ENDOSCOPY

High Accuracy of Narrow Band Imaging Without Magnification for the Real-Time Characterization of Polyp Histology and Its Comparison With High-Definition White Light Colonoscopy: A Prospective Study

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OBJECTIVES: **Standard white light colonoscopy has limited ability to differentiate between polyp types (adenomatous vs. hyperplastic). Narrow band imaging (NBI) highlights the superficial mucosal/vascular patterns on polyps and may facilitate real-time characterization of polyp histology. The aim of this study was to prospectively evaluate and compare the diagnostic characteristics of high-definition white light colonoscopy (HDWL) and NBI without magnification in the real-time prediction of polyp histology (adenomatous vs. hyperplastic) by evaluating the surface mucosal and vascular patterns.**

METHODS: **We conducted a prospective comparative study in a tertiary referral center. A total of 100 patients referred for screening or surveillance colonoscopy were prospectively enrolled and underwent colonoscopy using a high-definition colonoscope with NBI capability. Every polyp detected was initially evaluated with HDWL followed by NBI for the presence of surface mucosal/vascular patterns. Based on these patterns, polyp histology was predicted by both modalities. The main outcome measurements were: (i) diagnostic characteristics of HDWL and NBI in predicting polyp histology and (ii) impact of polyp size and learning effect (first half of study vs. second half) on the ability of NBI to predict adenomas.**

RESULTS: **A total of 236 polyps were detected in 100 patients—143 adenomas, 77 hyperplastic, and 16 others. Surface patterns (type A: hyperplastic; type B: adenomatous) were recognized in all polyps with NBI (100%) compared to 45% with HDWL. For predicting adenomas, NBI had a significantly higher sensitivity and greater accuracy (96 and 93% respectively) compared with HDWL (38 and 61% respectively) (all $P<0.0001$). Although the accuracy of NBI for predicting adenomas improved with increasing polyp size (≤5 mm; 6–9 mm; ≥10 mm) and in the second half compared with the first half of the study, these differences were not statistically significant.**

CONCLUSIONS: **Using a simple surface mucosal/vascular pattern classification, NBI without magnification was highly accurate and significantly superior to HDWL for the real-time prediction of adenomas.**

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INTRODUCTION

Colorectal cancer is the third most common cancer in both men and women and the second most common cause of cancer-related deaths in the United States. It is estimated that there will be approximately 149,000 newly diagnosed cases of colorectal cancer and about 50,000 colorectal cancer-related deaths in the year 2008 (1). Most colorectal cancers arise from preexisting adenomatous polyps, following the adenoma–carcinoma sequence (2,3). The other major type of colon polyps are the hyperplastic polyps that do not have a malignant potential except for the sessile serrated lesions that are considered to be the precursors of the microsatellite instable cancers (4). Colonoscopy with polypectomy of neoplastic polyps has been shown to reduce the risk of future colorectal cancer (5) and this procedure is considered by most as the gold standard for the detection and removal of colon polyps. However, standard colonoscopy is limited in its ability to distinguish between adenomatous and hyperplastic polyps and this necessitates the indiscriminate removal of all polyps detected during the procedure. This practice imposes an unnecessary economic cost burden (equipment used for polypectomy and histopathological analysis). It also results in futile resource utilization (time of endoscopist, endoscopy technician and pathologist) and risks associated with potentially avoidable polypectomies. Incorporation of a technique during standard colonoscopy that can accurately differentiate between adenomatous and hyperplastic polyps real time during the procedure is thus desirable.

Chromoendoscopy, that involves spraying dye over the colonic mucosa, is routinely utilized by Japanese endoscopists for differentiating between polyp types. Kudo *et al.* (6) described pit patterns (type I to type V) on polyp surface, using magnification chromoendoscopy, that had a high degree of accuracy for polyp differentiation along with good inter- and intra-observer reproducibility (7). However, in spite of being widely accepted in Japan, chromoendoscopy has remained restricted mainly to the research arena in the United States, as it is considered to be cumbersome, time consuming, and labor intensive. Narrow Band Imaging (NBI), also referred to as "electronic chromoendoscopy" provides a unique opportunity for the evaluation of surface mucosal and vascular patterns on polyps with the potential for *in vivo* histological diagnosis. This technique utilizes special narrow band filters in the endoscopic system that highlights the superficial vasculature and mucosal pattern on the polyps. The use of NBI has recently been reported for the characterization of colon polyps with encouraging results, but whether it performs better than high-definition white light colonoscopy is not clearly known (8–10). Moreover, few studies have evaluated NBI without optical magnification. In a pilot study, we have reported on a simple classification system based on the surface mucosal/vascular patterns visualized on polyps with NBI without magnification (11) that correlated accurately with polyp histology (that is, adenoma vs. hyperplastic). Furthermore, advances in miniaturization and specialized design of charged couple device chip have allowed for the development of high-definition colonoscopes. These charged couple device chip have a three-fold greater pixel density than standard definition and along with a high-definition video processor and high-definition monitor produce a high-definition image with 1080 effective scan lines.

The primary aim of this study was to prospectively evaluate and compare the diagnostic characteristics of high-definition white light colonoscopy (HDWL) and NBI without optical magnification in predicting polyp histology (adenomatous vs. hyperplastic) by using a simple, previously reported classification system in a large number of colon polyps (real time). The secondary aim was to study the impact of polyp size and learning effect on the diagnostic characteristics of NBI.

METHODS

Study population

This prospective, single-blinded study was conducted at the Kansas City Veterans' Affairs Medical Center and was approved by the local Institutional Review Board. Patients referred and already scheduled for screening or surveillance colonoscopy were enrolled and written informed consent was obtained from all patients. Inclusion criteria were referral for screening or surveillance colonoscopy and the ability to provide informed consent. Exclusion criteria were previous surgical resection of any part of the colon, previous history of colon cancer, inflammatory bowel disease, use of anti-platelet agents or anticoagulants that precluded removal of polyps, poor general condition or any other reason to avoid prolonged procedure time, history of polyposis syndrome or HNPCC or the inability to give informed consent.

Colonoscopy procedure

After undergoing a standard colonic preparation with polyethylene glycol-based lavage solution, patients were sedated with intravenous midazolam and meperidine or fentanyl. All colonoscopies were performed by a single experienced endoscopist (AR).

A standard, commercially available high-definition colonoscope with NBI capability (CF-H180AL, Olympus America, Center Valley, PA) was used for all procedures (no optical magnification). After cecal intubation, the colonic mucosa was carefully visualized with HDWL during withdrawal of the colonoscope. All polyps detected during the procedure were documented for their size, location, and morphology (sessile, pedunculated, and flat). The size was estimated by comparison with an open biopsy forceps or the sheath of a polypectomy snare placed against the polyp, whereas the location was estimated by the anatomic landmarks. For each polyp, before removal, the surface was assessed for the surface mucosal and vascular patterns, initially with HDWL and then with NBI. As previously reported by our group (11,12), the polyp surface patterns were classified as:

Type A (suggestive of hyperplastic)

- fine capillary network alone but absent mucosal pattern (**Figure 1**)

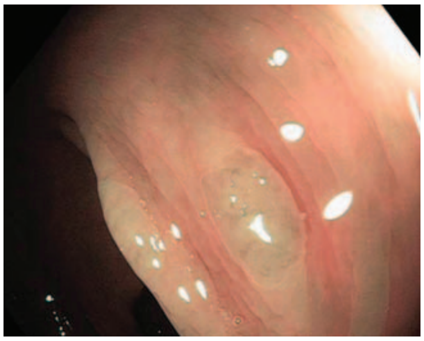

Figure 1. Fine capillary network alone but absent mucosal pattern.

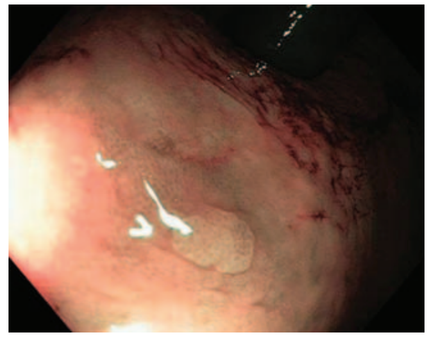

Figure 2. Circular pattern with dots—pattern with central dark area surrounded by clear lighter area.

- circular pattern with dots—pattern with central dark area surrounded by clear lighter area (**Figure 2**).

OR
Type B (suggestive of adenomas)

- round/oval pattern—central light area surrounded by dark outer area (**Figure 3**)
- tubulogyrus pattern—presence of tubules, either linear or convoluted (**Figure 4**)

Polyps with surface patterns not described above were classified in the miscellaneous category, whereas if a clear pattern was not visualized, then the "not identified" category was selected. If a surface pattern was not identified, then the histology could not be predicted by that imaging modality; guessing or predicting the histology based on polyp features other than surface patterns (such as location, size, and morphology) was not permitted. Polyps with both a type A and type B pattern were classified in the type B (adenoma) category. If the different patterns on a polyp were suggestive of the same histological type, then the predominant pattern was selected.

For all polyps, the histology was predicted real time with both HDWL and NBI separately based on the surface mucosal and vascular patterns identified by the respective techniques. Photo documentation of the surface patterns of the polyps was performed. Polyps were then removed with a biopsy forceps or snare and sent for histopathological examination, each in a separate jar that were appropriately labeled and numbered. Thus each jar had a single polyp whose mucosal/vascular pattern and predicted histology (with both HDWL and NBI) had been recorded. A standardized case report form was used for each procedure. The polyps were reviewed by histopathologists who were blinded to the colonoscopy findings. The histopathological assessment of the polyps was performed as per the Vienna classification.

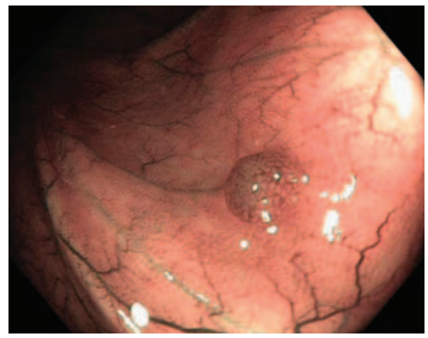

Figure 3. Round/oval pattern—central light area surrounded by dark outer area.

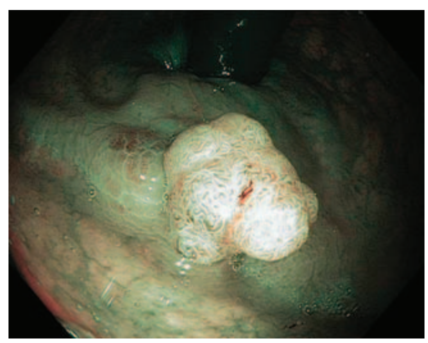

Figure 4. Tubulogyrus pattern—presence of tubules, either linear or convoluted.

Outcome variables

The outcome variables included:

- percentage of polyps in which the surface mucosal/vascular patterns were identified by each HDWL and NBI
- sensitivity, specificity, and accuracy in predicting polyp histology with HDWL and NBI
- the diagnostic characteristics of NBI for predicting adenomas across different polyp sizes (≤5 mm vs. 6–9 mm vs. ≥10 mm) and the learning effect that is, the first half vs. the second half of the study

Sample size calculation and statistical analysis

Assuming that the accuracy of HDWL in predicting polyp histology was 80% and that of NBI 90%, a sample size of 180 polyps was required to detect this difference with 80% power and an alpha of 0.05. In our previous colonoscopy study (11), 72 polyps were detected with HDWL in 40 patients. Therefore, we projected that a sample size of 100 patients would be sufficient to detect 180 polyps. The predicted histology (by surface mucosal/vascular patterns) and the actual polyp histology were compared to determine the sensitivity, specificity, and the accuracy of HDWL and NBI. McNemar's test was used to compare the diagnostic characteristics of both HDWL and NBI separately. The diagnostic characteristics of NBI for predicting adenomas across different polyp sizes and in the first 50 patients vs. the second 50 patients (learning effect) were compared by the two-sample test for proportions. A P value < 0.05 was considered to be statistically significant.

RESULTS

Patients

A total of 101 patients were prospectively enrolled; 100 completed the study and one was excluded due to inadequate bowel preparation. The mean age of the study population was 63 years; 97 male and 3 female patients. Seventy-nine patients were Caucasians and 21 were African Americans. The indication for the procedure was screening for colorectal cancer in 63 and surveillance for polyps in 37 patients. The cecum was successfully intubated in all but one patient (99%).

Polyps

A total of 236 polyps were detected in 100 patients. The distribution of the polyps was as follows: cecum 19 (8%), ascending colon 28 (12%), transverse colon 29 (12%), descending and sigmoid colon 78 (33%), and rectum 82 (35%). One hundred and ninety-eight polyps (84%) were Paris type 0-Is (protruded, sessile), four (2%) were Paris type 0-Ip (protruded, pedunculated) and 34 (14%) were Paris type 0-IIa (superficial, elevated). One hundred and seventy polyps (72%) were ≤5 mm in size, whereas 51 were between 6–9 mm (22%) and 15 were ≥1 cm (6%). The mean size (±s.d.) of the polyps was 4.9 mm±2.9 mm. Final histology showed that 143 polyps (61%) were adenomas (including three sessile serrated adenomas from three patients), 77 hyperplastic polyps (33%) and 16 (6%) in the others category: lymphoid nodule (1 polyp), mucosal edema (1 polyp), focal fibrosis with glandular distortion and mild chronic inflammation (1 polyp), focal dilation (1 polyp) and no diagnostic abnormality (12 polyps).

Surface pattern recognition and histology prediction with HDWL

Using HDWL, surface patterns were identified in only 107 polyps (45%) [**Figures 5–7**]. The surface patterns of the 107 polyps were: type A, 49 (15 fine capillary network with absent mucosal pattern, 34 circular pattern with dots) and type B, 58 (15 round or oval pattern, 43 tubulogyrus pattern). Based on these patterns visualized, polyp histology was predicted in these 107 polyps (hyperplastic in 49 polyps and adenomas in 58 polyps). In the remaining 129 polyps (55%) the histology could not be predicted as no surface patterns were visualized. Analysis of all polyps ($n = 236$) showed that the sensitivity and specificity of HDWL for adenomas was 38 and 97%, respectively with an accuracy of 61% (**Table 1**). The sensitivity and specificity for hyperplastic polyps was 45 and 91%, respectively with an accuracy of 76%. Analysis of polyps in which a surface pattern was identified ($n = 107$), showed a sensitivity, specificity, and accuracy of 89, 93 and 91%, respectively, for adenomas and 97, 80 and 86%, respectively, for hyperplastic polyps.

Surface pattern recognition and histology prediction with NBI

With NBI, surface patterns were identified in all 236 polyps (100%). The surface patterns identified were type A: fine capillary network with absent mucosal pattern in 26 polyps, circular with dots in 64 polyps and type B: round or oval pattern in 25 polyps, tubulogyrus pattern in 121 polyps. The predicted histology was hyperplastic in 90 and adenomatous in 146 polyps. The sensitivity and specificity of NBI for adenomas was 96 and 89%, respectively with an overall accuracy to predict adenomas of 93% (**Table 1**). NBI was significantly superior to HDWL with respect to (a) number of polyps in which a surface pattern was recognized (100 vs. 45%), (b) sensitivity (96 vs. 38%), and (c) overall accuracy for predicting adenomas (93 vs. 61%) (all $P < 0.0001$). The sensitivity and specificity of NBI for hyperplastic polyps was 92 and 88%, respectively with an overall accuracy to predict hyperplastic polyps of 89%.

All polyps were considered as independent observations in these analyses. As polyp characteristics among polyps detected in the same patient may lack independence, we calculated the diagnostic characteristics of NBI and HDWL for predicting adenomas based on just the "first" polyp detected in each patient. Polyps were detected in 69 patients. The sensitivity, specificity, and accuracy of HDWL for predicting adenomas in these 69 polyps was 33% (95% CI: 20–46%), 95% (95% CI: 75–100%), 51% (95% CI: 38–63%), respectively. The sensitivity, specificity, and accuracy of NBI for predicting adenomas in these 69 polyps was 94% (95% CI: 83–99%), 80% (95% CI: 56–94%) and 90% (95% CI: 80–96%). For the first polyp detected in each patient, the sensitivity and accuracy of NBI for adenoma prediction was significantly superior to that of HDWL ($P < 0.0001$).

Impact of the size of polyp and learning effect on ability to predict adenomas by NBI

The diagnostic characteristics of NBI to predict adenomas across different polyp sizes (≤5 mm, 6–9 mm, ≥10 mm) are summarized in **Table 2**. Although no statistically significant differences were seen across polyp sizes, the sensitivity, specificity, and accuracy of NBI to predict adenomas improved numerically as the size of the polyp increased. Similarly, the diagnostic characteristics of HDWL were not statistically different across different polyp sizes (**Table 3**). Furthermore, the diagnostic characteristics of NBI and HDWL for predicting

Figure 5. No obvious surface pattern seen with high definition white light (top image) on the polyp and tubulogyrus pattern seen with narrow band imaging (bottom image).

adenomas were also calculated for polyps divided into ≤5 mm and ≥6 mm size categories. The sensitivity, specificity, and accuracy of NBI for predicting adenomas for polyps ≤5 mm were 95, 88 and 92%, respectively, and that for polyps ≥6 mm were 98, 95, and 97%, respectively. These differences were not statistically significant. The sensitivity, specificity, and accuracy of HDWL for predicting adenomas for polyps ≤5 mm were 33, 97, and 61%, respectively, and that for polyps ≥6 mm were 49, 95, and 62%, respectively. Again, these differences were not statistically significant.

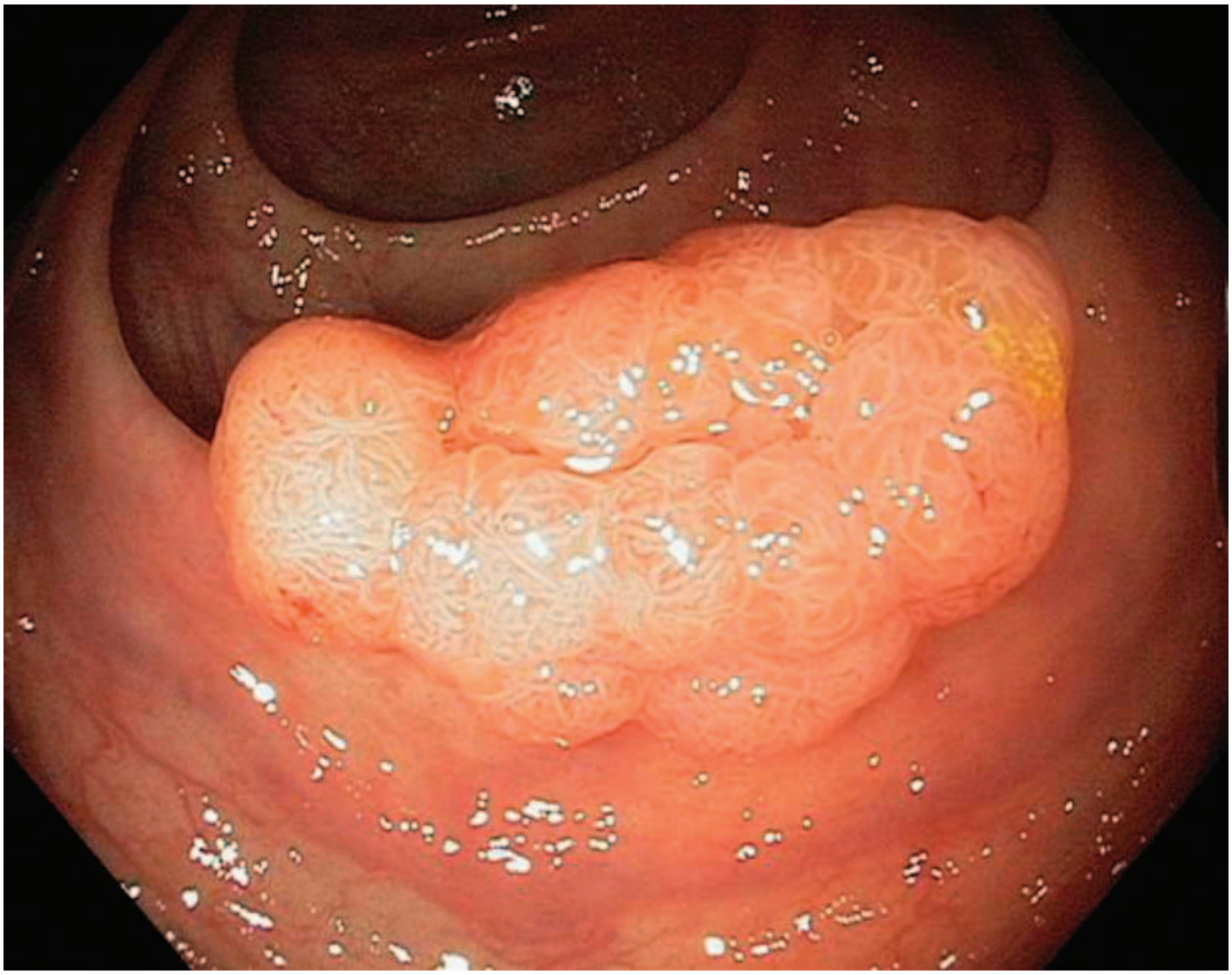

Figure 6. Tubulogyrus pattern seen with high definition white light.

Figure 7. Round/oval pattern seen with high definition white light.

Table 1. Diagnostic characteristics of HDWL and NBI colonoscopy for predicting adenomas

	HDWL	NBI	*P* value
Sensitivity (95% CI)	38% (30–45%)	96% (91–98%)	<0.0001
Specificity (95% CI)	97% (91–99%)	89% (81–95%)	NS
Accuracy (95% CI)	61% (55–68%)	93% (89–96%)	<0.0001

HDWL, high-definition white light colonoscopy; NBI, narrow band imaging; NS, not significant.

In the first half of the study ($n=50$ patients), 134 polyps were detected (mean size 4.72 mm±2.4 mm) and in the second half ($n=50$ patients), 102 polyps were detected (mean size 5.25 mm±2.5 mm). To evaluate for learning effect, the diagnostic characteristics of NBI for predicting adenomas were calculated separately in these two groups (**Table 4**). Again, although no significant learning effect was noted, the sensitivity, specificity, and accuracy of NBI for adenomas in the second fifty patients was numerically higher—only 1% of the adenomas were misclassified in the second 50 patients compared with 7% in the first 50 patients.

DISCUSSION

One of the limitations of standard white light colonoscopy is the inability to accurately distinguish between adenomatous and hyperplastic polyps. This distinction has clinical ramifications as adenomatous polyps are considered neoplastic

Table 2. Diagnostic characteristics of NBI for predicting adenomas across polyps of different sizes

	Polyps ≤5 mm (*n*=170)	Polyps 6–9 mm (*n*=51)	Polyps ≥1 cm (*n*=15)	*P* value
Sensitivity (95% CI)	95% (88–98%)	97% (84–100%)	100% (77–100%)	NS
Specificity (95% CI)	88% (78–94%)	94% (73–100%)	100% ([a])	NS
Accuracy (95% CI)	92% (87–95%)	96% (87–99%)	100% (78–100%)	NS

NBI, narrow band imaging; NS, not significant.
[a]NA due to small sample size.

Table 3. Diagnostic characteristics of HDWL for predicting adenomas across polyps of different sizes

	Polyps ≤5 mm (*n*=170)	Polyps 6–9 mm (*n*=51)	Polyps ≥1 cm (*n*=15)	*P* value
Sensitivity (95% CI)	33% (24–44%)	42% (25–61%)	64% (35–87%)	NS
Specificity (95% CI)	97% (91–100%)	94% (73–100%)	100% (*)	NS
Accuracy (95% CI)	61% (53–69%)	61% (46–74%)	67% (38–88%)	NS

HDWL, high-definition white light colonoscopy; NS, not significant.
[a]NA due to small sample size.

Table 4. Diagnostic characteristics of NBI for predicting adenomas in the first half vs. second half of the study

	First 50 patients (number of polyps=134)	Second 50 patients (number of polyps=102)	*P* value
Sensitivity (95% CI)	93% (84–98%)	99% (93–100%)	NS
Specificity (95% CI)	89% (79–95%)	90% (73–98%)	NS
Accuracy (95% CI)	91% (85–95%)	96 (90–99%)	NS

NBI, narrow band imaging; NS, not significant.

whereas hyperplastic polyps (with the exception of sessile serrated adenomas) are deemed not to have a malignant potential. Although removal of adenomatous polyps disrupts the adenoma–carcinoma sequence and protects against the development of colorectal cancer, hyperplastic polyps can potentially be left behind without deleterious consequences. With real-time identification of polyp type during colonoscopy, removal of hyperplastic polyps could be avoided leading to improved efficiency of colonoscopy by decreasing procedure duration, costs and risk of complications. These are significant advantages in this era of cost containment, decreasing reimbursements for procedures and strained professional resources.

We have previously reported a simple classification system based on polyp surface mucosal and vascular patterns with NBI (without magnification) that correlated well with histology (11). We have also evaluated the inter- and intra-observer agreement for the recognition of these patterns by endoscopists without previous NBI colonoscopy experience (12). The inter-observer agreement for polyp surface patterns was moderate (kappa = 0.57) and for prediction of polyp type was substantial (kappa = 0.63). These preliminary findings from our unit suggested that the described NBI patterns were reproducible, easy to learn, reasonably accurate and with the potential for the real-time differentiation of colon polyps. The goal of our current study was to prospectively evaluate and compare the diagnostic characteristics of NBI and HDWL colonoscopy in real-time polyp histology prediction employing the simple polyp surface pattern classification. Surface patterns were recognized in significantly higher number of polyps with NBI (100%) compared with HDWL (45%). For all polyps, the sensitivity and overall accuracy of NBI for adenoma prediction was significantly superior to HDWL; only 4% adenomas were misclassified as non-neoplastic polyps by NBI. The sensitivity and accuracy of HDWL for adenomas prediction was too low for it to be clinically useful. However, if HDWL was able to identify a polyp surface pattern, it was as good as NBI in the accurate characterization of polyp histology. Furthermore, no significant differences in the diagnostic characteristics of NBI to predict adenomas was seen across polyp sizes or in the first vs. the second half of the study. However, NBI outcomes improved as the polyp size increased and in the second half of study compared with the first half suggesting a learning effect. In fact, in the second half of the study only 1% of adenomas were misclassified as non neoplastic.

Other investigators have also evaluated the role of NBI for the identification of polyp type and/or compared it with chromoendoscopy and/or conventional colonoscopy (8–10,13,14). In these studies, NBI was shown to have a higher accuracy than conventional colonoscopy, but similar to chromoendoscopy in polyp differentiation (8–10). However, variety of complex

NBI classifications were used to differentiate adenomas from hyperplastic polyps, with some investigators using the Kudo's pit patterns (originally described for chromoendoscopy studies) whereas others have used the color of the polyp surface, contrast to the surrounding mucosa, presence of meshed capillary vessels, brown vascular meshwork or network. Given the heterogeneity between these studies, there appears to be little consensus as yet, with regards to the clinical utility of the polyp surface pattern classification with NBI. Moreover most of these studies (8,9,13,14) have used NBI with magnification—a technique not used routinely in clinical practice. Magnification colonoscopes which have the ability to magnify up to 100 times are larger in diameter, stiffer, and more expensive than the standard colonoscopes used for routine colonoscopy and are not commercially available in the United States.

Recently two studies have evaluated NBI (without magnification) for histologic analysis of colorectal polyps with the same endoscopy system as used in this current study that is commercially available in the United States (15,16). In the study by Rex (15), polyps were predicted to be adenomatous or hyperplastic with high confidence if they had one or more features associated with one histology and no features associated with the other histology. If there was uncertainty regarding the features or if there were features of both adenomatous and hyperplastic polyps, then a prediction of histology was made with low confidence. Endoscopic prediction of adenomas and hyperplastic polyps ≤5 mm in size were made with high confidence for 78 and 83% cases, respectively. These high-confidence predictions for adenomas and hyperplastic polyps ≤5 mm in size were correct for 91 and 95% cases, respectively. The NBI features suggestive of adenomatous and hyperplastic polyps reported in this study are very similar to our simplified NBI polyp classification (11) evaluated in the current project. In the second study, Rogart *et al.* (16) used the Kudo's pit pattern and vascular color intensity for polyp differentiation. For adenoma prediction, the diagnostic accuracy of NBI was 80% compared with 77% for white light ($P = 0.35$) leading the authors to conclude that Kudo's pit patterns (developed and validated for chromoendoscopy) may require modification for application with NBI. Another study evaluated the role of Kudo's pit patterns in NBI (17). A Japanese and a European endoscopist evaluated digital images of 33 polyps obtained with magnification NBI and magnification chromoendoscopy. The chromoendoscopic and NBI patterns were different in 12 of 33 polyps for the Japanese endoscopist and in 20 of 33 polyps for the European endoscopist. The combined kappa (that is, agreement) between the chromoendoscopy and NBI pit patterns was only 0.23. These studies suggest that the Kudo's pit pattern in its current form may not be entirely applicable to NBI. For future studies, consensus needs to be reached among investigators regarding the NBI surface patterns of polyps and terminologies need to be standardized.

Our study has several limitations. Although more polyps were evaluated compared with most other published studies, the total number of polyps was still relatively small. All the procedures and assessment of polyps for the surface patterns were performed by a single investigator with experience in recognition of these patterns. Involvement of multiple endoscopists would have perhaps made the results more generalizable. Although the surface pattern classification is simple and easy to remember, it nevertheless is subjective and requires some learning and practice. As the prediction of histology was performed real time during colonoscopy, investigator bias in the prediction based on the location, size and gross appearance of the polyps, and presence of other polyps cannot be excluded. As all polyps were initially evaluated by HDWL followed by NBI, an undue advantage could have been afforded to the NBI examination (sequence effect); randomization of polyp evaluation to either HDWL or NBI followed by the other modality would have been ideal. The polyp surface was assessed without any optical magnification using the current generation high-definition colonoscopes and this may be one of the factors accounting for the less than perfect accuracy. Future development of commercially available colonoscopes with optical magnification may have the potential to improve the accuracy further.

In conclusion, this study shows that NBI without magnification has a high degree of accuracy in predicting polyp histology real time using a simple pattern classification. In fact, with experience only 1% adenomas were misclassified as non neoplastic. HDWL was as good as NBI for the recognition of polyp type if a pattern was visualized. If the results of this study are reproduced and validated in large multicenter trials employing multiple endoscopists with varying levels of experience, then avoiding polypectomies of non-neoplastic polyps could become a reality in the future. With increasing demands for colonoscopy this could potentially result in enormous cost savings as well as improve the efficiency of colonoscopy.

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CONFLICT OF INTEREST

Guarantor of the article: Amit Rastogi, MD.
Specific author contributions: Conception and design of the study; performing the procedures; acquisition, analysis, and interpretation of data; and drafting of the article: Amit Rastogi; analysis and interpretation of data and statistical analysis: John Keighley; acquisition, analysis, and interpretation of data and statistical analysis: Vikas Singh; acquisition of data: Peggy Callahan; conception and design of the study and critical revision and editing of the article: Sachin Wani; conception and design of the study and critical revision and editing of the article: Ajay Bansal; conception and design of the study and critical revision of the article: Prateek Sharma.
Financial support: This study was supported by the Midwest Biomedical Research Foundation/Kansas City VA Medical Center Research Award (AR).
Potential competing interest: None.

Study Highlights

WHAT IS CURRENT KNOWLEDGE

- ✓ Standard white light colonoscopy has limited ability to differentiate between polyp types.
- ✓ Narrow band imaging (NBI) highlights the superficial mucosal/vascular patterns on polyps and may help differentiate polyp histology.

WHAT IS NEW HERE

- ✓ Using a simple surface mucosal/vascular pattern classification, NBI without magnification was highly accurate and significantly superior to high definition white light for the real-time prediction of adenomas. The accuracy of high-definition white light colonoscopy was too low for it to be clinically useful.
- ✓ There was some improvement (although not statistically significant) in the accuracy of NBI for predicting adenomas with increasing polyp sizes and in the second half of the study compared with the first half of the study.

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