Alimentary Tract

Magnetic resonance index of activity (MaRIA) and Clermont score are highly and equally effective MRI indices in detecting mucosal healing in Crohn’s disease

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A R T I C L E   I N F O

Article history:
Received 1 May 2017
Received in revised form 15 August 2017
Accepted 16 August 2017
Available online 31 August 2017

Keywords:
Clermont score
Crohn’s disease
MRI remission
Mucosal healing

A B S T R A C T

Background: Magnetic resonance index of activity (MaRIA) and Clermont score are currently the two main MRI indices that have been validated compared to endoscopy in Crohn’s disease (CD).

Aims: To compare the accuracy of MaRIA and Clermont score in assessing CD mucosal healing.

Methods: Forty-four CD patients underwent prospectively and consecutively MRI and colonoscopy.

Results: Considering 207 segments, MaRIA > 7 and Clermont score > 8.4 demonstrated substantial accuracy to detect endoscopic ulcerations (73.9% and 74.0%, respectively) and presented with high specificity (82.1% and 81.3%) and high negative predictive value (NPV) (82.1% and 82.4%) for MaRIA and Clermont score, respectively. The sensitivity for detecting deep ulcerations was 90.9% for both MaRIA > 11 and Clermont score > 12.5, with a specificity of 82.0% and 80.0%, respectively.

Among 44 patients, deep MRI remission predicted mucosal healing with specificity = 85.3% and NPV = 85.3% according to Barcelona criteria (no segmental MaRIA > 7), and specificity = 88.2% and NPV = 85.7% according to Clermont criteria (no segmental Clermont score > 8.4). In addition, MRI remission predicted mucosal healing with specificity = 76.5% and NPV = 86.7% according to Barcelona criteria (no segmental MaRIA > 11), and specificity = 79.4% and NPV = 84.4% according to Clermont criteria (no segmental Clermont score > 12.5).

Conclusion: MaRIA and Clermont score are equally effective in detecting CD endoscopic ulcerations supporting their use as therapeutic endpoints.

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1. Introduction

Crohn’s disease (CD) is a chronic relapsing and disabling disorder that can highly alter patients quality of life [1, 2]. In the era of biologics, mucosal healing is mainly defined as no endoscopic ulceration and is recognized as the best therapeutic endpoint in CD, as it was associated with sustained clinical remission, reduced rates of hospitalization and decreased risk of surgery [3–5]. The treat-to-target strategy needs repeated endoscopies to confirm mucosal healing [6, 7]. However, as colonoscopy is a burdensome monitoring tool for CD patients [8], alternative non-invasive approaches, such as magnetic resonance imaging (MRI), have been developed in the last decade. MRI offer several advantages to monitor CD patients compared to colonoscopy [9] such as better acceptability, concomitant evaluation of the small bowel and the colon, and detection of extra-enteric CD complications [10]. In addition, accumulating evidence have been suggesting that MRI is able to monitor therapeutic response leading some authors to propose the use of MRI criteria as endpoint in clinical trials [11–13]. Accordingly, the comparison of the available MRI scores is an essential step before spreading their use both in clinical trials and in daily practice. To date, magnetic resonance index of activity (MaRIA) [14–16] and Clermont score [17–21] (Table 1) are the two main available MRI indices in

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http://dx.doi.org/10.1016/j.dld.2017.08.033
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grading CD severity and evaluating mucosal healing [12]. Both have been validated compared to endoscopy. The Clermont score was derived from the MaRIA and is calculated from diffusion-weighted sequences. Magnetic resonance enterocolonography (DW-MREC) is a well-tolerated and a non-time-consuming tool, and is performed with no bowel cleansing the day before the examination and no rectal enema [17,18,22–26]. The use of Clermont score has the advantage of avoiding the use of gadolinium contrast, improving the acceptance and the safety of MRI without altering the accuracy [8,27]. Recently, Rimola et al. suggested from a retrospective study that MaRIA could have slightly better operational characteristics compared to the Clermont score in grading ileocolonic CD severity. In contrast, a prospective study reported conflicting results and concluded that Clermont score was at least as accurate as MaRIA in assessing distal small bowel inflammation [28].

The aims of our prospective study were (1) to compare the performances of MaRIA and Clermont score radiological disease activity indexes to detect endoscopic ulcerations in ileocolonic CD; (2) to assess the performances of the newly defined concepts of deep MRI remission and MRI remission to predict mucosal healing in CD patients.

2. Methods

2.1. Ethical considerations

The study was performed in accordance with the Declaration of Helsinki, Good Clinical Practice and applicable regulatory requirements. Informed consent was obtained from each patient included in the study. The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki (6th revision, 2008) as reflected in a priori approval by the institution’s human research committee. The study was approved by local Ethics Committee (IRB number 00008526 Ref 2015/CE006).

2.2. Population studied

Regarding the current study, we used prospective data from a previous observational study on a single-center cohort [20]. These data were prospectively collected but not used for the purpose of the previously published study [20]. Overall, 44 patients from the Clermont-Ferrand IBD Unit, with an established diagnosis of CD, were prospectively and consecutively included between December 2012 and May 2014. All the patients were assessed by experienced IBD physicians using a standardized evaluation and they consecutively underwent DW-MREC according to our routine MRI protocol [17–20]. Colonoscopy was performed within four weeks (mean interval = 17 ± 11 days) after MRI, with no therapeutic intervention between the two procedures. From the previous dataset, we were able to add 13 digestive segments. CDEIS and SES-CD were not calculated in these segments (excluded from the previous study) but the presence of ulcerations was recorded. The patients enrolled in the study had either symptomatic disease or were undergoing imaging to monitor CD activity under treatment. Radiologists were blinded from endoscopic findings and endoscopists were blinded from radiologic findings. Exclusion criteria were: patients with claustrophobia or other common MRI contraindications such as implanted cardiac device, metallic intraocular foreign body, allergy to gadolinium, or severe renal failure (Modification of Diet in Renal Disease (MDRD) < 30 ml/min) and patients with contraindications to colonoscopy.

2.3. Endoscopy

The endoscopic lesions were graded using CDEIS [29] and SES-CD [30] as routinely used in our IBD unit. Each endoscopic score was applied to each segment (distal ileum, caecum/right colon, transverse colon, left/sigmoid colon, and rectum) to obtain a segmental CDEIS and SES-CD. Mucosal healing was defined as no ulcer observed in endoscopy. Patients followed a bowel cleansing protocol via oral ingestion of 2000 ml of PEG (Fortrans, Ipsen Pharma, Paris, France) on the evening before examination and 2000 ml the morning of the examination. Endoscopy was performed under anaesthesia with propofol (PROPOFOL DAKOTA PHARM; Sanofi-Aventis, Paris, France). All colonoscopies were performed by two experienced endoscopists (AB, GB) using column video colonoscopy (QFCL 140; Olympus, Tokyo, Japan).

2.4. Magnetic resonance imaging examinations

MREC with diffusion-weighted and injected sequences were performed in all patients according to the usual protocol of our Radiology department as previously published [17–20]. Each examination was interpreted independently by an experienced radiologist (CH) [17–20] who was blinded from clinical data. On the day of DW-MREC, patients had to have been fasting for at least four hours before the examination. The MRI imaging examinations with no bowel cleansing the day before the examination and with no rectal enema were performed with a 1.5 T GE Optima MR 450 W (General Electric HealthCare, Fairfield, CT) as previously described [17–20]. MR protocol was given in supplementary files (Table S1). Regarding segmental analysis, we used a division into five segments as for endoscopic scores i.e. CDEIS and SES-CD. The MaRIA index was calculated using the previously published formula [14–16]: 1.5 × wall thickness (mm) + 0.02 × RCE (relative contrast enhancement) + 5 × oedema + 10 × ulcers. For quantitative assessment, the apparent diffusion coefficient (ADC) was calculated for each segment in the area of highest signal intensity in the bowel wall. As previously published, the definition of this area was based on the judgment of the radiologist [17–21]. The Clermont score [17–21] was calculated at least one month later using the following formula: 1.646 × bowel thickness − 1.321 × ADC + 5.613 × edema + 8.306 × ulceration + 5.039.

MaRIA > 7 and Clermont score > 8.4 has been suggested to be the best thresholds to define disease activity while MaRIA > 11 and Clermont score > 12.5 were considered the best cut-off values to detect severe disease activity [12,14,15,17,18,20]. Accordingly, we defined deep MRI remission as no segmental MaRIA > 7 according to Barcelona criteria and no segmental Clermont score > 8.4 according to Clermont criteria. MRI remission was defined as no segmen-

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Description of the items composing the magnetic resonance index of activity (MaRIA) and the Clermont score.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
<td>MaRIA</td>
</tr>
<tr>
<td>Presence of ulcerations</td>
<td>+10 (if yes)</td>
</tr>
<tr>
<td>Presence of oedema</td>
<td>+5 (if yes)</td>
</tr>
<tr>
<td>Bowel thickness (mm)</td>
<td>+1.5 × bowel thickness (mm)</td>
</tr>
<tr>
<td>Relative contrast enhancement (RCE)</td>
<td>−0.02 × RCE</td>
</tr>
<tr>
<td>Apparent diffusion coefficient (ADC)(mm²/s)</td>
<td>−</td>
</tr>
<tr>
<td>Constant</td>
<td>−</td>
</tr>
</tbody>
</table>

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*Note: The values in the table represent the scoring system for MaRIA and Clermont score. The presence of specific items is scored as indicated, with positive values indicating the presence of the item and negative values indicating the absence. The specific calculation formulae for MaRIA and Clermont score are detailed in the text.*
usual MaRIA > 11 according to Barcelona criteria and no segmental Clermont score > 12.5 according to Clermont criteria.

2.5. Data managing and statistical analysis

Study data were collected and managed using REDCap electronic data capture tools hosted at Clermont-Ferrand University Hospital [31]. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing (1) an intuitive interface for validated data entry; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages; and (4) procedures for importing data from external sources.

Statistical analysis was performed using Stata software (version 13, StataCorp, College Station, US). The tests were two-sided, with a Type I error set at \( \alpha = 0.05 \). Baseline characteristics were presented as mean (±standard-deviation) or median [interquartile range] according to statistical distribution (assumption of normality assessed using the Shapiro–Wilkinson test) for continuous data and as the number of patients and associated percentages for categorical parameters. Comparisons of patient’s characteristics between the independent groups were performed using the chi-squared or Fisher’s exact tests for categorical variables, and using Student t-test or the Mann–Whitney test for quantitative parameters (homoscedasticity verified using Fisher–Snedecor test). The correlation between quantitative parameters was explored using coefficient correlations (Pearson or Spearman according to statistical distribution). To study repeated measures for a single patient (due to several segments), random-effect models were performed to take into account between and within subject variability. Diagnosis parameters such as area under the curve (for Receiver operating characteristic analysis, noted AUROC) sensitivity, specificity, negative predictive value and positive predictive value were expressed as values and associated 95% confident interval (95%CI), and were compared using McNemar tests. As proposed by some statisticians, we chose to report all the individual p-values without doing any mathematical correction for distinct tests comparing groups [32]. A particular focus was given to the magnitude of improvement and to the clinical relevance [33,34].

### Table 2

Baseline characteristics of the patients.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N = 44 patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female gender, n (%)</td>
<td>23 (52.3%)</td>
</tr>
<tr>
<td>Age at baseline, median [IQR]</td>
<td>33.0 years [23.5–45.3]</td>
</tr>
<tr>
<td>Disease duration, median [IQR]</td>
<td>5.5 years [0.4–14.2]</td>
</tr>
<tr>
<td>Current smokers, n (%)</td>
<td>12 (27.3%)</td>
</tr>
<tr>
<td>Prior intestinal resection, n (%)</td>
<td>9 (20.5%)</td>
</tr>
<tr>
<td>Disease location: L1/L2/L3, n (%)</td>
<td>7 (15.9%)/10 (22.7%)/27 (61.4%)</td>
</tr>
<tr>
<td>Disease behavior: B1/B2/B3, n (%)</td>
<td>22 (50.0%)/12 (27.3%)/9 (20.5%)</td>
</tr>
<tr>
<td>Perianal lesions, n (%)</td>
<td>10 (22.7%)</td>
</tr>
<tr>
<td>Current medication, n (%)</td>
<td></td>
</tr>
<tr>
<td>Steroids, n (%)</td>
<td>17 (38.7%)</td>
</tr>
<tr>
<td>Immunosuppressant therapies, n (%)</td>
<td>5 (11.4%)</td>
</tr>
<tr>
<td>Anti-TNF agents, n (%)</td>
<td>8 (18.2%)</td>
</tr>
<tr>
<td>Endoscopic mucosal healing, n (%)</td>
<td>14 (31.8%)</td>
</tr>
</tbody>
</table>

Disease location and behavior are given according Montreal classification; n: number; IQR: interquartile range; TNF: tumor necrosis factor.

3. Results

3.1. Baseline characteristics of the patients

Forty-four CD patients, with a median disease duration at the time of inclusion of 5.5 years [0.4–14.2], were included in this study. The baseline characteristics of the patients are detailed in Table 2. Overall, 21 (47.7%) were male, 12 (27.3%) were active smokers and 9 (20.5%) have previously undergone intestinal surgery. Seven (15.9%), 10 (22.7%) and 27 (61.4%) patients had respectively pure ileal involvement (L1 according to Montreal classification), pure colonic (L2) or ileocolonic locations (L3). We observed that 22 (50.0%) patients presented with inflammatory phenotype (B1), 12 patients (27.3%) with stricturing phenotype (B2) and 9 (20.5%) with fistulizing CD (B3). In addition, 10 (22.7%) patients experienced perianal lesions. At the time of inclusion, the patients were mainly treated with steroids (38.7%), immunosuppressant therapies (11.4%) or anti-TNF agents (18.2%) with a median CDAI, CRP or faecal calprotectin level of 188 [106–266], 11.4 [3.5–38.8] and 1555 μg/g [384–1800], respectively. Endoscopic mucosal healing defined as no endoscopic ulceration was observed in 14 patients (31.8%).

3.2. Per segments analysis

Overall 207 segments, including 44 ileal segments and 163 colorectal segments were taken into account for the analyses.
Among them, 57 segments (27.5%) presented with endoscopic ulcerations encompassing 46 with superficial ulcerations (22.2%) and 11 with deep ulcerations (5.3%) [35]. MaRIA score correlated with segmental CDEIS (0.48; p < 0.001) and segmental SES-CD (0.44; p < 0.001). MaRIA correlated also with segmental CDEIS (0.48; p < 0.001) and segmental SES-CD (0.45; p < 0.001).

Segmental MaRIA was increased in segments with endoscopic ulcerations compared to those achieving mucosal healing (23.2 ± 7.6 for deep ulcerations, 13.0 ± 9.9 for superficial ulcerations and 6.7 ± 6.8 for mucosal healing, p < 0.001 for each comparison) (Fig. 1A). In the same line, the segmental Clermont score was 24.6 ± 7.1 for segments with deep ulcers, 14.6 ± 10.1 for segments with superficial ulcerations and 7.9 ± 6.9 for segments with mucosal healing (p < 0.001 for each comparison) (Fig. 1B). According to the previously established cut-off value i.e. MaRIA > 7 (AUROC = 0.67), we observed the following performances to detect the presence of endoscopic ulcerations: sensitivity = 51.8% [38.0%–65.3%], specificity = 82.1% [75.1%–87.9%], negative predictive value = 82.1% [75.1%–87.9%], positive predictive value = 51.8% [38.0%–65.3%] (Table 3). The previously determined Clermont score threshold of 8.4 (AUROC = 0.68) demonstrated similar performances with sensitivity = 54.4% [40.7%–67.6%], specificity = 81.3% [74.2%–87.2%], negative predictive value = 82.4% [75.3%–88.2%], positive predictive value = 52.5% [39.1%–65.7%] (Table 3). In addition, MaRIA and Clermont score demonstrated very high accuracy to detect the presence of deep endoscopic ulcerations (Table 3). The sensitivity in detecting deep ulcerations was 90.9% [58.7–99.8] for both MaRIA > 11 (AUROC = 0.86) and Clermont score >12.5 (AUROC = 0.86), with a specificity of 80.0% [73.5–85.5] and 82.0% [75.6–85.2], respectively (Table 3).

### 3.3. Per patients analysis
Among the 44 CD patients, deep MRI remission predicted mucosal healing with sensitivity = 50.0% [18.7%–81.3%], specificity = 85.3% [68.9%–95.0%], negative predictive value = 85.3% [68.9%–95.0%] and positive predictive value = 50.0% [18.7%–81.3%] according to Barcelona criteria (no segmental MaRIA > 7), and sensitivity = 50.0% [18.7%–81.3%], specificity = 88.2% [72.5%–96.7%], negative predictive value = 85.7% [69.7%–85.2%] and positive predictive value = 55.6% [21.2%–86.3%] according to Clermont criteria (no Clermont score > 8.4) (Fig. 2). In addition, MRI remission
predicted mucosal healing with sensitivity = 60.0% [26.2%–87.8%], specificity = 76.5% [58.8%–89.3%], negative predictive value = 86.7% [69.3%–96.2%] and positive predictive value = 42.9% [17.7%–71.1%] according to Barcelona criteria (no segmental MaRIA > 1), and sensitivity = 50.0% [18.7%–81.3%], specificity = 79.4% [62.1%–91.3%], negative predictive value = 84.4% [67.2%–94.7%] and positive predictive value = 41.7% [15.2%–72.3%] according to Clermont criteria (no Clermont score > 12.5) (Fig. 2).

4. Discussion

In the era of the treat-to-target strategy [6,7], MRI seems a promising alternative to colonoscopy, offering several advantages to monitor CD patients [9]. Firstly, MRI is more accepted than endoscopy by CD patients, which is essential to improve patients' adherence to the treat-to-target strategy and to limit the burden of repeated monitoring tools [6,7]. In a recent nationwide survey including 916 IBD patients, it has been confirmed that CD patients considered MRI as significantly more acceptable than endoscopy, especially owing to the lack of bowel cleansing and general anaesthesia [8]. Secondly, magnetic resonance enterocolonography (MRE) enables the concomitant evaluation of the small bowel and the colon using only one examination and remain feasible in case of stenosis or technical issues leading to impossible intubation of the terminal ileum. Thirdly, according to the transmural pattern of CD, MRI is able to assess the entire thickness of the bowel wall and also to detect extra-enteric signs of inflammation or complications such as fistula or abscesses allowing physicians to assess intestinal damage, which might not be visualized during endoscopic procedures [10]. Finally, accumulating evidences have been suggesting that MRI is able to monitor therapeutic response leading certain authors to propose the use of MRI criteria as endpoint in clinical trials [11–13]. In this context, the choice of the appropriate MRI score is a key point. Magnetic resonance index of activity (MaRIA) [14–16] and Clermont score [17–21] are currently the two main MRI indices available in grading CD severity and evaluating mucosal healing [12], that have been validated compared to endoscopy.

The MaRIA, constructed using a structured process, is highly correlated with endoscopic scores both in ileal and colonic CD [14,15], is able to assess mucosal healing [12] and to detect endoscopic improvement after therapeutic intervention [16]. Unfortunately, the MaRIA was developed using a burdensome MRI protocol including bowel cleansing the day before the examination (4000 mL of polyethylene glycol (PEG)), intestinal distension (1500 mL of PEG) and rectal enema during the examination. These requirements do not lead this procedure to be more acceptable than colonoscopy in daily practice [36]. In addition, MaRIA calculation needs intravenous gadolinium which is associated with rare, but serious, adverse effects such as hypersensitivity reactions, nephrogenic systemic sclerosis and more recently neuronal tissue deposition after multiple gadolinium contrast administrations [37–39]. Previous data have demonstrated that injected sequences did not increase the performances of MRI to assess inflammation in CD but could slightly improve the detection of CD complications especially fistula or abscess [27] and the percentage of gain of contrast medium could be useful to identify fibrosis [42]. This should be balanced by the results of a recent nationwide survey reporting that almost 20% of CD patients considered intravenous gadolinium as a factor decreasing the acceptability of MRI procedures [8].

The Clermont score was derived from the MaRIA and was calculated from diffusion-weighted magnetic resonance enterocolonography (DW-MREC), which is a well-tolerated and a non-time consuming tool, performed with no bowel cleansing the day before the examination and no rectal enema [17,18,22–26]. The use of Clermont score would have the advantage of avoiding the use of gadolinium contrast, thus improving its acceptance without altering the accuracy [8,27]. Independent teams have reported that Clermont score was highly correlated with endoscopic scores, to evaluate bowel inflammation [17,18,21,26] and was highly accurate to detect endoscopic ulcerations in ileocolonic CD [12,20]. While the Clermont score was initially dedicated to the ileum, we confirmed, in this study, previous retrospective data showing that Clermont score is a reliable tool to assess colonic CD [12]. A recent work showed that diffusion-weighted sequences parameters especially ADC are able to be improved after therapeutic intervention [13]. We are currently conducting a study to confirm that the Clermont score is able to be improved after therapeutic intervention and to define what degree of MRI scores improvement could alter the natural history of CD leading to intestinal damage.

In this prospective study, we performed a direct comparison of these two scores in evaluating mucosal healing in CD. We observed that MaRIA and Clermont score were equally effective in detecting endoscopic ulcerations with high specificity (82.1% and 81.3%, respectively), substantial negative predictive value (82.1% and 82.4%, respectively) and good accuracy (74.0% and 73.9%, respectively). In contrast, sensitivity and positive predictive values remain moderate. However, we consider that scoring systems with limited sensitivity but high specificity and negative predictive values in detecting mucosal healing could be relevant, as some studies have shown similar improved long-term outcomes with partial and complete mucosal healing [4]. Whether complete bowel healing is required to predict long-term favorable outcomes remains questionable to date and additional dedicated researches are warranted to confirm this. However, Deepak and colleagues reported recently that radiological remission or response demonstrated reduction in subsequent hospitalizations [40]. Recently, Rimola et al. suggested slightly better operational characteristics in using their own index namely MaRIA compared to the Clermont score (91.1% vs 88.4% of accuracy to detect endoscopic ulcerations) in a retrospective cohort [12]. In contrast, another recent larger prospective study (81 patients) by Kopylov et al. compared these two MRI indices to two wireless capsule endoscopy scores and considered that the Clermont score was at least as effective that MaRIA to detect moderate-to-severe inflammation in the terminal ileum [28]. They reported an almost perfect correlation between MaRIA and Clermont score (correlation coefficient = 0.991) [28]. Although additional independent studies should be conducted to firmly address the question, we consider these two MRI indices as equally accurate to detect endoscopic ulcerations in CD patients.

Besides accuracy, the choice of the best MRI scores should take into account other factors such as reproducibility. MaRIA and Clermont score share three common items i.e. oedema, ulcerations and bowel thickness, while the remaining item is the related contrast enhancement (RCE), needing gadolinium injection, in the MaRIA, and apparent diffusion coefficient (ADC) in the Clermont score. We previously demonstrated a higher inter-observer concordance regarding ADC compared to RCE (Lin coefficient = 0.96 vs 0.83, p < 0.05) in a prospective cohort of 130 CD patients including 848 bowel segments [18]. In addition, we performed recently a post-hoc analysis from this cohort and found minor inter-reader variation for ADC measurement with a mean difference of 0.09 ± 0.15 (variation coefficient = 1.44) confirming that ADC value is a reliable parameter with high reproducibility between radiologists [41]. In comparison, RCE calculation showed a mean variation of 10.0% ± 23.4% (variation coefficient = 2.35) in the same cohort, suggesting that ADC could be more reproducible than RCE for radiologists experienced in using quantitative parameters of diffusion-weighted sequences [41]. In contrast, Rimola et al. suggested that MaRIA presented with a slightly better inter-reader agreement compared to Clermont score (ICC = 0.70 and 0.65, respectively) [12]. Dedicated studies.
from independent teams should be required to answer this question. The use of diffusion-weighted sequences is often criticized due to the potential equipment-dependent metric value of ADC [12]. However, this reproach is also valuable for the RCE, even though RCE is a normalized measurement, feature that could limit but not eliminate this potential issue. We are currently performing a study to confirm that ADC is not more equipment-dependent than T2.

The main strengths of this study were the prospective design, including patients from the Clermont-Ferrand IBD centre with experienced radiologists in the use of diffusion-weighted sequences, and the choice of endoscopy as gold standard. To our knowledge, this is the first prospective study comparing the two main MRI scores in assessing mucosal healing and using ileocolonoscopy as reference in CD patients. We also provided clear definitions of MRI remission which could be very useful for IBD physicians and should be tested as therapeutic endpoint in the near future. The main limitation is that we did not perform any sample-size calculation for this prospective study because the initial study aimed to assess the correlation between MRI and endoscopy and was not dedicated to compare the two MRI scores. However, our sample-size was nearly the same that the previous retrospective study from Barcelona, Spain [12]. The relatively low number of segments with deep ulcerations and the examination performed by a single radiologist (even experienced) could also be some limitations.

This study confirms the high accuracy of the MaRIA and the Clermont score in assessing ileocolonic inflammation in CD patients. These two scores demonstrated very close efficacy and reproducibility while the use of diffusion-weighted sequences makes the Clermont score safer and more acceptable by CD patients. However, the capability of Clermont score to monitor therapeutic response remains to be addressed and is eagerly awaited. We strongly encourage IBD physicians to continue researches on the use of MRI as primary tool to monitor therapeutic response in using Clermont score and/or MaRIA both in clinical trials and daily practice.

Authors’ disclosures

AB has served as a speaker for MSD, Abbvie, Ferring, Hospira, Vifor Pharma, Sanofi-Aventis and Takeda, and as a consultant for Abbvie, Hospira and Takeda.

Conflict of interest

None declared.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.dld.2017.08.033.

References


