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EDITORIAL

Masked hypertension: where do we stand?

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A growing body of evidence indicates that office blood pressure (OBP) measurement alone, as performed by the physician, is not sufficient to determine a patient's true blood pressure (BP) value. Although home blood pressure (HBP) measurement or ambulatory blood pressure monitoring (ABPM) may provide us with a better estimate of a patient's BP, this may also cause problems if these two types of measurements lead to different treatment conclusions.

Most physicians are familiar with the discrepancy called white coat hypertension (WCH), which is defined as an elevated OBP value in the face of a normal BP outside the office, as determined by either ABPM or HBP. Since several studies have already shown that both ABPM and HBP correlate better with target organ damage than OBP, one may be inclined to think that WCH is rather harmless. However, some studies that evaluated the long-term effect of WCH on cardiovascular prognosis showed that subjects with WCH had an increased risk compared with normotensives, but a lower risk than those with sustained hypertension.[1] These data indicate that OBP values should not be completely ignored.

Much less is known about the second discrepancy and, in fact, the opposite of WCH, namely masked hypertension (MH). Although many physicians are unfamiliar with MH, it is not a rare phenomenon as its prevalence ranges from 8 to 33% among different populations.[2,3] Some studies even found higher numbers of masked hypertensives when compared with white coat hypertensive subjects. However, it is difficult to determine the real prevalence of MH from the present literature as studies about MH vary widely in definitions, equipment used, populations and measurement procedures. This also holds true for the paper by Aksoy *et al.*[4] in the present issue of the Journal. In this paper the authors dealt with the prevalence of MH among 57 seemingly well-controlled, treated hypertensive patients and 31 untreated normotensive subjects. They found that MH occurred frequently in the hypertensives but not in the normotensives, although in some normotensive subjects there was a clear difference between OBP and HBP. However, the OBP procedure, as performed by Aksoy and co-workers, is rather unusual. The time before the first duplicated measurement was taken and the time between the other duplicated measurements amounted to ten minutes. When such a long time elapses before measurements are taken, the white coat effect will become smaller.[5] Consequently, when patients are sitting longer in a chair before the OBP is taken, they will obtain a lower OBP value as compared with their HBP.

Another reason why we still do not know much about MH is related to the large population differences (normotensives, hypertensives, younger subjects, elderly, treated and untreated subjects) among studies that have investigated MH. The study by Aksoy and co-workers shows that there were more patients declared to have masked hypertension in the hypertensive group than in the normotensive group. This may be attributed to at least three factors. Firstly, these patients have BP values that are closer to the upper limits of the definition of MH than normotensive patients. This means that a minor discrepancy between OBP and HBP would more easily lead to a classification of MH in hypertensive patients than in normotensive individuals. Secondly, the hypertensive patients were on antihypertensive drugs that they may have taken in the morning. HBP was performed in the early morning, at the 'trough' moment of the antihypertensive activity of the medication. OBP was regularly performed in a range of two to eight hours after drug intake so that it might already have had its influence on the BP. Thirdly, the percentage of men in the studies differs between both groups (47% in the group with treated hypertensives and 71% in the group with healthy volunteers). Indeed, some studies have shown that the prevalence of MH was higher among females than among males; however, other

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studies found the opposite. Nevertheless, because of these differences in gender percentages between the two groups one should be careful when drawing conclusions from between-group comparisons.

In most studies OBP was performed with a mercury sphygmomanometer, which is highly susceptible to observer bias, while HBP was commonly performed with an automatic oscillometric device. Observer bias reduces reliability of the obtained BP values while employment of different measurement devices further complicates comparisons between OBP and HBP. Therefore, Aksoy and co-workers did do well to perform all measurements with the same device: the Omron 705CP automatic device. However, for validation of the BP device used, the European Society of Hypertension (ESH) and the British Hypertension Society (BHS) allowed inaccuracy to 5 mmHg.[6] This inaccuracy of the device should have been taken into account for analysis. Therefore, it is worth recommending the use of a 'grey zone' and allowing, for example, for 10 mmHg systolic and 6 mmHg diastolic BP differences between the OBP and SBP values. In that case MH would be defined as an HBP value that is at least 10 mmHg systolic and 6 mmHg diastolic higher than the OBP value.

Overall knowledge of MH would significantly improve if all studies followed the same guidelines for BP measurement procedures and used the same validated oscillometric measurement device for both OBP and HBP. This would prevent observer bias and facilitate comparison between the procedures.

The overall accepted definition of MH is the one recommended by the ESH[7] (an OBP value <140/90 mmHg and an HBP value ≥135 mmHg systolic and/or 85 mmHg diastolic). Aksoy and co-workers also determined MH according to the ESH definition. They used the first of the duplicated office measurements as the OBP value, which led to more patients above the OBP limit (this decreases the MH prevalence) and naturally more patients had BP values above the HBP limit as the threshold decreased from 140/90 mmHg to 135/85 mmHg (this increases the MH prevalence). Together, this resulted in a higher MH prevalence than the previous definition (37 *vs* 28%). Although the ESH definition is commonly accepted, it is remarkable that patients can be classified as masked hypertensives when they obtain similar OBP and HBP values (e.g. 138/86 mmHg). This may be a reason to revise the ESH definitions, also because they assume that a physician will perform the OBP with a mercury sphygmomanometer and the HBP is assessed with an automatic oscillometric device. Since Aksoy and co-workers used the same oscillometric device for OBP and HBP, differences in BP values could not result from the device. Therefore, their first definition of MH seems to be the most appropriate one.

The explanation for MH has been sought in factors that increase daytime ambulatory blood pressure such as physical activity, stressful conditions, tobacco and coffee,[8,9] alcohol,[10] sedentary habits[11] or greater reactivity to daily life stressors.[12] However, MH could, of course, also be due to an exceptionally low OBP in the face of increased HBP or ABPM values. Low OBP values can be due to a postprandial dip or previous antihypertensive drug intake. Therefore, when patients take antihypertensive treatment it is absolutely essential to instruct patients carefully on how to take their drugs and verify, at each visit when OBP is performed, if and how their treatment was taken. Despite all speculations, the true identity of MH has not yet been revealed as the reproducibility of MH has not been investigated until now.

Since ABPM and HBP are better risk predictors than OBP,[13-19] patients with MH, both treated and untreated, exhibit a cardiovascular risk similar to that of sustained hypertensive patients. When subjects have MH and their treatment is based on OBP results, these patients will not receive the treatment they should. For this reason it would be desirable if all patients performed HBP in addition to OBP. However, for practical reasons it is impossible to let all patients perform HBP. Therefore, HBP should be recommended, in particular, for patients with high cardiovascular risk or with symptoms possibly related to their BP level, or when there is a discrepancy between BP values and degree of target organ damage. Eventually, an additional ABPM could be performed to determine the most appropriate treatment if a discrepancy is found between OBP and HBP values.

REFERENCES

1. Celis H, Fagard RH. White-coat hypertension: a clinical review. Eur J Intern Med 2004;15:348-57.
2. Lurbe E, Torro I, Alvarez V, et al. Prevalence, persistence, and clinical significance of masked hypertension in youth. Hypertension 2005;45:493-8.
3. Sakaguchi K, Horimatsu T, Kishi M, et al. Isolated home hypertension in the morning is associated with target organ damage in patients with type 2 diabetes. J Atheroscler Thromb 2005;12:225-31.
4. Aksoy I. Does 'masked hypertension' exist in healthy volunteers and apparently well controlled hypertensive patients? Neth J Med 2006;64:72-7.
5. Mancia G, Bertinieri G, Grassi G, et al. Effects of blood-pressure measurement by the doctor on patient's blood pressure and heart rate. Lancet 1983;2:695-8.
6. O'Brien E, Mee F, Atkins N, Thomas M. Evaluation of three devices for self-measurement of blood pressure according to the revised British Hypertension Society Protocol: the Omron HEM-705CP, Philips HP5332, and Nissei DS-175. Blood Press Monit 1996;1:55-61.
7. O'Brien E, Asmar R, Beilin L, et al. Practice guidelines of the European Society of Hypertension for clinic, ambulatory and self blood pressure measurement. J Hypertens 2005;23:697-701.
8. Mann SJ, James GD, Wang RS, Pickering TG. Elevation of ambulatory systolic blood pressure in hypertensive smokers. A case-control study. JAMA 1991;265:2226-8.

9. Narkiewicz K, Maraglino G, Biasion T, Rossi G, Sanzuol F, Palatini P. Interactive effect of cigarettes and coffee on daytime systolic blood pressure in patients with mild essential hypertension. HARVEST Study Group (Italy).Hypertension Ambulatory Recording VEnetia STudy. J Hypertens 1995;13:965-70.

10. Vriz O, Piccolo D, Cozzutti E, et al. The effects of alcohol consumption on ambulatory blood pressure and target organs in subjects with borderline to mild hypertension. HARVEST Study Group. Am J Hypertens 1998;11:230-4.

11. Palatini P, Graniero GR, Mormino P, et al. Relation between physical training and ambulatory blood pressure in stage I hypertensive subjects. Results of the HARVEST Trial. Hypertension and Ambulatory Recording Venetia Study. Circulation 1994;90:2870-6.

12. Pickering TG, Gerin W. Ambulatory blood pressure and reactivity. J Hypertens 1992;10:299-300.

13. Perloff D, Sokolow M, Cowan R. The prognostic value of ambulatory blood pressures. JAMA 1983;249:2792-8.

14. Staessen JA, Thijs L, Fagard R, et al. Predicting cardiovascular risk using conventional vs ambulatory blood pressure in older patients with systolic hypertension. Systolic Hypertension in Europe Trial Investigators. JAMA 1999;282:539-46.

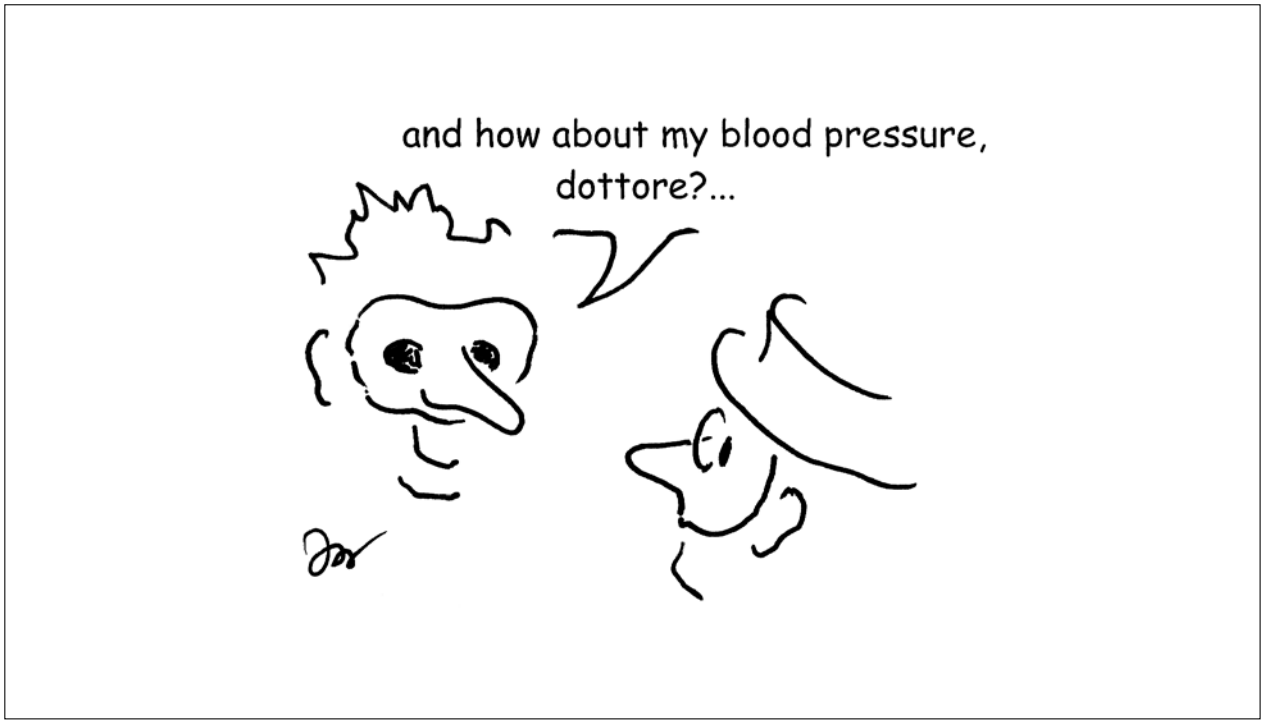
15. Ohkubo T, Imai Y, Tsuji I, et al. Prediction of mortality by ambulatory blood pressure monitoring versus screening blood pressure measurements: a pilot study in Ohasama. J Hypertens 1997;15:357-64.

16. Verdecchia P, Porcellati C, Schillaci G, et al. Ambulatory blood pressure. An independent predictor of prognosis in essential hypertension. Hypertension 1994;24:793-801.

17. Clement DL, De Buyzere ML, De Bacquer DA, et al. Prognostic value of ambulatory blood-pressure recordings in patients with treated hypertension. N Engl J Med 2003;348:2407-15.

18. O'Brien E, Asmar R, Beilin L, et al. European Society of Hypertension recommendations for conventional, ambulatory and home blood pressure measurement. J Hypertens 2003;21:821-48.

19. Ohkubo T, Imai Y, Tsuji I, et al. Home blood pressure measurement has a stronger predictive power for mortality than does screening blood pressure measurement: a population-based observation in Ohasama, Japan. J Hypertens 1998;16:971-5.



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