Gastroparesis, or slow emptying of the stomach, is a debilitating disease process that affects an estimated 4% of the population. The most common etiologies preceding the development of gastroparesis symptoms are diabetes (50%), status post vagotomy or gastric resection, and a viral episode before symptom development. Before the diagnosis can be made, however, mechanical or structural disorders of the gastrointestinal tract must be ruled out.

Clinically, patients with gastroparesis are at risk for fluid, electrolyte, and nutrient deficits and, in patients with diabetes, erratic glycemic control. Treatment is targeted at correcting fluid, electrolyte, and nutritional deficiencies, reducing symptoms, and correcting the precipitating cause of gastroparesis, if possible. Although the mainstay of treatment for gastroparesis is anti-emetic and prokinetic therapy, this article will focus on nutrition interventions.

Nutrition Assessment
Stratifying the nutrition status of patients with gastroparesis into mild, moderate, or severe malnutrition is an important first step in the treatment of gastroparesis. This will help identify those who need aggressive nutritional support early on versus those who might benefit from some initial adjustments in oral food selections.

Unintentional weight loss over time is one of the first and most important parameters to assess regardless of the patient’s overall appearance. A 5–10% unintentional loss of weight over a 3- to 6-month period signifies severe malnutrition. Most guidelines identify patients at nutritional risk if they:
- Are < 80% of ideal weight
- Have a BMI < 20 kg/m²
- Have lost 5 lb or 2.5% of baseline weight in 1 month
- Have lost 10 lb or 10% of usual body weight in 6 months

One often-overlooked population includes patients requiring hemodialysis. Given the percentage of hemodialysis patients who have a long-standing history of diabetes, gastroparesis can frequently be found if clinicians know what to look for. Because of the chronic fluid issues in hemodialysis patients, drastic weight changes may not be readily apparent early on, but may show up weeks later, when the target weight stabilizes below the patient’s usual body weight. If a patient with diabetes has a declining target weight and complains of early satiety, especially in the morning after an overnight fast, gastroparesis should be suspected. If unintentional weight loss has occurred in any patient with gastroparesis, it is important for the clinician and patient to set a goal weight. If the patient falls below the goal weight or fails to achieve an agreed-on weight, nutrition support should be seriously considered.

Nutrition Factors That May Slow Gastric Emptying
Although there are many factors, including those discussed below, that theoretically can slow gastric emptying, there have been no controlled clinical trials in patients with gastroparesis to determine the success of any particular nutrition intervention.

Volume. Large meals not only slow gastric emptying, but also can decrease the lower esophageal sphincter pressure, which enhances reflux of gastric contents and adds insult to injury. Some suggestions for decreasing gastric reflux include:
- Eat smaller, more frequent meals.
- Avoid large, high-fat meals.
- Avoid late-evening snacks.
- Avoid CATS: caffeine, alcohol, tobacco, and stress.
- Avoid chewing gum, which increases air swallowing.
- Avoid foods that lower esophageal sphincter pressure: peppermint, chocolate, fat, and caffeine.
- Eat slower (30-minute meals).
- Avoid eating on the run.
- Do not lie down immediately after eating.
- Eat and drink all foods and beverages while sitting up.
- Sit up after meals for ~ 1 hour.
- Lose weight if you are overweight.
- Elevate the head of the bed 6–8 inches to prevent reflux when sleeping; put pillows between mattress and box springs.
- Avoid clothing that fits tightly around the abdomen.

Fiber. Because patients with gastroparesis are prone to bezoar formation (an indigestible concretion of foods) that decrease their ability to clear indigestible fiber from the stomach, low-fiber foods are recommended. For patients who have difficulty with small bowel bacterial overgrowth, fiber-containing foods and even enteral formulas may aggravate symptoms because of fermentation in the upper gut, which causes gas, cramping, and bloat-

Diabetes Spectrum Volume 20, Number 4, 2007
Fat. Fat is often restricted in patients with gastroparesis, yet there is no clinical evidence to support the necessity of this intervention. The real problem may be the solid food that accompanies the fat. Fat-containing liquids will empty by gravity over time. Because fat provides a significant source of calories, which patients often need, fat sources should be allowed if patients tolerate them. For patients with diabetes, alternatives to saturated and trans fat sources should be encouraged.

Medications. All medications should be reviewed to identify any that might have a negative impact on gastric emptying. In particular, bulk-forming agents used to treat constipation may not empty well from the stomach in patients with gastroparesis (see Table 1). Narcotics delay gastric emptying and should be decreased or avoided altogether.

Oral Guidelines
Smaller meals and liquids. Because large meals empty slowly from the stomach in patients with gastroparesis, the first step is to start with smaller-volume meals. To meet nutrition requirements, more frequent meals and snacks will be necessary. Consumption of a greater percentage of calories in liquid form may help. On occasion, a trial of liquids as the sole source of calories may prove beneficial because liquid emptying is almost always preserved until gastroparesis is far advanced.

Vitamins and minerals. Any patient who has experienced a considerable, unintentional weight loss is at risk for total nutrient deficiency. To date, there have been no large, comparative studies evaluating vitamin and mineral status in patients with gastroparesis. Ferritin, 25-OH vitamin D, and B12 levels are useful parameters to check as indicators of potential nutrient deficiencies in this patient population, especially if there is a history of subtotal gastrectomy. If these levels indicate deficiency, chewable or liquid supplements may be better tolerated than supplements in tablet form.

Guidelines for Enteral Nutrition
For patients who fail to stabilize their weight loss or those who cannot gain weight with oral feedings, enteral nutrition support may be indicated. Enteral nutrition not only allows patients to be consistently hydrated and nourished, but also provides ready access for reliable medication delivery. Parenteral nutrition should be reserved only for those who have a dysmotility that extends throughout much of the small bowel and colon or those who fail enteral therapy. This is because parenteral nutrition is associated with more infectious complications (especially in patients with diabetes) and is significantly more expensive. The criteria listed in Table 2 can help identify patients who are candidates for enteral nutrition support. A more detailed review of all aspects of nutrition intervention in patients with gastroparesis is available elsewhere.

Improving Glucose Control and Nutritional Adequacy
The following guidelines may be useful to assist patients in improving glucose control and nutritional adequacy:

- Eat smaller, more frequent meals that are as consistent as possible in carbohydrate content. Generally, a person needs ~ 14–16 choices of carbohydrate (15 g = 1 carbohydrate choice) or 210–240 g of carbohydrate per day. If six small meals were eaten through-

### Table 1. High-Fiber Foods/Medications Associated With Bezoar Formation

<table>
<thead>
<tr>
<th>High-Fiber Foods</th>
<th>High-Fiber Medications/Bulking Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Legumes/dried beans</td>
<td>• Acacia fiber</td>
</tr>
<tr>
<td>○ Refried beans, baked beans, black-eyed peas, lentils, black beans, pinto beans, northern beans, fava beans, navy beans, kidney beans, garbanzo beans, soy beans</td>
<td>• Benefiber</td>
</tr>
<tr>
<td>• Bran/whole-grain cereals</td>
<td>• Citrucel</td>
</tr>
<tr>
<td>○ Bran cereals, Grape-Nuts, shredded wheat cereals, granolas</td>
<td>• FiberChoice</td>
</tr>
<tr>
<td>• Nuts and seeds</td>
<td>• Fibercon</td>
</tr>
<tr>
<td>○ Pumpkin seeds, soy nuts, chunky nut butters</td>
<td>• Konsyl</td>
</tr>
<tr>
<td>• Fruits</td>
<td>• Metamucil</td>
</tr>
<tr>
<td>○ Dried fruits (apricots, dates, figs,* prunes, raisins), blackberries,* blueberries,* raspberries,* strawberries,* oranges, apples,* kiwi, coconuts,* persimmons*</td>
<td>• Perdiem</td>
</tr>
<tr>
<td>• Vegetables</td>
<td></td>
</tr>
<tr>
<td>○ Green peas, broccoli, brussels sprouts,* green beans,* corn,* potato skins,* tomato skins,* sauerkraut*</td>
<td></td>
</tr>
</tbody>
</table>

*Foods known to cause bezoars. Reprinted with permission from Ref. 12.
out the day, each small meal should consist of approximately two to three carbohydrate choices (30–45 g). The 2006 American Diabetes Association nutrition recommendations do not suggest a specific amount for total carbohydrate.11 They do, however, state that there is a strong relationship between the premeal insulin dose and the postmeal glucose response to the carbohydrate content of the meal. The total carbohydrate in the meal does not influence the glucose response if the premeal insulin is adjusted for the carbohydrate content of the meal. For people receiving fixed doses of short- and intermediate-acting insulin, day-to-day consistency in the amount of carbohydrate is associated with a lower hemoglobin A1c level. Table 3 includes a semi-liquid sample meal plan and menu for three meals and snacks with the appropriate carbohydrate content.

- Solid foods may be better tolerated earlier in the day, with a switch to liquid meals later in the day if the patient begins to feel full. Monitor blood glucose before the small meal or snack is eaten, and adjust the insulin dose according to the blood glucose level and the anticipated amount of carbohydrate to be eaten. Table 4 includes suggestions for how to increase liquid calories when that is the only type of oral nutrition tolerated.

- An insulin regimen including a basal dose of insulin (intermediate-acting NPH or long-acting glargine or detemir) at bedtime or in the evening and bolus or supplemental doses of insulin (short-acting regular or rapid-acting aspart, lispro, or glulisine) before meals or snacks would be the most ideal to promote optimal glucose control. Some patients may need to take bolus doses of insulin ~ 30 minutes after their meal, once they are sure the meal will stay down.

Information about comprehensive meal planning for patients with diabetes and gastroparesis can be found online at www.uvadigestivehealth.org. Scroll down to “Nutrition Support Team Medicine” in the far left column, click on the pull-down menu, and find “Patient Educational Materials.” Scroll down to the heading for gastroparesis to find four different meals plans listed for patient use.

### Conclusion

Treating patients with gastroparesis remains a very challenging task. Chronic nausea and vomiting not only can precipitate dehydration, electrolyte disturbances, hyperglycemia, malnutrition, and inadequate medication delivery, but also have a serious impact on overall quality of life. Identifying and stratifying patients into level of nutrition risk will help clinicians identify those who would benefit from early nutrition support to restore nutrition and hydration status and, ultimately, improve quality of life. Because the goal of glycemic control is still primary, adjustments in the amount and timing of insulin, increased monitoring of food intake and/or

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### Table 2. Criteria for Enteral Nutrition

- Severe weight loss > 5–10% of usual body weight over 3–6 months
- Repeated hospitalizations for refractory gastroparesis requiring intravenous hydration and/or medication delivery
- Patient would benefit from gastric decompression
- Patient has maintained usual body weight but experiences significant clinical manifestations, such as diabetic ketoacidosis, cyclic nausea, and vomiting, and overall poor quality of life because of gastroparesis symptoms
- Inability to meet weight goals set by physician, dietitian, and patient

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### Table 3. Sample Semi-Liquid Meal Pattern

<table>
<thead>
<tr>
<th>BREAKFAST (three carbohydrate choices)</th>
<th>MID-MORNING SNACK (two carbohydrate choices)</th>
<th>LUNCH AND DINNER (three carbohydrate choices)</th>
<th>MID-AFTERNOON SNACK (two carbohydrate choices)</th>
<th>BEDTIME SNACK (two carbohydrate choices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus juice (1/2 cup: 15 g carbohydrate)</td>
<td>Liquid supplement or milkshake (10 oz milkshake: 30 g carbohydrate)</td>
<td>Thinned soup (1 cup chicken broth: 1 g carbohydrate)</td>
<td>Liquid supplement or milkshake (10 oz milkshake: 30 g carbohydrate)</td>
<td>Liquid supplement or milkshake (10 oz milkshake: 30 g carbohydrate)</td>
</tr>
<tr>
<td>Thinned cooked cereal (1/2 cup cooked cereal: 15 g carbohydrate)</td>
<td></td>
<td>Thinned or puréed meat or substitute</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk (1 cup: 15 g carbohydrate)</td>
<td></td>
<td>Thinned potato or substitute (3 oz potato: 15 g carbohydrate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffee or tea (unsweetened: 0 g carbohydrate)</td>
<td></td>
<td>Thinned or puréed vegetable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MID-MORNING SNACK (two carbohydrate choices)</td>
<td></td>
<td>Thinned dessert or puréed fruit (1/2 cup fruit: 15 g carbohydrate)</td>
<td></td>
<td>Liquid supplement or milkshake (10 oz milkshake: 30 g carbohydrate)</td>
</tr>
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</tr>
</tbody>
</table>

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food manipulations, and increased monitoring of blood glucose level need to be considered.

**References**


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**Table 4. Suggestions for Increasing Liquid Calories**

- Fortified milk can be substituted to increase protein, if needed. (To make fortified milk, pour 1 quart of whole milk into a deep bowl. Add 1 cup of nonfat instant dry milk. Beat slowly with a beater until dry milk is dissolved. Refrigerate and serve cold.)
- Soy or rice milks can be substituted for milk in any recipe.
- Flavor extracts, such as vanilla, almond, or coffee, can be added to enhance flavor.
- Other flavorings, such as dry gelatin or pudding mixes or syrups, can be added for additional flavor or extra calories.
- Ice/ice chips can always be blended in if desired.
- Frozen yogurts, ice creams, sorbets, sherbets, and frozen soy and rice products can be substituted in any recipe.
- For extra flavor, texture, and calories, add a frozen banana. (When bananas are ripe, peel, cut in half, and place in a covered container or plastic freezer bag. Freeze overnight).

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