



ORIGINAL ARTICLE

## Ambulatory blood pressure monitoring in heart failure and serum sodium levels



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### KEYWORDS

Heart failure;  
Sodium;  
Ambulatory blood  
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### Abstract

**Aims:** To determine whether there are differences in blood pressure profile on dynamic assessment by ambulatory blood pressure monitoring (ABPM) according to serum sodium levels in stable heart failure patients.

**Methods:** Data were collected from the Spanish National Registry on Ambulatory Blood Pressure Monitoring in Heart Failure (DICUMAP). Patients underwent ABPM by the oscillometric principle using a Spacelabs 90121 monitor. The sample was divided into three groups according to sodium levels and their clinical and laboratory data and echocardiographic findings were analyzed. Robust statistical methods were used to compare the groups in univariate and multivariate models.

**Results:** A total of 175 patients (44.57% male) were analyzed. We found a predominance of anomalous circadian blood pressure profiles in all three groups, with a significantly higher percentage of risers in the lowest serum sodium group ( $p=0.05$ ). In addition, in this group there were significant differences in mean 24-hour systolic blood pressure (SBP) (24-h SBP,  $p=0.05$ ) and in mean daytime SBP (dSBP,  $p=0.008$ ), with significant differences in nocturnal fall in SBP ( $p=0.05$ ) and in diastolic blood pressure ( $p=0.005$ ). In multivariate analysis a significant relationship was found between sodium levels and 24-h SBP (OR 0.97, 95% CI 0.95-0.99,  $p=0.01$ ) and dSBP (OR 0.96, 95% CI 0.94-0.99,  $p=0.004$ ).

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**PALAVRAS-CHAVE**

Insuficiência cardíaca;  
Sódio;  
Monitorização ambulatória da pressão arterial

**Conclusion:** A relationship was found between lower sodium levels and lower systolic blood pressure, especially during waking hours, with a lower decline between daytime and night-time blood pressure.

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### Monitorização ambulatória da pressão arterial na insuficiência cardíaca atendendo aos níveis de sódio sérico

**Resumo**

**Objetivos:** Determinar se existem diferenças no perfil da pressão arterial, através da monitorização da pressão ambulatória da pressão arterial como método de avaliação dinâmica nos doentes estáveis com insuficiência cardíaca, dependendo dos níveis de sódio sérico.

**Métodos:** Os dados do doente foram obtidos do Registo Nacional Espanhol para Insuficiência Cardíaca e Medição Ambulatória da Pressão Arterial. Submeteram-se à monitorização ambulatória da pressão arterial através do princípio oscilométrico, utilizando um monitor *Spacelabs* 90121. Dividimos a amostra em três grupos de acordo com os níveis de sódio e analisámos os dados clínicos e laboratoriais, bem como os achados ecocardiográficos. Utilizámos metodologia estatística consistente para comparar os grupos em modelos univariados e multivariados.

**Resultados:** Foram analisados 175 doentes (44,57%). Relativamente à pressão arterial, constatámos a predominância do perfil circadiano anómalo nos três grupos, com uma percentagem significativa mais elevada de um perfil de elevação no grupo com sódio sérico mais baixo ( $p=0,05$ ). Além disso, constatámos neste grupo diferenças significativas nos valores médios da pressão arterial sistólica em 24 h (PAS24 h,  $p=0,05$ ) e nos valores médios da pressão arterial sistólica durante período vigíl (PASd,  $p=0,008$ ), com uma diferença significativa na descida noturna da PAS ( $p=0,05$ ) e da pressão arterial diastólica ( $p=0,005$ ). Numa análise multivariada ajustada, constatámos uma relação significativa entre os níveis de sódio e a PAS24 h (OR 0,97, IC 95% 0,95-0,99,  $p=0,01$ ) e a PASd (OR 0,96, IC 95% 0,94-0,99,  $p=0,004$ ).

**Conclusão:** Constatámos uma relação entre os níveis mais baixos de sódio e a PAS mais baixa, especialmente durante o período vigíl, com uma descida decrescente entre a pressão arterial diurna e noturna.

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**Introduction**

Hyponatremia is a common complication in heart failure (HF), especially when the disease is advanced. Studies in various patient populations, ranging from acutely decompensated hospitalized patients to stable outpatients, have shown an association between low serum sodium concentrations and poor prognosis.<sup>1-3</sup> Equally, risk models developed in HF cohorts of outpatients<sup>4</sup> and hospitalized patients<sup>5,6</sup> have suggested that hyponatremia is one of the most powerful predictors of mortality. Blood pressure (BP) is another predictor of survival,<sup>7</sup> and lower sodium concentrations are often associated with low BP. However, this association has not been thoroughly studied and is poorly understood, due in part to the lack of studies that provide dynamic 24-hour BP measurement.

The influence of hyponatremia on BP in HF patients may be the result of changes in both plasma sodium levels and extracellular volume (ECV), but may also be secondary to antihypertensive drugs used to treat HF. It may therefore be

useful to know whether BP remains low at night or whether these patients' circadian profile is disrupted.

Our aim in this study was to determine whether there are differences in BP behavior on dynamic assessment by ambulatory blood pressure monitoring (ABPM) in stable HF patients with different serum sodium levels.

**Methods****Patients**

Data were collected from the Spanish National Registry on Ambulatory Blood Pressure Monitoring in Heart Failure (DICUMAP) of the Spanish Society of Internal Medicine. This was a multicenter prospective cohort study that ran from 2009 to 2013 and included data from 17 Spanish hospitals. The study complied with the principles outlined in the Declaration of Helsinki, the study protocol was approved by an ethics committee, and informed consent was obtained

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