ORIGINAL ARTICLE

Narrow Band Endoscopy Assessment of Ulcerative Colitis Activity and its Correlation with Histopathology

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Abstract

Background: ***Several grading schemes were established to accurately assess histopathological and endoscopic recovery in ulcerative colitis patients. A new virtual electronic chromoendoscopy score, known as the Paddington International Virtual Chromoendoscopy Score, was created to assess vascular and mucosal architecture.***

Aim: ***To evaluate the accuracy of virtual chromo endoscopy in recognition of UC activity and compare its results with those of the histopathological examination.***

Methodology: ***Fifty patients diagnosed with UC participated in this prospective study. For endoscopic evaluation, the Mayo Endoscopic Score, UC Endoscopic Index of Severity, and PICaSSO were used. Picasso Histologic Remission Index (PHRI), Nancy Histological Index (NHI), and Robarts Histological Index (RHI) were used to grade each biopsy sample.***

Results: ***We found a high association between PICaSSO and the histological and endoscopic rating methods. When evaluating histological remission (HR), PICaSSO ≤3 Demonstrated advantages, with the maximum accuracy of 98% for NHI, 94% for PHRI, and 90% for RHI. PICaSSO and histology scores (RHI, PHRI, and NHI) have a strong association, with correlation coefficients that are noticeably higher than those of the MES and the UCEIS as defined by RHI ≤3 (AUROC 0.76, 95% CI 0.53 to 1.00), PHRI (< 1 (AUROC 0.83, 95% CI 0.64 to 1.00), and NHI ≤1 (AUROC 0.99, 95% CI 0.96 to 1.00). HH was recognized with a PICaSSO score of ≤3.***

Conclusions: ***PICaSSO showed strong correlations with other ulcerative colitis scoring systems, including endoscopic and histological methods.***

Keywords: Endoscopic Remission; Histological Remission; Ulcerative Colitis

1. Introduction

Recurrent superficial mucosal inflammation is a hallmark of ulcerative colitis (UC) disease that affects the colon and rectum.[1] Clinical signs, endoscopic characteristics, and histological results are used to diagnose UC.[2] The Truelove–Witts severity score [3], Mayo Clinic Score [4] and UC Endoscopic Index of Severity (UCEIS)[5] are the common grading systems now available to evaluate the activity of UC disease. ER or HR evaluation garnered significant consideration since the treatment goal has changed to mucosal healing rather than clinical remission. White-light endoscopy (WLE) results are the primary basis for the Mayo endoscopic subscore (MES).[6] Although MES 0–1 is the primary definition of ER, numerous investigations have shown both its drawbacks and the benefits and clinical utility of histology scores.[7]

Endoscopy, however, is not always able to differentiate between moderate and quiescent UC, and histological evaluation for microscopic activity is becoming more and more helpful.[8]

Meanwhile, the latest Gastrointestinal Endoscopy guideline recommends using contemporary imaging-advanced devices to monitor disease activity, as they have significantly improved the detection of small mucosal alterations.[9]

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Advanced methods are bringing endoscopic remission and histological remission closer together.[10] Over time, VEC was suggested to be a superior substitute for closing the gap between histological and endoscopic evaluation.[11] The PICaSSO, a new VEC score that integrates the vascular architecture under VEC with the mucosal architecture under WLE.[12] NHI [13], RHI [14], Geboes score [15], and "Extent, Chronicity, Activity, Plus additional findings" (ECAP) score [16] were among the numerous histological indices with which it had a good correlation, along with MES and UCEIS. A score of less than or equal to 3 was shown in an international multicenter study to have predictive value for remission at 6 and 12 months[17], and PICaSSO had strong interobserver agreement. It can also be used on all VEC platforms and has good reproducibility.[18]

The intention of this prospective cross-sectional study was evaluating the accuracy of virtual chromo endoscopy in detection of UC activity and comparing its results with the histopathological examination.

2. Patients and methods

Fifty consecutive patients, diagnosed with ulcerative colitis (for a minimum of a year) by clinical, endoscopic and histological procedures, who underwent lower endoscopy at the Endoscopy Unit, Department of Internal Medicine, Al-Hussein University Hospital from September 2022 to August 2024, were included. All of them signed a written informed consent.

Inability to provide permission, pregnancy or lactation, a Boston bowel preparation score below 6, and a colonoscopy contraindication or intolerance were among the exclusion criteria. Additionally, patients with Crohn's disease, infectious colitis, ischaemic colitis, unclassified inflammatory bowel disease, or significant co-morbidities were not included. The study is prospective in nature.

According to the Modified Truelove and Witts criteria, clinical disease activity was divided into four categories: remission, mild, moderate, and severe. [19]

Proctitis (E1), left-sided colitis (E2), and extensive colitis (E3) were the three categories used to identify the disease's extent based on the Montreal classification. [20]

Endoscopic assessment.

The endoscopist was trained in the Paddington International virtual chromo endoscopy score one month before the study's commencement. The endoscopic procedures were done using high-definition narrow band imaging (HD-NBI) (290 series, Olympus, Tokyo, Japan).

The Mayo Endoscopic Score (MES) [21], Ulcerative Colitis Endoscopic Index of Severity (UCEIS), [22] and Paddington International Virtual Chromo Endoscopy Score (PICaSSO) [23] were used to grade the disease's activity. The mucosal and vascular scores of PICaSSO were evaluated by NBI after the colonic region was initially scored using MES and UCEIS, utilising high definition white light images (HD-WLE). According to PICaSSO, a brief, anonymised film of the severely inflamed or healing-representative regions was captured and assessed during the withdrawal.

The criteria for endoscopic remission (ER) were PICaSSO ≤ 3 [24], UCEIS < 1, and MES = 0. The most inflammatory regions yielded at least two targeted biopsy specimens. An expert endoscopist (A.G.) evaluated the endoscopic scores utilised for the analysis, and then two more experienced endoscopists (A.E. and A.M.) went over each film.

Histological assessment

Formalin was used to fix the biopsy for histological examination that depended on PICaSSO Histologic Remission Index (PHRI) [25], Robarts Histopathology Index (RHI) [14] and Nancy Histologic Index (NHI) [26] by expert GI pathologists (S.M.). Histological Remission (HR) was considered as PHRI ≤ 1 and > 1 = active [25], Robarts Histopathology Index (RHI) ≤ 3 with no polymorphonuclear cells in the lamina propria or epithelium and > 3 = active [27] and Nancy Histologic Index (NHI) ≤ 1 and > 1 = active. [14] Endoscopic and clinical data were hidden from the pathologist. [23]

Statistical analysis

Depending on the situation, the data were shown as mean ± standard deviation or median with interquartile range. Spearman correlation coefficients (ρ) and coefficients of determination (R2) were used to evaluate the relationships between the PICaSSO score and additional instruments for diagnosing severe ulcerative colitis (UC). When the p-value is less than 0.05, we consider these statistically significant results.

The next metrics were computed in order to differentiate between active UC and remission: sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy. Using p-values, standard error (SE), 95 percent confidence intervals, and the area under the receiver operating characteristic (ROC) curve (AUC), the discriminating power of these scores was evaluated. SPSS version 28 was utilized for all statistical analyses.

3. Results

Baseline demographics participants

Tables 1, 2, 3, and 4 display the demographics of the 50 UC participants in the study. The patients' average age was 27.72 ± 10.16 years and

56 % were males, The mean BMI of included patients was 23.52 ± 4.41 kg/m2. The mean duration of disease was 4.27 ± 2.88 years. Regarding co-morbidities 26 % of patients had history of smoking, 6% had history of HTN, 4% had history of DM, 2% had history of hypothyroidism and 2% had family history of UC. The extent of the disease was E1 in 16 %, E2 in 42 %, and E3 in 42% of the patients respectively. CRP was positive in 72% and negative in 28% of patients respectively. Calprotectin was also positive in 78% and negative in 22%. The medical treatment in the last 1 year prior to colonoscopy was 40% on biological therapy and 60% on conventional therapy.

Endoscopic scores accuracy in the prediction of HR

Table 1 provides a summary of the sensitivity, specificity, and accuracy of the ER to HR diagnostic performances. With the maximum accuracy of 98% for NHI-HR, 98% for PHRI-HR, and 90% for RHI-HR, PICaSSO-ER was very likely to represent HR. The accuracy of UCEIS-ER's HR assessment was 90% for NHI-HR, 86% for PHRI-HR, and 82% for RHI-HR. With an accuracy of 88% for NHI-HR and 84% for both PHRI-HR and RHI-HR, MES-ER was less accurate than UCEIS-ER and PICaSSO-ER in predicting HR.

Table 1. Endoscopic remission's sensitivity, specificity, and accuracy in histological remission prediction.

	PHRI-HR	RHI-HR	NHI-HR
MES-ER			
SENSITIVITY	95.1%	93%	93.3%
SPECIFICITY	33.3 %	28.6%	40%
ACCURACY	84 %	84%	88%
UCEIS-ER			
SENSITIVITY	97.6%	93%	95.6%
SPECIFICITY	33.3%	14.3%	40%
ACCURACY	86%	82%	90%
PICASSO-ER			
SENSITIVITY	100 %	95.3%	97.8%
SPECIFICITY	66.7 %	57.1%	100%%
ACCURACY	94%	90%	98%

Correlation between Endoscopic and Histological remission Scores.

Endoscopic scores and PHRI ≤ 1 are related (Table 2 and Figure 1). HR was defined as PHI ≤ 1, and HR was related with an AUROC of 0.83 (95% CI 0.64 to 1.00) if the PICaSSO total score was ≤ 3, with an AUROC of 0.65 (95% CI 0.43–0.88) if the UCEIS score was ≤1, and with an AUROC of 0.64 (95% CI 0.42–0.87) if the MES was 0.

NHI ≤ 1 and endoscopic scores are related (Table 3 and Figure 2). A PICaSSO total score of < 3 with an AUROC of 0.99 (95% CI 0.96 to 1.00) was linked to HR when defined as NHI ≤ 1, a UCEIS score of ≤1 was linked to HR with an AUROC of 0.68 (95% CI 0.39–0.97), and a MES of 0 was linked to HR with an AUROC of 0.67 (95% CI 0.38–0.96).

Table 4 and Figure 3 show the relationship between endoscopic scores and RHI ≤ 3. A PICaSSO total score of ≤ 3 was linked to HR with an AUROC of 0.76 (95% CI from 0.53 to 1.00), a UCEIS score of ≤1 was linked to HR with an AUROC of 0.54 (95% CI 0.30 to 0.78), and a MES of 0 was linked to HR with an AUROC of 0.61 (95% CI 0.36 to 0.86). HR was demarcated as RHI ≤ 3 when no polymorphonuclear cells are found in the lamina propria and the epithelium.

Table 2: Endoscopy of active UC versus remission using PHRI as the gold standard.

TOOL	AUC	SE	95% CI		P-VALUE
MAYO SCORE	0.64	0.12	0.42	0.87	0.19
UCEIS	0.65	0.12	0.43	0.88	0.15
PICASSO	0.83	0.10	0.64	1.00	<0.001*

Table 3: Endoscopy of active UC versus remission using NHI as the gold standard.

TOOL	AUC	SE	95% CI		P-VALUE
MAYO SCORE	0.67	0.15	0.38	0.96	0.23
UCEIS	0.68	0.15	0.39	0.97	0.20
PICASSO	0.99	0.01	0.96	1.00	<0.001*

Table 4: Endoscopy of active UC versus remission using RHI as the gold standard.

TOOL	AUC	SE	95% CI		P-VALUE
MAYO SCORE	0.61	0.13	0.36	0.86	0.36
UCEIS	0.54	0.12	0.30	0.78	0.76
PICASSO	0.76	0.12	0.53	1.00	0.03

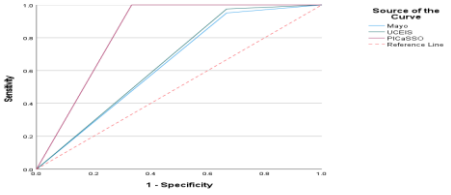

Figure 1. ROC curve for Diagnosis of active UC versus remission via PHRI as the gold standard.

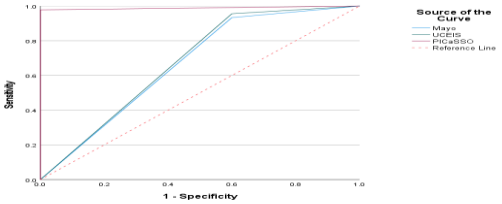

Figure 2. ROC curve for Diagnosis of active UC versus remission via NHI as the gold standard.

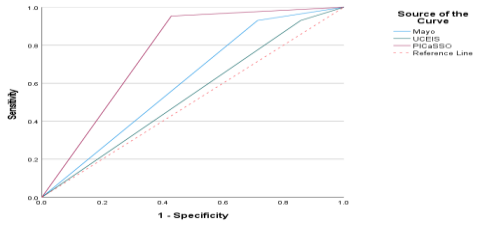

Figure 3. ROC curve for Diagnosis of active UC versus remission RHI as the gold standard.

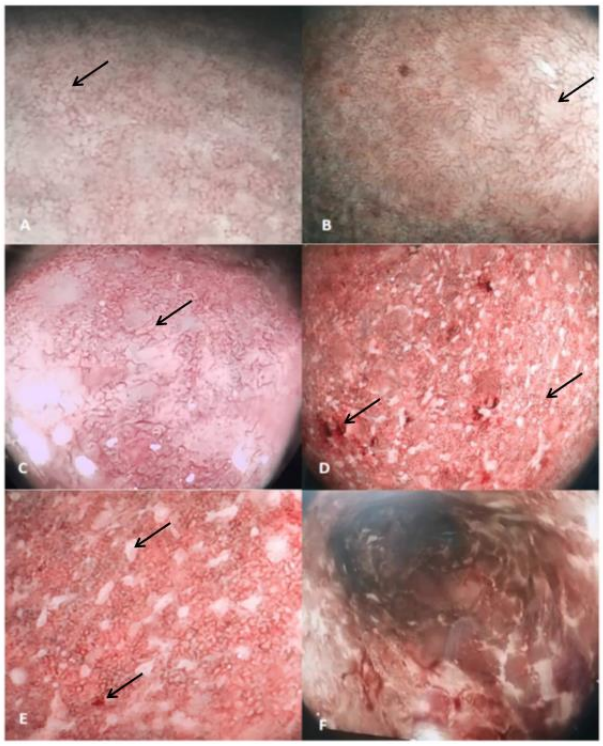

Figure 4. Representative figures assessed by NBI endoscopy.

A: normal vascular and mucosal pattern. B: normal vascular pattern roundish and sparse blood vessels. C: Crowded tortious blood vessels with dilatation. D: micro erosions and intra-mucosal bleeding E:erosion and intra-mucosal bleeding. F:diffuse ulcerations with intra-luminal bleeding.

4. Discussion

In this investigation, we used HD equipment with EVC to verify a novel electronic virtual chromo endoscopy score (EVC) that is more thorough in including information about minimal mucosal and vascular alterations, suggesting that UC patients have acute and chronic inflammation.

We took into account and incorporated both acute and chronic inflammatory alterations regarding vascular besides mucosal patterns in order to characterise the features of endoscopic MH in UC patients efficiently. In order to asess the relation between many histology scores and standard endoscopic UC ratings, we set out to establish PICaSSO-Score (The Paddington International virtual Chromo endoscopy Score).

We found a strong correlation between PICaSSO and histological scores (RHI, PHRI and NHI), with significantly higher association coefficients than those of the MES and the UCEIS. A PICaSSO score of ≤3 Detected HH, defined as RHI ≤3 (AUROC 0.76, 95% CI 0.53 to 1.00), PHRI ≤ 1 (AUROC 0.83, 95% CI 0.64 to 1.00) and NHI ≤1 (AUROC 0.99, 95% CI 0.96 to 1.00).

PICaSSO demonstrated superior diagnostic accuracy with a sensitivity of 97.8% (44/45), specificity of 100% (5/5), and an overall accuracy of 98% (49/50), indicating almost perfect agreement with the NHI, and the p-value (<0.001) confirmed its statistical significance. In contrast, the Mayo score and UCEIS had sensitivity (93.3% (42/45) and 95.6% (43/45), respectively) and specificity (40% (2/5) and 40% (2/5), with accuracy rates of 88% (44/50) and 90% (45/50), respectively indicating fair to moderate agreement with NHI, with p-values of 0.018 and 0.005, respectively, indicating statistical significance.

PICaSSO demonstrated the highest overall accuracy (94%) (47/50) and perfect sensitivity (100%) (41/41), indicating it correctly identified all patients with active UC. Additionally, PICaSSO had a strong specificity (66.7%) (6/9), reflecting substantial agreement with the PHRI, and its p-value (<0.001) indicated statistical significance. In contrast, the Mayo score and UCEIS had lower sensitivity (95.1% and 97.6%, respectively) and substantially lower specificity (both 33.3%), with accuracy rates of 84% and 86%, respectively, indicating fair to moderate agreement with PHRI, with p-values of 0.01 and 0.002, respectively, indicating statistical significance.

PICaSSO demonstrated the highest diagnostic performance, with a sensitivity of 95.3% (41/43), specificity of 57.1% (4/7), and an overall accuracy of 90% (45/50), indicating moderate agreement with RHI, and the p-value was <0.001, signifying statistical significance. In contrast, the Mayo score and UCEIS had sensitivity (93% (40/43) and 93% (40/43), respectively) and specificity (28.6% (2/7) and 14.3% (1/7), with accuracy rates of 84% (42/50) and 82% (41/50), respectively indicating fair to poor agreement with RHI, with p-values of 0.077 and 0.51, respectively, indicating no statistical significance.

PICaSSO outperformed the MES and UCEIS indices in distinguishing between quiescent and mild disease.

The PICaSSO score has several advantages, including accurate connection with HR, low false negative rate (PICASSO ≤ 3 for HR), and strong correlation with all histology scores (better than MES and UCEIS). Targeted biopsies helped to establish strong relationships between endoscopy and histology.

4. Conclusion

ER and HR could be detected by the first VEC PICaSSO, which can accurately detect, according to this prospective cross-sectional study we describe. It also has a significant association with histological activity scores across the endoscopic score range, particularly the NHI score, which is superior to the MES and UCEIS scores.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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