

## Prediction of Complication Risk Based on Biomarkers in Patients with Acute Diarrhea and Chronic Heart Failure

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### Abstract

Acute diarrhea is a common clinical syndrome that may cause dehydration, electrolyte imbalance, acute kidney injury and systemic inflammatory response. In patients with chronic heart failure, acute diarrhea has a particularly unfavorable clinical significance because fluid loss, hypovolemia and electrolyte disturbances can provoke heart failure decompensation, arrhythmias, renal dysfunction and cardiorenal complications. The aim of this study was to evaluate the prognostic value of laboratory biomarkers in predicting the risk of complications in patients with acute diarrhea and chronic heart failure. The study included patients with chronic heart failure who developed acute diarrhea. Clinical symptoms, hydration status, hemodynamic parameters and laboratory biomarkers were assessed. Special attention was paid to serum creatinine, estimated glomerular filtration rate, urea, sodium, potassium, C-reactive protein, leukocyte count, hematocrit and albumin levels. The results showed that elevated creatinine, increased urea, reduced estimated glomerular filtration rate, hyponatremia, hypokalemia, elevated C-reactive protein and leukocytosis were associated with a higher risk of complications.

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**Keywords:** *acute diarrhea, chronic heart failure, biomarkers, complications, dehydration, electrolyte imbalance, cardiorenal syndrome.*

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### Introduction

Acute diarrhea is one of the most common clinical syndromes in medical practice. It is characterized by frequent loose or watery stools and may be accompanied by abdominal pain, nausea, vomiting, fever, weakness and signs of dehydration. In most patients, acute diarrhea has a self-limited course; however, in elderly individuals and patients with chronic cardiovascular, renal or metabolic diseases, it may lead to serious complications.

Chronic heart failure is a progressive clinical syndrome associated with reduced cardiac reserve, impaired tissue perfusion, neurohormonal activation and fluid balance disturbances. Patients with chronic heart failure are especially vulnerable to acute fluid loss because their cardiovascular system has limited compensatory capacity. Even moderate dehydration may lead to arterial hypotension, renal hypoperfusion, electrolyte imbalance and worsening of heart failure symptoms.

The coexistence of acute diarrhea and chronic heart failure creates a complex clinical situation. Fluid loss caused by diarrhea can reduce circulating blood volume and impair renal blood flow. At the same time, many patients with chronic heart failure receive diuretics, renin-angiotensin-aldosterone system inhibitors, beta-blockers, mineralocorticoid receptor antagonists and other cardiovascular medications. During acute diarrhea, these drugs may increase the risk of hypotension, electrolyte disturbances and acute kidney injury if not carefully monitored.

Biomarkers play an important role in early detection of severe disease course and complications. Serum creatinine and estimated glomerular filtration rate reflect renal function. Urea may increase in dehydration and impaired renal perfusion. Sodium and potassium levels are essential for assessing electrolyte balance and arrhythmia risk. C-reactive protein and leukocyte count reflect inflammatory activity and possible infectious severity. Hematocrit may indicate hemoconcentration caused by dehydration, while albumin reflects nutritional and systemic status.

Therefore, biomarker-based assessment may help identify patients with acute diarrhea and chronic heart failure who are at increased risk of complications. Early recognition of such patients is important for timely hospitalization, correction of dehydration, prevention of arrhythmias, monitoring of renal function and optimization of heart failure therapy.

#### Purpose of the Study

The aim of this study was to evaluate the prognostic significance of laboratory biomarkers in predicting the risk of complications in patients with acute diarrhea and chronic heart failure, with special attention to renal dysfunction, electrolyte imbalance and inflammatory activity.

#### Materials and Methods

The study included patients diagnosed with chronic heart failure who presented with symptoms of acute diarrhea. Chronic heart failure was confirmed on the basis of clinical history, physical examination, electrocardiography, echocardiography and functional class assessment. Acute diarrhea was defined as the presence of loose or watery stools more than three times per day with a duration of less than 14 days.

The examined patients had chronic heart failure of functional classes II–IV. The main causes of heart failure included ischemic heart disease, arterial hypertension, post-infarction atherosclerosis, dilated cardiomyopathy and valvular heart disease. Patients with severe decompensated chronic kidney disease, oncological diseases, severe liver failure and chronic inflammatory bowel disease were excluded from the analysis.

Clinical assessment included evaluation of stool frequency, duration of diarrhea, presence of vomiting, fever, abdominal pain, signs of dehydration, blood pressure, heart rate, respiratory rate, peripheral edema, dyspnea and general weakness. Particular

attention was paid to the presence of clinical signs of heart failure decompensation, including increased dyspnea, edema, orthopnea and reduced exercise tolerance.

Laboratory examination included complete blood count, leukocyte count, hematocrit, serum creatinine, urea, sodium, potassium, albumin, glucose and C-reactive protein. Estimated glomerular filtration rate was calculated using standard clinical formulas. In selected cases, stool microscopy, coprological examination, bacteriological culture or rapid tests for infectious agents were performed.

Complications were defined as the development of at least one of the following conditions: severe dehydration, arterial hypotension, acute kidney injury, clinically significant electrolyte imbalance, heart failure decompensation, arrhythmia, need for hospitalization or need for intensive monitoring.

Patients were divided into two groups. The first group included patients who developed complications, and the second group included patients without complications. Biomarker levels and clinical parameters were compared between the groups.

Statistical analysis included calculation of mean values, standard deviations and percentage indicators. Correlation analysis was used to evaluate the relationship between biomarkers and clinical complications. Differences were considered statistically significant at  $p < 0.05$ .

## Results

The results showed that patients with chronic heart failure and acute diarrhea had a high risk of complications, especially when renal dysfunction, electrolyte imbalance and inflammatory activity were present simultaneously.

Elevated serum creatinine was more frequently observed in patients who developed complications. This finding indicates that renal function worsens significantly in high-risk patients during acute diarrhea. Increased creatinine was often accompanied by decreased estimated glomerular filtration rate, suggesting impaired renal filtration caused by dehydration, reduced renal perfusion and cardiorenal mechanisms.

Urea levels were also higher in patients with complications. Increased urea was associated with more pronounced dehydration, hemoconcentration and reduced effective circulating blood volume. Patients with both elevated urea and elevated creatinine had a more severe clinical course and required more active medical supervision.

Reduced estimated glomerular filtration rate was one of the most important predictors of complications. Patients with lower estimated glomerular filtration rate had a higher frequency of acute kidney injury, hypotension and heart failure decompensation. This marker was particularly important in elderly patients and in patients receiving diuretic therapy.

Electrolyte disorders were common among patients with complications. Hyponatremia was associated with general weakness, dizziness, hypotension and more severe heart failure symptoms. Hypokalemia was associated with an increased risk of cardiac rhythm disturbances, especially in patients receiving loop or thiazide diuretics. In some patients, potassium imbalance required urgent correction due to the risk of arrhythmia.

C-reactive protein levels were higher in patients with severe clinical course. Elevated C-reactive protein was associated with fever, intoxication, leukocytosis and possible infectious etiology of diarrhea. Leukocytosis was more frequently observed in patients with bacterial intestinal infection and systemic inflammatory response.

Hematocrit values were higher in patients with significant dehydration. Increased hematocrit reflected hemoconcentration and was associated with decreased circulating blood volume. This condition was clinically manifested by dry mucous membranes, reduced skin turgor, tachycardia and arterial hypotension.

Albumin levels were lower in patients with more severe disease course. Hypoalbuminemia was associated with poor general condition, reduced compensatory reserves, more pronounced edema and longer recovery period. Low albumin may also reflect chronic inflammation, malnutrition or protein loss.

The most unfavorable clinical profile was observed in patients with a combination of elevated creatinine, increased urea, decreased estimated glomerular filtration rate, hypokalemia and elevated C-reactive protein. These patients had the highest risk of acute kidney injury, arrhythmia, heart failure decompensation and hospitalization.

Correlation analysis demonstrated that serum creatinine and urea had a positive relationship with complication severity. Estimated glomerular filtration rate had a negative correlation with complication risk. Inflammatory markers such as C-reactive protein and leukocyte count were associated with infectious severity and systemic response.

## **Discussion**

The findings of this study confirm that patients with chronic heart failure who develop acute diarrhea require careful clinical and laboratory monitoring. In such patients, acute diarrhea should not be regarded as an isolated gastrointestinal disorder. It may become a trigger for serious cardiovascular and renal complications.

The pathophysiological basis of complications is related to fluid loss, electrolyte imbalance and reduced renal perfusion. In chronic heart failure, cardiac output may already be reduced. When acute diarrhea causes hypovolemia, renal blood flow decreases further. This may result in acute kidney injury, increased creatinine, elevated urea and decreased estimated glomerular filtration rate.

Renal dysfunction plays a central role in worsening the prognosis. The heart and kidneys are closely connected through hemodynamic, neurohormonal and <https://medjournal.it.com/>

inflammatory mechanisms. When renal function deteriorates, sodium and water balance becomes unstable, electrolyte disorders develop and heart failure symptoms may worsen. This interaction corresponds to the concept of cardiorenal syndrome.

Electrolyte imbalance is another important mechanism of complications. Potassium disorders are especially dangerous in patients with chronic heart failure because they may provoke arrhythmias. Hypokalemia may occur due to diarrhea-related potassium loss and diuretic therapy. Hyponatremia may reflect both severe dehydration and neurohormonal activation in heart failure.

Inflammatory biomarkers are also clinically important. Elevated C-reactive protein and leukocytosis may indicate infectious diarrhea with systemic inflammatory response. Inflammation increases metabolic demand, worsens endothelial function and may increase the risk of cardiovascular decompensation. In patients with limited cardiac reserve, even moderate inflammation can aggravate heart failure.

The results of the study show that individual biomarkers are useful, but their combined assessment has greater prognostic value. For example, elevated creatinine alone may indicate renal impairment, but when it is combined with reduced estimated glomerular filtration rate, high urea, hypokalemia and elevated C-reactive protein, the risk of complications becomes much higher.

Biomarker-based risk stratification may help physicians make timely clinical decisions. Patients with mild diarrhea and stable biomarkers may be managed with careful outpatient observation. In contrast, patients with renal dysfunction, electrolyte imbalance or high inflammatory markers require closer monitoring, correction of fluid and electrolyte status, adjustment of heart failure medications and, in some cases, hospitalization.

Treatment of acute diarrhea in patients with chronic heart failure requires special caution. Fluid replacement is necessary to correct dehydration, but excessive infusion may worsen congestion and provoke heart failure decompensation. Therefore, rehydration should be individualized and guided by clinical status, blood pressure, urine output, renal function and signs of congestion.

Medication management is also important. During significant dehydration, some drugs affecting renal hemodynamics may need temporary dose adjustment under medical supervision. Diuretic therapy should be reassessed depending on the balance between dehydration and congestion. Electrolytes must be monitored repeatedly, especially potassium and sodium.

Thus, laboratory biomarkers provide valuable information for predicting complications and optimizing treatment in patients with acute diarrhea and chronic heart failure.

### **Conclusion**

Acute diarrhea in patients with chronic heart failure is associated with an increased risk of dehydration, electrolyte imbalance, acute kidney injury, arrhythmia, heart failure decompensation and cardiorenal complications.

The most important biomarkers associated with complication risk are serum creatinine, urea, estimated glomerular filtration rate, sodium, potassium, C-reactive protein, leukocyte count, hematocrit and albumin.

Elevated creatinine, increased urea, decreased estimated glomerular filtration rate, hyponatremia, hypokalemia, elevated C-reactive protein and leukocytosis are associated with a more severe clinical course and higher probability of hospitalization.

The combination of renal dysfunction, electrolyte imbalance and inflammatory activity has the greatest prognostic significance. Patients with abnormalities in several biomarkers should be considered a high-risk group and require close clinical and laboratory monitoring.

Biomarker-based risk assessment is an effective approach for early identification of complications, optimization of treatment tactics and prevention of adverse outcomes in patients with acute diarrhea and chronic heart failure.

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