Home blood pressure monitoring: application in clinical practice

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Abstract Because of the white coat and the masked hypertension phenomena out-of-office blood pressure measurement using ambulatory (ABPM) or home monitoring (HBPM) is often required for the accurate diagnosis and treatment decision. ABPM has been extensively investigated, whereas only recently convincing evidence on the prognostic and diagnostic ability of HBPM has been accumulated. Both methods provide multiple measurements in the usual environment of each individual and have similar ability to detect the white coat and masked hypertension phenomena in both untreated and treated hypertensives. However, HBPM is more widely available, better accepted by patients and less costly, and therefore more appropriate for long-term application. For reliable HBPM validated electronic arm devices with automated memory and the recommended monitoring schedule should be used (7 days, duplicate morning and evening measurements; average after discarding the first day). HBPM is a valuable tool for the optimal management of most subjects with elevated blood pressure.

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PALABRAS CLAVE
Presión arterial en domicilio; Auto-medición; Diagnóstico; Tratamiento; Hipertensión de bata blanca; Hipertensión enmascarada

Monitorización de la presión arterial en el domicilio: aplicación en la práctica clínica

Resumen Debido al síndrome de la bata blanca y a los fenómenos de hipertensión enmascarada, a menudo es necesario realizar una medición de la presión arterial de forma ambulatoria (MAPA) o domiciliaria que permita obtener un diagnóstico preciso y decidir el mejor tratamiento. Si bien la monitorización ambulatoria de la presión arterial ha sido ampliamente investigada, la automedición de la presión arterial en domicilio (AMPA) no contaba hasta recientemente con pruebas convincentes sobre su capacidad de pronóstico y diagnóstico. Los dos métodos proporcionan mediciones múltiples de la PA dentro el entorno habitual del paciente y tienen una capacidad similar para detectar el síndrome de la bata blanca y la hipertensión enmascarada, tanto en hipertensos no tratados como en aquellos bajo tratamiento. No obstante, la AMPA es más asequible, está mejor aceptada por los pacientes y resulta menos costosa, por lo que es más apropiada para su uso a largo plazo. Para obtener una AMPA fiable solo es necesario utilizar dispositivos electrónicos de brazo validados, que cuenten con memoria automatizada, y que las mediciones se lleven a cabo mediante el programa recomendado (7 días, con mediciones de mañana y noche duplicadas, y la obtención de un promedio tras descartar las mediciones del
The need of out-of-office blood pressure measurement

The conventional measurement of blood pressure by the doctor in the office has been regarded as the cornerstone for the diagnosis of hypertension and the assessment of the effects of antihypertensive drug treatment. However, office blood pressure measurement can often be misleading mainly due to the white coat and the masked hypertension phenomena, the poor reproducibility of office measurements, the placebo effect and the observer bias. Assessment of blood pressure out of the office using either 24 hour ambulatory or self-home monitoring is often needed and has been shown to provide more reliable information, leading thereby to more accurate diagnosis and more appropriate treatment.

In contrast to ambulatory blood pressure monitoring that in the last two decades has been extensively studied and has established its role as a valuable technique that improves the management of hypertension, research in home blood pressure monitoring has been delayed by longer than one decade and only in 2008 major position papers from the US and Europe have fully endorsed this method for wide application in the hypertensive population.

Home blood pressure monitoring: advantages and limitations

Home blood pressure monitoring is a valuable tool for the initial assessment of subjects with elevated blood pressure, mainly because it allows the detection of the white-coat and the masked hypertension phenomena. Moreover, home monitoring is valuable in the long-term follow up of treated hypertensives. Apart from the detection of the white-coat and the masked hypertension phenomena, which are also common in treated hypertensives, home monitoring provides a more reliable evaluation of the efficacy of antihypertensive drugs as well as the duration of effect by assessing the ratio of morning to evening home blood pressure. Moreover, it allows the detection of excessive blood pressure-lowering effect in treated individuals. More importantly, the use of home monitoring has been shown to improve patients' compliance with treatment and thereby the control rates of hypertension. Finally, home monitoring has the potential to reduce the costs of health-care of hypertensive patients.

In order to take full advantage of the method and prevent potential problems associated with its use, home blood pressure monitoring should only be performed after patients' education and training, (which is less when electronic devices are used) and under medical supervision. However, there are still limitations because some patients make overuse of the method and the random blood pressure fluctuation might cause unnecessary anxiety. More importantly some patients may make self-adjustment of drug treatment which should be strongly discouraged.

Home versus ambulatory blood pressure monitoring

Home blood pressure monitoring is similar to 24 hour ambulatory monitoring because both methods provide multiple measurements away from the office or clinic setting in the usual environment of each individual and under routine daily conditions. However, these methods also have important differences because home measurements are taken only in the sitting posture, after a few minutes rest, and always at home, whereas ambulatory monitoring is performed during various routine daily conditions (walking, standing, sitting, lying), without a period of rest before each measurement, and at home, at work and during sleep. Despite these differences, home and ambulatory blood pressure appear to have similar advantages, in terms of reproducibility, ability to diagnose the white coat and masked hypertension phenomena and to predict target organ damage and cardiovascular events. Moreover, studies have found similar blood pressure levels with home and awake ambulatory measurement and therefore the use of the same normalcy threshold (<135/85 mm Hg) is applied for both methods. Because of their differences home and ambulatory monitoring appear to be complementary rather than competitive methods and when used in combination provide a more complete picture of the individual's blood pressure profile.

Home blood pressure monitoring in children and adolescents

Although ambulatory blood pressure monitoring has firmly established its role and is regarded as indispensable for the accurate diagnosis of hypertension in the pediatric population, the evidence on the clinical utility of home blood pressure monitoring is limited. Preliminary evidence favouring the use of the method has been recently published and reference values (percentiles of home blood pressure for gender and age) are now available and endorsed by recent guidelines. Interestingly, in children and adolescents the relationship between home and daytime ambulatory blood pressure is not the same as in the adults with daytime ambulatory blood pressure being significantly higher than home measurements, probably due to...
A Cochrane review of 72 trials showed that average home blood pressure higher for the long-term follow up of treated hypertension. Moreover, a meta-analysis concluded that this method is effective particularly when applied in combination with other adherence-enhancing strategies.

Thus, home blood pressure monitoring appears to have considerable potential in the assessment of elevated blood pressure in children. However, until more studies including ambulatory blood pressure monitoring and target damage become available, treatment decisions based solely on home measurements should be discouraged.

Home blood pressure monitoring, treatment compliance and hypertension control

Because of the wide use of home blood pressure monitoring in the population, and the suitability and acceptance of this method by the hypertensive patients for the long-term follow up, there is potential for this method to improve compliance with treatment and thereby the control rate of hypertension. A review of trials investigating the effect of home blood pressure monitoring on medication compliance concluded that this method is effective particularly when applied in combination with other adherence-enhancing strategies. A Cochrane review of 72 trials showed that home blood pressure monitoring is one of the few effective interventions aiming to improve blood pressure control in patients with hypertension. Moreover, a meta-analysis of trials involving 2,714 hypertensive subjects showed that the use of self-home blood pressure monitoring is associated with 10% greater chance of achieving optimal blood pressure control. This difference in blood pressure control might appear to be small, yet if applied in the entire population of hypertensive subjects is expected to have an important impact on cardiovascular disease prevention. The wide availability of home monitors in the population has the additional potential to detect undiagnosed hypertension and improve awareness. Moreover, several studies that applied modern home blood pressure tele-monitoring techniques aiming to improve blood pressure control have reported encouraging results.

It is important to note that, despite the wide use of home monitoring in many countries, its cost-effectiveness has not been thoroughly investigated. Home blood pressure monitoring has the potential for significant cost savings through the prevention of unnecessary treatment in untreated or treated subjects with white coat phenomenon, the lesser need for office visits, and the optimal treatment of untreated and treated masked hypertensives, which is expected to reduce the incidence of cardiovascular complications. Preliminary data have been favorable for the cost-effectiveness of home monitoring. Eventually, in many countries hypertensive patients have decided to cover themselves the cost of applying this method by purchasing their own devices, as indicated by the large sales of home blood pressure monitors worldwide. A recent call-to-action statement by the American Heart Association-American Society of Hypertension recommended that, as it is the case with home monitoring of glucose in diabetes, home blood pressure monitoring should be prescribed by healthcare providers and the cost of the method (device and training) should be reimbursed.

Home blood pressure monitoring schedule, reliability and standardization

Several studies have looked at the optimal home blood pressure monitoring schedule required for a reliable assessment. There is a consensus between European and American guidelines that home blood pressure should be monitored for 7 days of measurements (not less than 3 days), with duplicate morning (before drug intake if treated) and evening measurements on each day and that the average should be calculated after discarding the readings of the first day. Average home blood pressure higher than 135/85 mm Hg (systolic/ diastolic) is regarded as high, lower than 130/80 mm Hg low, and intermediate values borderline. For the long-term follow up of treated hypertension performing no more than 1-2 measurements per week is recommended. Home monitoring should be performed using validated electronic arm devices (for

Figure 1 Strategy for implementing office and out-of-office blood pressure (BP) measurements in clinical practice.
updated lists of validated devices see www.bhsoc.org and www.dableeducational.org).

When decision making for treatment is based on home blood pressure measurements an important requisite is to ensure that a reliable assessment of the blood pressure at home is made. Several studies have shown that hypertensive patients often misreport (over or under-report their home blood pressure values).

Therefore, standardization of home monitoring (recommended schedule and objective reporting (automated memory or PC link) is essential to prevent bias and misreporting, as it is currently the case with ambulatory monitoring that provides an unbiased assessment of the blood pressure profile (the patient cannot choose the time and number of measurements or select the readings to report). These requirements can easily be fulfilled by current technology of blood pressure monitors software with minimal increase in the cost. This is an essential prerequisite for physicians to rely on home blood pressure measurements in making treatment decisions in clinical practice.

Home blood pressure monitoring: application in clinical practice

Convincing evidence on the prognostic ability of home blood pressure monitoring and its clinical usefulness for the initial diagnosis and the long-term follow-up of treated hypertension is now available. Thus, recent European and American guidelines have endorsed the wide application of this method in the management of hypertension in clinical practice. The evidence on the usefulness of home blood pressure monitoring suggests that this method should be applied in most subjects with possible or treated hypertension.

The detection of masked hypertension remains a controversial issue in terms of which subjects should be screened and is not addressed in the proposed strategies. Subjects with borderline office blood pressure levels (office blood pressure higher than 120/80 mmHg in two or more visits), or elevated office blood pressure normalized in repeated measurement, as well as those at high total cardiovascular risk and all treated hypertensives would probably benefit from home blood pressure monitoring.

In cases with disagreement between office and home measurements (white coat or masked hypertension), because of the imperfect reproducibility of both methods a repeat home blood pressure monitoring session or ambulatory monitoring is required in order to confirm diagnosis. A strategy for implementing office and out-of-office blood pressure measurements in clinical practice is presented in Figure 1.

For the long-term follow-up of treated hypertension, home blood pressure monitoring clearly is the optimal method because of its wider availability, lower cost and better acceptance by patients for repeated use compared to ambulatory blood pressure monitoring. The evidence showing improvement of patients’ compliance and hypertension control rates by implementing home blood pressure monitoring are additional strong arguments for implementing this method in all treated hypertensives.

References


