Relationship between neutrophil percentage-to-albumin ratio and all-cause and cardiovascular mortality in hypertension cases

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As a recently recognised inflammatory indicator, the neutrophil percentage-to-albumin ratio (NPAR) has demonstrated prognostic significance across multiple conditions. Nevertheless, its ability to predict mortality among hypertensive patients has yet to be determined. Consequently, the present study aims at evaluating the association between NPAR and mortality risk within a hypertensive cohort. We analysed clinical data from 8,339 individuals with hypertension sourced from the National Health and Nutrition Examination Survey. To assess the dose-response dynamic, restricted cubic spline (RCS) models were utilised to identify any non-linear correlations between NPAR and mortality. The independent effect of NPAR on mortality was evaluated by Cox proportional hazards regression. Predictive accuracy at different follow-up intervals was measured using the concordance index alongside time-dependent receiver operating characteristic (ROC) curves. During the follow-up period (median time: 9.0 years), 2,862 of the 8,339 hypertensive subjects died, with 861 cardiovascular-related deaths. RCS modelling demonstrated a significant, positive relationship linking NPAR to both cardiovascular and total mortality. Individuals exhibiting higher NPAR levels faced a substantially elevated risk for all-cause death as well as cardiovascular death. Additionally, mediation analysis indicated that the estimated glomerular filtration rate accounted for 9.86% and 7.02% of the association between NPAR and all-cause and cardiovascular mortality, respectively. The area under the ROC curve for predicting all-cause mortality at 10, 15, and 20 years was 0.645, 0.641, and 0.639, respectively. Elevated NPAR levels independently increase the susceptibility of hypertensive patients to both all-cause and cardiovascular mortality, underscoring its promise as an effective prognostic biomarker.

Keywords: Hypertension, mortality, NHANES, NPAR, prognosis factor

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HIGH blood pressure continues to pose a severe challenge to global public health. Over the period spanning 1990 to 2019, the worldwide count of hypertensive adults (aged 30–79) practically doubled, escalating from 648 million to 1.28 billion individuals[1]. It is well-established that hypertension independently elevates the risk of developing renal dysfunction, stroke, and various cardiovascular disorders[2]. Notably, it accounts for approximately 8.5 million annual fatalities linked to ischaemic heart disease, stroke, and related vascular conditions, making it a leading driver of global cardiovascular mortality[1]. The primary cause of cardiovascular death and disease burden is hypertension[3,4]. Notably, it accounts for approximately 8.5 million annual fatalities linked to ischaemic heart disease, stroke, and related vascular conditions, making it a leading driver of global cardiovascular mortality[5]. Therefore, there is a pressing clinical requirement for affordable and easily measurable biomarkers that can improve risk stratification for mortality and track disease progression among hypertensive patients.

Neutrophils are key players in mediating inflammatory responses by producing inflammatory mediators[6]. An essential regulatory protein, albumin, plays crucial roles as an immunomodulator, buffer, transporter, and antidote[7]. The neutrophil percentage-to-albumin ratio (NPAR) can accurately reflect changes in neutrophils and albumin. Evidence is accumulating that NPAR serves as an indicator for prognosis, correlating with disease severity and outcomes in numerous cancers as well as non-malignant disorders[6,8–10]. Extensive evidence has consistently shown that a higher NPAR is correlated with greater risks of diabetic retinopathy[1] and fatty liver disease[12]. The strong predictive capacity of NPAR for prognosis has been demonstrated in not only atrial fibrillation[13] but also chronic heart failure[6], where it serves as an index of systemic inflammation. Nevertheless, its prognostic significance for survival outcomes specifically in hypertensive cohorts has yet to be assessed.