

## Upper oesophageal images and Z-line detection with 2 different small-bowel capsule systems

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### Abstract

Transmission of oesophageal images may vary between different small-bowel capsule endoscopy models. A retrospective review of 100 examinations performed with 2 different Small-bowel capsule endoscopy (SBCE) systems (PillCam<sup>®</sup> and MiroCam<sup>®</sup>) was performed. The oral cavity/aero-digestive tract (i.e., tongue, uvula and/or epiglottis) was captured/identified in almost all (99%) of PillCam<sup>®</sup> videos but in none of MiroCam<sup>®</sup> cases,  $P < 0.0001$ . Furthermore, oesophageal images (i.e., from the upper oesophageal sphincter to the Z-line) were captured in 99% of PillCam<sup>®</sup> videos (mean  $\pm$  SD, 60.5  $\pm$  334.1 frames, range: 0-3329 frames) and in 66% of MiroCam<sup>®</sup> cases (mean  $\pm$  SD, 11.1  $\pm$  46.5 frames, range: 0-382 frames),  $P < 0.0001$ . The Z-line was identified in 42% of PillCam<sup>®</sup> videos and 17% of MiroCam<sup>®</sup>,  $P = 0.0002$ . This information might be useful when performing SBCE in patients with high risks for aspiration.

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**Key words:** Capsule endoscopy; PillCam; MiroCam; Oesophagus; Aspiration; Detection; Z line; Transmission

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### TO THE EDITOR

Small-bowel capsule endoscopy (SBCE) is likely one of the safest procedures in every day gastroenterology practice. Aside acute small-bowel obstruction from retained capsules<sup>[1,2]</sup>, aspiration of capsule endoscopes has also been reported<sup>[3-5]</sup>. Albeit rare -and likely associated with spontaneous resolution-, capsule aspiration is a potentially life-threatening complication and a single fatality has been reported to date<sup>[6]</sup>.

We have previously noted that the MiroCam<sup>®</sup> SBCE system (IntroMedic<sup>®</sup> Co, Seoul, Korea) has a theoretical advantage, over other SBCE systems, of being smaller in size (11 mm  $\times$  24 mm), as well as lighter (3.25 g)<sup>[5,7]</sup>. The fact that to date there are no reported cases of tracheal aspiration involving MiroCam<sup>®</sup> capsules concurs to this. Conversely, PillCam<sup>®</sup> is 10.8 mm  $\times$  26 mm and weighs 3.45 g. Furthermore, the 2 capsule systems have different centre of gravity and that may have some role in determining the direction of propagation in the small-bowel<sup>[7]</sup>. The transmission of oesophageal images though may vary between different SBCE models and it is our experience that it fails more frequently with MiroCam<sup>®</sup>. In our hospital, a tertiary-care referral centre for capsule endoscopy for the East of Scotland, we have simultaneously operated two SBCE systems (MiroCam<sup>®</sup> and PillCam<sup>®</sup> SB, Given<sup>®</sup> Imaging Ltd, Yokneam, Israel) since May 2009<sup>[8]</sup>.

We retrospectively reviewed the last 100 examinations performed with each SBCE system in order to check the performance of the 2 systems in capturing images of

the upper most part of the gastrointestinal (GI) tract. Procedures involving endoscopic capsule placement ( $n = 2$ ) and those where a capsule stayed for  $> 30$  min in the oesophagus were excluded (one for each SBCE system). MiroCam<sup>®</sup> was used in 51 males/49 females (age:  $55.3 \pm 16.9$  years) with the following indications: suspected/established Crohn's disease: 25; overt/occult GI bleeding: 64; other indication/s: 11. PillCam<sup>®</sup> was used in 34 M/66 F (age:  $56.3 \pm 14.9$  years) of which, 32 had suspected/established Crohn's disease, 62 overt/occult GI bleeding and 6 other indication/s.

A single, experienced capsule endoscopist ( $> 1000$  SBCE reviews) re-evaluated the SBCE videos for confirmation of capture of oropharyngeal images, number of oesophageal frames and detection of Z-line. Any frame that included a part of Z-line, was calculated as positive for the latter. The Fisher's exact test, mean  $\pm$  SD were used;  $P$  values of  $< 0.05$  are considered statistically significant. All analyses were performed with GraphPad InStat (GraphPad Software, Inc, La Jolla, United States).

Interestingly, the oral cavity/aero-digestive tract (i.e., tongue, uvula and/or epiglottis) was captured/identified in almost all (99%) of PillCam<sup>®</sup> videos but in none of MiroCam<sup>®</sup> cases,  $P < 0.0001$ .

Furthermore, oesophageal images (i.e., from the upper oesophageal sphincter to the Z-line) were captured in 99% of PillCam<sup>®</sup> videos (mean  $\pm$  SD,  $60.5 \pm 334.1$  frames, range: 0-3329 frames) and in 66% of MiroCam<sup>®</sup> cases (mean  $\pm$  SD,  $11.1 \pm 46.5$  frames, range: 0-382 frames),  $P < 0.0001$ . The Z-line was identified in 42% of PillCam<sup>®</sup> videos and 17% of MiroCam<sup>®</sup>,  $P = 0.0002$ . MiroCam<sup>®</sup> uses electric field propagation rather than radiofrequency, with a single skin electrode, two external contact plates on the capsule and the body as a conductor for signal transmission<sup>[9]</sup>. This effectively means that a water interface would offer a better conductive surface area and it might explain the scarcity of images from the higher part of the GI tract and -potentially- the lack of documentation of a capsule aspiration.

In a recent retrospective study, Hong *et al*<sup>[10]</sup> compared the diagnostic yield of MiroCam<sup>®</sup> and PillCam<sup>®</sup> SB capsules using the detection rates of the Z-line and the duodenal ampulla in a cohort of 141 individuals who under-

went SBCE for various clinical indications. In this cohort, the Z-line was detected in 36.9% of PillCam<sup>®</sup> videos and 47.7% of MiroCam<sup>®</sup> examinations ( $P = 0.227$ ).

It is useful to remember that the advent of real-time viewers allows us to follow the procedure from the very first steps of capsule ingestion, providing of course that images are captured during this phase. This may have clinical implications, especially when the procedure is performed in unfit, elderly patients or individuals with known swallowing difficulties, since a number of capsule aspiration cases are relatively asymptomatic<sup>[4,5]</sup>.

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