



# GASTROPARESIS

## Overview

---

### What is Gastroparesis?

Gastroparesis literally translated means “stomach paralysis”. Gastroparesis is a digestive disorder in which the motility of the stomach is either abnormal or absent. In health, when the stomach is functioning normally, contractions of the stomach help to crush ingested food and then propel the pulverized food into the small intestine where further digestion and absorption of nutrients occurs. When the condition of gastroparesis is present the stomach is unable to contract normally, and therefore cannot crush food nor propel food into the small intestine properly. Normal digestion may not occur.

### Causes of Gastroparesis

There are many causes of gastroparesis. Diabetes is one of the most common causes for gastroparesis. Other causes include infections, endocrine disorders, connective tissue disorders like scleroderma, autoimmune conditions, neuromuscular diseases, idiopathic (unknown) causes, cancer, radiation treatment applied over the chest or abdomen, some forms of chemotherapy, and surgery of the upper intestinal tract. Any surgery on the esophagus, stomach or duodenum may result in injury to the vagus nerve which is responsible for many sensory and motor (muscle) responses of the intestine. In health, the vagus nerve sends neurotransmitter impulses to the smooth muscle of the stomach that result in contraction and forward propulsion of gastric contents. If the vagus nerve is injured during surgery gastric emptying may not occur. Symptoms of postoperative gastroparesis may develop immediately or even years after a surgery is performed.

Medications may cause delayed gastric emptying, mimicking the symptoms of gastroparesis; this is especially common with narcotic pain medications, calcium channel blockers and certain antidepressant medications (table 1). It is important to have the names of all your medications recorded and with you when you see a physician for evaluation of gastrointestinal symptoms. People with eating disorders such as anorexia nervosa or bulimia may also develop delayed gastric emptying. Fortunately, gastric emptying resumes and symptoms improve when food intake and eating schedules normalize.

Table 1

<u>Medications associated with impaired gastric emptying</u>
Narcotic
Tricyclic antidepressants
Calcium channel blockers
Clonidine
Dopamine agonists
Lithium
Nicotine
Progesterone

### What are the symptoms of Gastroparesis?

Symptoms of gastroparesis include bloating, nausea, early fullness while eating meals, heartburn, and epigastric pain. Ingestion of solid foods, high fiber foods such as raw fruits and vegetables, fatty foods or drinks high in fat or carbonation may cause symptoms. Perhaps the most common symptom is early satiety, or the sensation of feeling full shortly after starting a meal. Nausea and vomiting are also common. A person with gastroparesis may regurgitate or vomit undigested food many hours after their last meal. Weight loss can occur due to poor absorption of nutrients, or taking in too few calories.

## **How is gastroparesis diagnosed?**

A history of early satiety, bloating, nausea, regurgitation or vomiting with meals would normally prompt an evaluation to determine the cause of symptoms. Inflammation, ulcer disease, or obstruction by a tumor can also cause these symptoms and diagnostic tests would be used to determine the cause. Radiographic tests, endoscopic procedures, and motility tests are used to exclude obstruction, to view the stomach lining and obtain biopsies, and to examine muscle contraction patterns. These tests are described below.

Upper Endoscopy is a test that is performed by inserting a thin flexible tube through the mouth into the stomach. The endoscope has camera capabilities and allows the upper gastrointestinal tract to be evaluated for ulcers, inflammation, cancers, hernias or other abnormalities. These conditions can cause symptoms similar to gastroparesis. Upper endoscopy usually requires 10-15 minutes to complete. Medication is usually administered intravenously immediately before the test for comfort and sedation. If abnormal findings such as an ulcer or inflammation are noted biopsies can be obtained.

Gastric Emptying Study is a widely available nuclear medicine test that examines the rate of emptying of solid or liquid material from the stomach. A delay in gastric emptying indicates a diagnosis of gastroparesis. Subjects consume an egg or oatmeal meal containing a tiny amount of the radioactive material ( $^{99m}\text{Tc}$ ), which is measured by a scanning technique as it empties from the stomach.

Scintigraphic Gastric Accommodation is a test that measures the volume of stomach contents before and after a meal, and how well the stomach relaxes in response to food intake. This test uses a tiny amount of radioactive material ( $^{99m}\text{Tc}$ ) which is selectively taken up by the lining of the stomach, and indirectly measures the volume of the stomach. The subject consumes a nutrient drink over 30 seconds. A scan of the stomach is taken before and after the nutrient drink. The test indicates whether the stomach relaxes appropriately when filled. Symptoms of poor stomach relaxation can be identical to poor emptying, and this test can help distinguish the processes. Scintigraphic gastric accommodation is not readily available.

Gastroduodenal manometry is a test that measures how well the smooth muscle of the stomach and small intestine contracts and relaxes. The test is performed by placing a thin tube into the stomach usually with the aid of the endoscope. The tube is advanced into the small intestine and over the next few hours the contractile responses while the subject is fasting and eating are observed and recorded. The manometry catheter provides information on how strong and how often the muscles of the stomach and intestine contract and whether the stomach contractions are coordinated with the contractions in the small bowel. Gastric duodenal manometry may be helpful but is often not needed to make a diagnosis of gastroparesis. This test is not widely available.

A Small Intestinal X-ray is a contrast radiograph used to outline the anatomy of the small bowel. This study is not generally needed to make a diagnosis of gastroparesis, but a blockage anywhere in the small intestine will result in a back up of material and could account for delayed gastric emptying. An obstruction in the small bowel may cause symptoms similar to gastroparesis, but the treatment is different. Treatment for intestinal obstruction is avoiding intake of any food or liquid until the cause of obstruction such as inflammation resolves or surgery is performed to remove the blockage.

## **Emerging Diagnostic Tools**

### Wireless capsule GI monitoring system (SmartPill®)

The wireless capsule monitoring system is a non-digestible capsule that records pH, temperature and pressure changes as it travels through the intestine (figure 3). The information from the wireless capsule is transmitted to a receiver worn by the patient around their waist. The information is used to determine how fast or slow the stomach empties, and similarly how food and liquid move through the intestine. The test is done in an outpatient setting, takes generally 3-6 hours and within 24-72 hours the pill is passed from the body. A potential advantage of the wireless capsule system over conventional gastric emptying or scintigraphy would be that the study could be done in

the outpatient setting and would not involve radiation, though the amount of radiation used in alternative tests is very small and not considered harmful. Occasionally, if the capsule is not passed within three days your doctor may request an abdominal x-ray to assure it has left the body. Use of the wireless capsule monitoring system is not recommended in patients who have had previous surgery to decrease the amount of acid they are secreting, in patients who are unable to stop their antacid medications for the study or in patients with narrowing of the bowel lumen.

## **Importance of Nutrition as Treatment in Gastroparesis**

Diet is one of the mainstays of treatment for those who suffer from gastroparesis. Some foods are more difficult than others for the stomach to digest. Fatty foods take a longer time to digest, as do foods that are fibrous, like raw vegetables. People with gastroparesis should reduce their intake of fiber or avoid these foods. Fiber when eaten should be chewed well and cooked until soft. Food that is poorly digested can collect in the stomach and form what is called a bezoar. This mass of undigested matter may cause a blockage, preventing the stomach from emptying and result in nausea and pain. In such a case, it may be necessary to use endoscopic tools to break the bezoar apart and remove it. Fortunately, even when stomach emptying is significantly impaired, thick and thin liquids (e.g. pudding and nutrient drinks) are usually tolerated and can pass through the stomach. Many people with gastroparesis can live a relatively normal life with the aid of supplemental nutritional drinks, soft foods the consistency of pudding and by pureeing solid food in a blender. Feeding tubes placed in the small intestine (jejunostomy) may be required if gastric paralysis is severe and a person is unable to manage with a pureed or soft diet. These feeding tubes are usually placed endoscopically or surgically through the skin and directly into the small intestine (figure 1). Before such a feeding tube is placed, a temporary nasal or oral jejunal feeding tube is usually tried for a few days to make sure the individual can tolerate this form of feeding into the small bowel. The temporary feeding tube is usually placed by guiding it through the nose or mouth, down the esophagus or “food pipe”, through the stomach and finally into the small intestine with the aid of an endoscope (figure 2).

## **Medications prescribed for gastroparesis**

It is important to realize that medications prescribed for a variety of conditions may have side effects that cause gastric emptying to slow down. The most common drugs that delay stomach emptying are narcotics and certain antidepressants. Table 1 lists more medications that may delay stomach emptying. If possible, patients having symptoms of gastroparesis should discontinue the offending medications before undergoing any motility tests.

At the present time there are few medications available or are approved to treat gastroparesis and their use can be limited by undesirable side effects and limited effectiveness. The medications available include metoclopramide, domperidone, erythromycin and cisapride.

**Metoclopramide** is a medication that acts on dopamine receptors in the stomach and intestine as well as in the brain. This medication can stimulate contraction of the stomach that leads to improvement in emptying. This medication also has the effect of acting on the part of the brain responsible for controlling the vomiting reflex and therefore may decrease the sensation of nausea and the urge to vomit. Use of this medication is limited in some people due to the side effects of agitation and facial twitching or “tardive dyskinesia”. Metoclopramide can also cause painful breast swelling and nipple discharge in both men and women. It is not recommended that this medication be taken long term.

**Domperidone** is another medication, similar to metoclopramide, that acts on dopamine receptors. Domperidone does not have the side effect of tardive dyskinesia and agitation that are seen with metoclopramide because it does not act on receptors in the brain. Domperidone is not available in the United States but is used in Mexico and Canada and in some European countries.

**Erythromycin** is a commonly used antibiotic that binds to receptors in the small intestine and stomach called “motilin receptors”. Stimulation of motilin receptors results in contraction and improved emptying of the stomach. The beneficial effect of erythromycin can be short lived as individuals who use it frequently have a high likelihood of developing tolerance to the medication. Perhaps the best use of erythromycin is for a worsening of symptoms or used on an intermittent basis to reduce the potential for tolerance.

**Cisapride** binds to serotonin receptors located in the wall of the stomach that leads to contraction of stomach smooth muscle and improved gastric emptying. In the late 1990’s cisapride was taken off the market due to complications of cardiac arrhythmias in patients who were using this drug. It is once again available but its use is restricted. Individuals with underlying kidney or heart disease should not use cisapride.

## Emerging therapies

Medications approved for treatment of other motility disorders offer some promise for the treatment for gastroparesis.

Octreotide, a medication sometimes used to treat diarrhea has been shown in one small study to speed up gastric emptying in patients with scleroderma. In a separate study involving normal volunteers, octreotide caused a decrease in the uncomfortable sensation of fullness after a meal. This suggests that octreotide may prove to be beneficial in persons with gastroparesis, but more studies are needed before it could be recommended as a safe and effective treatment.

## Surgery for gastroparesis

Surgery for gastroparesis is reserved for individuals with severe and refractory symptoms, intolerance to therapy, or malnutrition related to the condition. Venting tubes placed into the stomach may reduce symptoms and hospitalizations for individuals with recurrent vomiting and dehydration. Varieties of tubes, including button gastrostomy tubes and percutaneous gastrostomy tubes are available to vent trapped air from within the poorly contracting stomach. A dual channel gastrostomy tube allows both gastric venting and nutritional supplementation delivered into the small intestine. A percutaneous jejunostomy tube is used for nutritional supplementation. In some cases the lower part of the stomach is stapled or bypassed and the small intestine reattached to the remaining stomach to improve emptying of stomach contents. Rarely the stomach is completely removed.

## Electrical Gastric Stimulation

An area generating a great deal of interest and research is the use of electrical stimulation to enhance gastrointestinal contractile activity. This technique uses electrodes that are surgically or endoscopically attached to the stomach wall and when stimulated, trigger stomach contractions (figure 4). While gastric electrical stimulation does not lead to a significant improvement in gastric emptying, in the subgroup of patients with nausea and vomiting as their main symptoms, this treatment may provide relief of symptoms. How the device works is not well understood at this point, but it is thought that it has its effect on the nerves that control sensation within the stomach wall. Several studies have shown patients have a better quality of life and spend less time in the hospital for gastroparesis symptoms after the placement of the electrical stimulator.

Figure 1: Gastrostomy and jejunostomy anatomy

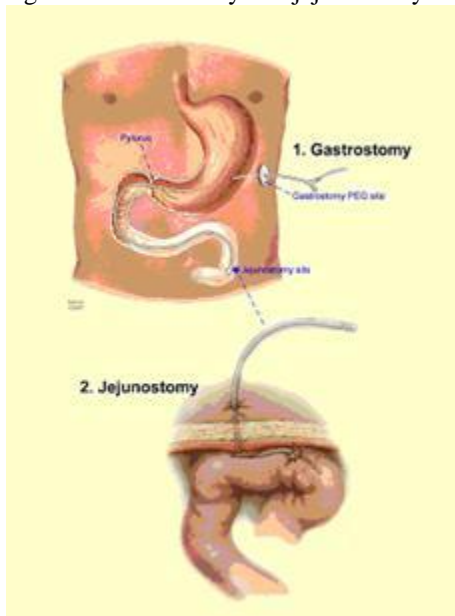


Figure 2: Oro-jejunal feeding tube

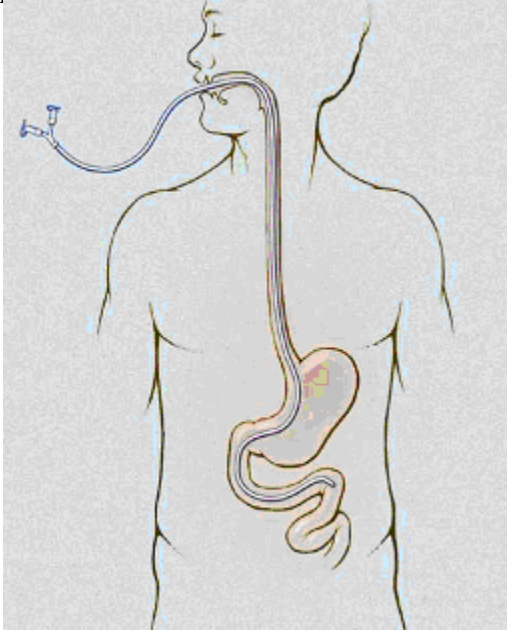


Figure 3: Wireless Capsule Monitoring System

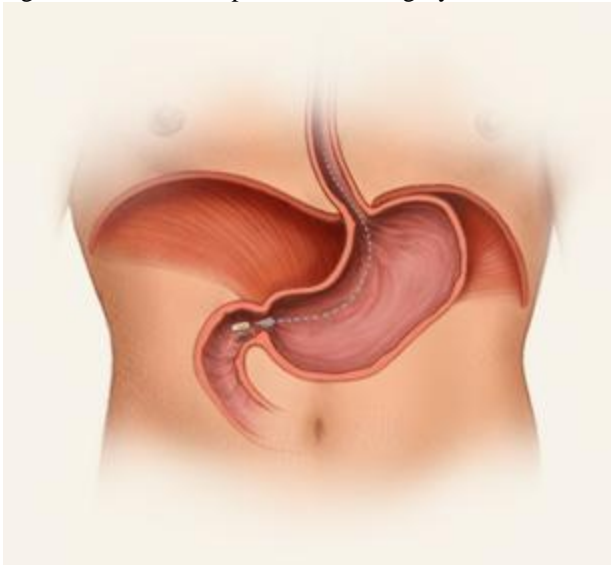
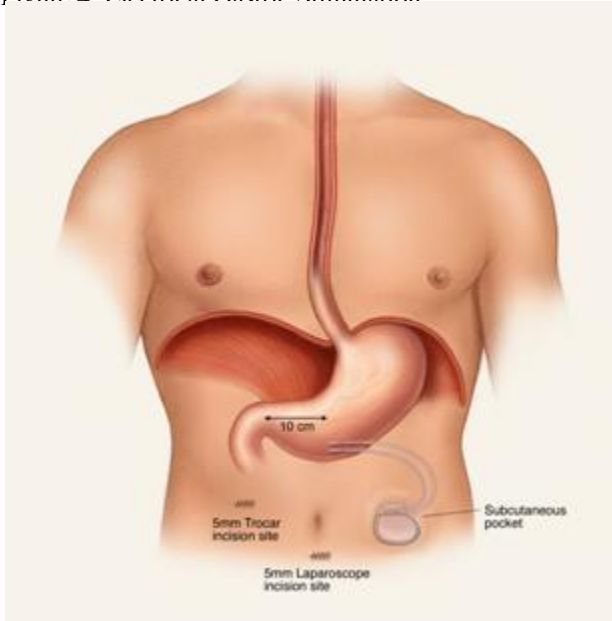


Figure 4: Electrical Gastric Stimulation



## Authors

---

*Jean Fox, MD and Amy Foxx-Orenstein, DO, FACG, Mayo Clinic, Rochester, MN*