



ORIGINAL ARTICLE

The relationship between 24-hour ambulatory blood pressure load and neutrophil-to-lymphocyte ratio



Tolga Çimen, Hamza Sunman, Tolga Han Efe*, Mehmet Erat, Haluk Furkan Şahan, Engin Algül, İlkin Guliyev, Ahmet Akyel, Mehmet Doğan, Sadık Açıkel, Ekrem Yeter

Department of Cardiology, Dışkapı Yıldırım Beyazıt Training and Research Hospital, Ankara, Turkey

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KEYWORDS

Ambulatory blood pressure;
Neutrophil-to-lymphocyte ratio;
Hypertension;
Inflammation

Abstract

Introduction and Objective: The neutrophil-to-lymphocyte ratio (NLR) is established as a reliable marker of systemic inflammation. Low-grade inflammation has a key role in the pathogenesis and progression of hypertension (HTN). Blood pressure (BP) load, defined as the percentage of abnormally elevated BP readings, is a good marker of HTN severity. We aimed to evaluate the relationship between HTN severity and NLR using averaged ambulatory BP readings and BP load.

Methods: A total of 300 patients with untreated essential HTN were included in this cross-sectional study. Patients were divided into quartiles according to NLR values (first: <1.55; second: 1.55-1.92; third: 1.92-2.48; and fourth: >2.48). Averaged ambulatory BP values and BP load were assessed for each quartile.

Results: In the interquartile evaluation there were no differences between quartiles in terms of baseline demographic, clinical and echocardiographic characteristics ($p>0.05$). Daytime systolic BP (SBP), 24-hour diastolic BP (DBP), daytime DBP, daytime SBP load, 24-hour DBP load and daytime DBP load were found to be significantly higher in the upper two quartiles ($p<0.05$ for all). In correlation analysis, log NLR values were found to be positively correlated with 24-hour SBP, DBP, SBP load and DBP load (Pearson coefficients of 0.194, 0.197, 0.157 and 0.181, respectively; $p<0.01$ for all). In multivariate analysis, log NLR had an independent association with 24-hour SBP and DBP and 24-hour SBP and DBP load.

Conclusion: This study showed for the first time that increased NLR is independently associated with HTN severity in untreated essential HTN patients.

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* Corresponding author.

E-mail address: medisay@gmail.com (T.H. Efe).

PALAVRAS-CHAVE

Pressão arterial em ambulatório;
Proporção neutrófilos/linfócitos;
Hipertensão;
Inflamação

A relação entre a carga da pressão arterial em ambulatório durante 24 horas e a proporção neutrófilos/linfócitos

Resumo

Introdução e objetivos: A relação neutrófilos/linfócitos (RNL) foi estabelecida como um marcador inflamatório sistémico fiável. Uma inflamação de baixo grau tem um papel fundamental na patogénese e na progressão da hipertensão (HT). A carga da pressão arterial (PA) definida como a percentagem de leituras da PA anormalmente elevadas é um bom marcador da gravidade da PA. O objetivo deste estudo é avaliar a relação entre a gravidade da PA e a RNL pela utilização da média de leituras ambulatórias da PA e da carga da PA.

Métodos: Um total de 300 doentes, com HT essencial não tratada, foram incluídos neste estudo transversal. Os doentes foram divididos em quartis, de acordo com os valores da RNL (primeiro <1,55; segundo 1,55-1,92; terceiro 1,92-2,48 e o quarto > 2,48). Os valores médios da PA em ambulatório e a carga da PA foram avaliados para cada quartil.

Resultados: Na avaliação interquartil, não houve diferença entre quartis nas características demográficas, clínicas e ecocardiográficas basais ($p > 0,05$). A PA sistólica diurna (PAS), a PA diastólica (PAD) a 24 horas, a PAD diurna, a carga da PAS diurna, a PAD a 24 horas e a PAD diurna foram significativamente mais elevadas nos dois quartis superiores ($p < 0,05$ para todos). Na análise de correlação, os valores do logaritmo de RNL foram positivamente correlacionados com a PAS a 24 horas, com a PAD, com a PAS carga e com a PAD carga (coeficientes de Pearson de 0,194, 0,197, 0,157 e 0,181, respetivamente; $p < 0,01$ para todos). Na análise multivariada, os valores do logaritmo da RNL mostraram uma associação independente com a PAS-PAD a 24 horas e com a carga da PAS-PAD a 24 horas.

Conclusão: Este estudo mostrou pela primeira vez que o aumento da RNL está independentemente associado à gravidade da PA nos doentes com HT essencial não tratada.

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Introduction

Hypertension (HTN) is a common condition that results in damage to important target organs including the heart, kidney and brain.^{1,2} Low-grade inflammation has a key role in its pathogenesis and progression.³ Inflammatory processes are assumed to have particularly significant involvement in vascular remodeling of resistance arteries.⁴ Increasing blood pressure (BP) may progressively cause a pro-inflammatory response and thus establish a vicious cycle. Furthermore, HTN is a significant risk factor in inflammatory conditions such as atherosclerosis.⁵

The relationship between various cardiovascular conditions and inflammation has been investigated in previous studies.⁶ Elevated C-reactive protein (CRP), vascular (VCAM-1) and intercellular (ICAM-1) adhesion molecules, monocyte chemoattractant protein-1 (MCP) and plasminogen activator inhibitor-1 (PAI-1) are some of the inflammatory molecules that are increased in HTN.^{7,8} Along with these well-known inflammatory markers, recent studies have shown the neutrophil-to-lymphocyte ratio (NLR) to be a reliable marker of systemic inflammation.⁹ It has been shown to have prognostic significance in various conditions such as coronary artery disease,^{10,11} malignancy,¹² heart failure,¹³ and cerebral and peripheral artery disease.^{14,15} Since HTN is considered a significant risk factor in most of these conditions, the relationship between NLR and HTN has also been thoroughly investigated.¹⁶ NLR is a good predictor in

high-risk conditions such as resistant HTN and non-dipper HTN.^{17,18}

Ambulatory blood pressure monitoring (ABPM) is an important tool that is frequently used by clinicians in daily practice to guide treatment and help to identify conditions such as white-coat and masked HTN.¹⁹ It is known that ABPM is a better predictor of target organ damage and cardiovascular endpoints than office BP.²⁰ However, it may have limitations in patients with 'high-normal' BP.²¹ In view of this limitation, some authors suggest that BP load, defined as the percentage of abnormally elevated BP readings, is a better predictor.^{22,23}

As far as we know, there are few data on the evaluation of severity of the inflammatory response in HTN using NLR, which is a simple and inexpensive method. Thus, in our study we aimed to evaluate the relationship between HTN severity and NLR using averaged ambulatory BP readings and BP load.

Methods**Study population**

This cross-sectional study included 300 consecutive patients with newly diagnosed essential hypertension by 24-hour ABPM using a validated device between December 2014 and December 2015. All patients had untreated essential HTN, defined as office BP of $\geq 140/90$ mmHg (the mean of ≥ 2 valid

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