Magnetic resonance assessment of gastrointestinal tract inflammation in Crohn's disease using the simplified MaRIA score In a Colombian center: MAGNETIC study

Evaluación por resonancia magnética de la inflamación del tracto gastrointestinal en la enfermedad de Crohn utilizando el puntaje MaRIA simplificado en un centro colombiano: estudio MAGNETIC

Viviana Parra Izquierdo[1,2] , Juan Sebastián Frías-Ordoñez[1,3] , Ginary Orduz Diaz[1] ,
Oscar Mariano Pinto[1] , Carlos Augusto Cuadros[1] , Johon Francisco Garcés[1] ,
Juan Javier Acevedo[1] , Andrés Guillermo Barco[1] , Danilo Solorzano[1] , Julian Ferreira[1] ,
Vanessa Duran[1] , Cristian Fabián Flórez[1,2] , Juancarlos Torres[4] , Maria Stella Serrano[5] ,
Samuel Cubillos Rodríguez[6]

[1] Center of Excellence in Inflammatory Bowel Disease, Hospital Internacional de Colombia, Bucaramanga, Colombia.
[2] Cellular and Molecular Immunology Group (INMUBO), Universidad El Bosque, Bogotá, Colombia.
[3] Medical and Surgical Specialties Research Group, Fundación Cardiovascular de Colombia, Floridablanca, Colombia.
[4] School of Medicine, University of Queensland, Queensland, Australia.
[5] Department of Pediatrics, Georgetown University, Washington DC, USA.
[6] Center of Excellence in Inflammatory Bowel Disease, Hospital Internacional de Colombia, Bucaramanga, Colombia.

ABSTRACT

Introduction: Magnetic Resonance Enterography (MRE) is a valuable imaging modality for the evaluation and follow-up of patients with inflammatory bowel disease (IBD), particularly Crohn's disease (CD). This study describes MRE findings in patients with suspected or confirmed CD at a national reference center for IBD in Colombia. **Materials and methods:** A descriptive observational study was conducted in patients evaluated with MRE at a specialized IBD center. **Results:** Of the 20 patients evaluated, 18 (90%) underwent MRE due to clinical or endoscopic suspicion of Crohn's disease, while 2 patients (10%) had a previously confirmed diagnosis and were assessed for follow-up evaluation. Overall, 40% of the cohort showed findings compatible with acute inflammatory activity. Overall, 40% of the cohort showed findings compatible with acute inflammatory activity. Intestinal involvement was most frequent in the terminal ileum (40%), followed by the sigmoid colon (15%), and the descending, transverse, and cecum colon (10% each). The average ileal segment length was 37 mm, with mean parietal thickening of 5.7 mm. Mesenteric fat signal alteration was observed in 55% of patients, mesenteric lymphadenopathy in 35%, and vascular changes in 10%. Chronic fibrostenotic changes were found in 15%, and 20% showed subocclusive-type obstructions. Findings not related to IBD were noted in 35% of cases. Based on the simplified Magnetic Resonance Index of Activity (MaRIA) score, 50% had a score of 0-1, 5% scored 2, 40% scored 3, and 5% scored 5. **Conclusions:** The MAGNETIC study confirms MRE's role in identifying active inflammation, chronic sequelae, and complications in Crohn's disease. It supports the use of the MaRIA score for objective disease assessment, enhancing clinical decision-making in specialized IBD centers.

Keywords: *Inflammatory Bowel Diseases; Crohn Disease; Dynamic Contrast Enhanced Magnetic Resonance Imaging; Diagnosis; Therapeutics (source: MeSH NLM).*

RESUMEN

Introducción: La enteroresonancia magnética (ERM) es una herramienta de imagen valiosa para la evaluación y seguimiento de pacientes con enfermedad inflamatoria intestinal (EII), particularmente con enfermedad de Crohn (EC). Este estudio describe los hallazgos de la ERM en pacientes con sospecha o diagnóstico confirmado de EC en un centro nacional de referencia para EII en Colombia. **Materiales y métodos:** Se realizó un estudio observacional descriptivo en pacientes evaluados mediante ERM en un centro especializado en EII. **Resultados:** De los 20 pacientes evaluados, 18 (90%) fueron remitidos a ERM por sospecha clínica o endoscópica de enfermedad de Crohn, mientras que 2 pacientes (10%) tenían diagnóstico confirmado y fueron evaluados como parte de su seguimiento. En conjunto, el 40% de la cohorte presentó hallazgos compatibles con actividad inflamatoria aguda. La localización intestinal más frecuente fue el íleon terminal (40%), seguido del colon sigmoide (15%) y de los segmentos descendente, transverso y ciego (10% cada uno). El promedio de la longitud del segmento ileal afectado fue de 37 mm, con un engrosamiento parietal

Correspondence:
Juan Sebastián Frías-Ordoñez
Center of Excellence in Inflammatory Bowel Disease, Hospital Internacional de Colombia, Bucaramanga, Colombia.
E-mail: jsfriaso@unal.edu.co

promedio de 5,7 mm. Se observó alteración de la señal de la grasa mesentérica en el 55% de los pacientes, linfadenopatía mesentérica en el 35% y cambios vasculares en el 10%. Se identificaron cambios fibroestenosantes crónicos en el 15% y obstrucciones de tipo suboclusivo en el 20%. En el 35% de los casos se encontraron hallazgos no relacionados con EII. Según el puntaje simplificado MaRIA, el 50% obtuvo un puntaje de 0–1, el 5% un puntaje de 2, el 40% un puntaje de 3 y el 5% un puntaje de 5. **Conclusiones:** El estudio MAGNETIC confirma el papel de la ERM en la identificación de inflamación activa, secuelas crónicas y complicaciones en la enfermedad de Crohn. Asimismo, respalda el uso del puntaje MaRIA como herramienta objetiva para la evaluación de la actividad inflamatoria, optimizando la toma de decisiones clínicas en centros especializados en EII.

Palabras clave: *Enfermedades Inflamatorias del Intestino; Enfermedad de Crohn; Imágenes por Resonancia Magnética con Contraste Dinámico Mejorado; Diagnóstico; Tratamiento (fuente: DeCS Bireme).*

INTRODUCTION

Crohn's disease (CD) is a chronic, autoinflammatory, disabling disease of unknown etiology, characterized by a course of relapses and remissions. It can involve the entire digestive tract, and the most affected sites include the terminal ileum and colon [1]. Its treatment is a challenge, with a focus on stimulation of mucosal healing, reduction of recurrence, as well as decreasing the need for surgery, hospitalization, and hormonal medications, with an overall emphasis on the improvement of the patients' quality of life [2]. While endoscopy has been considered one of the gold standards for diagnosis and follow-up, recent developments of endoscopic techniques such as high-definition ileo-colonoscopy, narrow band-imaging, and magnification ileo-colonoscopy have led to advances in gastrointestinal structural analysis [3], and the Simple Endoscopic Score for Crohn's Disease (SES-CD) has been implemented for endoscopic evaluation of therapeutic response [4]. However, it comes with its own share of complications; it provides little access to the small intestine, it is limited in identifying extra-luminal lesions, its field of vision is narrow, the diagnosis can be subjective, and it implies difficulties in visualization of peri-intestinal lesions [3]. Therefore, imaging techniques such as magnetic resonance enterography (enteroMRI) are rapidly gaining popularity as an interesting alternative.

EnteroMRI has proven its value for the evaluation of IBD and is currently one of the leading imaging modalities for the initial and follow-up evaluation of IBD, characterized by the quality of its visualization, its multidirectionality, multiple parameter settings, high-contrast images which are better suited for the resolution of soft tissues, among many others [3]. Its sensitivity and specificity for IBD is similar to that of CT enterography, and it can efficiently perform tissue characterization while decreasing radiation exposure and fewer contrast complications [5]. The quantitative indicator Magnetic Resonance Index of Activity (MaRIA) is used to assess inflammatory activity in Crohn's disease through MRE, using parameters such as bowel wall thickening, mural edema, mesenteric inflammation, and the presence of ulcers [6,7].

Colombia is a country with an intermediate prevalence of IBD. However, the burden of disease is growing [8,9], and socioeconomic and geographical factors strain the limits of its health system [10]. Although awareness and education about the clinical and therapeutic characteristics of patients with IBD are rapidly improving, there is much to learn about immunological findings in CD from technical imaging due to their increase in clinical implementation, such as enteroMRI. Therefore, we propose a summary of enteroMRI findings in CD patients in a national reference center for IBD in Colombia.

MATERIALS AND METHODS

Study design and data extraction

Descriptive observational study in patients diagnosed with IBD who have been admitted to the Center for IBD in the Hospital Internacional de Colombia and who have been evaluated with MR enterography. This study included adult patients (≥18 years) evaluated at the Inflammatory Bowel Disease Center of the Hospital Internacional de Colombia between June and September 2023 who underwent Magnetic Resonance Enterography (MRE) either for diagnostic purposes due to clinical suspicion of Crohn's disease (CD) or for disease monitoring in patients with a confirmed diagnosis. Inclusion criteria comprised: (1) confirmed or suspected CD according to clinical, endoscopic, histological, or biochemical findings consistent with ECCO criteria; (2) availability of complete MRE data with adequate image quality; and (3) signed informed consent for participation. Patients were excluded if they had incomplete clinical or imaging data, poor-quality MRE sequences, or contraindications to MRI contrast agents.

Demographic and clinical data were collected, including age, sex, disease duration, disease location and behavior according to the Montreal classification, and current treatment at the time of MRE (such as corticosteroids, immunomodulators, or biologic therapy).

Technical aspects

Magnetic Resonance Enterography (MRE) was performed using a 1.5T scanner. Oral contrast consisted of a biphasic hyperosmolar agent, with prior preparation including a low-residue diet. Images were acquired with the patient in the supine position. The protocol included FIESTA sequences, rapid T2-weighted sequences with and without fat saturation, dynamic LAVA sequences after intravenous contrast administration, diffusion-weighted imaging, and CINE sequences. Intravenous contrast enhancement was performed using gadobutrol (Gadovist®, Bayer AG, Berlin, Germany) at a dose of 0.1 mmol/kg, administered via peripheral vein with an injection rate of 2 mL/s followed by a saline flush. Post-contrast dynamic and delayed phases were obtained to assess mural enhancement patterns, vascularity, and the presence of penetrating complications. N-butyl scopolamine was administered to reduce bowel peristalsis during the exam.

A standardized reading protocol was used to assess signs of acute inflammation, chronic fibrostenotic changes, and chronic reparative–regenerative features. In addition, the presence of penetrating or fistulizing disease was systematically evaluated, including sinus tracts, entero-enteric or entero-vesical fistulas, intra-abdominal abscesses, and phlegmon formation, following conventional radiological definitions for Crohn's disease. Extraintestinal findings were also described. The simplified MaRIA score was applied to 100% of patients, based on the following items:

$$MaRIAs = (1 \times bowel\ wall\ thickness > 3\ mm) + (1 \times edema) + (1 \times fat\ stranding) + (2 \times ulcers).$$

Data collection

Information was collected for a three-month period, from June 2023 to September 2023, in the various institutions included in the study. The medical records and the imaging procedure performed were used as a primary source of information. Clinical imaging variables were collected, including type of IBD, disease extent and phenotype, and imaging parameters such as altered mesenteric fat signal, vascular alteration, mesenteric lymphadenopathy, signs of fibrostenosis, penetrating or fistulizing lesions (sinus tracts, abscesses, or entero-enteric fistulas), obstructive patterns, and the simplified MaRIA index value.

Definitions

In order to avoid subjectivity, in the present study the MARIAs score [6] was estimated, which is based on the evaluation of each intestinal segment looking for the presence of wall thickening, wall edema, fatty striation and ulceration, using the following simple equation:

$$MARIAs = (1 \times thickness > 3\ mm) + (1 \times edema) + (1 \times fat\ striation) + (2 \times ulcers)$$

Statistical analysis

The database was created in Excel (version 2019). Confidentiality of information was guaranteed and no record contained sensitive information on patient identity. The information review was carried out by three separate people. For the descriptive analysis of quantitative variables, arithmetic mean, median, minimum, maximum, interquartile range and standard deviation were used; for qualitative variables, absolute and relative frequencies were used.

Ethical considerations

The requirements established in the Declaration of Helsinki, version 2013, in Fortaleza, Brazil [11], and resolution 8430 of 1993 of the National Ministry of Health of Colombia [12], were taken into account in the study design so that it was considered a risk-free research, and confidentiality of the information collected was guaranteed. All participants signed informed consent. During the application of the instrument, the participants were explained what the study entailed. This research was reviewed and approved by the Research Ethics Committee of each participating institution.

Ethical approval and consent to participate: This research was reviewed and approved by the Research Ethics Committee of each participating institution.

Consent for publication: The requirements established in Resolution 8430 of 1993 of the Ministry of Health of the Republic of Colombia were taken into account, so that it was considered a risk-free investigation. All participants signed informed consent and the confidentiality of the information collected was guaranteed.

Availability of data and materials: The data and material available for publication are in the manuscript and no information is omitted.

RESULTS

The median age of the cohort was 34 years (interquartile range [IQR]: 27–46), with a female predominance (60%) and 40% male patients. The age distribution was homogeneous, with most patients (65%) belonging to the 25–45-year range, which aligns with the typical peak incidence of Crohn's disease in young adults. Among those with a confirmed diagnosis, the median disease duration was 5 years (range: 1–18 years), reflecting a cohort composed primarily of individuals with established disease and varying degrees of prior treatment exposure (Table 1).

Regarding pharmacological management at the time of imaging, 40% of patients were receiving biologic agents —predominantly anti-TNF therapies such as infliximab or adalimumab—, 25% were under immunomodulator therapy (azathioprine or methotrexate), and 20% were

Table 1. Demographic characteristics and distribution of intestinal involvement in patients evaluated by MRE.

Category / Measurement	n (%) or Median (IQR)
Total patients	20 (100%)
Sex	
Female	12 (60%)
Male	8 (40%)
Age (years)	
Median (IQR)	34 (27–46)
Range	19–69
Disease duration (years)	
Median (range)*	5 (1–18)
Current therapy	
Biologic agents	8 (40%)
Immunomodulators	5 (25%)
Corticosteroids	4 (20%)
Treatment-naïve	3 (15%)
Localization of intestinal involvement	
Terminal ileum	8 (40%)
Sigmoid colon	3 (15%)
Descending colon	2 (10%)
Transverse colon	2 (10%)
Cecum	2 (10%)
Multiple segments	3 (15%)
Type of MRE findings	
Acute inflammation	8 (40%)
Chronic fibrostenotic changes	3 (15%)
Suboclusive obstruction	4 (20%)
Non–IBD-related findings	7 (35%)

Note. Data are expressed as absolute frequencies and percentages unless otherwise specified. Age and disease duration are presented as median and interquartile range (IQR). Segmental involvement corresponds to the predominant intestinal site identified by Magnetic Resonance Enterography (MRE). Percentages may not total 100% due to rounding. Disease duration was analyzed only in patients with confirmed Crohn's disease.

on systemic corticosteroids for induction of remission. The remaining 15% were treatment-naïve individuals undergoing initial evaluation for suspected Crohn's disease. Notably, 45% of patients had previously required hospitalization related to disease activity, and 20% had a documented history of intestinal resection.

Of the 20 patients evaluated, 18 (90%) underwent MRE due to clinical or endoscopic suspicion of Crohn's disease, whereas 2 patients (10%) had a previously confirmed diagnosis and were examined for follow-up evaluation. Overall, 40% of the cohort presented findings compatible with acute inflammatory activity on MRE. In regard to mural findings, 40% of patients presented with a site of compromised intestinal integrity in the ileum, 15% in the sigmoid colon, and 10% in the descending, transverse, and sigmoid colon. At the level of the ileum, the average extent
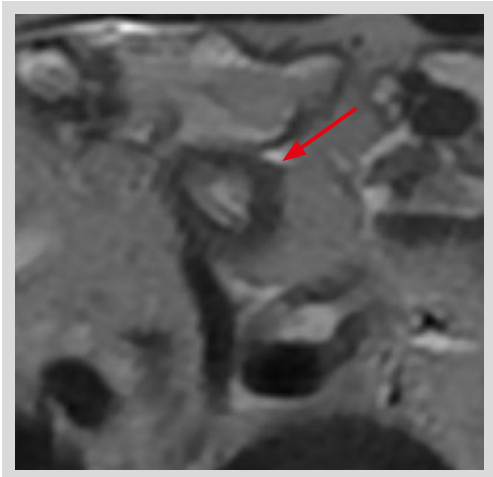

Figure 1. 19 year old man, abdominal pain and emesis, CT and Colonoscopy of ileitis, Diagnosis: Stenosing ileal CD. EnteroMR mixed disease of the distal ileum with signs of activity and chronic fibrostenotic changes MARIAs: 3. T2 SEQUENCE: Parietal thickening, T2 signal hyperintensity due to submucosal edema, inflammatory changes of the mesenteric fat as signs of activity.

of the intestinal compromise was 37mm, with a parietal thickening of 5.7mm.

Extramural findings were also identified, including altered mesenteric fat signal in 55% of patients, vascular alteration (using the comb sign) in 10%, and mesenteric lymphadenopathy in 35%. Chronic fibrostenotic signs were also described in 15%, while the type of obstruction was predominantly suboclusive in 20%. In 35% of patients, no findings related to IBD were found. The MARIAs Index was calculated for all of the patients, finding a score of 0 in 40%, a score of 1 in 10%, a score of 2 in 5%, a score of 3 in 40% and 5 in 5%.
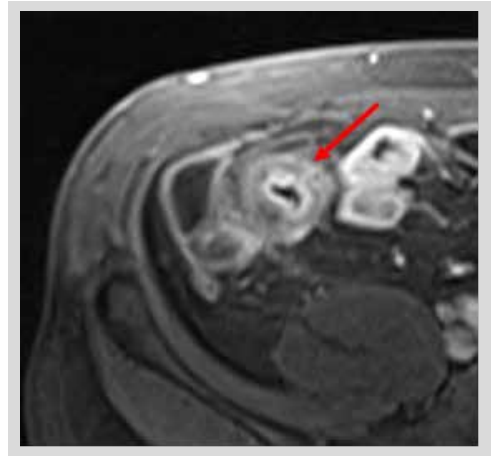

Figure 2. T1 FS sequence with contrast: Wall thickening, inner layer enhancement, submucosal edema with less enhancement, decreased lumen, inflammatory changes in the mesenteric fat of the distal ileum as signs of activity.
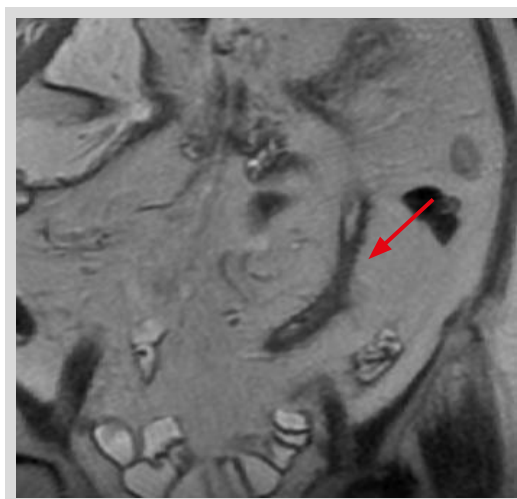
Figure 3. Woman 69 years old, weight loss 23Kg, upper digestive endoscopy with esophagitis, Colonoscopy: proctocolitis, perianal fistula. Diagnosis: severe CD. EnteroMR Acute mixed disease, chronic and regenerative fibrous changes MARIAs: 3. T2 sequence: Diffuse non-stratified thickening, hypointense on T2, Diffuse enhancement, mesenteric fibrotic changes, decreased lumen as chronic fibrostenotic signs.
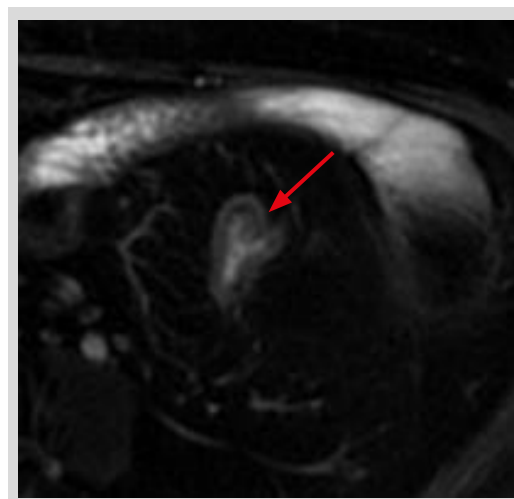

Figure 4. T2 FS sequence: Wall thickening, signal hypointensity on T2 FS due to mucosal atrophy with fatty replacement, as signs of chronic reparative-regenerative process.

Pathological assessment

The MARIAs score consists of several yes/no criteria, evaluated independently for each intestinal segment from the terminal ileum to the rectum. Intestinal wall thickness >3 mm is scored with 1 point, intestinal wall edema with 1 point, fatty striation 1 point and the presence of ulcers 2 points. Determining a consolidated score of 0 to 5 points. Some cases considered in the study are illustrated below (Figures 1, 2, 3 and 4).

DISCUSSION

This observational study highlights the principal advancements in the field of enteroMRI in patients with CD. As the use of enteroMRI becomes more common, each component of the enteroMRI scan is better evaluated and produces better outcomes for patients. In Latin America, the prevalence and incidence of inflammatory bowel disease (IBD) have shown a progressive increase over the past two decades, reflecting a pattern of epidemiological transition similar to that observed in industrialized regions [9]. In Colombia, national registry analyses have estimated an overall IBD prevalence ranging between 29 and 48 cases per 100,000 inhabitants, with a predominance of ulcerative colitis but a sustained rise in Crohn's disease diagnoses, particularly in urban centers such as Bogotá, Medellín, and Bucaramanga [8,9]. The Colombian Health and Social Protection Data System (SISPRO) and recent multicenter series describe an incidence of approximately 5–7 new IBD cases per 100,000 inhabitants per year, marking an almost three-fold increase since the early 2000s [10]. At the Latin American level, comparable trends have been reported in Brazil, Mexico, Chile, and Argentina, where the prevalence of

Crohn's disease has reached 20–40 per 100,000 inhabitants, emphasizing the growing clinical and economic burden of IBD across the region [1,8]. These data highlight the need for local imaging and clinical research, such as the present study, which provides one of the first Colombian descriptions of magnetic resonance enterography findings in Crohn's disease. Incorporating regional epidemiological information not only contextualizes the study population but also supports the relevance of adopting standardized imaging indices (e.g., MaRIA) in middle-income settings experiencing a rapid expansion of IBD care infrastructure.

Given that CD is chronic, a long-term evaluation of the patients' therapeutic response is crucial, and enteroMRI could be the main method used to monitor these patients [1,4]. One of the main concerns when performing the exam is patient cooperation, which in turn highlights the need for shorter scan times with better sequence selection, which will simultaneously contribute to obtaining better diagnostic results [4,5]. The use of accurate and simple scores can help quantify the severity of the disease to help modify treatment. EnteroMRI can help measure and predict the patients' therapeutic response and, therefore, help choose the most appropriate treatment [13]. In the study by Lunder et al. the MRI findings of patients with long-term CD (more than 20 years) were evaluated, finding that the majority of patients presented active inflammation, and also, to a lesser extent, presentations with stenosis. In most cases of stenosis, surgical treatment was administered without recurrence, while 20% of cases the stenosis was cured without surgical treatment, establishing the assumption that inflammation and fibrosis are a spectrum [14]. In the present study, results of methods to differentiate between

inflammation and intestinal fibrosis were presented, and their significant implications in the treatment of choice, finding that 40% of included subjects presented signs of disease activity, proposing therapeutic adjustments, while findings of stenosis were less commonly found.

Another important factor to consider when choosing an imaging method is the degree of radiation exposure. Imaging studies for diagnosis and monitoring of patients with IBD must be both non-invasive and highly accurate. The absence of radiation is crucial because patients undergo multiple imaging studies throughout their lives [15]. EnteroMRI and USI have traditionally been favored due to low radiation exposure; efforts are currently being made to reduce radiation exposure associated with diagnostic techniques such as computed tomography enterography (CTE), whose radiation has traditionally been considered a disadvantage in this technique [16]. However, its non-invasive method and the absence of radiation are clear advantages of enteroMRI. Regarding the diagnostic accuracy of enteroMRI, despite limitations in the sample of subjects included, our study provides solid evidence of adequate diagnosis of this modality by providing data on acute and chronic inflammation in a large part of the patients.

Another objective for the interpretation of enteroMRI is an acceptable and uniform scoring system, similar to that used in the liver imaging interpretation system LIRADS (Liver Reporting and Data System) [17]. Although some extraction systems have been proposed, none of them have yet become widespread. The goal is to create a score that standardizes reporting and data collection and categorizes enteroMRI findings with risk factors for developing penetrating and/or stenosing disease, as well as the ability to differentiate between inflammatory and fibrotic disease [18]. This standardized information system will allow radiologists to better communicate with referring physicians and gastroenterologists with consistent terminology, reduce variability in image interpretation, and facilitate quality assurance and research [3]. The results in our study are encouraging, and provide an initial glimpse into standardized communication between the radiologist and clinician in the interpretation of intestinal structural involvement in patients with IBD and their therapeutic goals.

This study has some limitations, mainly being its design that is able to neither evaluate a causal relationship between the exposure and the outcome nor make comparisons between groups of patients. Also, the quality of the information could have been affected when completing the medical records. Verification by at least two researchers of the data could reduce transcription bias. Another limitation is that its sample size was small with wide heterogeneity of the patients included, without being able to make estimates or comparisons between groups of patients. Although it was a purely descriptive study, without documenting statistically significant associations and with limitations in its extension and the centers included, the study's inclusion of adult subjects in remission of IBD by clinical criteria provides an initial overview of the imaging characteristics by enteroMRI in a sample of patients with CD who are undergoing multidisciplinary management, in a country without previously described data on this imaging modality.

In conclusion, the MAGNETIC study highlights the value of Magnetic Resonance Enterography (MRE) not only in accurately distinguishing between active inflammatory lesions, chronic fibrostenotic changes, and reparative-regenerative features in Crohn's disease, but also in assessing disease activity through the simplified MaRIA score. This non-invasive, reproducible tool strengthens comprehensive evaluation in specialized IBD centers and supports more precise, personalized management strategies for Colombian patients with Crohn's disease.

REFERENCES

1. Baumgart DC, Sandborn WJ. Crohn's disease. Lancet. 2012;380(9853):1590-1605. doi: 10.1016/S0140-6736(12)60026-9.

2. Danese S, Vuitton L, Peyrin-Biroulet L. Biologic agents for IBD: Practical insights. Nat Rev Gastroenterol Hepatol. 2015;12(9):537-545. doi: 10.1038/nrgastro.2015.135.

3. Zhang YN, Liu YB, Xu J, Cao KM, Zhang XX, Wang YB, *et al.* Magnetic resonance index of activity (MaRIA) is reliable in assessing response to treatment in patients with Crohn's disease (CD). Clin Radiol. 2024;79(3):230-236. doi: 10.1016/j.crad.2023.11.008.

4. Daperno M, D'Haens G, Van Assche G, Baert F, Bulois P, Maunoury V, *et al.* Development and validation of a new, simplified endoscopic activity score for Crohn's disease: The SES-CD. Gastrointest Endosc. 2004;60(4):505-512. doi: 10.1016/s0016-5107(04)01878-4.

5. Fidler JL, Guimaraes L, Einstein DM. MR imaging of the small bowel. Radiographics. 2009;29(6):1811-1825. doi: 10.1148/rg.296095507.

6. Ordás I, Rimola J, Alfaro I, Rodríguez S, Castro-Poceiro J, Ramírez-Morros A, *et al.* Development and validation of a simplified magnetic resonance index of activity for Crohn's disease. Gastroenterology. 2019;157(2):432-439.e1. doi: 10.1053/j.gastro.2019.03.051.

7. Minordi LM, Larosa L, Papa A, Cimino G, Bevere A, Brizi MG, *et al.* A review of magnetic resonance enterography classification and quantitative evaluation of active disease in patients with Crohn's disease. Clin Imaging. 2021;69:50-62. doi: 10.1016/j.clinimag.2020.06.006.

8. Juliao-Baños F, Kock J, Arrubla M, Calixto O, Camargo J, Cruz L, *et al.* Trends in the epidemiology of inflammatory bowel disease in Colombia by demographics and region using a nationally representative claims database and characterization of inflammatory bowel disease phenotype in a case series of Colombian patients. Medicine (Baltimore). 2021;100(7):e24729. doi: 10.1097/MD.0000000000024729.

9. Fernández-Ávila DG, Bernal-Macías S, Parra-Izquierdo V, Rincón-Riaño DN, Gutiérrez JM, Rosselli D. Prevalence of inflammatory bowel disease and related arthritis in Colombia, according to information from the Health and Social Protection Data System. Rev Colomb Reumatol. 2020;27(1):3-8.

10. Gil F, Juliao-Baños F, Amador L, Castano N, Reyes JM. Cost effectiveness of tofacitinib for the treatment of moderate to

severe active ulcerative colitis in Colombia. Pharmacoecon Open. 2022;6(6):837-846. doi: 10.1007/s41669-022-00360-4.

11. World Medical Association. World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. JAMA. 2013;310(20):2191-2194. doi: 10.1001/jama.2013.281053.

12. Ministerio de Salud. Resolución Número 8430 de 1993. Bogotá: MinSalud; 1993.

13. Bufman H, Eliakim R, Tau N, Amitai MM. Magnetic resonance enterography in Crohn's disease patients: Current state of the art and future perspectives. Expert Rev Med Devices. 2021;18(7):657-667. doi: 10.1080/17434440.2021.1939682.

14. Lunder AK, Bakstad LT, Jahnsen J, Borthne A, Hov JR, Vatn M, Negård A. Assessment of bowel inflammation and strictures by magnetic resonance enterography in long-term Crohn's disease. J Crohns Colitis. 2019;13(5):607-614. doi: 10.1093/ecco-jcc/jjy208.

15. Yoon HM, Suh CH, Kim JR, Lee JS, Jung AY, Kim KM, *et al*. Diagnostic performance of magnetic resonance enterography for detection of active inflammation in children and adolescents with inflammatory bowel disease: A systematic review and diagnostic meta-analysis. JAMA Pediatr. 2017;171(12):1208-1216. doi: 10.1001/jamapediatrics.2017.3400.

16. Mentzel HJ, Reinsch S, Kurzai M, Stenzel M. Magnetic resonance imaging in children and adolescents with chronic inflammatory bowel disease. World J Gastroenterol. 2014;20(5):1180-1191. doi: 10.3748/wjg.v20.i5.1180.

17. Cunha GM, Fowler KJ, Roudenko A, Taouli B, Fung AW, Elsayes KM, *et al*. How to use LI-RADS to report liver CT and MRI observations. Radiographics. 2021;41(5):1352-1367. doi: 10.1148/rg.2021200205.

18. Kaushal P, Somwaru AS, Charabaty A, Levy AD. MR enterography of inflammatory bowel disease with endoscopic correlation. Radiographics. 2017;37(1):116-131. doi: 10.1148/rg.2017160064.