

## Overview of Small Bowel Capsule Endoscopy <sup>1,2</sup>

Capsule endoscopy is a minimally invasive procedure used to diagnose digestive disorders, primarily within the small bowel. This procedure is used to obtain high-resolution photographic images that may not be accessible through other diagnostic procedures used to visualize and evaluate the digestive system.

The size of a vitamin, the capsule endoscope consists of batteries, a light source, camera, and transmitter. After the capsule is activated and swallowed easily with a glass of water by the patient, it begins transmitting images of the digestive system to a receiver worn by the patient. The capsule takes two pictures per second for approximately eight hours, as it travels through the esophagus, stomach, small intestine and large intestine, and is excreted naturally. After the exam, the patient returns the receiver to the physician or a nurse, who downloads the images to a computer, and reviews the images for abnormalities or sources of bleeding. The capsule cannot be controlled after it is inside the patient, it moves naturally through the digestive system through muscular contractions (also known as peristalsis). At this time, the capsule is purely diagnostic and does not take samples, apply therapy, or mark abnormalities.

## Why is Capsule Endoscopy Performed? <sup>1</sup>

A patient may receive a capsule endoscopy if he/she has shown symptoms of digestive disorders and has undergone previous tests to examine the gastrointestinal (GI) tract, but which did not yield conclusive diagnostic results. Symptoms of digestive disorders include, but are not limited to, chronic abdominal pain, unexplained weight loss or anemia, and/or GI bleeding. These symptoms could be caused by inflammatory bowel disease, such as Crohn's disease or ulcerative colitis, celiac disease, benign and cancerous tumors, or other digestive disorders. Capsule endoscopy is currently recognized as one of the least invasive procedures that provides direct and complete imaging of the entire small bowel.

## Other Procedures Used to Examine the Small Bowel <sup>2,3,4</sup>

The primary function of the small intestine (small bowel) is nutrient absorption. It is the longest portion of the GI tract and narrower than the large intestine (colon / large bowel). Approximately 5% of GI bleeding originates in the small bowel. However, because the small bowel is extensive in length, it can be difficult to find the source of the symptoms within the reach of a standard endoscope.

Procedures used to obtain a diagnosis of the small bowel include capsule endoscopy or radiologic tests, while procedures used to perform both diagnostic and therapeutic interventions include enteroscopy or intraoperative enteroscopy. In most cases, an upper and/or lower endoscopy will be used as a first approach to search for the source of the symptoms through direct visualization, and if these procedures do not yield a diagnosis, capsule endoscopy is frequently the next exam.

A GI endoscopy is the examination of the GI tract using an endoscope – a long, thin tube with a light source and camera at one end, which obtains and transmits images to a video monitor. Endoscopes have channels, through which, instruments can be passed in order to obtain tissue samples or to provide therapy to a targeted area. The first portion of the small bowel can be visualized through an endoscopy; the patient is sedated, and the scope is passed through the mouth, esophagus, stomach and first portion of the small bowel. If the source of the symptoms are not clear, and it is suspected that the bleed is lower in the GI tract, a longer scope, known as a push enteroscopy, can be used to reach as far as the middle portion of the small bowel. To reach further than a standard endoscope and a push enteroscopy, a deep small bowel enteroscopy can be performed with overtubes fitted with inflatable balloons, which fit over the enteroscopy, to help advance the scope further into the small bowel. The last option to provide a patient with a diagnosis, if all other approaches have failed, is intraoperative enteroscopy, an invasive surgical procedure performed in the operating room under general anesthesia.

<sup>1</sup> Johns Hopkins Medicine Gastroenterology and Hepatology. "About Capsule Endoscopy." 2009. Accessed August 14, 2009 [http://hopkins-gi.org/CMS\\_Page.aspx?SS=&CurrentUDV=31&CMS\\_Page\\_ID=BA0D3EB5-3193-438F-8347-1E076E14690F](http://hopkins-gi.org/CMS_Page.aspx?SS=&CurrentUDV=31&CMS_Page_ID=BA0D3EB5-3193-438F-8347-1E076E14690F)

<sup>2</sup> Travis MD, Anne C; Saltzman MD, John R. "Small Bowel Bleeding and Capsule Endoscopy." Harvard Medical School. American College of Gastroenterology. 2009. Accessed August 14, 2009 <<http://www.acg.gi.org/patients/gihealth/smallbowel.asp>>

<sup>3</sup> UW Medicine. "Small Bowel Follow Through Radiography: How to prepare for your procedure." University of Washington Medical Center. 2005.

<sup>4</sup> University of Maryland Medical Center (UMMC). "Enteroclysis." University of Maryland Medical System. 2009. Accessed August 21, 2009 <<http://www.umm.edu/ency/article/003818all.htm>>

Other examinations used to visualize the small bowel are radiologic tests such as small bowel follow through (SBFT) and enteroclysis. These tests are performed by a radiologist to study the lining of the intestine, and may reveal abnormalities or obstructions in the bowel. For a small bowel follow through, the patient must fast the night before to clear the stomach and first portion of the small bowel. Before the exam, the patient swallows liquid barium (contrast used to allow visualization under x-ray) and once it is consumed, he/she holds several different positions as the radiologist captures still images showing different views of the small intestine as the contrast travels through the bowel.

For enteroclysis (commonly referred to as small bowel enema), the patient must follow a clear liquid diet for 24 hours prior to the exam and prepare by cleansing the bowel the night previous to the examination. This test is performed by inserting a tube through the nose or mouth, into the stomach and part of the small bowel; barium and air flows through the tube as x-ray pictures are captured both still and real-time. This test could take several hours as the barium travels through the entire small bowel.

### **History of Capsule Endoscopy**<sup>5, 6, 7</sup>

The small bowel has historically been a difficult area to reach and examine due to the nature of the anatomy and location within the gastrointestinal tract.

Traditionally, visualization of the small bowel has occurred through radiologic techniques as described above; however, these techniques are limited in utility because they do not provide direct visualization of the tissue, as compared to endoscopy. However, the challenge with endoscopy, prior to the use of capsule technology, was that the entire GI tract was not completely accessible, except with invasive techniques.

The capsule endoscope, developed in 1997, establishes a minimally invasive procedure for direct and complete imaging of the entire small bowel.

### **Benefits of Capsule Endoscopy**<sup>6</sup>

The primary benefit of the small bowel capsule endoscope is its ability to provide physicians with complete and direct visualization for evaluation of the small bowel. Thus, by having direct visualization, the physician has a greater ability to detect vascular abnormalities that cause GI bleeding and other symptoms.

Benefits for the patient compared to traditional radiologic imaging modalities include lower risk from the absence of exposure to radiation and minimal patient discomfort. Additionally, compared to endoscopic procedures, capsule endoscopy is a minimally invasive procedure that is *sedation-free*; the patient can ingest the capsule endoscope, and go about their normal, daily routine while receiving a full examination of the small bowel, and simply return the equipment at the end of the day.

Lastly, before capsule endoscopy, if a diagnosis could not be obtained through endoscopy, enteroscopy, and/or radiologic testing, the patient would likely undergo an intraoperative enteroscopy. Now, with capsule endoscopy, physicians can avoid having to put a patient through surgery in order to obtain direct visualization and diagnosis for conditions within the small bowel.

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<sup>5</sup> Sidhu, R; Sanders, DS; Morris, AJ; McAlindon, ME. "Guidelines on small bowel enteroscopy and capsule endoscopy in adults." Gut. 2008; 57: 125 – 136.

<sup>6</sup> Hara MD, Amy; Leighton MD, Jonathan; Sharma MD, Virender; Fleischer MD, David. "Small Bowel: Preliminary Comparison of Capsule Endoscopy with Barium Study and CT." Radiology. 2004; 230: 260-265.

<sup>7</sup> Faigel, Douglas O; Cave, David R. Capsule Endoscopy. Elsevier Inc., 2008.