PRACTICE TOOL

Use of Blenderized Enteral Formula in Individuals with Common Neurological Impairments

General Information on Two Common Neurological Impairments and Nutrition Issues

Cerebral Palsy (CP)

Cerebral Palsy encompasses a group of neurological impairments (NI) resulting from damage to regions of the developing brain responsible for movement and posture.

- CP is frequently associated with additional challenges, including sensory deficits, cognitive limitations, communication difficulties, epilepsy, and musculoskeletal complications, underscoring its extensive impact beyond motor function.[1,2]
- Although the initial brain injury that leads to CP occurs during childhood, its consequences persist throughout an individual's lifespan, with current data indicating that more adults than children are living with CP.[2]

Amyotrophic Lateral Sclerosis (ALS)

Amyotrophic Lateral Sclerosis (also known as Lou Gehrig's disease):

- Is a progressive neurodegenerative disease that results in significant muscle weakness and atrophy, with voluntary muscles mainly affected.
- Number of estimated ALS cases in 2022 was 32,893 and by 2030, projected cases increase more than 10%, to 36,308.
- Largest increase occurs for the population ages 66 years and older, with a 25% increase (from 16,349 cases in 2022 to 20,438 cases in 2030).[3]
- Primary causes of death are respiratory failure and malnutrition.

What Contributes to Nutrition Issues?

Cerebral Palsy

- Individuals diagnosed with CP commonly experience eating and drinking difficulties, which are linked to undernutrition, impaired linear growth, and nutrient deficiencies.
- Feeding difficulties may manifest as insufficient intake, oral-motor impairment, nutrient loss, and alterations in energy expenditure. Although oral feeding is generally preferred, enteral nutrition (EN) is indicated for individuals who are unable to adequately meet their nutritional or hydration requirements orally, when mealtime becomes excessively prolonged or stressful, or when aspiration risk cannot be effectively controlled.[4]

Amyotrophic Lateral Sclerosis

- Causes of weight loss in patients with ALS include decreased intake due to dysphagia, upper limb motor difficulties, weakness of tongue and other oropharyngeal muscles, loss of appetite, dyspnea, depression, and hypermetabolism.[5]
- Malnutrition is an independent prognostic factor of ALS survival, with an 8-fold increase in risk of death when the patient is of poor nutrition status. About 16% to 53% of these patients are malnourished.[5]
- Early nutrition intervention has been shown to maintain good nutrition status for a longer period of time.[5]

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Why Enteral Nutrition (EN)?

Cerebral Palsy

- EN support enhances nutrition status, optimizes growth trajectories, and promotes developmental outcomes.[4]
- Children who receive nutrition support via gastrostomy tube (GT) early in the course of their neurological illness have better growth and nutrition outcomes. Children who receive late GT feeding may gain weight, but linear growth deficits often persist.[6,7]

Amyotrophic Lateral Sclerosis

- Maintaining adequate nutrition is of great importance in ALS, as weight loss, malnutrition, and dehydration may hasten muscle weakness, contribute to respiratory impairment, and shorten life span.[8]
- Once oral intake is not adequate or possible, EN should be initiated. A feeding tube is offered to those patients with difficulty swallowing (dysphagia) and to prevent weight loss and aspiration pneumonia.
- Both the American Academy of Neurology and the European Academy of Neurology recommend enteral support as an evidence-based intervention to improve nutrition status in these patients. However, the high prevalence of malnutrition may increase the risk of refeeding syndrome after EN initiation.[9]

What Type of Enteral Access Should be Used?

When deciding on the appropriate type of enteral access device (EAD) for individuals with a neurological impairment, several factors should be considered. These include:

- the nutrition and clinical conditions,
- the expected duration of EN support, and
- the feeding regimen that would best suit both the individual and their family.[4]

For those who require long-term nutrition support, a GT is generally preferred. There are various methods for placing a GT: open surgery, laparoscopic techniques, percutaneous endoscopic placement, or procedures performed by interventional radiology specialists. Currently, the laparoscopic insertion of a low-profile balloon gastrostomy device is considered the method of choice.[10,11] Most GT placement techniques are minimally invasive, result in minimal postoperative pain, and allow for feeding through the EAD just a few hours after the procedure.[12]

- From a sample of 8,575 Medicare beneficiaries from 2009–2014, it was reported that 27% of patients with ALS had a feeding tube.[13]
- Placement of a long-term feeding tube, such as a gastrostomy, is a difficult decision for many patients and caregivers. The most cited barriers were concerns about pain or infection, limitation of activities, impact on body image, concern about the procedure, and extension of life. Once the tube was placed, 92.5% of the patients reported an overall high level of satisfaction with the decision.[14]
- Individuals may require percutaneous endoscopic jejunostomy (PEJ) or surgical jejunostomy if gastric feedings are not tolerated.

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What are the Optimal Feeding Regimens?

There are several ways to administer EN to those with neurological impairments.

- EN can be given by "bolus" method using a syringe, gravity bag, or by extending the feeding times using a volumetric pump.
- Bolus feedings mimic the physiological response to food intake and offer convenience and flexibility. Patients with gastro-esophageal reflux or delayed gastric emptying may not tolerate bolus feeds and may require slower gravity feeding or pump feeding.
- For those receiving jejunal feeds, continuous formula infusions are needed though feeding rates can be adjusted, if tolerated, so that the feeds do not run over 24 hours.[15]

What are the Optimal Feeding Formulas?

Cerebral Palsy

The formula choice for EN should consider the child's age, co-occurring medical conditions, estimated calorie/nutrient requirements, and GI tolerance.

- Typically, the first formula chosen is an age-appropriate, casein-based, or whey-based polymeric formula.
- Children with formula intolerance may require plant-based, extensively hydrolyzed protein or amino acid-based formulas, or blenderized enteral formulas.
- Attention should be given to macronutrient and micronutrient content of EN, especially in children with NI with low energy needs may require fewer calories but still require the macro- and micro-nutrients of their peers.
- Supplemental vitamins, minerals, or electrolytes can help avoid or treat deficiencies. When using high energy formulas (1.2, 1.5, or 2 kcal/mL), hydration status needs to be carefully monitored to ensure fluid requirements are met.
- Additionally, when using high energy formulas, protein and micronutrient intake need to be monitored to ensure that excessive intake does not stress body systems. Formulas with added fiber may help promote regular bowel movements.[4]

Amyotrophic Lateral Sclerosis

- Since these patients are hypermetabolic, the EN should be high in calories and protein. Using a weight-based equation to estimate energy needs in these patients, 30–35 kcal/kg/day may be appropriate.
- Protein needs in ALS are not well studied and while adequate calorie and protein intake is necessary to prevent malnutrition-related muscle loss, the impact of protein intake on disease progression is not known. In the absence of high quality data, calculations of daily protein intake up to 1.5 gm/kg/day are used.[5]
- The formula choice for enteral nutrition support should consider the medical conditions, estimated calorie/nutrient requirements, and GI tolerance.

NOTE: ASPEN members can compare formula options using the ASPEN Enteral Nutrition Formula Guide at nutritioncare.org/ENformulaguide

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Why Blenderized Enteral Formula?

Blenderized enteral formula (BEF), formerly known as blenderized tube feeding (BTF), is emerging as a popular alternative to conventional commercial formula for nutrition support.

- Two types of BEF are in common usage: formula prepared in a home or hospital blender (prepared BEF) and formula manufactured with food ingredients or pureed foods (commercial BEF). Both options offer a variety of puréed whole foods from all food groups and are generally well tolerated. Prepared BEF can be relatively low cost and have the advantage of being customizable to a patient's tolerance and nutrient requirements. A growing number of peer-reviewed publications address the safe and effective use of BEF for medical purposes and family preferences.[16]
- Using BEFs decreases retching post fundoplication[17], lowers healthcare costs by reducing emergency department visits and hospital admissions among those with NI for both general and respiratory causes even when compared to postpyloric feeding.
- Patients with ALS tend to have GI complications which include diarrhea, reflux, gastric discomfort, nausea, constipation, and obstipation.[18] These can be further aggravated by dehydration, low fiber intake, lack of mobility, and medications.
- BEFs improve gastrointestinal symptom scores for vomiting, regurgitation and stooling.[19,20] Some of the health benefits with BEF may be related to viscosity (decreasing full column reflux), improved nutrient profile, reduced inflammation, and an enhanced gut microbiome diversity from the ingestion of whole foods.[20,21]
- Evidence suggests that utilizing BEFs provides enhanced patient and caregiver satisfaction in comparison to conventional formulas, as it enables families to participate in shared family mealtime experiences, which they can do when they blenderize their family meals. This provides families with a sense of normalcy and empowerment.[20]
- BEF can be managed with careful considerations, appropriate food safety techniques, and comprehensive education for those preparing BEFs. Hang time for the prepared BEF must be kept under two hours which is generally not a concern with the common practice of syringe feeding.[16]
- Clogging of the EADs with BEF can occur regardless of device size. Although no definitive evidence specifies an optimal size, a 14-French EAD is suggested.[16,19] A recent study on the use of BEF with ALS patients demonstrated no tube clogging in 20 patients who received BEF over 11 months.[22]
- There are currently no established guidelines for administering BEF for jejunal feeding and its use in this context should be approached with caution. This is related both to the restricted hang time given the need for pump feeding into the jejunum and the risk of intolerance that may arise when whole foods are administered directly into the jejunum.[16]
- Some of the biggest barriers to providing a BEF are caregiver capacity to prepare the formula and insufficient financial resources and infrastructure such as refrigeration, access to clean/hot water and sanitization supplies, blenders and equipment. The preparation of home prepared BEF requires a considerable time commitment on the part of the caregivers as well as ongoing involvement from a dietitian to ensure that the child's nutritional requirements are consistently met.[16,19,21]
- The use of commercially available BEFs, which may be covered by insurance, can help alleviate some challenges presented by home prepared BEFs.

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What About Feeding Intolerance?

Feeding intolerance may present as abdominal distension, discomfort, vomiting or regurgitation, constipation or diarrhea or delayed gastric emptying. Factors confounding feeding tolerance include progression of the neurological condition, co-occurring illness, mechanical obstruction in the GI tract, or changes in the feeding modality and nutrition care plan. Interventions to ameliorate feeding intolerance may involve:

- Adjusting the feeding schedule (such as smaller more frequent boluses or continuous feeds instead of bolus feeds),
- Modifying the formula concentration (either increasing the concentration and decreasing the overall volume or reducing it if osmolarity is a concern), or
- Trialing alternative formulas (such as hydrolyzed or amino acid-based formula, thickened feeding or initiating BEF).
- Consideration can also be given to post-pyloric feeding if there is ongoing emesis. Should symptoms persist, assessment for potential underlying conditions is warranted.
- Constipation must always be considered when there is feeding intolerance. Dietary changes to improve stooling and the use of stool softening agents and osmotic laxatives is often necessary.[4]

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