction in risk of death or poor outcome: 1.2% (NS)</td>
</tr>
<tr>
<td>3</td>
<td>321 dysphagic patients within 30 days of admission</td>
<td>Results in the percutaneous endoscopic gastrostomy group:</td>
</tr>
<tr>
<td></td>
<td>Enteral nutrition via naso-gastric tube vs. percutaneous endoscopic gastrostomy</td>
<td>- increase in risk of death: 1.0% (NS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- increase in risk of death or poor outcome: 7.8% (p=0.05)</td>
</tr>
</tbody>
</table>

A Cochrane systematic review found PEG and nasogastric tube (NGT) feeding not to differ for case fatality or the composite outcome of death or dependency, but PEG was associated with fewer treatment failures (t = 3; n = 72; OR 0.09; 95% CI 0.01 to 0.51; P = 0.007; I2 = 0%) and gastrointestinal bleeding (t = 1; n = 321; OR 0.25; 95% CI 0.09 to 0.69; P = 0.007), and higher feed delivery (t = 1; n = 30; MD 22.00; 95% CI 16.15 to 27.85; P < 0.00001) and albumin concentration (t = 3; n = 63; MD 4.92 g/L; 95% CI 0.19 to 9.65; P = 0.04; I2 = 58%) (23).

In two 800+ patient studies in US rehabilitation facilities, EN was significantly associated with higher discharge total and motor functional status scores for patients with severe (not moderate) stroke, even when controlling for degree of dysphagia and other variables (36, 37).

EN is frequently performed in the home setting. Neurological diseases (of which strokes account for the biggest part) are the single most important group of patients receiving home EN in Europe (44.3%) (38). In the UK, stroke patients fed enterally spend less than 1% of their time in the hospital: they account for 37% of home EN patients and it is estimated that 1.7% of all stroke patients receive home EN (39).

### 4.1.3 Parenteral

Although parenteral nutrition hasn’t been studied in this indication, there does not seem to be any room for this nutritional treatment, unless EN is contra-indicated or ill-tolerated (see LLL module 8.3). It needs to be strictly limited in time. A good example may be a patient with severe gastroparesis while waiting for jejunal access.

### 4.2 Amount of Nutrients

There is no specific need in stroke patients who will receive energy and proteins based on their maintenance (20-30 kcal, 30 mL water and 1 g protein/kg/day) and refeeding needs. An iso-osmolar formula can be safely used, taking into account the possibility of fluid imbalance (40). However, studies don’t show any effect of fluid supplementation on death or dependency (23). Glycaemia needs to be maintained at (sub)normal levels, but no “diabetic” formula has proven to help reach that goal (23).
4.3 Indications

4.3.1 Considerations and Results
Perry and McLaren developed evidence-based guidelines for nutritional support in acute stroke (Table 2), and implemented these guidelines in 200 stroke patients, resulting in a significant decrease in infective episodes compared to a pre-guideline 200-patient group (41).

Table 2
Example of guidelines for nutritional support in stroke. From (41).

| Screening | - All stroke patients will have their swallowing function screened within 24 h of admission to identify those with swallowing difficulties [B]
| - Screening will be via a validated water swallowing tool, with pre-screen checks for conscious level, oromotor and laryngeal function, signs of respiratory aspiration [B]
| - Detection of abnormalities in swallow function will be followed by immediate referral for full clinical swallowing assessment by an appropriately trained speech and language therapist (SLT) [B]
| - All stroke patients will be screened within 24 h of admission to identify degree of risk of nutritional risk [B]
| - Screening will be with a validated nutritional tool [B]
| - Detection of high risk of malnutrition [BMI <20] will be followed by immediate referral for dietetic assessment [B].

| Assessment | - Patients presenting with features indicating dysphagia and/or risk of pulmonary aspiration will receive a full clinical assessment of swallowing by an appropriately trained SLT [B]
| - SLT assessment will be initiated within 2 working days of referral [C]
| - SLT assessment will take place within 72 h of admission, where required [C]
| - Patients presenting with features indicating high risk of malnutrition or where there is inability to provide an adequate nutritional intake via normal catering provision will receive full assessment by a dietician [B]
| - Dietetic assessment will be initiated within 2 working days of referral [C]
| - Patients presenting with features indicating functional deficits resulting in eating disabilities will receive full clinical assessment by appropriate occupational or physio-therapists (PT or OT) or clinicians [B/C]
| - Referral for PT/OT assessment will proceed as soon as the patient is medically stable [C]
| - PT/OT assessment will be initiated within 2 working days of referral [C]

| Management | - Monitoring and documentation of nutritional intake and status (repeated NRS scoring, weight measurement, food record charts) will take place to facilitate early problem identification [B]
| - Where eating is possible but intake inadequate 1 kcal/mL supplements will be used with/ without dietetic referral [A]
| - Where swallowing is impaired appropriate therapeutic interventions will be initiated e.g. modification of food and fluid textures and consistencies [B]
| - Consideration of nutritional support will be instituted within 5 days of prescription of therapeutic nil oral regime [C]
| - Fine-bore feeding tubes with guidewires will be placed by appropriately trained medical or nursing staff [B/C]
| - Aspiration of gastric secretions will be used to check placement where possible [B/C]
| - Chest X-ray will be used where aspiration is not possible/ pH of aspirate >4 [B]
| - Feed delivery will match feed prescription, calculated to meet the patient's...
individual requirements [B]
- Gastrostomy will be considered where need for artificial nutrition persists beyond 3 weeks [A/C]
- If naso-gastric feeding is not established within 5 days of its institution suitable alternative nutrition support will be considered [B/C]

All stroke patients need to be screened for malnutrition. This will be best performed with a composite index such as the Subjective Global Assessment (6, 19), even if – like in many other clinical situations – low serum albumin levels have a negative prognostic value (7).

All patients also need to be screened for dysphagia; the extremely simple 3-oz water swallow test developed by De Pippo et al. identified 80% (16/20) of patients aspirating during a subsequent videofluoroscopic modified barium swallow examination (sensitivity, 76%; specificity, 59%). It also identified patients with more severe dysphagia aspirating larger amounts (sensitivity, 94%; specificity, 26%) or thicker consistencies (sensitivity, 94%; specificity, 30%) of test material. The 3-oz water swallow test is a sensitive screening tool for identifying patients at risk for clinically significant aspiration who need referral for more definitive modified barium swallow evaluation (42). More modern bedside tests are available, taking into account consistencies (from juice to nectar and pudding) (43), along with videofluoroscopy, videoendoscopy and spontaneous swallow frequency rate measurement, which are less available alternatives (44).

Dysphagia warrants artificial nutrition in malnourished patients: even if nasogastric tubes offer only limited protection against aspiration pneumonia (45), they improve nutritional status. The question is when to start the patient on EN; the answer is probably (after the FOOD trial) after at least one week (46).

As dysphagia will usually resolve in the first weeks of the stroke, a large percentage of patients with feeding tube placement in the acute post-stroke period will return to oral feeding within three months of stroke onset (47). Videofluoroscopy and videoendoscopy can allow assessment of the upper airway during swallowing attempts (48) (Fig. 1) and gives useful information on the tube feeding dependency (49). Preparation for the return to oral feeding in a tube-fed patient involves a daily collaboration between dieticians and speech-language therapists (Table 3).

Fig. 1. Videofluoroscopy showing aspiration.
From Prof. Jean-Claude Desport.
Table 3
Checklist for transitioning tube-fed patients back to oral feeding. From (48).

- Identify a safe oral bolus
- Provide intermittent tube feeds
- Ingest oral feedings before tube feeding
- Reestablish a normal meal routine
- Provide a specific diet in the initial stages
- Document the type, amount, and time to eat of all materials taken by mouth
- Document any problems with the oral diet and any complications
- Involve patient/family in preferences for advancing oral diet
- Monitor swallow performance, nutrition and hydration, and respiratory complications

Table 4 shows the survival probability of French dysphagic patients (most of them with stroke) on home EN, compared with other diagnostic groups.

Table 4
Outcome of home enteral nutrition patients. From (50).

<table>
<thead>
<tr>
<th></th>
<th>Head and neck tumours</th>
<th>Neurological dysphagia</th>
<th>Dementia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>76</td>
<td>148</td>
<td>54</td>
</tr>
<tr>
<td>Age</td>
<td>65</td>
<td>75</td>
<td>85</td>
</tr>
<tr>
<td>Body mass index</td>
<td>19.9</td>
<td>19.9</td>
<td>17.4</td>
</tr>
<tr>
<td>Reason for home EN</td>
<td>Dysphagia (100%)</td>
<td>Dysphagia (100%)</td>
<td>Anorexia (100%)</td>
</tr>
<tr>
<td>30-day survival</td>
<td>88%</td>
<td>83%</td>
<td>54%</td>
</tr>
<tr>
<td>1-year survival</td>
<td>37%</td>
<td>41%</td>
<td>20%</td>
</tr>
<tr>
<td>5-year survival</td>
<td>24%</td>
<td>21%</td>
<td>3%</td>
</tr>
</tbody>
</table>

4.3.2 ESPEN Guidelines
The ESPEN guidelines on EN in Geriatrics (51) state that in geriatric patients with severe neurological dysphagia, EN is recommended in order to ensure energy and nutrient supply and, thus, to maintain or improve nutritional status (A). For long-term nutritional support PEG should be preferred to nasogastric tube, since it is associated with less treatment failures, better nutritional status (A), and it may also be more convenient for the patient. In patients with severe neurological dysphagia EN has to be initiated as soon as possible (C). EN should accompany intensive swallowing therapy until safe and sufficient oral intake from a normal diet is possible (C).

4.3.3 Recommendations
Fig. 2 shows recommendations that can be made from the published evidence and clinical practice. PEG may be inserted earlier than after one month, should nasogastric tube not be tolerated.
4.4 Ethical Issues
The decision to start a stroke patient on artificial nutrition will raise ethical issues if the patient is non-competent.

5. Summary
Stroke is a frequent situation in which an often malnourished patient is further exposed to a risk of malnutrition (mainly from dysphagia), thus increasing the risk of death, disability and a poor outcome. Malnourished dysphagic patients need to be fed enterally, via a nasogastric tube placed after one week, with PEG indicated if the patient is still dysphagic after one month. Whether in non-malnourished dysphagic patients or in patients who are in the process of being taken off enteral nutrition, the help of a speech language therapist and the use of modified texture foods in warranted.
6. References


