

Correlation Between Fecal Calprotectin Levels and Mucosal Healing in Inflammatory Bowel Diseases Patients Under Biologics

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Abstract

Original Research Article

Introduction: Chronic inflammatory bowel diseases (IBD) mainly include two diseases: ulcerative colitis (UC) and Crohn's disease (CD). Fecal calprotectin is the most widely studied and best performing inflammation marker in IBD to date. **Methods:** In this study, we included patients followed for IBD (Crohn's disease and Ulcerative colitis) under anti-TNF alpha (Infliximab/Adalimumab) alone or in association with an immunosuppressive treatment. The assessment of mucosal healing for Crohn's disease was based on the Simplified Endoscopic Score for Crohn's Disease (SES-CD) and for ulcerative colitis on the endoscopic subscore of the Mayo score. Fecal calprotectin levels were evaluated according to the presence/absence of mucosal healing. **Results:** 43 patients were included in the study, in all our patients, statistical analysis of correlation using Spearman's test shows a very strong negative correlation between CF rate and mucosal healing ($r = -0.814$, $p < 0.001$). The ROC curve shows an area under the curve of 94%. This test can therefore be considered excellent for detecting mucosal healing at one year in IBD patients on biologic therapy. Using this curve and the Youden index we could determine the best Cut-Off of fecal calprotectin which is 182 $\mu\text{g/g}$ in our series. **Conclusions:** Fecal calprotectin levels correlate significantly with endoscopic disease activity in IBD. The test appears useful in clinical practice for assessment of endoscopic activity and remission.

Keywords: Chronic inflammatory bowel diseases (IBD), ulcerative colitis (UC), Crohn's disease (CD), biologic therapy.

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INTRODUCTION

Chronic inflammatory bowel diseases (IBD) mainly include two diseases: ulcerative colitis (UC) and Crohn's disease (CD). In terms of symptoms, CD and UC are characterised by chronic gastrointestinal disorders, inflammation of the mucosa of the digestive tract, abdominal pain and diarrhea, sometimes with blood. These diseases present alternating periods of flare-ups and remissions, and their etiology is not yet clearly defined, although certain factors seem to be involved. (1) The classic therapeutic objective in IBD, whether it is Crohn's disease or UC, is the control of symptoms. With the advent of biologic therapies, recent years have seen the emergence of the concept of endoscopic mucosal healing (EMS), and histologic remission which now appear to be the new goals. Calprotectin is the most widely studied and best performing fecal marker in IBD to date. However, the interpretation of its assay must take into account its lack of specificity with high concentrations in a certain number of gastroenterological situations

independent of IBD (digestive infections, colorectal cancer, diverticulitis, etc.) and under certain treatments.

MATERIALS AND METHODS

Patients:

This is a retrospective descriptive and analytical study conducted between the month of January 2018 and October 2022 at the Gastroenterology I unit of the Mohamed V Military Teaching Hospital. In this study, we included patients followed for IBD (Crohn's disease and Ulcerative colitis) and who are treated with anti-TNF alpha (Infliximab / Adalimumab) in monotherapy or in association with an immunosuppressive treatment (mainly Azathioprine), we performed a colonoscopy before starting the treatment and at 1 year of biologic therapy. If the patient has multiple colonoscopies prior to initiation of anti-Tnf Alpha therapy, the most recent is considered. The assessment of mucosal healing for Crohn's disease was based on the Simplified Endoscopic Score for Crohn's Disease (SES-CD) and for Hemorrhagic Rectocolitis on the endoscopic subscore of

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the Mayo score. In both groups, the absence of ulcerations at the follow-up colonoscopy was considered as endoscopic mucosal healing.

Treatment regimen:

Infliximab intravenous infusions were administered at the dose of 5 mg/kg over 2 hours at weeks 0, 2, 6 for the induction phase and every 8 weeks for maintenance therapy. Adalimumab was injected at the initial dose of 160 mg, followed by 80 mg and then 40 mg subcutaneously every otherweek. For patients receiving combination therapy, thiopurines were administered at full dose (Azathioprine 2.0-2.5 mg/kg, Mercaptopurine 1.0-1.5 mg/kg) at the start of treatment.

Follow-up procedures:

Patients were hospitalized for an initial disease assessment as well as for treatment initiation. Patients on Infliximab are hospitalized for each cure of treatment and a biological testing was done prior to drug administration. Patients on Adalimumab were followed up in consultation. In all patients, regular tests were done to judge efficacy, tolerance and adherence to treatment. A colonoscopy was performed after one year of starting biotherapy.

Statistical analysis:

Statistical analysis was performed using SPSS20 software, taking into account the following variables: age, sex, type of IBD, age of onset of disease, history of corticosteroid therapy, use of combination

therapy, severity of flare-up at admission, biological data at inclusion and at one year, and whether or not mucosal healing had occurred. Factors associated with mucosal healing were studied using binary logistic regression in univariate and multivariate analysis.

RESULTS

The study population:

43 patients were included in the study, the mean age of overall patients was 40.12 years with a standard deviation of 13.59, and extremes ranging from 16 years to 62 years. The number of patients with UC was 10 (23.26%), their mean age was 40.3 years with a standard deviation of ± 14.369 . The number of patients with crhon's disease is 33 (76.74%), with a mean age of 40.06 years and a standard deviation of ± 13.57 .

All UC patients had a history of intravenous corticosteroid therapy. The percentage of patients who received corticosteroid therapy was 42.4%, i.e. 14 out of 33 patients.

The percentage of patients with UC who had combotherapy was 80.00%, i.e. 8 out of 10 patients, compared with 2 out of 10 patients on anti-TNF alpha alone, i.e. 20% of patients. The percentage of CD patients who were put on combotherapy was 87.90%, i.e. 29 patients out of 33, compared with 4 patients out of 33 on anti-TNF alpha alone, i.e. 12.1% of patients.

Baseline characteristics of patients enrolled in the study:

Characteristics	Overall patients N=43	UC patients N=10	CD patients N=33
Age (years) ¹ Sex ²	40,12 $\pm$ 13,59	40,3 $\pm$ 14,3	40,06 $\pm$ 13,5
Male	23 (53,5%)	6 (60%)	17(51,5%)
Female	20 (46,5)	4 (40%)	16 (48,5%)
Age of onset ¹	33,8 $\pm$ 13,2	35,6 $\pm$ 14,1	33,2 $\pm$ 13
IV steroids ²	43 (55,8%)	10 (100%)	14 (42,4%)
Combotherapy ²	37 (86%)	8 (80%)	29 (87,9%)
Severity ²	25 (58,14%)	6 (60%)	19 (57,6%)
1 year FC (μ g/g) ¹	389 $\pm$ 302	421 $\pm$ 389	383 $\pm$ 381
Mucosal healing ²	22 (51,2%)	6 (60%)	16 (48,5%)

¹: Data presented as means and standard deviations.

²: Data presented as numbers and percentages.

Correlation between fecal calprotectin level at one year and mucosal healing:

in all our patients, statistical analysis of correlation using Spearman's test shows a very strong

negative correlation between CF rate and mucosal healing ($r = -0.814$, $p < 0.001$).

CORRELATIONS

			CF	healing
		Correlation coefficient	1,000	-,820**
	CF	Sig (bilateral)	.	,000
Spearman's Rho		N	42	41
		Correlation coefficient	-,820**	1,000
	healing	Sig (bilateral)	,000	.
		N	41	42

** . The correlation is significant at the 0.01 level (two-tailed).

In the subgroup of patients with ulcerative colitis, Spearman's correlation test also shows a very strong

negative correlation that is statistically significant ($r = -0.870$, $p = 0.002$)

Correlations^a

			CF	healing
		Correlation coefficient	1,000	-,870**
	CF	Sig (bilateral)	.	,002
Spearman's Rho		N	9	9
		Correlation coefficient	-,870**	1,000
	healing	Sig (bilateral)	,002	.
		N	9	10

** The correlation is significant at the 0.01 level (two-tailed).

a. typeMICI = UC

In the group of patients followed for Crohn's disease, the statistical analysis still shows a very strong negative correlation between the level of fecal

calprotectin and mucosal scarring, and this correlation is statistically significant ($r = -0.815$, $p < 0 ;001$)

Correlations^a

			CF	healing
		Correlation coefficient	1,000	-,815**
	CF	Sig (bilateral)	.	,000
Spearman's Rho		N	33	32
		Correlation coefficient	-,815**	1,000
	healing	Sig (bilateral)	,000	.
		N	32	32

**The correlation is significant at the 0.01 level (two-tailed).

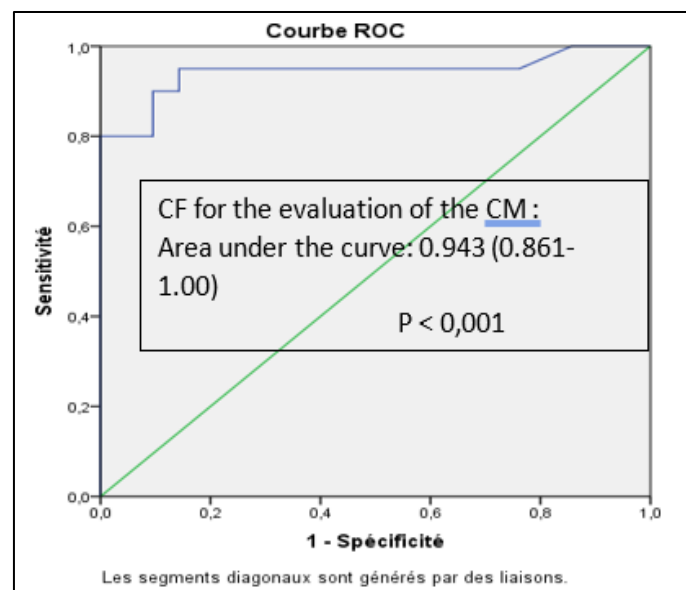
a. typeMICI = Crohn's

Diagnostic value of fecal Calprotectin at one year in detecting mucosal scarring

For this analysis we established the ROC curve (Receiver operating characteristics), from which we analyzed the area under the curve that shows the diagnostic value of this parameter. We also looked for

the best fecal calprotectin cut-off and determined the sensitivity, specificity, negative and positive predictive values.

ROC curve:



The ROC curve shows an area under the curve of 94%. This test can therefore be considered excellent

for detecting mucosal scarring at one year in IBD patients on biotherapy.

The analysis of this curve and the Youden index allowed us to determine the best Cut-Off of fecal calprotectin which was 182 µg/g in our series.

For this CF value: The sensitivity was 85.7%, the specificity was 95%, the positive predictive value was 94.7%, the negative predictive value was 86.3%.

DISCUSSION

To our knowledge, there are few published studies that have investigated an association between low FC and both endoscopic mucosal healing and histological remission in colonic IBD, and the results of these studies have not been consistent. [1,2,3]. FC is a clinically appreciated [4] inflammatory marker due to its feasibility (noninvasive sample collection and low-cost analyzing methods), and new appliances enabling patients to perform a home test with a rapid result [5]. One of the greatest challenges in IBD treatment is to develop more precise and less invasive diagnostic tests that could be useful in disease monitoring. Early detection of a disease flare can help optimize IBD care.[6] FC has already been adapted in clinical practice as a surrogate marker for intestinal inflammation. It highly correlates with endoscopic scores of activities, [7,8,9] we can conclude that this test is currently the best available surrogate marker for the presence of mucosal inflammation. Therefore, it should be considered a useful alternative to repeated endoscopic evaluations. Several relatively small studies have previously looked at the value of fecal calprotectin measurement in IBD clinical practice. [10,11,12] In the studies by Sipponen *et al.*, D'Inca *et al.*, and Schoepfer *et al.*, [11–13] the test was correlated with the CDEIS or the SES-CD with correlation coefficients ranging from 0.48–0.73, sensitivities ranging from 81%–91%, and specificities from 58%–100% for CD. The different histologic grading systems limit the utilization of histologic remission as a treatment target. Notably only the Nancy Index has been validated (after initiating of current study) [14,15]. Other factors that can impact the histologic score include the possibility of patchy healing, as well as the site of biopsies [16] which may have influenced the FC cutoffs presented in the different trials. Furthermore, different commercial FC ELISA assays have been used and may also have impacted the results [17,18].

Our results are perfectly in line with these previously published data and underscore the conclusion that fecal calprotectin is currently the best available surrogate marker for mucosal disease activity in IBD. The main limitation of this study is the lack of a multiple evaluation of FC: its levels can vary day-to-day, by the time of day, and even within the same bowel movement [19].

CONCLUSION

Fecal calprotectin levels correlate significantly with endoscopic disease activity in IBD. The test appears useful in clinical practice for assessment of endoscopic activity and remission. It could become the preferred method for differentiating IBD from IBS, for serial assessment of mucosal inflammation, and for the identification of IBD patients with active mucosal disease who are candidates for clinical trials.

REFERENCES

1. Molander P, Sipponen T, Kemppainen H, et al. Achievement of deep remission during scheduled maintenance therapy with TNF α blocking agents in IBD. *J Crohns Colitis*. 2013;7:730-735.
2. Takashima S, Kato J, Hiraoka S, et al. Evaluation of mucosal healing in ulcerative colitis by fecal calprotectin vs. fecal immunochemical test. *Am J Gastroenterol*. 2015;110:873-880.
3. Diamanti A, Colistro F, Basso MS, et al. Clinical role of calprotectin assay in determining histological relapses in children affected by inflammatory bowel diseases. *Inflamm Bowel Dis*. 2008;14:1229-1235.
4. Sands BE. Biomarkers of inflammation in inflammatory bowel disease. *Gastroenterology*. 2015;149:1275–1285.
5. Vinding KK, Elsborg H, Thorkilgaard T, et al. Fecal calprotectin measured by patients at home using smartphones—a new clinical tool in monitoring patients with inflammatory bowel disease. *Inflamm Bowel Dis*. 2016;22:336–344.
6. Jensen MD, Kjeldsen J, Nathan T. Fecal calprotectin is equally sensitive in Crohn's disease affecting the small bowel and colon. *Scand J Gastroenterol*. 2011; 46: 694-700.
7. Schoepfer AM, Beglinger C, Straumann A, et al. Fecal calprotectin correlates more closely with the Simple Endoscopic Score for Crohn's disease (SES-CD) than CRP, blood leukocytes, and the CDAI. *Am J Gastroenterol*. 2010; 105: 162-169.
8. Eder P, Stawczyk-Eder K, Lykowska-Szuber L, et al. Association between disease duration and usefulness of fecal calprotectin measurement in patients with Crohn's disease. *Pol Arch Med Wewn*. 2014; 124: 51-57.
9. Baert F, Moortgat L, Van Assche G, et al. Mucosal healing predicts sustained clinical remission in patients with early-stage Crohn's disease. *Gastroenterology*. 2010; 138: 463-468.
10. Sipponen T, Savilathi E, Kärkkäinen P, et al. Faecal calprotectin, lactoferrin and endoscopic disease activity in monitoring anti-TNF α therapy for Crohn's disease. *Inflamm Bowel Dis*. 2008;14: 1392–1398.
11. Sipponen T, Björkstén CG, Kärkkäinen M, et al. Faecal calprotectin and lactoferrin are reliable surrogate markers of endoscopic response during Crohn's disease treatment. *Scand J Gastroenterol*. 2010;45: 325–331.

12. Schoepfer AM, Beglinger C, Straumann A, et al. Fecal calprotectin correlates more closely with the Simple Endoscopic Score for Crohn's disease (SES-CD) than CRP, blood leukocytes, and the CDAI. *Am J Gastroenterol*. 2010;105:162–169
13. . Schoepfer AM, Beglinger C, Straumann A, et al. Ulcerative colitis: correlation of the Rachmilewitz endoscopic activity index with fecal calprotectin, clinical activity, C-reactive protein, and blood leukocytes. *Inflamm Bowel Dis*. 2009;15:1851–1858
14. Mosli M, Parker CE, Nelson SA, et al. Histologic scoring indices for evaluation of disease activity in ulcerative colitis. *Cochrane Database Syst Rev*. 2017;(5):CD011256.
15. Marchal-Bressenot A, Salleron J, Boulagnon-Rombi C, et al. Development and validation of the Nancy histological index for UC. *Gut*. 2017;66:43–49.
16. Peyrin-Biroulet L, Bressenot A, Kampman W. Histologic remission: the ultimate therapeutic goal in ulcerative colitis? *Clin Gastroenterol Hepatol*. 2014;12:929–934.
17. Mirsepasi-Lauridsen HC, Holmetoft UB, Halkjaer SI, et al. Comparison of three commercial fecal calprotectin ELISA test kits used in patients with Inflammatory Bowel Disease. *Scand J Gastroenterol*. 2016;51:211–217
18. ristensen V, Klepp P, Cvancarova M, et al. Prediction of endoscopic disease activity in ulcerative colitis by two different assays for fecal calprotectin. *J Crohn's Colitis*. 2015;9:164–169
19. Lasson A, Stotzer PO, Ohman L, et al. The intra-individual variability of faecal calprotectin: A prospective study in patients with active ulcerative colitis. *J Crohns colitis* 2015;9:26–32.