

A Study of Blood Urea Nitrogen and Serum Albumin Ratio in Patients of Pneumonia

Shailee A. Chandak¹, Sourya Paramanand Acharya², Anil Keshavrao Wanjari³, Sunil Nathoon Prasad Kumar⁴

¹Assistant Professor, Department of General Medicine, Jawaharlal Nehru Medical College, Sawangi (M), Wardha

²Professor, Department of General Medicine, Jawaharlal Nehru Medical College, Sawangi (M), Wardha

³Professor, Department of General Medicine, Jawaharlal Nehru Medical College, Sawangi (M), Wardha

⁴Professor, Department of General Medicine, Jawaharlal Nehru Medical College, Sawangi (M), Wardha

Email: meenabkn@yahoo.co.in Mobile No.- 9413143709

Corresponding author: Shailee A. Chandak

Conflict of interest: No conflict of interest.

Abstract

The serious lung infection pneumonia can develop into severe medical conditions which sometimes prove fatal. Early assessment of pneumonia severity needs to be understood for proper management and treatment to be successful. The Blood Urea Nitrogen (BUN) measurement along with serum albumin content provides researchers with valuable indicators to forecast pneumonia severity. BUN and albumin when measured alongside one another provide healthcare professionals with an enhanced insight into patient health status.

The research sought to identify how the comparison of BUN to albumin ratio (B/A ratio) could evaluate pneumonia severity in addition to predicting hospitalization duration and mortality outcomes.

A total of 100 pneumonia patients received hospital admission for this study according to its methodology. Healthcare personnel drew blood from patients to calculate BUN and albumin levels which were utilized in creating B/A ratios for each individual. Study investigators documented both hospital stay period and mortality dynamics as well as intensive care requirements for each participant.

Patients with elevated B/A ratios demonstrated poorer health results that included longer hospitalizations and required intensive care and experienced increased mortality.

Medical professionals can use the BUN/albumin ratio as an easy predictive method to determine how severe pneumonia cases will become. Healthcare workers can use this measurement to determine which patients require stronger treatment options.

Keywords: Blood Urea Nitrogen, Serum Albumin, Pneumonia, BUN/Albumin Ratio, Prognosis, Mortality.

Introduction

Pneumonia maintains its status as a major global mortality factor mainly affecting elderly patients together with those with weak immune systems and diabetes or heart disease patients. This lung illness produces symptoms including high temperature and coughing while causing the air sacs to become inflamed and breathing to become harder. [1] Although medical care continues to

develop pneumonia remains a centerpiece of public health concern so healthcare staff need fast pneumonia severity assessments to provide suitable treatments. [2]

Healthcare providers must evaluate the risk level of patients who have pneumonia due to its importance in management operations. Guardianship of high-risk patients by healthcare

providers delivers advanced care which both improves survival rates and achieves better results for patients. Doctors rely on biomarkers as blood substances to make patient health assessments. [3] Two well-known biomarkers for pneumonia assessment consist of procalcitonin and C-reactive protein (CRP) because they measure bodily inflammatory responses. BUN alongside serum albumin gives specific information regarding patient well-being along with their course of treatment prognosis. [4]

BUN pigments as waste products from protein metabolism get filtered through the kidneys. An elevated Blood Urea Nitrogen reading indicates kidney problems along with problems of dehydration or infection processes. The protein serum albumin functions as a liver-produced substance that works to preserve blood pressure and volume levels. Medical conditions leading to both systemic inflammation and malnutrition usually result in low albumin levels. [5] The BUN/albumin ratio provides healthcare practitioners with combined information about pneumonia severity and patient health status. Research indicates that worsened clinical results including death rates and longer hospitalizations exist when BUN/albumin ratio values exceed certain thresholds. [6-8]

This study investigates the potential of the BUN/albumin ratio as a predictive tool for pneumonia outcomes. The research examines the connection between BUN/albumin ratios and medical outcomes consisting of hospital stay duration and necessity for intensive care to achieve better understanding about this key assessment for pneumonia management and patient wellness.

Aim and Objectives:

Aim:

To evaluate the utility of the Blood Urea Nitrogen to Serum Albumin (BUN/albumin) ratio as a

marker for predicting the severity and outcomes of pneumonia.

Objectives:

1. To explore how the BUN/albumin ratio correlates with the severity of pneumonia in hospitalized patients.
2. To assess the relationship between the BUN/albumin ratio and clinical outcomes, such as hospital stay duration and mortality.

Materials and Methods:

A research study examined pneumonia patients aged 18 years and older in a hospital along with their BUN and albumin test results and CURB-65 scores. Upon hospital admission medical staff obtained blood samples to evaluate BUN together with albumin levels. Researchers determined the BUN/albumin ratio for every patient in the study. We assessed pneumonia severity through the CURB-65 score that examines confusion together with urea measurement and respiratory rate analysis and blood pressure assessments and patient age factors. The study recorded three main clinical outcomes: duration of hospital stay along with intensive care necessity and patient mortality statistics.

Inclusion Criteria:

- Adults aged 18-80 years.
- A diagnosis of pneumonia confirmed by a chest X-ray and clinical symptoms.
- Consent to participate in the study.

Exclusion Criteria:

- Patients with pre-existing kidney or liver disease.
- Pregnant or breastfeeding women.
- Patients with conditions that could affect BUN or albumin levels (like cancer or severe malnutrition).

The collected data were analyzed using standard statistical methods to determine whether the

BUN/albumin ratio had any significant correlation with patient outcomes.

Results:

Table 1: Patient Characteristics

Characteristic	Total (n=100)	Ischemic (n=50)	Pneumonia	Hemorrhagic (n=50)	Pneumonia
Mean Age (years)	60 ± 15	58 ± 12		62 ± 14	
Gender (Male/Female)	60/40	32/18		28/22	
Mean BUN (mg/dL)	22 ± 8	20 ± 7		24 ± 9	
Mean Albumin (g/dL)	3.5 ± 0.6	3.6 ± 0.5		3.4 ± 0.7	

Table 2: Association Between BUN/Albumin Ratio and Clinical Outcomes

Outcome	Low BUN/Albumin Ratio (≤ 10)	High BUN/Albumin Ratio (> 10)	P-value
Length of Hospital Stay (days)	5 ± 2	10 ± 4	0.01
Mortality (n, %)	2 (4%)	14 (28%)	0.02
ICU Admission (n, %)	5 (10%)	22 (44%)	0.01

Discussion:

The research reveals that pneumonia patient outcomes show a strong association with the BUN/albumin ratio measurement. Hospitalized patients with high BUN/albumin ratio experienced longer periods of treatment along with more ICU admissions and higher death rates. Research indicates that the BUN/albumin ratio provides valuable potential for assessing which patients face increased severe consequences. [9-11]

The increased BUN levels might show problems with kidney function or dehydration which frequently occur during severe infections that lead to pneumonia. The condition of critical illness coupled with severe inflammation leads to decreased albumin levels in patients. [12]The combination of these two laboratory indicators reveals a better understanding about patient health status than evaluation using one marker independently.

Conclusion:

BUN and albumin detection enable easy utilization of the BUN/albumin ratio as a cost-effective diagnostic instrument with ready availability. The BUN/albumin ratio enables doctors to discover patients at high risk early so they can establish appropriate treatment strategies. Physical tests of the BUN/albumin ratio show excellent potential as a pneumonia severity indicator and outcome predictor. The clinical results of patients show worse outcomes when their BUN-to-albumin ratio sits higher. This indicates longer hospital stays with higher mortality rates and more frequent need for intensive care systems. This basic biomarker presents an affordable option that can support better decisions about patient care.

References:

1. Sungurlu S, Balk RA. The role of biomarkers in the diagnosis and management of pneumonia. *Clinics in chest medicine*. 2018 Dec 1;39(4):691-701.

2. Ryu S, kwang Oh S, Cho SU, You Y, Park JS, Min JH, Jeong W, chul Cho Y, Ahn HJ, Kang C. Utility of the blood urea nitrogen to serum albumin ratio as a prognostic factor of mortality in aspiration pneumonia patients. *The American journal of emergency medicine*. 2021 May 1;43:175-9.
3. Akpinar E, Hosgun D, Doganay B, Gulhan M. The role of albumin level and blood urea nitrogen/albumin ratio in prediction of prognosis of community acquired pneumonia. *J Pulm Respir Med*. 2013;3(5):159.
4. Huang D, Yang H, Yu H, Wang T, Chen Z, Liang Z, Yao R. Blood urea nitrogen to serum albumin ratio (BAR) predicts critical illness in patients with coronavirus disease 2019 (COVID-19). *International journal of general medicine*. 2021 Aug 21:4711-21.
5. Nuchi SS. Study of Blood Urea Nitrogen to Serum Albumin Ratio and Serum Albumin Alone in Hospitalized Patients of Community Acquired Pneumonia (Doctoral dissertation, Rajiv Gandhi University of Health Sciences (India)).
6. Tian Y, Li Y, Jiang Z, Chen J. Urea-to-Albumin Ratio and In-Hospital Mortality in Severe Pneumonia Patients. *Can J Infect Dis Med Microbiol*. 2021 Oct 22;2021:5105870. doi: 10.1155/2021/5105870. PMID: 34721746; PMCID: PMC8556110.
7. Feng DY, Zhou YQ, Zou XL, Zhou M, Yang HL, Chen XX, Zhang TT. Elevated Blood Urea Nitrogen-to-Serum Albumin Ratio as a Factor That Negatively Affects the Mortality of Patients with Hospital-Acquired Pneumonia. *Can J Infect Dis Med Microbiol*. 2019 Jun 16;2019:1547405. doi: 10.1155/2019/1547405. PMID: 31316681; PMCID: PMC6604473.
8. McDonald J, Wilson M, Davis M, et al. Tian Y, Li Y, Jiang Z, Chen J. Urea-to-Albumin Ratio and In-Hospital Mortality in Severe Pneumonia Patients. *Can J Infect Dis Med Microbiol*. 2021 Oct 22;2021:5105870. doi: 10.1155/2021/5105870. PMID: 34721746; PMCID: PMC8556110. *Kidney Int*. 2020;98(2):305-312.
9. Akahane J, Ushiki A, Kosaka M, Ikuyama Y, Matsuo A, Hachiya T, Yoshiike F, Koyama S, Hanaoka M. Blood urea nitrogen-to-serum albumin ratio and A-DROP are useful in assessing the severity of Pneumocystis pneumonia in patients without human immunodeficiency virus infection. *J Infect Chemother*. 2021 May;27(5):707-714. doi: 10.1016/j.jiac.2020.12.017. Epub 2020 Dec 26. PMID: 33376033.
10. Ugajin M, Yamaki K, Iwamura N, Yagi T, Asano T. Blood urea nitrogen to serum albumin ratio independently predicts mortality and severity of community-acquired pneumonia. *Int J Gen Med*. 2012;5:583-9. doi: 10.2147/IJGM.S33628. Epub 2012 Jul 12. PMID: 22866010; PMCID: PMC3410717.
11. Farr BM, Sloman AJ, Fisch MJ. Predicting death in patients hospitalized for community-acquired pneumonia. *Ann Intern Med* 1991;115:428-436.
12. Lee JH, Kim K, Jo YH, Rhee J, et al. albumin and C- reactive protein have prognostic significance in patients with community acquired pneumonia. *J Crit Care* 2011;26:287-294