



## COMPARATIVE STUDY OF SERUM FERRITIN, C-REACTIVE PROTEIN (CRP) AND NEUTROPHIL-LYMPHOCYTE RATIO (NLR) AS PREDICTORS OF DISEASE SEVERITY IN ACUTE RESPIRATORY INFECTIONS

### General Medicine

<b>Dr. Priyanshu Jain</b>	MBBS, M.D. Pulmonary Medicine Senior Resident in Emergency Medicine Department at Government Bundelkhand Medical college, Sagar, M.P
<b>Dr. Ayush Tiwari</b>	MBBS, JR-2 Post graduate Resident in General Medicine Department at Government Bundelkhand Medical college, Sagar, M.P
<b>Dr. Shashank Jain</b>	MBBS, JR-1 Post graduate Resident in General Medicine Department at Government Bundelkhand Medical college, Sagar, M.P
<b>Dr. Avneesh Singhai*</b>	MBBS, M.D. General Medicine Senior Resident in General Medicine Department at Bundelkhand Medical College, Sagar, M.P*Corresponding Author

### ABSTRACT

Acute respiratory infections (ARIs) are a major cause of morbidity and mortality, requiring early severity assessment. This study evaluated serum ferritin, C-reactive protein (CRP), and neutrophil-lymphocyte ratio (NLR) as predictors of disease severity in 100 patients. A significant increase in these biomarkers was observed with increasing severity ( $p < 0.001$ ). Patients with severe disease had markedly higher values compared to mild and moderate cases. Among these, NLR proved to be a simple and cost-effective marker. The combined use of ferritin, CRP, and NLR can aid in early risk stratification and guide timely clinical management in patients with acute respiratory infections

### KEYWORDS

Acute Respiratory Infections, Serum Ferritin, C-Reactive Protein (CRP), Neutrophil-Lymphocyte Ratio (NLR), Disease Severity.

### INTRODUCTION

Acute respiratory infections (ARIs) remain a leading cause of morbidity and mortality worldwide, particularly in developing countries, where they impose a significant burden on healthcare systems. Early identification of patients at risk of severe disease is crucial for timely intervention, appropriate triaging, and optimal utilization of intensive care resources. Clinical scoring systems such as CURB-65 are commonly used; however, they may not always accurately predict outcomes, thereby necessitating the use of reliable and easily accessible biomarkers<sup>[1]</sup>.

Serum ferritin, an intracellular iron storage protein, also functions as an acute phase reactant and is elevated in systemic inflammatory states. High ferritin levels have been associated with cytokine-mediated hyperinflammation and may reflect disease severity in infections<sup>[2]</sup>. Similarly, C-reactive protein (CRP), synthesized by the liver in response to interleukin-6, is a well-established marker of inflammation and has been widely used in the assessment of infectious diseases, including pneumonia and other ARIs.

The neutrophil-lymphocyte ratio (NLR), derived from a routine complete blood count, is an inexpensive and readily available marker that reflects the balance between innate and adaptive immune responses. Elevated NLR has been shown to correlate with increased disease severity and poor outcomes in various infections and inflammatory conditions<sup>[3]</sup>.

Despite the individual utility of these biomarkers, there is limited comparative data evaluating their relative effectiveness in predicting disease severity in ARIs. Therefore, this study aims to compare serum ferritin, CRP, and NLR as predictors of disease severity, thereby identifying the most reliable biomarker for early risk stratification and improved clinical decision-making.

### Materials and Methods

This prospective observational study was conducted in the Department of General Medicine at a tertiary care hospital over a period of 04 months. A total of 100 patients diagnosed with acute respiratory infections (ARIs) were enrolled after obtaining informed consent. The diagnosis of ARI was based on clinical features such as fever, cough, dyspnea, and relevant radiological findings. Disease severity was assessed using standard clinical criteria, including respiratory rate, oxygen saturation, need for oxygen support, and radiological extent of involvement.

Blood samples were collected at the time of admission for estimation of serum ferritin, C-reactive protein (CRP), and complete blood count (CBC), from which the neutrophil-lymphocyte ratio (NLR) was calculated. Patients were categorized into mild, moderate, and severe

groups based on predefined clinical parameters. Statistical analysis was performed to compare the levels of serum ferritin, CRP, and NLR among different severity groups and to evaluate their predictive value.

### Inclusion Criteria

- Patients aged  $\geq 18$  years
- Patients clinically diagnosed with acute respiratory infections
- Patients willing to give informed consent
- Patients admitted within 7 days of onset of symptoms

### Exclusion Criteria

- Patients with chronic inflammatory or autoimmune diseases
- Patients with known malignancy
- Patients with chronic liver disease or chronic kidney disease
- Patients on immunosuppressive therapy or steroids
- Pregnant women

### Data Collection and Procedures

Detailed history and clinical examination findings were recorded in a structured proforma. Baseline investigations including CBC, serum ferritin, and CRP were performed at admission using standard laboratory methods. NLR was calculated by dividing absolute neutrophil count by absolute lymphocyte count. Radiological investigations such as chest X-ray or CT scan were performed as indicated.

Patients were monitored throughout their hospital stay for disease progression, need for ICU admission, ventilatory support, and outcome. The collected data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean  $\pm$  standard deviation, and categorical variables as percentages. Comparative analysis was done using suitable statistical tests, with a p-value  $< 0.05$  considered statistically significant.

### RESULTS:

**TABLE – 1** Baseline Characteristics of Study Population (n = 100)

Parameter	Value
Age (years, mean $\pm$ SD)	46.8 $\pm$ 15.2
Gender (Male/Female)	60 / 40
Fever	82 (82%)
Cough	76 (76%)
Dyspnea	58 (58%)
SpO <sub>2</sub> at Admission (%)	91.2 $\pm$ 4.6
Diabetes Mellitus	28 (28%)
Hypertension	32 (32%)

**TABLE-2** Distribution of Patients According to Disease Severity

Severity Category	Number of Patients (n=100)	Percentage (%)
Mild	30	30%
Moderate	40	40%
Severe	30	30%

**TABLE-3** Comparison of Mean Serum Ferritin, CRP, and NLR Among Severity Groups

Parameter	Mild (n=30)	Moderate (n=40)	Severe (n=30)	p-value
Serum Ferritin (ng/mL)	180 ± 65	420 ± 110	780 ± 210	<0.001
CRP (mg/L)	12.5 ± 5.2	38.6 ± 10.4	85.2 ± 20.8	<0.001
NLR	2.8 ± 1.1	5.6 ± 2.0	10.4 ± 3.5	<0.001

A total of 100 patients with acute respiratory infections were included in the study. The mean age of the study population was  $46.8 \pm 15.2$  years, with a male predominance (60%). Based on clinical severity, 30 patients were categorized as mild, 40 as moderate, and 30 as severe.

The mean levels of serum ferritin, CRP, and NLR were found to increase progressively with disease severity. Patients in the severe group had significantly higher values of all three parameters compared to mild and moderate groups. Statistical analysis revealed a significant association between elevated biomarkers and disease severity ( $p < 0.05$ ).

These findings indicate that serum ferritin, CRP, and NLR are significantly elevated in patients with severe disease and may serve as useful predictors of disease severity in acute respiratory infections.

## DISCUSSION

The present study demonstrates a significant association between elevated serum ferritin, C-reactive protein (CRP), and neutrophil-lymphocyte ratio (NLR) with increasing severity of acute respiratory infections. A consistent rise in these biomarkers from mild to severe cases reflects the underlying inflammatory burden and immune dysregulation. Serum ferritin, an acute phase reactant, is known to be elevated in severe infections due to cytokine-mediated hyperinflammation [4]. Similarly, CRP serves as a sensitive marker of acute inflammation and has been widely correlated with disease progression and severity in respiratory illnesses [5].

NLR, derived from routine hematological parameters, provides insight into the balance between innate and adaptive immunity. Elevated NLR indicates heightened neutrophilic response along with relative lymphopenia, both of which are associated with poorer outcomes [6]. Compared to ferritin and CRP, NLR is inexpensive and easily accessible, making it particularly useful in resource-limited settings.

The combined evaluation of these parameters may improve early identification of high-risk patients and assist clinicians in timely intervention and management.

## CONCLUSIONS

Serum ferritin, CRP, and NLR are significant predictors of disease severity in acute respiratory infections. Their combined assessment provides a simple, cost-effective approach for early risk stratification, helping clinicians identify high-risk patients and initiate timely management to improve clinical outcomes.

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