

## *The Real Estate of Small Bowel Lesions During Capsule Endoscopy; Location, Location, Location*

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The capsule endoscopic localization study by Scott et al.<sup>1</sup> in this current issue of VHJOE has once again emphasized the propensity of small bowel vascular lesions, thought to be involved in obscure gastrointestinal bleeding, to congregate within the proximal landscape of the midgut. The principal aim of the study was to examine the distribution of lesions found during capsule endoscopy within the small bowel in patients undergoing investigation of obscure bleeding. In 75% of their subjects, the indication was primarily persistent iron deficiency anemia while the remaining 25% had overt bleeding. The vast majority (80%) of the 135 subjects studied in this single-reader, retrospective analysis was felt to have angioectasia or red spots as the likely etiology of their obscure bleeding while the remainder had ulcers/erosions or tumors and non-small bowel sources. Although the percentage of vascular etiology seems high, the authors point out the possible effect of including red spots in the overall analysis. However, even if red spots were excluded, 56% of the subjects were felt to be bleeding from angioectasia.

Furthermore, in the included pilot study, 13 patients whose surgically documented lesion location was compared to their previous capsule endoscopy location using a quartile system demonstrated a reasonable accuracy. Employing this system of localization in the main study, 55% of all angioectasias were discovered in the 1st quartile (mean transit time of each quartile of 63.5 minutes) with a p value of <0.0001. The implication of this finding is clear from a therapeutic standpoint and has been used to justify an initial enteroscopic strategy in the proper clinical setting (older age group, Caucasian, co-morbid vascular, cardiac or renal disease) where angioectasia is common. In fact, the average age in the present Australian study was 65 years old which could bias the findings to an exceptionally high proportion of vascular etiologies. However, capsule endoscopy as a primary approach to obscure bleeding has the advantage of excluding tumors, ulcerative disease, celiac disease and its complications, in addition to a general assessment of the location of lesions within the small bowel.

Localization by capsule endoscopy has helped to guide the direction of initial enteroscopic approach which could avoid unnecessary invasive procedures. Unfortunately, the accuracy of location using a fractional time technique<sup>2</sup> of a lesion's position along the linear small bowel tissue bar can be quite deceptive. As the authors point out in their discussion, capsule movement and velocity can be significantly variable within a single study due to capsule stagnation alternating with rapid transit or even retropulsion.<sup>3</sup> Fractional time technique or quartile determination, as used in the above study, has its limitations despite the promising results of the pilot results presented. Prior attempts at localization using the "Localization Module," which detects the strongest signal from any of the eight abdominal sensors at any time of travel and via an algorithm represents the information in a linear graphic display based upon distance in centimeters from the umbilicus, are often misleading or un-interpretable despite initial promising accuracy.<sup>4</sup> The future clinical usefulness of capsule

endoscopy will not be solely based on its diagnostic abilities but will also depend on its accuracy at localizing lesions for efficient, cost saving therapeutic intervention.

An innovative approach attempting to improve the accuracy of lesion location during capsule reading was recently introduced as part of the newest upgrade of reading software from Given Imaging, Inc. (Yoqneam, Israel). Rapid 6®, unlike previous versions, which also included the Localization Module and the linear tissue bar based on time traveled, introduces a visual “Progress Indicator” which provides a percentage value of viewing progress compared to actual time elapsed from the first small bowel image (**Figures 1 and 2**). Progress of capsule movement and velocity throughout the small bowel is evaluated by a software image algorithm which ideally translates relative position into a percentage value of the amount of small bowel examined at any time along the tissue bar. The program is activated once the 1st small bowel and cecal landmarks are determined, therefore defining the small bowel segment. If the capsule moves slowly through a region of the small bowel, whether mechanical or functional, the percentage examined (“Progress”) will fall behind the associated percentage of time elapsed along the tissue bar which is necessarily linear. Conversely, if transit time is rapid, the percentage viewed will exceed the fractional segment of small bowel examined as determined by the time depicted by the tissue bar. Although the reliability and accuracy of this computer algorithm and therefore its utility has yet to be scrutinized in clinical studies, the theoretical potential of such a reading tool could further fine tune localization within a tertile or quartile by accounting for variable velocity.

An extreme example of separation between percentage examined and time elapsed along the tissue bar would be capsule transit delay at a stricture (**Video 1**). In this instance, the actual percentage examined will theoretically stall while the total percentage of small bowel time will continue along the linear time scale. The result is increasing fractional separation until capsule movement resumes. Such an observation by the capsule reader would call attention to the need to adjust the potential location of subsequent findings.

The accuracy of lesion location is particularly important for subsequent therapeutic intervention, histologic interrogation, or pre-operative marking by enteroscopic approaches. As balloon-assisted enteroscopy is a time consuming, relatively invasive, highly skilled procedure and may involve patient travel due to its lack of widespread availability, confidence in the initial approach (antegrade or retrograde) is of paramount importance.<sup>5</sup> Avoiding the need for a bidirectional procedure, which is often performed on separate days, saves morbidity, time and expense. Instances of significant Regional Transit Abnormality (RTA) could render the accuracy of a time-based quartile system ineffective and misleading resulting in a possibly incorrect initial enteroscopic approach.

The use of a quartile system by Scott et al. in their small surgical pilot study shows encouraging localization accuracy possibly due to less variable travel from the large percentage of non-obstructing mass lesions and no inflammatory stricturing disease. A larger, prospective examination of various types of lesions using this system as well as comparative investigations regarding the clinical utility of the new Given Imaging software in Rapid 6® are certainly desired.

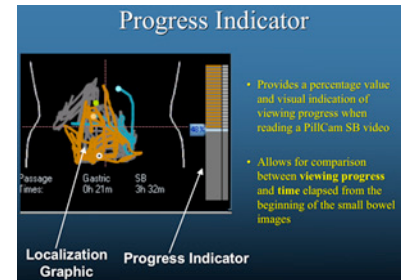


Figure 1:

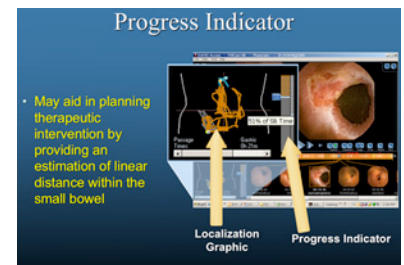


Figure 2:



Video Clip 1



Video Clip 2

## References

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