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***Observational Study***

**Comparison of bowel ultrasound and magnetic resonance enterography in Egyptian patients with inflammatory bowel disease**

Kamel S *et al*. Bowel ultrasound *vs* MRE in IBD

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**Abstract**

BACKGROUND

Bowel ultrasound and magnetic resonance enterography (MRE) are decisive medical imaging modalities for diagnosing and locating bowel lesions, their extramural extent and complications. These modalities assess the degree of activity, help clinicians to identify patients in need of surgery, and can be used for patient follow-up.

AIM

To compare the role of MRE and bowel ultrasound in the diagnosis and follow-up of inflammatory bowel disease (IBD) patients in Egypt.

METHODS

The study included 40 patients with IBD. All patients underwent clinical assessment, laboratory investigations, bowel ultrasound, MRE, and colonoscopy up to the terminal ileum with biopsies for histopathological examination.

RESULTS

This study included 14 patients (35%) with ulcerative colitis and 26 patients (65%) with Crohn's disease; 34 (85%) of these patients had active disease. Bowel ultrasound detected different bowel lesions with the following accuracies: ileum (85%), large bowel (70%), fistula (95%), stricture and proximal dilatation (95%) and abscesses (100%). It also showed a statistically significant difference for bowel ultrasound in the differentiation between remission and activity of IBD in comparison to MRE and colonoscopy.

CONCLUSION

In comparison to MRE, bowel ultrasound is a useful, non-invasive, and feasible bedside imaging tool for the detection of inflammation and complications, and in the follow-up of IBD patients when performed by the attending physician.

**Key Words:** Bowel ultrasound; Colonoscopy; Crohn's disease; Magnetic resonance enterography; Ulcerative colitis; Inflammatory bowel disease

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**Core Tip:** Crohn’s disease and ulcerative colitis are chronic, relapsing inflammatory bowel diseases (IBDs). Medical imaging is decisive for the diagnosis of bowel lesions and their complications. Magnetic resonance enterography (MRE) is one of these imaging techniques. In addition, bowel ultrasound is becoming progressively important in the management of IBD. The aim of this study was to compare the role of MRE and bowel ultrasound in the diagnosis and follow-up of Egyptian IBD patients.

**INTRODUCTION**

Crohn’s disease and ulcerative colitis are chronic, relapsing inflammatory bowel diseases (IBDx). Medical imaging is decisive for diagnosing and locating bowel lesions, their extramural extent and complications. Imaging determines the degree of activity, assigns patients in need of surgery and can be used for their follow-up.

Magnetic resonance enterography (MRE) is one specific imaging technique for these diseases[1].T2W and T1W images after intravenous gadolinium administration have high accuracy for the diagnosis and assessment of disease activity[2].

Bowel ultrasound is also becoming progressively important in IBD management. Ultrasonography is a noninvasive, non-radiating, inexpensive, and readily available technique that is acceptable and tolerated by patients and can be used repeatedly for follow-up examinations. Ultrasonography in these patients requires higher frequency linear array probes (5-15 MHz) for assessment of the five-layer bowel wall[3].

To date, no published studies have compared bowel ultrasound and MRE in Egyptian patients who suffered/are suffering from IBD, either ulcerative colitis or Crohn’s disease.

**MATERIALS AND METHODS**

***Study population***

Our study enrolled 40 patients who presented to our IBD center at Ain Shams University Hospital during the period from September 2017 to September 2018.

The study was approved by the medical ethics committee of Ain Shams University. The study population included adolescents who were over 18 years old. All patients provided written informed consent before enrollment. Patients were excluded if they had severe or uncontrolled comorbidities, such as cardio-respiratory, neurological, metabolic, liver or kidney diseases, claustrophobia, a cardiac pacemaker, or implanted metal objects that prohibited the use of MRE.

All patients had a complete medical history, and underwent thorough clinical examinations and laboratory investigations, including complete blood count, liver profile tests, renal profile tests, C-reactive protein, erythrocyte sedimentation rate, MRE, bowel ultrasound, and colonoscopy up to the terminal ileum with biopsies for histopathological examination.

Clinical activity score for Crohn's disease was assessed by The Crohn’s Disease Activity Index (CDAI). Clinical remission was determined if CDAI was < 150 points or no fistula drainage was found as assessed by the Fistula Drainage Assessment Index[4]. Ulcerative colitis activity was assessed using the Truelove and Witts classification based on clinical and laboratory parameters, such as fever, frequency of bowel movements, rectal bleeding, tachycardia, anemia, and elevated erythrocyte sedimentation rate[5].

Colonoscopies were performed with a videoscope system from Olympus Exera II CV-180 after colonic preparation and fasting for six hours.

***Bowel ultrasound***

Bowel ultrasound was carried out by one examiner who had performed several previous general ultrasound examinations. This examiner was trained to carry out several bowel ultrasound exams under the supervision of an ultrasound gastroenterologist specialist at Sacco Hospital, Italy. Bowel ultrasound assessment was reviewed blindly compared to MRE and colonoscopy.

Patients were examined by ultrasound after a six hour fasting period to minimize intestinal air contents. The examination was carried out using an ultrasound machine (Toshiba Xario, Japan) with a low frequency curved-array transducer (2.5-4.5 MHz) to determine any pathological bowel motility or distension and any para-intestinal structures, such as abscesses, in all abdominal quadrants. Examination with a high-frequency linear-array transducer (6.0-8.4 MHz) was used for bowel wall examination starting with examination of the proximal colon followed with the distal colon and then the small bowel[3]. This examination assessed inflammation criteria such as thickness of the bowel wall, inflammatory mesenteric fat and lymph nodes, hyperemia on color Doppler flow, and complications, such as stenosis, fistulas or inflammatory masses.

In the longitudinal direction, the bowel wall was measured for bowel thickness at its anterior wall or in an area in which it was more visible in order to avoid mucosal folds and haustrations. The cursor was placed at the end of the interface echo between the serosa and proper muscle to the start of the interface echo between the lumen and the mucosa[6,7].

Several criteria for stenosis diagnosis *via* ultrasound have been reported, such as thickened bowel wall, narrowing of the diameter of the lumen < 1 cm, hyperperistalsis of the pre-stenotic bowel, and proximal dilatation > 25-30 mm[8–10].

An abscess was indicated by bowel ultrasound as an irregular, avascular hypoechoic area with a small amount of internal echoes or air in the form of hyperechoic streaks[9].

***MRE***

The patient was instructed to have a low residue diet the day before the examination and was asked to fast at least 6 to 8 h before the procedure. Ingestion of 1 to 2 L of hyperosmolar oral contrast was performed about 45 min before the magnetic resonance (MR) exam started. After full distension of the bowel, a spasmolytic medication was given to decrease bowel peristalsis to provide better bowel visualization. The examination was performed on 1.5-T MR machine, Achieva, Philips Medical System, Best, Netherlands in the MRI Unit, Ain Shams University Hospital. The patient was placed in the supine position using a multi-element phased array Torso coil (16 channels). A dedicated MR study was then performed as described in Table 1. Pixel-based apparent diffusion coefficient maps were generated on the off-line workstation (extended workspace ‘‘EWS’’), Pride software (Philips Medical Systems). Intravenous gadolinium contrast was given (0.2 mmol/kg body weight) in a dynamic fashion obtaining three-dimensional enhanced T1 isotropic volume excitation (3D-eTHRIVE) coronal scans at 10 s, 20 s, 60 s, 70 s, and 90 s. The total MRE procedure took approximately 30 to 45 min.

The images were interpreted by a radiologist with 12 years of experience in abdominal imaging and who was blinded to the clinical and colonoscopy examination results.

The MRE evaluated bowel wall thickening, mural edema, enlarged mesenteric lymph nodes, restricted diffusion, peri-enteric vascularization (comb sign), peri-enteric fluid, and the presence of complications, such as abscesses or fistulas.

***Statistical analysis***

Statistical analysis was performed using the SPSS software (22.0 version: SPSS Inc., Chicago, IL, United States). The description of quantitative variables was expressed in the form of mean ± standard deviation (mean ± SD) or median and inter-quartile range. A description of qualitative variables was expressed by frequency and percentage. A comparison of qualitative variables was carried out using the chi-square test. *P* < 0.05 was taken as significant. The sensitivity, specificity, overall correctness of prediction, and positive and negative predictive values were calculated. Correlations were calculated using Pearson’s correlation coefficient. The receiver operating characteristic (ROC) curves and areas under the ROC (AUROC) curves were used to evaluate the prognostic values (specificity and sensitivity).

**RESULTS**

The demographic profile, clinical and laboratory parameters are shown in Table 2. Most of the patients were middle-age females who presented with abdominal pain and diarrhea. The results indicated that 14 (35%) of our patients had ulcerative colitis, and 26 (65%) had Crohn's disease while 34 (85%) of them had inactive disease. Four (4%) of the studied patients had pancolitis, and 18 (45%) had ileal lesions.

The results in Table 3 indicate that bowel ultrasound appears to detect ileal disease with a sensitivity, specificity, and diagnostic accuracy of 93.8%, 50%, and 85%, respectively. With respect to the large bowel, bowel ultrasound detected large bowel disease with a sensitivity, specificity, and accuracy of 37.5%, 91.7%, and 70%, respectively. Also, bowel ultrasound detected the thickness of the affected segment with a sensitivity, specificity, and accuracy of 83.3%, 50%, and 60%, respectively. Bowel ultrasound detected a fistulous track with a sensitivity, specificity, and accuracy of 85.7%, 100%, and 95%, respectively, and detected stricture and proximal dilatation with a sensitivity, specificity, and accuracy of 100%, 94.4%, and 95%, respectively. Abscess was detected by bowel ultrasound in six patients with high specificity, sensitivity, and accuracy (100%). In addition, there were no statistically significant differences between bowel ultrasound findings and disease activity index, which indicate that bowel ultrasound can differentiate between remission and active disease.

Table 4 demonstrates that there were no statistically significant differences between bowel ultrasound, MRE, and colonoscopy in the detection of disease activity, indicating that bowel ultrasound and MRE can differentiate between remission and active IBD.

Table 5 compares the clinical symptoms and bowel ultrasound and MRE findings. It can be seen that bleeding per rectum was statistically significant in patients with strictures and proximal dilatation during assessment by bowel ultrasound, while diarrhea was statistically significantly related to the extent of the lesions when assessed by MRE.

**DISCUSSION**

Endoscopy is still the most important diagnostic procedure as it permits biopsies for histological examination[11]. European guidelines have recommended imaging techniques, such as bowel ultrasound, computed tomography enterography, and MRE as complementary tools for IBD diagnosis that can help define lesion location, extension, and complications[12].

MRE is a cross-sectional non-ionizing imaging technique that can be used for IBD diagnosis and extra-intestinal assessment of disease activity and follow-up of patients. However, MRE is available at certain centers only and it takes a long time during scanning with sedation in some cases such as children to avoid motion artefacts in addition to non-compliance to contrast intake and the breath-hold technique[13].

Assessment of the gastrointestinal tract in IBD patients by intestinal ultrasound has evolved due to the development of ultrasound devices and increased skill of the examiners such as radiologists and gastroenterologists. Major parts of the small and large intestine can be easily examined by bowel ultrasound while the proximal part of the jejunum and the rectum may be difficult to assess due to overlying structures. Despite the various advantages of bowel ultrasound as a rapid bedside, inexpensive, non-radiating and tolerable test, the results are subjective to the examiner's expertise[14].

Our results showed similar sensitivity for the detection of ileal IBD compared with a previous study (92.7%), but with lower specificity than this study (88.2%). With regard to colonic IBD, our results showed lower sensitivity than that observed in the previous study (81.8%) but with similar specificity (95.3%), a finding which may be explained by interobserver variability between examiners[13]. This variability can explain why one study concluded that bowel ultrasound is more accurate in the assessment of IBD patients if combined with colonoscopy[16].

A bowel wall thickness cutoff value of 3 mm in our study showed a sensitivity (83.3%), specificity (50%), and accuracy (60%) compared with other studies, which showed sensitivities of 88% to 94%; however, specificity (93%-97%) and diagnostic accuracy (94%) were higher in previous studies than in our study[9,15]. This finding can be explained by the lack of international agreement regarding standardized measurement parameters, which leads to interobserver variability between examiners[18].

Mesenteric lymph nodes detected by bowel ultrasound in our study were non-sensitive and non-specific (16.7% and 71.4%, respectively) and subsided during remission; therefore, lymph node detection is not a good parameter of disease activity, which in agreement with previous studies[19,20].

Our results were in agreement with those from different trials and showed that the detection rate of fistulas, depending on their localization, resulted in a sensitivity between 67% and 82% and specificity between 90% and 100%[8,9,21–23].

The detection of strictures in our study by bowel ultrasound showed a sensitivity, specificity, and accuracy of 100%, 94.4%, and 95%, respectively, and were similar to those in other studies[15,24–26].

The sensitivity for detecting abscesses in different studies varied between 80% and 100%, and the specificity varied between 92% and 94%, which were similar to our results[27–29].

The findings in this study agreed with those from various trials in which it was shown that the diagnosis of IBD and assessment of disease activity cannot be dependent on clinical evaluation alone but should be combined with other investigations such as biomarkers, endoscopy, and imaging techniques such as bowel ultrasound and MRE[25,30].

Our results showed that aphthous ulcers at endoscopy, stricture and mesenteric lymphadenopathy at bowel ultrasound, thickness of bowel wall and proximal dilatation at MRE were significantly correlated with disease activity. Other studies showed that other bowel ultrasound parameters such as bowel wall thickening and its extent showed a significant correlation with disease activity[26,31,32].With regard to the MRE results in our study these agreed with the findings from other studies[33,34] and disagreed with those in another study[35].

This indicates that there is no clear gold standard imaging technique for the diagnosis of IBD including MRE and bowel ultrasound which could be used in addition to clinical history, biomarkers, and endoscopy for the diagnosis of IBD as shown in previous studies[25,30,36].

Bowel ultrasound may be more helpful in the follow-up of IBD patients and monitoring their response to treatment aside from its role in diagnosis by ultrasound- guided biopsy.

In Egypt, both MRE and colonoscopy are available with an estimated total cost of 93 dollars and 125 dollars, respectively. Bowel ultrasound costs only 18 dollars which is considered a low cost alternative and has prospects for widespread clinical use.

The limitations of our study included the relatively small number of patients, and comparative assessments of clinical decisions with and without bowel ultrasound were not available.

**CONCLUSION**

In comparison to MRE and colonoscopy, bowel ultrasound is a useful non-invasive and feasible bedside imaging tool for the detection of inflammation and complications, and as screening tool and for follow-up of IBD patients when performed by the attending physician.

**ARTICLE HIGHLIGHTS**

***Research background***

Bowel ultrasound is a new tool for the evaluation of inflammatory bowel disease.

***Research motivation***

To date, no previously published studies have compared bowel ultrasound and magnetic resonance enterography (MRE) in Egyptian inflammatory bowel disease (IBD) patients.

***Research objectives***

Compare the role of bowel ultrasound and MRE in Egyptian IBD patients.

***Research methods***

The study included 40 patients who presented to the IBD center of Ain Shams University Hospital. The patients were subjected to clinical, laboratory, colonoscopic and radiological assessments including bowel ultrasound and MRE.

***Research results***

Bowel ultrasound was a good predictor of disease activity, fistula, stricture, and abscess formation with high sensitivity in the ileum and greater specificity in the large bowel.

***Research conclusions***

Bowel ultrasound is a useful inexpensive bedside imaging tool in the diagnosis and follow-up of IBD patients.

***Research perspectives***

Further studies are necessary to compare clinical decisions with and without bowel ultrasound.

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**Footnotes**

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**Informed consent statement:** All study participants, or their legal guardian, provided informed written consent prior to study enrollment.

**Conflict-of-interest statement:** None to declare.

**Data sharing statement:** Technical appendix, statistical code, and dataset available from the corresponding author at ahmedelbaz75@gmail.com. Participants gave informed consent for publication of data. No additional data are available.

**STROBE statement:** The authors have read the STROBE Statement-checklist of items, and the manuscript was prepared and revised according to the STROBE Statement-checklist of items.

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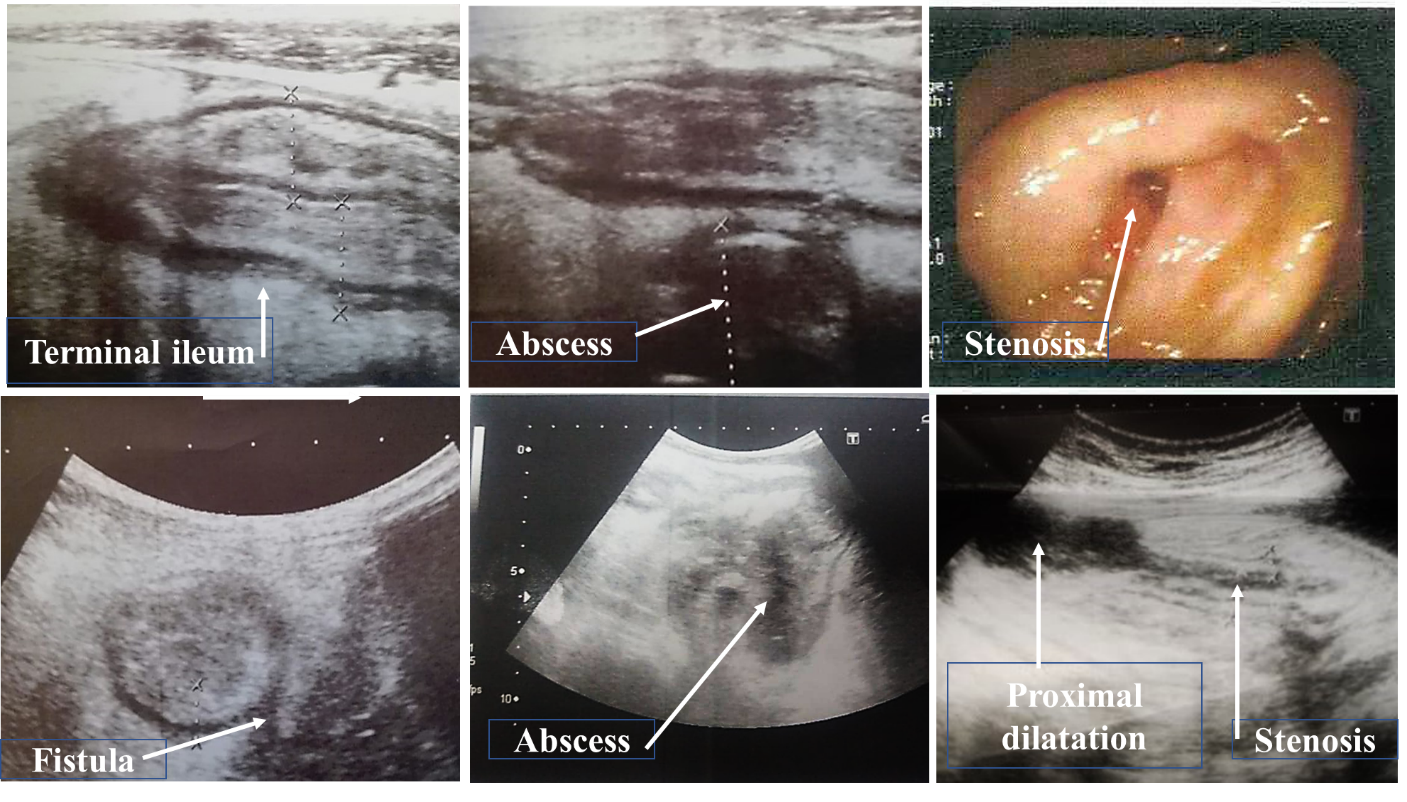
Grade B (Very good): B

Grade C (Good): C, C, C

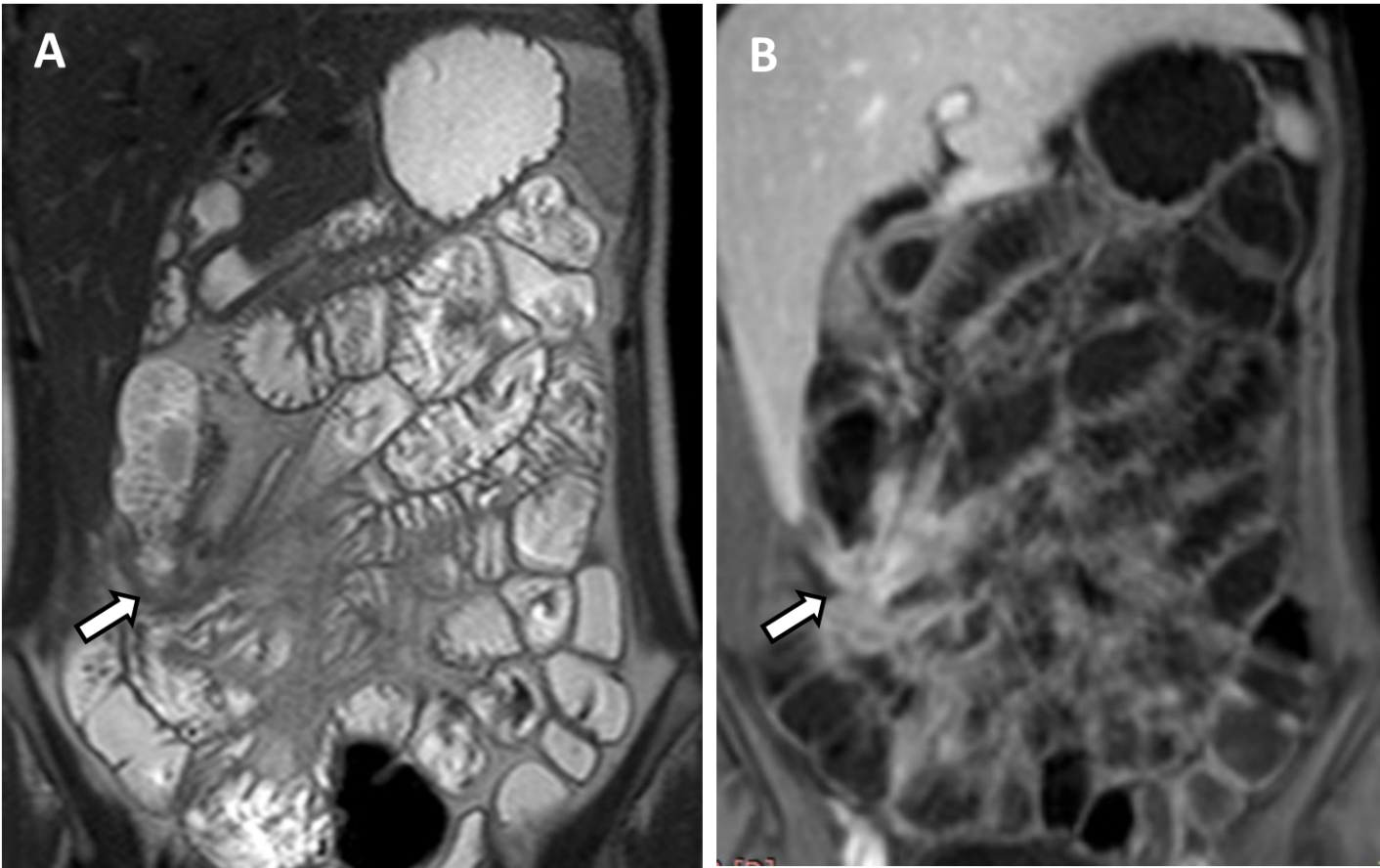
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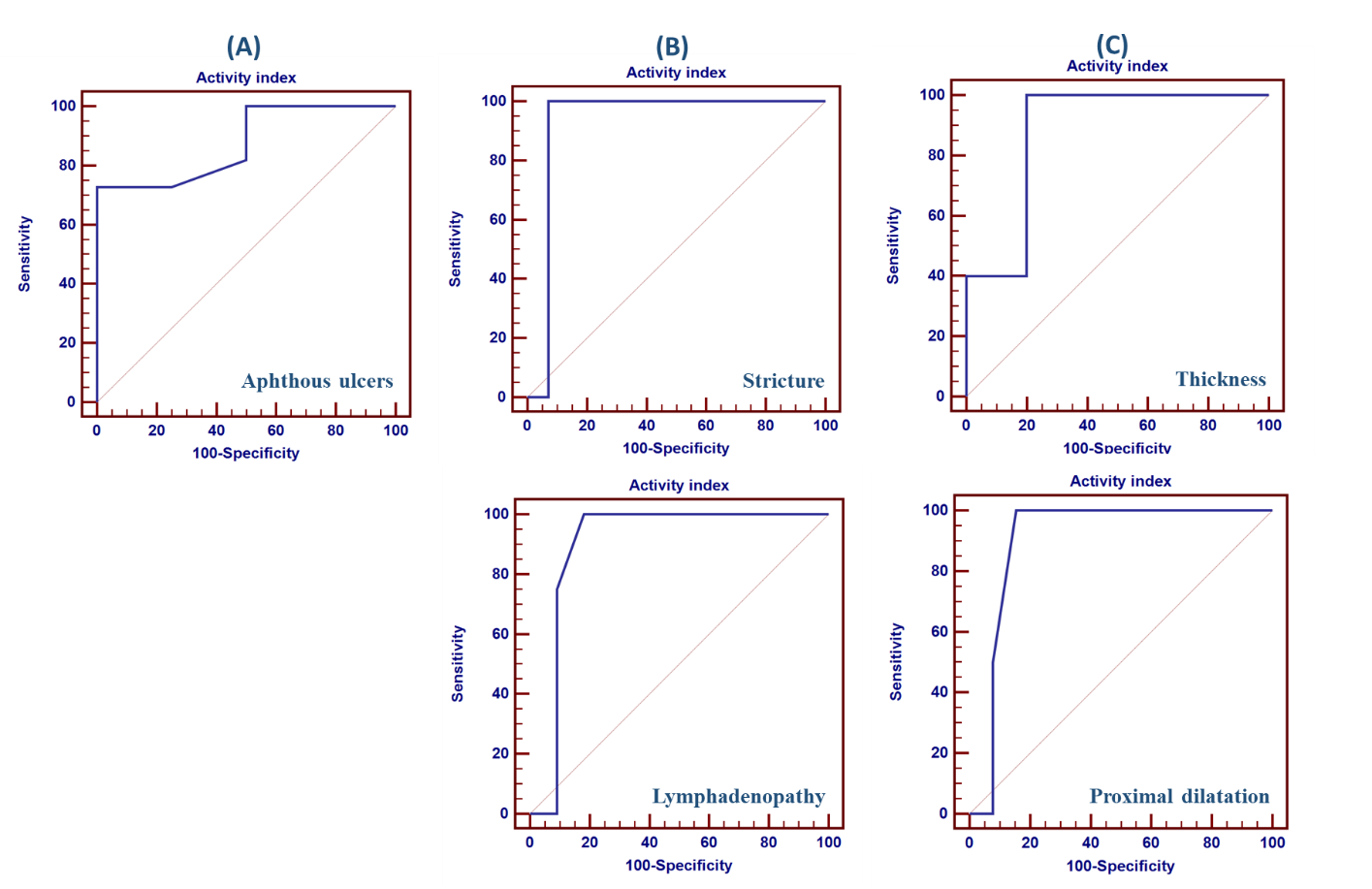
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**Figure 1** **Bowel ultrasound and colonoscopy images.** Bowel ultrasound demonstrates diffuse terminal ileal wall thickening likely inflammatory in nature with sonographic evidence of fistulization with mesenteric abscess formation. Stenosis which was detected during colonoscopy was detected by bowel ultrasound with proximal dilatation.

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**Figure 2** **Magnetic resonance enterography.** A: Coronal T2WI shows enteroenteric fistula at the right iliac fossa with stellate appearance of the thickened ileal loops (white arrow); B: Coronal fat-suppressed three-dimensional gradient echo postcontrast T1WI shows accentuated star-like enhancement at the right iliac fossa denoting fistulizing Crohn’s disease.

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**Figure 3 Receiver operating characteristic curve for prediction of active disease.** A: At endoscopy, aphthous ulcers mean area under the receiver operating characteristic (ROC) curve was 0.875 (*P* < 0.001), positive likelihood ratio infinity, and negative likelihood ratio 0.28; B: Bowel ultrasound showed that stricture and lymphadenopathy mean area under the ROC curve were 0.929 (*P* = 0.036) and 0.898 (*P* = 0.01), respectively, positive likelihood ratio infinity for both, and negative likelihood ratio of 0.94 and 0.71, respectively; C: Magnetic resonance enterography showed that the thickness and proximal dilatation mean area under the ROC curve were 0.880 (*P* < 0.001) and 0.904 (*P* = 0.033), respectively, positive likelihood ratio was 1.06 and infinity, respectively, and negative likelihood ratio was 0.88 for both.

**Table 1 Magnetic resonance enterography imaging protocol**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Imaging sequence and plane** | **TR/TE** | **Slice thickness (mm)** | **Gap** | **Field of view (mm)** | **Matrix** |
| Coronal T2 SSFSE | 1200/115 | 6 | 1 | 375 × 375 | 268 × 234 |
| Coronal SSFP | 3.2/1.56 | 6 | 0 | 375 × 375 | 252 × 233 |
| Axial T2WI | 1200/115 | 7 | 1 | 375 × 336 | 268 × 208 |
| Axial DWI | 2743/65 | 7 | 1 | 375 × 302 | 124 × 100 |
| 3D-THRIVE | 4/1.9 | - | 0 | 410 × 377 | 196 × 178 |
| Axial post contrast fat-suppressed gradient-echo T1WI | 3.8/1.8 | - | 0 | 375 × 314 | 196 × 157 |
| Coronal post contrast fat-suppressed gradient-echo T1WI | 4/1.9 | - | 0 | 410 × 314 | 196 × 178 |

TR: Repetition time; TE: Echo time; SSFSE: Single-shot fast spin-echo; SSFP: Single-shot free precision; 3D: Three dimensional.

**Table 2** **Demographic characteristics, laboratory and colonoscopic findings of the 40 cases studied**

|  |  |
| --- | --- |
| **Demographic characteristics, laboratory and colonoscopic findings** | **Value** |
| Age (yr) | 33.50 ± 8.19 |
| Gender (male/female) | 16/24 |
| Symptoms |  |
| Diarrhea | 14 (35%) |
| Diarrhea and bleeding | 10 (25%) |
| Bleeding | 4 (10%) |
| Abdominal pain | 36 (90%) |
| Total leukocyte count (103/cm3) | 7.32 ± 2.22 |
| Hemoglobin (g/dL) | 11.22 ± 1.86 |
| Total bilirubin (mg/dL) | 0.97 ± 0.14 |
| Alanine aminotransferase (IU/L) | 25.75 ± 10.49 |
| Total protein (g/dL) | 7.16 ± 0.73 |
| Albumin (g/dL) | 3.76 ± 0.44 |
| Blood urea nitrogen (mg/dL) | 22.10 ± 9.86 |
| Creatinine (mg/dL) | 0.87 ± 0.22 |
| Serum sodium (mmol/L) | 136.65 ± 6.19 |
| Serum potassium (mmol/L) | 3.96 ± 0.55 |
| C-reactive protein (mg/L) | 28 (6–55) |
| Erythrocyte sedimentation rate (mm/h) | 45 (31.5–60) |
| Colonoscopic findings |  |
| Opacity of mucosa | 28 (70%) |
| Excess exudate | 24 (60%) |
| Cobble stone | 26 (65%) |
| Bleeding on touch | 20 (50%) |
| Aphthous ulcers | 30 (75%) |
| Diffuse ulceration | 20 (50%) |
| Pseudopolyps | 20 (50%) |
| Polyps | 30 (75%) |
| Site of involvement |  |
| Rectum | 4 (10%) |
| Pancolitis | 4 (10%) |
| Descending colon | 4 (10%) |
| Rectum and sigmoid colon | 10 (25%) |
| Ileum | 18 (45%) |
| Type of disease |  |
| Ulcerative colitis | 14 (35%) |
| Crohn's disease | 26 (65%) |
| Activity |  |
| Remission | 6 (15%) |
| Activity | 34 (85%) |

Data are mean ± standard deviation, *n* (%) and median (inter-quartile range).

**Table 3 The diagnostic characteristics of the bowel ultrasound in the detection of small intestinal and large bowel disease and its correlation with the disease activity index**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Bowel ultrasound** | | | | | **Disease activity index** | | |
| **Sensitivity** | **Specificity** | **PPV** | **NPV** | **Accuracy** | **Remission** | **Activity** | ***P* value** |
| Large bowel | 37.5% | 91.7% | 75% | 68.8% | 0.700 | 0 (0) | 8 (23.5%) | 0.184 |
| Ileum | 93.8% | 50% | 88.2% | 66.7% | 0.850 | 6 (100%) | 28 (82.4%) | 0.264 |
| Thickness (> 3 mm) | 83.3% | 50% | 41.7% | 87.5% | 0.600 | 4 (66.7%) | 20 (58.8%) | 0.718 |
| Extent | 33.3% | 85.7% | 50% | 75% | 0.700 | 0 (0) | 8 (23.5%) | 0.184 |
| Mesenteric lymphadenopathy | 16.7% | 71.4% | 20% | 66.7% | 0.550 | 0 (0) | 10 (29.4%) | 0.125 |
| Fistula | 85.7% | 100% | 100% | 92.9% | 0.950 | 0 (0) | 12 (35.3%) | 0.082 |
| Stricture and proximal dilatation | 100% | 94.4% | 66.7% | 100% | 0.950 | 0 (0) | 6 (17.6%) | 0.264 |
| Abscess | 100% | 100% | 100% | 100% | 0.1 | 0 (0) | 6 (17.6%) | 0.264 |

Data are *n* (%). PPV: Positive predictive value; NPV: Negative predictive value.

**Table 4 Comparison between bowel ultrasound, magnetic resonance enterography and colonoscopy with regard to the detection of disease activity and remission**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Activity** | **Colonoscopy** | **Bowel ultrasound** | **MRE** | ***P* value** |
| Remission | 6 (15%) | 6 (15%) | 6 (15%) | 1.000 |
| Activity | 34 (85%) | 34 (85%) | 34 (85%) | 1.000 |

Data are *n* (%). MRE: Magnetic resonance enterography.

**Table 5 Comparison between clinical symptoms and imaging techniques; bowel ultrasound and magnetic resonance enterography**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Abdominal pain** | | ***P* value** | **Bleeding per rectum** | | ***P* value** | **Diarrhea** | | ***P* value** |
| **No, *n* (%)** | **Yes, *n* (%)** | **No, *n* (%)** | **Yes, *n* (%)** | **No, *n* (%)** | **Yes, *n* (%)** |
| Bowel ultrasound |  |  |  |  |  |  |  |  |  |
| Large bowel | 0 (0) | 8 (22.2) | 0.292 | 8 (25.0) | 0 (0) | 0.114 | 2 (10.0) | 6 (30.0) | 0.114 |
| Ileum | 4 (100.0) | 30 (83.3) | 0.376 | 26 (81.2) | 8 (100.0) | 0.184 | 18 (90.0) | 16 (80.0) | 0.376 |
| Thickness (> 3 mm) | 4 (100.0) | 20 (55.6) | 0.085 | 18 (56.2) | 6 (75.0) | 0.333 | 14 (70.0) | 10 (50.0) | 0.197 |
| Extent | 0 (0) | 8 (22.2) | 0.292 | 8 (25.0) | 0 (0) | 0.114 | 2 (10.0) | 6 (30.0) | 0.114 |
| Lymphadenopathy | 0 (0) | 10 (27.8) | 0.224 | 8 (25.0) | 2 (25.0) | 1.000 | 4 (20.0) | 6 (30.0) | 0.465 |
| Fistula | 0 (0) | 12 (33.3) | 0.168 | 8 (25.0) | 4 (50.0) | 0.168 | 4 (20.0) | 8 (40.0) | 0.168 |
| Stricture and proximal dilatation | 0 (0) | 2 (5.6) | 0.629 | 0 (0) | 2 (25.0) | 0.004 | 0 (0) | 2 (10.0) | 0.147 |
| Abscess | 2 (50.0) | 6 (16.7) | 0.114 | 6 (18.8) | 2 (25.0) | 0.693 | 6 (30.0) | 2 (10.0) | 0.114 |
| MRE |  |  |  |  |  |  |  |  |  |
| Large bowel | 0 (0) | 16 (44.4) | 0.085 | 14 (43.8) | 2 (25.0) | 0.333 | 6 (30.0) | 10 (50.0) | 0.197 |
| Ileum | 4 (100.0) | 28 (77.8) | 0.292 | 24 (75.0) | 8 (100.0) | 0.114 | 16 (80.0) | 16 (80.0) | 1.000 |
| Thickness (> 3 mm) | 2 (50.0) | 10 (27.8) | 0.358 | 10 (31.2) | 2 (25.0) | 0.730 | 6 (30.0) | 6 (30.0) | 1.000 |
| Extent | 0 (0) | 12 (33.3) | 0.168 | 10 (31.2) | 2 (25.0) | 0.730 | 2 (10.0) | 10 (50.0) | 0.006 |
| Lymphadenopathy | 0 (0) | 12 (33.3) | 0.168 | 8 (25.0) | 4 (50.0) | 0.168 | 8 (40.0) | 4 (20.0) | 0.168 |
| Fistula | 0 (0) | 14 (38.9) | 0.122 | 10 (31.2) | 4 (50.0) | 0.320 | 6 (30.0) | 8 (40.0) | 0.507 |
| Stricture and proximal dilatation | 0 (0) | 4 (11.1) | 0.482 | 4 (12.5) | 0 (0) | 0.292 | 2 (10.0) | 2 (10.0) | 1.000 |
| Abscess | 0 (0) | 6 (16.7) | 0.376 | 6 (18.8) | 0 (0) | 0.184 | 2 (10.0) | 4 (20.0) | 0.376 |

MRE: Magnetic resonance enterography.