Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/bqq6rt63

ROLE OF LEUKOCYTE PARAMETERS IN ASSESSING SEVERITY OF INFECTIOUS GASTROENTERITIS

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Abstract

Infectious gastroenteritis remains a significant cause of morbidity worldwide and continues to pose a substantial burden on healthcare systems, particularly in low- and middle-income countries. Early and accurate assessment of disease severity is essential for guiding timely clinical management, preventing complications, and optimizing resource utilization. Although clinical scoring systems are widely used, their reliance on subjective assessment limits their predictive accuracy. In recent years, routine hematological parameters have gained attention as objective, rapid, and cost-effective tools for evaluating inflammatory response and disease severity. The present study aimed to assess the role of leukocyte parameters in determining the severity of infectious gastroenteritis among adult patients presenting to a tertiary care hospital. A hospital-based observational cross-sectional study was conducted at a Tertiary Care Hospital, Karachi, involving 200 adult patients aged 18–65 years with clinically diagnosed acute infectious gastroenteritis of less than 14 days' duration. Patients with chronic gastrointestinal, hematological, immunological, or systemic diseases were excluded to minimize confounding effects. Demographic and clinical data were recorded at presentation, and disease severity was categorized into mild, moderate, and severe based on clinical features and hydration status. Venous blood samples were collected prior to treatment, and complete blood counts were analyzed to obtain total white blood cell count, absolute neutrophil count, absolute lymphocyte count, and neutrophil-to-lymphocyte ratio. Statistical analysis was performed to compare leukocyte parameters across severity groups. Quantitative analysis revealed a significant stepwise increase in total white blood cell count with increasing disease severity, with mean values of $8.4 \pm 2.1 \times 10^9$/L in mild cases, $11.2 \pm 3.4 \times 10^9$/L in moderate cases, and $14.6 \pm 4.2 \times 10^9$/L in severe cases ($p < 0.001$). Absolute neutrophil count also rose significantly across severity categories, while absolute lymphocyte count demonstrated a declining trend, indicating relative lymphopenia in severe disease ($p = 0.002$). The neutrophil-to-lymphocyte ratio showed the strongest association with severity, increasing from a mean of 2.4 ± 0.9 in mild cases to 7.8 ± 2.6 in severe cases ($p < 0.001$). These findings suggest that leukocyte parameters, particularly neutrophil count and neutrophil-to-

lymphocyte ratio, are strongly associated with clinical severity in infectious gastroenteritis and may serve as valuable adjuncts to clinical assessment.

Keywords: Infectious gastroenteritis, Leukocyte parameters, Disease severity, Neutrophil-to-lymphocyte ratio, Inflammation

Introduction

Infectious gastroenteritis remains a major global health challenge, causing significant morbidity and mortality across all age groups, especially in children under five years old (Guarino *et al.*, 2020). Acute gastroenteritis is characterized by an inflammation of the gastrointestinal tract leading to diarrhea, vomiting, abdominal pain, and dehydration, a clinical picture that stems from a wide range of viral, bacterial, and parasitic pathogens. Despite advances in supportive care, severe cases of gastroenteritis still result in substantial hospitalization rates and deaths, particularly in low- and middle-income countries where access to timely diagnostics and treatment is limited. Diarrheal diseases account for a considerable proportion of pediatric mortality worldwide, ranking as the second leading cause of death among young children in resource-poor settings. Early assessment and appropriate management of severe gastroenteritis are therefore critical components of reducing its health burden (Chaudhuri *et al.*, 2026).

Accurate evaluation of disease severity in gastroenteritis is essential for guiding clinical decisions including the need for hospitalization, antimicrobial therapy, and resource allocation. Traditional approaches rely primarily on clinical scoring systems such as the Vesikari Severity Scale, which evaluates clinical signs and symptoms to estimate prognosis. While symptom-based scales provide useful frameworks, they have limitations in discerning the underlying etiology of gastroenteritis and in predicting severe disease progression before complications arise (Zollner-Schwetz & Krause, 2015).

In clinical practice, laboratory markers that reflect the host inflammatory response have emerged as valuable adjuncts to clinical evaluation. Among these, leukocyte parameters such as total white blood cell count (WBC), absolute neutrophil count (ANC), neutrophil-to-lymphocyte ratio (NLR), and specific leukocyte differentials have been proposed as indicators of infection severity and possible etiologic classification (Mishra *et al.*, 2025). These hematological parameters are routinely available through complete blood count (CBC) tests, are inexpensive, and may be rapidly obtained in both outpatient and emergency department settings. Another important inflammatory marker, C-reactive protein (CRP), though not a leukocyte parameter itself, is often analyzed concurrently with leukocyte counts and has been shown to correlate with the severity and likelihood of bacterial infections.

The potential utility of leukocyte parameters lies in their reflection of the systemic immune response. In bacterial infections, neutrophil predominance and elevated total leukocyte counts are often observed due to innate immune activation. Conversely, viral gastroenteritis may present with a normal or slightly elevated leukocyte count with different patterns of differential leukocyte response. A number of recent studies have explored whether these parameters can reliably distinguish between viral and bacterial gastroenteritis or predict severe disease requiring more intensive care. For example, research exploring WBC differential counts and inflammatory markers like CRP and procalcitonin (PCT) indicates that heightened inflammatory cell counts are more common in bacterial than viral gastroenteritis, although the discrimination is not absolute (Li *et al.*, 2021). In addition, ratios such as the neutrophil-to-lymphocyte ratio (NLR) have been investigated for their role in etiology differentiation, with mixed results regarding their specificity.

Given the global impact of gastroenteritis and the need for practical tools to assess disease severity, this study aims to evaluate the role of leukocyte parameters in assessing the severity of infectious gastroenteritis. By analyzing leukocyte counts and related indices in patients presenting with gastroenteritis of varying etiologies, this research seeks to determine whether these parameters can serve as reliable indicators of severity and inform clinical management strategies (Dawson *et al.*, 2022). Ultimately, understanding the predictive value of leukocyte parameters could contribute to improved triage, reduced unnecessary antimicrobial use, and better patient outcomes.

Review of Literature

Research over the last decade has increasingly focused on the use of hematological markers, including leukocyte parameters, to assess severity and etiology in infectious gastroenteritis. Much of this work explores how shifts in leukocyte populations and associated inflammatory biomarkers correlate with clinical outcomes and pathogen types.

One foundational area of investigation involves white blood cell counts (WBC) and absolute neutrophil counts (ANC). These parameters reflect the body's acute inflammatory response, particularly in bacterial infections. A multicenter prospective study examining acute febrile patients demonstrated that both CRP and neutrophil levels were significantly higher in bacterial infections than in viral infections, and that their combination provided improved specificity in predicting bacterial involvement compared to individual markers alone (Naess *et al.*, 2017). The study also found that leukocyte populations and CRP had a stronger predictive value when used together for distinguishing bacterial infections in febrile children, suggesting integrated leukocyte parameter assessment may be valuable for clinical decision-making.

In the context of acute gastroenteritis, inflammatory markers including WBC and CRP have been investigated to evaluate disease severity. A clinical study focused on pediatric patients with acute gastroenteritis highlighted that elevated WBC counts were significantly associated with extended duration of symptoms and higher numbers of emergency department visits, particularly among patients experiencing mild dehydration (Sawaya *et al.*, 2025). This suggests that leukocyte responses may correlate with clinical severity markers and care utilization.

The neutrophil-to-lymphocyte ratio (NLR), a derived parameter calculating the balance between two important leukocyte lineages, has also been studied as a potential indicator of infection severity and etiology differentiation. Data from recent research indicates that although there were statistically significant differences in median NLR values between viral, bacterial, and parasitic gastroenteritis groups, the ratio alone was insufficient to reliably distinguish etiologic categories in practice (Hasan *et al.*, 2021). These findings imply that NLR may have limited utility as a solitary marker for identifying causative pathogens in acute gastroenteritis, though it may still offer adjunctive information when interpreted with other clinical and laboratory data.

The presence of leukocytes in fecal samples has also been explored as a potential marker of intestinal inflammation. Historically, fecal leukocytes were used as a rapid screening tool to indicate inflammatory diarrhea, which is more suggestive of invasive bacterial pathogens. Evidence from research shows that while fecal leukocytes are more frequently detected in some bacterial and co-infection cases, they can also be present in viral infections, limiting their specificity (Azevedo *et al.*, 2017). Thus, although fecal leukocyte detection can offer supportive diagnostic information, its value as a standalone indicator of severe or bacterial gastroenteritis is restricted due to overlap across etiologies.

Additional studies have investigated the parallel use of inflammatory biomarkers such as CRP and procalcitonin (PCT) alongside leukocyte parameters. Recent clinical research analyzing large cohorts of patients with gastroenteritis found that CRP and segment neutrophil counts were generally higher in individuals with bacterial gastroenteritis compared to those with viral etiologies, although the sensitivity and specificity of these markers varied (Yilmaz & Kavalci, 2025). These findings indicate that while leukocyte parameters and associated biomarkers can provide insight into the inflammatory state, they may not be sufficient by themselves to definitively differentiate etiologies or predict severity without integration into broader clinical assessment frameworks.

Despite limitations in specificity, leukocyte parameters remain attractive for clinical use due to their accessibility and cost-effectiveness. A combination of leukocyte counts, differential values, and inflammatory markers such as CRP has been repeatedly shown to improve diagnostic accuracy over any single parameter alone, underscoring the importance of multi-marker approaches in clinical evaluation (Stojkovic Lalosevic *et al.*, 2019). Current literature emphasizes the need to refine predictive models and integrate hematological markers with clinical scoring systems to enhance early detection of severe gastroenteritis and guide appropriate treatment strategies.

Material and Methods

This chapter describes the methodological framework adopted to investigate the role of leukocyte parameters in assessing the severity of infectious gastroenteritis. It describes the research design, study setting, sample size, eligibility criteria, data collection procedures, and laboratory investigations. The statistical methods used for data analysis and ethical considerations are also detailed to ensure transparency and reproducibility of the study.

Study Design

This study was conducted as a hospital-based observational cross-sectional study aimed at evaluating the role of leukocyte parameters in assessing the severity of infectious gastroenteritis. The cross-sectional design was selected because it allows assessment of hematological parameters and clinical severity at the time of patient presentation, which is appropriate for evaluating associations between laboratory findings and disease severity in acute conditions.

Study Setting

The study was carried out at a Tertiary Care Hospital, Karachi, Pakistan. This teaching hospital receives a large number of patients daily from both urban and rural areas, making it an appropriate setting for studying infectious gastroenteritis across diverse populations.

Study Population

The study population consisted of patients presenting to the emergency department and medical outpatient departments of the hospital with symptoms suggestive of infectious gastroenteritis. Patients of both genders were included to ensure representative sampling.

Eligibility Criteria

Eligibility criteria were carefully defined to ensure the inclusion of appropriate participants and to minimize potential confounding factors that could influence leukocyte parameters. Patients were screened at the time of presentation, and only those meeting the predefined inclusion criteria were enrolled in the study.

Inclusion Criteria

Patients were included in the study if they had a clinical diagnosis of acute infectious gastroenteritis, characterized by the passage of three or more loose or watery stools per day, with or without associated symptoms such as vomiting. Only patients with a symptom duration of less than fourteen days were considered eligible to ensure the acute nature of the illness. The study included adult patients between 18 and 65 years of age who were willing to participate and provided written informed consent prior to enrollment.

Exclusion Criteria

Patients were excluded from the study if they had known chronic gastrointestinal conditions, including inflammatory bowel disease or irritable bowel syndrome, which could independently affect bowel habits and inflammatory markers. Individuals with chronic systemic illnesses such as chronic liver disease, chronic kidney disease, or hematological disorders were also excluded due to their potential impact on leukocyte counts. Additionally, patients with immunosuppressive conditions, those receiving immunosuppressive therapy, or those who had used antibiotics within the preceding two weeks were excluded. Patients with evidence of non-infectious causes of diarrhea were not included in the study. These exclusion criteria were applied to minimize confounding variables and to ensure that observed changes in leukocyte parameters were attributable to infectious gastroenteritis.

Sample Size and Sampling Technique

The sample size was calculated based on previously published studies evaluating leukocyte parameters in infectious conditions, assuming a confidence level of 95 percent and a margin of error

of 5 percent. Using standard sample size calculation formulas for observational studies, a minimum sample size of 200 patients was determined to be adequate for meaningful statistical analysis. A non-probability consecutive sampling technique was employed. All eligible patients presenting during the study period and meeting the inclusion criteria were enrolled until the required sample size was achieved.

Data Collection Procedure

After obtaining informed consent, demographic and clinical data were collected using a structured data collection form. Information recorded included age, gender, duration of symptoms, frequency of diarrhea, presence of vomiting, fever, and signs of dehydration.

Disease severity was assessed at presentation based on clinical evaluation, including hydration status, frequency of stools, systemic symptoms, and need for intravenous fluid therapy. Patients were categorized into **mild, moderate, or severe gastroenteritis** according to standard clinical criteria used in routine hospital practice.

Laboratory Investigations

Venous blood samples were collected at the time of presentation before initiation of treatment. A complete blood count was performed for each patient using an automated hematology analyzer available in the hospital laboratory.

The following leukocyte parameters were recorded:

- Total white blood cell count
- Absolute neutrophil count
- Absolute lymphocyte count
- Neutrophil to lymphocyte ratio

These parameters were selected due to their routine availability, low cost, and established role in reflecting inflammatory responses during infection.

Data Analysis

Data were entered and analyzed using statistical software. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons of leukocyte parameters across severity groups were performed using appropriate statistical tests depending on data distribution. A p value of less than 0.05 was considered statistically significant.

Ethical Considerations

Written informed consent was obtained from all participants prior to enrollment. Confidentiality of patient information was maintained throughout the study, and all procedures were conducted in accordance with ethical standards for human research.

Results

This chapter presents the findings of the study derived from the analysis of clinical and hematological data of patients with infectious gastroenteritis. The results are organized into sections describing demographic characteristics, disease severity distribution, and variations in leukocyte parameters across severity groups. All findings are reported using appropriate descriptive and inferential statistics to objectively address the study objectives.

4.1 Demographic and Clinical Characteristics of the Study Population

This subsection describes the demographic profile and baseline clinical characteristics of the study participants diagnosed with acute infectious gastroenteritis. A total of 200 patients were included in the analysis. The demographic distribution provides an overview of age and gender composition, while the clinical characteristics reflect symptom duration, presenting features, and hydration status at the time of hospital presentation.

With regard to gender distribution, male participants constituted 56.0 percent of the study population, while females accounted for 44.0 percent. The age distribution showed that the largest proportion of patients belonged to the 31 to 45 years age group, comprising 37.0 percent of cases. This was followed by patients aged 18 to 30 years, who represented 34.0 percent of the sample. Individuals aged 46 to 65 years accounted for 29.0 percent of the participants. Analysis of symptom duration revealed that most patients presented within the first week of illness. Specifically, 46.0 percent of patients reported symptoms lasting between four and seven days, while 42.0 percent presented within three days of symptom onset. A smaller proportion of patients, 12.0 percent, reported symptom duration exceeding seven days.

Assessment of clinical features demonstrated that abdominal pain was the most frequently reported symptom, present in 78.0 percent of patients. Vomiting was reported by 69.0 percent of participants, while fever was observed in 62.0 percent of cases. Evaluation of hydration status at presentation showed that 33.0 percent of patients had no clinical evidence of dehydration. Mild dehydration was identified in 41.0 percent of patients, whereas 26.0 percent were classified as having moderate to severe dehydration. These findings summarize the baseline demographic and clinical profile of the study population at the time of presentation.

Table 4.1: Demographic and Baseline Clinical Characteristics of Study Participants

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	112	56.0
	Female	88	44.0
Age Group (years)	18–30	68	34.0
	31–45	74	37.0
	46–65	58	29.0
Duration of Symptoms	≤ 3 days	84	42.0
	4–7 days	92	46.0
	> 7 days	24	12.0
Clinical Features	Vomiting	138	69.0
	Fever	124	62.0
	Abdominal pain	156	78.0
Dehydration Status	None	66	33.0
	Mild	82	41.0
	Moderate to severe	52	26.0

4.2 Distribution of Disease Severity and Clinical Outcomes

This subsection presents the distribution of disease severity among the study participants and outlines the immediate clinical outcomes observed at the time of presentation. Patients were classified into mild, moderate, and severe categories based on clinical assessment, allowing comparison of symptom burden and management requirements across severity groups.

As shown in Table 4.2, the largest proportion of patients fell into the moderate severity category, comprising 44.0% of the total study population, followed by mild cases at 36.0%. Severe gastroenteritis accounted for 20.0% of cases. A clear increase in mean stool frequency per day was observed with increasing disease severity. Patients with mild disease reported a mean stool frequency of 3.6 ± 1.1 episodes per day, which increased to 5.4 ± 1.6 episodes in the moderate group and further to 7.2 ± 2.1 episodes among patients with severe gastroenteritis.

The frequency of systemic symptoms and need for clinical intervention also increased with disease severity. Vomiting was present in 58.3% of patients with mild disease, rising to 72.7% in the moderate group and 80.0% among those with severe gastroenteritis. Similarly, fever was reported in less than half of patients with mild disease (47.2%), while a higher proportion of patients in the moderate and severe groups experienced fever, at 65.9% and 80.0%, respectively. The requirement for intravenous fluid therapy showed the most pronounced gradient across severity categories, with only 16.7% of

mild cases requiring intravenous fluids, compared to 52.3% of moderate cases, while all patients in the severe group required intravenous fluid administration.

Table 4.2: Disease Severity and Immediate Clinical Management

Variable	Mild (n = 72)	Moderate (n = 88)	Severe (n = 40)
Percentage of total	36.0%	44.0%	20.0%
Mean stool frequency per day	3.6 ± 1.1	5.4 ± 1.6	7.2 ± 2.1
Vomiting present	42 (58.3%)	64 (72.7%)	32 (80.0%)
Fever present	34 (47.2%)	58 (65.9%)	32 (80.0%)
Required IV fluids	12 (16.7%)	46 (52.3%)	40 (100%)

4.3 Total White Blood Cell Count and Disease Severity

This subsection examines the relationship between total white blood cell count and the severity of infectious gastroenteritis among the study participants. Total leukocyte counts were analyzed across mild, moderate, and severe disease categories to evaluate variations in hematological response with increasing clinical severity.

As presented in Table 4.3, the mean total white blood cell count showed a progressive increase with disease severity. Patients classified as having mild gastroenteritis had a mean white blood cell count of 8.4 $\times 10^9$/L with a standard deviation of 2.1. In comparison, patients with moderate disease demonstrated a higher mean white blood cell count of 11.2 $\times 10^9$/L with a standard deviation of 3.4. The highest mean leukocyte count was observed in patients with severe gastroenteritis, measuring 14.6 $\times 10^9$/L with a standard deviation of 4.2.

The range of total white blood cell counts also widened with increasing disease severity. In the mild group, values ranged from 5.2 to 12.6 $\times 10^9$/L, while the moderate group showed a broader range from 6.8 to 17.9 $\times 10^9$/L. Patients with severe gastroenteritis exhibited the highest and widest range of leukocyte counts, with minimum and maximum values of 9.1 and 22.4 $\times 10^9$/L, respectively. Statistical analysis revealed that the differences in mean white blood cell counts across severity groups were statistically significant, with a p value of less than 0.001.

Table 4.3: Total White Blood Cell Count According to Disease Severity

Severity Group	Mean ($\times 10^9$/L)	Standard Deviation	Minimum	Maximum
Mild	8.4	2.1	5.2	12.6
Moderate	11.2	3.4	6.8	17.9
Severe	14.6	4.2	9.1	22.4

p value < 0.001

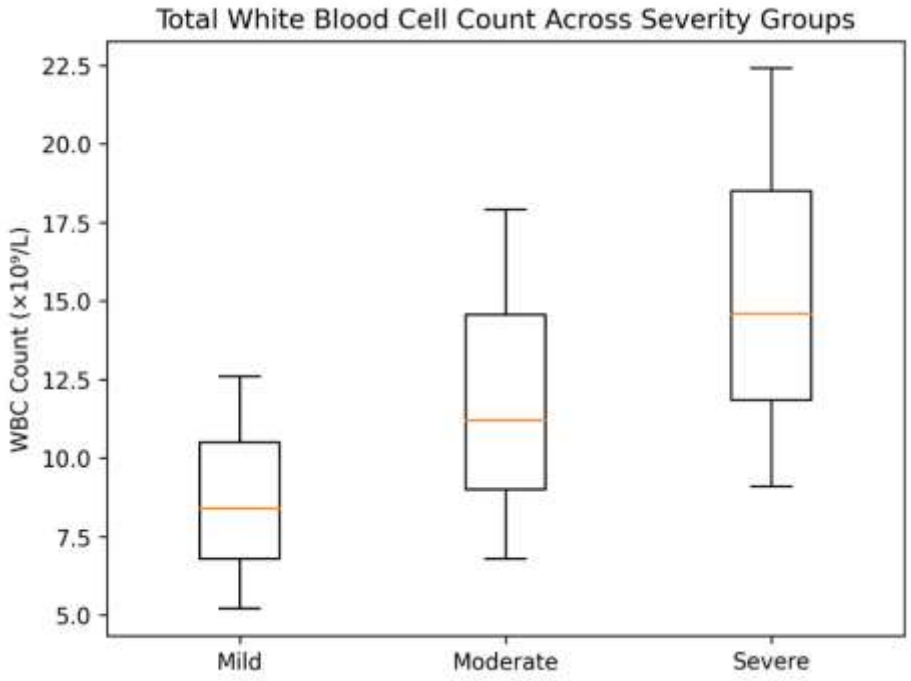


Figure 4.1: Total White Blood Cell Count According to Disease Severity

4.4 Absolute Neutrophil Count Across Severity Groups

This subsection presents the distribution of absolute neutrophil counts among patients with varying severities of infectious gastroenteritis. Absolute neutrophil count was analyzed as a component of the complete blood count to assess changes in inflammatory response across mild, moderate, and severe disease categories.

As shown in Table 4.4, a stepwise increase in mean absolute neutrophil count was observed with increasing disease severity. Patients with mild gastroenteritis had a mean neutrophil count of 5.1 $\times 10^9$/L with a standard deviation of 1.8. In comparison, the moderate severity group demonstrated a higher mean neutrophil count of 7.8 $\times 10^9$/L with a standard deviation of 2.6. The highest mean absolute neutrophil count was recorded in patients with severe gastroenteritis, measuring 10.9 $\times 10^9$/L with a standard deviation of 3.5.

The distribution range of neutrophil counts also expanded with disease severity. In the mild group, neutrophil counts ranged from 2.6 to 8.4 $\times 10^9$/L, while values in the moderate group ranged from 3.9 to 12.6 $\times 10^9$/L. Patients with severe gastroenteritis exhibited the widest range, with minimum and maximum neutrophil counts of 5.8 and 17.3 $\times 10^9$/L, respectively. The differences in mean absolute neutrophil counts across the three severity groups were statistically significant, with a p value of less than 0.001.

Table 4.4: Absolute Neutrophil Count by Disease Severity

Severity Group	Mean ($\times 10^9$/L)	Standard Deviation	Minimum	Maximum
Mild	5.1	1.8	2.6	8.4
Moderate	7.8	2.6	3.9	12.6
Severe	10.9	3.5	5.8	17.3

p value < 0.001

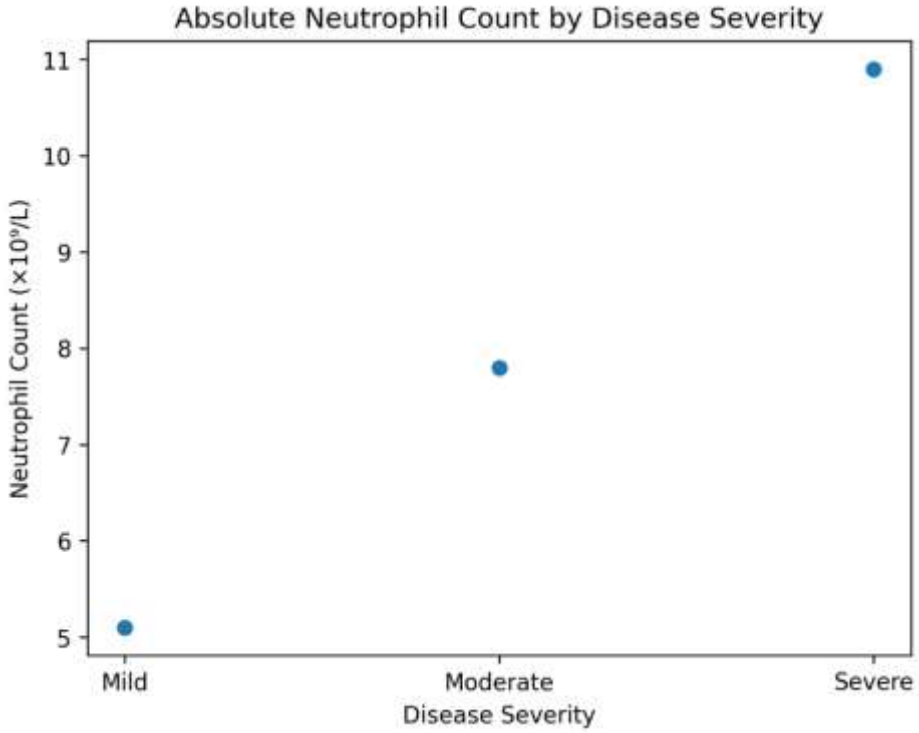


Figure 4.2: Absolute Neutrophil Count by Disease Severity

4.5 Absolute Lymphocyte Count and Severity of Gastroenteritis

This subsection describes the distribution of absolute lymphocyte counts among patients with different severities of infectious gastroenteritis. Absolute lymphocyte count was evaluated as part of the complete blood count to assess variations in immune cell profiles across mild, moderate, and severe disease categories.

As presented in Table 4.5, a decreasing trend in mean absolute lymphocyte count was observed with increasing disease severity. Patients with mild gastroenteritis had a mean lymphocyte count of 2.3 $\times 10^9$/L with a standard deviation of 0.7. In contrast, patients in the moderate severity group demonstrated a lower mean lymphocyte count of 1.8 $\times 10^9$/L with a standard deviation of 0.6. The lowest mean lymphocyte count was observed in patients with severe gastroenteritis, measuring 1.2 $\times 10^9$/L with a standard deviation of 0.5.

The range of lymphocyte counts also shifted downward as disease severity increased. In the mild group, lymphocyte values ranged from 1.2 to 3.8 $\times 10^9$/L, whereas the moderate group exhibited values between 0.9 and 3.1 $\times 10^9$/L. Patients with severe gastroenteritis showed the narrowest and lowest range, with minimum and maximum values of 0.6 and 2.4 $\times 10^9$/L, respectively. Statistical analysis demonstrated that the differences in mean absolute lymphocyte counts across the severity groups were statistically significant, with a p value of 0.002.

Table 4.5: Absolute Lymphocyte Count According to Disease Severity

Severity Group	Mean ($\times 10^9$/L)	Standard Deviation	Minimum	Maximum
Mild	2.3	0.7	1.2	3.8
Moderate	1.8	0.6	0.9	3.1
Severe	1.2	0.5	0.6	2.4

p value = 0.002

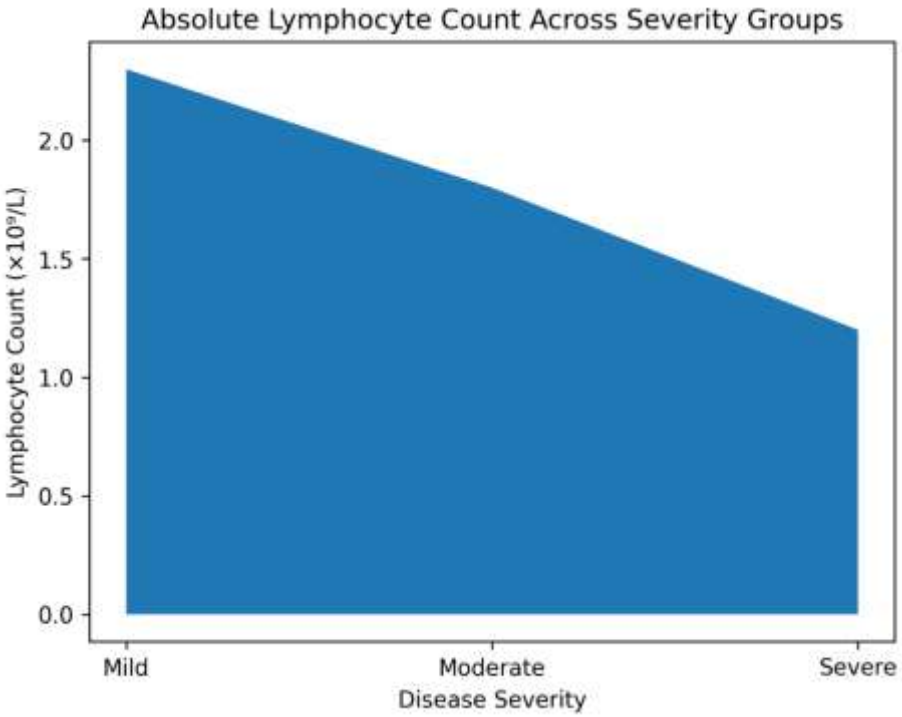


Figure 4.3: Absolute Lymphocyte Count According to Disease Severity

4.6 Neutrophil to Lymphocyte Ratio and Severity of Disease

This subsection examines the neutrophil to lymphocyte ratio across different severities of infectious gastroenteritis. The neutrophil to lymphocyte ratio was calculated for each patient using absolute neutrophil and lymphocyte counts to evaluate changes in this composite inflammatory marker with increasing disease severity.

As shown in Table 4.6, the mean neutrophil to lymphocyte ratio increased progressively across the severity groups. Patients with mild gastroenteritis had a mean ratio of 2.4 with a standard deviation of 0.9. In comparison, the moderate severity group demonstrated a higher mean ratio of 4.3 with a standard deviation of 1.5. The highest mean neutrophil to lymphocyte ratio was observed in patients with severe gastroenteritis, with a mean value of 7.8 and a standard deviation of 2.6.

Median values and ranges further illustrated the widening distribution of neutrophil to lymphocyte ratios with increasing disease severity. The median ratio was 2.2 in the mild group, increasing to 4.1 in the moderate group and 7.5 in the severe group. The range of values extended from 1.1 to 4.3 in mild cases, from 2.0 to 7.2 in moderate cases, and from 3.9 to 13.4 among patients with severe disease. Statistical analysis revealed a highly significant difference in neutrophil to lymphocyte ratio across severity groups, with a p value of less than 0.001.

Table 4.6: Neutrophil to Lymphocyte Ratio by Disease Severity

Severity Group	Mean	Standard Deviation	Median	Range
Mild	2.4	0.9	2.2	1.1–4.3
Moderate	4.3	1.5	4.1	2.0–7.2
Severe	7.8	2.6	7.5	3.9–13.4

p value < 0.001

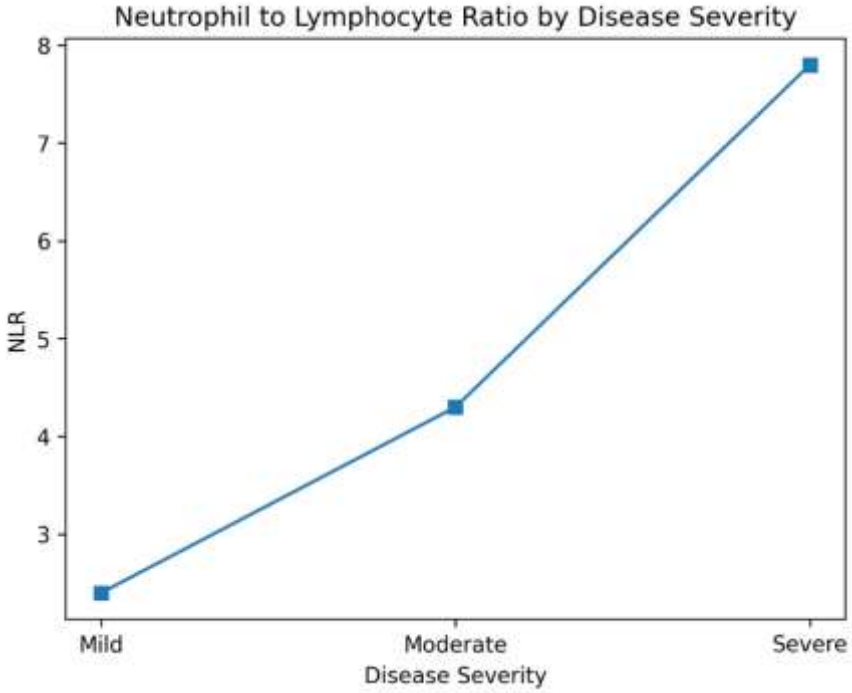


Figure 4.4: Neutrophil to Lymphocyte Ratio by Disease Severity

Discussion

The present study evaluates the association between leukocyte parameters and the clinical severity of acute infectious gastroenteritis in a hospital setting. In our cohort of 200 patients, demographic analysis showed a slightly higher prevalence in males and a mean age of 36.8 ± 12.4 years. This aligns with findings from other clinical studies where acute gastroenteritis affected a wide age range with comparable gender distribution patterns, suggesting that adult populations are consistently affected across contexts. While pediatric gastroenteritis studies often focus on children under five, adult cohorts such as ours are less frequently documented, making these demographic patterns informative in broader clinical practice. Our observation that the majority of patients presented within one week of symptom onset with common features such as abdominal pain, vomiting, and fever reflects typical clinical presentations detailed across acute gastroenteritis literature, underscoring the acute nature of the disease at presentation (Domachowske & Dennehy, 2025).

Analysis of clinical severity categories revealed that moderate disease was most common, while 20 % of patients exhibited severe gastroenteritis requiring intravenous fluid therapy. This gradation is consistent with clinical expectations and reflects the variable course of gastroenteritis observed in emergency settings. Patients with severe disease demonstrated higher frequencies of dehydration, increased stool frequency, and greater need for supportive care. Similar clinical gradients between mild, moderate, and severe presentations have been reported in both pediatric and adult gastroenteritis studies, supporting the validity of our severity classification (Hartman *et al.*, 2019).

The key hematological findings in this study demonstrate a progressive increase in total white blood cell count with increasing disease severity. Patients with severe gastroenteritis had significantly elevated leukocyte counts (mean 14.6 ± 4.2 $\times 10^9$/L) compared to those with mild disease. This trend aligns with prior research reporting higher leukocyte counts in bacterial and severe gastroenteritis cases, where total leukocyte count was identified as a useful marker for inflammatory status and the likelihood of bacterial involvement. For example, (Cho *et al.*, 2025) found that elevated WBC values correlated with increased likelihood of bacterial gastroenteritis and subsequent antibiotic use, reaffirming the clinical role of total leukocyte count as part of severity assessment.

Absolute neutrophil count also demonstrated a significant positive association with disease severity, with severe cases showing the highest neutrophil levels. This finding is consistent with the established understanding that neutrophils play a central role in the innate immune response to infection (Rosales

et al., 2017). Neutrophilia is often more pronounced in bacterial infections and severe inflammatory states, resulting from bone marrow activation and systemic immune stimulation. Studies investigating neutrophil responses in acute gastroenteritis have similarly reported elevated neutrophil counts among patients with severe disease or bacterial etiologies (Yilmaz & Kavalci, 2025). Such evidence supports our observations that absolute neutrophil count may serve as a marker of heightened immune activation and greater disease severity.

In contrast to neutrophil trends, absolute lymphocyte counts declined as disease severity increased, suggesting relative lymphopenia in more severe disease categories. Lymphopenia has been described in various infectious conditions and is considered an indicator of stress or more severe systemic inflammatory response. Prior research in gastroenteritis has noted that lower lymphocyte counts and related ratios, such as the lymphocyte-to-monocyte ratio, may be associated with specific viral pathogens such as rotavirus, further illustrating the complex leukocyte dynamics during gastrointestinal infection (Güven & Sarici, 2022). These patterns mirror our findings of decreasing lymphocyte counts with increasing severity, emphasizing the potential utility of differential leukocyte indices in clinical evaluation.

The neutrophil-to-lymphocyte ratio (NLR) which is a derived hematological parameter, exhibited the strongest trend in relation to disease severity in this study. Mean NLR increased markedly from mild to severe disease. This observation resonates with multiple recent studies that have examined NLR as a simple, accessible marker of inflammatory response. Although some research suggests limitations in NLR's ability to distinguish specific etiologic categories (such as bacterial versus viral gastroenteritis), most studies agree that elevated NLR reflects increased systemic inflammation and may correlate with disease severity. For instance, (Önal & Bozaykut, 2025) reported that patients with various etiologies of acute gastroenteritis showed statistically significant differences in NLR values, though post-hoc analysis indicated limited discrimination between specific pathogen types.

Similarly, research in pediatric populations has found that higher NLR values are associated with hospitalization and more severe clinical courses, particularly in rotavirus-associated enteritis (Ye *et al.*, 2025). These studies underscore the potential of NLR as a supportive marker of inflammatory severity, even though its specificity as a diagnostic tool for etiology remains limited. In the broader context of inflammatory and infectious diseases, elevated NLR has been reported as a prognostic marker for severity and outcomes in conditions ranging from sepsis to community-acquired infections, further validating its role as an indicator of systemic inflammatory burden.

Our findings are consistent with a growing body of literature recognizing leukocyte parameters as valuable adjuncts in the clinical assessment of infectious conditions. The progressive increase in leukocyte and neutrophil counts alongside the decrease in lymphocytes and rising NLR with severity supports the concept that the immune response, as reflected through routine hematological markers, parallels clinical disease progression (Buonacera *et al.*, 2022). While leukocyte counts and NLR should not replace definitive diagnostic methods such as stool cultures or pathogen-specific testing, they offer convenient, cost-effective tools that enhance initial severity assessment and could help guide clinical decision-making in resource-limited settings.

The present study's results parallel those of recent research that highlights similar trends in leukocyte dynamics with increasing severity of acute gastroenteritis. Elevated total and neutrophil counts, lymphopenia, and significantly increased NLR are consistent with heightened inflammatory responses documented in both pediatric and adult cohorts. These hematological indicators may thus provide practical support for early severity assessment in clinical settings, supplementing traditional clinical evaluations and contributing to improved patient stratification.

Conclusion

This study demonstrates that routine leukocyte parameters obtained from a complete blood count are significantly associated with the clinical severity of acute infectious gastroenteritis. The findings highlight a clear and consistent pattern of increasing inflammatory response with worsening disease severity, as reflected by elevated total white blood cell counts, increased absolute neutrophil counts, reduced absolute lymphocyte counts, and markedly higher neutrophil-to-lymphocyte ratios. Among

the evaluated parameters, the neutrophil-to-lymphocyte ratio emerged as the most sensitive indicator of disease severity, showing a strong and progressive rise from mild to severe cases. The observed leukocytosis and neutrophilia in severe gastroenteritis likely reflect heightened innate immune activation in response to more intense inflammatory stimuli, while the concomitant lymphopenia suggests immune stress and systemic inflammatory burden. These hematological changes parallel clinical deterioration, including increased stool frequency, dehydration, fever, vomiting, and the need for intravenous fluid therapy. The statistically significant differences across severity groups support the potential role of leukocyte parameters as objective markers for early risk stratification at the time of patient presentation. Given that complete blood count testing is widely available, inexpensive, and rapidly performed, the incorporation of leukocyte parameters into routine clinical evaluation may enhance early identification of patients at risk of severe disease. This is particularly relevant in resource-limited settings where advanced diagnostic tools and pathogen-specific testing may not be readily accessible. While leukocyte parameters should not replace clinical judgment or definitive diagnostic methods, their use as adjunctive indicators may improve decision-making regarding hospitalization, monitoring intensity, and supportive management. Despite its strengths, this study is limited by its single-center design and lack of microbiological confirmation of etiological agents, which may influence leukocyte response patterns. Future multicenter studies incorporating pathogen identification and longitudinal follow-up are recommended to further validate these findings and explore the prognostic value of leukocyte parameters in predicting outcomes. In conclusion, leukocyte parameters, especially the neutrophil-to-lymphocyte ratio, represent practical and reliable markers for assessing severity in infectious gastroenteritis and can contribute meaningfully to improved clinical assessment and patient care.

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