e-Appendix 1: Nutritional assessment of stroke patients

For stroke patients, nutritional assessment is used to determine the presence, type and severity of malnutrition and to evaluate the effectiveness of nutritional support. The goal of the assessment is to help the patient attain or maintain a sufficient level of energy and nutrients to reduce the risk of complications associated with poor nutrition and promote optimal health.

The nutritional assessment may range from a brief screening to a comprehensive evaluation. Components may include the nutritional history, and clinical, anthropometric and biochemical indices. Anthropometric indices include body weight, weight change over time and skinfold thicknesses, all of which estimate fat stores. Common skinfold-thickness sites are triceps, biceps, below the scapula and above the iliac bone. Measurements of body circumferences and areas, such as variations of the mid-upper-arm muscle circumference and area, reflect the amount of skeletal muscle. Bioelectrical impedance analysis estimates total body water, fat-free mass, fat mass and body-cell mass by measurement of the impedance of an electric current that passes through the body. Biochemical measures are used to assess the status of iron as well visceral proteins. Visceral protein status can be estimated with measurements of serum albumin, serum transferrin, thyroxine-binding prealbumin and retinol-binding protein, and a total lymphocyte count. Indicator levels found in mild, moderate and severe depletion are available.[1–4] No single test used alone can offer adequate sensitivity or specificity in the detection of poor nutritional status. Tests are most effectively used in combination or in sequence.

A simple way to estimate nutritional status is to monitor weight and the degree of weight change over time. Normative measures for Canada and the United States are available.[5,6] High rates of unintentional weight loss suggest the development of malnutrition, even if patients are within or above normal weight ranges. Since advanced malnutrition is associated with an increase in extracellular fluid and possibly edema, which may obscure the degree of weight loss, other methods of assessment have been advocated.[7] Among them is the subjective global assessment that is derived from the patient's history and physical examination and that has been validated against objective measures,[8] although it may underestimate malnutrition in nonsurgical patients compared with other methods involving biochemical measurements.[9] Weight change, dietary intake relative to normal intake, persistent gastrointestinal symptoms, functional capacity and metabolic stress related to the illness are evaluated. The physical examination includes an estimation of the loss of subcutaneous fat (triceps, chest), muscle-wasting (quadriceps, deltoids), ankle edema and ascites. On the basis of this information, patients are classified as well nourished, moderately (or suspected of being) malnourished or severely malnourished.

The majority of stroke patients are adequately nourished on admission, and their nutritional status is usually evaluated early in their care, before the described abnormalities occur. This presents an opportunity to take the initiative to ensure adequate nutrition and be vigilant as soon as the stroke occurs.

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e-Appendix 2: Enteral nutrition (tube feeding)

Tube feeding is a method of nutritional support for patients with a functional gastrointestinal tract. Symptoms such as gastric or intestinal obstruction, paralytic ileus, intractable vomiting or severe diarrhea preclude its use. The type of tube feeding and route of access are dictated by the medical condition, length of time that the tube feeding is expected to be used and the medical expertise available. Dietitians are knowledgeable about these choices and should be consulted about the type and quantity of tube feed to be administered. Physicians should become familiar with formulas commonly stocked and methods of delivery. The type of enteral formula selected will depend on the needs of the patient.

Types of enteral formulas

For most stroke patients with a functional gastrointestinal tract, polymeric formulas are appropriate. These formulas typically contain isolates of intact protein, triglycerides and carbohydrate polymers.[1] Various commercial polymeric formulas are available: standard, high fibre, high nitrogen, energy concentrated and milk based. Many are appropriate for both oral and enteral use. When sufficient quantities are administered (usually 1200–1900 mL) polymeric formulas can meet the nutrient and energy requirements of most patients. Fibre is generally lacking in standardized feedings, but variations with added fibre are available to promote normal bowel function. High-nitrogen polymeric formulas are useful for patients who have malnutrition, are in a catabolic state, or have or are at risk of pressure sores. Most formulas contain 1 kcal/mL, and their osmolarity varies between 300–450 mOsm/kg. Energy-concentrated formulas supply 1.5–2.0 kcal/mL and have a higher osmolarity (410–710 mOsm/kg).[2] They are useful for patients with fluid restrictions or limited formula tolerance. Use of these formulas requires close supervision, because rapid intestinal transit, diarrhea, dehydration or electrolyte disturbances may result.[1] The non-milk-based polymeric formulas are good for patients who are lactose intolerant.

Commercial puréed foods provide a standardized nutritional composition and are bacteriologically safe. Puréed natural foods may also be used. However, they can pose a high contamination risk, their nutrient composition is variable, and their nutritional adequacy is not ensured. They also require large-bore feeding tubes (> 12 French) because of their high viscosity. Specialized formulas are available for patients with gut malfunction, diabetes, or impaired renal or pulmonary function.

Routes of access

Feeding routes may be classified into naso-enteric and enterostomy types. Naso-enteric feeding includes the following routes: nasogastric (a tube from the nose to the stomach), nasoduodenal (a tube from the nose through the pylorus and into duodenum) and nasojejunal (a tube from the nose through the pylorus and into the jejunum). Nasogastric feedings are generally safe, particularly when there is no evidence of reflux or aspiration. The tube can cause some erosion in the nasal area, if not taped properly, or eventual esophageal stricture.

For enteral feeding that lasts longer than 2 weeks, enterostomies are advantageous because of their use of larger-diameter tubing (which aids formula administration), the reduced risk of aspiration because of the lack of migration of the tube to the esophagus and the convenience to the patient.[1] Enterostomies can be inserted surgically or percutaneously. A gastrostomy involves tube placement in the stomach. Tube sizes, pliability and techniques vary. Jejunostomy involves the creation of a jejunal stoma that can be intermittently catheterized by placement of a needle catheter or direct tube. With percutaneous endoscopic gastrostomy or jejunostomy, the feeding tube is percutaneously inserted under endoscopic guidance into the stomach or jejunum. The tube is secured by rubber “bumpers” or an inflated balloon catheter. The insertion is usually done with a local anesthetic by a gastroenterologist. If the patient exhibits an altered level of consciousness or dysfunction of cranial nerves IX, X and XII, feedings should be delivered distal to the pylorus.[3] Percutaneous endoscopic jejunostomy involves the percutaneous insertion of a guidewire and subsequently a feeding catheter into the jejunum through the stomach. A radiologist performs this procedure, which requires only local anesthetic.

The use of gastrostomy tubes in stroke patients with dysphagia has been associated with a lower mortality rate than the rate associated with the use of nasogastric tubes. However, a study of different patient populations may have contributed to this observation.[4] Although jejunostomy tube-feeding would be expected to provide more protection against aspiration, there is limited evidence available to support this claim. All types of tube placements can be associated with aspiration pneumonia,[5] probably because patients aspirate their saliva and other secretions.

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e-Appendix 2 (continued)

Methods of enteral-feeding administration

Continuous drip feedings are delivered by gravity drip or, for better volume accuracy and tolerance, by infusion pump. They are administered at a constant rate, usually over 24 hours. Continuous feedings are usually administered during the more acute period (1–5 days after stroke) and reduce the possibility of pulmonary aspiration.

A cyclic method of intermittent infusion may be used. The tube feeding is administered at a high infusion rate (e.g., 150 mL/h) over 8–16 hours. This may be helpful during the transition from tube feeding to an oral diet; tube feeding is delivered at night, and the oral diet is ingested by day.[3] This method allows for uninterrupted rehabilitation during the day.

Bolus feeding involves the rapid delivery of a feeding into the gastrointestinal tract by means of syringe or funnel. This method is suited to rehabilitation patients, those receiving tube feeding at home and noncritically ill patients. Up to 500 mL is usually administered in less than 15 minutes.[1] Some patients do not tolerate this method well; they feel nauseated and bloated.

Complications

Adverse reactions associated with tube feeding are relatively few. Complications may be categorized as mechanical, gastrointestinal or metabolic. Mechanical complications include tube blockages and skin infections at the site where the tube is inserted. Gastrointestinal complications (e.g., cramping and diarrhea) are frequent and may be rectified by an alteration of the rate of administration or the type or concentration of formula. More serious complications include peritonitis and free air in the abdomen (occurring as a result of the percutaneous insertion of the tube), which requires subsequent surgery to close the iatrogenic perforation. This complication is uncommon. Death has also been reported after insertion of the feeding tube, because of hemorrhage and pneumonia.[6] Aspiration pneumonia is often cited as a complication of tube feeding, but this may be misleading because it is also an indication for tube feeding. Metabolic complications are often related to inadequate monitoring of fluid and electrolyte balance, blood sugars and renal status. Comprehensive listings of potential adverse reactions to tube feeding, possible causes and management strategies are available.[2,3]

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e-Appendix 3: Nutritional and dietary concerns

1. The stroke patient's nutritional status should be monitored by his or her physician and a dietitian through routine continual nutritional screenings or comprehensive assessments every week or 2 weeks. Neurologists and physiatrists are frequently responsible for the nutritional management of stroke patients treated in acute and rehabilitation services. Geriatricians often have expertise with tube feedings.
2. The dietitian's input should be sought early to provide adequate nutrition to prevent malnutrition in patients at risk or to improve poor nutritional status. A high-energy, high-protein diet may be indicated. A dietitian or dietary technician should calculate energy and protein intake for patients suspected of eating poorly or for patients making the transition from enteral to oral diets.
3. Swallowing assessments are required if dysphagia is suspected. Tolerance to various solid food and fluid consistencies are evaluated separately, and modifications are recommended as necessary. A videofluoroscopic modified barium swallow or videofluoroscopic swallowing study may be recommended if there are serious concerns about aspiration. Regular communication with team members (physician, radiologist, speech–language pathologist, trained occupational therapist or dietitian, and nurse) about the patient's changing swallowing capabilities is essential if the patient is to progress from a dysphagia diet to a diet of food with normal textures.
4. To improve the dysphagic patient's dietary intake, the speech–language pathologist or trained occupational therapist should consider adjusting the patient's positioning, eating and feeding techniques and his or her eating environment.
5. Patients should be observed for signs of dehydration and their fluid balance monitored regularly. Although fluid support is clearly indicated for patients who are unable to consume food orally, it may also be important for dysphagic patients on exclusively oral diets in the circumstances previously described. Nurses in hospital and family members at home are frequently in the best position to indicate whether fluid intake is adequate.
6. If the patient is unable to consume food or fluid orally or is unable to consume sufficient quantities, or if the risk of aspiration is high, enteral nutrition should be provided until swallowing improves and oral intake is adequate. Nasogastric tube feeding is offered first if the problem is expected to be short term. During the transition back to oral intake, enteral feedings should gradually decrease as the oral portion is increased. Enteral feedings should be offered when they are least likely to interfere with rehabilitation or the patient's desire to eat (e.g., overnight or after meals). The adequacy of the oral intake should be verified by energy counts.
7. If tube feeding at home is planned, the family physician can ensure that there are no local skin infections if the patient has a percutaneously inserted tube and that the patient's weight is being monitored. Medical follow-up is necessary to ensure the proper functioning of the feeding tube and the appropriate progression of the dysphagia diet. The home care nurse should monitor the patient's ability to operate the feeding pump as well as the abdominal entry site of the feeding tube.