Al-Azhar International Medical Journal

Volume 5 | Issue 4 Article 50

4-30-2024
Section: Internal Medicine

Neutrophil Percentage to Serum Albumin ratio as a prognostic indicator for Acute Kidney injury in critically ill Patients

Atef Abu ElFotoh Ibrahim Mousa
Internal Medicine, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Mohammed Elsaid Mohamed Ahmed Habila
Internal Medicine, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Mohamed Ahmed Anwar Shaheen
Clinical Pathology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Mohamed Saad Ahmed ElMalla
Internal Medicine, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt,
drmohamed1822@gmail.com

How to Cite This Article

Mousa, Atef Abu ElFotoh Ibrahim; Habila, Mohammed Elsaid Mohamed Ahmed; Shaheen, Mohamed Ahmed Anwar; and ElMalla, Mohamed Saad Ahmed (2024) "Neutrophil Percentage to Serum Albumin ratio as a prognostic indicator for Acute Kidney injury in critically ill Patients," *Al-Azhar International Medical Journal*: Vol. 5: Iss. 4, Article 50.
DOI: https://doi.org/10.58675/2682-339X.2394

ORIGINAL ARTICLE

Neutrophil Percentage to Serum Albumin ratio as a prognostic indicator for Acute Kidney injury in critically ill Patients

Atef A. I. Mousa , Mohammed E. M. A. Habila [a], Mohamed A. A. Shaheen [b], Mohamed S. A. ElMalla[a] *

[a] Department of Internal Medicine, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt
[b] Department of Clinical Pathology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: ***Deterioration of renal function over hours, days, or weeks is referred to as Acute Kidney injury (AKI). Albumin & Neutrophils have been demonstrated to give more details regarding the outlook for acute kidney injury as markers of inflammatory and immunological responses.***

Aim and objectives: ***To determine the Role of Neutrophil Percentage to Serum Albumin ratio (NPAR) as a prognostic indicator for developing Acute Kidney injury in critically ill cases.***

Patient & methods: ***A total of sixty individuals were included in this prospective study, with thirty participants in Group A having blood albumin levels below 3.5 g/dl and 30 people in Group B having levels above 3.5 g/dl. The study was carried out at the Intensive Care Unit at Damanhur Educational Hospital.***

Results: ***With a cutoff value 16.4, NPAR showed a significant association with death occurrence, with sensitivity reaching (75%) and specificity of (77%). NPAR level in the cases that died was significantly higher than that of those who recovered (p under 0.0001), indicating a statistically significant difference. There was substantial negative association amongst NPAR & serum albumin, systolic blood pressure (SBP), haemoglobin (Hgb), diastolic blood pressure (DBP), platelet (Plt) & estimated glomerular filtration rate (e GFR) while there was significant positive correlation amongst Neutrophil Percentage to Serum Albumin ratio in addition to age, white blood cells (WBC) count, C-reactive protein (CRP), neutrophil percentage and creatinine level.***

Conclusion: ***Higher NPARs were related with severity & mortality among critically ill patients with AKI, and NPAR can be used as a prognostic marker with high accuracy.***

Keywords: AKI; NPAR; Critically ill Patients

1. Introduction

Acute kidney damage is characterized by a sudden and severe decline in renal function that lasts for hours, days, or weeks. [1] Additionally, it is identified by the drop in urine output and the rise of serum Creatinine. Patients in intensive care units (ICU) frequently experience AKI, which has a high morbidity and mortality. From 30% to 60% of patients in intensive care units are thought to experience acute kidney injury at some point during their severe illness, according to current estimates.[2]

In intensive care unit patients, pre-renal causes such as fluid volume deficit, sepsis, or drug-induced AKI, as well as renal causes like acute tubular injury, account for the majority of acute kidney injuries.[3] It has been demonstrated that neutrophils and Serum albumin are distinct predictors of mortality in intensive care unit patients. Finding a new biomarker to determine the degree of acute kidney injury and implementing an early, efficient intervention to increase survival is crucial given the dismal prognosis of AKI in ICU patients.[4]

Accepted 14 April 2024.
Available online 30 April 2024

* Corresponding author at: Internal Medicine, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt.
E-mail address: drmohamed1822@gmail.com (M. S. A. ElMalla).

https://doi.org/10.58675/2682-339X.2394

Numerous studies have demonstrated that acute kidney injury was linked to local and systemic inflammatory responses; hence, neutrophils & albumin have been shown to add evidence about the prognosis of acute kidney injury as markers of inflammatory & immunological responses. Hypoalbuminemia has been linked to the enlargement of AKI and a poor prognosis in intensive care unit patients, according to several studies.[5] Toxic chemicals are protected from the kidneys by serum albumin, which maintains appropriate colloid pressure to enable renal perfusion.[6] A predictive predictor for survival in persons with solid tumours that is independent of other factors according to the Neutrophil albumin ratio. According to the current investigation results, NPAR was a more accurate predictor of all-cause mortality in intensive care unit persons with acute kidney injury than Neutrophil percentage or albumin by itself. We have reasonable grounds to think that NPAR has a significant clinical significance.[7,8]

Work aimed to determine the Role of Neutrophil Percentage to Serum Albumin ratio as a prognostic indicator for developing AKI in critically ill individuals.

2. Patients and methods

This prospective trial was done on 60 participants who were separated into two groups: Group A: 30 individuals whose serum albumin levels are (below 3.5 g/dl) and Group B: 30 patients with average serum albumin levels (over 3.5 g/dl) at the Intensive care unit in Damanhur educational hospital.

Inclusion criteria: Intensive care unit patients, cases with AKI according to KDIGO criteria, and patients over 18 years old.

Exclusion criteria: Age under 18 years old, pregnant females, chronic kidney illness persons with no evidence of acute kidney injury, patients with neutropenia (HIV, Tuberculosis, leukaemia and lymphoma) and patients with decompensated liver disease or Known.

2.1.Method:

All patients were exposed to Complete history taking, Physical examinations (full general & Local examination) and Investigational Studies (routine laboratory investigations and

Radiological investigation such as Ultrasound and Echocardiogram)

Neutrophil Percentage to Serum Albumin Ratio: The technique for measuring the NPAR involved blood sample collection and laboratory testing. The laboratory performed a complete blood count to determine the total white blood cell count and the percentage of neutrophils in the sample. In addition, the laboratory measured the serum albumin level using standard laboratory techniques; calculation of NPAR: The NPAR was identified by dividing the % of neutrophils by the serum albumin level & interpretation of results.

Blood collection and sampling: Patients' venous blood was collected. The skin was sterilized using alcohol. A tourniquet was applied either at the upper mid-arm or on the back of the hand. A blood sample was collected using a syringe. The tourniquet was removed, and the needle was extracted from the vein. During the Complete Blood Count analysis, we utilized an EDTA tube to inhibit coagulation. In contrast, a vacant tube designed explicitly for Chemistry was employed to determine Serum Albumin, Creatinine, Blood Urea, and C-reactive protein. The specimen was promptly transported to the laboratory for examination.

Complete blood count (CBC): The CBC was analyzed by a Celtic Alfa (Nihon Kohden Cell Counter), an Automated Hematology Analyzer, by taking a whole blood sample. The method was electrical Impedance, DynaHelix Flow technology.

Serum Albumin: The serum was centrifuged at 3,500 revolutions per minute to extract the clear plasma for testing. Serum Albumin was analyzed by a Cobas C 311 Analyzer. The test principle was a Colorimetric analysis at a pH value of 4.1. Albumin exhibits a sufficiently cationic effect to attach with bromcresol green (BCG), an anionic dye, to form a blue-green complex.

(Albumin + bromcresol green PH 4.1 Albumin-BCG complex). The intensity of the blue-green colour, determined photometrically, directly correlates with the sample's albumin concentration.

Ethical Consideration: The methods adhered to the regulations set by the AL_AZHAR UNIVERSITY ETHICAL COMMITTEE. The data collected from participants is confidential. The study subjects were anonymized in all reports and publications related to this study. Before the inclusion of participants in this study, they were provided with an explanation of the study's objectives, methodology, and the evaluation of potential risks and benefits. A consent form was acquired after giving the necessary information & ensuring the individual's understanding.

2.2.Statistical analysis: The data underwent verification, input, and analysis using SPSS version 23 for data manipulation. The data were presented as numerical values & percentages for qualitative factors and as the mean plus standard deviation (SD) for quantitative variables. The data were condensed using: The arithmetic mean ($\bar{x}$) is a statistical measure representing the average value of a set of observations, providing a measure of their central tendency. The standard deviation is a statistical measure that quantifies how much the findings deviate from the mean. The analysis employed various statistical tests to compare different variables. The student "t" test

was used to compare the means of two independent groups. The Mann-Whitney test assessed the variation in quantitative variables in non-normally distributed data for these groups. The Chi-square test (X2) was utilized to determine the connotation amongst row & column variables. The Z-test for percentage was employed to compare the outcome percentages between the two groups. Lastly, the Odds ratio (OR) was calculated. Compare the odds or the risk of illness occurrence between persons with a specific attribute or exposure to a risk factor and individuals without the characteristic or exposure. The t statistic is used to test hypotheses, while sensitivity, specificity, & predictive value are measures of the accuracy of a diagnostic test. The significance level measures the probability of obtaining a result as extreme as the one seen, assuming the null hypothesis is true. The significance criterion was set at a 5% level (P-value). A P value over 0.05 implies that the results are not statistically significant. A P value less than 0.05 signifies statistically significant results. The outcomes were considered more important when a smaller P value was attained.

3. Results

Table 1. Demographic data of included subjects

Parameter	Value (N = 60)
Age (Years)	62.05 ± 10.89
Sex	
❖ Female	30 (50%)
❖ Male	30 (50%)
ICU stay (Days)	10.78 ± 6.66
BMI (Kg/m^2)	29.78 ± 5.48

Table 1 showed that the average age of the cases is 62.05 years with a standard deviation of 10.89 years. The sample consists of 30% male and 30% female participants. The average ICU stay for the subjects is 10.78 days with a standard deviation of 6.66 days. The average BMI (Body Mass Index) of the subjects is 29.78 Kg/m2 with a standard deviation of 5.48 Kg/m2.

Table 2. NPAR level comparison amongst cases survived & died

	Died (N = 30)	Recovered (N = 30)	P. Value
Mean ± SD	37.01 ± 10.09	20.52 ± 2.68	<0.0000001
Median (Range)	33.7 (25.8-65)	20.65 (14.88-25.1)	

Table 2 showed that the mean NPAR level in the cases that died was significantly higher (37.01 ± 10.09) compared to those who recovered (20.52 ± 2.68) with a p-value of under 0.0001, indicating a statistically significant change.

Table 3. Correlation among different parameters & NPAR

	NPAR	
	r	P value
Age	0.567	0.045
Female	-0.054	0.684
Male	0.054	0.684
ICU stay	.854**	0.0001
BMI	0.164	0.21
Hgb	-.668-**	0.0001
WBC	.845**	0.0001
Neutrophil	.705**	0.0001
Plt	-.566-**	0.0001
RR	.758**	0.0001
HR	.696**	0.0001
SBP	-.640-**	0.0001
DBP	-.667-**	0.0001
Temp	0.222	0.088
CVP	0.129	0.325
CRP	.739**	0.0001
Urea	.678**	0.0001
Albumin	-.965-**	0.0001

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 3 displayed that there was significant negative association amongst NPAR & Serum albumin, SBP, Hgb, DBP & Plt. There was significant positive correlation among NPAR & Age, WBC count, CRP, ICU stay, neutrophil percentage, urea and Creatinine. The rest parameters did not show any significant correlation.

Table 4. Correlation between Death, APACHE II Score and NPAR

		APACHE II	DEATH
NPAR	r	.862**	.751**
	P value	0.0001	0.0001
DEATH	r	.876**	1
	P value	0.0001	

There was significant positive correlation among NPAR & death occurrence. P value was less than 0.001. A significant correlation also originate among NPAR and APACHE II score. APACHE II score also correlated positively with incidence of death.

Table 5. Correlation between NPAR and e GFR and creatinine level

	NPAR	
	r	P value
Creatinine	.628**	0.0001
E GFR	-.700-**	0.0001

There was significant negative correlation between NPAR and e GFR. While significant positive correlation was found between NPAR and creatinine level.

Table 6. ROC curve analysis of NPAR association with death occurrence

	Cutoff value	AUC	Sensitivity	Specificity	Asymptotic 95% Confidence Interval		P. Value
					Lower Bound	Upper Bound	
NPAR	16.4	0.9474	75%	77%	0.98538	1	<0.0001*

With cutoff value of 16.4 NPAR showed significant association with death occurrence with sensitivity reached (75%) and specificity of (77%).

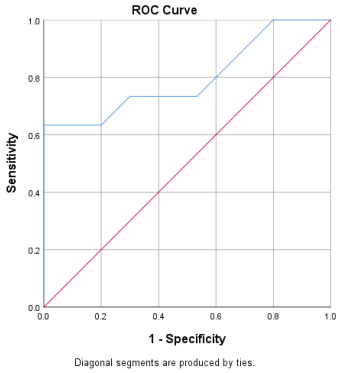

Figure 1. ROC curve analysis of NPAR association with death occurrence

4. Discussion

Regarding demographic data, the present trial showed that the mean age of the studied patients was 62.05 ±10.89 years, 50% males and 50% Females. The average BMI of the subjects was 29.78±5.48 Kg/m2. The present study also showed that there was no significant association between mortality, age, sex, and BMI (p over 0.05).

In agreement with the current study by Saxena & Meshram,[9] enrolled 229 AKI patients, and 65 (28.4 per cent) persons they have died while hospitalized. The study showed that there was no significant variance amongst survivors & non-survivors as regards age and sex.

Our results showed that the mean NPAR level in the cases that died was significantly higher (37.01 ± 10.09) than that in those who recovered (20.52 ± 2.68), with a p-value below 0.0001, indicating a statistically significant alteration. The median NPAR level was also higher in the cases that died (33.7, range 25.8-65) than in those who recovered (20.65, range 14.88-25.1). This suggests that higher levels of NPAR may be associated with increased mortality in this population.

In concordance with the current study, Wang et al.,[10] in multivariate analysis, after adjustments for confounding factors, showed that higher NPARs were linked with an amplified risk of mortality in critically ill patients with AKI (P trend <0.01).

Also, Lin et al.[11] concluded that the NPAR was related to all-effect mortality in critically ill cases with acute myocardial infarction.

Regarding the correlation between NPAR and different studied parameters, it was revealed that there was a significant negative association between NPAR and SBP, Serum albumin, DBP, Hgb, Plt, and eGFR. There was a significant positive correlation between NPAR and Age, WBC count, CRP, ICU stay, neutrophil percentage, urea, and Creatinine. The rest of the parameters did not show any significant correlation.

He et al.[12] revealed a significant association between NPAR and age, Hgb, albumin, Plt, WBC, Neutrophils, and ICU stay among patients with AKI.

Regarding the correlation between Death, APACHE II Score and NPAR, it was exposed that there was a significant positive correlation between NPAR & death occurrence. The P value was less than 0.001. A significant correlation was also found between NPAR and APACHE II scores. APACHE II score also correlates positively with the incidence of death.

In line with the current study, Wang et al.,[10] displayed that there was a significant association between NPAR with death and severity scores among patients with AKI admitted to ICU.

Regarding the correlation between NPAR, eGFR, and creatinine level, there was a significant negative correlation between NPAR and eGFR. A significant positive correlation was found between NPAR and creatinine levels.

He et al.,[12] initiate no significant connotation between NPAR with eGFR and creatinine level among patients with AKI. This disagreement may be due to the difference in sample size and study settings.

ROC curve analysis was performed to test the predictive ability of NPAR among AKI patients. With a cutoff value of 16.4, NPAR showed a significant association with death occurrence, with sensitivity reaching(75%) and specificity (77%).

With a lower cutoff point, He et al.[12] research demonstrated a significant relationship between NPAR above 15.7 and long-term mortality among individuals without chronic renal disease who underwent percutaneous coronary intervention. The follow-up period lasted for a median of 2.9 years, and the hazard ratio was 1.68 (95% CI: 1.32-2.13; p < 0.001).

As well, Wang et al.,[10] showed that NPAR was an independent predictor of mortality among AKI cases with an AUC of 0.693 (p <0.0001).

5. *Conclusion*

The present investigation revealed a significant correlation between elevated NPARs & both the severity & fatality rates of critically sick patients with AKI. Moreover, NPARs exhibit a high level of accuracy as a prognostic indicator. The limitations of our trial include a small sample size, being performed at a single centre, and a very short follow-up time. Additional comparison investigations, including a more significant number of participants and a longer duration of observation, are required to validate our findings.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

Funding

No Funds : Yes

Conflicts of interest

There are no conflicts of interest.

References

1. Awdishu L, Wu SE. Acute kidney injury. Renal/Pulmonary Critical Care. 2017;2:7-26.
2. Kellum JA, Sileanu FE, Murugan R, Lucko N, Shaw AD, Clermont G. Classifying AKI by Urine Output versus Serum Creatinine Level. J Am Soc Nephrol. 2015;26(9):2231-2238.
3. Bheemaraya D. Study of Etiology, Clinical Spectrum and Outcome of Acute Kidney Injury in Patients Admitted to Intensive Care Unit of Tertiary Care Hospital (Doctoral dissertation, Rajiv Gandhi University of Health Sciences (India)).2017.
4. 4Bellomo R, Ronco C, Mehta RL, et al. Acute kidney injury in the ICU: from injury to recovery: reports from the 5th Paris International Conference. Ann Intensive Care. 2017;7(1):49.
5. Grigoryev DN, Liu M, Hassoun HT, Cheadle C, Barnes KC, Rabb H. The local and systemic inflammatory transcriptome after acute kidney injury. J Am Soc Nephrol. 2008;19(3):547-558.
6. Davidson IJ. Renal impact of fluid management with colloids: a comparative review. Eur J Anaesthesiol. 2006;23(9):721-738.
7. Namikawa T, Shimizu S, Yokota K, et al. Neutrophil-to-lymphocyte ratio and C-reactive protein-to-albumin ratio as prognostic factors for unresectable advanced or recurrent gastric cancer. Langenbecks Arch Surg. 2022;407(2):609-621.
8. Kao HK, Löfstrand J, Loh CY, et al. Nomogram based on albumin and neutrophil-to-lymphocyte ratio for predicting the prognosis of patients with oral cavity squamous cell carcinoma. Sci Rep. 2018;8(1):13081.
9. Saxena A, Meshram SV. Predictors of Mortality in Acute Kidney Injury Patients Admitted to Medicine Intensive Care Unit in a Rural Tertiary Care Hospital. Indian J Crit Care Med. 2018;22(4):231-237.
10. Wang B, Li D, Cheng B, Ying B, Gong Y. The Neutrophil Percentage-to-Albumin Ratio Is Associated with All-Cause Mortality in Critically Ill Patients with Acute Kidney Injury. Biomed Res Int. 2020;2020:5687672.
11. Lin Y, Lin Y, Yue J, Zou Q. The neutrophil percentage-to-albumin ratio is associated with all-cause mortality in critically ill patients with acute myocardial infarction. BMC Cardiovasc Disord. 2022;22(1):115.
12. He HM, Zhang SC, He C, et al. Association between neutrophil percentage-to-albumin ratio and contrast-associated acute kidney injury in patients without chronic kidney disease undergoing percutaneous coronary intervention. J Cardiol. 2022;79(2):257-264.