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Development and Validation of an Endoscopic Classification of Diverticular Disease of the Colon: The DICA Classification

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## Development and Validation of an Endoscopic Classification of Diverticular Disease of the Colon: The DICA Classification

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## Key Words

Colonoscopy · Diverticular disease of the colon · Endoscopic classification

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## Abstract

**Background:** A validated endoscopic classification of diverticular disease (DD) of the colon is lacking at present. Our aim was to develop a simple endoscopic score of DD: the Diverticular Inflammation and Complication Assessment (DICA) score. **Methods:** The DICA score for DD resulted in the sum of the scores for the extension of diverticulosis, the number of diverticula per region, the presence and type of inflammation, and the presence and type of complications: DICA 1 ( $\leq 3$ ), DICA 2 (4–7) and DICA 3 ( $> 7$ ). A comparison with abdominal pain and inflammatory marker expression was also performed. A total of 50 videos of DD patients were reassessed in order to investigate the predictive role of DICA on the outcome of the disease. **Results:** Overall agreement in using DICA was 0.847 (95% confidence interval, CI, 0.812–0.893): 0.878 (95% CI 0.832–0.895) for DICA 1, 0.765 (95% CI 0.735–0.786) for DICA 2 and 0.891 (95% CI 0.845–0.7923) for DICA 3. Intra-observer agreement (kappa) was 0.91 (95% CI 0.886–0.947). A significant correlation was found between the DICA score and C-reactive protein values ( $p = 0.0001$ ), as well as between the median pain score and the DICA score ( $p = 0.0001$ ). With respect to the 50 patients retrospectively reassessed, occurrence/recurrence of disease complications was recorded in 29 patients (58%): 10 (34.5%) were classified as DICA 1 and 19 (65.5%) as DICA 2 ( $p = 0.036$ ). **Conclusions:** The DICA score is a simple, reproducible, validated and easy-to-use endoscopic scoring system for DD of the colon.

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## Introduction

Diverticular disease (DD) of the colon is very common in developed countries and its prevalence increases with age. To refer to an acquired deformity present in perhaps two thirds of the elderly as a ‘disease’ may be inaccurate, particularly as a large majority of those affected will remain entirely asymptomatic. Nonetheless, an estimated 20% of patients may manifest clinical illness [1].

There are several approaches to classify DD. Some classifications are based on imaging, in particular on the appearance of the disease by abdominal computerized tomography (e.g. Buckey or Ambrosetti of Hinchey’s modified classification) [2–4]. On the other hand, there are some clinical classifications that are looking at the clinical

appearance of the disease (e.g. the classification of the Scientific Committee of the European Association for Endoscopic Surgery, Sheth classification and, in particular, the Hansen-Stock classification, which is widely used in Northern Europe) [5–7]. However, most of them focused the attention on the severity of the diverticulitis rather than on the overall spectrum of DD.

Surprisingly, an endoscopic classification of the disease is still lacking. This is more surprising if we consider the high number of colonoscopies performed in our centres and if we consider that endoscopic signs of diverticular inflammation may be recognized in 0.48–1.75% of patients undergoing colonoscopy [8, 9].

Another important consideration is that we know that some radiological findings are predictors of the course of the disease [4]. On the other hand, we do not know whether the anatomical and/or endoscopic appearance of the disease may influence its outcome. It is hypothesized that patients differ from each other. For example, it is hypothesized that a patient having only scattered diverticula in the sigmoid colon may differ from a patient having diffuse diverticulosis and rigidity of the colon at the inflammation, but we do not know if these differences have a prognostic significance. However, what is the meaning of the terms ‘scattered diverticulosis’, ‘diffuse diverticulosis’ or ‘diverticular inflammation’ if a clear definition, based on endoscopic appearance, is lacking?

For these reasons, we present an endoscopic classification of the disease, considering the diverticulosis extension, the number of diverticula, the presence of inflammatory signs, and the occurrence of complications. We assessed both the reproducibility and the clinical validity of this classification.

## Patients and Methods

The study, developing an endoscopic classification called Diverticular Inflammation and Complication Assessment (DICA), was divided into three parts.

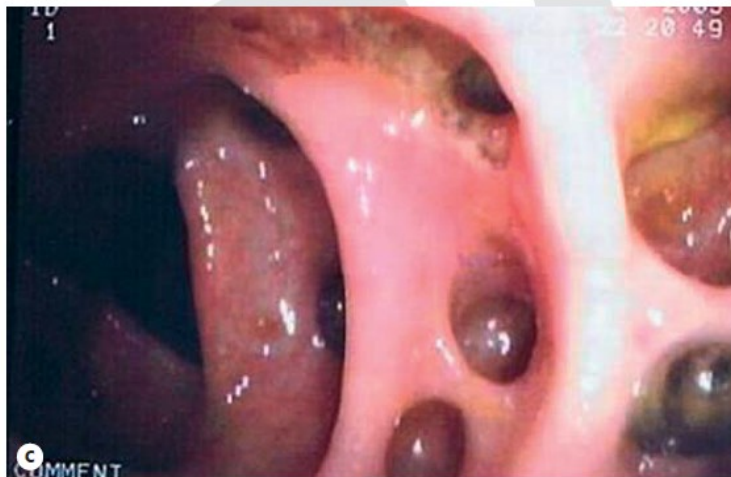
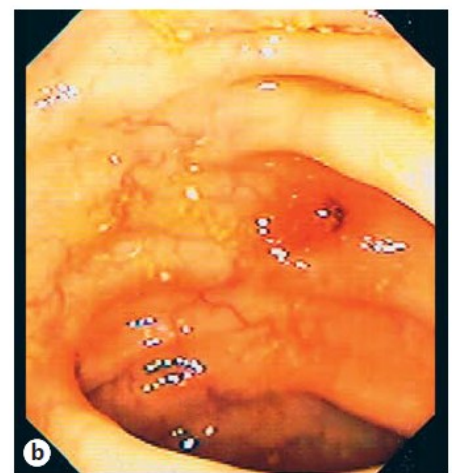
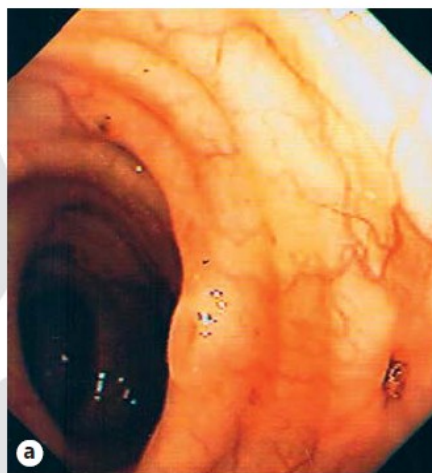
In the first part, the most relevant endoscopic variables were selected with the development of an endoscopic score.

In the second part, the development phase, the reproducibility level of the endoscopic score was evaluated in an inter-observer variation study. In this way, the set of items assessed was modified in order to improve the concordance, simplicity and reproducibility of the score.

In the third part, the validation phase, the final items were reassessed and the set of patients was evaluated again in order to assess the new concordance of the classification. At that time, the classification was finally validated.

The main steps in the implementation process were as follows: (1) the promoters of the DICA (A.T., G.B. and F.D.M.) selected a

**Fig. 1.** **a** Diverticular oedema: congestion of the diverticular opening, with loss of submucosal vascular pattern. **b** Hyperaemia: hyperaemia of the diverticular opening, with loss of submucosal vascular pattern. **c** Erosions: small fibrinous ulcerations surrounding and involving the diverticular opening. **d** Pus: severe inflammation of the colon harbouring diverticula, with purulent material coming from diverticular openings.



panel of experts in gastrointestinal endoscopy, coming from university hospitals, first-level, secondary and tertiary hospitals and territorial endoscopic centres; (2) visualization of the videos and assessment of the endoscopic variables under examination were performed during a plenary session lasting 2 days by the members of the expert group; during the plenary session, all items were discussed and improved – at that time, a first level of concordance was assessed, and (3) visualization of the videos and assessment of the modified endoscopic variables under examination were performed again 3 months later by the same experts using internet access – a final level of concordance was assessed, and the validation process was started up.

The promoters of the consensus did not interfere with the decisions of the experts.

#### Construction of DICA

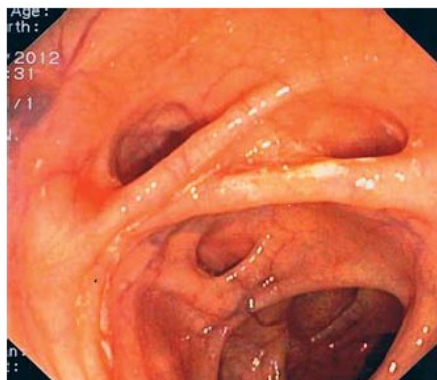
In order to select the endoscopic items, the promoters reviewed 300 videos coming from their gastroenterological structures and showing colonic DD. After visualization, they found that the most frequent items in assessing a colon harbouring diverticula were the presence and the extension of diverticulosis, the presence or not of inflammation, and the presence or not of complications (e.g. stenosis). Consequently, four items on which to build the classification were selected: (1) diverticulosis extension; (2) number of di-

verticula; (3) presence of inflammatory signs, and (4) presence of complications. This classification had to be applied to each colonic region harbouring diverticula.

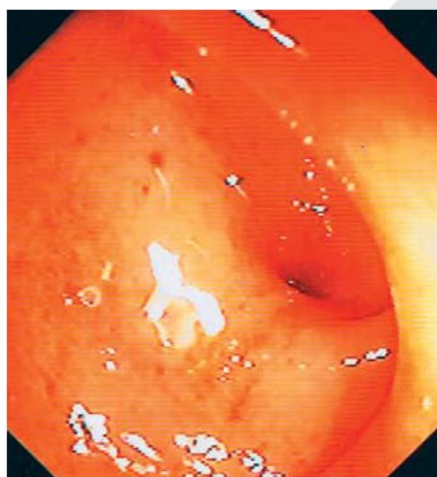
The items included in the DICA were the result of a careful review of the colonoscopies showing colonic diverticulosis with respect to the importance and the reproducibility of the most relevant endoscopic characteristics of the colonic DD. Only characteristics that were considered as contributing to clinical symptoms and that were considered easy to identify and with good potential reproducibility were considered for the DICA.

At the beginning of the developmental process, each endoscopic item was developed as follows:

- (1) Diverticulosis extent: sigmoid colon, descending colon, transverse colon, ascending colon, and caecum.
- (2) Number of diverticula in each region: grade I:  $\leq 5$ , grade II: 5–10, grade III: 10–20, and grade IV:  $>20$ .
- (3) Presence of inflammation: 4 different types of inflammation were identified: (i) oedema – congestion of the diverticular opening, with loss of submucosal vascular pattern (fig. 1a); (ii) hyperaemia – hyperaemia of the diverticular opening, with loss of submucosal vascular pattern (fig. 1b); (iii) erosions – small fibrinous ulcerations ( $<0.5$  cm) involving the diverticular opening or the peridiverticular mucosa (fig. 1c), and (iv) pus – purulent material coming from the diverticular opening



**Fig. 2.** If the contemporaneous presence of different severities of inflammation was detected in the same region, the most severe grade of inflammation was reported. In this case, hyperaemia and erosions surround the diverticular opening so that the patient was classified as grade 3 of the inflammatory items (presence of erosions and/or pus).



**Fig. 3.** Endoscopic appearance of diverticular stenosis. This patient underwent colonoscopy due to recurrent episodes of sub-occlusive attacks of abdominal pain associated with rectal bleeding. The patient showed 10 diverticula in the sigmoid colon, with no trespassing stenosis of the proximal sigmoid region. Due to the high risk of perforation, colonoscopy was suspended at this time.

(fig. 1d). Since the contemporaneous presence of different severities of inflammation may be detected during colonoscopy in the same region (e.g. some diverticula with hyperaemia and other with erosions), the most severe grade of inflammation was reported (fig. 2).

(4) Presence of complications: 5 different complications were identified: (i) rigidity of the colon – slight distension of the diverticular region at inflation; (ii) passing stenosis – whether the standard colonoscope could be passed through the narrowed lumen; (iii) incomplete colonic exploration – due to not passing stenosis or an elevated risk of perforation: when the stan-

ard colonoscope could not be passed through the narrowed lumen or when the presence of some anatomical characteristics (e.g. a lot of diverticula with rigidity at the spleen flexure) increased the risk of perforation, and it was advised to suspend the examination (fig. 3); (iv) segmental colitis associated with diverticulosis (SCAD) – as known, inflammation resembling inflammatory bowel diseases may be detected in patients harbouring diverticula; this type of inflammatory finding is detected in the interdiverticular mucosa and does not involve the diverticular opening [10]; also named diverticular-associated colitis, this type of inflammation has clinical, endoscopic and histological characteristics differing from DD [10] – however, it has been included in this classification because it may be sometimes detected in patients with diverticulosis and its presence may confound the endoscopist about the correct classification of those patients, and (v) bleeding.

After the identification of endoscopic items and their graduation, the next step was the construction of a numerical classification in which the power of each variable was related to its importance. For example, sigmoid diverticulosis had 2 points instead of 1 because in the Western world diverticulosis occurs more frequently in the left than in the right colon. At the same time, the detection of inflammation with progressive severity guarantees a higher score. Finally, the detection of complications with progressive severity guarantees a higher score. Arbitrarily, complication was graded from rigidity of the colon (considered the least important complication) to SCAD (considered the most severe complication due to its clinical outcome) [11].

At the end of this construction, four different numerical DICA were identified:

- DICA 0: when the sum of the points was up to 4;
- DICA 1: when the sum of the points was from 5 to 7;
- DICA 2: when the sum of the points was from 8 to 12;
- DICA 3: when the sum of the points was over 13.

#### *Development of DICA*

For the development phase of the study, 70 consecutive patients, who underwent colonoscopy due to abdominal symptoms (abdominal pain, bleeding, constipation, diarrhoea) and in whom a first diagnosis of DD was made, were enrolled at 3 gastroenterology departments between February and May 2012. This study was approved by the Institutional Review Board and all patients gave informed consent for participation in the study. Among them, 30 videos were selected according to the quality of the images (complete endoscopic exploration of the colon, adequate colonic cleansing and adequate visualization of the diverticula with or without inflammation and/or complications). The endoscopists involved did not know the DICA classification and were not involved in the construction of the DICA. Colonoscopy was recorded both at insertion and at withdrawal.

Videos were visualized during a plenary session as 6 blocks of 5 videos, with each block followed by a discussion of the results. Moreover, 5 videos were repeated with a new numeration in order to have an intra-observer agreement assessment.

After visualization, all items were reassessed under plenary discussion. A 4-step DICA score was considered too complex by experts, and items assessed were considered too much. In particular, the experts found it too difficult to differentiate between a low and medium number of diverticula (e.g. between 5 and 10). Another modified item was the extension of diverticulosis, now subdivided

**Table 1.** Items assessed in constructing DICA classification

Localization	Diverticula (in each region), n	Inflammation	Complications
Left	Grade I: $\leq 15$ diverticula	Absence of signs of inflammation	Rigidity
Right	Grade II: $> 15$ diverticula	Oedema/hyperaemia	Stenosis
		Erosions	Pus
		SCAD	Bleeding

between left (sigmoid and descending colon) and right colon (from caecum to transverse). Pus was moved from 'inflammatory finding' to 'complications', because it means the presence of acute inflammation (namely diverticulitis, which is considered a complication of DD). Finally, the detection of SCAD was moved from 'complications' to 'inflammation' items. This was because the experts consider SCAD an inflammatory finding rather than a complication of diverticulosis.

The definitive DICA classification comprised, therefore, the following items (table 1):

- (1) Diverticulosis extent: left colon, right colon.
- (2) Number of diverticula (in each region): grade I:  $\leq 15$ , grade II:  $> 15$ .
- (3) Presence of inflammation: oedema/hyperaemia, erosions, SCAD. Since the contemporaneous presence of different severities of inflammation may be detected during colonoscopy in the same region (e.g. some diverticula with hyperaemia and others with erosions), the most severe grade of inflammation was reported (fig. 2).
- (4) Presence of complications: (i) rigidity of the colon – slight distension of the diverticular region at inflation, and comprising also mild stenoses in which the standard colonoscope could be passed through the narrowed lumen; (ii) stenosis – not passing stenosis or narrowed lumen, with an elevated risk of perforation due to the presence of some anatomical characteristics (e.g. a lot of diverticula at the splenic flexure); (iii) pus – purulent material coming from the diverticular opening (fig. 1d), and (iv) bleeding.

Points in constructing the final DICA were assigned according to the severity of the anatomical/inflammatory finding. Again, 2 points were assigned to diverticulosis located in the left colon because in the Western world diverticulosis (and therefore diverticulitis) occurs more frequently in the left than in the right colon. The definitive DICA score was therefore constructed as follows (tables 1–3):

- DICA 1: when the sum of the points was up to 3 – this was a simple diverticulosis, probably without risk of complications;
- DICA 2: when the sum of the points was from 4 to 7 – this was a mild DD, probably with lower risk of complications;
- DICA 3: when the sum of the points was over 7 – this was a severe DD, probably with higher risk of complications.

The videos were again visualized 6 months later by internet access. Each expert accessed the videos by a case-sensitive password and reassessed them according to the final DICA classification. The videos had a different distribution from the first visualization in order to have a more sensitive inter-observer agreement. Moreover, 5 videos were again repeated with a new numeration in order to have an intra-observer agreement assessment. Each expert was blinded to the clinical and laboratory characteristics of the patient under examination, as well as to the answers provided by other experts.

**Table 2.** Numerical consistence of each item assessed in order to construct numerical DICA

	Left (2 points)	Right (1 point)
Diverticulosis grade I	0	0
Diverticulosis grade II	1	1
Absence of inflammation	0	0
Oedema/hyperaemia	1	1
Erosions	2	2
SCAD	3	3
Rigidity	4	4
Stenosis	4	4
Pus	4	4
Bleeding	4	4

**Table 3.** Numerical DICA classification

DICA classification	Numerical value
DICA 1	1–3 points
DICA 2	4–7 points
DICA 3	$> 7$ points

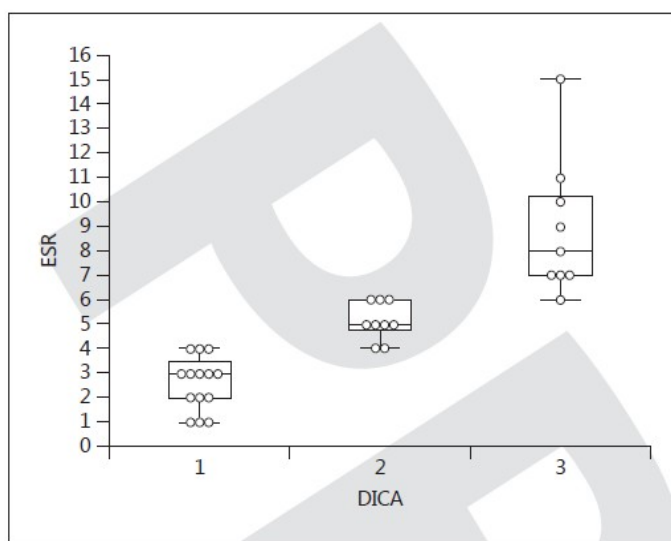
#### Validation of DICA

DICA score validation was carried out by estimating the correlation between the calculated index and the inflammatory indices: erythro-sedimentation rate (ESR) and C-reactive protein (CRP) expression. ESR and CRP were selected because they correlated with the severity of the DD [12].

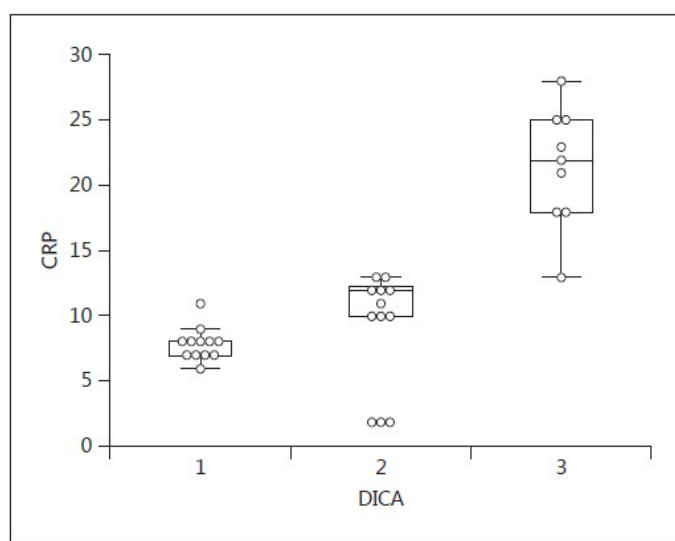
Correlation between the calculated index and the symptoms experienced by patients at the time of colonoscopy was assessed also. In this way, four main symptoms were assessed: abdominal pain, bleeding, constipation, and diarrhoea. In particular, abdominal pain was considered the main symptom characterizing DD [13], and it was assessed using a 4-point verbal scale (none, mild, moderate, or severe), assigning numerical values of 0–3. Mild pain was defined as an occasional disturbance that did not limit normal activities, moderate pain as pain that interfered with normal-day life activities and severe pain as pain that rendered the patient unable to perform normal activities.

#### Predictive Value of DICA

In order to make a first step in assessing the predictive value of the DICA classification, the coordinators (A.T., G.B. and F.D.M.)



**Fig. 4.** ESR values in the 3 DICA classes. The central box represents the values from the lower to upper quartile (25 to 75 percentile). The middle line represents the median. The whiskers extend from the minimum to the maximum value.



**Fig. 5.** CRP values in the 3 DICA classes. The central box represents the values from the lower to upper quartile (25 to 75 percentile). The middle line represents the median. The whiskers extend from the minimum to the maximum value.

revised and scored, according to the DICA classification, the videos of 50 patients enrolled in the placebo arm of a previous double-blind placebo-controlled trial – Symptomatic Uncomplicated Diverticular Disease (SUDD) [14]. Those videos were available because one of the secondary aims of that study was to assess the influence of the severity and the extension of the diverticulosis on the recurrence of SUDD [14]. This placebo group was chosen because the patients did not take any treatment influencing the outcome of the disease. Finally, the 1-year clinical follow-up of that group was reassessed according to the DICA score at the beginning of the follow-up.

#### Statistical Methods

Agreement between evaluations of endoscopic findings was assessed through kappa statistics (a coefficient of inter-observer agreement over and above the agreement that would be expected to occur by chance alone). Kappa values range from negative (disagreement) to +1 (total agreement): a value of 0 indicates agreement equal to that expected by pure chance, values  $\leq 0.4$  are classified as poor agreement, 0.41–0.60 as moderate agreement, 0.61–0.80 as good agreement, and  $>0.80$  as very good agreement [15]. Chance-adjusted Fleiss' kappa and Cohen's kappa statistics were used to determine inter- and intra-observer reliabilities, respectively [16]. To assess the precision of the kappa statistics, we calculated a 95% confidence interval (CI) for each correlation. Spearman's rank correlation coefficient was applied to calculate the correlation between the DICA classification and ESR, CRP and pain score. The  $\chi^2$  test was used for categorical variables.

Data were analysed with statistical software SPSS for Windows, version 11.0 (SPSS Inc., Chicago, Ill., USA).

## Results

Overall, 30 video clips were evaluated and rated by the 32 endoscopists, resulting in a total of 960 ratings.

#### Construction of DICA

Fleiss' kappa for inter-rater reliability was 0.686 (95% CI 0.596–0.701). Fleiss' kappa was 0.755 for grade 0 (95% CI 0.689–0.783), 0.557 for grade 1 (95% CI 0.501–0.578), 0.521 for grade 2 (95% CI 0.498–0.583) and 0.895 for grade 3 (95% CI 0.863–0.910).

#### Development of DICA

After modifying the items and the complexity of the classification, Fleiss' kappa in using the DICA increased to 0.847 (95% CI 0.812–0.893). Fleiss' kappa was 0.878 for grade 1 (95% CI 0.832–0.895), 0.765 for grade 2 (95% CI 0.735–0.786) and 0.891 for grade 3 (95% CI 0.845–0.7923). With respect to intra-observer agreement, kappa was 0.91 (95% CI 0.886–0.947). Significant inter-observer agreement for each item was also found, and results are reported in table 4.

#### Validation of DICA

Values of ESR and CRP in the 3 DICA classes are reported in figures 4 and 5. A significant correlation with DICA classification was found both for ERS and CRP val-



ues (ESR vs. DICA: Spearman's rank correlation coefficient 0.919,  $p = 0.0001$ ; CRP vs. DICA: Spearman's rank correlation coefficient 0.934,  $p = 0.0001$ ). The distribution of pain scores in the 3 DICA grades are reported in figure 6. A significant correlation was found between pain score and DICA classification (Spearman's rank correlation coefficient 0.591,  $p = 0.0001$ ). The distribution of the associated symptoms in the 3 DICA grades is shown in table 5. No significant difference was observed.

### Predictive Value of DICA

With respect to the 50 patients retrospectively reassessed, 30 (68%) were classified as DICA 1 and 20 (32%) as DICA 2. Overall, occurrence/recurrence of disease complications was recorded in 29 patients (58%). With respect to these 29 patients, 10 (34.5%) were classified as DICA 1 and 19 (65.5%) as DICA 2 ( $p = 0.036$ ). In particular, SUDD recurred in 23 patients: 9 (39.1%) patients were classified as DICA 1 and 14 (60.9%) as DICA 2 at the beginning of the study ( $p = 0.238$ ). Acute diverticulitis occurred in 6 patients: 1 (16.7%) patient was classified as DICA 1 and 5 (83.3%) as DICA 2 at the beginning of the study ( $p = 0.083$ ).

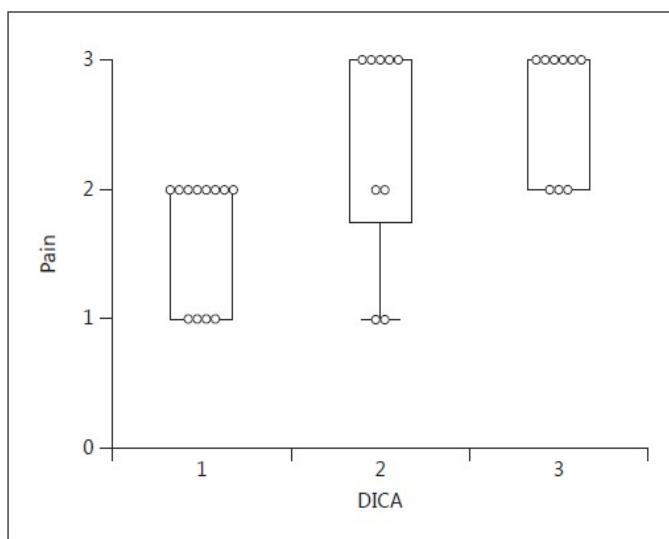
### Discussion

DD is one of the most common diseases in the world. It is commonly found in developed countries, slightly more frequently in the USA than in Europe, and is a rare condition in Africa. However, its prevalence seems to be increasing throughout the world, possibly because of changes in lifestyle [17].

Several radiological and clinical approaches are currently available to classify DD [2–7, 9]. However, most of them lack of adequate validation process and cannot be provided as standard references. Surprisingly, an endoscopic classification of the disease is still lacking so far, considering the high number of colonoscopies performed in our centres and the percentage of signs of diverticular inflammation detected by colonoscopy in current practice [8, 9].

We developed an endoscopic classification of DD for the first time. It describes all the items related to diverticulosis that can be detected during a colonoscopy, ranging from the number of diverticula in each colonic region to the presence of inflammatory signs and complications.

The first strength of this study is that this is the first systematic endoscopic classification of DD, putting together all the different items affecting colonic diverticulosis that may be detected during colonoscopy. Therefore, this is the first attempt to overcome some vague defini-



**Fig. 6.** Abdominal pain score in the 3 DICA classes. The central box represents the values from the lower to upper quartile (25 to 75 percentile). The middle line represents the median. The whiskers extend from the minimum to the maximum value.

**Table 5.** Presence of associated symptoms in the 3 DICA grades

Symptom	DICA 1 (12 patients)	DICA 2 (9 patients)	DICA 3 (9 patients)	p
Bleeding	4 (33.3)	3 (33.3)	3 (37.5)	0.978
Constipation	3 (25.0)	2 (22.2)	2 (25.0)	0.987
Diarrhoea	2 (16.7)	1 (11.1)	1 (12.5)	0.928

Values are expressed as number of patients (with percentages in parentheses). p values:  $\chi^2$  with 2 degrees of freedom.

**Table 4.** Fleiss' kappa for inter-rater reliability for endoscopic items in DICA classification

Endoscopic item	Fleiss' kappa	95% CI
Extension of diverticula	0.957	0.911–0.983
Number of diverticula	0.827	0.745–0.912
Presence of inflammation	0.877	0.853–0.902
Rigidity of the colon	0.925	0.849–0.983
Stenosis	1	–
Pus	0.989	0.977–0.993
Bleeding	1	–

tions that frequently describe the colon harbouring diverticula (e.g. 'diffuse' or 'severe' diverticulosis). For the first time, this classification focused its attention on four clear items that can be detected during the endoscopic exploration of a colon harbouring diverticula (diverticulosis extension, number of diverticula, presence of inflammatory signs, presence of complications), and permits us to have the same clear language: a 3-step DICA classification allows us to have a clear definition of the extension and the severity of diverticulosis, as well as to assess whether inflammation and/or complications affect diverticulosis.

The second strength of this classification is that the overall agreement is good. This is an important point in constructing a new classification, because agreement among experts is an objective parameter. Moreover, this agreement was obtained involving expert endoscopists coming from different experiences (i.e. university hospitals, primary care and primary, secondary or tertiary hospitals). The achievement of an excellent agreement confirms the good construction of the classification. It must be underlined that this high agreement was obtained despite the high number of experts involved in the development and validation process, as we know that the agreement decreases according to the increased number of people involved in the process. The excellent agreement obtained, not only in assessing each step of DICA classification but also in assessing each item evaluated in constructing the DICA, means that the DICA reproducibility may be very interesting. This classification could be easy to use in clinical practice. We know that the use of endoscopic classifications in inflammatory bowel disease patients is lacking in clinical practice due to their complexity. For example, two investigators are needed to classify a Crohn's disease patient using the SES-CD classification – the easier endoscopic classification of this disease [18]. In contrast, the numerical construction makes the DICA classification easier to use in clinical practice.

The third strength of this classification is that it was also validated. The validation offered by the authors refers to the agreement among experts and the correspondence to symptoms and inflammatory marker expression, which are both subjective parameters. We found that increased severity of the DICA score was significantly linked with increased severity of abdominal pain and increased expression of inflammatory indices. This is another important point, because the correspondence to symptoms and inflammatory indices, which are both objective parameters, reinforces the effectiveness of this classification.

This means that the DICA score may be useful in describing the severity of the disease because severity of the endoscopic appearance is linked to both the severity of

the symptoms and the severity of inflammatory marker expression. Moreover, the DICA classification may have an interesting potential predicting role too, as well as a significant role in constructing future studies investigating DD. In fact, most of the studies currently available do not consider the extension of diverticulosis or the number of diverticula for each region. It is hypothesized that these endoscopic items may be important in differentiating patients harbouring diverticula. For example, a patient harbouring scattered diverticula in the sigmoid colon is probably different from a patient harbouring a diffuse diverticulosis with rigidity of the colonic region. Therefore, the DICA may be useful in selecting either patients requiring treatment or the type of therapy.

As occurs for every new attempt, this classification may be controversial. Somebody may criticize colonoscopy in patients with DD. Performing colonoscopy in patients suffering from diverticular complications (e.g. acute diverticulitis) is still controversial because acute inflammation of the diverticula may expose to the risk of perforation or bleeding [19, 20]. As stated, patients enrolled underwent colonoscopy due to abdominal symptoms (abdominal pain, bleeding, constipation, diarrhoea), and endoscopic diagnosis of diverticular inflammation was incidental (nobody performs a colonoscopy if he suspects acute diverticulitis due to the risk of perforation). So, this isn't an endoscopic classification for patients affected by acute diverticulitis but an endoscopic classification of the colon harbouring diverticula in which inflammation is one of the items assessed. However, we know that endoscopic diagnosis of acute diverticulitis is often incidental, as clearly demonstrated by Ghorai et al. [8] already 10 years ago; in those cases, gentle colonoscopy with minimal air inflation can be carried out safely [21].

Another possible pitfall of the DICA score may be the overestimation of non-specific lesions because of inexperience with endoscopy in patients with DD (e.g. overlap between peridiverticular hyperaemia related to the disease and skipping hyperaemic areas related to bowel cleansing). The relative importance of these potential problems will probably be clarified by broader experience in clinical practice.

The most interesting question posed by this classification is whether it impacts upon the natural history of DD. Are patients with more, denser, inflamed, etc. diverticula at higher risk of diverticulitis or bleeding? Considering the lesson coming from the inflammatory bowel diseases, we know that endoscopic items are key points in predicting the outcome of the disease. Several endoscopic clas-

sifications assess the extension and the severity of the inflammation both in Crohn's disease [18, 22] and in ulcerative colitis [23]. This approach may also be used for DD by using the DICA classification. The main intent of the DICA classification is to have objective endoscopic parameters describing the endoscopic appearance of the colon harbouring diverticula. We propose that it might also predict the outcome of the disease. With respect to the results of the retrospective assessment of the videos of 50 patients classified according to the DICA score, this role seems to be confirmed. In fact, we found that the recurrence of SUDD and the occurrence of diverticulitis were significantly more frequent in DICA 2 than in DICA 1 patients. Of course, this question cannot be answered at this stage due to two main reasons: first, the outcome of those patients was retrospectively assessed, and second, the outcome of DICA 3 has not been assessed. However, the rigorous design of the randomized study from which the placebo group was taken was a strength of the results described above because any other confounding factor (e.g. therapy) was excluded. The outcome of patients ac-

ording to DICA 1 and 2 scores confirmed the hypothesis that objective endoscopic parameters in patients harbouring diverticula may predict the outcome of the disease. However, further prospective studies exploring this promising role are required to confirm this hypothesis.

In conclusion, DICA classification is a new and practical instrument that can be used by clinicians for the objective description of the colon harbouring diverticula. The simplicity of this classification, its excellent reproducibility and its correlation with biochemical and clinical disease markers make it very attractive in clinical practice. Of course, further studies are needed in order to validate this classification and to assess its reproducibility in clinical trials, as well as to assess whether its use may impact upon the natural history of DD.

### Disclosure Statement

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