Use of Narrow Band Imaging Colonoscopy in Diagnosis of Ulcerative Colitis Patients

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Abstract

Ulcerative colitis is a disease of increasing incidence and may progress to colonic cancer. Early detection of dysplastic changes is required. NBI is an added imaging procedure that is supposed to increase the yielding of diagnosis of ulcerative colitis.

Aim of the study: Validate the relation between histological pattern and NBI findings in diagnosing ulcerative colitis.

Patients and methods: 50 patients with diagnosed ulcerative colitis in Alexandria University Hospital were examined by colonoscopy and NBI then biopsies were taken from areas with detected lesions and histopathological examination was done.

Results: Patients were divided into active (27) and inactive (23) according to the clinical performance. From the 23 patients that were supposed to be inactive, 14 showed honeycomb appearance and 7 showed irregular vascular mucosal patterns by NBI examination. Histopathological examination revealed metaplasia in 55% of the patients that were under the category of inactive patients. There was a significant correlation between histological examination and NBI findings. NBI showed sensitivity of 58.3%, specificity of 100%, PPV of 100%, NPV of 23% and accuracy of 62.9% in active patients.

Conclusion: NBI is a valuable tool that can add value to colonoscopic examination in patients with ulcerative colitis.

Keywords

Ulcerative Colitis • Narrow Band Imaging • Colonoscopy • Inflammatory Bowel Disease • Abdominal pain • Extra-intestinal complications

Abbreviations

NBI: Narrow Band Imaging; PPV: Positive Predictive Value; NPV: Negative Predictive Value

Introduction

Endoscopic mucosal healing is now the endpoint target for ulcerative colitis rather than the mere clinical remission [1-3]. This is because the endoscopic mucosal healing is in concordance with the clinical remission, less hospital stay and fewer incidences of operations [4-6].

Although angiogenesis is supposed to be responsible for the healing process, it is suggested to play role in acute and chronic inflammations [7].

And angiogenesis is supposed to have a large part in the pathogenesis of ulcerative colitis.

Ulcerative colitis, being a long standing disease, is a predisposing factor to dysplasia and colorectal cancer [8]. This increased risk demanded the surveillance of patients suffering from left sided UC or extensive UC on a regular rhythm. This, in return, increased the need for finding a tool that has a good diagnostic value. For years, the 4 quadrant biopsies done by colonoscopy every 10 cm was the gold standard method [9]. But it had limitations as missing the site of dysplasia and the difficult sticking to that protocol [10-13].

Patients

This cross sectional study included 50 patients who presented to the Gastroenterology unit, Alexandria Main University, Faculty of Medicine, with diagnosed UC.

Assessment of activity of UC was done to all patients clinically by ulcerative colitis disease activity index (UCDAI), endoscopically by Ulcerative Colitis endoscopic index of severity (UCEIS), and pathologically by degree of neutrophilic invasion, crypt abscess or cryptitis, presence of oedema and mucosal surface ulceration. All patients agreed to participate in the study and signed written consent according to local Ethics Committee of the Faculty of Medicine, University of Alexandria. Patients with any degree of ulcerative colitis were included in the study except those with bleeding tendency, advanced renal, cardiac or hepatic diseases and patients who were poorly prepared.

Methods

Colonoscopy procedure

Each patient underwent a colonoscopy with an endoscope, using a prototype of the NBI system. When performing an NBI colonoscopy, the endoscope was advanced into the cecum using the White-Light Endoscopy (WLE) mode (Figures 1 and 2). During withdrawal, a routine observation was performed, and the inflamed area was identified using the WLE mode. When a lesion is identified, the imaging mode was switched to NBI with recording the image and biopsy was taken from this area for histopathologial examination (Figures 3-5).

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(a)   (b)
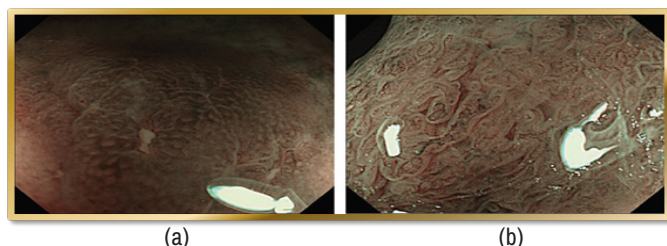
Figure 1. Colonoscopic findings under magnifying narrow band imaging (NBI) observation in the mildly active ulcerative colitis. (a) NBI depicts whitish round crypts, referred to as crypt opening type. (b) NBI shows villous structures, referred to as villous type.


(a)   (b)
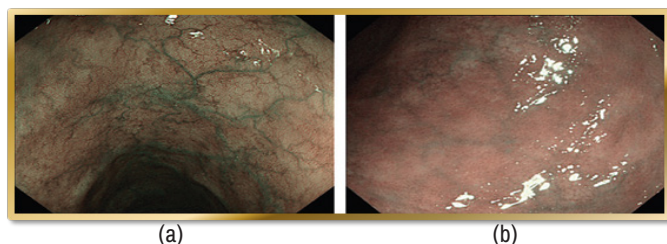
Figure 2. Shows Narrow band imaging (NBI) colonoscopic findings in the inactive ulcerative colitis. (a) Under NBI, distorted brownish intramucosal capillaries are evident (clear mucosal vascular pattern [MVP]). (b) NBI observation failed to identify brownish intramucosal capillaries (obscure MVP).

(a)   (b)
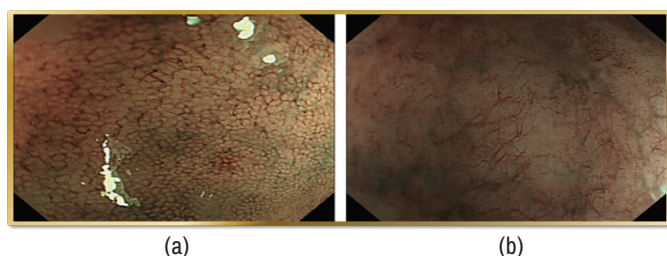
Figure 3. Shows Mucosal vascular pattern under magnifying narrow band imaging (NBI) observation in the inactive ulcerative colitis. (a) Intramucosal capillaries are arranged in a honeycomb-like structure. (b) NBI shows intramucosal capillaries with irregular, tortuous structure.
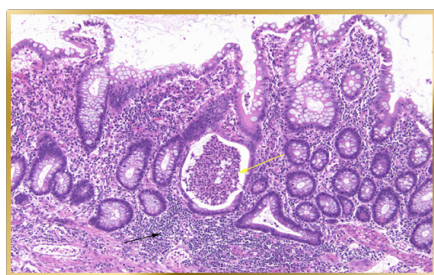
Figure 4. Chronic active colitis with mild to moderate activity. The biopsy shows crypt architectural distortion along with expansion of the lamina propria by lymphoplasmacytic inflammatory cell infiltrate. Basal lymphoid aggregate is also present (black arrow). A large crypt abscess is also identified (yellow arrow). Hematoxylin-eosin, original magnification *100.
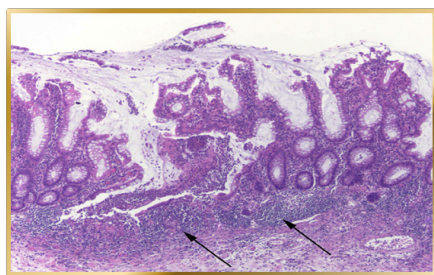
Figure 5. Chronic active colitis with severe activity. The biopsy shows foci of neutrophilic epithelial injury along with erosion. In addition, there is prominent basal lymphoplasmacytosis (arrows) as well as crypt architectural distortion. Hematoxylin-eosin, original magnification *40.

Figure 6. Chronic inactive colitis. The biopsy obtained from the left colon shows crypt architectural distortion (irregular size and shape of the crypts) along with Paneth cell metaplasia (arrow). The lamina propria is slightly expanded by lymphocytes and plasma cells. There is no evidence of activity (neutrophils or eosinophils within the epithelium). Hematoxylin-eosin, original *100 magnification.

NBI examination

Patients after being classified as active and inactive, they were further divided depending on the mucosal vascular pattern and on the surface pattern in case of absent vascular pattern. The patients were divided into crypt opening type where NBI depicts whitish round crypts, villous type where NBI shows villous structures, clear mucosal vascular pattern (honey comb type) and irregular mucosal vascular pattern.

Histological assessment

All biopsy specimens were fixed in 10% formalin, embedded in paraffin, and stained with hematoxylin and eosin. Quantification of the degree of inflammation was determined using a histological colitis score from zero to four (0: no inflammation, 1: mild edemaand inflammation in the lamina propria, 2: crypt abscess formation and inflammation in the lamina propria, 3: more severe inflammation with destructive crypt abscess, and 4: more severe inflammation with active ulceration) [16].

Statistical analysis

All statistical analyses were performed using the IBM SPSS Statistics 22 software package (IBM, New York, NY, USA). $P < 0.5$ was used to indicate significant differences. Descriptive data are demonstrated in the form of mean and percentage. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were calculated. In order to assess the differences in frequency of qualitative variables Chi-square test (X2) was applied.

Results

Fifty patients diagnosed as being ulcerative colitis (27 active and 23 inactive) were involved in our study, and all underwent initial colonoscopy. There were 36 males and 14 females with age ranging from 15-40 years old as shown in the demographic data in Table 1.

	Ulcerative Colitis					
	Active No (27)		Active No (23)			P value
	No	%	No	%		
Age (years)						
15-29	18	66.7	14	60.9	0.181	0.670
30-40	9	33.3	9	39.1		
Sex						
Male	20	74.1	16	69.6	0.125	0.723
Female	7	25.9	7	30.4		

Table 1. Demographic data of the patients.

NBI examination

NBI when applied, it detected 14 patients who are supposed to be inactive with honeycomb pattern and 9 of the inactive patients showed irregular vascular mucosal pattern. This showed the discrepancy between the white light endoscopy and the NBI. This is shown in Table 2.

	Narrow Banding Imaging (NBI) Colonoscopy							
	Crypt Opening Type		Villous Type		Clear Mucosal Vascular Pattern (MVP) (Honey Comb) Type		Irregular MVP	
	No.	%	No.	%	No.	%	No.	%
Ulcerative Colitis								
Active UC (n=27)	13	48.1	14	51.9	-	-	-	-
Inactive UC (n=23)	-	-	-	-	14	60.9	9	39.1

Table 2. Relation between ulcerative colitis (Active, Inactive) and Narrow band imaging (NBI) colonoscopy.

Ulcerative colitis disease activity index (UCDAI)

This index was applied first without using NBI. It divided the patients in normal, mild, moderate and severe (Table 3). It divided the active patients into 5 patients with mild stage, 10 with moderate and 12 patients with severe stage. When the NBI was involved, it changed the results and increased the detection of lesions in inactive patients with high statistical significant p value (Table 4). This revealed 35% of the supposed normal patients to have honeycomb appearance and 44% with irregular mucosal vascular pattern.

	Ulcerative Colitis				X²	MCp
	Active UC (n=27)		Inactive UC (n=23)			
	No.	%	No.	%		
Ulcerative Colitis Disease Activity Index (UCDAI)						
Normal	0	0.0	23	100.0		
Mild	5	18.5	0	0.0	57.671*	<0.001*
Moderate	12	44.4	0	0.0		
Severe	10	37	0	0.0		

Table 3. Ulcerative colitis disease activity index (UCDAI).

	Narrow Band Imaging (NBI) Colonoscopy					
	Active UC		Inactive UC		X²	MCp
Histology	Crypt Opening Type (n=13)	Villous Type (n=14)	Clear Mucosal Vascular Pattern (MVP) (Honeycomb)	Irregular MVP (n=9)		
	%	%	%	%		
UC Endoscopic Index of Severity (UCEIS)						
Normal	0.0	0.0	35.7	44.4		
Mild	23.1	14.3	64.3	55.6	36.407*	<0.001*
Moderate	30.8	57.1	0.0	0.0		
Severe	46.2	28.6	0.0	0.0		

Table 4. Relation between NBI and UCEIS demonstrating a significant correlation between the four types of UC under NBI colonoscopy which were classified into normal, mild, moderate and severe.

NBI and histopathological examination

Multiple biopsies were taken at the sites detected with abnormality according to NBI examination. There was significant correlation between the histological finding and NBI examination with high statistical significant p value. Metaplasia was detected in 55% of the cases that were supposed to be inactive by white light colonoscopy. This is shown in Table 5.

	Narrow Band Imaging (NBI) Colonoscopy					
	Active UC		Inactive UC			
Histology	Crypt Opening Type (n=13)	Villous Type (n=14)	Clear Mucosal Vascular Pattern (MVP) (Honeycomb) Type (n=14)	Irregular MVP (n=9)	X²	MCp
	%	%	%	%		
Basal Plasmacytosis						
Absent	0.0	0.0	28.6	0.0	7.062*	0.011*
Present	100.0	100.0	71.4	100.0		
Goblet Cell Depletion						
Absent	23.1	14.3	35.7	0.0	4.424	0.189
Present	76.9	85.7	64.3	100.0		
Metaplasia						
Absent	100.0	100.0	100.0	44.4	15.042*	<0.001*
Present	0.0	0.0	0	55.6		

Table 5. Relation between NBI and histology.

Validation of the NBI

NBI showed 100% specificity in diagnosing active patients with ulcerative colitis and 68.7% in those with inactive stage. This is presented in Tables 6 and 7.

	Infiltration by inflammatory cells		Sensitivity	Specificity	PPV	NPV	Accuracy
	Absent	Present					
	%	%					
NBI Colonoscopy							
Absent	100	41.7	58.3	100	100	23.08	62.96
Present	0	58.3					
Total	100	100					

Table 6. Agreement (sensitivity, specificity) between and infiltration by inflammatory cells and narrow band imaging (NBI) colonoscopy in active UC (n=27).

	Infiltration by inflammatory cells		Sensitivity	Specificity	PPV	Absent	Accuracy
Narrow band endoscopy	Absent	Present					
	%	%					
Absent	60.9	0	0	60.87	100	0	60.87
Present	39.1	0					
Total	100	100					

Table 7. Agreement (sensitivity, specificity) between and infiltration by inflammatory cells and narrow band imaging (NBI) colonoscopy in inactive UC (n=23).

Discussion

Early detection of colonic caner, specifically in the stage of dysplasia, is one of the tasks during the surveillance of colonic cancer. Added to that, evaluating the response to treatment and the timing of surgical intervention in cases of ulcerative colitis is important. Colonoscopy has a known value in evaluating the response to treatment in cases of UC. Carbonyl and his colleagues stated that severe endoscopic lesions show greater risk of treatment failure with intravenous steroids [17]. Another study carried out by Cacheux et al. concluded that severe endoscopic lesions were predictive of colectomy in those on CsA [18].

This demanded improving the diagnostic tools to reach a better evaluation of the patient condition. NBI shows improved detection of angiogenesis, and consequently the areas of inflammation when compared to conventional colonoscopy [19].

The aim of our study was to evaluate the ability of NBI to evaluate the different stages of ulcerative colitis in active and inactive patients.

The findings of the NBI were divided into crypt opening type, villous type, clear mucosal vascular pattern (honey comb) and irregular mucosal vascular pattern. So, first, we compared these findings with the degree of activity in the examined patients. The inactive patients showed irregular mucosal vascular pattern in 9 of them. Some studies have discussed the role of vascularization in UC in predicting areas of active inflammation, and declared that angiogenesis and inflammation are correlated chronically in the process of the disease [20,21]. Also, the increased angiogenesis is associated with an increase in the vascular leakage which leads to increased inflammatory cell infiltrate. And this is one of the methods that promotes persistent inflammation in UC [22,23].

This indicates that the clinical evaluation could differ from the NBI evaluation. And consequently, some cases may require changing or increasing the medical treatment in spite of good clinical state.

UC endoscopic index of severity (UCEIS) was used in our study. This score depends on evaluating the vascular pattern, bleeding, erosions and ulcerations [24]. When we applied this score on our patients, 5 patients showed mild activity, 10 showed moderate activity and 12 showed severe activity. None of the inactive patients showed any signs of activity according to this score.

When we added the NBI colonoscopy findings to the UCEIS, it increased the yielding of the score and demonstrated a significant correlation with a very significant p value of <0.001. A study carried out by Seiko and his colleagues showed similar discrepancy between the NBI and the scoring system [25]. This finding emphasizes the lower limit of scoring systems when depending only on conventional colonoscopy.

Then we studied the correlation between NBI and histological finding. It gave strong correlation with high statistical significant p value. It could detect the metaplasia with a p value of <0.001. The histological examination showed metaplasia in 55.6% of the 9 inactive patients that had an irregular mucosal vascular pattern by the NBI. It also showed the presence of basal plasmocytosis in 71% of the 14 patients with clinical inactivity and clear mucosal vascular pattern and Goblet cell depletion in 64% of the same group. These are considered features of chronicity and their detection in inactive patients gives the hint to reconsider the staging in those patients. Our results agreed with the work conducted by Tao and his colleagues where histological examination was in concordance with the NBI examination [26].

Lastly, we validated the NBI as a diagnostic technique in both active and inactive patients. It had a sensitivity of 58.3% with a specificity of 100% and accuracy of 62.9% in active patients with UC.

Our study has few limitations as the small sample size used and the lack of follow up for the inactive patients who were diagnosed by having irregular mucosal vascular pattern and degree of metaplasia. Also, the study lacked the relation between the line of management and the NBI findings.

Conclusion

Narrow band imaging colonoscopy is an easy method that adds value for the conventional colonoscopic evaluation of the patients suffering from ulcerative colitis. NBI seems to provide additional information that might lead to further classification of the endoscopic activity rather than the active or inactive.

Conflict of Interest

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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