

Gastrointestinal and Nutritional Issues in Cerebral Palsy



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Cerebral palsy (CP) is a relatively common pediatric disease defined as a non-progressive static encephalopathy with a wide spectrum of neuromuscular manifestations, including disturbances in gastrointestinal motility. Common gastrointestinal manifestations of CP consist of gastroesophageal reflux disease (GERD), dysphagia, impaired gastric motility, and constipation. The diagnosis and treatment of the more common gastrointestinal findings in CP are discussed as well as nutritional considerations for the complex disorder.

INTRODUCTION

CP is a broad-spectrum neurologic disorder commonly defined as a non-progressive static encephalopathy which affects approximately 4 per 1000 live births. Its etiology is unknown although many children with CP have underlying anatomic anomalies not associated with the central nervous system suggesting a disorder in fetal development. CP leads to a wide array of neurologic disorders including mental retardation, seizures, and other neuromuscular disorders. Table 1 delineates some of the more common presentations of CP. The inherent neuromuscular abnormalities of this disorder make it common for CP patients to have gastrointestinal abnormalities such as dysphagia, GERD, altered gastric motility, and constipation (1).

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ESOPHAGEAL CONSIDERATIONS

Feeding problems are common in CP and have been reported in 37% of children with diplegia or hemiplegia and in 86% of children with quadriplegia. In general, affected children with severe motor delay are more likely to have feeding and swallowing problems which places them at risk of nutritional failure and respiratory infections from aspiration. Previous studies have demonstrated that inherent dysphagia associated with CP requires a longer feeding period for the child and lack of caretaker time in giving a child adequate caloric intake. Both of these factors may affect nutrition (2). The use of an occupational therapist with expertise in this disorder is very helpful for training parents correct feeding patterns.

The impaired swallow in a child with CP can present as increased drooling, recurrent pneumonias, and poor growth. Radiographic testing often is needed to

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Table 1
Clinical Presentations of Cerebral Palsy (1)

- Spastic hemiplegia
Weakness and contractures on affected body side
- Spastic diplegia
Spasticity in bilateral legs
- Spastic quadriplegia
Impairment of all extremities with contractures
- Athetoid
Hypotonia with athetoid movements

delineate an impaired swallowing mechanism (2,3). In particular, a videofluoroscopic study of the upper esophagus, also known as the “video swallow study,” can determine the integrity of the three phases of swallowing (oral, pharyngeal, and esophageal). If the study demonstrates aspiration or a significantly impaired clearance of food, further work-up for possible gastrostomy tube placement as well as fundoplication may be warranted (2). At our institution, we routinely combine the videofluoroscopic study with the upper gastrointestinal barium series to determine both the swallowing capacity of pediatric patients with CP and the possible presence of other gastrointestinal abnormalities that may be interfering with swallowing and nutrition, such as GERD or an anatomical malrotation.

As a sole entity, GERD is a common problem in the CP population and can manifest as anemia (including iron-deficient anemia), failure to thrive, and recurrent pulmonary infections. GERD can occur in the CP patient independent of the gastric emptying rate (4). The etiology of reflux disease in the CP pediatric patient is multi-factorial. In general, pediatric patients have a normal lower esophageal sphincter (LES) pressure compared to adults; however, those patients with significant GERD appear to have increased periods of transient episodes of LES relaxation (TLESRs). As an anatomical consequence, GERD in the CP patient can be worsened by disruption of the LES with anatomical abnormalities such as a hiatal hernia (5).

In general, a standard work-up for GERD in the pediatric CP population should consist of the upper gastrointestinal barium series, a 24-hour pH probe, and

upper endoscopy. Upper endoscopy should include esophageal biopsy to rule out other causes of esophagitis, such as infectious or eosinophilic esophagitis. Esophageal manometry may be necessary in certain select cases (5).

In a manner similar to the adult population, CP patients with GERD can benefit from usage of H₂-receptor antagonists, proton pump inhibitors, and motility agents. Cisapride, in particular, has been shown to have benefit in the treatment of GERD in children although this drug is generally not available. Other potential motility agents, including baclofen and tegaserod, are currently being evaluated (5–7). Interestingly, nutritional intervention also may be of benefit in GERD treatment. One small study of 9 children with CP demonstrated both endoscopic and histologic improvement of GERD after 4 weeks of using an elemental formula (Neocate™) (8).

Regardless, GERD refractive to medical therapy may necessitate fundoplication. It cannot be reiterated enough that there are risks with performing fundoplication in the CP population. Gilger, et al evaluated the post-operative complications and symptoms of children after surgical fundoplication. This retrospective review of 198 patients at a large, tertiary children’s hospital showed that 70% of those children undergoing fundoplication had neurodevelopmental delay. Children with underlying medical problems, including CP, had an increased rate of respiratory infections and dumping syndrome compared to those children who were otherwise healthy. Approximately two-thirds of all children had GERD symptoms or required medical therapy for GERD within 2 months after fundoplication (9). These results demonstrate that fundoplication may not be the correct treatment choice for all CP patients with GERD who fail medical therapy. Additionally, the expertise of the individual surgeon performing the fundoplication cannot be over-emphasized.

GASTRIC MOTILITY AND ENTERAL FEEDING TUBE PLACEMENT

Although there is debate as to the degree of gastric motility impairment in children with CP (4), some studies have demonstrated gastric motility disturbances as well as abnormal antral contractions associ-



Figure 1. An 8-year-old male with cerebral palsy, mental retardation, and failure to thrive continued to experience significant feeding problems despite placement of a gastrostomy button with fundoplication (Top). Symptoms resolved with placement of a surgical jejunostomy tube (Bottom) and use of continuous tube feeding with a feeding pump.

ated with retching in some patients (10). Gastric scintigraphy can demonstrate a delay in liquid emptying as well (11). In light of the combination of neurological impairment with possible dysphagia and motility disturbances, gastrostomy tube placement is a viable option for children with significant oral intake impairment or failure to thrive. A more rapid normalization to mean weight z-score has been demonstrated in CP patients who have undergone gastrostomy tube placement for enteral nutrition. Gastrostomy tubes can be placed endoscopically or by surgical placement. At our institution most pediatric gastrostomy tube placements are made endoscopically except if a patient has a history of abdominal surgery or if the patient has unusual anatomy (such as severe scoliosis).

Although there are obvious benefits of gastrostomy tube placement, many parents of children with CP express concern and even negative reactions when this procedure is discussed in the clinic setting. Therefore, the idea of gastrostomy button placement should be made in the context of the procedure's benefits, its positive health potential, and details regarding gastrostomy placement (12). Sullivan, et al has demonstrated that children with CP receiving gastrostomy tube placement had significant weight gain associated with

parental realization of their child's health improvement and decreased time required for feeding (13).

Another feeding option to consider in children with CP is jejunal tube placement. This procedure is a viable consideration in children with multiple congenital anomalies, underlying intestinal dysmotility, or neurologic impairment that is worsened with fundoplication (for example, retching after fundoplication). Jejunal feeding tube placement, either percutaneous or via a Roux-en-Y jejunostomy, may be an option in such children (14). An example of a jejunostomy tube placement is shown in Figure 1.

CONSTIPATION

Although not necessarily a nutritional issue, constipation is a common problem in the CP pediatric population. The child with CP can develop constipation due to delayed colonic transit time, poor ambulatory ability, and poor coordination of the anal sphincter and pelvic muscle floor (15,16). Adequate fiber and water intake with the possible combination of osmotic laxatives or stimulants is effective (17). Various medications including magnesium citrate, lactulose, senna, and polyethylene glycol can be used for the initial clean-out and subsequent maintenance therapy for children with CP. Tegaserod, which functions as 5-HT₄ receptor agonist to stimulate colonic transit, may have therapeutic benefits although its use in children has not yet been clearly defined (18). Mineral oil should never be used as an osmotic laxative due to its association with lipoid pneumonia in neurologically impaired children who can aspirate the product (19).

Surgical relief of constipation may be necessary for the most recalcitrant patients. Surgical procedures, including appendicostomy and cecostomy are viable options for antegrade enemas of saline or polyethylene glycol (18).

NUTRITIONAL ISSUES IN CEREBRAL PALSY

Assessing growth parameters for children with cerebral palsy is of utmost importance for determination of nutritional requirements. Estimated caloric needs may be lower, higher, or equivalent to their non-affected

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aged peers, depending on their level of activity, presence of spasticity, and co-existing health conditions. An accurate estimation of calorie, protein, and fluid needs are based on the weight, length, and age of the child (20–24). Nutritional provisions should provide the child with adequate calories, protein, vitamins, minerals and fluid that will promote controlled and consistent growth without impeding the health of the individual.

Height (or length in very young children or children who cannot ambulate) is a useful tool in assessing caloric needs for the child with cerebral palsy. Although estimating caloric needs at 60%–70% of the recommended daily allowance (RDA) for calories for age for an unaffected child can be used, obtaining a linear length is helpful in assessing true growth and is a more precise measurement of caloric needs. Table 2 establishes references using linear growth to estimate caloric requirements. Weight should represent a slow steady weight gain acceptable to the growth curve the child normally follows. A decline of more than two growth channels on a growth chart indicates a need for nutrition intervention (20,21). Weight for age and height for age may be acceptable below the 5th percentile on Center for Disease Control (CDC) growth charts in some children if physical development is delayed, but in general, weight for height determination from the CDC growth charts should help achieve a goal of at least the 10th to the 25th percentile for weight for length/height in the cerebral palsy population (20–22,25,26).

Nutrient needs consist of supplying appropriate calories, protein, fluid, fiber, and micronutrients. Calorie requirements are determined based on the equation in Table 2 or using a percentage of estimated energy requirements. Protein needs are based on the child's ideal body weight (or the 50th percentile for weight for height). The ideal body weight can be calculated by finding the 50th percentile of weight in kilograms for the age of a child and multiplying using the child's length in meters twice. Adequate fluid intake should be assessed to eliminate the risk of constipation or impaired renal clearance of medications. Fiber supplementation decreases intestinal transit time and improves bowel movement regularity in children with cerebral palsy who have impaired muscle tone. Micronutrient needs are often overlooked in this patient

Table 2
Energy Requirements for Children with CP

1. Mild to moderate activity level (for example, ambulatory): 12–15 kcal / cm
2. Restricted activity level (for example, non-ambulatory): 10–11 kcal / cm
3. Severe central nervous system disease with restricted activity (for example, severe CP at risk of excessive weight gain): 5–9 kcal / cm

In addition:

1. Protein requirements should provide 100% of RDA for ideal body weight
2. Fluid requirements should provide 100% of needs for ideal body weight
3. Vitamin and mineral supplementation is necessary if nutrient base per milliliter is limited

population. Any child who receives a low volume of formula may not reach the nutrient base for the RDA's vitamin and mineral supplementation (usually 1000 milliliters for children up to 10 years of age). In these children, supplementation with a crushed or liquid children's multivitamin with minerals will replace deficit micronutrients (25,26). Calcium intake is very important as many children with cerebral palsy are at risk of osteopenia. Adequate supplementation of calcium, as well as biphosphonate usage when warranted, should be considered for prevention of bone fractures (27).

There are many enteral formulas available for use in children with cerebral palsy. Most children can be maintained on a lactose-free, gluten-free standardized intact formula, and this formula can be supplemented with or without fiber. However, some children with special feeding problems or feeding intolerances may require the assistance of a more hydrolyzed formula type. In patients with illnesses such as pancreatitis or severe food-related allergy, a completely elemental formula may be the best choice. Many families desire to create a blenderized tube feeding formula. Although it is difficult to quantify caloric intake, this option can be an acceptable choice if the child maintains and gains weight. Commercial blenderized pasteurized enteral formulas are an alternative to home blends.

Modular substrates are formula additives that can be used to boost the particular macronutrient desired. A common modular substrate is protein powder (for example, ProMod™), and its supplementation is especially helpful in children who are neurologically impaired and who require adequate protein intake to prevent a large increase in weight from other caloric sources. Fat and carbohydrate modular substrates (for example, medium-chain triglyceride oil or Polycose™) also increase caloric density when higher caloric provisions are needed (21,26,28–30).

The goal of growth should be to maintain the pediatric patient on the growth curve which the child has established. Weight for height should be at the tenth percentile or greater on the CDC growth curve (21,26,28,29). Overfeeding of children with cerebral palsy may hinder developmental progress and can lead to frequent equipment changes and worsening of contractures. Therefore, a patient's weight velocity should be monitored to ensure appropriate growth progress.

CONCLUSIONS

The child with cerebral palsy is at risk for multiple gastrointestinal complications including dysphagia, GERD, aspiration, poor weight gain, gastric and intestinal dysmotility, and constipation. Nutrition, given by various enteral routes, should provide good growth and nutrition. In the end, patient quality of life should not be impaired by stressors associated with feeding, and the medical team should promote patient health and caregiver satisfaction while providing for needs associated with optimal growth and development. ■

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