

# WIRELESS CAPSULE ENDOSCOPY

**Background:** Small bowel is the last unconquered frontier of GI endoscopy

1. Push Enteroscopy (PE)
  - 50 to 100cm of upper jejunum can be reached, requires experienced endoscopist and deep anesthesia, uncomfortable for patient
2. Sonde Enteroscopy
  - Long, thin, balloon tipped enteroscope pulled by peristalsis; all parts of mucosa were not visualized due to uncontrolled movements, generally fallen out of favor
3. Intra-operative Enteroscopy
  - Used more frequently. Disadvantages include – prolonged ileus, intestinal obstruction, perforation and fistula.
4. Radiological and blood-pool Scintigraphy
  - Mesenteric angiography requires .5 to 1 ml/min of blood to be sensitive
  - Barium enema, helical CT, MRI, MRI- Angio under investigation

## **History:**

1. Jointly pioneered by two groups working independently in Israel and London
2. Appleyard et al. compared sensitivity, specificity and safety of capsule and push enteroscopy in an animal model.
  - Beads were sewn in the small bowel

	Capsule	Push Enteroscopy
Full Length sensitivity/specificity	64% / 92%	37% / 97%
Sensitivity within range of PE	53%	94%

3. August 1999 first human volunteer study
4. August 2001 FDA approved for patient use

## **How it Works:**

1. Components:
  - A disposable capsule (11X27mm) takes color video images as it is swallowed and carried by peristalsis and excreted naturally
  - A recorder held by a belt around the waist receives signals transmitted from the capsule through a system of sensors located on the abdomen
  - A computer station for processing, viewing and reporting images and data acquired through the GI tract

## 2. Current Technology:

- Images are obtained as the capsule sweeps past gut wall without requiring air inflation
- Propelled by peristalsis, unimportant if capsule is facing backward or forward
- Antennas estimate location in abdomen with an accuracy of +/- 3cm with images being transmitted at 2 frames per second
- Total transit time of 7 hours
- 45min to 2 hours needed to evaluate downloaded images. Highly dependent on experience and concentration of examiner
- blood recognition algorithms give a color marker when blood is detected

## **Clinical Evidence:**

1. WCE has performed well in clinical trials in patients with difficult GI bleeding
  - Blinded comparison of WCE and PE in 20 patients with recurrent bleeding with negative gastroscopy and colonoscopy: abnormalities were found in 55% with WCE and 30% with PE
  - Several studies presented at the Digestive Disease Week 2002 have confirmed that WCE is superior to PE in its ability to find bleeding abnormalities

## **Indications:**

1. Difficult GI bleeding with negative gastroscopy and colonoscopy. A recent review by Lewis, et al. suggested that WCE will soon be the first line method in evaluating patients with obscure GI bleeding
2. To evaluate small bowel abnormalities found on barium studies
3. Crohn's and celiac disease : however, limited by the fact that there is no non-surgical method of retrieving a capsule that gets stuck in strictures
4. Its use to identify anatomical source of bleeding diathesis in Von Willebrand's disease is being investigated
5. Unclear indications in non-bleeding patients

## **Contraindications and Complications:**

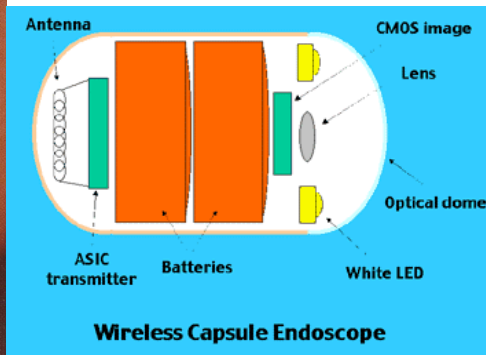
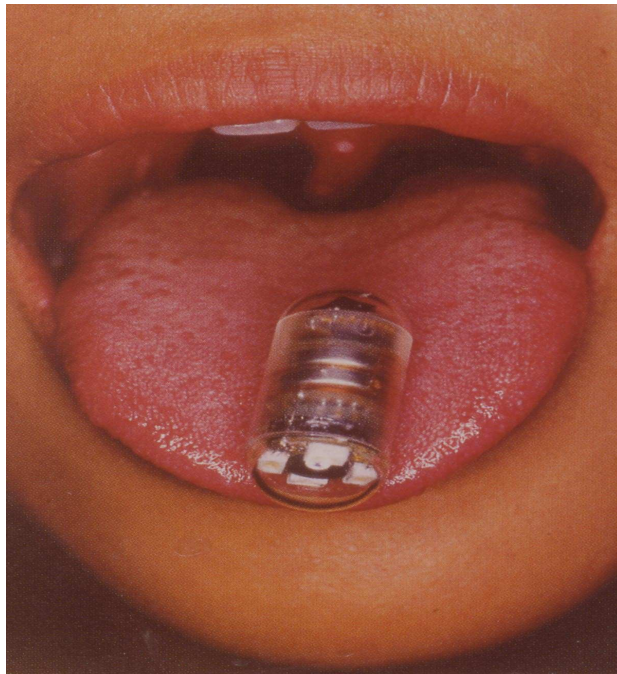
1. 1% incidence of capsule lodging in diverticulae and strictures that are inaccessible to flexible endoscopy
  - an abdominal radiograph might be used to evaluate patients who do not visualize passage of capsule into the toilet and in whom images of passage to cecum are not recorded
  - test passage of a biofragmentable sizer and the occasional use of a capsule on a thread
2. Though the device lists use in children and in patients with pacemakers as contraindications, groups have used the device in both these populations

### **Limitations:**

1. Random image sampling
2. no control over the progress of the capsule through the small bowel
3. lack of precise information about the capsule's location
4. restricted field of view
5. limited battery life

### **References:**

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2. Lewis B, Goldfarb N. The advent of capsule endoscopy--a not-so-futuristic approach to obscure gastrointestinal bleeding. *Aliment Pharmacol Ther.* 2003 May 1;17(9):1085-96. Review.
3. *Med Clin North Am.* 2002 Nov;86(6):1319-56. Review.
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5. Rossini FP, Pennazio M. Small-bowel endoscopy. *Endoscopy.* 2002 Jan;34(1):13-20. Review.
6. Swain P. Wireless capsule endoscopy. *Gut.* 2003 Jun;52 Suppl 4:iv48-50. Review.



Camera size comparison to a quarter



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