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PRACTICE

GUIDELINES

Management of hypertension: summary of NICE guidance

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This is one of a series of *BMJ* summaries of new guidelines based on the best available evidence; they highlight important recommendations for clinical practice, especially where uncertainty or controversy exists.

Hypertension is one of the most important preventable causes of death worldwide and one of the commonest conditions treated in primary care in the United Kingdom, where it affects more than a quarter of all adults and over half of those over the age of 65 years.[1] This article summarises the most recent recommendations from the National Institute for Health and Clinical Excellence (NICE) on the management of hypertension,[2] which updates the 2004 and 2006 clinical guidelines.[3-5]

Recommendations

NICE recommendations are based on systematic reviews of best available evidence and explicit consideration of cost effectiveness. When minimal evidence is available, recommendations are based on the Guideline Development Group's experience and opinion of what constitutes good practice. Evidence levels for the recommendations are given in italic in square brackets.

Diagnosing hypertension

- If blood pressure measured in the clinic is 140/90 mm Hg or higher:

  -Take a second measurement during the consultation

  -If the second measurement is substantially different from the first, take a third measurement

  -Record the lower of the last two measurements as the clinic blood pressure.

(Updated recommendation) [*Based on the experience and opinion of the Guideline Development Group (GDG)*]

- If the clinic blood pressure is 140/90 mm Hg or higher, use ambulatory blood pressure monitoring to confirm the diagnosis of hypertension. This strategy will improve the accuracy of the diagnosis compared with current practice[6] and was also shown to be cost effective—indeed, cost saving—for the NHS. (Updated recommendation) [*Based on a systematic review of randomised controlled trials ranging in quality from poor to good and on cost effectiveness evidence*]
- When using ambulatory blood pressure monitoring to confirm a diagnosis of hypertension, ensure that at least two measurements an hour are taken during the person's usual waking hours (for example, between 0800 and 2200). Use the average value of at least 14 measurements taken during the person's usual waking hours to confirm a diagnosis of hypertension. (New recommendation) [*Based on prognostic and reliability or reproducibility studies determined to be at low risk of bias*]
- If a person cannot tolerate ambulatory blood pressure monitoring, home blood pressure monitoring is a suitable alternative to confirm the diagnosis. (New recommendation) [*Based on a systematic review of randomised controlled trials ranging in quality from poor to good and on cost effectiveness evidence*]
- When using home blood pressure monitoring to confirm a diagnosis of hypertension:

  -For each blood pressure recording, take two consecutive measurements, at least one minute apart and with the person seated, and

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-Record blood pressure twice daily, ideally in the morning and evening, and

-Continue recording blood pressure for at least four days, ideally for seven days, and

-Discard the measurements taken on the first day and use the average value of all the remaining measurements to confirm a diagnosis of hypertension.

(New recommendation) [*Based on prognostic and reproducibility studies determined to be at low risk of bias*]

- While waiting for a confirmed diagnosis of hypertension, investigate target organ damage (such as left ventricular hypertrophy, chronic kidney disease, and hypertensive retinopathy) and formally assess cardiovascular risk. (New recommendation) [*Based on the experience and opinion of the GDG*]
- Use risk equations to assess cardiovascular risk—for example, the Framingham risk calculator[7] (as used in the Joint British Societies' risk charts available in the *British National Formulary* and available from http://bnf.org/bnf/bnf/61/204016.htm) and QRISK2 (available from http://qrisk.org/).[8] [*Based on the NICE guideline on lipid modification*[9]]

Thresholds for intervention

- If the person has severe hypertension (clinic blood pressure ≥180/110 mm Hg), consider starting antihypertensive drug treatment immediately, without waiting for the results of ambulatory or home blood pressure monitoring. (New recommendation) [*Based on the experience and opinion of the GDG*]
- Offer lifestyle advice to people with hypertension at initial diagnosis and then periodically thereafter [*Based on the experience and opinion of the GDG*]
- Offer antihypertensive drug treatment to people aged under 80 years with stage 1 hypertension (that is, an average ambulatory or home blood pressure of ≥135/85 mm Hg and <150/95 mm Hg; a clinic blood pressure of ≥140/90 mm Hg and <160/100 mm Hg) and who have one or more of the following:

  -Target organ damage

  -Established cardiovascular disease

  -Renal disease

  -Diabetes

  -A 10 year cardiovascular risk equivalent to ≥20%.

(Updated recommendation) [*Based on systematic reviews and meta-analyses of low quality observational and low to high quality randomised controlled trials; prognostic studies determined to be at low risk of bias; and a blood pressure equivalence study of low quality*]

- Offer antihypertensive drug treatment to people of any age with stage 2 hypertension (an average ambulatory or home blood pressure of ≥150/95 mm Hg; a clinic blood pressure ≥160/100 mm Hg) irrespective of the presence of target organ damage, cardiovascular disease, renal disease, or the 10 year risk of cardiovascular disease. (Updated recommendation) [*Based on systematic reviews and meta-analyses of low quality observational and low to high quality randomised controlled trials; prognostic studies determined to be at low risk of bias; and a low quality observational study*]
- For people aged under 40 years with stage 1 hypertension and no evidence of target organ damage, cardiovascular disease, renal disease or diabetes, consider seeking specialist evaluation for secondary causes of hypertension and a more detailed assessment of potential target organ damage. This is because 10 year cardiovascular risk assessments can underestimate the lifetime risk of cardiovascular events in these younger people. (Updated recommendation) [*Based on systematic reviews and meta-analyses of low quality observational and low to high quality randomised controlled trials; prognostic studies determined to be at low risk of bias; and a blood pressure equivalence study of low quality*]

Blood pressure medication

The figure⇓ outlines an algorithm showing the four steps in the drug treatment of hypertension.

- If blood pressure is not controlled by the treatment offered at each step, review medication to ensure that the treatment is at optimal or best tolerated doses before moving to the next step. (Updated recommendation) [*Based on the experience and opinion of the GDG*]
- For people aged 80 years and over, offer the same antihypertensive drug treatment as for people aged 55-80 years, taking into account any comorbidities. (Updated recommendation) [*Based on a systematic review and meta-analysis including moderate to high quality randomised controlled trials, and on cost effectiveness evidence*]

Step 1

- For people aged under 55 years, offer an angiotensin converting enzyme (ACE) inhibitor or a low cost angiotensin II receptor blocker (ARB). If an ACE inhibitor is prescribed and is not tolerated (for example, because of cough), offer an ARB. (Updated recommendation) [*Based on a low to high quality randomised controlled trial and on cost effectiveness evidence*]
- Do not combine an ACE inhibitor with an ARB to treat hypertension. This is not the most rational combination to reduce blood pressure and may result in more adverse events without any additional clinical benefit.[10] (Updated recommendation) [*Based low to high quality evidence from a randomised controlled trial*]
- For people aged over 55 years and black people of African or Caribbean family origin of any age, offer a calcium channel blocker. If this is not suitable—for example, because of oedema or intolerance—or if there is evidence of heart failure or a high risk of heart failure, offer a thiazide-like diuretic. (Updated recommendation) [*Based on a moderate to high quality randomised controlled trial and cost effectiveness evidence*]
- If diuretic treatment is to be started or changed, offer a thiazide-like diuretic, such as chlortalidone (12.5-25.0 mg once daily) or indapamide (1.5 mg modified release once daily or 2.5 mg once daily), in preference to a conventional thiazide diuretic such as bendroflumethiazide or hydrochlorothiazide. (Updated recommendation) [*Based on moderate to very low quality evidence from randomised controlled trials*]
- For people who are already taking bendroflumethiazide or hydrochlorothiazide and whose blood pressure is stable

and well controlled, continue treatment with the bendroflumethiazide or hydrochlorothiazide. (Updated recommendation) [*Based on moderate to very low quality evidence from randomised controlled trials and on the experience and opinion of the GDG*]

Step 2

- Offer a calcium channel blocker in combination with either an ACE inhibitor or an ARB. (Updated recommendation) [*Based on evidence from a moderate quality randomised controlled trial*]
- If a calcium channel blocker is not suitable for step 2 treatment—for example, because of oedema or intolerance—or if there is evidence of heart failure or a high risk of heart failure, offer a thiazide-like diuretic. (Updated recommendation) [*Based on a moderate quality randomised controlled trial*]

Step 3

- If treatment with three drugs is needed, offer an ACE inhibitor or ARB, combined with a calcium channel blocker and a thiazide-like diuretic. (Updated recommendation) [*Based on moderate to very low quality evidence from randomised controlled trials and on the experience and opinion of the GDG*]

Step 4 (Resistant hypertension)

- If clinic blood pressure remains higher than 140/90 mm Hg after treatment with the optimal or best tolerated doses of the drug combination mentioned in step 3 (an ACE inhibitor or an ARB combined with a calcium channel blocker and a diuretic), regard this as resistant hypertension, and consider adding a fourth antihypertensive drug and/or seeking expert advice. (Updated recommendation) [*Based on low quality observational evidence*]
- For treatment of resistant hypertension:

  -Consider further diuretic treatment with low dose spironolactone (25 mg once daily) if the blood potassium concentration is 4.5 mmol/L or lower. Use particular caution in people with a reduced estimated glomerular filtration rate because they have an increased risk of hyperkalaemia

  -Consider higher dose thiazide-like diuretic treatment if the blood potassium concentration is higher than 4.5 mmol/L.

(Updated recommendation) [*Based on low quality observational evidence*]

- If further diuretic treatment for resistant hypertension at step 4 is not tolerated or is contraindicated or ineffective, consider an α blocker or β blocker. (Updated recommendation) [*Based on low quality observational studies*]

If blood pressure remains uncontrolled with the optimal or maximum tolerated doses of four drugs, seek expert advice if not yet obtained. (Updated recommendation) [*Based on the experience and opinion of the GDG*]

Monitoring blood pressure treatment

- Use clinic blood pressure measurements to monitor the response to antihypertensive treatment with lifestyle modifications or drugs. (Updated recommendation) [*Based on systematic reviews of very low to moderate quality randomised controlled trials, and cost effectiveness evidence*]

For people identified as having a "white coat effect"—that is, a discrepancy of more than 20/10 mm Hg between clinic and average daytime ambulatory blood pressure or average home blood pressure measurements at the time of diagnosis—consider ambulatory or home blood pressure monitoring as an adjunct to clinic blood pressure measurements to monitor the response to antihypertensive treatment with lifestyle modification or drugs. (Updated recommendation) [*Based on systematic reviews and meta-analyses of very low to moderate quality randomised controlled trials*]

Blood pressure targets

- Aim for a target clinic blood pressure below 140/90 mm Hg in people aged under 80 years with treated hypertension. (Updated recommendation) [*Based on systematic reviews of very low to moderate quality randomised controlled trials, and observational studies*]
- Aim for a target clinic blood pressure below 150/90 mm Hg in people aged 80 years and over with treated hypertension. (Updated recommendation) [*Based on a systematic review and meta-analysis that included moderate and high quality randomised controlled trials*]

Overcoming barriers

The recommendation that ambulatory blood pressure rather than clinic blood pressure measurements should be used to confirm the diagnosis of hypertension will have a profound impact on patient care by reducing the number who are incorrectly labelled as hypertensive and thus inappropriately prescribed antihypertensive treatment. Currently, only some primary care practices have access to ambulatory blood pressure monitoring devices, with the rest having to access them through referral to secondary care. Sufficient numbers of validated ambulatory devices (refer to www.bhsoc.org/blood_pressure_list.stm for a list of clinically validated monitors) will need to be procured and adequately maintained. Staff will need to be trained in their use and how to interpret data generated in the reports. The implementation of ambulatory blood pressure monitoring should be determined locally, reflect what is best and most convenient for patients, and not necessarily be based on current models of service configuration. The Guideline Development Group anticipates that practices and consortiums will devise various strategies that do not involve specialist referral to expand provision, and that procurement costs will fall as demand increases.

The members of the Guideline Development Group were Bryan Williams (chair), Helen Williams, Jane Northedge, John Crimmins, Mark Caulfield, Michaela Watts, Naomi Stetson, Richard McManus, Shelley Mason, Terry McCormack, Bernard Higgins, Kate Lovibond, Paul Miller, Rachel O'Mahony, and Taryn Krause.

TK wrote the first draft, and all authors were involved in writing further drafts and reviewed and approved the final version for publication. BW is the guarantor.

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Further information on the guidance

This updated guideline contains key recommendations that relate to the diagnosis of hypertension, thresholds for starting antihypertensive treatment, blood pressure treatment targets, monitoring blood pressure treatment, and an updated algorithm for antihypertensive treatment. Recommendations from the previous guidelines that have not been updated remain, including those on lifestyle advice, which were not reviewed for this update.

What's new

- Ambulatory blood pressure monitoring is more accurate and cost effective than clinic blood pressure measurement for confirming the diagnosis of hypertension.
- Home blood pressure monitoring is more accurate than clinic blood pressure measurement but less accurate than ambulatory blood pressure monitoring for confirming the diagnosis of hypertension.
- A diagnosis of stage 1 hypertension in patients aged under 40 years might not be benign, and these people should not automatically be excluded from receiving antihypertensive treatment.
- Evidence supports the provision of antihypertensive treatment to people aged over 80 years.
- There is an absence of evidence for use of bendroflumethiazide at the doses commonly prescribed in current UK practice.

Methods

The Guideline Development Group followed the standard NICE methods in the development of this guideline (www.nice.org.uk/aboutnice/howwework/developingniceclinicalguidelines/developing_nice_clinical_guidelines.jsp). This involved systematic searching, critically appraising, and summarising the clinical and cost effectiveness evidence. New cost effectiveness analysis was also undertaken, comparing different methods for diagnosing hypertension, and the previous developed cost effectiveness analysis of first line drug treatment was updated. The draft guideline went through a rigorous reviewing process, in which stakeholder organisations were invited to comment; all comments were taken into consideration when producing the final version of the guideline.

The guideline group comprised a consultant in cardiovascular medicine (chair), two patient representatives, one pharmacist, three general practitioners, a clinical pharmacologist, and two nurses.

Evidence statements in this summary relate to the guideline update. Quality ratings were based on GRADE methodology (www.gradeworking group.org). These relate to the quality of the available evidence for assessed outcomes rather than the quality of the clinical study. Outcomes assessed included mortality, heart failure, new onset diabetes mellitus, vascular procedures, angina, health related quality of life, and blood pressure response to treatment.

Cost effectiveness analysis for method of diagnosis

An economic model was developed to compare the cost effectiveness of three different options for blood pressure measurement for diagnosing hypertension: clinic, home, and ambulatory blood pressure monitoring. Ambulatory blood pressure monitoring was the most cost effective strategy for men and women of all ages. It was cost saving for all ages considered for both men and women and resulted in more quality adjusted life years (QALYs) for male and female age groups over 50. This result was robust to a wide range of sensitivity analyses around the base case but was sensitive if home monitoring was considered to have equal test performance to ambulatory monitoring or if treatment was considered effective in individuals who were not hypertensive.

Cost effectiveness analysis for first line drug treatment

The economic model assessing first line drug treatment developed as part of the clinical guideline 34[4] was updated. This compared no intervention, ACE inhibitor or ARB, β blockers, calcium channel blockers, and thiazide-type diuretics in terms of lifetime costs and quality adjusted life years (QALYs) from a UK health service perspective. Drug costs were based on generic UK list prices. Treating hypertension was highly cost effective, resulting in improved health outcomes (more QALYs) and cost savings with all drug classes compared with no treatment. Calcium channel blockers were shown to be the most cost effective intervention, with an incremental cost effectiveness ratio of under £2000 (€2290; $3260) per QALY gained for both men and women. Costs and savings with ACE inhibitors (or ARBs) and thiazide-type diuretics were fairly similar to those for calcium channel blockers; however, β blockers had considerable lower cost savings and QALY gains.

Future research

The Guideline Development Group identified the following areas as needing further research:

Does the use of out of office monitoring (home or ambulatory blood pressure measurements) improve response to antihypertensive treatment?

What is the appropriate threshold for intervention with antihypertensive treatment in people aged under 40 years?

What is the most accurate method of assessing the lifetime risk of cardiovascular events and the impact of therapeutic intervention on this risk in people aged under 40?

What is the optimal systolic blood pressure in people with treated hypertension?

Which drug treatment (diuretic treatment versus other step 4 treatments) is the most clinically and cost effective for step 4 antihypertensive treatment for people with hypertension?

Which automated blood pressure monitors are suitable for people with hypertension and atrial fibrillation?

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travel from Takeda UK and Boehringer Ingelheim. MC is president of the British Hypertension Society and a member of the European Society of Hypertension Council.

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Figure

Step 1	**A** (for patients aged <55 years) or **C*** (for patients aged ≥55 years and all black people of African or Caribbean descent)
Step 2	**A + C***
Step 3	**A + C + D**
Step 4	**Resistant hypertension** **A + C + D + further diuretic**† (or α blocker or β blocker if further diuretic treatment is not tolerated or is contraindicated or ineffective) Consider seeking specialist advice

Key
A = Angiotensin converting enzyme inhibitor or angiotensin II receptor blocker
C = Calcium channel blocker
D = Thiazide-like diuretic
* Calcium channel blocker preferred, but consider thiazide-like diuretics in people with oedema or high risk of heart failure
† Consider low dose spironolactone or higher doses of thiazide-like diuretic

Drug treatment of hypertension