Small Bowel Capsule Endoscopy: New Innovations for Future Visions

Yun Jeong Lim, M.D.
Department of internal medicine, Dongguk University Ilsan Hospital, Dongguk University College of Medicine, Goyang, Korea

Introduction

Capsule endoscopy (CE) has been available in clinical practice for the evaluation of small-bowel disease since 2001. CE has many advantages compared to conventional wired endoscopy, such as convenience and less invasiveness. However, CE still has several limitations. For example, only passive images can be obtained while the capsule passes through the GI tract. Lesions may be missed in CE. Standard bowel preparation for CE has not been decided. It takes too long to administer CE and interpret capsule images. CE cannot be used to take a biopsy specimen, nor does it have therapeutic capabilities. New Innovations for future visions are like this; Clinicians should have control over the position and orientation of the capsules. Consequently, strategies are being pursued in the development of magnetically guided and actuated capsule robots for the next generation of CE.

Reports of small bowel CE based on the 10-year data (October 2002 ~ September 2012) from the Korean Capsule Endoscopy Registry¹

1. The common reasons included obscure gastrointestinal bleeding (OGIB) (59.3%), abdominal pain (17.1%), healthy volunteer (5.4%), suspected Crohn’s disease (3.6%), chronic diarrhea (3.5%), and small bowel tumor (2.9%).
2. Lesions were detected in 66% of CE examinations, while normal findings were reported in 34% of procedures. The most common CE diagnosis was small bowel tumor.
3. The 2 L PEG preparation was the most widely used preparation regimen in Korea for 10 years (52%).
4. The overall incomplete rate was 33%. The incomplete rate was significantly higher in elderly patients and poor bowel preparation.
5. The overall capsule retention rate was 3%. The rate was high in patients with small bowel tumors (5.7%) and Crohn’s disease (3.4%).
Present status of CE

1. A recent clinical guideline has recommended CE as a first-line investigation tool in patients with OGIB\textsuperscript{2,3} and national health insurance program supports CE in OGIB in Korea since 2014.

2. At present, there are five small-bowel CE models [PillCam, Given Imaging, Yoqneam, Israel; EndoCapsule, Olympus, Tokyo, Japan; MiroCam, IntroMedic, Seoul, Korea; OMOM, Jinshan Science, Chongqing, China; CapsoCam, CapsoVision, Saratoga, CA, USA] on the market worldwide.

Future direction

1. Real time viewer, controlled locomotion and positioning of the CE

Use of the external real time viewer to check the progress of the capsule significantly improved the completion rate. Currently, the movement of the capsule is absolutely dependent on gravitational and peristaltic force. Self- or external ordinary positioning or propulsion are needed for active movement.\textsuperscript{4} For better locomotion and steering, some groups have suggested a hybrid of the magnetic system and self-propelled CE, as well as of the magnetic system and legged locomotion.\textsuperscript{5}

2. Therapeutic capability

Tagging module that mark the precise location of a target lesion, microbiopsy module consists of paraffin block, a rotating tissue-cutting razor, and a controller, a nitinol clip for bleeding control were developed with a magnetically maneuvered capsule in animal model.\textsuperscript{6,7}

Conclusions

CE has evolved very rapidly to become an important tool for the visualization of the gut mucosa. Small-bowel CE is recommended as the first-line investigation technique in patients with obscure gastrointestinal bleeding and seems sufficiently accurate as an alternative tool in other small-bowel diseases. To lessen the interpretation time, artificial intelligence which can select significant gut image has been proposed, but, it is still insufficient for clinical application.\textsuperscript{8} Many methods have been proposed and are in development, such as enhanced image modality, controlled air insufflation, decreased battery consumption, and several therapeutic and biopsy tools.

References


