

Unmasking Hypertension

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Conventional blood pressure measurement using a mercury sphygmomanometer and stethoscope has clearly shown a strong relationship between blood pressure and cardiovascular risk,¹ and the technique has also demonstrated the benefit of lowering high blood pressure with antihypertensive medication.² However, despite these merits, conventional measurement has been criticized on many counts that have included inaccuracy and the banning of mercury on environmental grounds.³ The technique has come under further pressure from national bodies recommending measurement with automated techniques to provide profiles of blood pressure behavior outside the medical environment.^{4,5} Among such techniques, ambulatory blood pressure measurement (ABPM) is now increasingly recognized as being indispensable to the diagnosis and management of hypertension.⁶ Quite apart from the potential for ABPM to predict outcome more accurately than conventional blood pressure measurement,⁴ the technique has contributed significantly to our understanding of hypertension by revealing or "unmasking" blood pressure phenomena that were not readily apparent using traditional techniques of measurement in clinical practice. These have included the dipping and nondipping patterns of nocturnal blood pressure,⁷ and white-coat hypertension,⁸ to which must now be added masked hypertension, a condition in which subjects classified as normotensive by conventional office or clinic measurement are hypertensive with ABPM or self-measurement.⁹ White-coat hypertension has also been called "isolated clinic hypertension," and "isolated ambulatory hypertension," "reverse white-coat hypertension," "undetected ambulatory hypertension," and "white-coat normotension" have been proposed as alternative terms for masked hypertension.⁹ These names are unlikely to replace the "catchy" appeal of the original nomenclature, although "isolated clinic hypertension" and "isolated ambulatory hypertension" are useful in further defining white-coat and masked hypertension, respectively, and are likely to find a continuing role as complimentary terms.

The prevalence of masked hypertension in adults seems to be at least 10% and may be higher with a tendency to decrease with age.⁹⁻¹² Whatever the prevalence, it is a sobering thought that even if masked hypertension is only

present in 5% of the population, this translates into 10 million people in the United States.⁹ Now Lurbe et al have examined the condition in youth and shown that some 10% of children and adolescents, who appear normotensive, are, in reality, hypertensive when blood pressure is measured with ABPM during the daytime.¹³ Importantly, as in adults,⁹ the phenomenon persisted in nearly half of the children studied.¹³

So much for the existence of masked hypertension in children; its importance as a clinical entity will depend on whether it carries risk for future cardiovascular outcome. In adults, there seems to be little doubt but that masked hypertension confers an increased cardiovascular risk. First, adults with masked hypertension are at increased risk for sustained hypertension,^{9,12} and this is also the case with the children and adolescents in the study of Lurbe et al in whom nearly half had persistent masked hypertension or sustained hypertension when followed-up over 3 years.¹³ Second, adult subjects with masked hypertension have increased target organ involvement as denoted by left ventricular mass and carotid atherosclerosis.^{9,14-16} Again, this finding appears to be mirrored in youth, with those children who progressed from masked to sustained hypertension having a higher left ventricular mass index than normotensive controls.¹³ Finally, as might be expected when target organ involvement is increased, the likelihood is that cardiovascular morbidity will also be greater, and such is the case.^{16,17} The logical extension of this line of reasoning is that future studies will also show cardiovascular mortality to be increased.

The reason why subjects with low office blood pressure may have elevated ABPM is still unknown. In adults regression to the mean, increased variability, smoking, alcohol drinking, sedentary habits, greater reactivity to daily life stressors, and standing have all been suggested as possible factors.^{9,10,12} In youthful subjects, the blood pressure reaction to standing, which is more pronounced in young individuals and is known to affect average daytime blood pressure and physical activity, neither of which were assessed in the study by Lerbe et al, could have been relevant in inducing masked hypertension.

Masked hypertension in children and adults presents clinicians with the serious problem of identifying subjects with the condition. Clearly, it is not practical to perform ABPM in all subjects with normotension in the office or clinic to unmask those with ambulatory hypertension. Yet the consequences of not identifying masked hypertension carry serious implications for patients, especially those who may already have cardiovascular involvement, such as adults with overt coronary and cerebrovascular disease in whom antihypertensive medication would carry real benefit. Now, we have to face the reality that children with masked hypertension may also be seriously disadvantaged if ABPM is not performed. Because there are no striking characteristics to indicate subjects likely to have masked hypertension, we can only

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examine characteristics that may be suggestive of the condition, bearing in mind that the underlying mechanisms may change with age. It is also possible that the characteristics of youth may also be relevant in adulthood. In the study by Lerbe et al, nearly 50% of the youngsters with persistent masked hypertension had a positive parental history of hypertension.¹³ Moreover, in keeping with other epidemiological studies this association was even more pronounced when parents became hypertensive early in their life. This association highlights the importance of a taking a detailed family history in patients with cardiovascular disease. Children with masked hypertension tended to be obese,¹³ and central obesity has also been implicated as a characteristic of adults with masked hypertension.⁹ In studies relating obesity to masked hypertension, it is important to ensure that the inflatable bladders used for blood pressure measurement are appropriate in the clinic and ambulatory settings, because use of a cuff that is too small for ABPM could result in ambulatory cuff hypertension that might be attributed erroneously to masked hypertension. Children with masked hypertension tend to have a higher ambulatory pulse rate than normotensive subjects,¹³ which may indicate greater reactivity to the stressors of daily life or to the effect of standing, which has also been shown to be associated with masked hypertension in adults.¹² Children with masked hypertension also have higher nocturnal blood pressure than normotensive subjects, suggesting that future study might focus on nighttime blood pressure, which, being less influenced by daily activity, might provide a more reproducible profile of masked hypertension. The detection of left ventricular hypertrophy in children or adults without an obvious cause is another indication for ABPM to exclude masked hypertension.^{9,13} It is possible that normotension in the office or clinic merely captures blood pressure during a hypotensive period of an otherwise hypertensive circadian profile, or that some subjects, perhaps children especially, are more relaxed in the office environment than when having blood pressure recorded by ABPM during daily activity. However relevant, such hypotheses may be the important message for clinicians is that subjects of all ages who are referred for blood pressure assessment are referred because an abnormal measurement has been recorded and, if the characteristics listed are present, these subjects are potential candidates for masked hypertension.

The occurrence of masked hypertension and the reverse phenomenon of white-coat hypertension in at least 10% of children and adults introduce the potential for misdiagnosing >20% of subjects who present to doctors to have blood pressure measured. This estimate, which is conservative, must surely make ABPM an indispensable investigation for the diagnosis and management of hypertension in children, adolescents, and adults. Bobrie et al have shown recently that self-measurement of blood pressure may also detect masked hypertension, but it will be necessary to show that both techniques are identifying similar patients.¹⁶

Detecting masked hypertension is one exercise; how to manage it is one that is not easy to answer given the lack of evidence available. Establishing reproducibility of the phenomenon is clearly important and requires repeat ABPM in the assurance

that the rewards of confirming the condition will be worthwhile. In adults and children, the decision to prescribe antihypertensive medication will be dependent on the total risk profile and the perceived need to protect the cardiovascular system from the burden of hypertension. The case for ABPM to be available with suitable reimbursement is one that should no longer be resisted in pediatric and adult practice.

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