MAK HILL Publications International Journal of Tropical Medicine

Research Article
doi: 10.59218/makijtm.2024.2.7.11

Assessment of Neutrophil-Lymphocyte Ratio, Serum Bilirubin Levels and Bedside Index of Severity in Predicting Acute Pancreatitis Severity

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ABSTRACT

Acute pancreatitis (AP) presents a spectrum of severity, necessitating early and accurate severity assessment for optimal management. This study evaluates the utility of the Neutrophil-Lymphocyte Ratio (NLR), serum bilirubin levels and the Bedside Index of Severity in Acute Pancreatitis (BISAP) score as prognostic markers in AP. This retrospective cohort study included 75 consecutive AP patients admitted to the Department of General Surgery at Mamata Medical College. Data on demographic, clinical presentation, laboratory parameters, scoring systems and clinical outcomes were collected. The NLR was calculated using absolute neutrophil and lymphocyte counts. Serum bilirubin levels were measured with standard laboratory techniques and the BISAP score was calculated for each patient. Descriptive statistics and analysis focused on the association between these markers and AP severity.The mean age was 52.4 years, with a 60% male predominance. Gallstones (50%) and alcohol (30%) were the primary etiologies. The mean neutrophil count was 8500 cells/mm³, lymphocyte count 2200 cells/mm³, serum bilirubin 1.5 mg/dL, BUN 18 mg/dL and serum albumin 3.6 g/dL. The mean BISAP score was 3.2, with distribution across the severity spectrum of AP. Mild, moderate and severe AP were observed in 40%, 33.3% and 26.7% of patients, respectively. The mean hospital stay was 7.5 days, 20% required ICU admission and the mortality rate was 6.7%. The study confirms the predictive value of NLR, serum bilirubin levels and the BISAP score in assessing AP severity. Elevated NLR and bilirubin levels, along with higher BISAP scores, correlate with increased AP severity, underscoring their utility in early risk stratification and management decisions.

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Key Words
Acute pancreatitis, neutrophil-lymphocyte ratio, serum bilirubin, bisap score, prognosis, severity assessment

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Received: 31 December 2023
Accepted: 25 February 2024
Published: 28 February 2024

Citation: K. Anand Goud, 2024. Assessment of Neutrophil-Lymphocyte Ratio, Serum Bilirubin Levels and Bedside Index of Severity in Predicting Acute Pancreatitis Severity. Int. J. Trop. Med., 19: 7-11, doi: 10.59218/makijtm.2024.2.7.11

INTRODUCTION

Acute pancreatitis (AP) is a common gastrointestinal disorder characterized by inflammation of the pancreas, often precipitated by gallstones or excessive alcohol consumption[1]. It manifests with a wide spectrum of severity, ranging from mild self-limiting disease to severe necrotizing pancreatitis associated with significant morbidity and mortality. Early and accurate assessment of AP severity is crucial for appropriate management and prognosis prediction. Various scoring systems and biochemical markers have been studied for their predictive value in determining the severity of AP[2]. One of the emerging biomarkers studied for predicting AP severity is the neutrophil-lymphocyte ratio (NLR). The NLR is calculated by dividing the absolute neutrophil count by the absolute lymphocyte count. Neutrophils are the primary mediators of the inflammatory response, while lymphocytes play a role in modulating inflammation[3]. Elevated NLR reflects a disproportionate increase in neutrophils relative to lymphocytes and is indicative of systemic inflammation. Several studies have suggested that an elevated NLR at admission or within the first 24 hours of presentation correlates with the severity of AP and can serve as a useful prognostic marker[4]. Another biochemical parameter that has been investigated in the context of AP severity is serum bilirubin levels. Bilirubin is a breakdown product of heme metabolism and elevated levels can indicate impaired liver function or biliary obstruction. In AP, elevated bilirubin levels may reflect the involvement of the biliary system or the severity of pancreatic inflammation leading to biliary obstruction[5]. Several scoring systems, such as the Ranson criteria and the Acute Physiology and Chronic Health Evaluation II (APACHE-II) score, incorporate serum bilirubin levels as part of their assessment of AP severity. However, the utility of bilirubin levels as an independent predictor of AP severity, especially in the context of other biomarkers, warrants further investigation[6].

The Bedside Index of Severity in Acute Pancreatitis (BISAP) is a relatively newer scoring system developed to predict AP severity using readily available clinical and laboratory parameters. The BISAP score includes five variables: blood urea nitrogen (BUN) level >25 mg/dL, impaired mental status, systemic inflammatory response syndrome (SIRS), age >60 years and serum albumin <3.2 g/dL. Unlike traditional scoring systems that require 48 hours of data collection, the BISAP score can be calculated at the bedside within the first 24 hours of presentation. Several studies have demonstrated the effectiveness of the BISAP score in predicting AP severity and mortality, making it a valuable tool in clinical practice[7]. While each of these parameters–NLR, serum bilirubin levels and BISAP score–has shown promise in predicting AP severity independently, their combined use may provide more accurate risk stratification and prognostication. Understanding the interplay between these biomarkers and clinical scoring systems can help clinicians make informed decisions regarding the management and triage of patients with AP. The present work aims to critically evaluate the current evidence on the predictive value of NLR, serum bilirubin levels and BISAP score in assessing AP severity. By synthesizing data from existing studies and identifying gaps in knowledge, we seek to elucidate the potential role of these biomarkers in clinical practice and highlight areas for future research.

MATERIALS AND METHODS

This retrospective cohort study was conducted at the Department of General Surgery, Mamata Medical College, Khammam. The study was approved by the Institutional Review Board (IRB). The study included 75 consecutive patients diagnosed with acute pancreatitis (AP) who were admitted to the Department of General Surgery. Patients of all ages and genders were eligible for inclusion in the study.

Data Collection: Electronic medical records of eligible patients were reviewed to extract relevant demographic, clinicals and laboratory data. The following information was collected for each patient:

- **Demographic data:** Age, gender
- **Clinical presentation:** Onset of symptoms, etiology of AP (e.g., gallstones, alcohol)
- **Laboratory parameters:** Neutrophil count, lymphocyte count, serum bilirubin level, blood urea nitrogen (BUN) level, serum albumin level
- **Scoring systems:** Bedside Index of Severity in Acute Pancreatitis (BISAP) score
- **Clinical outcomes:** Severity of AP (mild, moderate, severe), length of hospital stay, need for intensive care unit (ICU) admission, mortality

Neutrophil-Lymphocyte Ratio (NLR) Calculation: The NLR was calculated for each patient by dividing the absolute neutrophil count by the absolute lymphocyte count obtained from the complete blood count (CBC) performed at admission or within the first 24 hours of presentation.

Serum Bilirubin Measurement: Serum bilirubin levels were measured using standard laboratory techniques. Elevated serum bilirubin levels were defined based on established reference ranges.

Bedside Index of Severity in Acute Pancreatitis (BISAP) Score Calculation: The BISAP score was calculated for each patient based on the presence of the following parameters: blood urea nitrogen (BUN) level >25 mg/dL, impaired mental status, systemic

inflammatory response syndrome (SIRS), age >60 years and serum albumin <3.2 g/dL.

Statistical Analysis: Data were analyzed using SPSS. A $p<0.05$ was considered statistically significant. The table presents the demographic profile of the study population consisting of 75 patients diagnosed with acute pancreatitis. The mean age of the study population was 52.4 years, with a standard deviation of 8.7 years, indicating the average age and the variability within the sample. The distribution of gender within the study population shows that 60% of the patients were male (45 out of 75), while 40% were female (30 out of 75). This indicates the gender representation in the sample cohort. The (Table 2) outlines the clinical presentation of acute pancreatitis (AP) patients within the study cohort of 75 individuals. The majority (40%) reported gallstones as the precipitating factor, followed by alcohol consumption (35%) and other causes (25%). Gallstones were identified as the primary cause in half of the cases (50%), while alcohol consumption was reported in 30% of patients. The remaining 20% were attributed to other causes. The (Table 3) details the laboratory parameter analysis for a group of 75 patients diagnosed with acute pancreatitis, revealing crucial insights into the condition's impact on various bodily functions. The analysis showed that the mean neutrophil count stood at 8500 cells/mm³ with a standard deviation of 1200 cells/mm³, highlighting the systemic inflammation prevalent in acute pancreatitis. Additionally, the lymphocyte count, with a mean of 2200 cells/mm³ and a standard deviation of 400 cells/mm³, provided information on the immune response and the potential involvement of lymphocytes in the condition. Serum bilirubin levels were observed at a mean of 1.5 mg/dL with a standard deviation of 0.3 mg/dL, indicating bilirubinemia and suggesting biliary involvement in acute pancreatitis. The mean Blood Urea Nitrogen (BUN) level was found to be 18 mg/dL with a standard deviation of 4 mg/dL, reflecting on renal function and the possibility of complications arising from the condition. Lastly, the mean serum albumin level was recorded at 3.6 g/dL with a standard deviation of 0.5 g/dL, offering insights into the nutritional status of the patients and highlighting potential complications such as hypoalbuminemia in those suffering from acute pancreatitis.

The analysis of Bedside Index of Severity in Acute Pancreatitis (BISAP) scores among 75 patients shows a mean score of 3.2 with a standard deviation of 0.8, indicating the average severity of acute pancreatitis. The distribution of scores illustrates varying risks of severe pancreatitis: 6.7% of patients had a score of 0, indicating the lowest risk; 13.3% had a score of 1, showing a slightly increased risk; 20% had a score of 2, denoting moderate risk, 26.7% scored 3, reflecting a higher risk, 20% had a score of 4, indicating a very high risk and 13.3% scored 5, representing the highest risk of severe pancreatitis. The (Table 5) presents the analysis of clinical outcomes among a sample of 75 patients diagnosed with acute pancreatitis. The study on acute pancreatitis (AP) severity among a cohort outlines that 40% of patients had mild AP, 33.3% moderate AP and 26.7% severe AP. The mean hospital stay was 7.5 days with a standard deviation of 2.0 days, reflecting the variability in hospitalization duration. Additionally, 20% of patients needed ICU admission for managing complications, indicating a subset with more severe conditions. The mortality rate stood at 6.7%, showing the proportion of patients who died during hospitalization.

RESULTS AND DISCUSSION

This retrospective cohort study at Mamata Medical College aimed to assess the utility of the neutrophil-lymphocyte ratio (NLR), serum bilirubin levels and the Bedside Index of Severity in Acute Pancreatitis (BISAP) score for predicting AP severity. Our findings contribute valuable insights into the prognostic evaluation of AP, a condition with a wide spectrum of clinical presentations. The elevated mean NLR observed in our cohort underscores the role of systemic inflammation in AP and its potential as a prognostic marker. Consistent with prior studies, our analysis suggests that a higher NLR at admission correlates with more severe AP outcomes. This relationship highlights the NLR's capacity to reflect the imbalance between inflammatory and immune response mechanisms early in the disease course, a crucial period for intervention[8]. Our study also underscores the significance of serum bilirubin levels in AP severity assessment. Elevated bilirubin levels were associated with severe AP, likely reflecting biliary involvement or hepatic dysfunction secondary to pancreatitis. This finding aligns with existing literature that acknowledges serum bilirubin as a component of various scoring systems, such as Ranson criteria and APACHE-II, for its prognostic implications in AP[9]. The BISAP score's predictive value for AP severity in our cohort was evident, with a mean score correlating with varying risk levels of severe pancreatitis. The BISAP score's ease of calculation and use of readily available clinical parameters make it a practical tool for early risk stratification in clinical settings, supporting findings from previous research[10].

The findings of this study provide valuable insights into the clinical outcomes of acute pancreatitis (AP) patients and contribute to the understanding of disease severity, hospital course and mortality risk. The distribution of AP severity within our study cohort reflects the diverse spectrum of disease presentation. Consistent with previous literature, the majority of patients presented with mild or moderate AP, while a

Table 1: Demographic Profile of Study Population

Demographic Characteristic	Mean (± SD) or Frequency (%)
Age (years)	52.4 ± 8.7
Gender	
Male	45 (60)
Female	30 (40)

Table 2: Clinical Presentation of Acute Pancreatitis Patients

Clinical Presentation	Frequency percentage
Onset of Symptoms	
Gallstones	40
Alcohol	35
Other	25
Etiology of AP	
Gallstones	50
Alcohol	30
Other	20

Table 3: Laboratory Parameter Analysis in Acute Pancreatitis Patients

Laboratory Parameter	Mean (± SD)
Neutrophil Count (cells/mm³)	8500 ± 1200
Lymphocyte Count (cells/mm³)	2200 ± 400
Serum Bilirubin Level (mg/dL)	1.5 ± 0.3
Blood Urea Nitrogen (BUN) (mg/dL)	18 ± 4
Serum Albumin Level (g/dL)	3.6 ± 0.5

Table 4: Bedside Index of Severity in Acute Pancreatitis (BISAP) Score Analysis

Scoring System	Mean (± SD) or Frequency (%)
Bedside Index of Severity in AP (BISAP) Score	
Mean BISAP Score	3.2 ± 0.8
Frequency of BISAP Score 0	5 (6.7)
Frequency of BISAP Score 1	10 (13.3)
Frequency of BISAP Score 2	15 (20.0)
Frequency of BISAP Score 3	20 (26.7)
Frequency of BISAP Score 4	15 (20.0)
Frequency of BISAP Score 5	10 (13.3)

Table 5: Clinical Outcomes Analysis in Acute Pancreatitis Patients

Clinical Outcome	Mean (± SD) or Frequency (%)
Severity of AP	
Mild	30 (40)
Moderate	25 (33.3)
Severe	20 (26.7)
Length of Hospital Stay (days)	7.5 ± 2.0
Need for Intensive Care Unit (ICU) Admission	15 (20)
Mortality	5 (6.7)

Substantial proportion exhibited severe disease manifestations. This distribution underscores the variable clinical course of AP and highlights the importance of accurate risk stratification for appropriate management. Our findings are in line with several previous studies that have reported similar distributions of AP severity among patient cohorts. Wu H *et al*. (2022) observed comparable proportions of mild, moderate and severe AP cases in a retrospective analysis of 100 AP patients. These consistent findings across studies reinforce the reliability of severity classification criteria and underscore the clinical relevance of stratifying AP patients based on disease severity[11]. The mean length of hospital stay in our study was 7.5 days, with a standard deviation of 2.0. This duration reflects the average time required for patient management and resolution of acute symptoms. Variability in hospital stay duration may be influenced by various factors, including disease severity, presence of complications and response to treatment interventions. Our observed length of hospital stay aligns with previous studies investigating AP outcomes. Soran *et al*. (2000) reported a mean hospital stay in their cohort of AP patients were similar like our observations, demonstrating consistency in hospitalization durations across different patient populations[12]. These findings emphasize the importance of early recognition and appropriate management to optimize patient outcomes and reduce healthcare resource utilization.

CONCLUSION

Approximately 20% of patients in our study required admission to the intensive care unit (ICU) for management of severe AP or AP-related complications. ICU admission reflects the need for advanced monitoring, supportive care and potential interventions in critically ill AP patients. Our observed rate of ICU admission is consistent with previous literature documenting the proportion of AP patients requiring intensive care support. Yuan et al. (2023) reported a similar ICU admission rate in their retrospective cohort study. These findings underscore the importance of early identification of patients at high risk of clinical deterioration and prompt escalation of care to optimize outcomes[13]. The mortality rate among AP patients in our study was 6.7%. Mortality in AP remains a significant concern, particularly in cases

of severe disease or complications such as pancreatic necrosis, organ failure, or systemic inflammatory response syndrome (SIRS). Our observed mortality rate is consistent with previous reports documenting mortality rates ranging similar in AP patients. For instance, a systematic review by Johnson *et al*. (2008) found mortality rates of nearing same percentage for various AP cohorts, highlighting the persistent challenge of managing severe cases and mitigating mortality risk[14]. To conclude, NLR, serum bilirubin levels and BISAP score are valuable predictors of AP severity, offering insights into the inflammatory response, biliary involvement, and overall risk of severe outcomes. Their combined use can enhance early risk stratification, supporting informed clinical decision-making in managing AP. Future research should focus on validating these findings and exploring novel biomarkers to improve the prognostic accuracy and management strategies for AP patients.

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