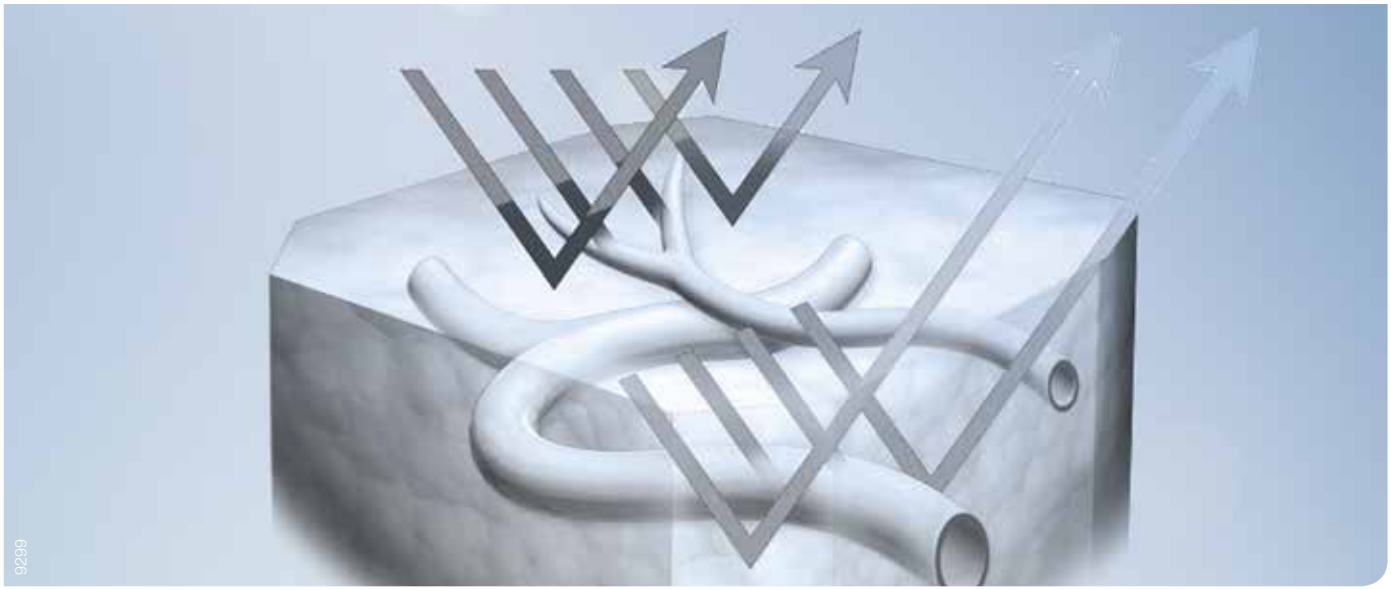
OLYMPUS

Your Vision, Our Future

NARROW BAND IMAGING (NBI)

A New Wave of Diagnostic Possibilities.



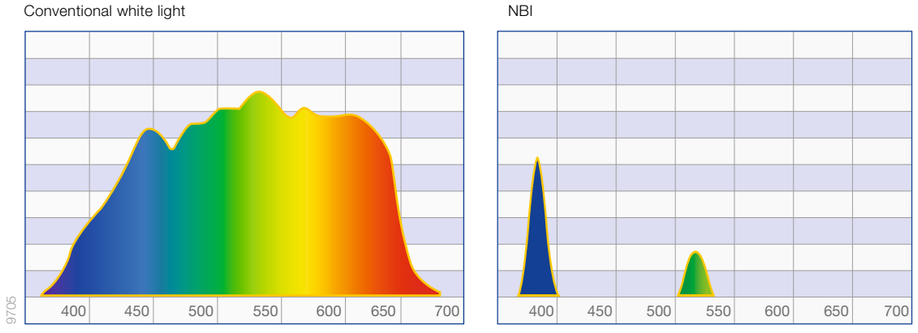
LIGHT ABSORPTION MAKES ALL THE DIFFERENCE

Olympus Narrow Band Imaging (NBI) has set a new standard for endoscopy. Now, the improved NBI with EVIS EXERA III takes imaging to a completely new level. This brochure provides an insight into this innovative technology, highlighting how NBI works and how to optimize images, plus various studies that analyze its overwhelming potential for the early detection of cancers.

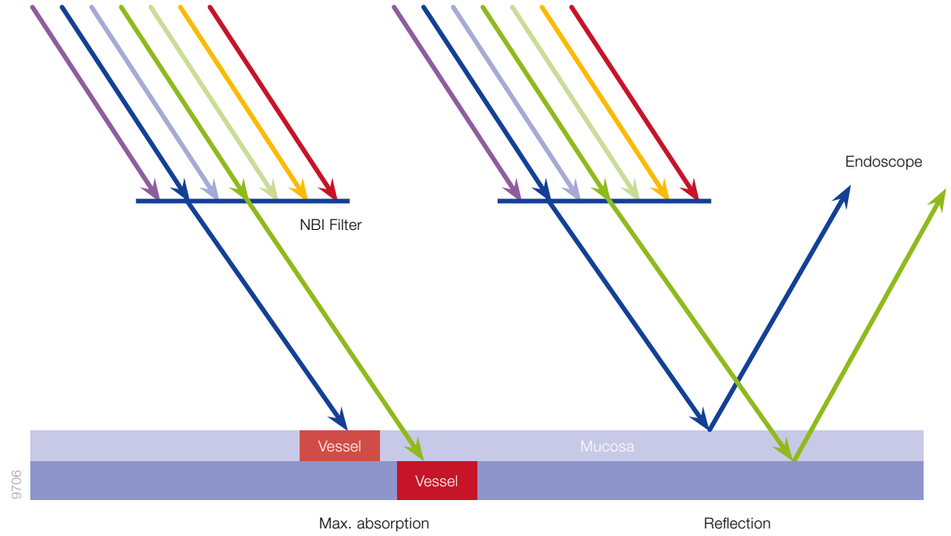
Achieve More with NBI

Being a powerful optical image enhancement technology, Narrow Band Imaging improves the visibility of blood vessels and mucosal structures. But how does it work? Narrow Band Imaging exploits certain properties of light. Light consists of a number of wavelengths. Only a small section of the whole light spectrum is visible. The human eye perceives light within this section as colors. Once an object is illuminated, some of the colors are absorbed, and others are reflected. The reflected colors are the ones we see. White light usually comprises the full spectrum of visible light. So when using white light endoscopy (WLE), a large number of wavelengths is emitted from the endoscope. In contrast, NBI light passes through a special narrow band filter before hitting the tissue. This filter only allows light frequencies that match the absorption spectrum of hemoglobin contained in blood to pass. Therefore, narrow band light only consists of two wavelengths – namely, 415 nm blue light and 540 nm green light.

NBI light is absorbed by vessels but reflected by mucosa. This offers a huge benefit: NBI achieves a maximum contrast of vessels and the surrounding mucosa. The shorter NBI light wavelength only penetrates the superficial layers of the mucosa and is absorbed by capillary vessels on the surface. This facilitates the detection of tumors, as they are often highly vascularized. The longer 540 nm NBI light penetrates deeper and is absorbed by blood vessels located deeper within the mucosal layer. Thus, it is particularly helpful to display the deeper vasculature of suspect lesions. In addition, the visualization of the capillary system is less blurred or distorted by scattering as compared to white light endoscopy.



In contrast to white light, NBI light is composed of only two specific bands of light.



Absorption of narrow band light by capillaries on the mucosal surface (blue) and veins in the submucosa (green).

NBI with EVIS EXERA III – More Power for Accurate Diagnosis

The cutting-edge EVIS EXERA III video endoscopy system from Olympus features improved NBI technology. Each component has been enhanced to achieve the best possible images. Combining a brighter light source, a more sensitive CCD, and 3D noise reduction, the whole system provides up to twice the viewable distance as compared to EVIS EXERA II, giving you much more flexibility and helping to speed up your endoscopic examination.

CREATE HIGH-QUALITY IMAGES

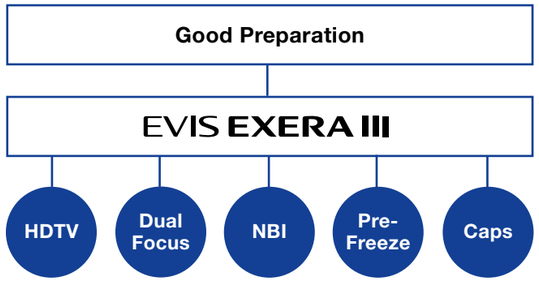
With a large number of innovative functions, EVIS EXERA III opens up entirely new possibilities for diagnosis. The following chapter will show you how to get the most out of the system's latest technologies.

Begin with Good Preparation

Especially when it comes to colonoscopy, good preparation is obligatory. If the bowel is poorly prepared, optical diagnoses are very difficult to make. Regardless of the technique you are using, there are some steps you can take to ensure a sound basis for the examination. Good communication provides the best conditions for endoscopy and for using the possibilities of EVIS EXERA III. First of all, ensure that the patient understands and adheres to the dietary restrictions. Secondly, when treating inpatients, make sure that you and your colleagues are acting in unison and that the patient receives all necessary information. And in case you choose a polyethylene glycol (PEG) regime instead of sodium phosphate, consider splitting the dose to increase acceptance.

Flushing Pumps

Flushing pumps can easily be attached to the endoscope to irrigate fluid either via the instrument or the auxiliary water channel. This is very helpful to efficiently wash away any debris and remaining organic material during endoscopic examinations. The use of flushing pumps also facilitates the identification of bleeding sources. Furthermore, these accessories can rapidly fill organs with fluid for "underwater" endoscopy, also assisting in endoscopic ultrasound procedures. Underwater viewing enhances the clarity of structures.

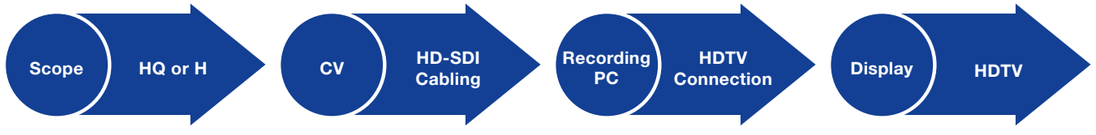


Technologies for Better Vision – and the Best Image Composition

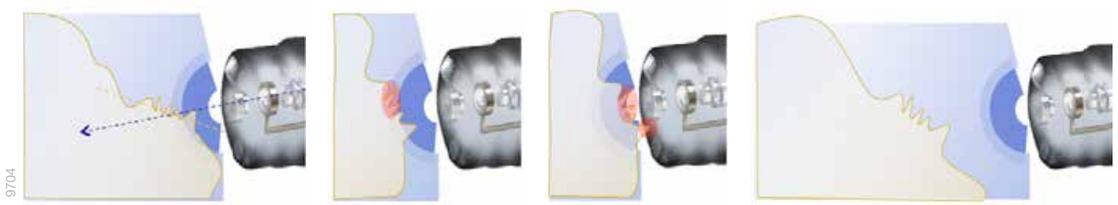
The cutting-edge EVIS EXERA III endoscopy system provides you with several versatile technologies to enhance image quality: HDTV, Dual Focus, NBI, Pre-Freeze, and caps. Read here why these technologies can take you to the next level of endoscopy – and which settings to choose for the best results.

HDTV

The higher the image resolution, the greater the chance to detect lesions at an early stage. EVIS EXERA III offers a resolution of 1,920 × 1,080 pixels, which helps you to see significantly more. However, you should consider that your images must pass through several stations before being displayed. At Olympus, we refer to this as the HDTV chain.



To get the best out of your images, verify that none of the components breaks the HDTV chain.



Orientation toward lesion here **too flat** | Lesion partly **out of focus** | Lesion partly **too close** | OK, but **only for general** observation

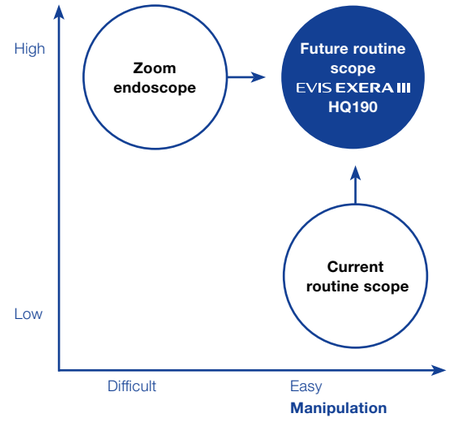
In "near mode," ensure that the lesion is at the right distance and orientation. Otherwise, the still image may not be sufficient to confirm your diagnosis.

Dual Focus

Using an innovative two-stage optical system, EVIS EXERA III allows you to switch between two focus settings: "normal mode" and "near mode." Although they are comparable with older zoom endoscopes in terms of diagnostic power, the new Dual Focus endoscopes HQ190 exceed zoom scopes in terms of handling. Zoom endoscopes offer 7–100 mm depth of field in "wide mode" and 2–3 mm in near mode ("tele mode"). Between those modes, a viewing gap of 3–7 mm causes a blind area. In addition, due to its small range, the "tele mode" only provides a limited field of view. In contrast to that, the modes of the new Dual Focus endoscopes conveniently overlap each other. The "normal mode" suits normal observation at a distance of 5–100 mm and a 170° field of view, while the "near mode" allows close observation of finest mucosal surfaces at a distance of 2–6 mm. If you switch to the "near mode" at the simple push of a button, the field of view will remain almost the same (160°). This does not only save you valuable time to attain the desired view but also facilitates staying in focus and achieving a good diagnostic image.

Thanks to HDTV capability and the more sensitive CCD of the HQ190, its resolving power in "near mode" almost equals the power of the zoom endoscope in "tele mode."a Apart from that, Dual Focus endoscopes offer much more flexibility than zoom endoscopes, as the optical zoom mechanism is significantly decreased in size. This makes the Dual Focus HQ190 much easier to maneuver inside a human being.

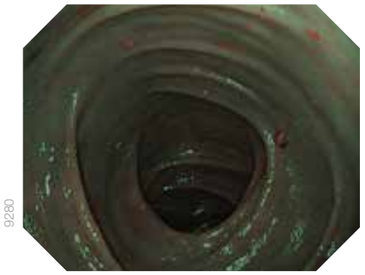
Resolving Power



The new HQ190 combines the benefits of zoom endoscopes and current routine endoscopes: High resolving power, a wide field of view, and easy manipulation.

CREATE HIGH-QUALITY IMAGES

EVIS EXERA III offers a range of technologies that help to achieve outstanding image quality for diagnosis.



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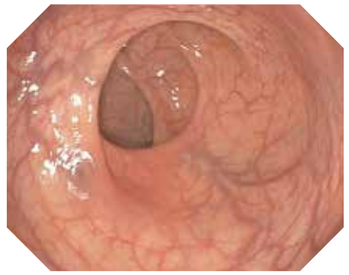
EVIS EXERA II, 180 series, NBI



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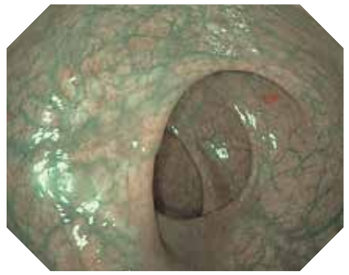
EVIS EXERA III, 190 series, white light



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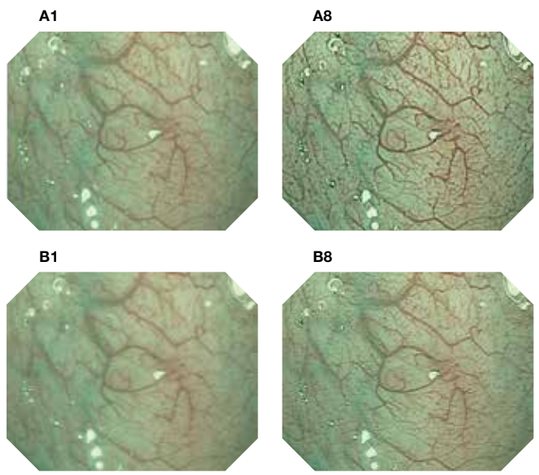
EVIS EXERA III, 190 series, NBI

NBI Images …

EVIS EXERA III allows for comfortable switching between white light and narrow band (NBI) light. As NBI increases the contrast of blood vessels, it enhances the visualization and assessment of the microvessel architecture. Thus, it has the potential to dramatically improve the detection and characterization of tissue alterations – particularly alterations that are known to be associated with early gastrointestinal cancers and their precursors. Furthermore, NBI with EVIS EXERA III illuminates the lumen twice as far when compared to EVIS EXERA II, so it may open new possibilities for lesion detection during colonoscopy, for example.

… With Structural Enhancement

The structural enhancement feature of the video processor CV-190 can increase the effect of NBI. Using an intelligent algorithm, it detects those areas of the image with the highest diagnostic yield and helps to electronically emphasize the detailed patterns. In total, there are 16 settings to choose from: Two modes (A and B Modes) and eight graduations of each of them (A1–A8, B1–B8). A Mode enhances the overall image, which is particularly suitable for mucosal pattern and pit pattern observation. B Mode enhances tiny details, which is optimal for vascular pattern and detailed mucosal pattern observation. To enable rapid switching between different modes and graduations, you can preselect three settings and activate them with the touch of a button. Extensive tests have shown that the settings A5, A7, and B7 achieve the best results for use with NBI. Therefore, these are the default settings of the CV-190 processor.



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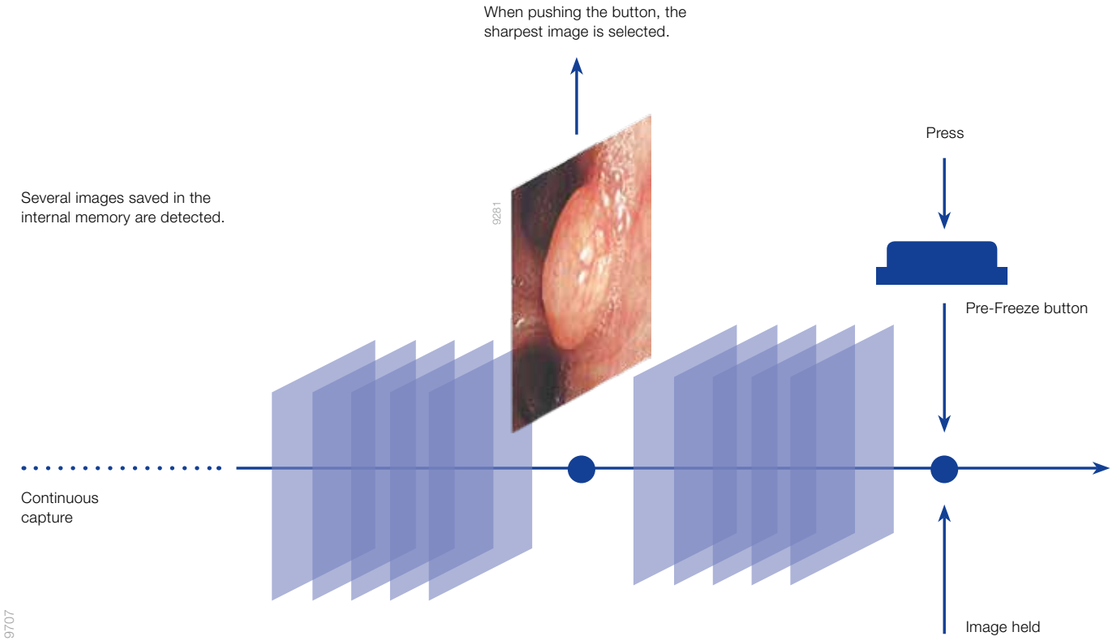
To enhance the display of structures, you can choose among different settings.

Pre-Freeze

The Pre-Freeze function helps to achieve the sharpest still images. By continuously saving the most recent video footage in the CV's interim storage, it is capable of automatically selecting the sharpest image whenever you freeze your view. In this way, Pre-Freeze helps to speed up recording and achieve maximum image quality.

Cap-Assisted Endoscopy

Attaching a cap to the endoscope can help to achieve the correct distance and orientation to lesions. As the heartbeat often affects the wall of the esophagus, the use of caps may particularly ease steady endoscopy in this part of the body.



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The system continuously buffers a series of images. When you take an image, it automatically analyzes the previous pictures and selects the sharpest one.

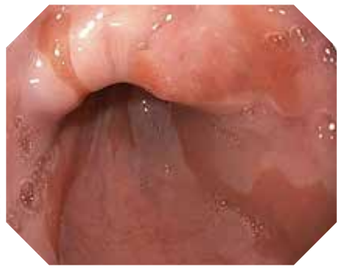
NBI-TARGETED BIOPSY IMPROVES DIAGNOSTIC EFFICIENCY OF BARRETT'S ESOPHAGUS SCREENING

Can NBI replace time- and cost-intensive White Light Endoscopy (WLE) with random biopsies to detect intestinal neoplasia in patients with Barrett's esophagus? Prateek Sharma, et al., compared both technologies in a prospective clinical trial to find the answer.

7864

What Is the Main Issue when Diagnosing Barrett's Esophagus?

The recommended current standard for endoscopic surveillance of patients with Barrett's esophagus (BO) is the Seattle protocol. This method combines white-light endoscopy (WLE) and two kinds of biopsies: Four quadrant biopsies every 2.0 cm and targeted biopsies of any endoscopically visible lesions. But the Seattle protocol has several limitations.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On the one hand, the subtle changes of dysplasia and early esophageal adenocarcinoma (EAC) in patients with BO are often not visible using WLE. On the other hand, performing biopsies randomly has a significant sampling error, as the samples are only taken from a small section of the BO segment. However, intestinal metaplasia (IM) and dysplasia, in particular, have a patchy distribution.[1] Apart from that, the biopsy protocol is labor intensive and tedious, so endoscopists often do not follow it. In fact, the longer the BO segment, the lower the compliance to the Seattle protocol.[2]


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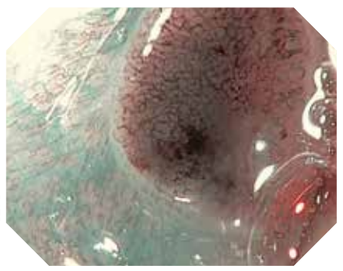
Therefore, techniques to make screening and surveillance strategies more efficient are highly desirable.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How Can NBI Help Make the Surveillance of Patients with BO More Efficient?

The spectral narrow band filters of NBI can help to visualize esophageal, mucosal, and vascular patterns. This is similar to chromoendoscopy but without the time- and cost-intensive necessity to spray dye. Furthermore, the prediction of the presence of IM and dysplasia is feasible using NBI. The aim of the study was to compare high-definition white light endoscopy (HD-WLE) applying the Seattle protocol and NBI targeted biopsy for detection of IM and neoplastic tissue in BO. The authors carried out a highlighted prospective, international, randomized controlled trial to examine the differences of HD-WLE and NBI biopsies with respect to (1) the proportion of patients with IM and neoplasia; (2) the proportion of neoplastic area; and (3) the number of overall biopsies performed.[1]

Medical Benefits of NBI

- Targeted biopsy with NBI is a feasible method for the surveillance of Barrett's esophagus
- The use of NBI targeted biopsies may improve the efficiency of screening and surveillance of BO

Financial Benefit of NBI

- NBI may reduce pathology costs, thanks to fewer biopsies being taken

Open the page at the right to learn more.

RELATED STUDY DETAILS

123 patients with BO randomly underwent upper endoscopy with either HD-WLE – and targeted, as well as random, biopsies according to the Seattle protocol – or NBI targeted biopsies.[1]

Table 1: Histological Yield of HD-WLE and NBI Targeted Biopsies

	HD-WLE Diagnosis (n)				
	No IM	**IM**	**LGD**	**HGD**	**OAC**
NBI diagnosis (n)					
No IM	10	14	6	0	0
IM	8	44	11	1	0
LGD	0	10	6	1	0
HGD	1	1	3	4	0
OAC	0	0	0	2	1

NBI, Narrow Band Imaging; IM, intestinal metaplasia; LGD, low-grade dysplasia; HGD, high-grade dysplasia; OAC, esophageal adenocarcinoma; HD-WLE, high-definition white light endoscopy.

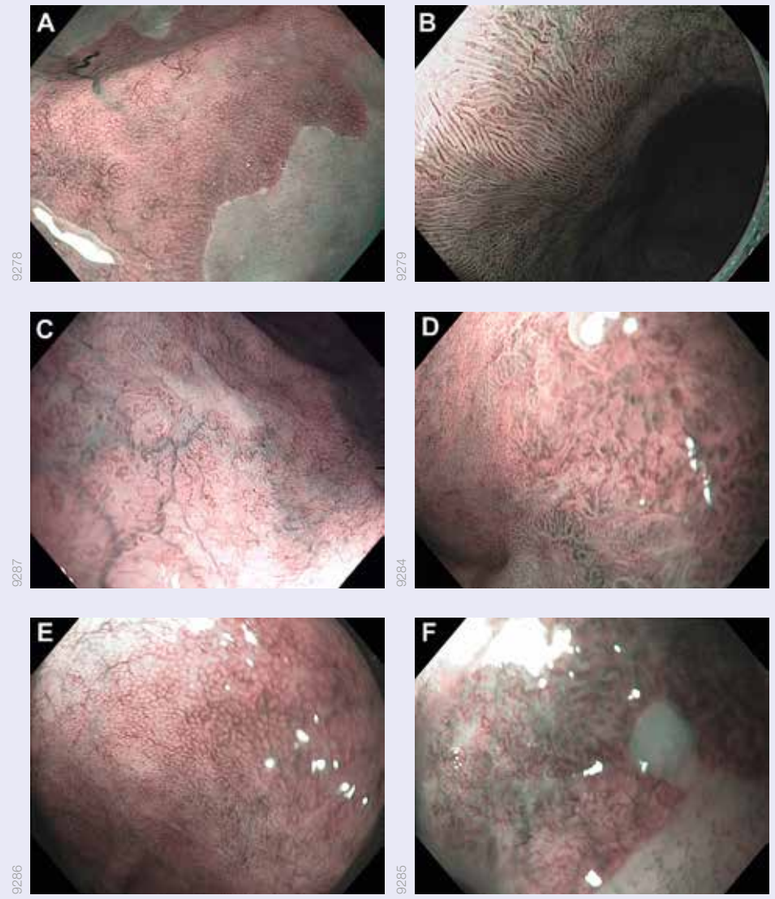
In 65 patients, NBI and HD-WLE obtained the same histological diagnosis.[3]

Results

For detection of IM, HD-WLE and NBI each yielded detection rates of 92%. While HD-WLE required a mean of 7.6 biopsies per patient, NBI only required 3.6 biopsies. For detection of dysplasia, the diagnostic yield of HD-WLE and NBI were equivalent. However, NBI required fewer biopsies than HD-WLE in patients with short-segment BO (3.0 vs 3.9) and patients with long-segment BO (4.1 vs 10.9).[1]

Conclusion

As shown in the study, the diagnostic yield of NBI is equivalent to HD-WLE for detection of neoplastic tissue and/or even superior for detection of IM in BO with fewer biopsies performed. Thereby, NBI can improve the efficiency, as well as save costs, of either BO screening or surveillance in endoscopic practice.[2]



Examples of the different esophageal surface patterns seen during Narrow Band Imaging: (A) Circular mucosal pattern. (B) Ridged/villous pattern. (C) Absent mucosal pattern. (D) Irregular mucosal pattern. (E) Regular vascular pattern. (F) Irregular vascular pattern.[4]

Source:
Sharma, Prateek et al., "Standard Endoscopy with Random Biopsies versus Narrow Band Imaging Targeted Biopsies in Barrett's Oesophagus: A Prospective, International, Randomised Controlled Trial," Gut, 62 (1), 2013, 15–21.

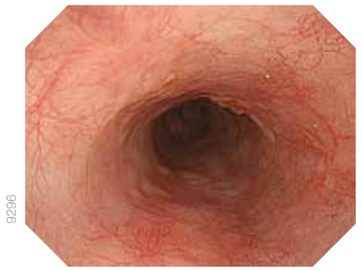
[1] pp. 15–16 [2] p. 20; [3] p. 19; [4] p. 17

EARLIER DETECTION OF ESOPHAGEAL CANCER WITH NBI

NBI has the potential to provide a powerful tool for early detection of esophageal cancer – indicated by a controlled clinical study from Manabu Muto, et al. This section summarizes the most relevant parts of their work.

What Is the Main Issue when Diagnosing Esophageal Neoplasia?

Esophageal cancer is the eighth most common cancer in the world. In 2002, 462,000 new cases were counted. Also ranking number six on the list of the most common causes of cancer-related death, it caused 386,000 deaths in the same year. The most common histological type worldwide is squamous cell carcinoma (SCC), which is also the most common histological type of head and neck (H&N) cancer. In 2002, H&N cancer totaled 607,000 new cases and 261,000 deaths.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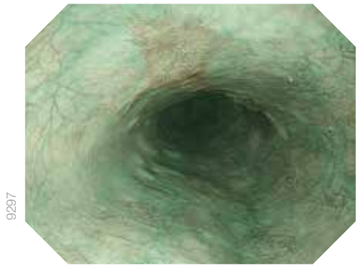
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The earlier the cancer is detected, the better the prognosis is for the patient. But in fact, esophageal SCC (ESCC) and H&N SCC (HNSCC) are currently often detected at a late stage, which significantly worsens the prognoses. The reasons lie in the difficulty of detecting these cancers by conventional white light endoscopy (WLE). Although lugol chromoendoscopy can be used for the detection of superficial ESCC, it can cause unpleasant side effects; for example, severe chest pain or other discomfort.[1] Apart from that, the lugol solution takes a lot of time – especially for administration – and makes accurate diagnosis difficult because the staining pattern shows wide variations. As this method increases the chance to detect false-positive lesions, it often leads to unnecessary biopsies.[2] For HNSCC, lugol chromoendoscopy cannot be used at all because of the risk of aspiration.[1]


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How Can NBI Help Enhance the Detection of Esophageal Cancer?

Because NBI light is well absorbed by hemoglobin, NBI can considerably improve the visualization of the microvascular structure of the organ surface. This facilitates the identification of early neoplasm in the GI tract. The authors of the study compared the detection rates of ESCC and HNSCC between WLE and NBI to find out whether NBI is more appropriate to detect these cancers at an early stage. Furthermore, they aimed to evaluate the diagnostic accuracy of the two imaging methods.[1]

Medical Benefits of NBI

- Increased detection rate of superficial cancer as compared to WLE in both the H&N region and the esophagus
- Easy to apply and easy to understand

Financial Benefit of NBI

- Faster procedure times as compared to WLE with lugol staining

Open the page at the right to learn more.

RELATED STUDY DETAILS

To compare the real-time detection yield of superficial SCC and HNSCC cancers between WLE and NBI, a total of 360 patients randomly received primary WLE or primary NBI. In a back-to-back fashion, primary WLE was followed by NBI and vice versa.[1]

Table 1: Detection Rates of Superficial Cancers in the H&N Region and the Esophagus with WLE and NBI[3]

Variable	Primary WLE (n = 162)			Primary NBI (n = 158)			P
	No.	%	95% CI	No.	%	95%	
Head and neck region							
No. of superficial cancers	1/13	8	0.2–36.0	15/15	100	78.2 to 100	<0.001
Size of superficial cancer, mm							
<10	0/7	0	0 to 41.0	10/10	100	69.2 to 100	<0.001
11–20	1/5	20	0.5 to 71.6	5/5	100	48.7 to 100	0.12
≥21	0/1	0	0.0 to 0.0	to			-
Esophagus							
No. of superficial cancers	58/105	55	45.2 to 65.0	104/107	97	92.0 to 99.4	<0.001
Size of superficial cancer, mm							
<10	7/18	39	17.3 to 64.3	17/18	94	72.7 to 99.9	0.03
11–20	7/21	33	14.6 to 57.0	18/19	95	74.0 to 99.9	0.02
≥21	44/66	67	54.0 to 77.8	69/70	99	92.3 to 100	<0.005

Results

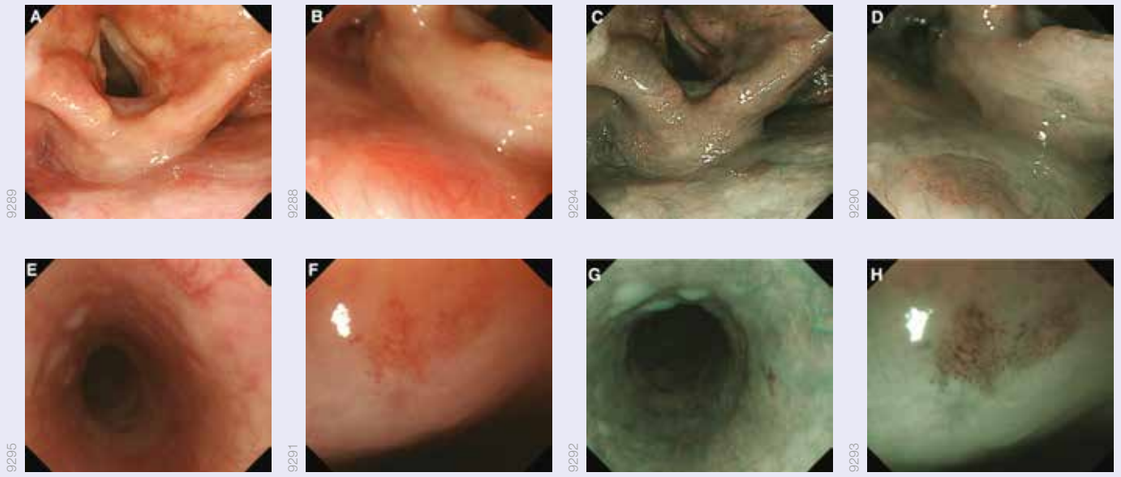
While primary NBI detected all (100%) of the superficial cancers in the H&N region, primary WLE detected only 8.0% (Table 1). In the esophagus, primary NBI detected 97% of the lesions while primary WLE reached only 55%. The detection rate of secondary NBI after primary WLE significantly increased in both the H&N region (8.0% vs 77%) and esophagus (55% vs. 95%). In contrast, if NBI was followed by secondary WLE, the detection rate declined. A total of 57% of superficial cancers in the H&N region and even 23% in the esophagus even were detected by NBI alone. There was only one lesion that was detected by WLE but was missed by secondary NBI.[3]

Primary NBI achieved much higher sensitivity and accuracy than primary WLE, whereas the specificity values were similar for both imaging techniques (Table 2). Concerning the positive predictive value, there was no clear difference between NBI and WLE, but the negative predictive value was again significantly higher for primary NBI than for primary WLE in both regions.[3]

Conclusion

The study showed that the combination of NBI and magnifying endoscopy can significantly improve the detection rates for superficial SCC in the H&N region and the esophagus. Early detection also increases the potential of minimally invasive treatment; for example, endoscopic or partial surgical resection. Furthermore, NBI can not only easily be applied with limited experience, but it also be learned much more rapidly than WLE.[4]

As it reduces the number of unnecessary biopsies and shortens examination time, as compared to WLE with lugol staining, “NBI is the ideal method for effectively detecting superficial SCC.”[5] The authors even recommend NBI as the standard examination method.[4]



Superficial cancer in the H&N region and esophagus.
A: WLE shows a small reddish area (arrows) in the posterior wall of the hypopharynx.
B: Magnifying WLE shows a slightly reddish area with tiny microdots.
C: NBI shows a well-demarcated brownish area (arrows) in the posterior wall of the hypopharynx.
D: Magnifying NBI shows many tiny dots in the brownish area. This lesion was diagnosed histologically as squamous cell carcinoma in situ.
E: WLE shows a slightly reddish and depressed lesion (arrows) in the oseophagus, although it is difficult to detect by WLE alone.
F: Magnifying WLE shows a slightly reddish area with an irregular microvascular pattern.
G: NBI shows a well-demarcated brownish area (arrows).
H: Magnifying NBI shows many tiny dots in the brownish area. This lesion was diagnosed histologically as high-grade intraepithelial cancer.[6]

Table 2: Performance Rates of WLE and NBI with Regards to Sensitivity, Specificity and Accuracy, for the Diagnosis of Superficial Cancers[3]

Variable		Primary WLI			Primary NBI			P
		No.	%	95% CI	No.	%	95%	
Head and neck								
Sensitivity		1/13	7.7	0.2 to 36.0	15/15	100	100	<0.001
Specificity		21/22	95.5	77.2 to 99.9	11/14	78.6	54.6 to 98.1	0.28
Accuracy		22/35	62.9	47.6 to 76.4	26/29	86.7	72.6 to 97.8	0.02
	PPV	1/2	50	1.3 to 98.7	15/18	83.3	58.6 to 96.4	0.37
	NPV	21/33	63.6	54.1 to 79.6	11/11	100	100	0.02
Esophagus								
Sensitivity		58/105	55.2	45.2 to 65.0	104/107	97.2	92.0 to 99.4	<0.001
Specificity		12/19	63.2	38.4 to 83.7	8/19	42.1	20.3 to 66.5	0.33
Accuracy		70/124	56.5	47.3 to 65.3	112/126	88.9	82.1 to 93.8	<0.001
	PPV	58/65	89.2	79.1 to 95.6	104/115	90.4	85.3 to 95.1	0.80
	NPV	12/59	20.3	11.0 to 32.8	8/11	72.8	39 to 94	<0.002

Source:
Muto, Manabu et al., “Early Detection of Superficial Squamous Cell Carcinoma in the Head and Neck Region and Esophagus by Narrow Band Imaging: A Multicenter Randomized Controlled Trial,” Journal of Clinical Oncology, 28 (9), 2010, 1566–1572.

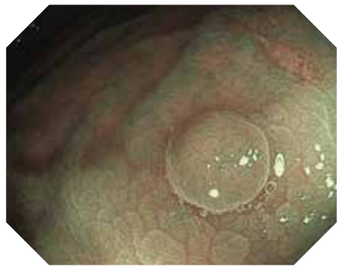
[1] pp. 1566–1567; [2] p. 1571; [3] pp. 1569–1570; [4] pp. 1570–1571; [5] p. 1570; [6] p.1568

USE NBI TO ACHIEVE TIME AND COST SAVINGS IN COLONOSCOPY

When it comes to the endoscopic examination of the colon, NBI offers substantial advantages. A study recently conducted by David Hewett, et al., has shown tangible benefits for NBI. The authors validated a simple classification system for diminutive polyps. This section deals with the details.

What Is the Main Diagnostic Issue with This Part of the Anatomy?

In almost all cases, colorectal polyps that are less than or equal to 5.0 mm are benign. However, current practice requires costly pathological analysis. In particular, the resection and submission of diminutive polyps to pathological assessment are very cost intensive. The greatest potential for saving expenses lies in the endoscopic differentiation between hyperplastic and adenomatous colorectal polyps.[1]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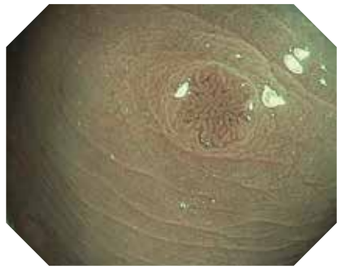
A promising practice in this regard is the resect-and-discard policy. This approach comprises the classification of diminutive polyps in real time, followed by their resection, and then discarding them without the analysis of a pathologist. Afterwards, the intervals of post-polypectomy surveillance are determined on the basis of two factors: The endoscopic estimation of diminutive polyp histology, on the one hand, and the pathologic report of any larger polyps that are submitted to pathology, on the other hand.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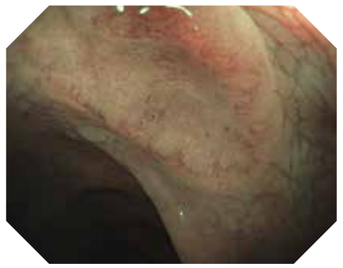
A second cost-saving strategy is the do-not-resect strategy. This method comprises the identification of diminutive distal colon hyperplastic polyps in real time by endoscopy. Detected polyps are then left in place without sampling and submission to pathology.[2]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How Can NBI Help to Reduce the Cost of Colonoscopy?

When tissue becomes neoplastic, the pattern and size of microvessels in the mucosa and submucosa change. Narrow Band Imaging has the potential to allow for characterization of these lesions. As studies have shown, colocteral polyps can be characterized by NBI.[1] In fact, NBI and high-definition colonoscopies can be used to accurately designate the histology and assign surveillance intervals in real time – even without optical magnification.[2]

In order to make NBI useful for clinical practice, however, simple classification systems are needed, enabling both experienced and inexperienced clinicians to apply NBI.[1]

As a first step towards more targeted therapeutic decisions, the authors of the study developed and established the validity of a practical, simple, NBI-based classification system: The NICE (NBI International Colorectal Endoscopic) classification. This system provides a means for accurate differentiation of diminutive polyps located within the colon.[3]

Medical Benefits of NBI

- Accurate, in situ, optical diagnosis of diminutive polyps possible
- Possibility to provide faster patient feedback on polyp histology

Financial Benefit of NBI

- The use of NBI may open new possibilities to reduce the need for conventional tissue sampling in the future

Open the page at the right to learn more.

RELATED STUDY DETAILS

The study aimed to develop a classification for histology prediction. The criteria were then validated by both NBI-untrained users and NBI-trained gastroenterology fellows. As a result, the NICE classification was set up.

Table 1: The NBI International Colorectal Endoscopic (NICE) Classification*

NICE Criterion	Type 1	Type 2
Color	Same or lighter than background	Browner relative to background (verify color arises from vessels)
Vessels	None, or isolated lacy vessels coursing across the lesion	Brown vessels surrounding white structures**
Surface pattern	Dark or white spots of uniform size or homogeneous absence of pattern	Oval, tubular, or branched white structures[a] surrounded by brown vessels
Most likely pathology	Hyperplastic	Adenoma

* Can be applied using colonoscopes both with or without optical (zoom) magnification.
** These structures may represent the pits and the epithelium of the crypt opening.[4]

Results

The NICE classification system is based on three simple criteria that were defined to differentiate polyps: color, vessels, and surface pattern (Table 1). For each criterion, there are clear descriptions for determining the different types of histology, although some polyps will not display all three criteria. This led to a classification of polyps into three types: Type 1 corresponds to the most likely pathology being hyperplastic, type 2 being adenomam, and type 3 being deep submucosal invasive cancer.

Apart from the rating of experts (Table 2), gastroenterology fellows also rated the criteria for each polyp together and afterward gave an overall prediction of histology (Table 3). Surface pattern reached the highest values in accuracy, sensitivity, specificity, and negative predictive value. When combining the criteria, the presence of adenomateous features achieved an accuracy, sensitivity, and specificity of 91% and a negative predictive value of 92%.[5]

Conclusion

In the study, the classification system performed very well – even when previously NBI-untrained fellows applied it to the set of polyp photographs. A pilot application during real-time endoscopy obtained similar results.[6]

Thus, if using high-definition colonoscopy, NICE classification is suitable to differentiate between hyperplastic and adenomatous polyps. It promises to fulfill the minimum performance benchmarks for assessing the histology of diminutive colorectal polyps in real time. Therefore, the application of this classification can substantially contribute to reducing the cost of colonoscopy.[3]

Table 2: Combined Performance Characteristics of Experts in Predicting Adenomatous Histology in Still Colorectal Polyp Images

	High Confidence (n = 471) (95% CI)	Low confidence (n = 119) (95% CI)
Accuracy	98.9 (98.0–99.9)	95.9 (94.3–97.5)
Sensitivity	98.0 (94.5–99.4)	94.2 (90.9–96.6)
Specificity	100 (98.3–100)	97.6 (95.2–99.0)
NPV	97.7 (94.8–99.3)	94.4 (91.2–96.7)
PPV	100 (98.5–100)	97.5 (95.0–99.0)

CI, confidence interval; NPV, negative predictive value; PPV, positive predictive value.[5]

Table 3: Performance Characteristics of the NBI International Colorectal Endoscopic Criteria and Overall Classification When Rated by Fellows (n = 19)

	Accuracy Median (Range)	Sensitivity Median (Range)	Specificity Median (Range)	NPV Median (Range)	PPV Median (Range)
Individual criteria					
Color	91% (62–95)	92% (25–98)	92% (85–100)	91% (57–98)	92% (86–100)
Vessels	92% (78–97)	92% (59–98)	97% (81–100)	92% (70–98)	95% (83–100)
Surface	92% (82–97)	90% (66–98)	91% (85–100)	91% (74–98)	96% (85–100)
Individual criteria in combination					
Any 2 of 3	92% (75–97)	90% (53–98)	95% (83–100)	91% (67–98)	95% (85–100)
Overall prediction					
All predictions	92% (85–97)	92% (75–98)	95% (78–100)	90% (80–98)	95% (81–100)
High confidence	98% (88–100)	97% (74–100)	100% (79–100)	98% (82–100)	100% (85–100)

CI, confidence interval; NPV, negative predictive value; PPV, positive predictive value.[6]

Table 4: Performance of the NBI International Colorectal Endoscopic (NICE) Classification during Real-Time Colonoscopy for High-Confidence Predictions

Endoscopist	High-Confidence Predictions, n (%)	Accuracy (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)	NPV (95% CI)	PPV (95% CI)
1	85 (72%)	77/85 91% (82–96)	56/56 100% (94–100)	21/29 72% (53–87)	21/21 100% (84–100)	56/64 88% (77–94)
2	93 (79%)	81/93 87% (79–93)	62/64 97% (89–100)	19/29 66% (46–82)	19/21 90% (70–99)	62/72 86% (76–93)
Combined	178 (75%)	158/178 89% (83–93)	118/120 98% (94–100)	40/58 69% (55–80)	40/42 95% (84–99)	118/136 87% (80–92)

CI, confidence interval; NPV, negative predictive value; PPV, positive predictive value.[6]

Source:
Hewett, David G. et al., "Validation of a Simple Classification System for Endoscopic Diagnosis of Small Colorectal Polyps Using Narrow Band Imaging," Gastroenterology, 143 (3), 2012, 599–607.

[1] p. 599; [2] p. 605; [3] p. 606; [4] p. 601; [5] p. 602; [6] pp. 603–605

Refer to page 15 for sample images and more information.

PROMISING PROSPECTS FOR DIAGNOSIS

Much better image quality and more flexibility in less time: NBI with EVIS EXERA III really has great potential for diagnosis. This benefits endoscopists, hospitals, and – last, but not least – patients.

The Future of Endoscopy Has Already Begun

NBI represents a major step forward for the detection and characterization of gastrointestinal lesions – especially neoplasia. With twice the visibility, NBI with EVIS EXERA III provides much better insights, particularly into large lumen organs such as the colon and the stomach, and is intended to improve the detection of neoplastic tissue.

As different studies have proven, NBI is not only a useful tool to establish the diagnosis, but NBI may also help to reduce the necessity for tissue sampling or, in the future, even avoid biopsy. Thus, it can help to save time and money while simultaneously safeguarding procedural quality – which translates to tangible benefits for the hospital and the patient.

To ease usage in daily clinical routines, proprietary Dual Focus technology offered in EVIS EXERA III HQ scopes helps to easily visualize the mucosa and thus helps to make decisions regarding biopsies or where to delineate a lesion for further treatment.

In addition, NBI can be used before and after interventional procedures. NBI is ideal for determining the extent of vessels, as well as lesions, before treatment. But it is also suitable to follow up vascularization of the operated area and its circumference.

Major Benefits of NBI at a Glance

- Helps to visualize mucosal and vascular patterns to facilitate early detection
- Depending on location, equivalent or even better than WLE while reducing the number of biopsies and thus expected to be more cost effective

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DIAGNOSIS TRAINING PORTAL

9300

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NARROW BAND IMAGING (NBI)

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