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Efficacy of the revised Vienna Classification for diagnosing colorectal epithelial neoplasias

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Abstract

AIM: To prospectively investigate the efficacy of the revised Vienna Classification for diagnosing colorectal epithelial neoplastic lesions in cold biopsy specimens.

METHODS: Patients were selected for inclusion if they had colorectal epithelial lesions that were not considered suitable for direct endoscopic resection. These included colorectal polyps ⩾ 10 mm and lesions suspected of being carcinomas capable of invading the colorectal submucosa or beyond, including strictures, based on the cold biopsies obtained from each lesion prior to resection. We investigated the relationship between diagnoses based on cold biopsy samples using the revised Vienna Classification and resected specimens of the same lesions, and the therapeutic implications of diagnoses made using the revised Vienna Classification. The same cold biopsy specimens were also examined using the Japanese Group Classification guidelines, and compared with the resected specimens of the same lesions for reference.

RESULTS: A total of 179 lesions were identified. The sensitivity, specificity, positive and negative predictive values of the revised Vienna Classification for distinguishing between intramucosal lesions and submucosal invasive carcinomas in cold biopsy specimens was 22.2%, 100%, 100%, and 71.4%, respectively, and for distinguishing between intramucosal lesions and those invading the submucosa or beyond was 59.7%, 100%, 100%, and 37.6%, respectively. The sensitivity, specificity, positive and negative predictive values of the Japanese Group Classification for distinguishing between intramucosal lesions and submucosal invasive carcinomas in cold biopsy specimens was 83.3%, 91.4%, 83.3%, and 91.4%, respectively, and for distinguishing between intramucosal lesions and those invading the submucosa or beyond was 95.1%, 91.4%, 97.9%, and 82.1%, respectively. A total of 137 of 144 carcinomas that had invaded the submucosa or beyond and three high-grade intraepithelial neoplasias were diagnosed as "carcinoma" using the Japanese Group Classification system.

CONCLUSION: The revised Vienna Classification for cold biopsy specimens has high positive predictive value in the diagnosis of colorectal carcinoma invasive to the submucosa or beyond.

Key words: Biopsy; Cancer; Colonoscopy; Colorectal epithelial neoplasia; Revised Vienna Classification

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INTRODUCTION

Considerable discrepancies have been reported between diagnoses of colorectal epithelial neoplastic lesions made by Western and Japanese pathologists from endoscopic cold biopsies and resected specimens of the same

lesions[1,2]. Japanese pathologists have distinguished five groups of lesions within the spectrum of colorectal epithelial neoplasia for cold biopsy specimens [Japanese Group Classification (JGC)], namely: normal or benign changes (inflammation/hyperplasia) without atypia [Group 1 (G1)]; non-neoplastic lesions with atypia resulting from inflammation, hyperplasia or regeneration [Group 2 (G2)]; neoplastic lesions with low-grade atypia, including adenomas with mild or moderate atypia and lesions difficult to diagnose as neoplastic or non-neoplastic [Group 3 (G3)]; neoplastic lesions strongly suspected of carcinoma, including adenomas with severe atypia [Group 4 (G4)]; and definite carcinoma [Group 5 (G5)], irrespective of intramucosal or submucosal invasion[3,4]. This different criterion for the diagnosis of "colorectal carcinoma" may be the reason why there are fewer discrepancies between diagnoses from cold biopsies and resected specimens by Japanese pathologists.

In the clinical setting, cold biopsies are required to facilitate management decisions for large and/or advanced lesions. The therapeutic implications of resecting adenomatous polyps equal to or larger than 10 mm ($\geqslant$ 10 mm) should be considered carefully because these polyps are at risk of becoming submucosal invasive carcinomas[5]. Compared to the endoscopic diagnosis of colorectal polyps including submucosal invasive carcinomas, the endoscopic diagnosis of more advanced colorectal carcinomas rarely presents a problem and can be referred for surgical resection[6]. However, histopathologic confirmation of these lesions from cold biopsy specimens should always be sought. Discrepancies between diagnoses based on cold biopsies and resected specimens of the same lesions are more likely to occur for these large and/or advanced lesions because cold biopsy-based diagnoses are subject to the limitations of superficiality and sampling errors[3]. In contrast, direct endoscopic resection (ER) without prior cold biopsy of small (< 10 mm) colorectal polyps is feasible and histopathologic examination of completely resected lesions enables adequate diagnosis and appropriate treatment, therefore, cold biopsies for small polyps are not mandatory.

Diagnostic discrepancies do not matter to patients if Western and Japanese physicians understand the implications of their respective pathology reports and apply management strategies that are appropriate to the needs of their patients[7]. However, continued attempts to unify Western and Japanese reporting systems are desirable because merging the terminologies of these systems will help codify the advantages of each into a language that is universally understood[8].

To overcome the differences between the conventional Western criteria and the JGC, the Vienna Classification attempted to combine the basic concepts of the conventional Western criteria, which emphasizes that invasion is an indicator of metastatic potential, with the strong points of the JGC, which values consistency between diagnoses of cold biopsy and resected specimens[2,9]. In the revised Vienna Classification (rVC), histopathologic diagnoses are classified into five categories according to neoplastic severity and depth of invasion. This classification also distinguishes between epithelial neoplastic lesions limited to the mucosa and those invading the submucosa[2].

To examine the efficacy of the rVC for diagnosing colorectal polyps $\geqslant$ 10 mm, and colorectal lesions suspected of being carcinomas invasive to the submucosa or beyond, including strictures, we prospectively compared the diagnoses from cold biopsy specimens using the rVC guidelines with the diagnoses from resected specimens of the same lesions using the World Health Organization (WHO) classification[10]. We investigated the value of the rVC system for distinguishing intramucosal lesions from those capable of invading the submucosa or beyond, with special reference to distinguishing between intramucosal lesions and submucosal invasive carcinomas because of the different therapeutic implications among these lesions. In addition, the same cold biopsy specimens were examined using the JGC guidelines and the resulting diagnoses compared to those obtained from the resected specimens of the same lesions, graded according to the WHO classification.

MATERIALS AND METHODS

Patients

In total, 5465 colonoscopies, sigmoidoscopies or proctoscopies were performed prospectively on 3719 patients at the Toho University Ohashi Medical Center, Tokyo, Japan, between January 2001 and December 2003. The study was approved by the Toho University Ohashi Hospital ethics committee. Signed informed consent was obtained from all participating patients. This study was performed in accordance with the Helsinki Declaration.

Inclusion/exclusion criteria

Patients were selected for inclusion in this study if they had colorectal epithelial lesions that were not considered suitable for direct ER. These included colorectal polyps $\geqslant$ 10 mm and lesions suspected of being carcinomas capable of invading the colorectal submucosa or beyond, including strictures, based on the cold biopsies obtained from each lesion prior to resection. The histopathologic diagnosis of each cold biopsy specimen was compared with the final histopathologic diagnosis of each resected lesion. Exclusion criteria included: no epithelial lesions; polyps < 10 mm; polyps $\geqslant$ 10 mm and lesions suspected of being carcinomas invasive to the submucosa or beyond, including strictures, but with no cold biopsy specimens; the inability to compare the histopathologic diagnosis of cold biopsy specimens with the final histopathologic diagnosis of the resected lesion; carcinoid tumors; familial adenomatous polyposis; inflammatory bowel disease; local recurrence after resection for epithelial neoplastic lesions; and the inability to give informed consent.

Endoscopic evaluation

All lesions were diagnosed macroscopically using

conventional colonoscopes (CF-200I, 230I, or 240I; Olympus Co, Ltd, Tokyo, Japan) by endoscopists who had performed more than 500 colonoscopic procedures by direct visualization. If necessary, the lesions were then delineated using 0.1% indigo carmine solution. Polyps and early colorectal carcinomas were classified as Ⅰp (pedunculated type), Ⅰsp (semipedunculated type), Ⅰs (sessile type), Ⅱa (superficial elevated type), Ⅱb (superficial flat type), or Ⅱc (superficial depressed type) according to the criteria outlined by the Japanese Society for Cancer of the Colon and Rectum[4]. Early colorectal carcinoma was defined as carcinoma with invasion limited to the mucosa or submucosa, regardless of the presence or absence of lymph node metastases[1,4]. Lesions that had become invasive carcinomas and had advanced into the muscularis propria or beyond were classified as exophytic/fungating, endophytic/ulcerative, diffusely infiltrative/linitis plastica, or annular according to the WHO classification[10].

Measurements of lesions and tissue sampling

The size of each lesion was estimated *in situ* by using a fully opened standard biopsy forcep (8 mm) (FB-24Q-1; Olympus) adjacent to the lesion, and measured after resection. The cold biopsies were performed using the same forceps (FB-24Q-1; Olympus). The number of cold biopsy specimens and the areas biopsied were dependent on the discretion of each endoscopist; if possible, specimens were obtained from different areas, and included the edges and the center of the lesion.

Treatment modality

Treatment modality was dependent on the size of the lesion, the endoscopic assessment of the depth of invasion and the degree of stricture, and on factors such as the patient's age and morbidity. This was also aided by the histopathologic diagnoses from cold biopsy specimens according to the JGC as routinely practiced.

Histopathologic evaluation

The cold biopsy specimens were fixed with 10% buffered formalin, embedded in paraffin, and stained with hematoxylin and eosin. The only clinical information available to the examining pathologists was that the specimen in question represented a biopsy/biopsies of a colorectal epithelial lesion. All cold biopsy specimen slides were examined independently by two experienced pathologists, and all discrepancies were resolved by a conjoint review of the slides in question. Histopathologic type and grade was evaluated according to the WHO classification[10]. Histopathologic diagnosis of each cold biopsy specimen was made using both the rVC and JGC guidelines[2-4]. If more than one cold biopsy specimen was taken, the most advanced diagnosis was taken as the final diagnosis of the lesion. After resection, tissue samples of the entire lesion were cut from resected specimens that had been fixed in 10% buffered formalin, embedded in paraffin, and stained with hematoxylin and eosin. The histopathologic diagnoses of resected specimens were made for each lesion using the WHO classification[10]. The relationship between the diagnoses of cold biopsy specimens using the rVC and JGC guidelines, and the depth of invasion in resected specimens of the same lesions was investigated.

Statistical analysis

The sensitivity and specificity, and positive and negative predictive values were all calculated with 95% confidence intervals (CI)[11]. The varying proportion of categorical variables between two groups (i.e. intramucosal lesions *versus* submucosal invasive carcinomas, and intramucosal lesions *versus* those invading the submucosa or beyond) was tested by Fisher's exact test. Statistical significance was defined as $P < 0.05$.

RESULTS

Clinicopathologic data

One patient with subserosal invasive transverse colon carcinoma with three cold biopsy specimens was excluded from the analysis because all three specimens showed necrotic tissue only. There were 171 patients (93 men, 78 women; mean age, 66.9 years; range, 33-93) with 179 lesions. A single lesion was found in 165 (96.5%) cases with five (2.9%) and one (0.6%) patients having two or four lesions, respectively. Ten lesions were located in the cecum (5.6%), 34 in the ascending colon (19.0%), 25 in the transverse colon (14.0%), 11 in the descending colon (6.1%), 46 in the sigmoid colon (25.7%), and 53 in the rectum (29.6%). Eight lesions were classified as Ⅰp (4.5%), seven as Ⅰsp (3.9%), 20 as Ⅰs (11.2%), 13 as Ⅱa (7.3%), six as Ⅱa + Ⅱc (3.4%), seven as exophytic/fungating (3.9%), 63 as endophytic/ulcerative (35.2%), and 55 as annular (30.7%). The lesions ranged from 10 to 180 mm in diameter (mean, 46.8 mm). No carcinomas < 10 mm invading the submucosa or beyond were found. Ileocecal resection ($n = 7$), right hemicolectomy ($n = 40$), partial resection of the transverse colon ($n = 6$), left hemicolectomy ($n = 5$), partial resection of the descending colon ($n = 3$), sigmoidectomy ($n = 32$), anterior resection ($n = 37$), abdominoperineal resection ($n = 7$), subtotal colectomy ($n = 4$), Hartmann's procedure ($n = 3$), transsacral resection ($n = 1$), transanal resection ($n = 4$), and ER ($n = 30$) procedures were performed.

Histopathologic diagnoses of cold biopsy specimens from 179 lesions

A total of 404 cold biopsy specimens were obtained from 179 lesions, ranging from one to six specimens per lesion (mean, 2.3). Five inadequate specimens [exudative material (2); granulation tissue (2); necrotic tissue (1)] were excluded; therefore, 399 cold biopsy specimens were included in the analysis. The histopathologic type and grade of each cold biopsy specimen was classified as follows: four non-neoplastic lesions; one indefinite neoplastic lesion; 31 low-grade intraepithelial neoplasias; 55 high-grade intraepithelial neoplasias; 69 well-differentiated adenocarcinomas; 16 moderately differentiated adenocarcinomas; and three poorly differentiated adenocarcinomas.

Table 1 Relationship between the histopathologic diagnoses of cold biopsy specimens using the revised Vienna Classification and the depth of invasion in resected specimens of the same lesions

Invasion depth[1]	The revised Vienna Classification								Total (%)
	C1	C2	C3	C4.1	C4.2	C4.3	C4.4	C5	
Non-N	2	0	0	0	0	0	0	0	2 (1.1)
LGIN	0	0	12	0	0	0	0	0	12 (6.7)
HGIN	0	0	16	2	1	0	2	0	21 (11.7)
Submucosa	0	0	2	1	0	3	8	4	18 (10.1)
MP or beyond	2	1	1	0	6	4	30	82	126 (70.4)
Total (%)	4 (2.2)	1 (0.6)	31 (17.3)		57 (31.8)			86 (48.0)	179 (100)

C: Category; Non-N: Non-neoplastic; LGIN: Low-grade intraepithelial neoplasia; HGIN: High-grade intraepithelial neoplasia; MP: Muscularis propria. [1]The histopathologic diagnoses of resected specimens were made using the World Health Organization classification. The comparison of two groups (intramucosal lesions (i.e. Non-N, LGIN and HGIN) *versus* submucosal invasive carcinomas) tested by Fisher's exact test showed $P = 0.01$. The comparison of two groups (intramucosal lesions *versus* those that had invaded the submucosa or beyond) tested by Fisher's exact test showed $P < 0.001$.

Table 2 Relationship between the histopathologic diagnoses of cold biopsy specimens using the Japanese Group Classification and the depth of invasion in resected specimens of the same lesions

Invasion depth[1]	The Japanese Group Classification					Total (%)
	G1	G2	G3	G4	G5	
Non-N	2	0	0	0	0	2 (1.1)
LGIN	0	0	12	0	0	12 (6.7)
HGIN	0	0	16	2	3	21 (11.7)
Submucosa	0	0	2	1	15	18 (10.1)
MP or beyond	2	1	1	0	122	126 (70.4)
Total (%)	4 (2.2)	1 (0.6)	31 (17.3)	3 (1.7)	140 (78.2)	179 (100)

G: Group. [1]The histopathologic diagnoses of resected specimens were made using the World Health Organization classification. The comparison of two groups [intramucosal lesions (i.e. Non-N, LGIN and HGIN) *versus* submucosal invasive carcinomas] tested by Fisher's exact test showed $P < 0.0001$. The comparison of two groups (intramucosal lesions *versus* those that had invaded the submucosa or beyond) tested by Fisher's exact test showed $P < 0.0001$.

Relationship between the diagnoses of cold biopsy specimens made under the rVC guidelines and the depth of invasion in resected specimens

The histopathologic diagnoses of 399 cold biopsy specimens made using the rVC guidelines were as follows: 51 for C1; one for C2; 50 for C3; four for C4.1; 14 for C4.2; 28 for C4.3; 98 for C4.4; and 153 for C5. The final rVC diagnoses for the 179 lesions included four C1 lesions, one C2 lesion, 31 C3 lesions, 57 C4 lesions, and 86 C5 lesions. Table 1 shows the relationship between the final histopathologic diagnoses of the cold biopsy specimens using the rVC criteria and the depth of invasion in resected specimens of the same lesions. The resected specimens were diagnosed as follows: 35 intramucosal lesions (two non-neoplastic lesions; 12 low-grade intraepithelial neoplasias; 21 high-grade intraepithelial neoplasias); 18 submucosal lesions; and 126 lesions in the muscularis propria or beyond. The sensitivity of the rVC system to distinguish intramucosal lesions from submucosal invasive carcinomas was 22.2% (95% CI, 3.0%-41.4%), with a positive predictive value of 100%. Specificity and negative predictive value were 100% and 71.4% (95% CI, 58.8%-84.1%), respectively. The comparison of two groups (intramucosal lesions *versus* submucosal invasive carcinomas) tested by Fisher's exact test showed $P = 0.01$. The sensitivity of the rVC system to distinguish intramucosal lesions from lesions invasive to the submucosa or beyond was 59.7% (95% CI, 51.7%-67.7%), with a positive predictive value of 100%. Specificity and negative predictive value were 100% and 37.6% (95% CI, 27.7%-47.4%), respectively. The comparison of two groups (intramucosal lesions *versus* those that had invaded the submucosa or beyond) tested by Fisher's exact test showed $P < 0.001$.

Relationship between the diagnoses of cold biopsy specimens made under the JGC guidelines and the depth of invasion in resected specimens

Histopathologic diagnoses of 399 cold biopsy specimens made using the JGC criteria were as follows: 51 specimens in G1; one in G2; 50 in G3; four in G4; and 293 in G5. The final diagnoses for the 179 lesions using the JGC guidelines were as follows: four G1 lesions; one G2 lesion; 31 G3 lesions; three G4 lesions; and 140 G5 lesions. Table 2 shows the relationship between the final histopathologic diagnoses of the cold biopsy specimens using the JGC guidelines and the depth of invasion in resected specimens of the same lesions. The histopathologic diagnoses made for the 179 resected specimens are described in the section above. The sensitivity of the JGC system to distinguish intramucosal lesions from submucosal invasive carcinomas was 83.3% (95% CI, 66.1%-100%), with a positive predictive value of 83.3% (95% CI, 66.1%-100%). Specificity and negative predictive value were 91.4% (95% CI, 82.2%-100%) and 91.4% (95% CI, 82.2%-100%), respectively. The comparison of two groups (intramucosal lesions *versus* submucosal invasive carcinomas) tested by Fisher's exact test showed $P < 0.0001$. The sensitivity of

the JGC system to distinguish intramucosal lesions from lesions invasive to the submucosa or beyond was 95.1% (95% CI, 91.6%-98.7%), with a positive predictive value of 97.9% (95% CI, 95.5%-100%). Specificity and negative predictive value were 91.4% (95% CI, 82.2%-100%) and 82.1% (95% CI, 70.0%-94.1%), respectively. The comparison of two groups (intramucosal lesions *versus* those that had invaded the submucosa or beyond) tested by Fisher's exact test showed $P < 0.0001$. Three high-grade intraepithelial neoplasias and 137 of 144 carcinomas that had invaded the submucosa or beyond were diagnosed as "carcinoma" (G5) under the JGC guidelines.

DISCUSSION

From a therapeutic point of view, the most important histopathologic distinction in cold biopsy specimens taken from colorectal epithelial neoplastic lesions is whether there is evidence of invasion into the submucosa (or beyond). Histopathologic confirmation of lesions using cold biopsy specimens are ideal for predicting the therapeutic implications of colorectal epithelial neoplasia that cannot be treated by direct ER. We have shown that the rVC system had a high positive predictive value (100%) in diagnosing submucosal invasive carcinomas and carcinomas that had invaded the muscularis propria or beyond from cold biopsy specimens. These results may provide both patients and physicians with valuable information that will facilitate management decisions.

In cases of colorectal polyps, Livstone *et al*[12] reported 13 discrepancies (26%) between the diagnoses from single fractional biopsies and the final diagnoses of colonic lesions in 42 patients with 50 colonic polyps (0.8 to 4.5 cm in diameter). Of these discrepancies, four carcinomas invasive to the submucosa or beyond were found; adenomatous epithelium was detected in the fractional biopsies from two cases and normal colonic epithelium in the other two cases[12]. Pugliese *et al*[13] reported that among 53 patients with 59 colorectal polyps ($\geqslant$ 5 mm), seven cases had carcinomas that had invaded the submucosa or beyond, and four of these had been underestimated from the cold biopsy specimens. Gondal *et al*[14] reported that among 442 patients with a total of 532 colorectal adenomas ($\geqslant$ 2 mm) biopsied by flexible sigmoidoscopy and removed by colonoscopy, the assessment of the intraepithelial neoplasia status was changed in 51 adenomas (10%), and 38 (7%) of these had been underestimated from the cold biopsy diagnoses compared with the diagnoses based on polypectomy samples. Of these lesions, 389 (73%) were < 10 mm in diameter. In addition, four carcinomas invading the submucosa or beyond had been underestimated as being low-grade or high-grade intraepithelial neoplasias[14].

These observations suggest that cold biopsy-based diagnoses underestimate histopathologic diagnoses of the resected lesions in some cases of colorectal epithelial neoplastic lesions. In our study, the rVC system underestimated the distinction between intramucosal lesions and submucosal invasive carcinomas in 26.4% (14/53) of lesions. The sensitivity of the rVC system for distinguishing between intramucosal lesions and submucosal invasive carcinomas was poor (22.2%). Therefore, histopathologic examination of completely resected lesions was essential for the adequate diagnosis and appropriate treatment of the colorectal polyps including submucosal invasive carcinomas[15].

Overall, the rVC system had a high specificity (100%) for the histopathologic diagnoses of carcinomas invasive to the colorectal submucosa or beyond, whereas the sensitivity was poor (59.7%). The rVC system underestimated the distinction between intramucosal lesions and lesions that invaded the submucosa or beyond in 32.4% (58/179) of lesions. The poor sensitivity and high underestimation rate of the rVC system was caused by the high prevalence (80.4%) of submucosal or beyond invasive colorectal carcinomas in our cohort, and because the pathologists used invasion of the submucosa or beyond as an obligatory criterion for the diagnosis of carcinoma.

Direct ER without prior cold biopsy of small (< 10 mm) lesions is usually feasible and histopathologic examination of completely resected lesions enables adequate diagnosis and appropriate treatment. Therefore, cold biopsies for small lesions are not needed and our cases did not include these lesions. Under the JGC criteria, 137 of 144 carcinomas that invaded the submucosa or beyond were diagnosed as "carcinoma" (i.e. G5). The diagnostic criteria for colorectal carcinoma according to the JGC guidelines appear to attach more importance on nuclear features and glandular structures, and the presence of evident invasion into the submucosal layer is not considered mandatory[1]. Therefore, although the cold biopsy forceps were usually capable of sampling intramucosal lesions only, the diagnosis of "carcinoma" was possible under the JGC guidelines. For the same reason, distinguishing between intramucosal lesions and those invasive to the submucosa or beyond, or overestimating intramucosal lesions as those invasive to the submucosa or beyond was not a problem under the rVC guidelines, whereas three high-grade intraepithelial neoplasias were diagnosed as "carcinomas" using the JGC system.

Lesions can be diagnosed as low-grade dysplasia in the West and as carcinomas in Japan due to the differences in interpreting nuclear and structural features[1]. Japanese pathologists consider these features as clues for the diagnosis of carcinoma, but Western pathologists either do not take these features into consideration (such as rounded nuclei and variable shape of glands) or do not attach similar importance to these features with regard to the severity of dysplasia (such as marked hyperchromatism of nuclei and enlarged prominent nucleoli)[1]. These different histopathologic interpretations of the nuclear and structural features of lesions between Western and Japanese pathologists require further investigation.

The use of the rVC guidelines for cold biopsy specimens has a high positive predictive value in diagnosing carcinomas invasive to the colorectal

submucosa or beyond. However, it is of limited value in predicting the depth of invasion assigned to the resected specimens, especially for the diagnosis of submucosal invasive carcinomas. This should be supplemented by endoscopic assessment of the depth of invasion.

COMMENTS

Background

Large differences have been found between Western and Japanese pathologists in their diagnosis of colorectal epithelial neoplastic lesions. To overcome the differences between the conventional Western and the Japanese criteria, the Vienna Classification attempted to combine the basic concepts of the conventional Western criteria, which emphasizes that invasion is an indicator of metastatic potential, with the strong points of the Japanese criteria, which values consistency between diagnoses from cold biopsies and resected specimens. In the revised Vienna Classification, histopathologic diagnoses are classified into five categories according to neoplastic severity and depth of invasion. However, the efficacy of the revised Vienna Classification for diagnosing colorectal epithelial neoplastic lesions has not been reported.

Research frontiers

Diagnostic discrepancies do not matter to patients if Western and Japanese physicians understand the implications of their respective pathology reports and apply management strategies that are appropriate to the needs of their patients. However, continued attempts to unify Western and Japanese reporting systems are desirable because merging the terminologies of these systems will help codify the advantages of each into a language that is universally understood.

Innovations and breakthroughs

This is the first report investigating the efficacy of the revised Vienna Classification for diagnosing colorectal epithelial neoplastic lesions in cold biopsy specimens.

Applications

The revised Vienna Classification of colorectal epithelial neoplastic lesions seeks to be more closely in tune patient management, however, it should be emphasized that cold biopsy-based diagnoses are subject to the limitations of superficiality and sampling errors.

Peer review

The authors prospectively investigated the efficacy of the revised Vienna Classification for diagnosing colorectal epithelial neoplastic lesions in cold biopsy specimens. The studies are well done, and the manuscript is well written.

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