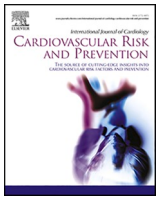
International Journal of Cardiology Cardiovascular Risk and Prevention 15 (2022) 200148

Contents lists available at ScienceDirect

International Journal of Cardiology
Cardiovascular Risk and Prevention

journal homepage: www.journals.elsevier.com/international-journal-of-cardiology-cardiovascular-risk-and-prevention



Normality thresholds for ambulatory blood pressure monitoring (ABPM) in the European, American and Brazilian guidelines: is there a need for revision?

Ambulatory blood pressure monitoring (ABPM) is a very useful method for diagnosing arterial hypertension (AH), as well as for evaluating treatment effectiveness. Among the most often consulted clinical guidelines are the European, American and Brazilian ones [1–3]. The mean values that establish the diagnosis of hypertension in these three guidelines are yet to be well established [1–3]. It is expected that when the patient has an overall mean BP value outside the threshold, the mean BP during wakefulness and/or during sleep will also be outside the threshold.

It has been observed, based on clinical findings from a reference center in Brazil, that this does not always happen. From January 2, 2019 to June 30, 2021, 5,810 ABPMs were performed at the Unicordis Cardiology Center in Fortaleza, Ceará, Brazil. The ABPMs were performed using the Dinamapa equipment (Cardioservice Ltda., Salvador, Brazil).

Among the performed exams, 2,723 were requested to assess the diagnosis of AH and 3,087 for the therapeutic evaluation of AH. In 40 of the 5,810 exams (0.68%), the mean total BP level was above the normal values, while the mean BP during wakefulness and sleep were normal. This occurred in 17 diagnostic investigation tests (0.61%) and in 23 therapeutic evaluation tests (0.74%). However, the mean BP in these cases was within the thresholds considered to be the normal range during wakefulness and sleep. Of the 23 exams performed for therapeutic evaluation, 11 were male and 12 were female patients. Of the 17 tests for diagnostic investigation, 9 patients were males and 8 females. Sociodemographic characteristics, as well as mean BP values and medications used in these cases are summarized in Table 1.

It is observed that, mathematically, it is not possible to obtain an abnormal total mean value and two other means, included in the total mean, with values within the normal range. Even with a small number of patients (0.61% for the diagnostic investigation and 0.74% for the therapeutic evaluation), we believe this type of error should not occur in any case, for a matter of definition. It is known that there is usually a variability in blood pressure levels in the population, including values during wakefulness and sleep [4], and that isolated BP measurements are not accurate for the diagnosis of AH [5], hence the importance of tests such as ABPM. There is also evidence that BP measured by primary care physicians and in medical offices has low accuracy when compared to BP measurements obtained by ABPM [6,7]. There are studies that have questioned the threshold for defining controlled BP, suggesting, for instance, that the 130/80 mmHg has better accuracy than the 140/90 mmHg threshold for uncontrolled resistant hypertension [8].

For this reason, we suggest that the levels that have been pre-established as a criterion for BP normality in the ABPM, in the European, American and Brazilian guidelines should be revised, as the currently used thresholds can lead to errors, which are not admissible.

Table 1
Sociodemographic characteristics, mean blood pressure values obtained at ambulatory blood pressure monitoring (ABPM) and antihypertensive medications, showing a total mean above the normal threshold and normal means during wakefulness and sleep.

Patient	Gender	Age (yrs.)	BP Total mean (mmHg)	BP mean in wakefulness (mmHg)	BP mean in sleep (mmHg)	Antihypertensive medication
1	M	58	110/80	111/82	98/64	Amlodipine and losartan
2	F	69	131/60	134/61	115/65	Losartan and furosemide
3	F	87	129/81	131/82	116/69	Olmesartan and Levamlodipine
4	M	68	130/81	134/84	113/62	Valsartan e bisoprolol
5	F	47	118/80	122/84	108/69	Valsartan and amlodipine
6	M	70	124/81	128/84	105/61	Olmesartan and amlodipine
7	F	69	129/81	132/83	113/66	–
8	M	56	128/80	131/82	113/69	–
9	F	58	130/70	134/71	119/66	Atenolol
10	F	44	117/82	118/84	109/68	Enalapril
11	F	32	118/81	121/84	107/66	–
12	M	45	120/80	126/84	106/69	Valsartan and amlodipine
13	F	38	119/80	120/83	111/65	Olmesartan and hydrochlorothiazide (HCT)
14	F	32	130/81	132/83	115/63	–
15	F	48	111/81	113/83	99/69	Alphamethyldopa
16	M	42	115/80	117/82	105/69	–
17	F	40	119/80	122/83	102/62	–
18	M	66	132/82	134/84	118/65	Perindopril and nebivolol
19	M	53	122/82	125/84	119/69	Losartan

(*continued on next page*)

https://doi.org/10.1016/j.ijcrp.2022.200148
Received 2 August 2022; Accepted 4 August 2022
Available online 27 August 2022
2772-4875/© 2022 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Table 1 (*continued*)

Patient	Gender	Age (yrs.)	BP Total mean (mmHg)	BP mean in wakefulness (mmHg)	BP mean in sleep (mmHg)	Antihypertensive medication
20	F	70	130/67	134/70	113/56	Olmesartan + HCT and nebivolol
21	M	35	121/81	121/82	113/69	–
22	F	55	122/81	123/83	119/69	Perindopril
23	M	46	123/80	125/82	112/68	–
24	F	72	121/83	122/84	116/69	–
25	F	26	123/81	124/84	113/69	–
26	F	55	129/80	132/82	112/69	Losartan and amlodipine
27	M	54	119/80	122/834	105/67	Candesartan
28	F	44	123/80	125/83	113/69	Losartan and amlodipine
29	F	59	124/81	128/84	107/67	Metoprolol
30	M	36	121/80	125/84	108/62	–
31	M	48	130/80	134/83	108/59	Losartan
32	F	61	130/69	133/70	118/65	Atenolol
33	F	36	124/80	127/82	109/69	–
34	M	38	122/81	123/84	109/69	Amlodipine
35	M	58	128/80	124/83	107/68	Olmesartan
36	F	50	126/81	129/83	108/63	–
37	F	43	125/81	129/84	108/63	–
38	M	27	129/80	131/82	118/69	–
39	M	42	121/80	123/82	109/68	Losartan
40	M	80	117/80	117/83	144/67	–

M, male; F, female.

Declaration of competing interest

The authors declare no conflicts of interest regarding this study.

References

[1] B. Williams, G. Mancia, W. Spiering, E.A. Rosei, M. Azizi, M. Burnier, et al., ESC/ESH Guidelines for the management of arterial hypertension, Eur. Heart J. 39 (33) (2018) 3021–3104, 2018.

[2] P.K. Whelton, R. Carey, W. Aronow, B. Ovbiagele, D. Casey, S.C. Smith, et al., ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: executive summary: a report of the American college of Cardiology/American heart association task force on clinical practice guidelines, Hypertension 71 (6) (2017) 1269–1324, 2018.

[3] A.A. Brandão, A. Alessi, A.M. Feitosa, C.A. Machado, C.E.P. Figueiredo, C. Amodeo, et al., 6ª Diretrizes de monitorização ambulatorial da pressão arterial e 4ª Diretrizes de monitorização residencial da pressão arterial, Arq. Bras. Cardiol. 110 (5 Suppl 1) (2018) 1–29.

[4] B.C. Jaeger, J.N. Booth 3rd, M. Butler, L.J. Edwards, C.E. Lewis, D.M. Lloyd-Jones, et al., Development of predictive equations for nocturnal hypertension and nondipping systolic blood pressure, J. Am. Heart Assoc. 9 (2) (2020), e013696.

[5] A.J. Viera, Y. Yano, F.C. Lin, D.L. Simel, J. Yun, G. Dave, et al., Does this adult patient have hypertension?: the rational clinical examination systematic review, JAMA 326 (4) (2021) 339–347.

[6] G.B. Grezzana, D.W. Moraes, A.T. Stein, L.C. Pellanda, Impact of different normality thresholds for 24-hour ABPM at the primary health care level, Arq. Bras. Cardiol. 108 (2) (2017) 143–148.

[7] M. Korogiannou, P. Sarafidis, M.P. Theodorakopoulou, M.E. Alexandrou, E. Xagas, et al., Diagnostic performance of office versus ambulatory blood pressure in kidney transplant recipients, Am. J. Nephrol. 52 (7) (2021) 548–558.

[8] C.J. Lee, J.H. Ha, J.Y. Kim, I.C. Kim, S.K. Ryu, M.Y. Rhee, Office blood pressure threshold of 130/80 mmHg better predicts uncontrolled out-of-office blood pressure in apparent treatment-resistant hypertension, J. Clin. Hypertens. 23 (3) (2021) 595–605.

Ricardo Pereira Silva*
Federal University of Ceará, School of Medicine. Rua Costa Mendes, 1608, 4° andar, CEP: 60430-140, Fortaleza, Ceará, Brazil
Unicordis Cardiology Clinic, Fortaleza, Ceará, Brazil

Deyvison Henrique da Silva Rodrigues
Federal University of Ceará, School of Medicine. Rua Costa Mendes, 1608, 4° andar, CEP: 60430-140, Fortaleza, Ceará, Brazil

Antônio Brazil Viana Junior
Federal University of Ceará, School of Medicine. Rua Costa Mendes, 1608, 4° andar, CEP: 60430-140, Fortaleza, Ceará, Brazil
Unicordis Cardiology Clinic, Fortaleza, Ceará, Brazil

Geraldo Bezerra da Silva Junior
Federal University of Ceará, School of Medicine, Rua Costa Mendes, 1608, 4° andar, CEP: 60430-140, Fortaleza, Ceará, Brazil
School of Medicine, University of Fortaleza, Fortaleza, Ceará, Brazil

* Corresponding author. Federal University of Ceará, School of Medicine, Rua Costa Mendes, 1608, 4° andar, CEP: 60430-140, Fortaleza, Ceará, Brazil.
E-mail address: ricardop@ufc.br (R.P. Silva).