



California Pacific
Medical Center

A Sutter Health Affiliate
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Diagnosis and Treatment of Upper Gut Motility Disorders

Advanced Gastroenterology

COMPLEX DIGESTIVE DISEASE CENTER

CENTER FOR NEUROGASTROENTER- OLOGY AND MOTILITY

At California Pacific Medical Center we are committed to bringing new and advanced diagnostic tools, medical treatments, and surgical options to the physicians we serve and the patients they care for. Through this procedure profile, our physicians illustrate actual medical situations that provide you with a window into their practice of diagnosis, treatment and patient follow-up.

At California Pacific we go beyond medicine to treat the whole person, not just the illness. Our promise to our patients is to deliver the highest quality expert care with kindness and compassion. Because medicine can transform a body, but going beyond medicine can transform a life.

For patient referrals:
888-637-2762
www.cpmc.org/gi

Beyond Medicine.

Upper Gut Motility Disorders

Upper gut motility disorders involve functional disorders within the **esophagus, stomach, and small intestine**. There are three primary components to functional gastrointestinal disorders: **motility, GI tract sensation, and brain-gut dysfunction**, all of which affect both the lower and upper gut.

MOTILITY: Normal motility or peristalsis is an orderly sequence of muscular contractions from top to bottom. In functional GI disorders, muscular spasms can cause pain, or contractions can be very rapid or very slow, altering the speed or direction of gut transit.

GI TRACT SENSATION: The stomach nerves are sometimes so sensitive that even normal contractions can induce pain or discomfort in response to physiological stimuli, such as digesting a meal.

BRAIN-GUT DYSFUNCTION: The regulatory connection between brain and gut function may be impaired, causing disharmony in the way the brain and gastrointestinal systems communicate altering the transit of luminal contents.

Esophageal Manometry

Esophageal motility encompasses four distinct areas of the esophagus: pharynx, upper esophageal sphincter, esophageal body, and lower esophageal sphincter.

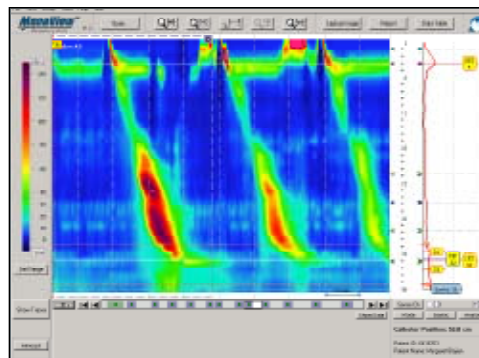
PHARYNGEAL MANOMETRY tests pharynx contractions or tone to diagnose movement dysfunctions that can lead to misdirected swallowing.

UPPER ESOPHAGEAL SPHINCTER (UES) MANOMETRY tests UES tone, pressure, and relaxation. The UES may fail to relax or be unsynchronized with the pharynx causing peristaltic dysfunction or the sensation of an object being stuck in the throat.

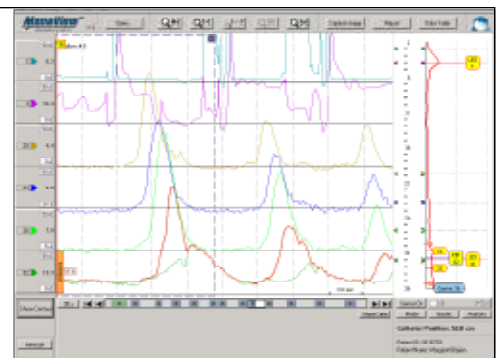
ESOPHAGEAL BODY MANOMETRY tests the muscle contractions and esophagus peristalsis.

LOWER ESOPHAGEAL SPHINCTER (LES) MANOMETRY tests sphincter tone and relaxation ability.

High-resolution esophageal manometry testing utilizes a small tube containing solid state pressure sensors. The tube is inserted through the nose into the esophagus to measure esophagus contractions and the relaxation of the



Normal Peristalsis

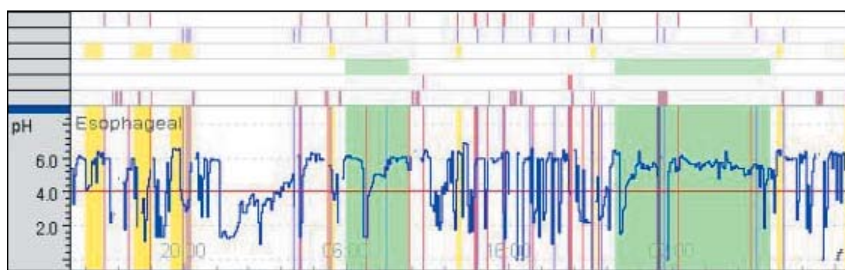


LES. The high-resolution system provides accurate measurement and timing of pharyngeal and upper esophageal sphincter contractions. Esophageal manometry also measures the pressure and contractions of the LES muscle, identifying or ruling out LES muscle weakness. To measure esophageal pH levels, an **esophageal impedance catheter** or a **Bravo™ pH capsule** is used. The catheter measures impedance caused by reflux of either acidic or non-acidic fluid from the stomach. The catheter is the diameter of a string of spaghetti and is inserted through the nose for 24 hours. The Bravo capsule, temporarily attached to the esophageal lining, captures pH levels over a 48-hour period.

Esophageal Motility Disorders

ACHALASIA: Characterized by the absence of esophageal contractions, achalasia is caused by nerve degeneration in the esophagus and LES, thus preventing food passage into the stomach. Persons with achalasia experience progressive difficulty with eating and drinking, usually with symptoms of vomiting and chest pain. These patients can be treated with pneumatic dilatation or laparoscopic myotomy.

DYSPHAGIA: Ineffective swallowing can occur for many reasons. Stroke or nerve and muscle diseases affecting the tongue and throat are very common causes. Dysphagia also can cause food to back up in the esophagus, resulting in vomiting.

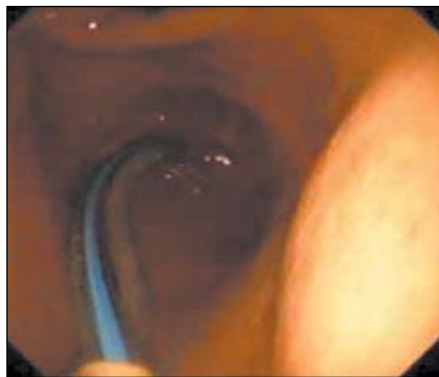


Bravo™ Capsule Recording Graph

High-resolution manometry records pharyngoesophageal coordination with high fidelity.

GASTRO ESOPHAGEAL REFLUX DISEASE (GERD): The major symptoms of GERD are heartburn, sour mouth, and hoarseness with throat pain and chest pain. GERD, left untreated, can cause severe damage to the esophageal lining. In addition to a low LES pressure, GERD patients may also have transient LES relaxation that is unrelated to swallows.

A special sleeve manometer, **Dent Sleeve**, is used to measure the pressure in the pyloric sphincter, the



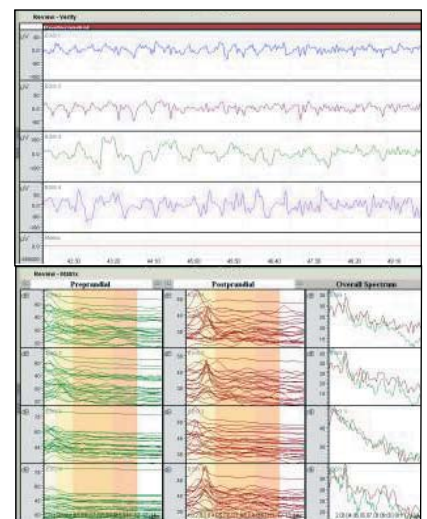
Dent Sleeve manometer in pylorus.

ring of smooth muscle creating the boundary between the stomach and the small intestine. Pressure sensors in the manometer can also measure contractions of the stomach and upper intestine. If the pyloric pressure is elevated, the effect of Botox injection on the pyloric pressure can be immediately measured. In addition to the Dent Sleeve, a new solid-state catheter is also being used to measure the pyloric pressure.

Stomach Manometry

Gastric emptying studies measure the flow of solid or liquid meals as they empty into the small intestine. Gastric emptying is controlled by contraction and tone of the stomach wall. California Pacific utilizes a computer-controlled pump called the **barostat** which shows whether the upper stomach relaxes adequately during eating and how much filling of the stomach it takes to cause pain or discomfort.

The **electrogastrogram (EGG)** is a diagnostic tool used to measure the electrical control of the stomach's contractions. EGG frequently identifies dysrhythmias, especially after meals, in patients with gastroparesis, chronic dyspepsia, anorexia nervosa and bulimia, cyclic vomiting syndrome, and other conditions characterized by a delayed gastric emptying. Dysrhythmias can be caused by specialized muscular conduction system abnormalities, present in the stomach.



Raw EGG and Data Analysis

Stomach Motility Disorders

GASTROPARESIS-DELAYED GASTRIC EMPTYING: Many gastroparesis patients have difficulty eating, and experience severe, chronic vomiting and nausea.

Some patients may even require tube-feeding to ensure adequate nutrition. There are a number of causes for gastroparesis, including diabetes mellitus, anorexia, bulimia, lupus, and brain disorders. However, nearly 40% of the cases have an unknown origin. Patients who have not responded or are intolerant of conservative therapies are candidates for injection of Botox into a hypertensive pyloric sphincter or Gastric Electrical Stimulation (GES). GES is used only when medication is ineffective in controlling symptoms that can be serious, including malnutrition and severe dehydration.



Gastric Electrical Stimulation

FUNCTIONAL DYSPEPSIA (NONULCER DYSPEPSIA):

An abnormal gastric accommodation reflex or decreased relaxation of the fundus (upper body of the stomach) may cause functional dyspepsia. Patients' symptoms include pain or discomfort and bloating in the upper abdomen, fullness, and nausea. New drugs are currently being used to normalize the accommodation reflex.

Small Intestine (Duodenum, Jejunum, and Ileum) Manometry

ANTRODUODENAL MANOMETRY: testing measures the pressure waves in the stomach and adjacent small bowel. Part of diagnostic testing includes measuring muscle contraction and responses to physiological stimuli (i.e. meals, erythromycin) using a manometer. A lactulose breath test is used to estimate small intestinal transit,

as well as small bowel bacterial overgrowth. Additional diagnostic testing, in conjunction with nuclear medicine, includes measuring stomach emptying and transit in the small intestine using a nuclear medicine scan.

Small Intestine Motility Disorders

INTESTINAL PSEUDO-OBSTRUCTION OR BLOCKAGE: Resulting from either weak or chaotic peristalsis, intestinal pseudo-obstruction presents with symptoms of abdominal bloating, pain, nausea, and vomiting which vary in severity and frequency. Abnormal small bowel contractions can result in muscle ineffectiveness, which in turn affects peristaltic movement. Scleroderma or other autoimmune diseases can cause weak contractions, while chaotic contractions are often caused by nerve abnormalities in the myenteric plexus.

State-of-the-Art Motility Diagnostic Tools

HIGH-RESOLUTION ESOPGAL MANOMETRY: Solid-state pressure transducers allow for simultaneous recording of the entire esophagus. The rapid and high-fidelity recording provides an accurate description of esophageal motility disorders. A similar system is used to measure pyloric pressures.

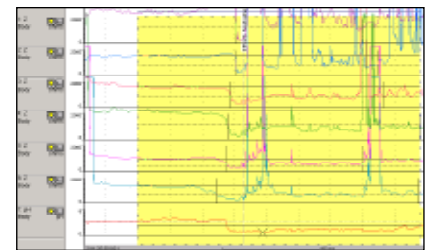
BAROSTAT STUDIES: Barostat studies measure the tone and compliance (stretch) of the esophagus and upper stomach. It also measures gastric accommodation and gastric sensation. Barostat studies can show whether the upper stomach relaxes adequately during eating and how much filling of the stomach it takes to cause pain or discomfort. An intragastric balloon measures resistance and volume changes. Filling the balloon bit by bit with air, the motility specialist is able to determine volume related abdominal pressure

pain levels, in addition to esophageal and stomach muscle tone and elasticity. In some patients, a barostat is used to diagnosis GERD and GERD related conditions that may be due to altered esophageal and stomach pressures.

An advantage of the barostat for gut measurement is its close contact with the stomach wall. Manometry testing can accurately detect stomach wall contractions in the esophagus, pylorus and small intestine. However, it does not accurately measure gut tone.

BRAVO pH TEST: The Bravo pH test offers patients with severe chronic reflux disease a viable option to an upper GI or 24-hour pH test. With the Bravo pH test, a tiny pH transmitter—about the size of a vitamin capsule—is attached to the esophageal lining. The capsule sends esophagus pH level data to a pager-sized recording device worn around the waist.

Patients are able to continue their regular daily routine and consume normal meals. After 24 to 48 hours the transmitter capsule is naturally sloughed off and eliminated through a normal bowel movement. After two days, the patient returns the recording device to the motility office for data analysis.



Esophageal Impedance Acid Reflux

ESOPHAGEAL IMPEDANCE/ SIMULTANEOUS MOTILITY:

Esophageal impedance measures the reflux of not only acidic gastric contents, but also non-acidic material. This test is very useful for the evaluation of patients with continued GERD symptoms who

are prescribed adequate doses of acid suppression. A combination with manometric recordings gives a full description of the underlying pathophysiology, allowing for better therapy.

ELECTROGASTROGRAM (EGG):

Similar to an electrocardiogram (EKG) of the heart, the EGG records the electrical signals that travel through the stomach muscles controlling the muscles' contractions. Additionally, EGG measures stomach-wall nerve activity before and after food ingestion, as well as the conduction and coupling between muscle cells. The new EGG system records on four channels simultaneously, allowing for complete activity data collection in a short time frame.

EGG is a non-invasive test, relatively inexpensive, and easy to perform. Electrodes are placed cutaneously on the abdominal skin over the stomach. While the patient is lying down relaxing, the electrodes record the electrical activity of the stomach. Initially, the gastric electrical activity is recorded after fasting, then again after a small meal is ingested. Sometimes EGG is done in conjunction with or after gastric emptying studies to diagnose and manage functional dyspepsia and idiopathic gastroparesis.

Utilizing computer analysis, the power of the stomach muscle electrical current is measured. In a normal stomach muscle, the regular electrical rhythm generates an increased current after a meal. In persons with stomach muscle or nerve irregularities, the post-meal electrical rhythm is irregular or the voltage does not increase.

PYLORIC MANOMETRY: Pyloric pressures can be measured using either the water-perfused Dent Sleeve or the e-sleeve from the high-resolution manometry system. The contribution of the pylorus to

altered gastric emptying can be immediately measured and treated.

ANTRODUODENAL MANOMETRY:

Measuring pressure waves in the stomach and adjacent small bowel before and after physiological stimuli (i.e. meals, erythromycin), and recording the pressure changes in the antrum and duodenum provides information about how well the muscles and nerves in the stomach and small intestine work. A manometry catheter is placed over a guide within the stomach and small intestine. The catheter records the muscle signals and pressure changes in the fasting state and also as food or liquid are digested. Test data is down loaded onto a computer upon completion of the study allowing for thorough evaluation of gastric and small intestinal motor function. Antroduodenal manometry records the presence of muscle contractions and their site of initiation, direction of propagation, frequency, and duration.

Motility Disorder Treatments

Although motility disorders are functional, many can be controlled or corrected with surgical interventions. Surgical interventions are usually performed using minimally invasive or interventional endoscopic techniques.

BOTOX INJECTION in the pyloric sphincter helps gastric emptying by paralyzing the LES or the pylorus. The response can be measured by pyloric manometry and gastric emptying studies.

ENDOSCOPIC GASTROPLICATION OR LAPAROSCOPIC FUNDOPLICATION can lessen GERD symptoms and LES dysfunction.

GASTRIC ELECTRIC STIMULATOR ENTERRA™ THERAPY, implanted laparoscopically, is a device for treating gastroparesis, improving gastric emptying and symptoms.

NEW DRUG AND TREATMENT

OPTIONS in research clinical trials offer patients access to current investigational protocols for upper gut motility disorders.

Patient Referral and Insurance Coverage

Patients need a referral from their primary care provider or physician specialist prior to scheduling their gastrointestinal motility evaluation. Many pre-evaluation laboratory and radiological results can be forwarded to the Center for Neurogastroenterology and Motility prior to consultation.

Most motility diagnostic testing is covered by Medicare, Medi-Cal and private insurance companies. In order to avoid unexpected medical expenses, it is always best for patients to contact their insurance company prior to treatment and confirm coverage for this service, as well as obtain prior authorization.

Information or Patient Referral

Please contact our specialty referral coordinators at **888-637-2762** for patient referral. If you have any questions regarding the **Center for Neurogastroenterology and Motility** please call **415-600-1138**.

Physicians are members of the Physician Foundation at California Pacific Medical Center (PFCPMC), a not-for-profit medical foundation. PFCPMC member physicians are committed to providing the highest quality health care, combining the latest in medical technology with a compassionate touch. To learn more about PFCPMC visit www.pfcpmc.org.

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Images courtesy of William J. Snape, Jr., M.D.