

## Index of the Mayo Endoscopy and Ulcerative Colitis Endoscopy Index of Severity: are they equally valid?

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### ABSTRACT

**Introduction:** endoscopy plays an essential role in the management of patients with ulcerative colitis (UC), as it allows us to visualize and assess the severity of the disease. Different scores have been devised to standardize the findings because such assessments are not always objective.

**Aims:** the aim of this study was to assess the interobserver variability between the Index of Mayo Endoscopy (IME) and the Ulcerative Colitis Endoscopy Index of Severity (UCEIS), analyzing the severity of the endoscopic lesions in patients with UC. The secondary aim was to analyze if the cathartic preparation affected the degree of concordance amongst the endoscopists.

**Material and methods:** this was a single-cohort observational, comparative study in which a colonoscopy was performed in patients with UC, as the normal clinical practice. The results were classified according to the IME and the UCEIS by three endoscopic specialists. In order to assess the degree of interobserver correlation, the Kappa index for IME was used and the intraclass correlation coefficient was used for UCEIS.

**Results:** sixty-seven patients were included in the study. The average age was 51 (SD ± 16.7) and the average Mayo Clinic index was 3.07 (SD ± 2.54). The weighted Kappa index between endoscopists A and B for the IME was 0.8, 0.52 between A and C and 0.49 between B and C. The intraclass correlation coefficient for UCEIS was 0.922 between the three endoscopists (95 % CI: 0.832-0.959). A better interobserver correlation was found when the cathartic preparation was ≥ 8 based on the Boston Scale.

**Conclusions:** there was a higher correlation between the different endoscopists for the UCEIS than for the IME. Thus,

this should be considered to be the best index to use in the clinical practice. A good cleansing preparation is important to improve the interobserver correlation.

**Keywords:** Index of Mayo Endoscopy. Ulcerative Colitis Endoscopy Index of Severity. Ulcerative colitis. Endoscopic score.

### INTRODUCTION

Colonoscopy is a fundamental tool for the diagnosis of ulcerative colitis (UC) due to the fact that it allows a differential diagnosis, an assessment of severity of the disease and screening for colorectal cancer (1). Even though any experienced endoscopist is able to distinguish affected mucosa (Fig. 1), it is not easy to make a correct objective assessment of the mucosa. Different endoscopic consensus (2) and scores have been developed to improve assessment.

The two most popular scores used in the clinical practice are the Index of Mayo Endoscopy (IME) and the Ulcerative Colitis Endoscopy Index of Severity (UCEIS). The IME (Table 1), developed in 1987 by Schroeder et al. (3), assesses the vascular pattern, the reliability and the presence of

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**Fig. 1.** A. Mucosa with a normal vascular pattern, without erythema or erosion. B. Mucosa without a vascular pattern, erythema and erosions. C. Deep ulcers with a slightly raised edge, no vascular pattern and spontaneous bleeding.

erosions and is scored in a simple way from 0 to 3 (4). This score has never been validated in any study, only through its use in the habitual clinical practice (5). The IME is the most used endoscopic index in order to assess the therapeutic response of mucosal healing within clinical trials, due to its simplicity.

**Table 1.** Index of Mayo Endoscopy (IME)

Endoscopic features	Score
Normal or inactive	0
Mild: erythema, decreased vascular pattern, mild friability	1
Moderate: marked erythema, absent vascular pattern, friability, erosions	2
Severe: spontaneous bleeding, ulceration	3

Subsequently, in 2012, Travis et al. created the UCEIS index (Table 2) as a tool to accurately predict the general assessment of the endoscopic severity in UC. The score is based on a scale of nine points (0-8), which assesses the vascular pattern, the presence of bleeding and the presence of erosions/ulcerations. Each one has a different and well-defined level of severity (6). This index has been validated with a high correlation with the visual scale of severity (Kappa 0.9) and the IME, with an interobserver correlation of K0.50 (7). However, it is more complex than the former.

A study demonstrating a good correlation between UCEIS and IME (Kappa index 0.713,  $p < 0.001$ ) (8) has recently been published. Nonetheless, there are different factors that affect the endoscopic assessment, such as the experience of the endoscopist, their knowledge of inflammatory bowel disease, the cathartic preparation, and the lesions and findings seen during colonoscopy. Until now, there are few studies directly comparing these scores, as most of them analyze the different scores independently.

**Table 2.** Ulcerative Colitis Endoscopic Index of Severity (UCEIS)

Endoscopic features	Scale	Definition
Vascular pattern	Normal (0)	Normal vascular pattern with arborization of capillaries clearly defined, or with blurring or patchy loss of capillary margins
	Patchy obliteration (1)	Patchy obliteration of vascular pattern
	Obliterated (2)	Complete obliteration of vascular pattern
Bleeding	None (0)	No visible blood
	Mucosal (1)	Some spots or streaks of coagulated blood on the surface of the mucosa, which can be washed away
	Luminal mild (2)	Some free liquid blood in the lumen
	Luminal moderate or severe (3)	Frank blood in the lumen or visible oozing from the mucosa after washing intraluminal blood, or visible oozing from a hemorrhagic mucosa
Erosions/ulcers	None (0)	Normal mucosa, no visible erosions or ulcers
	Erosions (1)	Tiny ( $\leq 5$ mm) defects in the mucosa, of a white or yellow color with a flat edge
	Superficial ulcer (2)	Larger ( $> 5$ mm) defects in the mucosa, which are discrete fibrin-covered ulcers when compared with erosions, but remain superficial
	Deep ulcer (3)	Deeper excavated defects in the mucosa, with a slightly raised edge

The primary aim of the study was to assess the interobserver concordance of the degree of activity in UC amongst the three endoscopists from our center, according to two endoscopic scores (Mayo and UCEIS). The secondary aim was to analyze if the cathartic preparation affected the degree of concordance amongst the endoscopists.

## MATERIAL AND METHODS

This is a single-cohort observational, comparative study of patients diagnosed with UC who underwent a colonoscopy according to normal clinical practice at the Hospital Universitario Virgen Macarena (HUVVM). The illness was classified according to IME and UCEIS by three different expert endoscopists. An expert endoscopist was defined as having more than 15 years of experience and/or having carried out more than 10,000 colonoscopies and they were classified in the categories A, B and C.

The inclusion criteria were: age > 18, previous diagnosis of UC, follow-up at the Inflammatory Bowel Disease section at the HUVVM, a good-quality video of the colonoscopy lasting at least 60 seconds and an acceptable bowel preparation (cathartic preparation  $\geq 4$ ).

The exclusion criteria were: pregnancy, NYHA > 2, severe chronic obstructive pulmonary disease (COPD), refusal to sign the informed consent for the colonoscopy, patients with inadequate cathartic preparation (Boston Scale < 4 points), impenetrable colonic stenosis in the sigma, suspicion of toxic megacolon and an extensive intestinal resection (subtotal colectomy).

### Source of information

The video recordings were performed using the Endobase® program when withdrawing the colonoscopy from the cecum to the rectum, or at least of the most affected section for no less than 60 seconds. The clinical data and the data for the rest of variables were collected from the electronic digitized clinical histories in the DIRAYA® program of the Andalusian Public Health System (SSPA).

### Data analysis

The following values were calculated for the descriptive analysis: absolute frequency (N), relative frequency (%), average values, typical deviation (T.D.), minimum, maximum and 25 %, 50 % and 75 % values. The Chi-squared test was used to analyze the qualitative variables. Both the Kappa and the weighted Kappa scores and the correlation coefficient were calculated in order to evaluate the concordance amongst the different measurements of the endoscopists. The confidence level was considered to be 95 %. Thus, the experimental p-value was compared to the level of significance of 5 %.

## RESULTS

Seventy-four patients were included in the study, three were excluded due to lack of a histological diagnosis, three due to screening failure and Crohn's disease and one due to an

invalid video. Therefore, the final sample was of 67 patients whose demographic characteristics are shown in table 3.

Colonoscopy results led to changes in treatment in 34.3 % of the patients, of whom 87 % underwent an intensified treatment and the treatment was withdrawn or discontinued in 13 %. The median basal clinical Mayo index in those patients who had a change in their treatment after colonoscopy was 4.5, whilst there was only one patient with no change in treatment ( $p < 0.001$ ). In addition, 95.8 % of patients whose treatment was changed after colonoscopy had a clinical Mayo index  $\geq 2$  ( $p < 0.001$ ).

### Interobserver correlation of IME and UCEIS

The weighted Kappa index between endoscopists A and B for IME was 0.8 (good), 0.52 between A and C (acceptable) and 0.49 between B and C (acceptable). When the endoscopists were divided into subgroups, the extreme IME values (0 and 3) of the correlation between endoscopists A and B, endoscopists A and C and endoscopists B and C had a Kappa index of 1. For the central IME values (1 and 2), the Kappa index was 0.715 for endoscopists A and B, 0.259 for endoscopists A and C and 0.252 for endoscopists B and C.

With regard to UCEIS, the inter-class correlation coefficient of average values was 0.922 amongst the three endoscopists (95 % CI: 0.832-0.959). The inter-class correlation coefficient between endoscopists A and B was 0.943, 0.892 between A and C and 0.920 between B and C. These values were divided into two subgroups with the extreme values (UCEIS 0.1 and 8) and the central values (2, 3, 4, 5, 6 and 7) of the index. A weighted Kappa of 0.72 was

**Table 3.** Demographic characteristics

Demographic characteristics	67 n (%)
<i>Sex:</i>	
Female	31 (46.3 %)
Male	36 (53.7 %)
Age: mean (DE)	51.2 (16.7)
<i>Tobacco:</i>	
Yes	16 (23.9 %)
No	48 (71.6 %)
Former smoker	3 (4.5 %)
<i>Extent:</i>	
Ulcerative proctitis	26 (38.8 %)
Left-sided UC	30 (44.8 %)
Extensive UC	11 (16.4 %)
Mayo Clinic index: mean (DE)	3.07 (2.54)
<i>Treatment:</i>	
Corticosteroids	1 (1.5 %)
Mesalazine	30 (44.8 %)
Corticosteroids + mesalazine	10 (14.9 %)
Mesalazine + azathioprine	12 (17.9 %)
Mesalazine + biological	7 (10.4 %)
Mesalazine + azathioprine + biologic treatment	6 (8.9 %)

**Table 4.** Differences between the interobserver correlation of the endoscopic scores (IME and UCEIS), according to colonic preparation by the Boston scale

	Boston < 8			Boston 8 y 9		
	Endoscopists A and B	Endoscopists A and C	Endoscopists B and C	Endoscopists A and B	Endoscopists A and C	Endoscopists B and C
IME. Weighted Kappa index	0.78	0.38	0.42	0.78	0.63	0.56
UCEIS. Intraclass correlation coefficient	0.851	0.786	0.873	0.860	0.876	0.869

obtained between endoscopists A and B for the extreme values and 0.34 for the central values. A weighted Kappa of 0.33 was obtained for extreme values and 0.21 for central values between endoscopists A and C, and it was 0.295 for extreme values and 0.11 for central values between endoscopists B and C.

### Correlation of the endoscopic scores according to cathartic preparation

The following results were observed when the patients were divided into groups according to their colonic preparation using the Boston scale. With regard to the patients with a Boston scale score < 8, the interobserver correlation according to the weighted Kappa index for IME between endoscopists A and B was 0.78, 0.38 for endoscopists A and C and 0.42 for endoscopists B and C. On the other hand, in the subgroup of patients with a Boston scale score of  $\geq 8$ , the weighted Kappa index for the correlation between endoscopists A and B was 0.78, 0.63 between endoscopists A and C and 0.56 between endoscopists B and C (Table 4).

Likewise, any possible interobserver correlation change for the UCEIS index for the subgroups was analyzed according to cathartic preparation. For those patients with a Boston scale score of < 8 for preparation, the inter-class correlation between endoscopists A and B was 0.851, 0.786 between endoscopists A and C and 0.873 between endoscopists B and C. On the other hand, for those patients with a Boston scale score of  $\geq 8$  for colonic preparation, the inter-reviewer correlation was 0.860 between endoscopists A and B, 0.876 between endoscopists A and C and 0.869 between endoscopists B and C (Table 4).

## DISCUSSION

The aim of this study was to assess the influence of the correlation of endoscopic scores on mucosal affectation according to three expert endoscopists. A good correlation in the Mayo index was found. However, there was a better correlation for the UCEIS index, which seemed to be more complex at first sight and is used less frequently in the usual clinical practice.

As mentioned previously, there are few studies to compare with ours. Nonetheless, the study by Travis et al. (6) assessed the interobserver variability for the UCEIS index and the weighted Kappa index for the reliability value was 0.3 (not acceptable) and 0.45 (acceptable) for the values of erosions and ulcers. Subsequently, the same author reported another study where the interobserver correlation for

the same index was analyzed. The weighted Kappa index score was 0.47 (acceptable) (95 % CI: 0.46, 0.49) and 0.47 (acceptable) (95 % CI: 0.44, 0.50) for blinded and non-blinded readers, respectively (9). In our study, the interobserver variability of the index was analyzed globally and a good correlation was found (0.922). This indicates that there was good concordance amongst the three endoscopists with regard to the assessment of the mucosa of the UC patients. The improvement in our results is probably due to the fact that a general analysis was performed, as opposed to subgroups within this index, its different sub-sections and the number of patients included in each study (41 versus 67). There has also been a growing number of cases of UC over the last few years, which implies a better understanding of the problem by the endoscopist. Furthermore, when the interobserver correlation was analyzed differentiating central values (2, 3, 4, 5, 6, 7) from extreme values (0, 1, 8) for the general analysis of the correlation of the UCEIS index, the results dropped quite significantly. The weighted Kappa index for central values was between 0.34 and 0.11 amongst the different specialists. On the other hand, the study by Xie et al. (10) found that patients with a UCEIS score higher than or equal to 7 had an 80 % probability of needing a colectomy. Thus, underlying the importance of having a good correlation due to its important clinical implications.

With regard to the IME, our results are similar to those reported in the study by Daperno et al. (11). In this study, there was an interobserver correlation with a Kappa index of 0.53 (95 % CI: 0.47-0.56) and 0.71 (95 % CI: 0.67-0.76) amongst expert endoscopists and non-experts in inflammatory bowel disease. In our study, a good correlation was found globally, with a weighted Kappa index between 0.8 (good) and 0.49 (acceptable). However, the extreme values (0 and 3) had an excellent correlation (Kappa index 1) as opposed to central values (1 and 2) (from 0.715 to 0.252) for the subgroup analysis. This is proof that it is difficult to catalogue the endoscopic findings within the subgroups 1 and 2 with this index. This is connected to the findings of the Ikeya study (5), in which the IME was reported to poorly detect any slight changes in mucosa. This is probably due to the fine line of difference between the central categories. Thus, the authors described that the average UCEIS score improved significantly from  $6.6 \pm 0.5$  to  $5.4 \pm 0.8$  ( $p = 0.005$ ) in the clinical response group, whilst there was no significant decrease in the IME in this group (3 to 3).

It is important to highlight that both scores were generally improved in those patients with a better cathartic preparation (Boston scale 8-9), according to the correlation amongst the different endoscopists. However, these findings are more noteworthy in the IME. For example, the Kappa index between endoscopists A and C was 0.38

in those patients with a Boston scale of < 8, whereas the Kappa index score was 0.63 in those patients whose Boston scale score was 8 or 9. This tendency for improvement was also seen in the UCEIS index. The intraclass correlation for endoscopists A and C was 0.786 in the Boston score group of < 8 compared to 0.876 in the Boston score group of 8-9. Therefore, the importance of good colonic cleansing is essential to be able to assess the mucosa completely and determine what lesions are present and their severity with a greater certainty.

To our knowledge, this is the first study to directly compare the two most commonly used endoscopic scores that assess UC activity. The results were comparable, even though we could not use the same correlation assessment index for the two endoscopic scores, as they do not present the same number of variables. Furthermore, they do allow us to demonstrate that the UCEIS index is superior to the IME, with regard to the interobserver correlation.

Our study does have some limitations which are worth mentioning. On the one hand, not all the videos showed a complete examination, which could underestimate the stage of the illness. Nonetheless, the three endoscopists received the same video and therefore, the assessment was performed with the same images of the mucosa.

On the other hand, not all of the patients had a good-excellent cathartic preparation with a Boston score of 8-9. This could impede a better visualization of the colonic mucosa and certain patterns, for example the vascular pattern. This is shown in our study as the interobserver correlation of both scores increased when a better cathartic preparation was present.

Thirdly, a histological correlation was not performed and some recent studies have aimed to study the histological healing of the mucosa. However, this has not been proven to be efficient up to now. Furthermore, there is no standardized points system for this.

Finally, calprotectin and its correlation with the endoscopic findings were not investigated, which would have been interesting. However, we did not have access to this test in our center at the beginning of the study and were therefore unable to perform this study.

In conclusion, there is a higher correlation amongst the different endoscopists for UCEIS than IME, and the better the colonic cleansing the greater the correlation of both scores.

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## REFERENCES

1. Magro F, Gionchetti P, Eliakim R, et al. Third European Evidence-based Consensus on Diagnosis and Management of Ulcerative Colitis. Part 1: definitions, diagnosis, extra-intestinal manifestations, pregnancy, cancer surveillance, surgery, and ileo-anal pouch disorders. *J Crohns Colitis* 2017;11(6):649-70. DOI: 10.1093/ecco-jcc/jjx008
2. Annese V, Daperno M, Rutter MD, et al. European evidence based consensus for endoscopy in inflammatory bowel disease. *J Crohns Colitis* 2013;7(12):982-1018. DOI: 10.1016/j.crohns.2013.09.016
3. Schroeder KW, Tremaine WJ, Ilstrup DM. Coated oral 5-aminosalicylic acid therapy for mildly to moderately active ulcerative colitis. A randomized study. *N Engl J Med* 1987;317(26):1625-9. DOI: 10.1056/NEJM198712243172603
4. D'Haens G, Sandborn WJ, Feagan BG, et al. A review of activity indices and efficacy end points for clinical trials of medical therapy in adults with ulcerative colitis. *Gastroenterology* 2007;132(2):763-86. DOI: 10.1053/j.gastro.2006.12.038
5. Ikeya K, Hanai H, Sugimoto K, et al. The Ulcerative Colitis Endoscopic Index of Severity more accurately reflects clinical outcomes and long-term prognosis than the Mayo Endoscopic Score. *J Crohns Colitis* 2016;10(3):286-95. DOI: 10.1093/ecco-jcc/jjv210
6. Travis SP, Schnell D, Krzeski P, et al. Developing an instrument to assess the endoscopic severity of ulcerative colitis: the Ulcerative Colitis Endoscopic Index of Severity (UCEIS). *Gut* 2012;61(4):535-42. DOI: 10.1136/gutjnl-2011-300486
7. Corte C, Fernandopulle N, Catuneanu AM, et al. Association between the ulcerative colitis endoscopic index of severity (UCEIS) and outcomes in acute severe ulcerative colitis. *J Crohns Colitis* 2015;9(5):376-81. DOI: 10.1093/ecco-jcc/jjv047
8. Jong DC, Lowenberg M, Koumoutsos I, et al. Validation and investigation of the operating characteristics of the Ulcerative Colitis Endoscopic Index of Severity. *Inflamm Bowel Dis* 2019;25(5):937-44. DOI: 10.1093/ibd/izy325
9. Travis SPL, Schnell D, Feagan BG, et al. The impact of clinical information on the assessment of endoscopic activity: characteristics of the Ulcerative Colitis Endoscopic Index of Severity (UCEIS). *J Crohns Colitis* 2015;9:607-16.
10. Xie T, Zhang T, Ding C, et al. Ulcerative Colitis Endoscopic Index of Severity (UCEIS) versus Mayo Endoscopic Score (MES) in guiding the need for colectomy in patients with acute severe colitis. *Gastroenterol Rep (Oxf)* 2018;6(1):38-44. DOI: 10.1093/gastro/gox016
11. Daperno M, Comberlato M, Bossa F, et al. Inter-observer agreement in endoscopic scoring systems: preliminary report of an ongoing study from the Italian Group for Inflammatory Bowel Disease (IG-IBD). *Dig Liver Dis* 2014;46(11):969-73. DOI: 10.1016/j.dld.2014.07.010