Lowering blood pressure to prevent myocardial infarction and stroke

Lowering blood pressure to prevent myocardial infarction and stroke: a new preventive strategy

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Executive summary

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Executive summary

Background

The traditional approach to the use of blood pressure-lowering drugs has been limited, because intervention has been directed only to the small percentage of people in the upper part of the blood pressure distribution. The term 'hypertension' exacerbates the problem. It suggests a condition that is a disease in itself. It implies that the aim of treatment is to reduce blood pressure to a 'normal' or average level but no lower, and tends to conceal the fact that blood pressure measurement (detecting 'hypertensives') is a poor test to detect persons who will develop stroke or ischaemic heart disease. This approach is misplaced because it focuses on the level of blood pressure rather than a person's overall level of risk of stroke and heart disease, taking all the important determinants of risk into account (notably the presence of existing cardiovascular disease and age). Moreover, the traditional approach to using blood pressure-lowering drugs involves treating no more than a small minority of the population, yet stroke and ischaemic heart disease account for one-third of all deaths, so it will not be possible to make a significant impact on this high mortality without treating a substantial proportion of the population. Although the approach is slowly changing, significant advances in preventing heart disease and stroke will not take place until it is abandoned.

Methods and results

The dose–response relationship between blood pressure and the incidence of stroke and heart disease is continuous. Across the range of values in Western populations there is no evidence of a threshold below which there is no association. Lowering blood pressure reduces the risk of heart disease and stroke whatever the starting blood pressure; a given reduction in blood pressure produces a similar **proportional** reduction in risk from any initial value. Lowering blood pressure by 5 mmHg diastolic reduces the risk of stroke by an estimated 34% and ischaemic heart disease by 21%; these estimates, derived from cohort studies, have been corroborated by the results of randomised trials in persons with high, average and below average levels of blood pressure.

Although blood pressure is an important cause of stroke and heart disease, it is not a good screening test in distinguishing persons who will and will not develop the diseases. Most strokes and ischaemic heart disease events occur in persons who do not have high blood pressure. For example, the 10% of persons with the highest blood pressure experience only 28% of all strokes and 21% of all ischaemic heart disease events. In any age–sex group, the incidence of stroke and myocardial infarction in those whose blood pressure is above any specified level (such as 100 mmHg diastolic) is similar to the incidence in those 10–15 years older whose blood pressure is below this specified level. It may seem paradoxical that blood pressure measurement is a poor screening test for stroke and heart disease even though reducing blood pressure is very effective in reducing the risk from these two diseases. The paradox results from the fact that the average blood pressure is high and the distribution of blood pressure within a given population is relatively narrow – everyone is 'exposed' and the variation in exposure between individuals is small.

Combining several of the 'reversible' cardiovascular risk factors (such as blood pressure, smoking and serum cholesterol) adds little to the screening performance of blood pressure alone. At a 5% false-positive rate, 17% of those who subsequently have ischaemic heart disease events would be identified with screening based on systolic blood pressure alone, 22% with systolic blood pressure and apolipoprotein B (apo B) [a marker for low-density lipoprotein (LDL) cholesterol] in combination, and 28% with six risk factors in combination (including blood pressure, apo B and smoking). It is not possible in this way to identify most people who will develop cardiovascular disease without also identifying many who will not.

Nonetheless, screening has an important role although not through measuring blood pressure. The main method of screening should be to identify systematically all persons with a ▶

history of stroke or myocardial infarction at any time in the past, or of angina or transient ischaemic attacks, since they are all at very high risk of death or a recurrent event. However, once a first cardiovascular event has occurred, the ability of blood pressure and other risk factors to predict recurrent events is very weak. Although a history of past events is an effective way of identifying persons who will have new cardiovascular events and deaths, combining a history of past events with blood pressure and other cardiovascular risk factors is not more effective. Patients who have had a stroke or myocardial infarction have a risk of dying of about 5% per year without treatment; these deaths occurring after a first event account for about half of all deaths from stroke and heart disease, and most of them are preventable.

Among persons without known cardiovascular disease, most, if not all, persons above a specified age need to be treated to ensure that the majority of those who would have had an event will receive preventive treatment; the 'reversible' risk factors, even in combination, are not discriminatory. The principal screening test is determining the age above which treatment would generally be offered (this might be 55 years). With both screening approaches (existing disease and age), blood pressure-lowering drug treatment is offered on the basis of the main determinants of risk, not on blood pressure itself. The two approaches (previous disease and age) would together enable blood pressure-lowering drugs (and other preventive treatment) to be offered to virtually all (98%) persons who would otherwise die of stroke and heart disease.

Studies have shown that realistic changes in diet and lifestyle can reduce average blood pressure levels to only a limited extent (2–3 mmHg diastolic), in the absence of a substantial reduction by the food industry in the salt content of manufactured food. Blood pressure-lowering drugs are needed to achieve larger reductions. Thiazides, beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, angiotensin-II receptor antagonists and calcium-channel blockers are all effective drugs in lowering blood pressure. Meta-analyses of randomised trials showed that the average reductions in systolic blood pressure produced by the five categories of drugs in standard dose were 8.8 mmHg for thiazides, 9.2 mmHg for beta-blockers, 8.5 mmHg for ACE inhibitors, 10.3 mmHg for angiotensin-II receptor antagonists and 8.8 mmHg for calcium-channel blockers. The corresponding diastolic blood pressure reductions were 4.4, 6.7, 4.7, 5.7 and 5.9 mmHg. The drugs significantly reduced blood pressure from all starting levels though the higher the initial level of blood pressure the greater was the reduction in blood pressure. Combinations of drugs from different categories are additive in their blood pressure-lowering effects. From an initial diastolic blood pressure of 90 mmHg (about the average level in persons having a myocardial infarction or stroke), one drug alone on average reduced diastolic blood pressure by 4.7 mmHg, two in combination by 8.9 mmHg and three in combination by 12.6 mmHg. These blood pressure reductions would be expected to reduce the incidence of stroke by 32, 52 and 65% and the incidence of ischaemic heart disease events by 20, 34 and 45%, respectively.

The proportion of persons experiencing any symptom caused by blood pressure-lowering drugs in standard doses (treated minus placebo) was 9.9% for thiazides, 7.5% for beta-blockers, 3.9% for ACE inhibitors, 0.0% for angiotensin-II receptor antagonists and 8.3% for calcium-channel blockers. These symptoms remitted on stopping the drug. The metabolic effects of thiazides and beta-blockers in standard dose (such as changes in serum lipids) are negligible and their use without routine biochemical monitoring is safe. The drugs are inexpensive (the cost to the NHS is £5 per year for hydrochlorothiazide and £9 per year for atenolol). The efficacy of these drugs, their low cost and their safety make them suitable for widespread use.

Conclusions

There are considerable limitations to current guidelines that specify that blood pressure should be lowered only in persons in whom it exceeds a specified level (such as 100 mmHg diastolic). This approach limits the number who can be treated and does not address the inconsistency that an older person with average blood pressure has a substantially greater risk of myocardial infarction or stroke than a younger person with high blood pressure. It also ignores the fact that there is benefit in changing all reversible risk factors (not only blood pressure) in persons who are at high risk for any reason.

The authors have identified a range of policy options in relation to treatment of high blood pressure and considered these in light of the findings of this research. It is suggested that a combination of identifying all people with established cardiovascular disease and offering treatment to all persons above a specified ▶

age are likely to have the greatest public health impact (may reduce stroke by about two-thirds and ischaemic heart disease by half), on the basis of the epidemiological evidence presented. Further research into treatment effectiveness and into the economic implications of policy options is required.

Publication

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The NHS R&D Health Technology Assessment (HTA) Programme was set up in 1993 to ensure that high-quality research information on the costs, effectiveness and broader impact of health technologies is produced in the most efficient way for those who use, manage and provide care in the NHS.

Initially, six HTA panels (pharmaceuticals, acute sector, primary and community care, diagnostics and imaging, population screening, methodology) helped to set the research priorities for the HTA Programme. However, during the past few years there have been a number of changes in and around NHS R&D, such as the establishment of the National Institute for Clinical Excellence (NICE) and the creation of three new research programmes: Service Delivery and Organisation (SDO); New and Emerging Applications of Technology (NEAT); and the Methodology Programme.

This has meant that the HTA panels can now focus more explicitly on health technologies ('health technologies' are broadly defined to include all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care) rather than settings of care. Therefore the panel structure was replaced in 2000 by three new panels: Pharmaceuticals; Therapeutic Procedures (including devices and operations); and Diagnostic Technologies and Screening.

The HTA Programme will continue to commission both primary and secondary research. The HTA Commissioning Board, supported by the National Coordinating Centre for Health Technology Assessment (NCCHTA), will consider and advise the Programme Director on the best research projects to pursue in order to address the research priorities identified by the three HTA panels.

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