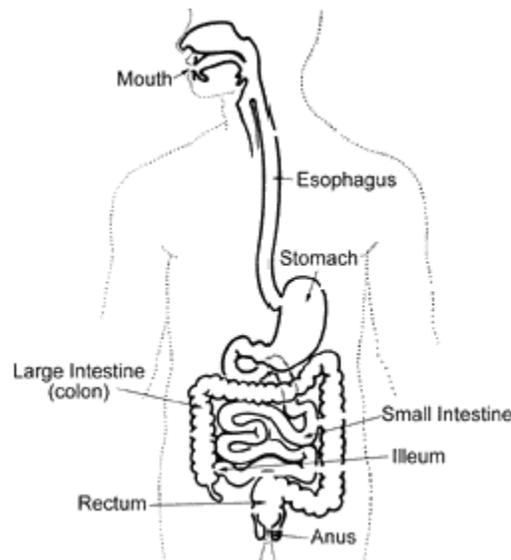


Small Bowel Bleeding (Arteriovenous Malformations [AVMs])

Overview

The small bowel (or small intestine) is the longest portion of the gastrointestinal (GI) tract. It is called "small" because it is thin or narrow compared with the "large" bowel (also known as the colon), but it is much longer than the large bowel (14 feet on average). The small intestine is involved in nutrient absorption from food.



GI bleeding occurs when an abnormality on the inner lining begins to bleed. Approximately 5% of all GI bleeding comes from the small bowel. Abnormal blood vessels (arteriovenous malformations or AVMs) cause 30 to 40% of bleeds. AVMs are the main source of bleeding in patients over the age of 50 years. Tumors (benign and malignant), polyps, Crohn's disease, and ulcers are some of the other causes of bleeding.

Multiple tests can be used to diagnose and treat the source of small bowel bleeding, including: endoscopy, enteroscopy, x-ray studies, capsule endoscopy, deep small bowel enteroscopy, and intraoperative enteroscopy. AVMs can typically be treated with cautery delivered through an endoscope or enteroscope. Tumors (benign and malignant) can be biopsied and have their location marked using endoscopy, but surgery is typically required to take them out. Other conditions, such as Crohn's disease, are often treated with medications.

Symptoms

Bleeding from the small bowel may be slow or fast. When the bleeding is slow, it may cause anemia (a low blood count). When the bleeding is slow it may not be visible in the stool. Anemia may cause symptoms such as tiredness and shortness of breath, but many people have no symptoms. If the bleeding is fast it is called a hemorrhage. People with hemorrhage may notice blood when they move their bowels, or their bowel movements may be black and tarry.

Causes

The causes of bleeding in the small bowel are different from those in the colon or the stomach. The most common causes of bleeding from the colon are polyps, diverticulosis (small out-pouchings in the wall of the colon), or cancer. Upper GI (esophagus, stomach, or duodenum) bleeding is most often due to ulcers. In the small bowel, 30 to 40% of bleeding is caused by abnormal blood vessels in the wall of the small bowel. These abnormal blood vessels have many names, including angioectasias, angiodysplasias, or arteriovenous malformations (AVMs). In people over the age of 50 years, AVMs are the most common cause of small bowel bleeding. Other causes of small bowel bleeding include benign (non-cancerous) and malignant (cancerous) tumors, polyps, Crohn's disease (a type of inflammatory bowel disease), and ulcers.

Risk Factors

AVMs become more common as people age and are associated with other medical problems, such as chronic kidney disease and certain types of heart disease (called valvular heart disease). The use of nonsteroidal anti-inflammatory drugs (NSAIDs) like ibuprofen or aspirin can cause ulcers in the small bowel.

Diagnosis

There are multiple tests for evaluating the small bowel. In most cases, the first step is endoscopy and/or enteroscopy. If that fails to find the source of bleeding, a common next step is capsule endoscopy. X-ray options include a small bowel follow-through or a computed tomographic scan (also known as a CT or CAT scan) of the small bowel. Deep small bowel enteroscopy can now be performed using special scopes with inflatable balloons and/or overtubes. The final option is intraoperative enteroscopy. Intraoperative enteroscopy requires surgery and is usually only done if the other tests are negative. All of these methods are discussed in detail below.

Endoscopy and enteroscopy

Endoscopes and enteroscopes are instruments used by doctors to evaluate the stomach and small bowel. Endoscopy refers to the examination of the bowel using a scope. At times the term is used specifically to indicate a procedure using a standard upper endoscope, but it can also be used more broadly to include tests done with any type of scope. Endoscopes and enteroscopes resemble long, thin tubes with a light and a camera at one end. The images obtained are displayed on a monitor. The scopes have channels that allow special equipment to be passed down them. This equipment can be used to treat whatever is bleeding, to take biopsies, or to mark the location of a problem with a tattoo to aid a surgeon in locating it later.

The test begins with the patient receiving medications to make him or her sleepy. The doctor then passes the scope through the mouth. A regular endoscope is capable of examining the esophagus, stomach, and the first portion of the small bowel, known as the duodenum. In cases where the source of bleeding is thought to be lower down in the small bowel, a longer scope, known as an enteroscope, can be used. This scope is capable of reaching the middle portion of the small bowel, known as the jejunum.

X-ray studies

X-ray studies are sometimes used in people with bleeding because 20-25% of small bowel bleeding is caused by abnormalities in the intestinal wall that can be seen by standard or specialized x-ray studies, such as tumors. There are three x-ray tests commonly used in the evaluation of the small bowel – small bowel follow-through, enteroclysis, and CT enterography.

The small bowel follow-through test is a series of abdominal x-rays that are taken at different times after a patient drinks a white, chalky fluid called barium that shows up on x-rays. The test allows the doctor to

examine the lining of the intestine for any irregularities. The test is good for large abnormalities, but can miss many smaller ones. However, it is safe and easy to tolerate.

A second x-ray test, the enteroclysis study, is similar to the small bowel follow-through in that it uses barium to visualize the inner wall of the small bowel. It is more invasive because it requires a small tube called a catheter to be slowly advanced from the nose down the esophagus, through the stomach, and into the small bowel, to allow for air and barium to be instilled. The advantage of this study is that pictures from enteroclysis have better resolution, so abnormalities missed by the small bowel follow-through test may be detected. A disadvantage of the enteroclysis study is that it can be an uncomfortable examination due to the presence of the catheter and the use of air to distend the small bowel while taking pictures. In some cases a CT scan is used instead of regular x-rays. This allows for even more detail to be seen.

A third test is known as a CT enterography. A CT enterography is done the same way a normal CT scan is done. The patient drinks an oral contrast solution (often dilute barium), while also receiving intravenous (IV) contrast. Then numerous, very detailed images are obtained. A CT enterography differs from a standard CT scan in that the type of contrast that the patient drinks is designed to allow for a more detailed inspection of the lining of the small bowel.

While none of these tests is perfect at finding abnormalities, the advantage of these tests is that they can sometimes find bleeding sources that are out of reach of a standard endoscope. The major limitations of these studies are that they cannot detect AVMs, and if an abnormality is seen, there is no way to apply immediate treatment to stop the bleeding, to take biopsies to confirm a diagnosis, or to mark the location of the lesion with a tattoo. In addition, some patients are allergic to the IV contrast that is used as part of the CT scan.

Capsule endoscopy

Capsule endoscopy uses a device that is about the size of a large pill. It is 1-1/8 inches long and 3/8 inches wide (26 mm x 11 mm). It is made up of a battery with an 8-hour lifespan, a strong light source, a camera, and a small transmitter. Once swallowed, the capsule begins transmitting images of the inside of the esophagus, stomach, and small bowel to a receiver worn by the patient. The capsule takes two pictures per second, for a total of about 55,000 images. After 8 hours, the patient returns the receiver to the doctor who downloads the information to a computer and then can review in detail the 8 hours of pictures of the capsule passing through the intestine. The patient passes the capsule through the colon and it is eliminated in the stool and discarded.

The capsule is generally safe and easy to take; however, rarely the capsule can get stuck in the small intestine. This may happen if there has been prior abdominal surgery causing scarring or other conditions that cause narrowing of the small intestine. If the capsule becomes stuck, endoscopic or surgical removal is necessary. However, if the capsule becomes stuck, there is a good chance that it is stuck at the place where the bleeding is coming from. So the procedure to get the capsule (endoscopy or surgery) may be able to treat the bleeding site at the same time. In about 15% of exams, the capsule does not view the entire small bowel prior to the battery running out and may need to be repeated.

Like x-rays, the capsule cannot be used to take biopsies, apply therapy, or mark abnormalities for surgery. Moreover, the capsule cannot be controlled once it has been swallowed, so once it has passed a suspicious area, it cannot be slowed to better look at the area. Despite these limitations, capsule endoscopy is frequently the test of choice for finding a source of small bowel bleeding if standard endoscopy has failed to do so because it is able to look at the whole small bowel and is an easy test for most people to do.

Overall, in patients with occult bleeding (blood is microscopically present in the stool, but the stool looks normal), capsule endoscopy finds a cause of bleeding in up to 67% of patients. In cases of overt bleeding (blood is seen in the stool or the stool is black and tarry), the results are highly variable. If the bleed happened in the past, the yield may be as low as 6%. If, however, the doctor believes that there is active bleeding occurring at the time of the test, the yield is >90%.

Deep small bowel enteroscopy

In cases where a lesion has been found deep in the small bowel, beyond the reach of standard endoscopy, evaluation of the deep small bowel may be needed. One option to further evaluate or to treat the lesion is known as double balloon enteroscopy. Double balloon enteroscopy uses two balloons attached to the scope to help the scope move through the small bowel. Double balloon enteroscopy is able to reach very far into the small bowel (in some cases as far as the ileum, which is the final segment of the small bowel). This scope can also be inserted through the anus, which allows for examination of the deepest parts of the small bowel (the scope must first pass through the colon). In some cases, by doing the test through both the mouth and through the anus, it is possible to examine the entire length of the small bowel, though this is not always possible.

A double balloon enteroscopy test often takes a couple of hours to perform, as opposed to 20 minutes for standard endoscopy. Because an examination using a double balloon enteroscope is much more involved than standard endoscopy, it is usually only used if a bleeding site is found on either an x-ray or capsule endoscopy and is out of reach of a standard enteroscope. In one study, double balloon enteroscopy was able to locate a bleeding source in 74% of patients.

Because the test is done with an enteroscope, if a source of bleeding is found it may be possible to treat it, take biopsies, or mark the area with a tattoo. If a source is found, it can be treated in about 60 to 70 percent of people.

In addition to double balloon enteroscopy, there are two other options for deep small bowel enteroscopy. One is single balloon enteroscopy, which is a test similar to double balloon enteroscopy, though in this case there is only one balloon attached to the scope. A second option is deep small bowel enteroscopy using a special spiral tube that fits over the scope and allows the endoscope to be advanced into the deep small bowel.

Intraoperative enteroscopy

In some cases, surgery may be needed. Intraoperative enteroscopy is carried out in the operating room under general anesthesia. The surgeon, often working with a gastroenterologist (a doctor who specializes in the GI tract), inserts the endoscope through the patient's mouth or through a small incision in the small bowel (an enterotomy). The surgeon then advances the endoscope through the intestine to examine the entire small bowel. The advantage of intraoperative enteroscopy is that it allows the doctor to treat the cause of bleeding if it is found (for AVMs), or to remove masses or polyps. Because it is an invasive, surgical procedure, however, intraoperative enteroscopy is usually only used when other methods have failed to find or treat the source of bleeding. Overall, it is effective in treating the source of bleeding in approximately 70% of the patients who require the procedure.

Treatment

In cases of AVMs, a small amount of electric current can be delivered through the endoscope to cauterize the abnormality. If the AVM is discovered during endoscopy, the treatment can be done immediately without requiring further endoscopy. If the bleeding source is found by capsule endoscopy, treatment options include endoscopy, standard enteroscopy, deep enteroscopy, or intraoperative enteroscopy (depending on the location of the bleeding site and prior attempts at treating it). In rare cases when there are a lot of AVMs in a segment of small bowel, the segment of small bowel may need to be removed surgically.

Polyps can often be removed with an endoscope. Sometimes surgery is needed if the polyp cannot be removed with an endoscope. Tumors, both benign and malignant, typically require surgical removal (while benign tumors do not always need to be removed, if they are causing a lot blood loss they usually need to be taken out). Other causes of small bowel bleeding can be treated with medicines (e.g., Crohn's disease or medication induced ulcers).

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