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Physiological Testing of the Colon, Rectum and Anus

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Many people suffer from disorders related to function of the bowel. The most frequent complaints include fecal incontinence or the inability to control stool, constipation, pelvic, rectal or anal pain, and irritable bowel/spastic colon with abdominal pain or cramps. When these complaints are bad enough to interfere with your life, it is the duty of your physician to attempt to discover the underlying condition. Only then may appropriate treatment be recommended. Often a diagnosis may be made after an initial visit to your physician which is based on a history and physical examination. However, occasionally extensive testing may be necessary before the cause is found. This article examines some of the tests that may be recommended by your doctor or by a specialist such as a colon and rectal surgeon or a gastroenterologist.

The first set of tests that are often recommended define the anatomy of the intestinal tract. Structural problems need to be ruled out before proceeding to the second set of studies – the physiological tests – which evaluate how the bowel functions.

Structural Tests

Radiological studies. The structure and anatomy of the bowel are generally determined using x-ray tests and scopes. The x-ray tests are performed by putting a contrast material such as barium or gastrograffin into the bowel. This may be swallowed by the individual for an upper gastrointestinal and small bowel study (UGI- SBS) or it may be placed into the rectum and colon through a small tube for a lower gastrointestinal study or barium enema (BE). The barium coats the inside of the bowel and allows the physician to see an outline or silhouette of the lining of the bowel, since the bowel itself is not visible on x-ray exams.

Endoscopy. Endoscopy or looking at the inside of the bowel through a scope is a much more recent method of evaluation. Although rigid endoscopes have been used for a long time, they only allowed a very limited view of the first and last portions of the intestinal tract. With the introduction and refinement of flexible scopes, almost all of the intestine may now be viewed. The upper intestine including the esophagus, stomach and duodenum may be viewed with the upper GI endoscope or the esophagogastroduodenoscopy (EGD). The colon and, occasionally, the last few inches of the ileum (small bowel) may be seen with the colonoscope.

These tests will discover problems such as cancer, polyps, strictures or narrowing of the bowel, obstructions or blockages, inflammatory bowel disease (Crohn's disease or ulcerative colitis), significant diverticular disease or other anatomic or structural problems. Once these are ruled out, further physiological testing may be pursued.

Physiological Tests – Pressure

Manometry. Manometric testing of the anal canal provides information about the strength of the anal sphincter muscles. The test measures the pressures in the rectum and in the anal canal and is helpful in defining the strength or weakness of the anal muscles and the sensation and reflex activity of the rectum. It helps to identify the nature of anorectal disorders such as incontinence, constipation and pain. The test is performed with the individual lying comfortably on an examination table on his or her left side.

The manometry catheter is made of soft plastic and has a small balloon on the upper end. It is about one quarter of an inch in diameter and has 4-8 small openings around its circumference so that pressure may be measured in the front, the back and both sides of the anal canal at the same time. A small amount of sterile, distilled water is slowly pushed through the tube and out of these small holes. Occasionally, a little water may be felt on the skin. The catheter is well lubricated and slid into the rectum through the anal canal. Pressures are then measured as the catheter is slowly pulled out. During the test you will be asked to relax as much as possible, to squeeze the anal muscles and to bear down or push as though you were having a bowel movement. The test takes about 30 minutes and is well tolerated by most people.

Balloon capacity & compliance. This test studies the function of the rectum and its ability to expand and contract. The test takes about 45 minutes and is performed with the individual on his or her left side on an examination table. An empty, soft, latex balloon attached to a thin plastic catheter is lubricated and gently placed through the anus into the rectum. The balloon is slowly filled with warm water while measurements of volume and pressure are recorded. The doctor or technician will ask about the initial sensation of filling, the first urge to evacuate and the sensation of complete filling.

Balloon evacuation. This study tests pelvic floor relaxation and opening of the anal canal. It is useful in determining how easy or difficult it is to pass a bowel movement. A thin catheter with a small balloon is placed in the rectum. The balloon is gently blown up to different small volumes and the patient is asked to push the balloon out. The maximal volume balloon able to be evacuated is determined.

Neurological Tests

Neurologic problems are frequently a factor in colon and rectal disorders. A large number of neurological disorders including those present since birth (congenital) and those developed later in life (acquired) may be associated with bowel and bladder

dysfunction. Injury to the nerves controlling anal and rectal function may occur after a fall or other accident or during childbirth. Even if there is no history of these disorders or accidents, one or more of these tests may be recommended to ensure that these nerves are functioning normally.

Pudendal nerve terminal motor latency. The pudendal nerves are the main bundles of nerve fibers going to the anal sphincter muscles. There is one on each side of the pelvis starting at the spinal column and running down around the inside of the pelvis against the side walls and then across the ischioanal or fat space beneath the pelvic muscle floor to the anal muscles. These nerves may be injured by direct trauma, by age, by stretching during childbirth, or during prolonged straining during bowel movements.

This test is performed with the person on his or her left side. A specially designed probe with stimulating and recording electrodes is mounted on the physician's gloved finger which is then placed into the rectum. A very small current is used to stimulate the nerve through the rectal wall. The response of the muscle is recorded and the time from stimulation to response is calculated. A little tingling is usually all that is felt. Injury is indicated by slowed conduction through the nerve.

Electromyography. Electromyography (EMG) tests the electrical activity in the anal sphincter and pelvic floor muscles. The electrode reads the electrical activity produced by the muscles and amplifies it. Since the electrodes are fine needles and must be placed directly into the muscle body, there may be some discomfort. Generally, this is only with placement of the electrode, and once in place it does not hurt. Generally, the muscles are tested in four quadrants: left, right, front and back. When necessary, areas in between will be examined.

Concentric needle EMG. A concentric needle electrode has a central core that is the active reading surface and is only exposed at the tip of the needle. The outer sheath is the reference surface. Several motor units or individual nerve fibers are usually measured simultaneously and so this study gives a general picture of the electrical activity in the portion of the muscle in which it is placed.

Single fiber EMG. The single fiber EMG (SF-EMG) electrode also has an active reading core but it is only exposed to the muscle through a very small hole in the side of the needle shaft. This allows single nerve fibers to be recorded. These waveforms may be analyzed quantitatively and give very specific information about the muscle's electrical activities. This test takes longer to perform, and many laboratories do not perform this study routinely.

Sensory evoked potentials. Sensory evoked potentials (SEP) test the nerves that run from the bottom all the way up to the brain. The skin of the legs and the areas around the anus, penis and clitoris are stimulated with a very small electrical current. In addition, several locations along the spinal cord on the back are tested. In this way, abnormalities in function of these nerves may be discovered and the location of the defect may be found.

Colonic and Transit Tests

Transit time. Colonic transit time is a simple but effective method of studying how well the bowel propels food along. Normally, it takes only a little time for food that is eaten to progress through the small intestine into the colon. It then may take longer periods for the remaining material to pass through the colon and to be expelled as stool. There are several ways of performing the study. In our laboratory, three capsules containing small markers are swallowed, one on each of three successive mornings (Days 1, 2 & 3). On the following day

(Day 4) and three days later (Day 7) a plain x-ray of the abdomen is taken. All of the markers seen on the x-rays of each day are counted and added together. This number is the total transit time. This test is very useful for detecting different types of constipation.

Scintigraphic emptying and transit. Scintigraphic or nuclear medicine studies may be performed by labeling a material with a low-grade nuclear isotope and then following the progress of the material through the intestine. The emissions from the isotope are picked up by a special camera and the data is analyzed by a computer. The radiation dose is very small, even compared with standard contrast x-rays. This technology may be used to evaluate emptying of the stomach, transit through the intestines or emptying of the rectum.

Defecating proctography. Defecating proctography, fecogram, and defecography all refer to a study in which the rectum is filled with a semi-solid paste with a consistency of soft stool containing contrast. The individual sits on a commode within an x-ray machine and is then asked to relax, to squeeze, to tense the abdomen and to evacuate the material. X-ray films and video are taken during each phase. The study is then analyzed for anatomic defects such as internal or complete rectal prolapse, enterocele or rectocele, anorectal angles and function of the puborectalis muscle and emptying. This study is particularly useful when evaluating complaints of constipation and difficult evacuation.

Anorectal Ultrasound

Ultrasound is an imaging technique that allows parts of the body beneath the skin to be "seen" without the use of radiation such as x-rays. Sound waves are beamed through the tissues, and the waves bounced back are read and displayed. Ultrasound may be used through the abdominal wall to "look" at the contents of the abdomen such as the liver, gallbladder, pancreas and female organs. It is commonly used to check on fetal growth during pregnancy. Imaging of the rectum has become a standard part of the evaluation of many lesions including rectal polyps and small cancers. Recently, ultrasonography of the anal sphincters has become more popular and some centers are using this technique to search for defects and injuries of these muscles. Fistula tract and abscesses may also occasionally be identified when other methods have failed.

Conclusions

Physiological tests of the colon, rectum and anus are very important in the evaluation of many disorders of intestinal function. However, they do not replace the basic elements of a good history – listening to what you, the patient, have to say – and a good physical examination. Many of these studies are only available at specialized centers. They provide supplemental information to support the diagnosis that your physician may suspect based upon his or her primary evaluation. In this way, they are often quite helpful.

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This article is in no way intended to replace the knowledge or diagnosis of your doctor. We advise seeing a physician whenever a health problem arises requiring an expert's care.

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