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SECRETS OF THE INNER WORLD

Background. Since the discovery of fiber-optic endoscopy to examine upper and lower gastrointestinal tract, diagnosis and therapy of gastrointestinal diseases were revolutionized. However, by these methods, of the small bowel, only the proximal duodenum and distal ileum could be examined. Hence, rest of the small bowel, which is more than four meters in length, remained like a black box.

In science, what is fiction today, may become reality tomorrow. This is amply documented once again by discovery of capsule endoscopy.

Capsule Endoscopy. Is a procedure that uses a tiny wireless camera to take pictures of your digestive tract. A capsule endoscopy camera sits inside a vitamin-size capsule you swallow. As the capsule travels through your digestive tract, the camera takes thousands of pictures that are transmitted to a recorder you wear on a belt around your waist.

Manufacturers. Capsule endoscopy is a combination of the device that physicist G. Iddan had developed and that devised by Paul Swain. This was an attempt to reproduce the movie fiction filmed by R. Fleischer in 1966, based on a story by I. Asimov. The first reported use of capsule endoscopy in ten human volunteers was published in 2000 by P. Swain in Nature. The first model of capsule endoscopy was made available by Israeli Company Given Imaging by the name of M2A.

Capsule Structure. Most capsules consist of a lens, 4 light emitting diodes, a color camera, 2 batteries, a radiofrequency transmitter and an antenna . The camera transmits multiple (usually 2/second) images by radiofrequency through sensor to a recorder.[1]

Why is capsule endoscopy done? Capsule endoscopy helps your doctor evaluate the small intestine. This part of the bowel cannot be reached by traditional upper endoscopy or by colonoscopy. The most common reason for doing capsule endoscopy is to search for a cause of bleeding from the small intestine. It may also be useful for detecting polyps, inflammatory bowel disease (Crohn's disease), ulcers, and tumors of the small intestine.

An empty stomach allows for the best and safest examination, so you should have nothing to eat or drink, including water, for approximately twelve hours before the examination. Your doctor will tell you when to start fasting.

Tell your doctor in advance about any medications you take including iron, aspirin, bismuth subsalicylate products and other over-the-counter medications. You might need to adjust your usual dose prior to the examination.

Discuss any allergies to medications as well as medical conditions, such as swallowing disorders and heart or lung disease.

Tell your doctor of the presence of a pacemaker or defibrillator, previous abdominal surgery, or previous history of bowel obstructions in the bowel, inflammatory bowel disease, or adhesions.[2]

Anatomy and physiology. Capsule endoscopy can be used to evaluate the esophagus, stomach, small intestine, and colon. It is ingested just like any other capsule and travels through the esophagus into the stomach. It then passes through the pyloric sphincter into the duodenum, jejunum, and ileum. The capsule proceeds through the ileocecal valve into the cecum. It then advances through the colon and is excreted during a bowel movement. In many cases, the patient will witness the passage of the capsule, but plain abdominal films can be used to evaluate the complete passage of the video capsule.

Indications. There are many indications for capsule endoscopy. The most common indication is for obscure gastrointestinal bleed thought to be located in the small bowel after upper and lower endoscopic procedures failed to find a bleeding source. Video capsule has a 35% to 77% detection rate of obscure gastrointestinal bleeds. Other indications for small bowel capsule endoscopy are as follows: diagnosis of Crohn's disease and evaluation of Crohn's disease activity, diagnosis of celiac disease, and evaluation of refractory celiac disease, polyposis syndrome surveillance, small intestine tumors such as neuroendocrine tumors, or carcinoid tumors. Capsule endoscopy is indicated to evaluate the esophagus for esophageal varices screening, Barrett's esophagus screening, and esophagitis identification. Colon capsule endoscopy is indicated for colon cancer screening in patients with a previous incomplete colonoscopy, patients that have major risks for a colonoscopy itself, and patients that cannot tolerate sedation

Technique. Prior to video capsule ingestion, the patient is outfitted with a sensor belt which gathers the capsule's transmitted images. Once a magnet is removed from the capsule, it becomes activated, and the patient can ingest the capsule while in an upright position. As mentioned above, the capsule can also be placed in the stomach or duodenum endoscopically. Patients are advised not to participate in any activities that may cause sensor belt detachment. The patient can resume a clear liquid diet 2 hours after capsule ingestion. They can have a small meal 4 hours after ingestion. Patients undergoing esophageal capsule endoscopy only need to fast for 2 hours before the procedure and will need to consume 100 mL of water just prior to capsule ingestion. The patient will swallow the capsule while lying supine and slowly move into an upright sitting position over a 5-minute period.[3]

What to expect after capsule endoscopy. Avoid any powerful electromagnetic fields. If you require magnetic resonance imaging (MRI) it is imperative that you wait until the capsule is excreted and undergo an x-ray to confirm that the capsule has left your body. Please return to the Laboratory 8-12 hours after ingesting the capsule for equipment removal.

After removal of the equipment, you may return home and resume all normal activities and diet. Results will generally be available within 24 to 72 hours.[4]

Risks. Capsule endoscopy is a safe procedure that carries few risks. However, it's possible for a capsule to become lodged in your digestive tract rather than leaving your body in a bowel movement within several days.

The risk, which is small, might be higher in people who have a condition — such as a tumor, Crohn's disease or previous surgery in the area — that causes a narrowing (stricture) in the digestive tract. If you have abdominal pain or are at risk of a narrowing of your intestine, your doctor likely will have you get a CT scan to look for a narrowing before using capsule endoscopy. Even if the CT scan shows no narrowing, there's still a small chance that the capsule could get stuck.

What are the disadvantages of this procedure? One disadvantage is that capsule endoscopy is an all-day test, although patients do not usually stay in the hospital to complete it. Another disadvantage is the potential for the capsule to become impacted or lodged within a narrow area or stricture in the small intestine. This complication can occur because the capsule is not pliable. Patency capsules, which are dissolvable “dummy” capsules, can be administered in these cases, as the passing of a patency capsule within 24 hours ensures that a regular capsule will pass through without consequence.

In addition, a capsule may occasionally have difficulty exiting the stomach, or it may stay in the stomach for its entire battery life. This problem has been partially alleviated by the use of a real-time viewer, which allows clinicians to see the location of the capsule.

Results. The camera used in capsule endoscopy takes thousands of color photos as it passes through your digestive tract. The images saved on the recorder are transferred to a computer with special software that strings the images together to create a video. Your doctor watches the video to look for abnormalities within your digestive tract.

It might take a few days to a week or longer to receive the results of your capsule endoscopy. Your doctor will then share the results with you.[5]

So, in the future, new capsule devices may offer a great potential for minimally invasive diagnosis and targeted therapy. Moreover, capsule movement will be actively controllable thereby opening new avenues for advanced specific diagnosis and targeted therapy.

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