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ORIGINAL ARTICLE

비확대 협대역 대장내시경을 이용한 대장용종의 감별진단

김봉진, 박무인, 박선자, 문 원, 박은택, 김성은, 임창섭, 유재훈, 강성주
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Differential Diagnosis of Colorectal Polyps with Narrow Band Imaging Colonoscopy without Magnification

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Background/Aims: Narrow band imaging (NBI) endoscopy can be used for gross differentiation between the types of colonic polyps. This study was conducted as a retrospective study for estimation of the interobserver and intra-observer agreement of the pit pattern of the mucosal surface and the accuracy of histology prediction.
Methods: A total of 159 patients underwent complete colonoscopy and 219 polyps examined by NBI endoscopy without magnification were assessed. Interobserver and intra-observer agreement were calculated by investigators in each group for determination of the surface pattern and prediction of histology based on the modified Kudo's classification using intraclass correlation coefficient.
Results: Interobserver agreement for the surface pit pattern and prediction of polyp type was 0.84 and 0.73 in experienced endoscopists, and 0.86 and 0.62 in trainees, respectively. Intra-observer agreement for the surface pit patterns and prediction of polyp type was 0.81, 0.83, 0.85, 0.83, 0.56, 0.84, 0.51, 0.83, and 0.71; and 0.71, 0.70, 0.82, 0.54, 0.72, 0.37, 0.51, 0.34, and 0.30, respectively. The diagnostic accuracy for prediction of polyp type was 69.4% for experienced endoscopists and 72.9% for trainees.
Conclusions: NBI endoscopy without magnification showed fairly good inter and intra-observer agreement for the pit pattern of the mucosal surface and the accuracy of histology prediction; however, it had some limitation for differentiation of colon polyp histologic type. Training and experience with NBI is needed for improvement of accuracy. **(Korean J Gastroenterol 2014;63: 276-282)**

Key Words: Colonic polyps; Narrow band imaging; Pit pattern; Intraclass correlation coefficient; Diagnostic accuracy

INTRODUCTION

Colon polyps are classified according to two groups based on the histologic type; neoplastic or non-neoplastic polyps. Non-neoplastic polyps are hyperplastic polyps, which almost never progress to cancer, whereas neoplastic polyps, also known as adenomas, are known to be precancerous lesions based on the adenoma-carcinoma sequence. Therefore, early diagnosis and removal of adenomas is very important in prevention of colon cancer.

Currently, the best diagnostic tool for adenoma is histologic confirmation through biopsy. However, endoscopic diagnosis of colon polyp prior to pathological confirmation is important because of cost saving by way of resect and dis-

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card strategy.

Magnified chromoendoscopy is useful in differentiation of colon polyps in real time using the Kudo's classification; however, it does have certain limitations, including longer examination time, which have prevented its widespread use.[1] Narrow band imaging (NBI) endoscopy is a new technique that enables better visualization of enhanced pit and capillary patterns of colonic mucosal lesions through the use of two optical filters for short wavelengths as an alternative to chromoendoscopy.[2,3] NBI endoscopy is performed by simply pressing a button on the scope, and the usefulness of magnified NBI endoscopy for differentiation of colon polyps has been proven in previous studies, with a diagnostic accuracy for the histology of colon polyps of 77% to 93% and a κ-value for agreement of vascular and pit patterns of 0.9 and 0.75, respectively.[4-8]

Despite the usefulness of magnified NBI, it is not in routine use due to its high cost. On the other hand, unmagnified NBI endoscopy is more common, and, therefore, it is important to define an exact estimation of the accuracy of unmagnified NBI endoscopy in differentiation of colon polyps.

In the current study, we estimated the diagnostic accuracy and interobserver and intra-observer agreement of unmagnified NBI endoscopy based on pit pattern for endoscopic differentiation of colon polyps.

SUBJECTS AND METHODS

1. Patient characteristics and NBI images

A total of 159 patients (103 male, 56 female) examined with NBI endoscopy in Kosin University Gospel Hospital from March to April 2011 were enrolled in this study. Their mean

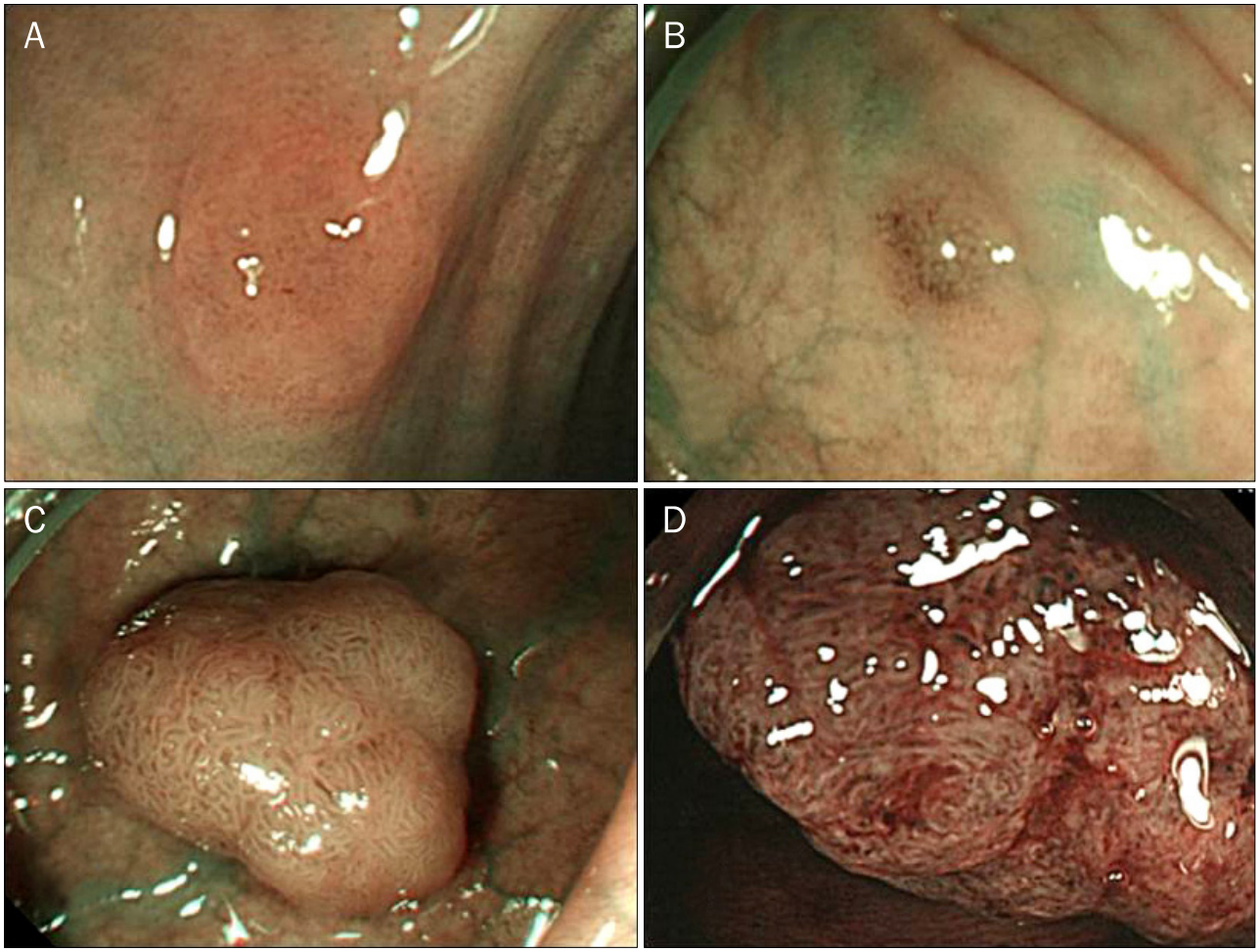

Fig. 1. Polyp pattern on narrow banding imaging (whitish color). (A) Circular pattern with dots. (B) Round-oval pattern. (C) Tubulogyrus pattern. (D) Irregular pattern.

Table 1. Polyp Patterns by Narrow Banding Imaging Colonoscopy[7]

	Type 2	Type 3	Type 4	Type 5
Pattern type	Circular pattern with dots	Round/oval	Tubulogyrus	Irregular/ sparse
Histology	Hyperplasia	Adenoma	Adenoma	Adenocar cinoma

Revised from the article of Rastogi et al. (Gastrointest Endosc 2009;69:716-722).[7]

Table 2. Characteristics of Colon Polyps Assessed by Narrow Band Imaging

Investigator	Size (mm)			
	＜5	6-10	＞11	Total
Hyperplasia	3	3	1	7
Adenoma (serrated adenoma)	50 (1)	111 (6)	46 (1)	205 (8)
Carcinoma	0	0	7	7
Total	53	114	54	219

age was 61.7 years (range, 34 to 84 years). White-light colonoscopy and NBI without magnifying colonoscopy were performed in every patient with successful intubation of cecum, and bowel preparation was fair. All polyps were detected using white-light colonoscopy (CF-H260AZI; Olympus, Tokyo, Japan), and the EVIS LUCERA system (Olympus Optical, Tokyo, Japan) was used in all procedures. All images were collected by nine investigators and the image format was portable network graphics; pictures with obvious pit patterns were selected and arranged randomly for review by one investigator. Pathologic examination was performed by five pathologists who were unaware of the features of each case, based on the World Health Organization criteria.

2. Education and review of investigators

Nine investigators were divided into two groups: three experienced endoscopists who had been performing colonoscopy for more than five years and six trainees who had been performing colonoscopy for less than one year. However, the three experienced endoscopists also have little experience in performance of NBI endoscopy. In terms of NBI pit patterns, colon polyps were classified according to four types; type 2, 3, 4, and 5 (Fig. 1, Table 1).[7] All participants reviewed a training module with the selected 17 pictures for 15 minutes before reviewing 219 pictures for 15 seconds per picture for assessment of the surface pit pattern and prediction of histologic type. The training module consisted of four reference images and 13 tested images, and was performed only once before the first review. In the case of polyp of mixed type pit pattern, the pit pattern of the upper step was adopted. Feedback for pathological results was not acquiredd after the first assessment.

Reevaluation of all polyps was performed two months later for calculation of intra-observer agreement.[7]

Table 3. Inter-observer Agreement for Pit Pattern and Differentiation of Polyp Type

Investigator	Intraclass correlation coefficient	
	Pit pattern	Polyp histologic type
Experienced (n=3)	0.84	0.73
Trainees (n=6)	0.86	0.62

3. Statistical analysis

Statistical analysis was performed using PASW Statistics software ver. 18.0 (IBM Co., Armonk, NY, USA). The interobserver agreement for the surface pit pattern and prediction of histology was calculated among investigators in each group using intraclass correlation coefficient (ICC; good 0.8-1.0; fair 0.6-0.79; poor ＜0.59). The diagnostic accuracy of prediction was calculated for each investigator according to the final histology.

RESULTS

1. Colon polyps

A total of 219 colon polyps were assessed (hyperplasia, 7; adenoma, 205; adenocarcinoma, 7). The mean size was 10 mm, the number of polyps 6-10 mm in size was 114, and the number of polyps less than 5 mm or more than 11 mm was 53 and 54, respectively (Table 2).

2. Interobserver and intra-observer agreement

The ICC value for interobserver agreement for surface pit pattern was 0.84 for experienced endoscopists and 0.86 for trainees. The ICC value for prediction of polyp type was 0.73 for experienced endoscopists and 0.62 for trainees (Table 3). The ICC values for the intra-observer agreement of the nine investigators for the surface pit patterns were 0.81, 0.83, and 0.85 for experienced endoscopists, and 0.83, 0.56, 0.84, 0.51, 0.83, and 0.71 for trainees. For prediction of polyp type, the ICC values were 0.71, 0.70, and 0.82 for experi-

Table 4. Intra-observer Agreement for Pit Pattern and Differentiation of Polyp Type

Investigator	Intraclass correlation coefficient	
	Pit pattern	Polyp histologic type
E1	0.81	0.71
E2	0.83	0.70
E3	0.85	0.82
T1	0.83	0.54
T2	0.56	0.72
T3	0.84	0.37
T4	0.51	0.51
T5	0.83	0.34
T6	0.71	0.30

Table 5. Diagnostic Accuracy for Differentiation of Polyp Type Based on Pit Pattern

Investigator	Accuracy (%)		
	1st reading	2nd reading	Mean
E1	75.0	71.7	73.4
E2	63.2	71.2	67.2
E3	66.5	68.9	67.7
T1	82.5	78.8	80.7
T2	73.1	83.0	78.1
T3	61.3	86.3	73.8
T4	50.5	40.1	45.3
T5	66.5	83.0	74.8
T6	75.9	92.9	84.4
Mean	68.3	75.1	71.7

enced endoscopists, and 0.54, 0.72, 0.37, 0.51, 0.34, and 0.30 for trainees (Table 4).

3. Diagnostic accuracy for prediction of polyp type of various sizes of polyps

In the first review, the diagnostic accuracy for prediction of polyp type was 68.2% (63.2-75.0%) for experienced endoscopists and 68.3% (50.5-82.5%) for trainees, and 70.5% (68.9-71.7%) for experienced endoscopists and 77.4% (40.1-92.9%) for trainees in the second review (Table 5). The mean accuracy for experienced endoscopists and trainees was 42.7%, 59.7% for polyps less than 5 mm in size, 73.4%, 75.3% for polyps 6-10 mm in size, and 90.0%, 80.7% for polyps greater than 11 mm, respectively (Table 6).

DISCUSSION

The surface of the colonic mucosa has pits, which are the openings of the glands. Epithelial lesions of the colon have specific pit patterns according to their neoplastic characteristics; this pit pattern can be easily observed with magnified endoscopy after staining of colonic mucosa with indigocarmine or crystal violet. Kudo et al.[9,10] defined five pit patterns ranging from normal mucosa to adenocarcinoma (normal mucosa, round; hyperplasia, star-like; adenoma, small round or tubulogyrus; adenocarcinoma, irregular or non-structure). Huang et al.[1] reported that the pit pattern of the mucosal surface was useful in differentiation of colon polyps without biopsy based on Kudo's classification. In a previous study, the diagnostic accuracy for prediction of colon polyp type by magnified chromoendocopy was found to be 90.9% and the κ-values for interobserver and intra-observer agreement were 0.716 and 0.810, respectively (κ-value: poor <0.4, fair 0.41 to 0.60, good 0.61 to 0.80, excellent >0.80).[1,11] However, chromoendoscopy has some limitations, including a longer procedure time due to the use of dye.

Table 6. Diagnostic Accuracy for Differentiation of Polyp Type according to Size

Investigator	Size of polyp (mm)					
	<5		6-10		>11	
	1st	2nd	1st	2nd	1st	2nd
E1	52.8	32.1	79.5	82.1	89.4	91.5
E2	39.6	39.6	63.4	75.9	89.4	95.7
E3	43.4	49.1	70.5	68.8	83.0	91.5
T1	75.5	66.0	81.3	78.6	93.6	93.6
T2	47.2	62.3	81.3	87.5	83.0	95.7
T3	47.2	73.6	63.4	89.3	72.3	93.6
T4	32.1	11.3	54.5	39.3	61.7	74.5
T5	54.7	83.0	69.6	80.4	72.3	89.4
T6	73.6	90.6	82.1	96.4	63.8	87.2
Mean	51.8	56.4	71.7	77.6	78.7	90.3

NBI endoscopy with a filter for short wavelengths (415 nm, 540 nm) was recently introduced. This technique is simple to perform, requiring only pushing an extra button on the scope.[2,3] NBI endoscopy, also known as electronic chromoendoscopy, is an alternative to conventional chromoendoscopy. NBI endoscopy aids in differentiation of colon polyps by emphasizing pit and vascular patterns.[12-16] It has been actively used in various fields, including diagnosis of cancerous lesions of the esophagus and stomach, estimation of depth in cancer, diagnosis of Barrett's esophagus, and screening of dysplasia in inflammatory bowel disease.[17-22]

East et al.[6] showed that there is a correlation between NBI endoscopy and chromoendoscopy in terms of pit pattern;

however, it is not identical. Therefore, they recommended a modification of Kudo's classification for use in NBI that makes use of capillary patterns, which can differentiate polyps as well as pit pattern. In a study of polyps less than 6 mm in size, the agreement between NBI and chromoendoscopy was poor (κ-value=0.23). In this study, the pit pattern was similar to that of chromoendoscopy in cases of adenoma and adenocarcinoma; however, a star-shaped pattern was not typically found in cases of hyperplastic polyps. Therefore, we used a new classification system of four types of pit patterns, including adenocarcinoma, which modified Rastogi's classification system.[7]

In our study, the ICC value for interobserver agreement for surface pit pattern was more than 0.8 for both experienced endoscopists and trainees, similar to the results of a previous study.[4,6,8] Through this result, we reconfirmed that there is good interobserver agreement in NBI endoscopy, and we suggest that education time influenced the good agreement of the trainees. The ICC values for the intra-observer agreement for surface pit pattern were 0.81-0.85 for experienced endoscopists and 0.56-0.83 for trainees. The fluctuation of the ICC value in trainees suggests that accumulation of sufficient experience is needed for consistent intra-observer agreement. However, a lower ICC value was observed for interobserver and intra-observer agreement for prediction of polyp type than for pit pattern, which reflects the fact that investigators had difficulty in deciding on histologic type with NBI endoscopy and considered other elements besides pit pattern.

Diagnostic accuracy of differentiation of colon polyps by NBI is known to be significantly higher than by conventional endoscopy.[4-8] Zhou et al.[23] reported that the accuracy for predicting the histologic type of a polyp based on pit pattern with magnified NBI endoscopy was 93%. In another study of polyps less than 6 mm in size, the accuracy of two investigators was reported to be 72% and 84%, respectively.[6] The accuracy of unmagnified NBI endoscopy for prediction of polyp type was found to be 80% to 86% among four researchers.[5] Despite its high accuracy, performance of NBI endoscopy is still difficult for beginners, and many studies have shown that training can be helpful in improvement of accuracy for differentiation of polyp type. After an education program, the accuracy of NBI endoscopy with magnification for polyps less than 5 mm in size improved from 73% to 90% in beginners.[24] Studies of unmagnified NBI endoscopy showed an improvement of accuracy (65% to 78%, 75% to 90%) ($p<0.001$).[25]

Rogart et al.[26] showed that confirmation of approximately 130 lesions and 200 pit patterns is needed for improvement of the accuracy of differentiation of polyp type with unmagnified NBI endoscopy. This learning curve can be shortened, and improvement of diagnostic accuracy is possible through educational sessions.[24,25,27] Raghavendra et al.[27] reported that a 20-minute training program was effective in improving accuracy and interobserver agreement. For this reason, as part of our study, we included a 15-minute training session on unmagnified NBI endoscopy.

The total mean accuracy was 71.7%, and the accuracies of experienced endoscopists and trainees were 69.4% and 72.9%, respectively. In particular, accuracy in polyps less than 5 mm was 54.1%. Our accuracy was lower than that reported in previous studies of unmagnified NBI endoscopy. In a study of diminutive polyps with obscured pit patterns, Higashi et al.[24] reported accuracy of 66% for the experienced group, which showed correlation with our results. In addition, hyperplastic polyps were more easily detected and diagnosed with NBI endoscopy. In other words, visualization and diagnosis of adenomatous polyps was relatively more difficult with NBI endoscopy.[28] We thought that the obscured pit pattern, low confidence of investigators for pit pattern, and low portion of non-adenomatous polyps influenced the low accuracy observed in our study. Some of our results had weak points in representing prediction of all types of polyps; however, these results may be meaningful for evaluation of adenomatous polyps and useful in conduct of further studies.

Our study has some limitations. As noted above, the proportion of adenomatous polyps was relatively high. Unfortunately, the proportion of hyperplastic polyps, which included serrated adenomas, and carcinoma were relatively low. Therefore, in the next studies, it will be necessary to divide evenly among the histologic types of polyps. We did not evaluate the color and vascular patterns using white light endoscopy at the same time. In addition, variability of image quality, bias of image selection, and confining to pit patterns for differentiation of polyps could also affect the results of this study. If a video image is much more vivid, it could increase the accuracy rate and overcome some of these limitations.

In conclusion, we confirmed that the pit pattern of colon polyps seen with unmagnified NBI endoscopy showed good

interobserver agreement for all investigators but good intra-observer agreement in experienced endoscopists and a varied level of intra-observer agreement in trainees. In this study, the diagnostic accuracy of unmagnified NBI endoscopy was lower than that of the previous study, and the exclusive use of the pit pattern had limitations in differentiation of polyp type. Continuous training and experience with NBI endoscopy is needed for improvement of accuracy and we expect that addition of the vascular pattern can be helpful in improving the accuracy of differentiation of colon polyp types.

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