



ORIGINAL ARTICLE

## Reproducibility of ambulatory blood pressure values and circadian blood pressure patterns in untreated subjects in a 1–11 month interval<sup>☆</sup>



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### KEYWORDS

24-hour ambulatory blood pressure monitoring;  
Reproducibility;  
Circadian patterns;  
Dipping

### Abstract

**Objective:** To evaluate in untreated subjects the reproducibility of mean values and four circadian patterns between two ambulatory blood pressure monitoring (ABPM) recordings separated by 1–11 months.

**Methods:** We performed a retrospective analysis of 481 individuals (59% women) evaluated by ABPM on two occasions, visit 1 (V1) and 2 (V2), separated by 5.5±0.2 months. Four circadian patterns were defined by night/day systolic blood pressure (SBP) ratios: reverse dippers (RD), ratio >1.0; non-dippers (ND), ratio 0.9–1.0; dippers (D), ratio 0.8–<0.9; and extreme dippers (ED), ratio <0.8. Coefficients of correlation and concordance between the ABPM values at V1 and V2 and the reproducibility of the RD, ND, D and ED patterns were calculated by the percentage of the same profile from V1 to V2.

**Results:** Mean 24-h blood pressure (BP) at V1 and V2 was 126.8/75.9±0.5/0.5 vs. 126.5/75.7±0.5/0.4 mmHg (NS). Nighttime SBP fall was 9.8±0.4 (V1) and 9.6±0.3% (V2) (NS). The correlation coefficient of ABPM data at V1 vs. at V2 was 0.41–0.69 (p<0.001) and the concordance coefficient was 0.34–0.57 (p<0.01). At V1, 38 subjects were classified as ED (7.9%); D, n=216 (44.9%), 187 as ND (38.9%) and 40 as RD (8.3%). At V2 only 26.3% of ED, 44.9% of D, 54.5% of ND and 40% of RD maintained the same profile as at V1.

**Conclusion:** In untreated subjects ABPM has high reproducibility for mean values but only modest reproducibility for circadian profiles, thereby challenging the prognostic value of BP dipping patterns.

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**PALAVRAS-CHAVE**

Pressurometria ambulatoria de 24 horas; MAPA; Reprodutibilidade; Perfis circadiários (*dipping*)

## Reprodutibilidade dos valores da pressurometria ambulatoria de 24 horas e dos perfis circadiários de descida noturna registados com intervalo 1-11 meses em indivíduos não medicados

**Resumo**

**Introdução:** Avaliar em indivíduos não medicados a reprodutibilidade dos valores médios e dos quatro perfis circadiários entre dois registos de pressurometria ambulatoria de 24 horas (MAPA) separados de 1-11 meses.

**Métodos:** Análise retrospectiva de 481 indivíduos (59% mulheres) avaliados por MAPA em dois dias, visita um (V1) e visita dois (V2) separados por 5,5 + 0,2 meses. Perfis circadiários definidos pelos *ratios* noite/dia da pressão sistólica (PAS) em: *reverted dippers*, RD se *ratio* > 1,0, *non-dippers*, ND se *ratio* 0,9- < 1,0, *dippers*, D se *ratio* 0,8- < 0,9 e *extreme dippers*, ED se *ratio* < 0,8. Cálculo dos coeficientes de correlação (CCc) e de concordância ( $\Phi$ ) entre os valores da MAPA nas V1-V2 e a reprodutibilidade dos perfis RD, ND, D e ED em V1 pela proporção de indivíduos que permaneceram no mesmo perfil em V2.

**Resultados:** As médias de 24 horas foram 126,8/75,9 ± 0,5/0,5 (V1) versus 126,5/75,7 ± 0,5/0,4 mm Hg (V2) (n.s.). A descida noturna da PAS foi 9,8 ± 0,4 (V1) e 9,6 ± 0,3% (V2) (n.s.). Entre os vários parâmetros da MAPA, os CC oscilaram 0,41-0,69 (p < 0,001) e os  $\Phi$ C entre 0,34-0,57 (p < 0,01). Em V1, ED foram n = 38 (7,9%), D n = 216 (44,9%), ND n = 187 (38,9%) e RD n = 40 (8,3%). Em V2 somente mantiveram o perfil de V1, 26,3% dos ED, 44,9% dos D, 54,5% dos ND e 40% dos RD.

**Conclusão:** Em indivíduos não tratados, a reprodutibilidade a menos de um ano da MAPA é elevada para os valores médios mas modesta relativamente aos perfis circadiários, sugerindo baixa preditibilidade de risco cardiovascular dos perfis de descida noturna da pressão arterial. © 2015 Sociedade Portuguesa de Cardiologia. Publicado por Elsevier España, S.L.U. Todos os direitos reservados.

**Introduction**

Ambulatory blood pressure (BP) monitoring (ABPM) is the gold standard for assessment of overall BP load. ABPM has high predictive value for cardiovascular events and target organ damage, provides information on circadian BP patterns, and can be used to monitor the effects of various antihypertensive therapies.<sup>1-4</sup>

Several studies have shown that compared to a dipper pattern (nighttime BP fall of >10% or ratio of nighttime to daytime BP <0.9), the absence of the usual nighttime BP fall – non-dipper pattern – is associated with greater target organ damage,<sup>2,5</sup> higher albuminuria levels,<sup>6</sup> left ventricular hypertrophy,<sup>2</sup> renal dysfunction<sup>7</sup> and cerebrovascular lesions.<sup>8-11</sup> However, an issue with ABPM is its reproducibility<sup>12-21</sup> in two or more recordings separated in time with regard to mean 24-h, daytime and nighttime BP values and to dipper vs. non-dipper patterns. In a recent review of 12 studies,<sup>22</sup> the reproducibility of circadian BP patterns in normotensive, hypertensive and diabetic individuals ranged between 29% and 92%. Furthermore, in most if not all of these studies only dipper and non-dipper patterns were analyzed, not other patterns such as extreme dipper or reverse dipper, the prognostic value of which differs from that of the classic patterns.<sup>23-25</sup> Another little-studied question is the reproducibility of mean 24-h BP and circadian patterns by ABPM in individuals for whom the European guidelines<sup>1</sup> recommend postponing initiation of antihypertensive medication in favor of monitoring BP by repeat ABPM after some months.

The aim of the present study is to evaluate the reproducibility of ABPM values and the four principal circadian patterns in untreated subjects undergoing two ABPM recordings separated by less than 12 months.

**Methods**

The data for the study were taken from our database of ABPM records, a total of 21 000 ABPM recordings. We selected only recordings from individuals aged over 18, with no cardiovascular events, not taking antihypertensive medication, not diabetic, and with office BP <150/95 mmHg, for whom ABPM had been requested by their attending physician. All subjects were at low or moderate to low cardiovascular risk according to the table in the European guidelines<sup>1</sup> based on BP values and other cardiovascular risk factors. Only individuals whose attending physicians had requested a second ABPM recording within 12 months were included; those who took any antihypertensive medication or whose weight changed by more than 5% between the two recordings, and those with any cardiovascular complication, including arrhythmias, were excluded.

**24-hour ambulatory blood pressure monitoring**

All subjects underwent two 25-hour ABPM recordings using a SpaceLabs 90207 monitor (SpaceLabs Inc., Redmond, WA), measured on two normal working days or equivalent every 20 min during the day and every 30 min during the night. The

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