CLINICAL AND IMMUNOLOGICAL SIGNIFICANCE OF CALPROTECTIN IN ULCERATIVE COLITIS

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INTRODUCTION

Ulcerative colitis (UC) is a chronic inflammatory disease of the colon characterized by inflammation and ulceration of the mucosal layer. The disease follows a relapsing clinical course with periods of remission. Non-invasive, accurate, and cost-effective biomarkers are essential for assessing disease activity and monitoring treatment efficacy.

Fecal calprotectin (FC) is a calcium- and zinc-binding protein present in the cytoplasm of neutrophil granulocytes and is considered a highly sensitive biomarker of intestinal inflammation. FC comprises 60% of neutrophil cytosol and reflects neutrophil migration toward the intestinal lumen.

IMMUNOLOGICAL CHARACTERISTICS OF CALPROTECTIN

Molecular properties. Calprotectin is an S100A8/A9 (MRP 8/14) protein with a molecular mass of 36 kDa that binds calcium and zinc ions. It is an acute-phase inflammatory protein produced by neutrophils, monocytes, and macrophages.

Role in immune response. During intestinal inflammation, neutrophil activation and migration to the mucosal layer are observed. In this process, calprotectin is released and excreted with feces. FC concentration is 6 times higher than in blood, making it a direct indicator of intestinal inflammation. Calprotectin exhibits antibacterial and antifungal effects by inhibiting microbial growth through metal ion sequestration.

Biochemical stability. Calprotectin demonstrates high resistance in the aggressive fecal environment and remains stable for up to 7 days at room temperature, more than 1 week at +4°C, and for extended periods at -20°C. This property makes it an ideal biomarker for laboratory diagnostics.

CLINICAL SIGNIFICANCE IN ULCERATIVE COLITIS

1. Diagnostic value. FC demonstrates high efficacy in differentiating ulcerative colitis from functional bowel syndrome. Studies show that at a cutoff value of 164-200 µg/g, FC has 85% sensitivity and 73% specificity. In active UC, calprotectin levels (402.16±48.0 µg/g) are significantly higher compared to patients in remission (35.93±3.39 µg/g) and healthy individuals (11.5±3.42 µg/g).

2. Assessment of disease activity. FC shows high correlation with the Mayo endoscopic score ($r=0.678$, $p<0.001$) and the Ulcerative Colitis Endoscopic Index of Severity (UCEIS) ($r=0.711$, $p<0.001$). FC reflects endoscopic mucosal activity more accurately than clinical indices (Lichtiger index), C-reactive protein, platelets, and hemoglobin.

3. Prediction of relapses. FC is a stronger prognostic indicator for predicting relapses in ulcerative colitis compared to Crohn's disease. Elevated FC levels in patients in remission

indicate the risk of near-term relapse. This enables close monitoring of patients and timely adjustment of treatment.

4. Assessment of mucosal healing. At a cutoff value of 154.5 µg/g, FC demonstrates 72.34% sensitivity and 85.71% specificity in predicting mucosal healing. Complete mucosal healing ensures long-term remission and reduces the risk of colectomy.

5. Monitoring treatment efficacy.

Dynamic monitoring of FC levels enables assessment of treatment response. FC reduction may be observed before clinical improvement, allowing optimal treatment management.

Persistently elevated FC levels during treatment indicate the need for therapeutic modification.

ADVANTAGES OF CALPROTECTIN TESTING

Non-invasive method.

The FC test is a non-invasive, painless, and safe examination method compared to colonoscopy. This improves patients' quality of life and reduces the need for invasive procedures.

Cost-effectiveness.

The FC test is inexpensive and easy to perform compared to costly endoscopic examinations. It helps optimize healthcare volume by reducing unnecessary colonoscopies.

Objective indicator. FC is a more accurate, objective indicator of intestinal inflammation compared to clinical symptoms. It can detect subclinical inflammation.

LIMITATIONS AND CONSIDERATIONS

Calprotectin is a non-specific inflammatory marker. Its level may be elevated in other conditions: intestinal infections (bacterial, viral), damage to intestinal mucosa from nonsteroidal anti-inflammatory drugs (NSAIDs), colorectal cancer, polyps, diverticulitis, ischemic colitis, and microscopic colitis.

Therefore, the FC test should be evaluated in conjunction with clinical data and other examinations.

Elevated FC levels do not always indicate UC and require additional differential diagnosis.

CONCLUSION

Fecal calprotectin is a biomarker of significant immunological and clinical importance in ulcerative colitis, performing the following functions:
● Differentiating UC from functional bowel syndrome
● Assessing disease activity with high correlation to endoscopic activity
● Predicting relapses
● Monitoring mucosal healing
● Evaluating treatment efficacy

The FC test is a non-invasive, cost-effective, and highly sensitive method that plays an important role in managing UC patients.

It contributes to reducing the number of endoscopic examinations and optimizing treatment.

Multicenter studies should be continued to establish cutoff values.

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