Magnetic Resonance Enterography (MRE) in Crohn's Disease: How We Do It and Common Imaging Findings

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Abstract

Background: Crohn's disease (CD) is a chronic inflammatory bowel disease that affects children and adults. MRE is the primary imaging technique for assessment due to its non-invasive characteristics and absence of ionizing radiation. MR enterography can identify both mural and extramural manifestations of CD, serving as a crucial tool for radiologists and clinicians in disease management.

Methods: This cross-sectional study was conducted at outpatient clinics, the National Liver Institute, Menoufia University, and the Tropical Medicine Department at the Faculty of Medicine, Alexandria University, from January 2022 to December 2024. The study included 54 patients, aged 12 to 45 years, diagnosed with Crohn's disease through colonoscopy findings.

Results: All patients underwent MR enterography to evaluate various imaging features during active or complicated disease stages. Active bowel inflammation was characterized by bowel wall thickening in 46 patients (85%), bowel wall edema in 15 patients (27.8%), and mural wall hyperenhancement in 43 patients (79.6%). Inflammatory mesenteric fat stranding was detected in 41 patients (75.9%), mesenteric lymphadenopathy in 29 patients (53.7%), and vascular engorgement within the affected mesentery in 39 patients (72.2%). Fistula formation is a characteristic of penetrating disease, comprising two types: intra-abdominal fistulas in 9 patients (16.7%) and perianal fistulas in 11 patients (20.4%). Chronic bowel wall inflammation, which may progress to fibrostenotic complications, was observed in only two patients (3.7%).

Conclusion: MR enterography is a pivotal diagnostic tool in assessing the typical imaging features of Crohn's disease and its associated complications. *Keywords: Crohn's disease; Small bowel inflammation; MR enterography.*

Introduction

Crohn's disease (CD) is an inflammatory bowel disease characterized by chronic relapsing/remitting immune-mediated conditions ⁽¹⁾. It most commonly presents during the second and third decades of life, with approximately 25% of patients developing the disease during adolescence ^(2,3). CD triggers an acute inflammatory response that impacts different segments of the alimentary tract, particularly the terminal ileum, potentially resulting in permanent injury ⁽⁴⁾.

Patients with CD commonly experience recurrent bowel motility, abdominal pain, and diarrhea, while other manifestations such as fever, nausea, and vomiting may occur. Approximately 25% of affected patients may also present with symptoms, including uveitis, episcleritis, arthritis, or erythema nodosum ⁽⁵⁻⁷⁾.

Actively inflamed bowel segments generally exhibit segmental mural wall thickening, intramural edema, and occasionally microabscesses along the mesenteric border ^(8,9). Skip lesions, characterized by alternating inflamed and unaffected bowel loop segments, are considered hallmark features of Crohn's disease ⁽¹⁰⁾.

A complicated CD is presented by the development of strictures, which are associated with symptoms of bowel obstruction, and penetrating disease, which manifests as abscess formation and fistulas ⁽¹¹⁾. CD is a chronic condition affecting various parts of the gastrointestinal tract over time. Therefore, the initial management strategy typically involves anti-inflammatory medications, whereas surgical intervention is recommended for cases resistant to drugs or present complications ⁽¹²⁻¹⁴⁾.

The role of imaging in Crohn's disease stems from the need to assess bowel segments that are not accessible through optical endoscopy. Generally, barium studies have been utilized to determine the upper and lower alimentary tract. However, their use has diminished due to limited diagnostic ability, especially in evaluating extramural manifestations ^(15, 16).

CT enterography (CTE) is a cross-sectional imaging approach to assess the SB loops by administering neutral oral contrast followed by intravenous contrast during

the enteric phase ^(17,18). CTE is considered a valuable imaging modality for evaluating CD due to its wide use in urgent situations, rapidity, and ability to assess mural and extramural manifestations of CD ^(19, 20). However, the potential ionizing radiation risks associated with CT scanning should be considered, particularly in pediatric patients and long-term follow-up cases ⁽²¹⁾.

MR enterography (MRE) was established as an alternative for CTE to image the small bowel in pediatric and adult patients with CD ^(22, 23). MRE offers high tissue contrast, enabling the accurate detection of submucosal wall edema while providing multiparametric data and functional insights without ionizing radiation, making it particularly suitable for teenagers with Crohn's disease ⁽²⁴⁻²⁹⁾.

Additionally, MRE can assess inaccessible SB segments via ileocolonoscopy, rule out complications such as abscesses and strictures requiring urgent intervention, and assess active disease ⁽³⁰⁻³⁴⁾.

This study aimed to demonstrate the feasibility and utility of MR enterography in detecting complications in pediatric and adult populations with Crohn's disease, aid clinicians in determining treatment options, and provide an overview of MR imaging in Crohn's disease.

Patients and Methods Patient Enrollment

All cases included were diagnosed with Crohn's disease and were scheduled for MR enterography due to symptom exacerbation and/or complications. Scanning was conducted following informed consent from our patients between January 2022 and December 2024. Informed consent was obtained from a parent for individuals under 18. Exclusion criteria included MRI-incompatible metallic implants and patients with impaired renal function.

Ethics approval and consent to participate were obtained, with all participants' legal guardians signing informed consent following a comprehensive overview of the study's objectives. The National Liver Institute's local ethical scientific committee approved the study procedures (Registration number: NLI IRB 00014014/FWA00034015).

Clinical information such as age, sex, and presenting complaints, as well as a family history of similar illnesses, was collected from patients. Laboratory data and ultrasonographic data were retrieved from patients' medical records. Colonoscopy with terminal ileum intubation was performed using PENTAX video scopes (A Division of PENTAX of America, Inc., Montvale, NJ, USA) in the endoscopy unit, National Liver Institute, and Tropical Medicine Department, Faculty of Medicine at Alexandria University. The biopsies were taken from the terminal ileum and colonic mucosa, followed by histopathological examination. The procedure was conducted under sedation after confirming standard coagulation profiles, platelet counts, and adequate bowel preparation according to protocol.

MR Enterography Technique

MRI examinations were conducted on a 1.5 T system (GE, Optima 450W, 32 channels) using a body phased-array coil. Before the examination, patients fasted for 4–6 hours. In adult patients, approximately 1–2 L of a mixed oral contrast solution (comprising mannitol, methylcellulose, and polyethylene glycol) was ingested to obtain adequate bowel distention. In pediatric patients, less oral contrast volume was used and adjusted according to the patient's weight. Mannitol is considered a biphasic agent, exhibiting low signal intensity on T1-WIs and high signal intensity on T2-WIs. The oral contrast intake was administered over 40-60 minutes at regular intervals before commencing the procedure.

Patients were imaged in prone and supine positions (the prone position is especially recommended when an abdominal stoma is present), as the prone position provides better bowel distention, reduced peristalsis, and a shorter scan time. Spasmolytic agents, such as hyoscine butylbromide, were administered before imaging to minimize bowel peristalsis and reduce motility artifacts.

Standard MRE protocols included a balanced steady-state free precession (bSSFP) sequence with single-shot T2-weighted images in the coronal plane. Additionally, axial T2 fat-suppressed images and coronal multiphase 3D T1 fat-suppressed post-contrast images were obtained following IV gadopentetate dimeglumine (Gd-DTPA) administration. Cine motility imaging must be conducted before administering a spasmolytic agent to assess bowel peristalsis accurately.

Diffusion-weighted imaging (DWI) has recently been incorporated into the MRE protocol to identify active bowel wall inflammation and complicated extraluminal collections. The DWI sequence does not require a breath-hold technique.

The pelvic MR protocol evaluates perianal disease by obtaining high-spatial resolution FS and non-FS T2-weighted, FS contrast-enhanced T1-weighted, and DWI images.

Image Data Analysis

We examined the imaging characteristics of Crohn's disease from the uncomplicated acute phase to the acute phase with complications. Pathologic involvement of the small bowel loops and associated mesentery is observed, accompanied by signs of inflammation.

The affected bowel loop exhibits active inflammation characterized by increased wall thickening, intramural edema, segmental hyperenhancement, reduced bowel motility, and sometimes ulceration.

Segmental mural hyper-enhancement is defined as an increase in mural signal intensity observed on contrast-enhanced images of an uncontracted small bowel segment, compared to a standard bowel loop. It may present as asymmetrical, stratified, or homogeneous. The asymmetrical mural hyper-enhancement of the affected loop and significant involvement of its mesenteric border are specific imaging features of small bowel CD. Stratified mural hyperenhancement is observed when the submucosa is affected by edematous or inflammatory changes (demonstrated by high T2 signal) along with an enhanced endoluminal mucosa, forming a bilaminar pattern; a trilaminar pattern is noted when an additional contrast-enhancing serosal layer is present. Homogeneous, symmetrical mural hyperenhancement, which manifests as uniform enhancement of the entire intestinal wall, is not specific to CD and may indicate other pathologies.

Bowel wall enhancement can be assessed during scanning: the enteric phase (45– 50 seconds post IV contrast injection) and the portal venous phase (60–70 seconds post IV contrast injection). An adequately distended bowel loop (at least 2 cm in caliber) is needed to assess increased bowel wall thickness with wall measurement in the maximum thickness. Mild (4-5 mm), moderate (6-9 mm), or severe (\geq 10 mm) bowel wall thickness can be assessed. A neoplastic lesion may be considered when bowel wall thickening is more than 15 mm, especially with uneven thickening. On FS T2-WI images, intramural bowel wall edema can be identified as a hyperintense signal intensity. Due to previous intestinal inflammation, intramural fat also displays high T2 signal intensity but differs from edema by a signal drop in fat-suppressed sequences.

Ulceration of the bowel wall mucosa affected by active CD is seen as a high T2 nidus, with a moderate signal intensity surrounding rim. Deep and transmural ulcerations may be seen with severe bowel inflammation. The typical "cobblestone" manifestation results from confluent mucosal ulcerations combined with protruding edematous mucosa.

Cine MRE can detect diminished bowel motility in the diseased bowel loop, thus helping to differentiate an undistended from an inflamed bowel. Inflammatory bowel stenosis should unwrap on cine imaging, while the fibrotic bowel narrowing remains constant with pre-stenotic dilatation. Establishing the nature of bowel stenosis is of significant therapeutic concern, as an inflammatory bowel stenosis may respond to antiinflammatory therapy. In contrast, a fibrostenotic bowel stricture will most likely require surgical intervention.

In CD, the active inflammation of the bowel wall can display restricted diffusion, with high signal intensity on DWI and corresponding low signal intensity on apparent diffusion coefficient (ADC) maps. However, diffusion restriction is a nonspecific sign for CD, particularly if the loops are not adequately distended.

Regarding mesenteric involvement, the mesentery is affected in cases with advanced bowel inflammation. Typically, the mesentery may show edematous and inflammatory changes, vascular engorgement, fibrofatty proliferation, and enlarged mesenteric lymph nodes. Perienteric inflammation, also defined as "fat stranding," represents an extension of the transmural bowel inflammation and is seen as an increased signal in T2-WI and DWI in the mesenteric fat. Mesenteric vascular engorgement is established by dilating the feeding vessels, draining an inflamed intestinal loop, and extending perpendicular to the bowel wall, giving the comb sign. It can be seen in current intestinal inflammation as well as in previous inflammation.

Fibrofatty proliferation, or "creeping fat," results from acute inflammation, especially with repeated attacks. It can be detected on the mesenteric side or circumferentially and visualized as slightly decreased signal intensity on T1-WIs compared to normal fat due to the inflow of fluid and inflammatory cells.

Mesenteric lymphadenopathy is usually of reactive origin and is seen in the mesenteric fat during acute inflammation. It is presented by enlarged, enhanced mesenteric lymph nodes (up to 1-1.5 cm in the short axis).

Regarding the perianal disease, active perianal inflammation is frequent in Crohn's disease. The perianal fistula is usually following active inflammation with mucosal ulceration in the rectal or anal canal, extending to the perianal skin surface. As fistula management varies, it is essential to specify the type of fistula (simple or complex) and whether there is an associated abscess.

Penetrating Crohn's disease and complications

Penetrating CD involves the sinus tract, complex/straightforward fistula, abscess, and free perforation. These findings can be found in about 30% of the affected cases. Determining whether there is penetrating CD is significant, as it may need antibiotic therapy and/or drainage before giving biologic medications.

A sinus tract is a blind-ending tract extending from the intestinal lumen and beyond the serosa into the adjacent fatty tissue but not reaching the nearby organs or skin. On T2-weighted images, it appears as a hyperintense blind-ending tract.

A CD-related fistula is a tract that communicates the affected intestinal lumen to another epithelial surface and is named according to its connected structure, such as an enteroenteric, enterocolic (penetrates a bowel loop), enterovesical (into the urinary bladder), or enterocutaneous fistula (into the skin). It displays a T2 hyperintense signal due to the presence of internal fluid with peripheral rim enhancement and enhanced surrounding soft tissues on postcontrast T1-WIs during the active stage. Chronic fistula lacks internal T2 hyperintensity due to scarring and fibrous tissue formation.

A simple fistula represents a single tract, whereas a complex fistula results from more than one fistulous tract. The stellate appearance of fistulas, with spiculated margins, is likely due to a desmoplastic reaction in the surrounding mesenteric tissue.

An abscess is a fluid collection within a thickened enhanced wall (on contrastenhanced MRE) with or without internal gas foci. Abscesses usually display central restricted diffusion on DWI/ADC imaging, allowing for the assessment of patients who cannot administer IV contrast. Abscesses can occur in the mesentery, peritoneal cavity, retroperitoneum, perirectal, and/or perianal region. Free perforation is a rare complication in penetrating Crohn's disease. It is characterized by free intraperitoneal air and needs surgical assessment to confirm the diagnosis.

Eventually, the inflammatory bowel disease may be associated with an increased risk of mesenteric venous thrombosis. Thrombosis may occur during acute inflammation, which is related to the inflamed intestinal loops. Identifying whether the thrombosis is acute or chronic is essential to determine the patient's need for anticoagulant therapy. Acute thrombosis is associated with a distended vein by an endoluminal thrombus. In chronic thrombosis, the mesenteric veins may be narrowed or discontinued with difficult assessment, while the collateral mesenteric vessels that occur in chronic cases are evident due to ectasia.

Pitfalls

However, MRE may be more acceptable to patients than intubation. Inadequate bowel loop distention can be countered frequently by an inability to identify partial bowel strictures. Early mural wall changes of CD may be missed in areas of collapsed bowel loops. Food debris within the bowel lumen may mimic filling defects or polyps; a low-residue diet and fasting before scanning help eliminate these artifacts. Preceding surgery, especially stricturoplasty, may simulate fibrotic strictures or sharp margins of neoplastic lesions. A survey of these segments in the three imaging planes aids differentiation, as a lobulated or bi- or trifoliate appearance could be observed in stricturoplasty surgery.

Statistical Analysis

Data were fed to the computer and analyzed using the IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Categorical data were represented as numbers and percentages. The different MRE findings in Crohn's disease were presented as the patients' percentages, showing each abnormality.

Results

Patient characteristics

Fifty-four patients with proven Crohn's disease were included in this study, and they underwent MR enterography to assess the different imaging features during the active or complicated disease stage. Our study included two groups regarding age: the adult group (from >18 to 45 years, representing about 38 subjects, 70.4%) and the pediatric age group (from 12 to 18 years, representing about 16 subjects, 29.6%). Regarding the gender, 29 female subjects & 9 male subjects were within the adult group, while the pediatric group included 11 & 5 adolescent girls and boys, respectively. (**Fig. 1**).



Fig 1. Distribution of the studied cases (n = 54) according to age range (12-18 and > 18-45 years old).

MR Enterography features of Crohn's disease (CD)

We analyzed our patients using MR enterography, and an active bowel inflammation or complicated disease was diagnosed.

Tab 1.	Different MR	imaging features	associated with	Crohn's disease	in the studied case	es (n = 54).
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MRI features	No./Total (%)
Wall thickening	46 (85%)
Mild (4-5 mm)	19 (35.2%)
Moderate (6-9 mm)	15 (27.8%)
Severe (≥10 mm)	12 (22.2%)
Intramural edema	15 (27.8%)
Mural wall hyperenhancement	43 (79.6%)
Symmetrical	33 (61.1%)
Asymmetrical	10 (18.5%)
Mucosal ulceration	3 (5.6%)
Reduced bowel motility	44 (81.5%)
Diffusion restriction	34 (63.0%)
Mesenteric involvement	41 (75.9%)
Mesenteric inflammation with fat stranding	41 (75.9%)
Fibrofatty proliferation	17 (31.5%)
Mesenteric lymphadenopathy	29 (53.7%)
Mesenteric vascular engorgement	39 (72.2%)
Thrombosed mesenteric veins	8 (14.8%)
Complicated/Penetrating Crohn's disease	
Sinus tract	3 (5.6%)

Fistula	9 (16.7%)
Simple Fistula	8 (14.8%)
Complex Fistula	1 (1.9%)
Abscess	6 (11.1%)
Free bowel perforation	0 (0.0%)
Perianal disease	11 (20.4%)
Bowel stenosis	14 (25.9%)

Assessment of extra-intestinal CD manifestations and following their progression was also done. A systematic overview of the available patients (**Tab 1**) was obtained as follows: *Bowel wall thickening* was considered a sign of active inflammation in about 46 out of 54 patients (85%) and graded into mild (35.2%), moderate (27.8%) and severe (22.2%) thickening as increasing wall thickness associated with increasing disease severity. *Bowel wall edema* was another criterion of active inflammation, found in 15 out of 54 patients (27.8%). Severe inflammatory bowel wall thickening with intramural edema was associated with subsequent luminal narrowing, representing active inflammatory bowel stenosis (**Fig. 2**) in CD, detected in about 12 patients (22.2%) in our studied cases.



Fig 2. Active inflammatory stricture in a patient with Crohn's disease. Axial T1W Fat Sat post-contrast showing severe mural wall thickening and enhancement (White arrow) affecting distal ileal loops. Skip lesion is noted in the adjacent bowel loop (Grey arrow).

Mural wall hyperenhancement was a specific sign of active inflammation on dynamic contrast-enhanced images. It was detected in 43 out of 54 patients (79.6%); it

was seen as symmetrical in 61.1% and asymmetrical in 18.5% of the total patients. Active inflammatory bowel wall also displayed restricted diffusion (on DWI/ADC imaging) in 34 patients (63%) and reduced bowel peristalsis (on cine MRE) in 44 patients (81.5%).

Mucosal ulceration is an uncommon MRE finding of active Crohn's disease. It requires adequate bowel distention for definitive detection. It was present in only 3 of 54 patients (5.6%).



Fig 3. Fibrofatty proliferation in a patient with Crohn's disease. Coronal T2W shows eccentric fibrofatty proliferation (white arrows) adjacent to a thick-walled small bowel segment (black arrow) with mild lumen narrowing and upstream dilatation.

Various mesenteric MR signs in the active disease stage have been delineated in our patients, including inflammatory mesenteric fat stranding (**Fig. 3**) in 41/54 patients (75.9%), mesenteric lymphadenopathy in 29/54 patients (53.7%), and vascular

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engorgement within the affected mesentery in 39/54 patients (72.2%). Mesenteric venous thrombosis could also be detected in about eight patients (14.8%) (**Fig. 4**).



Fig 4. Chronic mesenteric venous occlusion in a patient with Crohn's disease. Coronal T1W Fat Sat post-contrast showing chronic mesenteric occlusion of the right ilio-colic vein with multiple dilated mesenteric venous collaterals (white arrows). There is diffuse striated mural wall enhancement of the distal ileum (grey arrows).

Fistula formation has been reported in about 37% of our patients and is a feature of penetrating disease. Two types of fistulous disease are seen in our study: intraabdominal (in 9 patients, 16.7 %) and perianal fistula (in 11 patients, 20.4%) (**Fig. 5**).



Fig 5 Shows a 13-year-old female with Crohn's disease and perianal disease. **A&B** Coronal T2 Fat Sat.. **C.** Axial T1 Fat Sat post-contrast showing complex trans-sphincteric branching perianal fistula. **D.** Clinical examination showing the perianal fistula.

Simple fistula is the foremost intra-abdominal fistula, as seen in 8 out of 9 patients (89%), with the remaining one being complex (Entero-entero-cutaneous fistula) (Fig. 6). Our study could also identify a sinus tract with a blind end in three patients (5.6%).

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Fig 6. Active Crohn's disease, complicated by Complex (Entero-entero-cutaneous) fistula. A. Coronal T1 post-contrast Fat Sat, showing active inflammation, mild wall thickening, and enhancement of the distal ileal loops, associated with mesenteric combing. **B&C.** Coronal and axial T1 post-contrast Fat Sat showing complex entero-entero-cutaneous fistula. **D.** axial DWI showing diffusion restriction of the complex fistula.

Other regional complications of CD include abscess formation, which was detected in about six patients (11.1 %). This is characterized by inhomogeneous content and an enhancing peripheral lesion edge.

Chronic bowel wall inflammation with long-term intestinal injury is likely to progress to fibrostenotic complications (bowel stricture with luminal obstruction), which are seen in only two patients (3.7%). The chronic disease stage was identified by submucosal fat deposition, which can be differentiated from submucosal edema on T2-weighted images by reduced fat signal on the fat saturation sequence.

Discussion

This survey defined MR enterography as a potential imaging technique for assessing Crohn's disease. Generally, barium fluoroscopy and enteroscopy are the traditional methods of detecting abnormal bowel findings in Crohn's disease patients. However, neither tool is sensitive for detecting extramural complications, which need to be ruled out in patients with acute exacerbated attacks. Nowadays, CT has become the initial imaging tool to assess Crohn's disease as it can estimate both mural and extramural manifestations of the involved bowel loops ⁽³⁵⁾.

Additionally, CT imaging has common accessibility, multiplanar capability, and fast image acquisition ⁽³⁶⁾. Recent concerns have focused on the ionizing radiation risk associated with CT imaging, especially Crohn's disease, which could be discovered during childhood and require repeated follow-up during the disease process. So, MR imaging likely provides diagnostic CT values without the risk of ionizing radiation ⁽³⁷⁾.

The target individuals accepted the MRE protocol applied in our research well. The scan time extended from 40 to 60 minutes, and no people were ruled out due to an inability to finish the scanning. We noted that some of the subjects involved in our study could not swallow the needed oral contrast volume. So, adding sugar-free fruit-flavored components to the used oral preparation appreciably improved subject compliance.

As far as we know, this research is to estimate MR enterography as the prime imaging tool in assessing Crohn's disease, especially in pediatrics. A 2004 survey ⁽³⁸⁾ established high sensitivity and specificity of contrast-enhanced MRI in pediatric patients with inflammatory bowel disease (IBD) with ability to discriminate Crohn's disease from ulcerative colitis, whereas a 2009 survey ⁽³⁹⁾ of MRE in pediatrics with IBD revealed a relation between unusual small-bowel wall enhancement and serum C-reactive protein measures. Both exhibited MRE to be practical in pediatric subjects with IBD.

MR enterography can distinguish active from non-active bowel inflammation, a significant status during follow-up scanning of CD patients receiving medical treatment. This differentiation is severe in the new approach of biologic therapies, selecting specific inflammatory molecules, such as tumor necrosis factor α , which are more effective in the active inflammatory stage ^(40,41).

The ability of MRE to reveal mural wall fibrosis in the affected bowel loop is also appreciated in our work, which is a characteristic sign of fibrostenotic strictures with subsequent bowel obstruction that often need surgical management ⁽⁴²⁾. In our study, bowel stenosis was recognized in about 14 patients, as the active inflammatory bowel stenosis was seen in 12 patients with severe submucosal edema (T2 hyperintensity), and the last two patients were likely fibrostenotic in nature with submucosal fat deposition (loss of signal on fat saturation sequence). Gee et al. ⁽⁴⁰⁾ reported that the sensitivity (58.3%) and accuracy (64.9%) of MRE for identifying fibrosis were reduced compared with observing active inflammation. Their data likely showed that MRE missed mural wall fibrosis due to superimposed active bowel wall inflammation.

The facility of MR enterography to discriminate chronic fibrosis from fibrosis with concurrent active inflammation is clinically significant. It implies that MRE can aid patients with CD, especially teenagers with obstructing bowel stenosis, to receive medical treatment first (with associated active condition) before surgical management ⁽⁴³⁾.

If the results of MR imaging affect clinician management, this is a remarkable aspect. Mendoza et al. ⁽⁴⁴⁾ noticed that MR-supported decision-making involved more than 50% of patients, especially when applied to biological therapy and surgery. Messaris et al. ⁽⁴⁵⁾ exhibited that 69% of patients transferred to medical and/or surgical management after therapists were given MR findings. Similar studies have revealed that MR findings guide surgical procedures for managing Crohn's patients ⁽⁴⁶⁾.

A limitation of this study is that anesthesia may be needed in the pediatric population due to a long scan time. Claustrophobia in some patients and the high cost of MR imaging were also encountered.

In conclusion, CD is a composite disease, and imaging plays a crucial role in describing it. Using ultrasound, CTE, and MRE, along with the last-mentioned modality, serves as the gold standard of our study, offering structural and functional information without the risk of ionizing radiation. MRE must be achieved by a meticulous protocol with efficient patient preparation followed by specific dedicated sequences for a perfect evaluation. The radiologist's attempt must be directed to CD assessment by reporting its extension, the degree of activity, and the potential complications, identifying the most accurate medical and/or surgical management for each patient.

List of abbreviations

MRE: Magnetic resonance enterography. CD: Crohn's disease. CTE: Computed tomography enterography. SB: Small bowel. bSSFP: balanced steady-state free precession. 3D: Three-dimensional. Gd-DTPA; Gadopentetate dimeglumine. DWI: Diffusion-weighted imaging. ADC: Apparent diffusion coefficient. SPSS: Statistical Package for Social Science.

Footnotes.

Ahmed Fathy (Professor of internal medicine, gastroenterology, and hepatology unit),
Mohamed Emara (professor of gastroenterology, hepatology, and infectious diseases), Emad Emara (assistant professor of radiology), and Amany Mohamed (professor of family medicine, biostatistician) were the peer reviewers.
E- Editor: Salem Youssef Mohamed, Osama Ahmed Khalil, Amany Mohammed.

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Ethical approval:

All procedures followed were by the ethical standards of the responsible committee on human experimentation (Institutional Review Board (IRB)) of National Liver Institute, Menoufia University, and with the Helsinki Declaration of 1964 and later versions. The committee's reference number is NLI IRB 00014014/FWA00034015. Informed consent was obtained before commencing the study.

Study protocol:

In adherence to the principles outlined in the Helsinki Declaration, the study protocol was implemented with approval from the institutional review board. Before commencing the research, written consent was obtained to utilize their clinical information.

Data and materials availability: The datasets used or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests: The authors declare that they have no competing interests.

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This work was done according to the **STROBE** guidelines.

Authors' contributions

RAA, MAA, and RAM wrote the research, selected the research cases, prepared the figures for case demonstration, and reviewed the study. MSA, assess cases for initial diagnosis. HSE assesses case selection and carries out cases on the workstation. "All authors read and approved the final manuscript."

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