Making Good Use of Diastolic and Systolic Blood Pressures in the Management of Hypertension

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In the modern era, physicians who wish to measure blood pressure for the management of hypertension are faced by many dilemmas and controversies. In the 1960s and 1970s it was very simple—use a mercury sphygmomanometer in the clinic, measure both the systolic blood pressures (SBPs) and diastolic blood pressures (DBPs), and base your decisions for managing the hypertension on the diastolic pressure. As time passed and the 20th century progressed, the situation became rapidly more complex. First, many new sphygmomanometers became available, aneroids and semiautomatic devices, and, indeed, the mercury sphygmomanometer is now on death row in many countries. Then the clinic pressure came under severe criticism in view of issues, such as white coat or office hypertension and masked hypertension, leading to the increasing use of ambulatory blood pressure monitoring and the introduction of home blood pressure measurement, using a wide range of devices. The role of the physician in measuring the pressure also came under the spotlight. Over this period, the emphasis for determining the optimal blood pressure to measure moved progressively from the accuracy of the measurement itself to the accuracy and use of each measure in predicting the risk of major cardiovascular events, both fatal and nonfatal. As a result, the systolic pressure has come to be preferred over the diastolic pressure. In large part, this has reflected the changes attributable to the ageing of the population with progressive stiffening of the large arteries leading to a situation in which the SBP continues to rise with age, whereas the diastolic pressure reaches a peak around the age of 50 years before beginning to fall as people live beyond this age. In turn, this has introduced further dilemmas—should we use the pulse pressure as the preferred index or maybe the central blood pressure? And if the latter, how should we measure it? An even more recent complication comes from the reports that visit-to-visit variability of blood pressure may be at least as important as the usual or mean level of blood pressure in predicting stroke incidence and mortality and is independent of the mean level as a predictor.

In the midst of all this complexity, it is refreshing to get some clarity even if only on 1 limited aspect of the problem. This month’s issue of Hypertension has a report from the MOnica Risk, Genetics, Archiving, and Monograph (MORGAM) project, examining the relative importance of the SBPs and DBPs in determining the risk of stroke, both fatal and nonfatal. The report is based on data from 34 cohorts in 10 European countries, with baseline collections between 1982 and 1997. Subjects numbering 68,551 between the ages of 19 and 78 years were followed up for a mean of 13.2 years. The associations between baseline SBPs and DBPs and stroke risk were analyzed in relation to age at baseline using age as a continuous variable and also splitting the subjects into 4 subgroups of age (19–39, 40–49, 50–59, and 60–78 years). Because tests for nonlinearity in the association of DBP with stroke revealed a J-curve with lowest stroke risk at 71 mm Hg, further analyses were performed separately for DBP above and below 71 mm Hg.

A very comprehensive set of analyses can be summarized along the following lines. For people with a DBP >71 mm Hg, the subgroup analyses indicate that both SBP and DBP are positively associated with the risk of stroke up to the age of 39, with the DBP being superior in this group; both SBP and DBP are again positively associated with stroke risk between 40 and 59 years, with the SBP gradually establishing its superiority with increasing age in this group; and the SBP is clearly superior from and above the age of 60 years. The analysis with age as a continuous variable in those with DBP >71 mm Hg puts the thresholds at 47 and 62 years (rather than 40 and 60 years). For people with DBP <71 mm Hg, the subgroup analyses indicated that there was an inverse relationship between DBP and stroke risk, such that the stroke risk increased with decreasing blood pressure, and this was significant above the age of 60 years. The analyses with age as a continuous variable in this subset with DBP >71 mm Hg also indicated an inverse relationship between DBP and stroke risk, which became significant from the age of 50 years. These age-related shifts between SBP and DBP in the association with stroke risk remained consistent regardless of geographical location or the presence of cardiovascular risk factors, such as diabetes mellitus, smoking, high body mass index, or high cholesterol.

The inverse relationship between DBP and the risk of stroke in those with DBP <71 mm Hg poses a problem. As the authors state, the relevance of this association is questionable. In part, this is because the number of subjects was very limited in this subset, and, in part, because there is extensive evidence that the treatment of isolated systolic hypertension, which is commonly associated with quite low DBPs, does reduce stroke risk. There is also evidence that intensification of blood pressure–lowering treatment does reduce cardiovascular events in elderly subjects, at least until DBP reaches 55 mm Hg. The Framingham investigators have also reported that an excess of...
cardiovascular events was only observed at DBP <80 mm Hg when accompanied by SBP >140 mm Hg, with increasing increments of SBP accompanied by increasing tendency to J curve.\(^9\) However, it should be recognized that very low DBP in the range below 50 or 55 mm Hg may well indicate the presence of other cardiovascular conditions, such as heart failure, requiring investigation and appropriate management.

Putting all this together in a manner that might be digestible for the general practitioner or internist suggests a schema along the following simple lines for managing hypertension with a view to reducing the risks of future stroke. If the diastolic pressure is >70 mm Hg, decisions should be based on both DBP and SBP up to the age of 60 years but on SBP alone above this age. For those with DBP <70 mm Hg decisions should be based on the SBP, but an eye should be kept on those with very low DBP, as low as 50 to 55 mm Hg, because they may well be at greater risk of cardiovascular complications. The take home message is that it is still important to measure and consider the DBPs for the management of the patient with hypertension.

Some aspects of the report do raise questions. First, it is limited to European populations, and second, it does not differentiate between stroke subtypes, such as hemorrhagic stroke and ischemic stroke. Given the very different patterns of stroke in Asian and white populations with greater proportions of intracerebral hemorrhage in major Asian populations, such as those of China and Japan, this raises the possibility that the present findings may not apply across the board. However, a study from the Asia Pacific Cohort Studies Collaboration reported that for both these stroke subtypes there was a similar positive association between SBP and stroke risk in Asian and Australasian cohorts, albeit somewhat steeper in the Asian.\(^10\) In addition, this report from the MORGAM project is clearly addressing the relationship between blood pressure and the risk of stroke and does not examine the relationship with cardiac outcomes, such as coronary heart disease, myocardial infarction, or heart failure. It is hoped that the MORGAM investigators will perform a parallel set of studies on the association between SBP and DBP and these cardiovascular outcomes in relation to ageing.

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**References**

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