International Journal of Chemical and Biochemical Sciences
(ISSN 2226-9614)

Journal Home page: www.iscientific.org/Journal.html

Correlation of Fecal Calprotectin Level with Mayo Endoscopic Score and Disease Extent Assessed by Magnetic Resonance Enterography in Ulcerative Colitis Patients

Hayam Yahia Hamed[1], Samy Abdel Aziz Sayed[1], Mohamed Zidan[1], Mohammed A Medhat[2], Ahmed M Abdel Hakam[1], Momtaz Thabet Allam[1]

[1]*Diagnostic Radiology Department, Faculty of Medicine-Assiut University, Egypt*

[2]*Tropical Medicine and Gastroenterology Department, Faculty of Medicine-Assiut University, Egypt*

Abstract

Ulcerative colitis (UC) diagnosis depends on clinical, endoscopic and radiological evaluation. Fecal calprotectin (FC) is a fecal test used to evaluate local gut inflammation. This study was conducted to determine the relation between level of FC and disease activity assessed by Mayo endoscopic score (MES), also relation between FC and disease extent assessed by cross sectional Magnetic Resonance Enterography (MRE). A total of 20 patients diagnosed with UC were included, age (Mean ± SD33.75 ± 12.36), 60.0% males, 40.0% females, Mayo endoscopic score of disease activity was assessed using Ileocolonoscopy, Fecal calprotectin levels were measured and cross-sectional MRE was evaluated for disease extent. In UC patients, FC level is correlated with disease activity assessed by Mayo Endoscopic Score (MES) (correlation coefficient r =0.517, P= 0.02) with no significant correlation between measured FC levels and disease extents assessed by MRE (P= 0.810). FC level is correlated with disease activity assessed by MES in UC patients but not related to disease extent assessed by cross sectional imaging MRE.

Keywords: Ulcerative colitis, Fecal Calprotectin, Magnetic Resonance Enterography

Full length article **Corresponding Author*, e-mail: hayamyahia@aun.edu.eg

1. Introduction

Ulcerative colitis (UC) is a major entity of inflammatory bowel diseases (IBDs) characterized by recurrent episodes of disease relapse and remission with chronic inflammatory changes limited to the mucosal layer. Usually, the rectum is affected and to a variable extent the colon in a continuous pattern [1]. Diagnosis and monitoring of UC rely on clinical, endoscopic and radiological parameters [2]. Endoscopic mucosal healing (MH), which is associated with sustained clinical remission and reduced rates of hospitalization and surgical resection, has emerged as a major treatment goal for UC patients [3]. Endoscopy is the gold standard and most reliable method for assessment of colonic mucosa; however, endoscopic procedures are costly, time-consuming, unpleasant and often painful. Furthermore, bowel-cleansing techniques are required to guarantee optimal visualization and assessment. Consequently, researchers are looking for surrogate markers that could reflect mucosal inflammation severity and partially replace endoscopic procedures [4]. Detecting inflammation using Fecal tests has great potential. Measuring inflammatory proteins released in the feces by neutrophils is one of the most appealing methods. A Such protein that can be reliably measured in stool samples is Fecal Calprotectin (FC), which measures the degree of local gut inflammation than systemic inflammation. Calprotectin is a calcium-binding protein that belongs to the S100 family of zinc-binding proteins. It makes up around 60% of the protein content in the neutrophil cytosol [5]. Non-invasive measurement of FC levels has been suggested as reliable surrogate marker of mucosal inflammation associated with UC [6]. The Mayo endoscopic score (MES) is one of the most often used endoscopic indices established for the assessment of endoscopic activity in UC patients [7]. Within the endoscopic component of the Mayo Score, a score of 0 is given for normal mucosa or inactive UC, while a score of 1 is given for mild disease with evidence of mild friability, reduced vascular pattern and mucosal erythema. A score 2 is indicative of moderate disease with friability, erosions, complete loss of vascular pattern, and significant erythema and a score 3 indicates ulceration and spontaneous bleeding

[7]. Previous studies assessed correlation between FC levels and mucosal activity depending on endoscopic scores obtained for segment of most severe level of inflammation in colorectum without considering disease extent to evaluate clinical usefulness of FC. Not enough research has been done on the relationship between FC and the severity of the UC according to disease extent [8].

Cross-sectional imaging, more specifically Magnetic Resonance Enterography (MRE) is an essential tool providing complementary information to endoscopy, allowing one to examine the entire length of the gastrointestinal tract lesions [9]. MRE can accurately assess mural abnormalities and mucosa in diseased colonic segments in UC patients. In the present study, we correlated FC levels with disease activity assessed by Mayo endoscopic score in UC patients also with disease extent assessed by MRE.

2. Patients and Methods:

A prospective study conducted from December 2020 to March 2023 at Assiut University Hospitals. Patients with established diagnosis of UC referred from gastroenterology department and scheduled for an Ileocolonoscopy were included. Fecal samples for assessment of FC were obtained. MRE study was done in the same period at Radiology department of Assiut University Hospitals. Patients with history of colorectal surgery, acute infections or infectious enterocolitis were excluded. The present study was approved by the medical research ethics committee of our institution. An informed written consent was taken.

2.1 Fecal calprotectin measurement:

FC level was measured in fecal samples collected few days before preparation for Ileocolonoscopy. These samples were processed in external laboratories using the values recommended by the LABs and patients brought them to the hospital.

2.2 Ileocolonoscopic assessment:

Ileocolonoscopic assessment of UC disease activity using Mayo score was done after protocolized bowel cleansing (polyethylene glycol-based electrolyte solution for bowel preparation). An experienced Ileocolonoscopy team performed all of the examinations using standard equipment (PENTAX MACHINE). Ileocolonoscopic assessment was always performed under anesthesia with propofol.

2.3 MRE technique:

MRE various sequences were acquired through the abdomen and pelvis with the patient in supine position in a 1.5-T MR imaging unit (siemens, Magnetom sempra, German) with an 8 -channel receive-only head coil. Patients fasted for about 8 hours before MRE study and asked to do rectal enema at home before coming to radiology unit to wash the colon and provide adequate image assessment. To adequate distend small and large bowel loops each patient was asked to drink a 20% mannitol solution (about 250 cc) mixed into 1250 cc water (total about 1500 cc fluid) in regular divided doses within one hour prior to MRE study depending on passive distension of the colon by oral solution. MRE sequences included Coronal HASTE (T2-weighted single-shot fast spin echo) without fat suppression, Coronal and Axial TRUFI (True Fast Imaging with Steady State Free precession), Axial HASTE with fat suppression (T2-weighted single-shot fast spin echo), Axial T1W1and axial diffusion-weighted images (b = 0, 400, 800 and s/mm2)

2.4 Statistical analysis:

Data was fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Categorical data were represented as numbers and percentages. For continuous data, they were tested for normality by the Shapiro-Wilk test. Quantitative data were expressed as range (minimum and maximum), mean, standard deviation, median and Inter quartile range. Kruskal Wallis test was used to compare different groups for not normally distributed quantitative variables. Spearman coefficient was used to correlate between not normally distributed quantitative variables. The significance of the obtained results was judged at the 5% level.

3. Results and discussion

Twenty patients diagnosed with UC were included in our study ;12 male (60.0%) and 8 females (40.0%) of different ag groups (15-36 years, mean age 33.75 ± 12.36), all of them presented by abdominal pain and diarrhea, 50.0% had fresh bleeding per rectum. Disease activity was determined by MES and disease extent was assessed by MRE; 65 % had pan colitis, 4% left sided colitis and 3% rectosigmoid (Table 1). Statistically significant correlation between measured FC levels and Mayo endoscopic score (MES), increase in FC level is associated with increase in MES (correlation coefficient r =0.517, P= 0.02) Table (2) &Figure (1). No statistically significant difference in the means between measured levels of FC and different disease extents (P = 0.810) Table (3).

The relationship between FC level and endoscopic disease activity in UC patients had been widely studied, correlation coefficients between FC level and UC disease activity reported to range from 0.51 to 0.83 (8,10–12). In these studies, the endoscopic index for UC was determined by examining the part of the colorectum with the most severe inflammation. Similarly in our study, severity of mucosal inflammation was determined by endoscopic assessment of most inflamed colonic segment using MES, results revealed agreement between us and previous studies; statistically significant correlation between disease activity in UC patients and FC levels, correlation coefficient is 0.517 and P = 0.020.

Previous studies assessed the extent of the disease in UC patients by determining MES in each of the 5 colonic segments to evaluate the extent of affected mucosa as well as endoscopic severity [8]. Kawashima, Kousaku, et al. [8] showed that FC level is significantly correlated with both endoscopic severity and the extent of affected mucosa in patients with UC, revealing the importance of its measurement as an indicator of mucosal inflammation.

Table 1: Distribution of the studied cases according to different parameters (n = 20).

	No. (%)
Gender	
Male	12 (60.0%)
Female	8 (40.0%)
Age (years)	
Min. – Max.	15 –56
Mean ± SD.	33.75 ±12.36
Clinical Presentation	
Abdominal pain	20 (100.0%)
Diarrhea	20 (100.0%)
Bleeding per rectum	10 (50.0%)
Fecal Calprotectin (FC)	
Min. – Max.	110 –930
Median (IQR)	525 (325 –710)
Mayo Endoscopic Score (MES)	
1	3 (15.0%)
2	5 (25.0%)
3	12 (60.0%)
Disease Extent	
Rectosigmoid	3 (15.0%)
Left colon	4 (20.0%)
Pan colitis	13 (65.0%)

IQR: Inter quartile range SD: Standard deviation.

Table 2: Correlation between and Mayo Endoscopic Score (MES) (n = 20).

Fecal calprotectin	**r**	**p**
Mayo Endoscopic Score	0.517	0.020

r: Spearman coefficient : Statistically significant at $p \leq 0.05$

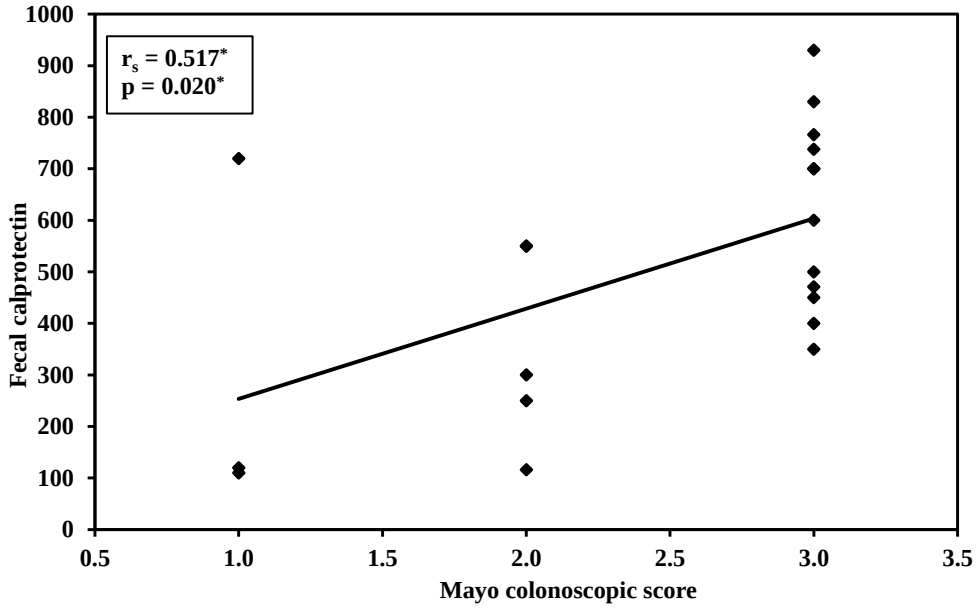

Figure 1: Correlation between Fecal calprotectin and Mayo Endoscopic Score (MES) (n = 20).

Table 3: Relation between Fecal Calprotectin and Disease Extent (n = 20).

	N	Fecal calprotectin		
		Median (Min. – Max.)	H	P
Disease extent				
Rectosigmoid	**3**	300 (116 – 930)		
Left colon	**4**	475 (250 – 720)	0.422	0.810
Pan colitis	**13**	550 (110 – 830)		

SD: **Standard deviation** H: H for **Kruskal Wallis test**

p: p value for comparing between different categories.

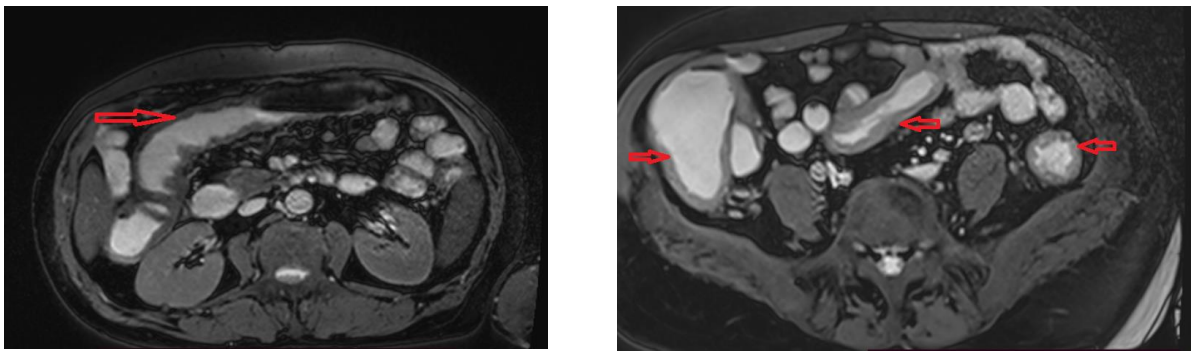

Fig 2: Axial TRUFI images of MRE study in adult male patient 55 years diagnosed with UC showing mural thickening and mucosal ulceration involving the whole colon (pancolitis), FC level = 471 and MES = 3

In the present study the assessment of disease extent was determined using MRE depending on morphological features; mural thickening, mucosal ulceration and lost haustral folds of chronic diseased colonic segments. No disease activity was assessed on MRE only extension of the disease either limited to rectosigmoid, affecting left side of the colon or being extensive (pan colitis). Results revealed no statistical significant relation between FC levels and different disease extents (P= 0.810). So, FC level in UC patients is important for vital assessment of mucosal inflammation showing good correlation to disease activity assessed by MES but according to our results there is no statistical relation between FC level and disease extent assessed by MRE without evaluation of activity on imaging. Our study has some Limitations: First, small sample size of our study, further studies with larger sample may provide more added value and validation of relation between FC and disease extent. Second, further assessment of disease activity by MRE and evaluation of relation with FCP level may support the role of FCP in assessing disease activity in UC patients. Furthermore, histopathological correlation is necessary to understand the correlation between FC levels and diseases activity.

5.Conclusion

Significant correlation is present between FC levels and endoscopic assessed disease activity in UC patients using MES, but no statistical relation between FC level and disease extent assessed by MRE.

References

[1] F. Magro, A. Rodrigues, A.I. Vieira, F. Portela, I. Cremers, J. Cotter, et al. (2012). Review of the disease course among adult ulcerative colitis population-based longitudinal cohorts. Inflammatory bowel diseases, 18(3), pp.573-583.

[2] S. Nikolaus, S. Schreiber. (2007). Diagnostics of inflammatory bowel disease. Gastroenterology. 133(5), 1670–1689.

[3] G. Meucci, R. Fasoli, S. Saibeni, D. Valpiani, R. Gullotta, E. Colombo, et al. (2012). Prognostic significance of endoscopic remission in patients with active ulcerative colitis treated with oral and topical mesalazine: a prospective, multicenter study. Inflammatory bowel diseases. 18(6), 1006–1010.

[4] K. Acharya, V. Bhardwaj, I. Chuahan, S. Mushfiq, S. Bhatt, B.M. Lamba. (2023). Comparison of Fecal Calprotectin with Different Endoscopic Scores in the Assessment of Ulcerative Colitis (UC) Activity and Its Utility in Differentiating IBS from IBD. Euroasian Journal of Hepatogastroenterol. 13(2), 120.

[5] M.Z. Mazlam, H.J. Hodgson. (1994). Why measure C reactive protein? Gut. 35(1), 5.

[6] M. Daperno. (2011). Scientific Committee of the European Crohn's and Colitis Organization: Results of the 2nd part Scientific Workshop of the ECCO. II: Measures and markers of prediction to achieve, detect, and monitor intestinal healing in inflammatory bowel disease. Journal of Crohn's and Colitis, 5(5), pp.484-498.

[7] K.W. Schroeder, W.J. Tremaine, D.M. Ilstrup. (1987). Coated oral 5-aminosalicylic acid therapy for mildly to moderately active ulcerative colitis. New England Journal of Medicine. 317(26), 1625–1629.

[8] K. Kawashima, S. Ishihara, T. Yuki, N. Fukuba, N. Oshima, H. Kazumori, et al. (2016). Fecal calprotectin level correlated with both endoscopic severity and disease extent in ulcerative colitis. BMC Gastroenterol. 16, 1–6.

[9] Mignini, R. Maresca, M.E. Ainora, L. Larosa, F. Scaldaferri, A. Gasbarrini, et al. (2023). Predicting Treatment Response in Inflammatory Bowel Diseases: Cross-Sectional Imaging Markers. Journal of Clinical Medicine. 12(18), 5933.

[10] G. D'Haens, M. Ferrante, S. Vermeire, F. Baert, M. Noman, L. Moortgat, et al. (2012). Fecal calprotectin is a surrogate marker for endoscopic lesions in inflammatory bowel disease. Inflammatory bowel diseases, 18(12), pp.2218-2224.

[11] A.M. Schoepfer, C. Beglinger, A. Straumann, E. Safroneeva, Y. Romero, D. Armstrong, et al. (2013). Fecal calprotectin more accurately reflects endoscopic activity of ulcerative colitis than the Lichtiger Index, C-reactive protein, platelets, hemoglobin, and blood leukocytes. Inflammatory bowel diseases, 19(2), 332–341.

[12] A.M. Schoepfer, C. Beglinger, A. Straumann, M. Trummler, P. Renzulli, F. Seibold. (2009). Ulcerative colitis: correlation of the Rachmilewitz endoscopic activity index with fecal calprotectin, clinical activity, C-reactive protein, and blood leukocytes. Inflammatory bowel diseases, 15(12), 1851–1858.