

ADVANCES IN ENDOSCOPY

Current Developments in Diagnostic and Therapeutic Endoscopy

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The Use of Cecal and Terminal Ileal Images for Verifying the Completion of Colonoscopy

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G&H What is the optimal modality for documenting colonoscopy completion?

NP The purpose of documenting colonoscopy completion is to provide objective evidence in an individual case that complete examination of the colon has been performed. It is desirable that the selected method is safe, easy to perform, and capable of convincing independent reviewers that colonoscopy completion has been achieved. Potential modalities include static cecal images, real-time video recording (of all or part of the procedure), static terminal ileal images, and terminal ileal biopsies. Fluoroscopic and other radiologic techniques have also been used in the past and in research settings, but they are seldom employed in routine practice.

In recognition of the demand for documentary evidence of colonoscopy completion, both the American Society for Gastrointestinal Endoscopy (ASGE) and the European Society of Gastrointestinal Endoscopy (ESGE) have published guidelines on suitable targets for quality control. However, the evidence regarding the optimal modality is poor; furthermore, there is a lack of consensus on this issue among practitioners. Despite the relative paucity of evidence in its favor, both the ASGE and the ESGE currently recommend still images of the cecum as the preferred modality for documenting colonoscopy completion; consequently, this is the most commonly employed modality used by colonoscopists. Photographs

that depict recognizable landmarks, such as the ileocecal valve (ICV), triradiate fold, and appendiceal orifice (AO), are favored.

G&H What are the advantages and disadvantages of using cecal images compared to terminal ileal images for verifying the extent of colonoscopy?

NP Real-time recognition of the cecum is relatively straightforward in most colonoscopies. However, it is increasingly evident that capturing representative still images is more difficult. The triradiate fold can be mistaken for more proximal areas of the colon, such as the hepatic flexure, and unless the AO is captured in the same still image as surrounding structures, the AO may also be less compelling than it appears in real time. The ICV is the most compelling image to capture, but only when photographs depict the valve en face with open lips or “volcanic” morphology (Figure 1). Occasionally, ICV images can be difficult to capture, and anatomic variants, such as thin-lipped valves or valves facing away from the visual field, sometimes fail to convincingly depict the cecum.

On the other hand, terminal ileal images that illustrate villi have a high likelihood of convincing independent reviewers that a complete colonoscopy has been performed. In 2 separate prospective studies, my colleagues and I showed that terminal ileal images are superior to cecal images and are comparable to terminal ileal biopsy (which provides unequivocal proof of ileal intubation). Critics of this modality might argue that attempting to intubate the terminal ileum in every patient, even when it is not clinically indicated, will unnecessarily prolong pro-

cedure times. However, data from a number of studies, including our own, suggest that this is not the case. The impact on procedure time is minimal, and endeavoring to intubate the terminal ileum also serves to improve technique, such that when intubation of the terminal ileum is clinically indicated, the endoscopist is more likely to be successful.

In our second study, terminal ileal intubation was harder to accomplish in technically more demanding cases, which included patients with diverticulosis, older patients, and patients in whom intubation of the cecum was prolonged. In our study, terminal ileal intubation was abandoned (unless clinical need dictated otherwise) if it could not be achieved within 5 minutes of cecal intubation.

With regard to other modalities, acquisition of a terminal ileal biopsy has been discouraged because of theoretical concerns regarding the transmission of new variant Creutzfeldt-Jakob disease and because sample processing may be prohibitively expensive. Real-time video recording is likely superior to static cecal imaging, but widespread adoption remains unlikely until recording equipment is more widely available.

G&H Have there been any studies comparing cecal images with other modalities, including terminal ileal images?

NP To date, there has been relatively little research in this area. One of the key messages emerging from the few studies that have been conducted thus far is that static cecal images are frequently ineffective for the purpose of colonoscopy verification. It is also evident that many colonoscopists do not routinely strive to record documentary evidence of colonoscopy completion, perhaps because they have little faith in the effectiveness of cecal images for this purpose.



Figure 1. A still image of the cecum depicting an ileocecal valve (ICV). Images showing an ICV with open lips, “volcanic” morphology, or an obvious ICV “notch” (as seen in this image) are frequently viewed favorably by independent reviewers.

In terms of prospective data comparing cecal images with other modalities, it is likely that both real-time video capture and terminal ileal images are superior to cecal images, but additional studies in routine clinical practice are required to confirm these findings. Although no prospective studies other than our own have compared terminal ileal images with cecal images, a study by Hurlstone and colleagues retrospectively assessed terminal ileal images versus cecal images and was unable to show superiority of terminal ileal images. Importantly, accentuation of villi by water instillation was not routinely performed in this study. Notably, in the few cases where water instillation was performed, reviewers were more likely to be convinced that ileal intubation had occurred.

G&H Could you discuss the study you and your colleagues conducted to compare cecal and terminal ileal images?

NP We conducted a prospective, observational study in routine clinical practice. Gastroenterology consultants and trainees were instructed to take representative images of the cecum and the terminal ileum in over 200 consecutive procedures. The acquired images were then assessed by independent reviewers who completed a questionnaire designed to gauge how convinced they were that total colonoscopy had been achieved based on the provided documentary image. We also recorded the amount of time it took to intubate or to attempt to intubate the terminal ileum, the need for additional sedation in cases where a prolonged attempt to intubate the terminal ileum was undertaken, and other safety parameters.

The most important finding was that terminal ileal images consistently outperformed cecal images among all reviewers. Endoscopists were able to intubate the terminal ileum in 87% of cases, and the median time taken to intubate the terminal ileum was 1.24 minutes (although endoscopists were instructed to stop trying after 5 minutes unless it was clinically indicated). Extra sedation was not required, and no adverse events were recorded in patients who underwent prolonged attempts to intubate their terminal ileum. Importantly, all prolonged attempts to intubate the terminal ileum were motivated by clinical need (eg, abnormal terminal ileal imaging prior to the procedure), rather than the desire to capture a documentary image. We concluded that terminal ileal intubation and image capture could be reliably achieved in the majority of cases, with little impact on overall procedure time. Furthermore, the documentary image acquired of the ileal mucosa was considered more convincing of procedure completion than a cecal image acquired from the same patient.

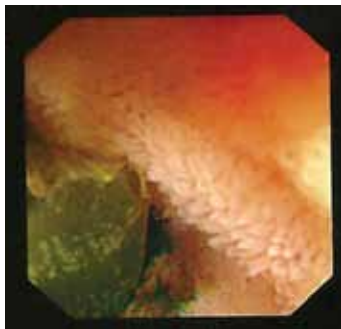


Figure 2. A still image of the terminal ileum showing villi. Prior to taking this photograph, 50 mL of sterile water was instilled via the biopsy channel to accentuate the “frond-like” appearance of villi. Such images are highly likely to convince independent reviewers that ileal intubation has been accomplished (and, hence, that the entire colon has been intubated) during the procedure.

G&H What methods can be used to highlight surface anatomy of the bowel while obtaining cecal or terminal ileal images?

NP Instilling water via the biopsy channel to accentuate villi in the terminal ileum is highly effective and crucial for the effectiveness of this modality (Figure 2). Although studies have yet to be performed looking at chromoendoscopy or narrow-band imaging of the terminal ileum for the purpose of documenting procedure completion, both methods have been shown to enhance identification of villi, even to the point of defining individual villi and their characteristic microvascular patterns. However, this process typically requires *in vivo* magnification. The advantage of water instillation is that it is available in all endoscopy units and does not require additional equipment or reagents. In order for terminal ileal photodocumentation to become the standard-of-care modality for documenting complete colonoscopy, it must be possible to use this technique in all endoscopy units without needing any additional colonoscopy equipment beyond the standard components. It is, of course, important that quality assurance methods keep pace with evolving technologies, and it is foreseeable that new methods for documenting villi will be recommended in the future.

G&H Should the AO be used as a landmark in still images for identifying the cecum?

NP The AO is a reliable landmark for identifying the cecum, particularly when viewed in real time and interpreted in the context of other surrounding features, such



Figure 3. A still image of the appendiceal orifice. Unless surrounding structures, such as the ileocecal valve or the triradiate fold, are clearly visible in the same static image, some reviewers are unconvinced that the image truly depicts the cecum.

as the triradiate fold and/or ICV. However, the AO may not be very useful in static images because it may be difficult to capture it in the same static image as other landmarks previously mentioned. Rex has demonstrated that images showing only close-up views of the AO without familiar surrounding structures are frequently considered to be unconvincing by reviewers. Without recognition of surrounding structures, the image by itself could be misinterpreted, perhaps as a diverticulum (Figure 3).

G&H What ileal intubation rates have been reported in studies?

NP Iacopini and associates reported an ileal intubation rate exceeding 80% after performing 50 procedures, even among trainees, which appears quite impressive. However, it is important to stress that all of the trainees in this study were already competent colonoscopists. The purpose of the study was to evaluate the learning curve in blocks of 10 consecutive colonoscopies when a dedicated attempt to intubate the terminal ileum was mandated in every procedure. Therefore, gastroenterology trainees who were already independent colonoscopists could achieve a high level of competence in terminal ileal intubation in a relatively short time (by the 5th block of 10 colonoscopies) if they attempted to do so in every procedure they performed.

In our study, established specialists achieved a slightly higher terminal ileal intubation rate than trainees (92% vs 82%), although this difference did not achieve statistical significance. It should also be noted that these figures do not represent absolute terminal ileal intubation rates, as

our protocol excluded incomplete procedures from the outset. Therefore, these terminal ileal intubation rates reflect the ability of the colonoscopists to intubate the terminal ileum if they had already successfully intubated the cecum.

G&H What other methods could be used as quality measures for colonoscopy?

NP Photodocumentation of procedure completion represents only a small part of quality assurance. In order to continue the improvement of service to patients, as well as improve our own performance as endoscopists, it is necessary to develop additional meaningful measures of proficiency. Recently, withdrawal time has been shown to have an impact on diagnostic yield; accordingly, it could be argued that an objective record of withdrawal time should be used as a quality indicator in colonoscopy practice. Other clinically relevant measures of endoscopy performance might include adenoma detection rate, polyp retrieval rate, colonic biopsy rate in patients with diarrhea, and duodenal biopsy rate in patients with iron-deficiency anemia. Smarter and more clinically meaningful quality indicators can only improve our practice and benefit our patients.

G&H What are the next steps in research?

NP It is important to conduct additional studies comparing cecal images with terminal ileal images or other

modalities (such as real-time video capture), particularly in the context of routine clinical practice at centers that are not main teaching units.

I also think that colonoscopists would be motivated to acquire better documentary evidence to verify their completion rates if research in this area was able to identify harder endpoints. For instance, an important driver for change might come from research directed at showing a reduction in medical errors or an improvement in patient satisfaction in cases where convincing evidence of colonoscopy completion had been documented.

Suggested Reading

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