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Patient Information for Motility and Breath Tests

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Esophageal Manometry

What is esophageal manometry?

Esophageal manometry is a procedure that measures the strength and function of the muscles in your esophagus (the "food pipe") that work to push food and liquids from the mouth down to the stomach.

PREPARATION FOR THE ESOPHAGEAL MANOMETRY TEST:

- **Do not eat or drink after midnight** the night before the test, until your test is over.
- Medications that need to be taken regularly, such as high blood pressure and heart medication, can be taken with small sips of water when you awaken in the morning.
- If you have diabetes, skipping breakfast may affect your need for diabetic medication. Generally one-half of your usual dose of diabetic medication is taken in the morning of the test. This should be reviewed with your physician or health care provider.

Medications that are not essential should not be taken on the day of the test until after the test is completed.

- If you have questions about a specific medication, ask your physician or nurse.

How is esophageal manometry performed?

Esophageal manometry takes about 45 minutes. The technician will verify that you have not eaten anything within 6 hours of the study. At the start of the test, you will be sitting upright. One nostril is anesthetized with a numbing lubricant. A thin flexible plastic tube approximately one-eighth inch in diameter is passed through the anesthetized nostril, down the back of the throat, and into the esophagus as you swallow. With further swallowing, the tube is passed down into the stomach. There may be some gagging during some of the passage, but it is easily

controlled by following instructions. Occasionally, the tube is passed through the mouth and not the nose.

With the tube inside the esophagus, you will lie down on your back. After a short rest to allow the pressures to equilibrate, the test will begin. The pressures generated by the esophageal muscle will be measured when the muscle is at rest and during swallows. During the test, the technician usually asks the patient to swallow on command with some water (called a wet swallow). Multiple swallows are tested to allow measurement of the lower esophageal sphincter (the barrier to reflux), the esophagus (the swallowing tube), and the upper esophageal sphincter (in the throat). Pressure recordings are made throughout the study and the tube is then withdrawn.

Patients can usually resume regular activity, eating, and medicines immediately after the test.

What are the side effects of esophageal manometry?

Although esophageal manometry may be slightly uncomfortable, the procedure is not really painful because the nostril through which the tube is inserted is anesthetized. Once the tube is in place, patients talk and breathe normally. The side effects of esophageal manometry are minor and include mild sore throat, nosebleed, and, uncommonly, sinus problems due to irritation and blockage of the ducts leading from the sinuses and into the nose. Occasionally, during insertion, the tube may enter the larynx (voice box) and cause choking. When this happens, the problem usually is recognized immediately, and the tube is rapidly removed. Care must be used in passing the tube in patients who are unable to easily swallow on command because without a swallow to relax the upper esophageal sphincter the tube often doesn't enter the esophagus but instead enters the larynx.

When is esophageal manometry used?

Esophageal manometry is used primarily in several situations. The first is to evaluate the cause of reflux of stomach acid and contents back into the esophagus (gastroesophageal reflux disease or GERD). Symptoms of GERD include heartburn and regurgitation. The second is to determine the cause of problems with swallowing food, such as food or liquids getting stuck in the chest after swallowing. The third is to evaluate patients with chest pain that may be coming

from the esophagus rather than the heart. Finally, the test may be needed to correctly place an acid sensing probe (pH probe) in the esophagus (see patient information sheet on esophageal pH monitoring).

How is esophageal manometry used?

Esophageal manometry can diagnose several esophageal conditions that result in food sticking after it is swallowed. For example, achalasia is a condition in which the muscle of the lower esophageal sphincter does not relax with each swallow to allow the swallowed food into the stomach. As a result, food is trapped within the esophagus. Abnormal function of the muscle of the body of the esophagus also may result in food sticking. For instance, there may be failure to develop the wave of muscular contraction to help propel the food down the esophagus (as can occur in patients with scleroderma). The abnormal functioning of the esophageal muscle also may cause episodes of severe chest pain that can mimic heart pain (angina). Such pain may occur if the esophageal muscle goes into spasm (esophageal spasm) or contracts too strongly. In either case, esophageal manometry can identify the muscular abnormality.

Esophageal manometry is also used to evaluate patients who might have gastroesophageal reflux disease (GERD). Manometry often can identify weakness in the lower esophageal sphincter - the muscle that prevents stomach acid and contents from refluxing back up into the esophagus. The procedure will also help localize the lower esophageal sphincter which would help if esophageal pH monitoring is performed.

Esophageal pH Monitoring

Esophageal pH monitoring is a test used to evaluate for gastroesophageal reflux disease and to determine the effectiveness of medications that prevent acid reflux. This test measures the amount of acid refluxing or backing up from the stomach into the esophagus (food pipe).

Esophageal pH monitoring is used in several situations to assess for gastroesophageal reflux disease (GERD). The first is to evaluate typical symptoms of GERD such as heartburn and regurgitation that do not respond to treatment with medications. In this situation, there may be a question whether the patient has gastroesophageal reflux disease or whether anti-acid medications are adequate to suppress the acid production. The second is when there are atypical

symptoms of GERD such as chest pain, coughing, wheezing, hoarseness, sore throat. In this situation, it is not clear if the symptoms are due to gastroesophageal reflux. Occasionally, this test can be used to monitor the effectiveness of medications used to treat GERD. The test is often used as part of a pre-operative evaluation before anti-reflux surgery.

PREPARATION FOR THE TEST:

- **Stop medications used for treating reflux and for treating stomach acid problems** unless you are told to continue these medications by your physician.

Some medications should be stopped for 2-3 weeks prior to the test. These include omeprazole, esomeprazole, rabeprazole, lansoprazole, pantoprazole, Ranitidine and Famotidine.

Note that your physician may want you to continue these medications up to and during the test to determine how effective they are in suppressing acid production. If so, please take these medications at your regular time of the day prior to the test and the morning of the test (with a little bit of water).

- If you have questions about other medications, talk with your physician.
- **Do not eat or drink after midnight** the night before the test.
- Wear a shirt or blouse which opens in the front so that it is easier to dress after the probe is placed.

PROCEDURE:

There are two types of pH monitoring. One might be better for you and will be decided by your doctor. Each type uses pH sensors that register the reflux of acid from the stomach into the esophagus. For each type of monitoring, you should try to perform your regular activities during the day, including the ones that may bring on your symptoms. Regular meals should be eaten during the test. Follow your doctor's instructions regarding medication use or avoidance during the test.

Catheter-based esophageal pH monitoring

In order to determine the correct placement of the esophageal pH probe, it may be necessary to perform a short test called esophageal manometry (see additional instructions).

The nose is numbed for a short time. A thin wire-sized plastic catheter is passed into one nostril, down the back of the throat, and into the esophagus as the patient swallows. The tip of the catheter contains a sensor that senses acid. The sensor is positioned in the esophagus so that it is just above the lower esophageal sphincter, a specialized area of esophageal muscle that lies at the junction of the esophagus and stomach and prevents acid from refluxing back up into the esophagus. Sometimes the probe has other pH sensors to measure pH in the stomach and to measure pH in the upper esophagus. These extra sensors do not change the size of the small catheter. Placing the probe takes approximately 10 minutes. No sedation is necessary. The other end of the small catheter comes out the nose and is connected to a small battery-powered recorder that is worn on a strap over the shoulder. The patient is sent home with the catheter and recorder in place. During the 24 hours that the catheter is in place, the patient goes about his/her usual activities, for example, eating, sleeping, and working. Meals, periods of sleep, and symptoms are recorded by the patient in a diary and by pushing buttons on the recorder. The diary helps the doctor to interpret the results. The patient returns the next morning for removal of the catheter. After the catheter is removed, the recorder is attached to a computer so that the data recorded can be downloaded into the computer where it is then analyzed.

There are very few side effects of esophageal pH monitoring. There may be mild discomfort in the back of the throat while the catheter is in place. The vast majority of patients have no difficulty eating, sleeping, or going about their daily activities. Most patients, however, prefer not to go to work because they feel self-conscious about the catheter protruding from their nose.

Wireless, capsule esophageal pH monitoring

Monitoring esophageal pH can also be performed with Bravo pH monitoring which uses a capsule that is attached to the esophageal lining. The capsule is approximately the size of an eraser on a pencil. The capsule contains an acid sensing probe, a battery, and a transmitter. During an upper endoscopy using conscious sedation, the capsule is introduced into the esophagus on a catheter through the nose or mouth and is attached to the lining of the esophagus with a clip. The catheter then is detached from the capsule and removed. The probe monitors the acid in the esophagus and transmits the information to a recorder that is worn by the patient on a belt. With this method, there is no catheter protruding from the nose for the recording. For this test, the monitoring period is longer, 48 hours (2 days), which allows more symptom events to be captured. During the recording, the patient goes about his or her usual activities, for example, eating, sleeping, and working. Meals, periods of sleep, and symptoms are recorded by the patient in a diary and by pushing buttons on the recorder. The diary helps the doctor to interpret the results. The patient returns 48 hours after placement and the recorder is attached to a computer so that the data recorded can be downloaded into the computer where it is then

analyzed. The capsule will eventually fall off the esophageal lining, usually after five to several days, and is passed in the stool. The capsule is not reusable. The advantages of the capsule device are related to the absence of a catheter connecting the probe to the recorder and the longer duration of the study. There is greater comfort without a catheter in the back of the throat, and patients are more likely to go to work and do more normal activities. One disadvantage of the capsule is that it only measures the pH at one level since it cannot be used in the pharynx or the stomach.

The capsule device may cause a vague sensation in the chest or discomfort when swallowing. This may be due to food tugging on the capsule as the food passes, although discomfort occasionally can be felt when swallowing only saliva. In rare instances, the Bravo capsule can cause chest pain requiring removal of the capsule with an endoscopy. Patients cannot have an MRI (Magnetic Resonance Imaging) during the test and for 30 days afterwards. Some patients cannot have this type of monitoring. Patients with pacemakers, implantable defibrillators or neurostimulators cannot use Bravo. Patients with a history of bleeding diatheses, strictures, severe esophagitis, varices, obstruction, and prior esophageal resection are not candidates for Bravo pH monitoring.

Hydrogen Breath Test

A hydrogen breath test provides information about the digestion of certain sugars or carbohydrates, such as milk sugar (lactose) or fruit sugar (fructose). This will help determine if you are intolerant to certain sugars. One example is the use of this test to detect lactose intolerance, a disorder in which people have symptoms from abnormal processing of lactose, a substance in many foods including milk and ice cream. The test is also used for detecting abnormal growth of bacteria within the small bowel by having the patient ingest lactulose. Bacterial overgrowth can cause a variety of symptoms including diarrhea, bloating, gas, and abdominal cramps.

PREPARATION FOR THE TEST:

- For four (4) weeks before your test, you should not take any antibiotics.
- For one (1) week before your test, do not take any laxatives or stool softeners (for example Colace, Milk of Magnesia, Ex-Lax) or stool bulking agents (for example Metamucil or Citrucel). You should also not undergo any test that requires cleansing of the bowel, such as colonoscopy or barium enema.
- The day before your test:

You may consume only the following foods and drinks: plain white bread, plain white rice, plain

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white potatoes, baked or broiled chicken or fish, water, non-flavored black coffee or tea. Only salt may be used to flavor your food. Butter or margarine is not permitted. Soda Pop/cola drinks are not permitted. **DO NOT EAT OR DRINK ANYTHING ELSE** - it could give false results for the test. Specifically, avoid beans, pasta, fiber cereals, high fiber foods. The night before the test, have an early dinner of rice and meat.

- For 12 hours before your test:

You must stop eating and drinking 12 hours before the test.

For example, if your test is at 9:00 a.m., you would stop eating and drinking at 9:00 pm the night before.

You may continue to take your usual prescription medicines with water until 12 hours before the test.

Take no medications the morning of your test.

Please bring all prescription medications to your appointment.

- The day of your test:

You should not eat or drink anything in the morning. You may take your medications with a small amount of water. If you are diabetic requiring insulin or diabetic pills, ask your physician if you should change your morning dose. Generally, half of your normal long acting insulin is given. Oral hypoglycemic medications are usually not taken that morning until completion of the test and resumption of eating meals.

Two hours before the test, brush your teeth.

DO NOT EAT, DRINK, CHEW GUM OR TOBACCO, SMOKE CIGARETTES, EAT BREATH MINTS OR CANDY BEFORE OR DURING THE TEST.

Do not sleep or exercise while the test is being done.

- Your test may last for two to four hours. Please allow yourself sufficient time to complete you test.

The Test Procedure

- The technician will verify that you have not had anything to eat or drink after midnight
- A breath sample will be collected by having you exhale into bag.
- A solution of lactose, lactulose, or fructose will be given to drink. You should drink this whole amount.
- Breath samples will be collected every 15 minutes. After each sample is collected, the sample will be removed from the bag with a syringe, allowing collection of another sample into the bag.
- During the test, you should take notice of your symptoms and inform the technician if you have your typical symptoms for which the test is being performed.
- During the test, you should not eat, chew candy, smoke, sleep, or exercise.
- When the test is over, generally after two or four hours, you may leave. You may return to your usual diet and activity after the test.
- The samples will be processed in the afternoon. The report will be sent to your doctor.

Principles of Hydrogen Breath Testing

Hydrogen gas in the body is produced from intestinal bacteria. Bacteria, normally in the large intestine, produce hydrogen through fermentation of carbohydrates - such as lactose, lactulose, and fructose which are substrates given for the hydrogen breath test. Some of the hydrogen produced by bacteria is absorbed by intestinal mucosa whereby it enters the vasculature and is transported to the lungs. Hydrogen is then exhaled by the lungs by normal breathing. This is collected in the bag for subsequent analysis.

In small intestinal bacterial overgrowth, the small intestinal bacteria metabolize the lactulose given and produce an early rise in the breath hydrogen.

In lactose intolerance, the individual has a deficiency in lactase, the enzyme that breaks down lactose. Normally, lactose is broken down in the small intestine by lactase and very little lactose reaches the large intestine where the bacteria break it down to produce hydrogen. In lactose intolerance (lactase deficiency), the ingested lactose is not metabolized in the small intestine and reaches the colon where it is metabolized by colonic bacteria producing a large amount of hydrogen which is measured in the breath sample.

Anorectal Manometry

What is anorectal manometry?

Anorectal manometry is a test performed to evaluate patients with constipation or fecal incontinence. This test measures the pressures of the anal sphincter muscles, the sensation in the rectum, and the neural reflexes that are needed for normal bowel movements.

PREPARATION FOR THE PROCEDURE

Give yourself one or two Fleet® enemas 2 hours prior to your study. You can purchase the Fleet enema from a pharmacy or supermarket.

You should not eat anything during the two hours prior to the procedure. If you are diabetic, this may involve adjusting your diabetic medications.

You may take regular medications with small sips of water at least 2 hours prior to the study.

THE PROCEDURE

The test takes approximately 30 minutes. You will be asked to change into a hospital gown. A technician or nurse will explain the procedure to you, take a brief health history, and answer any questions you may have. The patient then lies on his or her left side. A small, flexible tube, about the size of a thermometer, with a balloon at the end is inserted into the rectum. The catheter is connected to a machine that measures the pressure. During the test, the small balloon attached to the catheter may be inflated in the rectum to assess the normal reflex pathways. The nurse or technician may also ask the person to squeeze, relax, and push at various times. The anal sphincter muscle pressures are measured during each of these maneuvers. To squeeze, the patient tightens the sphincter muscles as if trying to prevent anything from coming out. To push or bear down, the patient strains down as if trying to have a bowel movement. Two other tests may be done: first, an anal sphincter electromyography (EMG), a test to evaluate the nerve supply to the anal muscle; second, measurement of the time it takes to expel a balloon from the rectum. After the examination, you may drive yourself home and go about your normal activities.

Anal Sphincter EMG

Anal sphincter electromyography (EMG) is recorded with a small plug electrode placed in

the anal canal. The patient then is asked to relax, squeeze and push at different times. The anal sphincter muscle electrical activity is recorded and displayed on a computer screen.

Anal sphincter EMG confirms the proper muscle contractions during squeezing and muscle relaxation during pushing. In people who paradoxically contract the sphincter and pelvic floor muscles, the tracing of electrical activity increases, instead of decreasing, during bearing down to simulate a bowel movement (defecation).

Normal anal EMG activity with low anal squeeze pressures on manometry may indicate a torn sphincter muscle that could be repaired.

Balloon Expulsion Test

For this procedure, a small balloon is inserted into the rectum and then inflated with water. The patient goes to the bathroom and tries to defecate (expel) the small balloon from the rectum. The amount of time it takes to expel the balloon is recorded. Prolonged balloon expulsion suggests a dysfunction in the anorectum area.

What can be learned from anorectal manometry?

The anal and rectal area contains specialized muscles that are helpful to regulate proper passage of bowel movements.

Normally, when stool enters the rectum, the anal sphincter muscle tightens to prevent passage of stool at an inconvenient time. If this muscle is weak or does not contract in a timely way, incontinence (leakage of stool) may occur.

Normally, when a person pushes or bears down to have a bowel movement, the anal sphincter muscles relax. This will cause the pressures to decrease allowing evacuation of stool. If the sphincter muscles tighten when pushing, this could contribute to constipation.

Anal manometry measures how strong the sphincter muscles are and whether they relax as they should during passing a stool. It provides helpful information to the doctor in treating patients with fecal incontinence or severe constipation.

There are many causes of fecal incontinence. Weak anal sphincter muscles or poor sensation in the rectum can contribute to fecal incontinence. If these abnormalities are present, they can be treated. Biofeedback techniques using anal manometry and special exercises of the pelvic floor muscles can strengthen the muscles and improve sensation. This can help treat fecal incontinence.

There are many causes of constipation. Some involve sluggish movement through the whole colon, whereas others involve the anal sphincter muscles. In some patients with constipation, the anal sphincter muscles do not relax appropriately when bearing down or pushing to have a bowel movement. This abnormal muscle function may cause a functional type of obstruction. Muscles that do not relax with bearing down can be retrained with biofeedback techniques using anal manometry.

Risks of Anorectal Manometry

Anorectal manometry is a safe, low risk procedure and is unlikely to cause any pain. Complications are rare: it is possible that a perforation (tearing) or bleeding of the rectum could occur. Equipment failure is a remote possibility. If you are allergic to latex, you should inform the nurse/technician before the test so that a latex free balloon can be used.