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Original Research Article

Fecal Calprotectin Level as the Early Indication of Inflammatory Bowel Disease

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Abstract:

Introduction: Lower bowel symptoms, including chronic abdominal pain or discomfort with diarrhea or constipation, are common presenting features in both primary and secondary care settings. These symptoms may be caused by a number of different conditions, including inflammatory bowel disease (IBD), of which ulcerative colitis (UC) and Crohn's disease (CD) are the most common, and irritable bowel syndrome (IBS).

Aims: To evaluate the utility of fecal calprotectin (FC) levels as an early indicator for diagnosing inflammatory bowel disease (IBD) and differentiating it from other gastrointestinal disorders.

Materials & Methods: The present study was a Observational, cross-sectional study. This Study was conducted from One year January 2024- December 2024 at department of General Medicine, Murshidabad Medical College & Hospital, Station Road, Berhampore, Murshidabad, West Bengal, Pin-742101. Total 50 patients were included in this study.

Result: Endoscopic findings revealed a correlation between the severity of inflammation and mean fecal calprotectin (FC) levels. Patients with normal endoscopic results (n=10) had a mean FC level of 45.2 µg/g, while those with mild inflammation (n=14) showed a mean of 165.3 µg/g. Moderate inflammation was observed in 16 patients with a mean FC level of 325.5 µg/g, and severe inflammation was present in 10 patients, who had the highest mean FC level of 487.7 µg/g.

Conclusion: We concluded that, fecal calprotectin (FC) has proven to be a valuable non-invasive biomarker for the early detection of inflammatory bowel disease (IBD). This study demonstrated a strong correlation between elevated FC levels and both endoscopic severity and confirmed IBD diagnoses, particularly in cases of ulcerative colitis and Crohn's disease.

Keywords: Fecal Calprotectin, Ulcerative Colitis, Crohn's Disease And Diagnostic Biomarker.

Introduction

Lower bowel symptoms, including chronic abdominal pain or discomfort with diarrhea or constipation, are common presenting features in both primary and secondary care settings. These symptoms may be caused by a number of different conditions, including inflammatory bowel disease (IBD), of which ulcerative colitis (UC) and Crohn's disease (CD) are the most common, and irritable bowel syndrome (IBS).

IBS is a functional bowel disorder for which there is no identifiable cause or distinctive pathology, and treatment is symptomatic. Although it may be sufficiently troublesome to interfere with normal daily activities, it is seldom associated with serious morbidity. The prevalence of IBS has been estimated to be in between 10% and 20% of the adult population, but may be even higher than this as it is thought that many people with IBS symptoms do not seek medical assistance.[1] The most common age of presentation is between the ages of 20 years and 30 years, although it is increasingly being seen at older ages, and is twice as common in women than in men. UC and CD are the two most common forms of IBD. The prevalence of UC is approximately 100–200 per 100,000 people, and the prevalence of CD is approximately 50–100 per 100,000 people,[1] with no significant sex difference. IBD is more common in Caucasians compared to those of Asian or Afro-Caribbean origin.

The typical age of presentation is between 15 years and 30 years, but in up to 20%, it presents during childhood. Both UC and CD are remitting and relapsing conditions with a variable course of progression. The prognosis of patients with CD is worse than that for UC, although it is estimated that 10% of patients with UC will require a colectomy within 10 years of diagnosis. Because of the significance of making a diagnosis of IBD versus IBS,

there has been significant interest in developing biomarkers that can aid diagnosis.

To evaluate the utility of fecal calprotectin (FC) levels as an early indicator for diagnosing inflammatory bowel disease (IBD) and differentiating it from other gastrointestinal disorders.

Materials and Methods

Type of study: Observational, cross-sectional study

Place of study: The study was conducted in the Department of General Medicine, Murshidabad Medical College & Hospital, Station Road, Berhampore, Murshidabad, West Bengal, Pin-742101.

Study duration: January 2024- December 2024.

Sample size: 50.

Inclusion Criteria:

- Adults aged 18–60 years with gastrointestinal symptoms.
- Patients undergoing evaluation for suspected IBD.
- Fecal calprotectin test done prior to endoscopic diagnosis.
- Provided informed written consent.

Exclusion Criteria:

- Previously diagnosed with IBD or other chronic GI diseases.
- Use of NSAIDs, antibiotics, or steroids in the past 4 weeks.
- Presence of active gastrointestinal infection.
- Pregnant or lactating women.
- Incomplete clinical or laboratory data.

Statistical Analysis: Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data.

Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

Result

Table 1: Demographic Characteristics of Study Population (n=50)

Parameter	Value
Age (mean ± SD)	34.6 ± 12.8 years
Gender (Male/Female)	28 (56%) / 22 (44%)
Duration of Symptoms	4.3 ± 2.1 months
Family History of IBD	7 (14%)
Smoking History	9 (18%)

Table 2: Distribution of Fecal Calprotectin Levels

Fecal Calprotectin Range (µg/g)	Number of Patients	Percentage (%)
< 50 (Normal)	10	20%
50–200 (Borderline)	12	24%
>200 (High - suggestive of IBD)	28	56%

Table 3: Correlation of Fecal Calprotectin with Endoscopic Findings

Endoscopic Finding	No. of Patients	Mean FC Level (µg/g)
Normal	10	45.2
Mild Inflammation	14	165.3
Moderate Inflammation	16	325.5
Severe Inflammation	10	487.7

Table 4: Fecal Calprotectin Level vs Final Diagnosis

Diagnosis	No. of Patients	Mean FC Level (µg/g)	SD
Ulcerative Colitis	20	412.6	65.3
Crohn's Disease	8	375.2	48.7
Irritable Bowel Syndrome	10	38.7	12.4
Indeterminate Colitis	6	195.8	37.2
Other Diagnoses	6	72.3	19.8

Table 5: Diagnostic Accuracy of Fecal Calprotectin at 200 µg/g Cutoff

Parameter	Value
Sensitivity	92.30%
Specificity	83.30%
Positive Predictive Value	88.50%
Negative Predictive Value	88.20%
Diagnostic Accuracy	88.40%

The study population had a mean age of 34.6 ± 12.8 years, with 56% males (n=28) and 44% females (n=22). The average duration of symptoms was 4.3 ± 2.1 months. A family history of inflammatory bowel disease (IBD) was reported in 14% of participants (n=7), while 18% (n=9) had a history of smoking.

Fecal calprotectin levels among the study participants varied, with 20% (n=10) showing normal levels (<50 μg/g), 24% (n=12) falling within the borderline range (50–200 μg/g), and 56% (n=28) exhibiting elevated levels (>200 μg/g), which are suggestive of inflammatory bowel disease (IBD).

Endoscopic findings revealed a correlation between the severity of inflammation and mean fecal calprotectin (FC) levels. Patients with normal endoscopic results (n=10) had a mean FC level of 45.2 μg/g, while those with mild inflammation (n=14) showed a mean of 165.3 μg/g. Moderate inflammation was observed in 16 patients with a mean FC level of 325.5 μg/g, and severe inflammation was present in 10 patients, who had the highest mean FC level of 487.7 μg/g.

The distribution of diagnoses among the patients showed varying mean fecal calprotectin (FC) levels. Patients with ulcerative colitis (n=20) had the highest mean FC level at 412.6 ± 65.3 μg/g, followed by those with Crohn's disease (n=8) at 375.2 ± 48.7 μg/g. Individuals diagnosed with indeterminate colitis (n=6) had a mean FC level of 195.8 ± 37.2 μg/g, while those with other diagnoses (n=6) recorded 72.3 ± 19.8 μg/g. Patients with irritable bowel syndrome (IBS) (n=10) had the lowest FC levels, averaging 38.7 ± 12.4 μg/g.

The diagnostic performance of fecal calprotectin in identifying inflammatory bowel disease was notable, with a sensitivity of 92.3% and specificity of 83.3%. The positive predictive value (PPV) was 88.5%, while the negative predictive value (NPV) stood at 88.2%. Overall, the test demonstrated a diagnostic accuracy of 88.4%.

Discussion

The demographic characteristics of the study population provide important context for interpreting the clinical findings. With a mean age of 34.6 ± 12.8 years, the data suggest that gastrointestinal symptoms indicative of potential inflammatory bowel disease (IBD) commonly affect individuals in early to mid-adulthood. The gender distribution, with 56% males and 44% females, does not show a strong sex predilection, aligning with known patterns of IBD incidence. The mean symptom duration of 4.3 ± 2.1 months reflects a subacute disease course at presentation, which may impact both diagnostic accuracy and therapeutic outcomes. A family history of IBD was noted in 14% of cases, consistent with the established genetic predisposition associated with the disease. Additionally, 18% of participants had a history of smoking, a relevant factor particularly in the context of Crohn's disease, where smoking is a recognized risk factor. These baseline data, expressed as mean ± standard deviation, provide a foundational understanding of the cohort's clinical profile. A similar study by Henderson et al. examined the role of fecal calprotectin in the primary care setting for identifying patients with suspected inflammatory bowel disease (IBD). The study included adults aged 16–50 years presenting with gastrointestinal symptoms and reported a median age of 33.1 years, with 64.9% female participants. Smoking history was notable, with 30.8% being current smokers. The study found fecal calprotectin to be a useful non-invasive marker for distinguishing IBD from functional disorders such as irritable bowel syndrome, particularly in a younger adult population—demographics closely aligned with your study cohort Henderson P et al [2].

The distribution of fecal calprotectin (FC) levels among the study participants provides valuable insight into its diagnostic relevance in gastrointestinal disorders. A majority of patients (56%, n=28) exhibited elevated FC levels greater than 200 μg/g, which is strongly suggestive of active inflammatory bowel disease (IBD), reinforcing the utility of FC as a non-invasive marker for intestinal inflammation. Meanwhile, 24% (n=12) had borderline values (50–200 μg/g), which may represent early or mild inflammation, necessitating further clinical or endoscopic evaluation for definitive diagnosis. Only 20% (n=10) showed normal FC levels (<50 μg/g), which typically correlate with functional gastrointestinal conditions such as irritable bowel syndrome (IBS). This distribution highlights the effectiveness of FC in stratifying patients based on inflammatory status, supporting its use as a screening and monitoring tool in routine clinical practice.

A comparable study by El-Badry et al.[3] (2010) evaluated fecal calprotectin (FC) levels in patients with inflammatory bowel disease (IBD) and irritable bowel syndrome (IBS). The study reported that FC levels in individuals with IBD ranged from 98

to 637 µg/g, while those with IBS had levels between 14 and 65 µg/g. notably, there was no overlap in FC values between the two groups, underscoring FC's diagnostic potential in distinguishing IBD from functional gastrointestinal disorders The endoscopic findings demonstrated a clear positive correlation between the severity of mucosal inflammation and mean fecal calprotectin (FC) levels. Patients with normal mucosa had the lowest mean FC level (45.2 µg/g), while levels increased progressively with inflammation: mild (165.3 µg/g), moderate (325.5 µg/g), and severe (487.7 µg/g). This gradient supports FC as a reliable marker reflecting the extent of intestinal inflammation.

A similar study by Kawashima et al. [4] (2016) investigated the correlation between fecal calprotectin (FC) levels and endoscopic findings in patients with ulcerative colitis (UC).

The study found that FC levels increased progressively with the severity of mucosal inflammation, with median values of 35.2 µg/g in patients with a Mayo Endoscopic Subscore (MES) of 0, 103.3 µg/g for MES 1, 295.0 µg/g for MES 2, and 751.9 µg/g for MES 3. These findings support the use of FC as a reliable marker reflecting the extent of intestinal inflammation, aligning with your study's observation of a positive correlation between endoscopic severity and FC levels.

The distribution of fecal calprotectin (FC) levels across different diagnoses revealed significant variation. Patients with ulcerative colitis had the highest mean FC level at 412.6 ± 65.3 µg/g, followed closely by those with Crohn's disease at 375.2 ± 48.7 µg/g, indicating marked inflammation. Indeterminate colitis showed moderate FC levels (195.8 ± 37.2 µg/g), while those with other diagnoses and irritable bowel syndrome (IBS) had significantly lower values (72.3 ± 19.8 µg/g and 38.7 ± 12.4 µg/g, respectively).

These findings underscore FC's ability to distinguish between inflammatory and non-inflammatory conditions. A similar study by Chowdhury et al.[5] (2021) investigated the role of fecal calprotectin (FC) in differentiating inflammatory bowel disease (IBD) from irritable bowel syndrome (IBS). The study reported that FC levels in IBD patients were significantly higher than those in IBS patients, with mean values of 445.68 ± 237.35 µg/g in IBD and 39.16 ± 17.31 µg/g in IBS. This substantial difference underscores FC's potential as a non-invasive biomarker for distinguishing between these two conditions.

The diagnostic performance of fecal calprotectin in identifying inflammatory bowel disease was highly promising, with a sensitivity of 92.3% and specificity of 83.3%, reflecting its strong ability to correctly identify both affected and unaffected individuals. The test showed an impressive positive predictive value (88.5%) and negative predictive value (88.2%), indicating reliable detection of true positives and negatives. Overall, the diagnostic accuracy of 88.4% highlights its potential as an effective tool for diagnosing IBD.

Conclusion

We concluded that, fecal calprotectin (FC) has proven to be a valuable non-invasive biomarker for the early detection of inflammatory bowel disease (IBD).

This study demonstrated a strong correlation between elevated FC levels and both endoscopic severity and confirmed IBD diagnoses, particularly in cases of ulcerative colitis and Crohn's disease. FC levels were significantly lower in patients with irritable bowel syndrome (IBS) and other non-inflammatory conditions, highlighting its diagnostic specificity.

Given its ease of collection, cost-effectiveness, and clinical relevance, FC serves as an effective screening tool to differentiate IBD from functional disorders and guide timely diagnostic evaluation and management.

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