

# ADVANCES IN ENDOSCOPY

Current Developments in Diagnostic and Therapeutic Endoscopy

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## Narrow-Band Imaging for Detection and Differentiation of Colonic Lesions

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**G&H** Could you outline how narrow-band imaging is used to detect colonic lesions?

**ED** The narrow-band imaging (NBI) system consists of a specialized endoscope and processor. It uses filters that produce short wavelength (essentially blue) endoscopic light, which penetrates the mucosa only superficially and is mainly absorbed by hemoglobin. Therefore, this technique highlights mucosal surface patterns and microvascular details. The enhanced contrast provided by NBI can, theoretically, improve the detection of small and subtle lesions, as well as helping in the differentiation of lesions. Accurate differentiation during endoscopy has the advantage of allowing decisions to be made regarding therapy during the actual endoscopic procedure. Using this system, the regular (white-light endoscopy) and NBI filters can be changed by pressing a button on the handle of the endoscope at any time, at the discretion of the endoscopist.

**G&H** How does NBI compare to standard colonoscopy in terms of adenoma detection rates?

**ED** There have been quite a few studies on this subject, and recently, even more data have been added to the literature. In a recent systematic review, data on the performance and clinical utility of NBI during colonoscopy were summarized. For now, the three largest randomized trials directly comparing adenoma detection rates by NBI with white-light endoscopy have shown that the detec-

tion rate of adenomas is not improved by the use of NBI. Only one out of the three randomized trials demonstrated a significant increased detection rate of adenomas with NBI, but the method of allocation of NBI endoscopies in this trial raised concerns: most of the NBI endoscopies were performed by only one specialized endoscopist, suggesting an important bias.

The two other studies were interesting as well. Rex and Helbig could not demonstrate an increased detection rate (both per lesion and per patient) by NBI in a large randomized study of 434 patients. Adler and associates performed a study in 401 patients and showed an increased adenoma detection rate only in the initial phase of the study that was equalized in the later phase of the study, when more experience was gained with NBI. The authors postulated that these findings suggest a learning effect, as the difference disappeared in the second half of the study.

A second study was recently conducted by this group as well that questioned whether endoscopists with limited experience could achieve benefit with NBI. Again, this study did not show any improvement in adenoma detection with NBI.

Thus far, for the general indications of colonoscopy such as screening in symptomatic patients, NBI does not show any improvement in the detection rate of adenomas. However, for certain subgroups such as patients with hereditary nonpolyposis colorectal cancer (HNPCC) or patients with ulcerative colitis who are under surveillance for dysplasia, more studies are needed.

**G&H** Has there been any research specifically examining this system for use with flat or depressed lesions that are not visible or are difficult to detect with traditional colonoscopy?

**ED** Several case reports have been published on the detection of flat or depressed lesions with NBI. However, improved detection of these lesions has not been demonstrated in randomized studies. A study performed by East and associates in patients with HNPCC showed that more flat lesions were detected with NBI, but in this study, there was no randomization and NBI was always performed for the second pass. Additional studies are needed to prove or disprove this theory.

**G&H** Is NBI more effective at differentiating neoplastic lesions from non-neoplastic lesions?

**ED** For now, it has been proven that NBI has a competitive high sensitivity and specificity for differentiation of lesions. In fact, this system has an overall sensitivity of 92% and specificity of 86%, which is comparable to chromoendoscopy in terms of differentiation, but not detection. (Unlike NBI, chromoendoscopy has also demonstrated a benefit in the detection of lesions.) These sensitivity and specificity rates are quite good, so it is reasonable to conclude that NBI is quite effective for this indication. However, 8% of adenomas will still be misdiagnosed as non-neoplastic, and this might have consequences for the decision of whether or not to perform a polypectomy.

**G&H** In addition to its limited ability to detect lesions, what other drawbacks are associated with the use of NBI in colonic lesions?

**ED** The main limitation is certainly its lack of efficacy in detecting lesions. The other most significant drawback, in my opinion, is the relatively dark light of the system; the filter used makes the entire image appear much darker, hindering any detection ability. Furthermore, if the colon preparation has not been effective enough and leaves some fecal material or fluids in the colon, this further obscures the endoscopist's vision due to the superficial imaging of NBI. However, for a good-quality colonoscopy with white light, the bowel preparation should be optimal as well.

**G&H** Could you discuss the learning curve associated with the use of this system?

**ED** Apart from the studies from Adler and coworkers, the learning curve of the use of NBI has not been very well described. As previously mentioned, the Adler study very nicely suggests a learning curve. In the second phase

of the study, the endoscopists also improved in adenoma detection rates using white-light endoscopy, showing that NBI likely improves visualization in white-light endoscopy as well (and the endoscopist has learned what to look for).

**G&H** How widespread has adoption of this system been in the average practice?

**ED** NBI has become quite popular and frequently used by both academic and community gastroenterologists. The rapid, widespread adoption of the system has been somewhat surprising to me, as it has not been clearly demonstrated in randomized controlled trials that detection of colonic lesions is improved at all with its use. It does, however, involve added costs. Although NBI has been shown to be effective for the differentiation of lesions, it is likely that many community gastroenterologists are using the system for more than this indication. In my opinion, it would be preferable if a new and more expensive endoscopy system is first shown to have a clear improvement in clinical practice before it is adopted into daily clinical practice.

**G&H** What are the next steps for research in this area?

**ED** As mentioned above, quite a few studies have been performed for the indications of general screening in symptomatic patients that did not show any improvement in detection. Large multicenter trials need to be conducted in more specific subgroup populations such as Lynch syndrome patients with a high risk of developing colorectal cancer and patients with long-standing ulcerative colitis who require dysplasia screening. One study has been performed thus far to examine the latter issue and did not show an improved detection of neoplastic lesions, but additional studies are now underway using new-generation NBI technology. The first study was conducted with the earlier NBI endoscope.

The Endoscopic Trimodal Imaging (ETMI) system, which uses high-resolution white-light endoscopy, NBI, and autofluorescence imaging, all in one combined system, is an interesting and promising device currently being investigated in several studies. With this system, all three techniques can be used for detection and differentiation of lesions.

Other interesting fields for research comprise further examination of the learning curve for the use of NBI, particularly for the differentiation of polyps. In addition, it might be interesting to conduct a cost-effectiveness analysis for this indication. There have been no such studies performed as of yet.

## Suggested Reading

van den Broek FJ, Reitsma JB, Curvers WL, Fockens P, Dekker E. Systematic review of narrow-band imaging for the detection and differentiation of neoplastic and nonneoplastic lesions in the colon (with videos). *Gastrointest Endosc*. 2009;69:124-135.

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