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Endoscopic features of solitary colorectal hamartomatous polyps: solitary juvenile polyp and Peutz-Jeghers polyp

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Abstract:
Background and study aims: The aim of this study was to clarify the endoscopic characteristics of colorectal hamartomatous polyps, including solitary juvenile polyp (JP) and solitary Peutz-Jeghers polyp (PJP).
Patients and methods: We reviewed the clinicopathological and endoscopic findings of 151 colorectal polyps with a diagnosis of solitary JP or solitary PJP. The clinicopathological and endoscopic findings of 119 JPs and 32 PJPs were retrospectively compared.
Results: Endoscopic findings included significantly higher incidences of erosion, whitish exudates, and chicken-skin mucosa in JPs compared to PJPs. A lobular surface was more common in PJPs. Magnified narrow-band imaging endoscopic findings indicated that expanded crypt openings, sparse marginal crypt epithelia, and proliferation of capillary vessels were characteristic of JPs. Branching structures were more prevalent in PJPs. Magnifying chromoendoscopy found a predominance of star-like pit patterns and decreased pit densities in JPs, whereas tubular and branching pit patterns were more frequent in PJPs. Neither type of polyp was found to contain adenomas, dysplasia, or malignant cells. Combinations of specific characteristic endoscopic findings in the JPs and PJPs showed high diagnostic accuracy for those polyps.
Conclusions: Solitary JPs and PJPs in the colorectum manifested characteristic endoscopic findings, and combinations of specific characteristic endoscopic findings may be useful for the endoscopic diagnosis of solitary JPs and PJPs.

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Introduction

Colorectal polyps are outgrowths of the colorectal mucosa. Colorectal polyps are divided into epithelial and nonepithelial polyps, or neoplastic and non-neoplastic polyps [1, 2]. Epithelial neoplastic colorectal polyps include conventional adenomas, serrated lesions, adenocarcinomas, neuroendocrine tumors, and others; whereas epithelial non-neoplastic colorectal polyps include hamartomatous polyps, inflammatory polyps, and others [1]. The hamartomatous colorectal juvenile polyp (JP) and Peutz-Jeghers polyp (PJP) have characteristic pathological features. JPs and PJPs occur almost exclusively in the context of the juvenile polyposis syndrome and Peutz-Jeghers syndrome, respectively, while solitary JPs and PJPs are rare [3, 4].

Conventional colonoscopy, endoscopic ultrasonography, magnifying narrow-band imaging endoscopy (M-NBI), and magnifying chromoendoscopy (MCE) have been widely used to diagnose colorectal polyps [5, 6]. Because the clinical incidence of epithelial neoplastic colorectal polyps is high, there have been many reports on the endoscopic findings of those polyps. However, the endoscopic features of epithelial non-neoplastic colorectal polyps, such as solitary JPs and PJPs, have been rarely reported because they are very uncommon. Furthermore, to our best knowledge, there are no previously published reports on comparisons of the endoscopic findings of solitary JPs and PJPs. Here, we report the results of a retrospective analysis of the endoscopic findings of solitary JPs and PJPs in the colorectum.

Materials and Methods

Study population

This study was based on retrospective data from 2005 to 2024 that were obtained from the endoscopy databases at Kyushu University and Matsuyama Red Cross Hospital. All patients with a diagnosis of solitary JP or solitary PJP in the colorectum that were removed endoscopically or surgically were enrolled. The protocol of this retrospective study was approved by the Institutional Review Boards at Kyushu University and Matsuyama Red Cross Hospital. Informed consent was obtained in the form of opting out on the web-site. Patients who opted out of the study were excluded.

Data collection

Data extracted from the database included the following patient characteristics: age, sex, indications for colonoscopy, colonoscopic findings, tumor histopathology, and treatment. Indications for colonoscopy included hematochezia, positive fecal occult

blood test and screening, and laboratory data, including the hemoglobin level. The location of each lesion was classified as right side (cecum to transverse colon) or left side (descending colon to rectum). The gross morphology of each polyp was based on the Paris classification and designated as either a pedunculated/subpedunculated type or a sessile type [7].

Colonoscopic evaluation

The evaluation of conventional endoscopic findings consisted of the following general characteristics: (1) color (reddish or similar to the surrounding mucosa), (2) surface (erosions, whitish exudates, or lobular), and (3) mucosa surrounding the colonic polyp (chicken-skin mucosa) [8]. Findings obtained by M-NBI and MCE after indigo carmine or crystal violet staining were also taken into consideration. M-NBI findings were reviewed with respect to structure (round, tubular, or branching; expanded crypt openings; or sparse marginal crypt epithelium) and vessels (proliferation of capillary vessels, or dense pattern which is defined as well developed and rather thick vessels) [5, 9, 10]. MCE findings were reviewed with respect to surface patterns (round, star-like, tubular, branching, or round-open pit pattern; or decreased pit density) [6, 11]. The endoscopic findings were evaluated independently by two experienced colonoscopists. Any lesions with discordant evaluations were discussed by the two colonoscopists until agreement was obtained.

Histopathological evaluation

The histological diagnosis was based on information in previous publications [12-14]. The histopathological features of JPs have been reported to be cystic ducts, mucus retention, stromal hyperplasia, and inflammatory cell infiltration (Fig. 1a). The features of PJPs have been reported to include hamartomatous hyperplasia of mucosal epithelium and dendritic growth of smooth muscle fiber bundles from the muscularis mucosae (Fig. 1b). The histopathological diagnoses of colorectal polyps were determined independently by two pathologists. Immunohistochemical staining for desmin was added when there was difficulty in assessing the muscularis mucosae (Fig. 1c, d). We also investigated whether each polyp showed coexisting dysplastic changes such as adenoma, dysplasia, or cancer.

Definition of a "solitary" JP and PJP

We defined a solitary JP or solitary PJP as a single lesion in the colorectum that did not fulfill the diagnostic criteria of juvenile polyposis syndrome or Peutz-Jeghers syndrome, respectively [13].

Statistical analysis

Parametric data are expressed as means ± standard deviation (SD). Nonparametric data are expressed as numbers and percentages. Comparisons between any two groups were performed by the Mann-Whitney test or chi-squared test where appropriate. The diagnostic characteristics of endoscopy with regard to a significantly different prevalence for each characteristic examined in the JPs and PJPs were determined by calculating the values for sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy. The degrees of interobserver agreement were based on kappa statistics and were defined as follows: poor, 0–0.2; fair, 0.21–0.4; moderate, 0.41–0.6; substantial, 0.61–0.8; and excellent, 0.81–1. JMP version 17 software was used for all statistical computations, and probabilities less than 0.05 were considered significant (Statistical Discovery Program, Cary, NC, USA).

Results

Clinical features and laboratory data from the patients with solitary JPs or PJPs

During the study, a total of 151 polyps in the colorectum of 151 patients were found to be either a solitary JP or solitary PJP. There were 119 JPs and 32 PJPs. Patients with a JP were younger than patients with a PJP at the time of diagnosis (42.3 ± 27.9 years vs. 64 ± 18.6 years, respectively; $P < 0.05$). The proportions of patients who had JPs or PJPs, who were male, were similar (69.8% vs. 65.6%, respectively). The incidence of a positive fecal occult blood test was higher in patients with JPs than in patients with PJPs (31.1% vs. 12.5%, respectively; $P < 0.05$). Every patient with a JP was treated by endoscopy, whereas two patients with a PJP underwent surgery.

Endoscopic characteristics of the solitary JPs and PJPs in this study

All JPs were reddish in color, whereas the same color as the surrounding mucosa was seen more frequently in PJPs (9.4%) than in JPs (0.84%) ($P < 0.05$) (Table 1) (Fig. 2, 3). The incidences of erosion (JP 76.5%, PJP 31.3%, $P < 0.05$) and whitish exudates (JP 77.3%, PJP 21.9%, $P < 0.05$) were higher in JPs than in PJPs (Fig. 2). A lobular surface (Fig. 3) was observed more frequently in PJPs (50%) than in JPs (8.4%) ($P < 0.05$). Chicken-skin mucosa surrounding the colonic polyp (Fig. 2) was seen more frequently around JPs (38.7%) than around PJPs (0%) ($P < 0.05$). Differences between the sizes, locations, and morphologies of the two polyp types were not significant.

Magnifying endoscopic findings

M-NBI was performed for 82 lesions (Table 2). The incidences of tubular and branching structures were higher in PJPs than in JPs (tubular: PJP 95% vs JP 67.7%, $P < 0.05$; branching: PJP 95% vs JP 24.2%, $P < 0.05$) (Fig. 3). JPs showed higher frequencies than PJPs of expanded crypt openings (JP 85.5% vs PJP 45%, $P < 0.05$), sparse marginal crypt epithelium (JP 91.9% vs PJP 10%, $P < 0.05$), and proliferation of capillary vessels (JP 91.9%vs PJP 35%, $P < 0.05$) (Fig. 2). Differences between the incidences of round structures and dense patterns were not significant (Fig. 3).

MCE using indigo-carmine or crystal violet staining was performed for 63 lesions (Table 2). Star-like pit patterns and decreased pit density were seen more frequently in JPs than in PJPs (star-like pit patterns: JP 95.8% vs PJP 56.3%, $P < 0.05$; decreased pit density JP 93.6% vs PJP 6.3%, $P < 0.05$) (Fig. 2). The incidences of tubular and branching pit patterns were higher in PJPs than in JPs (tubular: PJP 100% vs JP 72.3%, $P < 0.05$; branching: PJP 87.5% vs JP 27.7%, $P < 0.05$) (Fig. 3). Differences between the incidences of round and round-open pit patterns in the two patient groups were not significant (Fig. 3).

Prevalence of adenoma, dysplasia, or cancer in the polyps of the study patients

No evidence of adenomas, dysplasia, or malignancy was observed in the solitary JPs and PJPs of the study patients (Table 1).

Diagnostic performance of endoscopy for the diagnosis of solitary JPs and PJPs

The diagnostic characteristics of endoscopy with regard to a significantly different prevalence for each characteristic examined in the JPs and PJPs were determined (Table 3). For JPs, the value for proliferation of capillary vessels had the highest sensitivity and NPV, the value for chicken-skin mucosa had the highest specificity and PPV, and the value for decreased pit density had the highest accuracy.

For PJPs, the value for tubular pit pattern had the highest sensitivity and NPV, the value for color similar to that of the surrounding mucosa had the highest specificity and PPV, and the value for lobular surface had the highest accuracy.

When the combinations of the two criteria showing highest diagnostic accuracies for each polyp were taken into account, the diagnostic accuracy for JPs was 91.4% for sparse marginal crypt epithelium+decreased pit density, and that for PJPs was 86.2% for lobular surface+branching pit pattern.

Interobserver variations for determination of M-NBI and MCE findings

The interobserver agreement for the diagnosis of the presence of each endoscopic finding under M-NBI was substantial for round structures (κ = 0.79), branching structures (κ = 0.74), and sparse marginal crypt epithelium (κ = 0.71); and was moderate for tubular structures (κ = 0.59), expanded crypt openings (κ = 0.48), proliferation of capillary vessels (κ = 0.5), and dense patterns (κ = 0.43).

With regard to MCE, the interobserver agreement was substantial for round pit patterns (κ = 0.79), tubular pit patterns (κ = 0.62), and decreased pit density (κ = 0.61); and was moderate for star-like patterns (κ = 0.54), branching pit patterns (κ = 0.60), and round-open pit patterns (κ = 0.51).

Discussion

In this study, solitary JPs and PJPs in the colorectum were found to have characteristic endoscopic findings. We also found high diagnostic capabilities in patients with JPs for sparse marginal crypt epithelium under M-NBI, decreased pit density under MCE, and the combination of these characteristics. In addition, high diagnostic capabilities were found in patients with PJPs for lobular surface under conventional colonoscopy, branching-pit pattern under MCE, and the combination of these characteristics.

The term “JP” was coined by Horrilleno et al [15] in 1957. Histopathologically, the JP, which is classified as a hamartomatous polyp, is characterized by cystic ducts, mucus retention, stromal hyperplasia, and inflammatory cell infiltration [12, 13]. Juvenile polyposis syndrome has multiple hamartomatous polyps. Germline pathogenic variants in the *SMAD4* or *BMPR1A* gene are known to be causative genes [13].

On the other hand, a solitary JP is a sporadic polyp, for which the pathogenesis has not yet been fully explained. Roth et al [16] have hypothesized that the pathogenesis of solitary JPs involves ulceration of the mucosa or inflammation of the main excretory duct of colorectal glands. This is followed by the obstruction, proliferation, and dilatation of the affected glands; which ultimately result in the development of granulation tissue and further development of glands and granulation tissue, which finally lead to the formation of a polyp.

Solitary colorectal JPs usually appear in pediatric patients, showing a peak incidence between 2 to 5 years of age. They account for 80% to 90% of polyps in pediatric patients. They rarely occur in adults aged between 25 and 55 years, and comprise less than 1% of all polyps detected in the adult population [12, 16-22]. Male children and adults are predominantly affected.

The clinical symptoms commonly manifested by patients with solitary JPs are hematochezia, abdominal pain, diarrhea and/or intussusception. Solitary JPs with sizes ranging from 5 to 50 mm usually occur in the left colon, especially in the sigmoid colon or rectum [17, 19, 20, 23-25]. Under colonoscopy, 50% to 80% of solitary JPs appear macroscopically to be pedunculated or subpedunculated [19, 24, 26]. Most solitary JPs are reddish in color, and the surface is often accompanied by erosion or whitish exudates [27, 28]. Chicken-skin mucosa is also observed around JPs. Under endoscopy, chicken-skin mucosa is characterized by a speckled pattern of light-yellow colorectal mucosa [8, 29, 30]. Histopathologically, it is characterized by accumulations of fat in the macrophages of the lamina propria. In previous reports, the prevalence of chicken-skin mucosa in adults and children with solitary JPs has been reported to be 16% and 43%, respectively [24, 29].

The solitary PJP was first described in 1989 by Kuwano et al [31] as a solitary polyp without mucocutaneous pigmentation. Histopathologically, the PJP, which is classified as a hamartomatous polyp, is hamartomatous hyperplasia of the mucosal epithelium with dendritic growth of smooth muscle fiber bundles from the muscularis mucosae [13, 14]. The pathogenesis of the solitary PJP is unknown, but since no somatic or germline mutations were found at the *STK11* locus, it appears to arise from a genetic background different from that of the Peutz–Jeghers syndrome [2]. The mean age of patients with solitary PJPs ranges between 57 to 66 years, with a male predominance [32, 33]. Many patients with a solitary PJP are asymptomatic, but have a positive fecal occult blood test. The mean size is 15 mm, and they usually occur in the sigmoid colon or rectum. Colonoscopy reveals polyps that are pedunculated or subpedunculated and slightly erythematous [32, 33]. Some lesions are branching or multinodular.

Our findings also showed that solitary JPs and solitary PJPs occur predominantly in male patients. They are mostly located in the left colon, are reddish in color, and have macroscopic pedunculated or subpedunculated configurations. Thus, these 2 types of polyps have some clinical and endoscopic findings in common.

There have been few studies in which solitary JPs and PJPs in the colorectum have been examined by image-enhanced endoscopic methods such as M-NBI and MCE [28, 30]. Takeda et al [28] used MCE and found that open pits and low pit density are characteristic of JPs. They reported that these endoscopic findings accurately reflected the pathological features of JP. We found similar MCE findings in our study patients. However, the characteristic M-NBI features of these polyps are unknown. When we took the histopathological features of each polyp into

consideration, we speculated that the M-NBI findings in our study appeared to correspond to the histopathological characteristics of each polyp.

To our best knowledge, no studies have compared the endoscopic findings of solitary JPs with those of solitary PJPs in the colorectum. In this study, we report our comparisons between those findings in the two types of polyps. We found that solitary JPs frequently exhibited erosions, whitish exudates, and chicken-skin mucosa under conventional colonoscopy; expanded crypt openings, sparse marginal crypt epithelia, and proliferation of capillary vessels under M-NBI; and star-like pit patterns and decreased pit density under MCE. Solitary PJPs frequently exhibited lobular surfaces under conventional colonoscopy, tubular and branching structures under M-NBI, and tubular and branching pit patterns under MCE. Thus, JP and PJP exhibited characteristic endoscopic findings. Additionally, combinations of the characteristic endoscopic findings show high diagnostic capabilities. Therefore, we think that the combinations we identified are useful for diagnosing each type of polyp.

Our study did not identify adenomas, dysplastic tissue, or malignancies in either the solitary JPs or solitary PJPs. In general, solitary JPs and PJPs are not thought to have malignant potential, unlike juvenile polyposis syndrome and Peutz-Jeghers syndrome. However, there have been several reports of adenoma, and dysplastic and malignant tissue in solitary JPs and PJPs [30, 32-34]. Dong et al [24] found incidences of malignant tissue and low-grade dysplasia in 107 solitary JPs of 1 (0.9%) and 7 (6.5%), respectively. Ibrahami et al [25] found that 12% of solitary JPs showed adenomatous changes. Liu BL et al [32] showed that 7 of 87 (8%) solitary PJPs were dysplastic. Hypothetical oncogenic pathways of solitary JPs and PJPs include a hamartoma to carcinoma transition, *de novo* carcinogenesis, or adenoma to carcinoma transition. In previous immunohistochemical and molecular analyses, malignant tissue in solitary JPs showed higher levels of Ki-67 and p53 expression than low-grade dysplastic tissue in solitary JPs [24]. Solitary PJPs showed global hypomethylation and CpG island hypermethylation [2]. Thus, solitary JPs and PJPs appear to be associated with malignant transformation.

Therefore, we believe that it is important for endoscopists to recognize that neoplasms may occur in solitary JPs and PJPs, and that those polyps should be removed to prevent the possible development of cancer. Regarding monitoring the patient after endoscopic resection because of the risk of metachronous and/or recurrent lesions, previous studies reported that cases with solitary JPs and PJPs showed no recurrence on repeat colonoscopy [25, 33]. However, another study showed that initial repeat surveillance colonoscopy detected recurrence in 3 (16.7%)

of 18 patients with a single JP [17]. Therefore, monitoring after endoscopic resection should be examined in a prospective study of a much larger number of patients with solitary JPs and PJPs.

Our study has limitations. First, since we included only those patients with lesions removed by endoscopy or surgery and did not include patients with small lesions, the results are not representative of all patients with solitary JPs and PJPs. However, considering the rarity of these conditions, we believe that our 151 patients are an adequate number of participants on which to base a study on solitary JPs and PJPs. Second, because this was a retrospective study, the characteristic endoscopic findings for the diagnosis of solitary JPs and PJPs need to be validated in a prospective study. Third, we were not able to examine the M-NBI and MCE findings for some of these polyps, since this was a retrospective study. Fourth, because we were not able to perform genetic evaluations in our study, some of these cases may have been associated with germline pathogenic variants. Additional prospective studies of large cohorts that include genetic analysis are needed.

In conclusion, this study found that solitary JPs and PJPs manifested characteristic endoscopic findings. In patients with JPs, high diagnostic capabilities were found for sparse marginal crypt epithelium under M-NBI, decreased pit density under MCE, and the combination of these characteristics. In patients with PJPs, high diagnostic capabilities were found for lobular surface under conventional colonoscopy, branching-pit patterns under MCE, and the combination of these characteristics. These findings support the conclusion that we may be able to use endoscopy for the diagnosis of each of these types of polyps.

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Figure legends

Fig. 1. Histopathological findings of juvenile polyp (JP) and Peutz-Jeghers type polyp (PJP) in the colorectum

a: Histopathological findings of JP. There are cystic ducts, mucus retention, stromal hyperplasia, and inflammatory cell infiltration.

b: Histopathological findings of PJP. There is hamartomatous hyperplasia of the mucosal epithelium and dendritic growth of smooth muscle fiber bundles from the muscularis mucosae.

c: Desmin staining of Fig. 1a. There is no proliferation of smooth muscle.

d: Desmin staining of Fig. 1b. There is dendritic growth of smooth muscle fiber bundles from the muscularis mucosae.

Fig. 2. Endoscopic findings of colorectal solitary juvenile polyps

a: Colonoscopy shows a subpedunculated lesion. The surface shows erosion in the rectum. The lesion appears to be reddish in color, and chicken-skin mucosa is seen around the lesion.

b: Colonoscopy shows a pedunculated lesion in the sigmoid colon. The lesion appears to be reddish in color, and the surface is covered with whitish exudate.

c: Magnifying narrow-band endoscopic image (M-NBI). There are expanded crypt openings and proliferation of capillary vessels.

d: M-NBI image. There are tubular structures, sparse marginal crypt epithelium, and proliferation of capillary vessels.

e: Magnifying chromoendoscopic (MCE) image (crystal-violet staining). A star-like and tubular pit patterns, and decreased pit densities are seen.

f: MCE image (crystal-violet staining). Tubular and branching pit patterns, and decreased pit densities are seen.

Fig. 3. Endoscopic findings of colorectal solitary Peutz-Jeghers polyps

a: Colonoscopy shows a protruding lesion with a lobular surface in the sigmoid colon. The lesion appears reddish in color.

b: Colonoscopy shows a pedunculated lesion with a lobular surface in the transverse colon. Both red color and the color the same as the surrounding mucosa are seen on

the surface of the lesion.
c: Magnifying narrow-band imaging (M-NBI) endoscopic view. There are round, tubular, and branching structures, and proliferation of capillary vessels.
d: M-NBI image. Round and branching structures, and a dense pattern are seen.
e: Magnifying chromoendoscopic (MCE) view (crystal violet staining). Star-like, tubular, and branching pit patterns are seen.
f: MCE view (crystal violet staining). There are round pit patterns.

Table 1. Endoscopic and histopathological characteristics of solitary JPs and PJPs

		Solitary JP n=119	Solitary PJP n=32	*P*-value
Size, mm		12.8 ± 7.2	14.6 ± 7.6	0.163
Location	Right side of the colon	35 (29.4)	8 (25)	0.826
	Left side of the colon	84 (70.6)	24 (75)	
Morphology	Pedunculated or subpedunculated	115 (96.6)	32 (100)	0.579
	Sessile	4 (3.4)	0 (0)	
Color	Reddish	119 (100)	31 (96.7)	0.212
	Similar to the surrounding mucosa	1 (0.84)	3 (9.4)	0.030
Surface	Erosion	91 (76.5)	10 (31.3)	0.0001
	Whitish exudates	92 (77.3)	7 (21.9)	0.0001
	Lobular	10 (8.4)	16 (50)	0.0001
Surrounding mucosa	Chicken-skin mucosa	46 (38.7)	0 (0)	0.0001
Incidence of adenoma, high-grade dysplasia, and cancer		0 (0)	0 (0)	1

Continuous values are indicated as means ± SD (standard deviation). Values in parentheses refer to percentages.

JP: juvenile polyp, PJP: Peutz-Jeghers polyp

Table 2. Magnifying NBI and chromoendoscopic findings of solitary JPs and PJPs

	JP	PJP	*P*-value
Magnifying NBI endoscopic findings	n=62	n=20	
Round structure	60 (96.8)	19 (95)	1
Tubular structure	42 (67.7)	19 (95)	0.017
Branching structure	15 (24.2)	17 (85)	0.0001
Expanded crypt openings	53 (85.5)	9 (45)	0.0006
Sparse marginal crypt epithelium	57 (91.9)	2 (10)	0.0001
Proliferation of capillary vessels	57 (91.9)	7 (35)	0.0001
Dense pattern	32 (51.6)	13 (65)	0.317
Magnifying chromoendoscopic findings	n=47	n=16	
Round pit pattern	46 (97.9)	15 (93.8)	0.447
Star-like pit pattern	45 (95.8)	9 (56.3)	0.0005
Tubular pit pattern	34 (72.3)	16 (100)	0.027
Branching pit pattern	13 (27.7)	14 (87.5)	0.0001
Round-open pit pattern	29 (61.7)	6 (37.5)	0.145
Decreased pit density	44 (93.6)	1 (6.3)	0.0001

Values in parentheses refer to percentage.

NBI: narrow-band imaging, JP: juvenile polyp, PJP: Peutz-Jeghers polyp

Table 3. Performance of endoscopic findings for the diagnosis of solitary JPs and PJPs

	Solitary JPs					Solitary PJPs				
Findings	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**Accuracy**	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**Accuracy**
Similar to the surrounding mucosa						12.5	100	100	75	75.9
Erosion	88.1	62.5	86	66.7	81					
Whitish exudates	90.5	75	90.5	75	86.2					
Lobular surface						62.5	90.5	71.4	86.4	82.8
Chicken skin mucosa	33.3	100	100	36.4	51.7					
Tubular structure						93.8	26.2	32.6	91.7	44.8
Branching structure						87.5	69	51.9	93.5	74.1
Expanded crypt openings	85.7	56.3	83.7	60	77.6					
Sparse marginal crypt epithelium	92.9	87.5	95.1	82.4	91.4					
Proliferation of capillary vessels	97.6	62.5	87.2	90.9	87.9					
Star-like pit pattern	95.2	43.8	81.6	77.8	81					
Tubular pit pattern						100	28.6	34.8	100	48.3
Branching pit pattern						87.5	73.8	56	93.9	77.6
Decreased pit density	95.2	93.8	97.6	88.2	94.8					
Combinations of findings										
Sparse marginal crypt epithelium+decreased pit density	90.5	93.8	97.4	78.9	91.4					
Lobular surface+branching pit pattern						62.5	95.2	83.3	87	86.2

Values refer to percentages. JP: juvenile polyp, PJP: Peutz-Jeghers polyp, PPV: positive predictive value, NPV: negative predictive value