

THE ROLE OF DIFFUSION-WEIGHTED MAGNETIC RESONANCE IMAGING IN THE EVALUATION OF CROHN'S DISEASE ACTIVITY

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Introduction

Crohn's disease (CD) is an inflammatory condition occurs throughout the gastrointestinal tract, characterized by segmental inflammation across the bowel wall which extends transmurally. This inflammation leads to erosions and ulcerations, culminating in complications such as strictures, penetration, obstruction, and irreversible damage to the bowel. Colonoscopy serves as the primary diagnostic procedure for evaluating CD. It effectively predicts the anatomical severity with a high degree of accuracy. CTE is the primary imaging modality for diagnosis and evaluation of CD and its complications. MR Enterography (MRE) plays a crucial role in assessment of CD, due to its noninvasiveness, superior soft tissue contrast, and absence of ionizing radiation exposure, making it particularly suitable for longitudinal monitoring of patients with CD. There is increasing interest in evaluating DWI as an important factor in assessment of CD activity.

Aim of the work

The aim of this study was to evaluate activity in Crohn's disease by using Magnetic Resonance Imaging (MRI) and Diffusion-Weighted Magnetic Resonance (DWI).

Patients and Methods

This research included 20 patients with clinical, endoscopic, and histopathological confirmation of recent activity of Crohn's disease referred from the department of Internal Medicine gastrointestinal tract unit to the Radiology department at Alexandria Main University Hospitals for assessment. All included patients underwent endoscopic evaluation and calculation of SES-CD score. All patients underwent routine MRI examination and diffusion weighted MRI sequence. ADC maps were created from the diffusion weighted images, and ROIs were drawn on the DWIs and copied to the corresponding ADC map. Three ADC values were quantitatively measured, and the mean ADC was calculated and used in statistical analysis. The disease activity was subjectively assessed according to MR imaging parameters mural thickness, mural signal intensity and DWI each scored as 0 (normal), 1 (mild), 2 (moderate), or 3 (severe) according to the disease activity.

Results

The mean apparent diffusion coefficient (ADC) values for each case were calculated to quantitatively assess disease activity and correlated with the Simple Endoscopic Score for Crohn's Disease (SES-CD), the results revealed normally distributed values with a statistically significant difference among the groups ($p < 0.001$) which stratifies patients into mild, moderate, and severe groups (as shown in Table 1).

Table 1: Relation between ADC with SES-CD score (n = 20)

SES-CD score	N	ADC ($\times 10^{-3} \text{mm}^2/\text{s}$)	t	p
		Mean \pm SD.		
Mild	7	1.53 \pm 0.26	5.059*	<0.001*
Moderate + Severe	13	0.97 \pm 0.23		

SD: Standard deviation

t: Student t-test

p: p value for Relation between ADC with SES-CD score

*: Statistically significant at $p \leq 0.05$

Table 2: Diagnostic performance for ADC ($\times 10^{-3} \text{mm}^2/\text{s}$) to discriminate Severe SES-CD score patients (n = 7) from Mild/Moderate SES-CD score patients (n = 13)

	AUC	p	95% C.I	Cut off#	Sensitivity	Specificity	PPV	NPV
ADC ($\times 10^{-3} \text{mm}^2/\text{s}$)	0.934	0.002*	0.817 – 1.000	≤ 1.003	85.71	92.31	85.7	92.3

AUC: Area Under a Curve

CI: Confidence Intervals

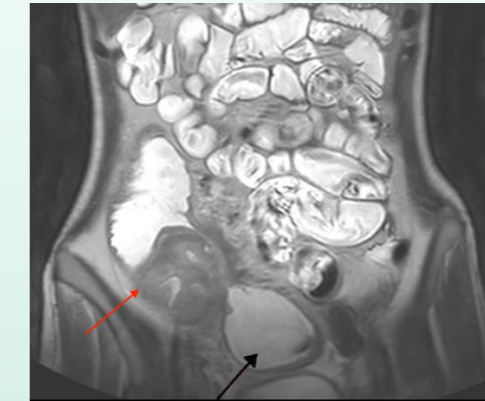
NPV: Negative predictive value

*: Statistically significant at $p \leq 0.05$

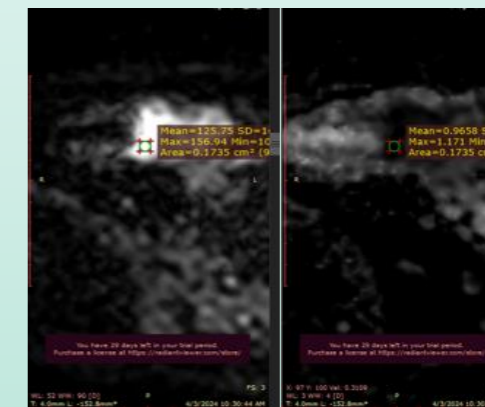
p value: Probability value

PPV: Positive predictive value

#Cut off was choose according to Youden index



coronal T2-weighted image demonstrating severe asymmetric mural thickening reaching 1.2 cm (red arrow) with moderate intramural edema as a T2 hyperintense signal, notably at the cecum, terminal ileum, and appendicular base, along with terminal ileum stricture with moderate to severe upstream dilatation (black arrow) measuring 6 cm, marked surrounding fat stranding, engorged mesenteric vessels and mild pelvic free fluid collection



axial cuts DWI and ADC map showing severe diffusion restriction

Conclusion

MRE is increasingly utilized to evaluate disease activity and monitor response to therapy, serving as a valuable complement to clinical indices and optical endoscopy, especially in cases involving strictures and severe disease activity.

New MRE techniques, like DWI and ADC values, expanded the MRI role in differentiating between varying degrees of disease activity and complications. DWI is a valuable tool for assessing disease activity, highlighting complications, planning, and monitoring treatment response in patients with Crohn's disease.