Endoscopic characteristics to differentiate SSLs and microvesicular hyperplastic polyps from goblet cell-rich hyperplastic polyps

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ABSTRACT

Background and study aims Among colorectal serrated polyps (SPs), sessile serrated lesions (SSLs) and hyperplastic polyps (HPs) have a similar endoscopic appearance. However, the endoscopic distinctions between those two categories, microvesicular HPs (MVHPs) and goblet cell-rich HPs (GCHPs), are not well understood. Therefore, we compared the endoscopic features of SSLs, MVHPs, and GCHPs.

Methods This retrospective, cross-sectional study was conducted at the Toyoshima Endoscopy Clinic. We examined polyp size, location, Paris classification type, mucus cap, indistinct border, expanded crypt opening, varicose microvascular vessels, and JNET classification type. Multivariable analysis of each endoscopic finding using a binomial logistic regression model determined the factors that predicted SP histology.

Results A total of 670 SPs were enrolled in this study, comprising 159 SSLs, 361 MVHPs, and 150 GCHPs. On comparing the SSL + MVHP group and the GCHP group, a mucus cap (partial regression coefficient 1.705), expanded crypt opening (1.828), and varicose microvascular vessels (1.270) were more often observed in the SSL + MVHP group compared with the GCHP group. In the comparison between MVHPs and GCHPs, a mucus cap (1.564), expanded crypt opening (1.802), and varicose microvascular vessels (1.288) were more often found in MVHPs in contrast to GCHPs. When comparing SSLs and MVHPs, SSLs were more likely to be in the proximal colon (0.662) and were larger (0.198) than the MVHPs. No significant differences were observed in other endoscopic findings.

Conclusions SSLs and MVHPs have endoscopic appearances that differ from those of GCHPs. Considering MVHPs and GCHPs as distinct entities may aid in endoscopic diagnosis of SPs.

Introduction

Globally, colorectal cancer (CRC) is the most common type of gastrointestinal cancer. Conventional adenomas and sessile serrated lesions (SSLs) are precursors to CRC [1, 2]. Risk of CRC can be reduced by removing conventional adenomas and SSLs; therefore, detection and diagnosis of these precursor lesions during colonoscopy is crucial [3, 4, 5]. New CRCs that evolve via serrated polyps (SPs), namely the serrated pathway, account for 25% to 30% [6, 7]. Colorectal SPs are histologically characterized by a serrated epithelial architecture. Currently there is an understanding of the different types of colorectal SPs and their biological characteristics, including SSLs, hyperplastic polyps (HPs), and traditional serrated adenomas (TSAs) [8].

An overall distortion of the normal crypt architecture is the characteristic histological feature of SSLs. Crypt architectural changes observed in SSLs are as follows: 1) crypts grow along the muscularis mucosa; 2) the crypt base dilates in contrast to superficial serrations in HP; 3) crypts asymmetrically proliferate; and 4) they contain a mixture of goblet cells with microvesicular mucin droplets. HPs are identified by exclusion if the architectural criteria for the SSL are not met. The overall architecture of HPs is unchanged compared with that of the normal colonic mucosa, and the crypts remained evenly spaced. HPs have two histological variants, microvesicular HPs (MVHPs) and goblet cell-rich HPs (GCHPs), based on crypt architecture and mucin type. MVHPs have funnel-shaped crypts with serrations limited to the upper two-thirds, with mucin type of mixed microvesicular and goblet cells. GCHPs are characterized by elongated crypts that resemble enlarged normal crypts with little to no serration and goblet cell-predominant mucin (▶ **Fig. 1**) [9, 10].

The serrated pathway includes a sequence of genetic and epigenetic alterations that lead to development of sporadic CRCs. Activating mutations in *BRAF* in MVHPs and SSLs, or *KRAS* in GCHPs are thought to initiate development of SPs and are mutually exclusive [6, 8, 11, 12, 13].

Among SPs, SSLs and HPs have a similar appearance on endoscopy, such as being flat and having a similar color to that of healthy colonic mucosa [14, 15, 16]. A previous study comparing the endoscopic appearance of SSLs and HPs (including both MVHPs and GCHPs) found that SSLs were larger and more frequently had a mucus cap and an indistinct border than HPs [17]. However, the differences in endoscopic appearance between the two categories, MVHPs and GCHPs, are poorly understood. Therefore, we divided HPs into two distinct categories (MVHPs and GCHPs) and compared the endoscopic features of SSLs, MVHPs, and GCHPs.

Patients and methods

Study overview

This retrospective cross-sectional study was conducted at the Toyoshima Endoscopy Clinic, a specialized outpatient endoscopy clinic located in an urban area of Japan. Patients were enrolled between September 2022 and February 2023. When patients had multiple SPs, they were treated individually. Indications for colonocopy included screening, evaluation of symptoms, investigation for abnormal laboratory findings including fecal immunochemical tests, and surveillance [18].

Ethics

This study was conducted in accordance with ethical guidelines for medical studies in Japan and received approval from the Ethics Committee of the Certified Institutional Review Board of Yoyogi Mental Clinic (certificate number: RKK227). We have published the study protocol on our clinic's website (https://www.ichou.com/?p=7125), allowing patients to opt out of the study if they so desired. Participants provided written consent to participate in the study prior to undergoing endoscopy. This study complied with the guidelines of the Declaration of Helsinki.

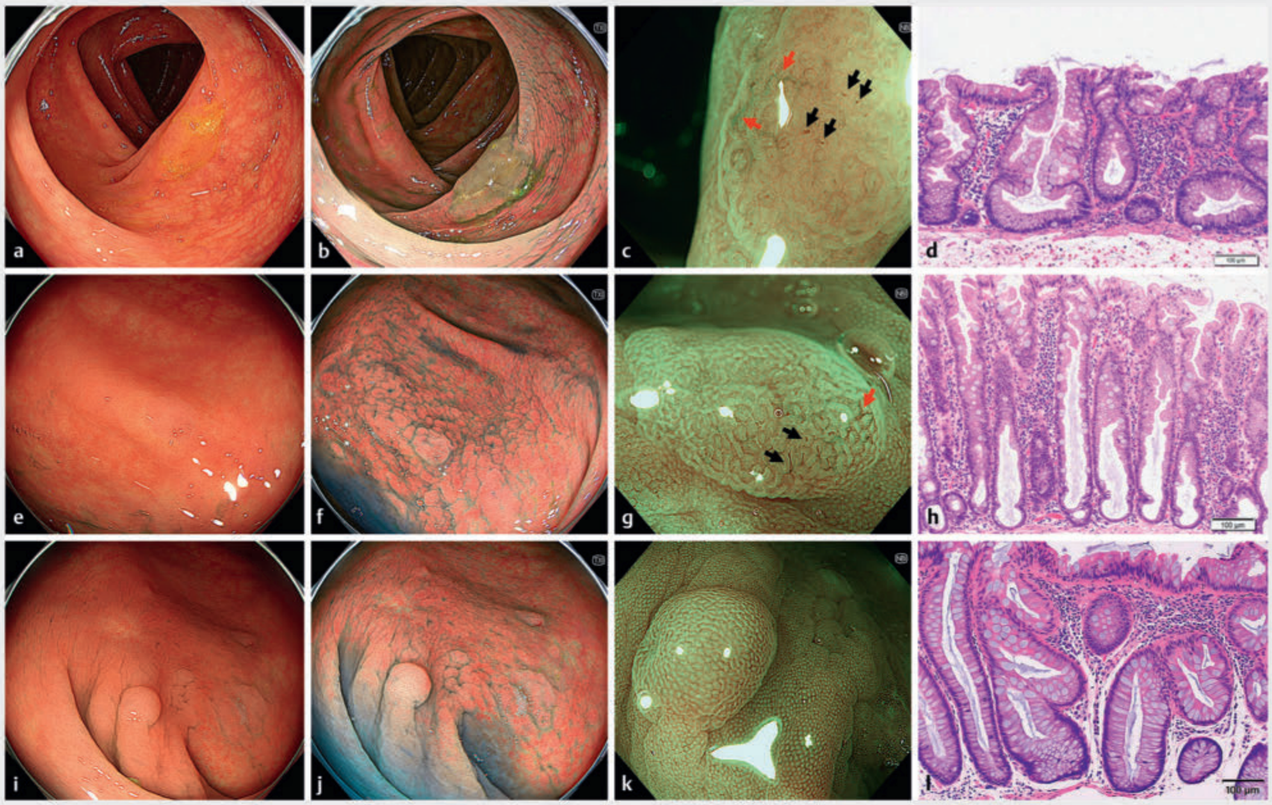
Colonoscopy

Three expert endoscopists (T.N., S.Y., and O.T.) performed the colonoscopies. Toyoshima Endoscopy Clinic has incorporated an EVIS X1 video system center (CV-1500; Olympus Co., Tokyo, Japan) featuring a 4 K resolution ultrahigh-definition liquid crystal display monitor (OEV321UH; Olympus Co., Tokyo, Japan). The clinic utilized colonoscopes (PCF-H290Z, CF-HQ290Z, or CF-XZ1200; Olympus Co., Tokyo, Japan) for the procedures. The T-File System (STS-Medic Inc., Tokyo, Japan) was used for managing endoscopic reports and images. Endoscopic sedation was administered using pethidine, midazolam, and/or propofol with a targeted depth of sedation set at "moderate sedation" (or conscious sedation). Pancolonic chromoendoscopy utilizing 0.05% indigo carmine was routinely conducted. The observation modes included white-light imaging and/or texture and color enhancement imaging (TXI) [19, 20, 21]. All detected SPs were gently washed with water and observed using narrow-band imaging (NBI) with magnification.

Clinically significant SPs (CSSPs) were defined as all SSLs, TSAs, and HPs ≥10 mm, and HPs >5 mm in the proximal colon [2]. In this study, the endoscopists removed the polyps suspected to be CSSPs [18]. An HP was eligible for resection if it was >5 mm in the proximal colon or ≥10 mm in the distal colorectum. When a polyp was suspected to be an SSL owing to its mucus cap, indistinct border, expanded crypt opening, and/or varicose microvascular vessels, it was resected even if it was ≤5 mm in the proximal colon or <10 mm in the distal colorectum. Diminutive polyps (i. e., ≤5 mm) in the distal colorectum, which were predicted with high confidence to be HPs, were not resected. TSAs were not included in this study because the endoscopic appearance of TSAs is distinct from that of other SPs [6].

Colorectal polyps

Endoscopic reports included the location, size, shape, and endoscopic appearance of each SP. The proximal colon was delineated as extending from the cecum to the descending colon. Polyp size was measured by comparing it to the thickness or width of a snare or forceps. Endoscopic morphology was assessed according to the Paris classification [22], indistinct borders [17], presence of a mucus cap [23], expanded crypt opening, varicose microvascular vessels [24, 25], and Japan NBI expert



▶ **Fig. 1** Endoscopic and histological images of serrated polyps. **a, b, c, d** Sessile serrated lesion. **e, f, g, h** Microvesicular hyperplastic polyp. **i, j, k, l** Goblet cell-rich hyperplastic polyp. **a, e, i** White-light imaging. **b, f, j** Texture and color enhancement imaging with indigo carmine dye. **c, g, k** Narrow-band imaging with magnification. Black and red arrows show expanded crypt opening and varicose microvascular vessels, respectively. An EVIS X1 video system center (CV-1500) and a colonoscope (CF-XZ1200; Olympus Corporation) were used. **d, h, l** Hematoxylin and eosin stain.

team (JNET) classification [26]. The mucus cap was defined as a rich mucus covering, while indistinct borders referred to vague demarcations of the lesion border [23]. An expanded crypt opening, also referred to as a dark spot within the crypt or corresponding to Kudo pit pattern type II-Open, was defined as the heterogeneous expansion of nearby crypts [27]. Varicose microvascular vessels were defined as those thicker than meshed capillary vessels and meandering as varicose veins, which differed from the capillary pattern of the mucosal vascular network. The lengths of the varicose microvascular vessels varied, and their location was inconsistent on the lesion surface [24]. Representative images are shown in ▶ **Fig. 1**.

An expert gastrointestinal pathologist (Emeritus Professor Hidenobu Watanabe) diagnosed SPs using hematoxylin and eosin staining. Data were extracted from the Toyoshima Clinic Endoscopy Database.

Statistical analysis

We divided the SPs into two groups: a microvesicular mucin group and goblet cell-rich mucin group (i. e., SSLs + MVHPs versus GCHPs). We then assessed the differences in endoscopic appearance between the two groups. Next, a subgroup analysis was conducted for HPs (i. e., MVHPs versus GCHPs). Finally, we performed a subgroup analysis of the microvesicular mucin group (i. e., SSLs versus MVHPs).

We examined the means and standard deviations for each continuous variable (patient age and polyp size) and frequencies for each categorical variable (patient sex, proximal polyp location, Paris classification type 0-II, mucus cap, indistinct border, expanded crypt opening, varicose microvascular vessels, and JNET classification type 1).

We performed univariable and multivariable analyses of each endoscopic finding using a binomial logistic regression model to determine the factors that predicted the histology of SP, reported as partial regression coefficients. Multivariable analysis was restricted to observations with no missing data. The effects model consisted of variables that were statistically significant in univariable analysis. Two-tailed $P < 0.05$ was considered statistically significant.

We assigned 1 point to the significant variables in the multivariable analysis and developed the sum of these points as the endoscopic SSL/MVHP score. The receiver operating characteristic (ROC) curve was constructed to predict SSLs and MVHPs other than GCHPs in SPs, and the area under the curve (AUC), sensitivity, specificity, and positive predictive value (PPV) of the endoscopic SSL/MVHP score were measured. The optimal

▶ **Table 1** Characteristics of serrated polyps.

	Total	SSL	MVHP	GCHP
N	670	159	361	150
Age, mean ± SD, years	59.0±11.3	57.9±10.8	58.6±11.2	61.1±11.8
Male sex, %	44.8	34.6	47.9	48.0
Proximal colon, %	70.3	86.8	63.4	69.3
Paris classification, type 0-II, %	98.4	97.5	98.3	99.3
Size, mean ± SD, mm	6.42±3.97	9.65±4.96	5.80±3.15	4.45±2.18
Mucus cap, %	51.0	81.1	53.7	12.7
Indistinct border, %	48.5	76.7	49.3	16.7
Expanded crypt opening, %	44.8	69.2	49.3	8.0
Varicose microvascular vessels, %	27.0	45.3	26.9	8.0
JNET classification, type 1, %	93.4	95.6	93.6	90.7

SSL, sessile serrated lesion; MVHP, microvesicular hyperplastic polyp; GCHP, goblet cell-rich hyperplastic polyp; SD, standard deviation; JNET, Japan narrow-band imaging expert team.

cut-off value of the ROC curve was determined using the Youden index. Calculations were performed using BellCurve for Excel version 4.05 (Social Survey Research Information Co., Ltd., Tokyo, Japan).

Results

A total of 670 lesions comprising 159 SSLs, 361 MVHPs, and 150 GCHPs were included in this study. The characteristics of the SPs are listed in ▶ **Table 1**. Mean age was 59.0 years and 44.8% of the patients were men. SPs located in the proximal colon accounted for 70.3%. The majority of SPs showed Paris 0-IIa morphology and JNET classification 1. The mean polyp size was 6.42 mm. The frequencies of mucus cap, indistinct border, expanded crypt opening, and varicose microvascular vessels were 51.0%, 48.5%, 44.8%, and 27.0%, respectively.

Comparison between SSL + MVHP group and GCHP group

▶ **Table 2** shows the effect of endoscopic appearance on the histological diagnosis of SPs in univariable and multivariable analyses. The mucus cap (partial regression coefficient 1.705, 95% confidence interval [CI] 1.141–2.269), expanded crypt opening (1.828, 1.159–2.496), and varicose microvascular vessels (1.270, 0.590–1.949) were more frequently observed in the SSL + MVHP group than in the GCHP group. The mucus cap, expanded crypt opening, and varicose microvascular vessels were each assigned 1 point, and the sum of the points was defined as the endoscopic SSL/MVHP score. The ROC curve for the endoscopic SSL/MVHP score is shown in ▶ **Fig. 2a**. Of the endoscopic SSL/MVHP score, the AUC was 0.83 (95% CI 0.81–0.86) and the optimal cut-off value was 1; the sensitivity, specificity, and PPV were 81.5%, 74.7%, 91.8%, respectively.

Comparison between MVHPs and GCHPs

Univariable and multivariable analyses of the differences in endoscopic appearance between MVHPs and GCHPs are shown in ▶ **Table 3**. Similar to the above analysis, the mucus cap (partial regression coefficient 1.564, 95% CI 0.988–2.139), expanded crypt opening (1.802, 1.127–2.477), and varicose microvascular vessels (1.288, 0.596–1.980) were more often found in MVHPs than in GCHPs. The AUC of the endoscopic SSL/MVHP score was 0.80 (95% CI 0.76–0.83) and the optimal cut-off value was 1 (▶ **Fig. 2b**). The sensitivity, specificity, and PPV were 76.7%, 74.7%, and 87.9%, respectively.

Comparison between SSLs and MVHPs

▶ **Table 4** presents the results of univariable and multivariable analyses comparing the endoscopic findings for SSLs and MVHPs. SSLs were more likely to be located in the proximal colon (partial regression coefficient 0.662, 95% CI 0.087–1.237) and larger (0.198, 0.134–0.262) than MVHPs. No significant differences were observed in the other endoscopic findings.

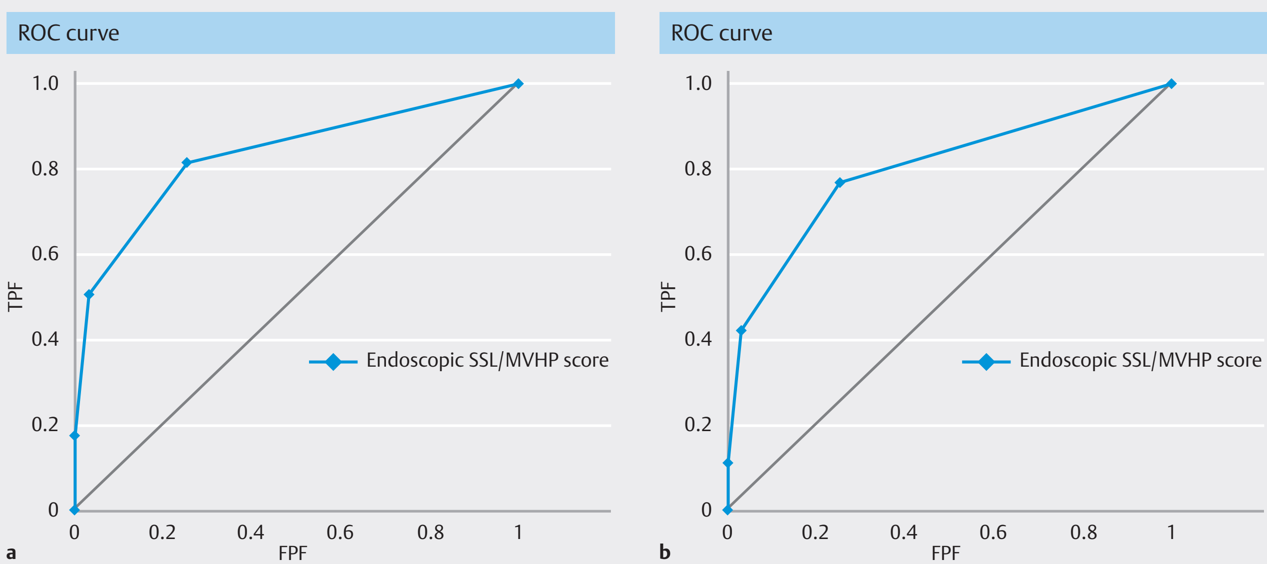
Discussion

We found that the SSL and MVHP groups exhibited distinct endoscopic appearances compared with the GCHP group. Furthermore, a subanalysis of HPs revealed that MVHPs and GCHPs presented with different endoscopic findings. These differences were consistent when comparing the combined SSL + MVHP group with the GCHP group. Adhesion of the mucus, expanded crypt opening, and varicose microvascular vessels were independently and more frequently observed in SSLs and MVHPs than in GCHPs. Furthermore, a comparison between SSLs and MVHPs showed that SSLs were more prevalent in the proximal colon and had a larger diameter. However, there were no significant differences in other endoscopic features.

▶ **Table 2** Comparison of endoscopic appearance of SSL + MVHP group vs GCHP group.

	Univariable analysis			**Multivariable analysis**			
	Partial regression coefficient	**95% CI**	***P* value**	**Partial regression coefficient**	**95% CI**	**Degree of freedom**	***P* value**
Proximal location	0.059	−0.336–0.454	0.77				
Polyp size	0.273	0.194–0.353	<0.001	0.074	−0.014–0.162	1	0.10
Paris classification, type 0-II	−1.072	−3.136–0.992	0.31				
Mucus cap	2.425	1.912–2.938	<0.001	1.705	1.141–2.269	1	<0.001
Indistinct border	1.920	1.456–2.383	<0.001	0.395	−0.182–0.971	1	0.18
Expanded crypt opening	2.659	2.044–3.273	<0.001	1.828	1.159–2.496	1	<0.001
Varicose microvascular vessels	1.711	1.094–2.329	<0.001	1.270	0.590–1.949	1	<0.001
JNET classification, type 1	0.520	−0.143–1.182	0.12				

P values were calculated using binomial logistic regression analysis.
SSL, sessile serrated lesion; MVHP, microvesicular hyperplastic polyp; GCHP, goblet cell-rich hyperplastic polyp; CI, confidence interval; JNET, Japan narrow-band imaging expert team.



▶ **Fig. 2** ROC curve to predict histology of serrated polyp. ROC curve was based on the endoscopic SSL/MVHP score. The mucus cap, expanded crypt opening, and varicose microvascular vessels were each assigned 1 point, and the sum of the points was defined as the endoscopic SSL/MVHP score. **a** ROC curve to distinguish the SSL + MVHP group (n = 520) from the GCHP group (n = 150). **b** ROC curve to distinguish the MVHP group (n = 361) from the GCHP group (n = 150). ROC, receiver operating characteristic; TPF, true-positive fraction; FPF, false-positive fraction; SSL, sessile serrated lesion; MVHP, microvesicular hyperplastic polyp; GCHP, goblet cell-rich hyperplastic polyp.

These distinctions in endoscopic appearance may be attributed to histological and molecular similarities between SSLs and MVHPs, unlike with GCHPs. Histologically, the mucin types of SSLs and MVHPs are mixed microvesicular and goblet cells, whereas GCHPs are goblet cell-predominant. This property of mucus may contribute to endoscopic mucus adhesion [28]. Similar to MVHPs, SSLs are characterized by bland cytology and crypts with prominent serrations. Although an SSL is identified when at least one crypt shows unequivocal distortion according to the updated World Health Organization (WHO) criteria, the majority of SSL crypts lack abnormal architecture, and most crypts resemble those seen in MVHPs [6, 8]. Regard-

▶ **Table 3** Comparison of endoscopic appearance of MVHPs vs GCHPs.

	Univariable analysis			Multivariable analysis			
	Partial regression coefficient	95% CI	P value	Partial regression coefficient	95% CI	Degree of freedom	P value
Proximal location	−0.265	−0.673–0.143	0.20				
Polyp size	0.197	0.113–0.280	<0.001	0.014	−0.083–0.111	1	0.78
Paris classification, type 0-II	−0.924	−3.049–1.202	0.39				
Mucus cap	2.081	1.557–2.604	<0.001	1.564	0.988–2.139	1	<0.001
Indistinct border	1.582	1.105–2.058	<0.001	0.434	−0.153–1.020	1	0.15
Expanded crypt opening	2.415	1.790–3.040	<0.001	1.802	1.127–2.477	1	<0.001
Varicose microvascular vessels	1.441	0.807–2.075	<0.001	1.288	0.596–1.980	1	<0.001
JNET classification, type 1	0.414	-0.280–1.108	0.24				

P values were calculated using binomial logistic regression analysis.
MVHP, microvesicular hyperplastic polyp; GCHP, goblet cell-rich hyperplastic polyp; CI, confidence interval; JNET, Japan narrow-band imaging expert team.

▶ **Table 4** Comparison of endoscopic appearance of SSLs vs MVHPs.

	Univariable analysis			Multivariable analysis			
	Partial regression coefficient	95% CI	P value	Partial regression coefficient	95% CI	Degree of freedom	P value
Proximal location	1.332	0.825–1.838	<0.001	0.662	0.087–1.237	1	0.024
Polyp size	0.250	0.191–0.308	<0.001	0.198	0.134–0.262	1	<0.001
Paris classification, type 0-II	−0.423	−1.702–0.856	0.52				
Mucus cap	1.309	0.861–1.757	<0.001	0.521	−0.008–1.049	1	0.054
Indistinct border	1.221	0.799–1.643	<0.001	0.113	−0.429–0.655	1	0.68
Expanded crypt opening	0.836	0.442–1.231	<0.001	0.132	−0.352–0.617	1	0.59
Varicose microvascular vessels	0.812	0.423–1.201	<0.001	0.299	−0.155–0.754	1	0.20
JNET classification, type 1	0.390	-0.477–1.258	0.38				

P values were calculated using binomial logistic regression analysis.
SSL, sessile serrated lesion; MVHP, microvesicular hyperplastic polyp; CI, confidence interval; JNET, Japan narrow-band imaging expert team.

ing molecular features, more than 90% of SSLs and 70% to 80% of MVHPs have *BRAF* mutations, whereas SSLs and MVHPs do not have *KRAS* mutations. In contrast, > 90% of GCHPs have *KRAS* mutations, but no GCHPs have *BRAF* mutations. Given that SSLs and MVHPs are recognized as the *BRAF* serrated pathway, GCHPs are thought to be the *KRAS* serrated pathway and are mutually exclusive [8, 13]. The similarities between SSLs and MVHPs may be reflected in their endoscopic appearances [13]. In the endoscopic diagnosis of SPs, including the use of artificial intelligence (AI), a more accurate diagnosis could be made if SPs were evaluated based on three categories: SSL, MVHP, and GCHP, instead of classifying them into two categories: SSL and HP.

In contrast to HPs, SSLs are frequently covered with a mucus cap [6]. An expanded crypt opening is believed to correspond to crypt dilation, which is an important histological feature of SSLs [23]. Varicose microvascular vessels are defined as thickened vessels that differ from the capillary pattern of the mucosal vascular network and are inconsistently located on the lesion surface [24]. Thus, a mucus cap, expanded crypt opening, and varicose microvascular vessels have been reported as findings specific to SSLs; however, this study demonstrated that they were also associated with MVHPs. Recent advances in endoscopy (e. g., improved image quality and image enhancement with TXI) may lead to identification of these findings in MVHPs (▶ **Fig. 1**) [20, 29].

In this study, the differences between SSLs and MVHPs were their localization and size. Pai et al. reported that the majority of HPs (75%–90%) are found in the distal colon and rectum, whereas SSLs have a predilection for the proximal colon (70%–80%). SSLs are characterized by larger size and distal HPs are usually small (<5 mm). Furthermore, SSLs are known precursors to CRC, although HPs, particularly proximal MVHPs, are probable precursors to SSLs [6, 8, 17]. These results are in agreement with those of the present study. Collectively, among the SPs, the mucus cap, expanded crypt opening, and varicose microvascular vessels are predictors of not only SSLs but also MVHPs. Among the SPs with these endoscopic appearances, large polyps in the proximal colon are more likely to be SSLs. Endoscopic appearance, size, and location could allow for prediction of the type of SP [8].

The endoscopist's level of confidence in optical diagnosis of a colorectal lesion is an important factor in its application to clinical practice. The majority of lesions have typical endoscopic features that enable a high-confidence prediction of histology [30]. However, our findings suggest that optical diagnosis performance may be decreased in differentiation of SSLs from MVHPs. The confidence level may increase if the SPs are categorized as the SSL + MVHP group vs the GCHP group instead of SSLs vs HPs. At least, the individual endoscopic diagnosis of MVHPs and GCHPs is warranted. Currently, computer-aided diagnosis (CADx) using AI is progressing in endoscopic diagnosis [31]. Education about HPs as separate from MVHPs or GCHPs would enable the differential diagnosis of MVHPs and GCHPs. Our findings are particularly promising for development of future AI CADx modules and may substantially contribute to the field.

Pathologically, making the differential diagnosis of SPs is also challenging. Singh et al. [32] reported that nearly one-fifth of previously diagnosed HPs in the proximal colon and those >5 mm in size were histologically reclassified as SSLs on reassessment by other pathologists. Because MVHPs, in particular, bear histological similarities to SSLs [9, 10], pathologists should carefully differentiate proximal MVHPs and MVHPs >5 mm from SSLs. When pathologists arbitrarily diagnose MVHP and GCHP separately, the chance of misdiagnosing SSLs as HPs might be reduced.

Varicose microvascular vessels have two entities, as follows: the dilated and branching vessels (DBVs) reported by Yamada et al. [33] and the thick and branching vessels (TBVs) reported by Yamashina et al. [34]. DBVs are defined as thickened capillary vessels with branching on the surface and differ from the "meshed capillary vessels" in the Sano et al. capillary pattern classification [35]. DBVs are usually dark brown, which indicates that the vessels are in the superficial layers. Yamashina et al. described that TBVs were dark green and much thicker than meshed capillary vessels. The dark green color on NBI indicates that the vessels are in the deeper layers. The sensitivities of varicose microvascular vessels, DBVs, and TBVs for being SSLs are reportedly 57.9%, 65%, and 45.1%, respectively. Their specificities for being SSLs were 87.8%, 76%, and 68.9%, respectively. Our study used the diagnostic criteria for varicose microvascular vessels (▶ **Fig. 1c** and ▶ **Fig. 1g** (red arrows) represent TBVs and DBVs, respectively). Varicose microvascular vessels should be assessed individually for DBVs and TBVs, and that is a topic for future research.

The present study has some limitations. First, it had a retrospective design and was limited to a single center with expert endoscopists. However, the data source was well-controlled. Future prospective investigations involving multiple centers, including non-expert practitioners, are warranted. Second, we used NBI and TXI as image-enhancing modalities (Olympus Corporation). To further validate our results, it is necessary to verify these findings using other image enhancement methods, such as blue laser imaging, and linked color imaging (LCI, Fujifilm Corporation) is required [36]. Third, mutations in *BRAF* and *KRAS* may contribute to differences in endoscopic appearance. However, this study did not explore the association between molecular profiles and endoscopic features. Fourth, the present study was conducted in routine clinical practice, and polyp resection was limited to those suspected to be CSSPs [2]. Therefore, certain small HPs in the distal colorectum were excluded from this study. Conversely, all endoscopically diagnosed SSLs were removed, including the small ones in the distal colorectum. If all HPs were also resected, it might have underscored the larger and more frequent occurrence of SSLs in the proximal colon.

Conclusions

In conclusion, SSLs and MVHPs had distinct endoscopic appearances including mucus cap, expanded crypt opening, and varicose microvascular vessels, compared with GCHPs. There were no differences in endoscopic findings between SSLs and MVHPs, other than their location and size. Thus, interestingly, MVHPs and GCHPs, while belonging to the same HP category, displayed different endoscopic appearances. Conversely, SSLs and MVHPs, despite belonging to different histopathological categories, demonstrated striking endoscopic similarities. Results of this study build upon our current understanding of SPs, particularly for distinguishing between JNET type I lesions. It offers information about variables that differ in SSLs, MVHPs, and GCHPs, advancing the endoscopist's ability to distinguish among them.

Diagnosing HP as an individual category (i. e., MVHP or GCHP), rather than diagnosing it inclusively, is vital in clinical practice for both endoscopists and pathologists. Although MVHPs are categorized into HPs according to the WHO classification [7], they may be precursors to SSLs and share a very similar endoscopic appearance. Differentiating MVHPs from GCHPs would influence pathological awareness, endoscopic therapeutic strategies, and surveillance interval recommendations. More evidence from longitudinal studies is needed to determine appropriate therapeutic strategies for SPs.

Conflict of Interest

The authors declare that they have no conflict of interest.

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