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Module 10

Cardiovascular risk: Managing hypertension in type 2 diabetes

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Roger Gadsby

People with diabetes are at a high risk of developing vascular complications, all of which are known to be reduced by optimal blood pressure (BP) management. Type 2 diabetes is itself associated with hypertension, increasing the already high cardiovascular (CV) risk in this population. A variety of therapeutic options exist for the management of hypertension in people with diabetes, along with national guidelines and targets for BP measurement and treatment. This article discusses vascular risk as a function of high BP in people with type 2 diabetes, and explores the evidence and recommendations for the prevention and treatment of hypertension.

Learning objectives

After reading this article, the participant should be able to:

1. Describe the key trial data supporting the use of blood pressure (BP) management in people with diabetes.
2. Outline the components of good BP measurement.
3. Discuss NICE and SIGN targets and QOF indicators for the management of hypertension in people with diabetes.
4. Explain the main therapeutic options for the management of hypertension in people with diabetes.

Key words
- ACE inhibitor
- Blood pressure
- Cardiovascular risk
- Hypertension

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Approximately 80% of all people with type 2 diabetes die prematurely from cardiovascular (CV) complications (Emerging Risk Factors Collaboration et al, 2010). Furthermore, around 80% of people with type 2 diabetes are classified as having hypertension (blood pressure [BP] >140/90 mmHg; Barnett and O'Gara, 2003), a condition that increases the already high risk of CV disease (CVD) associated with type 2 diabetes (Hypertension in Diabetes Study Group, 1993).

The risk of developing such macrovascular complications (as well as microvascular complications such as retinopathy and nephropathy) is known to be reduced by improved BP control (UKPDS; UK Prospective Diabetes Study Group, 1998). This article explores the evidence base for the management of hypertension in people with diabetes, discusses national recommendations, and outlines the main therapeutic options available for the prevention and treatment of this condition. Although people with type 1 diabetes are also at increased risk of hypertension, much research and guidance does not distinguish between types 1 and 2 diabetes. Therefore, this article focuses on hypertension in type 2 diabetes where it is such an important issue.

The evidence base

In the UKPDS BP study, 1148 people with hypertension and type 2 diabetes were randomised to either a tight control arm (n=758)

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or a less tight control arm (*n*=390). The final mean difference between the two groups was 10/5 mmHg (144/82 mmHg in the tight control group vs 154/87 mmHg in the less tight control group). Over 9 years, those assigned to the tight control arm had significant reductions in morbidity and mortality, with a 32% reduction in diabetes-related death, a 44% reduction in fatal and non-fatal stroke, a 56% reduction in congestive cardiac failure, and a 37% reduction in developing microvascular complications (UKPDS Group, 1998).

People in the tightly controlled group were treated with the beta-blocker atenolol or the angiotensin-converting enzyme (ACE) inhibitor captopril, but the study was not sufficiently powered to say which agent was superior.

Further evidence for the benefit of BP lowering in type 2 diabetes comes from the HOT (Hypertension Optimal Treatment) trial (Hansson et al, 1998), which randomised 18 790 people with hypertension into three groups, aiming to achieve diastolic pressures of ≤90, ≤85 and ≤80 mmHg in each group. The trial contained around 1500 people with type 2 diabetes, in which significant reductions in CV morbidity and mortality were observed in the tightest control group, with a relative risk reduction of 51%.

Evidence on the beneficial effect of BP lowering in people with type 2 diabetes is strong, and the NICE (2008) guideline for type 2 diabetes concluded that it is likely to be highly cost-effective in people with the condition, more so than in the general population. Aggressive treatment of CV risk factors, including raised BP, is therefore essential to improve CV outcomes in this high-risk group.

There is evidence from the Steno-2 study that treating all CV risk factors together produces substantial risk reductions for CVD and mortality (Gaede et al, 2003). This study was carried out in 160 people with type 2 diabetes and microalbuminuria – a population at significant risk of CVD. Eighty people were randomised to conventional treatment and 80 to intensive treatment. For those who received intensive treatment, the aim was to reduce cholesterol to ≤4.5 mmol/L, HbA_{1c} level to ≤6.5% (≤48 mmol/mol), BP to ≤130/80 mmHg, to prescribe aspirin and for participants to stop smoking. After the mean follow-up of 7.8 years there was a significant reduction in both macro- and microvascular disease endpoints.

An observational follow-up of the Steno-2 study reported that after 13.3 years of follow-up, the benefits of tight BP control in at-risk people with type 2 diabetes continued (Gaede et al, 2008). Twenty-four people in the intensive treatment group had died compared with 40 in the standard treatment group, and intensive therapy was associated with a lower risk of death from CV causes (hazard ratio, 0.43; 95% confidence interval [CI], 0.19–0.94; *P*=0.04) and of CV events (hazard ratio, 0.41; 95% CI, 0.25–0.67; *P*<0.001).

Association of hypertension and diabetes

In type 2 diabetes, hypertension is associated with insulin resistance and other features of the metabolic syndrome, including central obesity and dyslipidaemia (Eckel et al, 2010).

There are several ways in which insulin resistance and/or hyperinsulinaemia could lead to hypertension. One is through the loss of insulin's normal vasodilatory activity, an action mediated by the release of nitric oxide from endothelium (Williams and Pickup, 2004).

Insulin also has other actions that raise BP and which could be accentuated by the hyperinsulinaemia that accompanies insulin resistance. Insulin promotes sodium and water reabsorption at the distal renal tubule; it also stimulates the cell membrane sodium–potassium adenosine triphosphate (ATP)ase, which could raise intracellular sodium and potassium in vascular smooth muscle, thereby enhancing contractility and peripheral resistance (Williams and Pickup, 2004).

Blood pressure assessment in diabetes: How, when and who?

BP measurement needs to be performed by a trained, competent person using an appropriately calibrated device in a situation where the individual being measured is relaxed, to enable an accurate and reliable figure to be obtained. *Table 1* lists the key components of good BP

Page points

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2. In type 2 diabetes, hypertension is associated with insulin resistance and other features of the metabolic syndrome, including central obesity and dyslipidaemia.
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Page points

1. In comparison with isolated measurements in the clinic, 24-hour ambulatory blood pressure (BP) monitoring can detect alterations in BP profiles, such as absence of nocturnal BP fall, postprandial hypotension or increased BP variability.
2. NICE (2008) recommends a BP target for people with type 2 diabetes of <140/80 mmHg, and <130/80 mmHg for those with type 2 diabetes and microalbuminuria or proteinuria.
3. For adults with type 1 diabetes, NICE (2004) recommends intervention levels of 135/85 mmHg unless the person has an abnormal albumin excretion rate or two or more features of the metabolic syndrome, in which case it should be 130/80 mmHg.

measurement. Where there are any symptoms suggestive of postural hypotension, such as a feeling of dizzyness on standing, it is important to check BP in both the sitting and standing position, to detect any drop in BP on standing, which is indicative of postural BP fall.

In the UKPDS (UKPDS Group, 1998), and many other hypertension outcome studies, BP was measured with a mercury sphygmomanometer. The use of mercury in medical devices was in danger of being phased out due to concerns about its safety by the European Union (Medicines and Healthcare products Regulatory Agency, 2006). Semi-automatic electronic sphygmomanometers are replacing the traditional mercury device in many clinics, because of these presumed safety concerns. It is vital if using a non-mercury machine to use one that has been appropriately validated. Practical information and a list of validated BP monitors can be found at: http://www.bhsoc.org/blood_pressure_list.stm.

Some clinics have devices that are lent to people for home BP monitoring. As these become cheaper, some individuals are starting to buy their own. It is also possible that the use of devices for continuous ambulatory BP monitoring will become more widespread in the next few years.

Home BP monitoring, with its multiple measurements over time, may be found to give better prognostic information than isolated clinic readings (Petrie, 2003). However, it needs to be remembered that the thresholds and targets upon which BP management is based – in research studies and in the QOF – are derived from clinic measurements made with mercury devices.

Table 1. Key components of good blood pressure measurement.

- Ensure subject is sitting at rest for 5 mins in quiet surroundings.
- Ensure arm is supported at heart level; check blood pressure in both the sitting and standing position to detect postural hypotension.
- Use appropriately sized cuff.
- Use appropriately calibrated device.
- Take three separate readings.
- Record these (and average) to nearest 2 mmHg.

Adapted from: Gadsby (2004)

Role of ambulatory BP measurement

In comparison with isolated measurements in the clinic, 24-hour ambulatory BP monitoring can detect alterations in BP profiles, such as absence of nocturnal BP fall, postprandial hypotension or increased BP variability. It has the disadvantages of a relatively high cost, problems with validation of the devices and undefined diagnostic thresholds in high-risk populations, but may be indicated in people with diabetes when (Parati and Bilo, 2009):

- Clinic values are found to be close to threshold values for treatment intervention or change. This is because these people are most likely to have "white-coat" hypertension (high BP in the clinic environment but normal ambulatory BP) or masked hypertension (when ambulatory BP will be raised). However, home BP monitoring may be easier, cheaper and equally effective at delineating these differences.
- Used to detect signs of end-organ damage despite apparently normal clinic BP.
- Used to detect whether nocturnal BP is being controlled in those on antihypertensive therapy, especially where there is autonomic neuropathy or obstructive sleep apnoea.

Targets and guidance

NICE (2008) recommends a BP target for people with type 2 diabetes of <140/80 mmHg, and <130/80 mmHg for those with type 2 diabetes and microalbuminuria or proteinuria. For adults with type 1 diabetes, NICE (2004) recommends intervention levels of 135/85 mmHg unless the person has an abnormal albumin excretion rate or two or more features of the metabolic syndrome, in which case it should be 130/80 mmHg.

Many guidelines, however, do not distinguish between type 1 and type 2 diabetes in either the intervention and target levels for BP treatment, or in the BP-lowering therapies they recommend. For example, the recently published SIGN (2010) guideline recommends an optimal BP of ≤130/80 mmHg for people with diabetes.

Quality and Outcomes Framework

In 2004 the revised General Medical Services contract for GPs introduced the QOF – a

"pay-for-performance" system that rewards the attainment of both process and intermediate outcome achievement for a number of long-term conditions (NHS Employers, 2009).

The QOF diabetes clinical indicators focus on three main therapeutic interventions in people with diabetes: glycaemic control, lipid lowering and BP reduction. GPs are awarded points according to the percentage of people with diabetes who meet the indicators outlined in the QOF. These include HbA_{1c} level, the original indicators for which were ≤7.5% (≤58 mmol/mol) and ≤10% (≤86 mmol/mol) (NHS Employers, 2006), but which were intensified in 2009 to ≤7%, ≤8% and ≤9% (≤53, ≤64 and ≤75 mmol/mol, respectively), total cholesterol ≤5 mmol/L and BP ≤145/85 mmHg (NHS Employers, 2009).

The challenge for primary care practitioners is to implement the best possible standard of care for people with type 2 diabetes in terms of glycaemic control, lipid-lowering and BP reduction, along with other CV risk factors, to improve CV outcomes.

QOF data suggest that there has been improvement in both process and intermediate outcome measures for CVD risk factors in diabetes over the years since the introduction of QOF in 2004, as illustrated in *Tables 2* and *3* (Gadsby, 2009; Vaghela et al, 2009).

Table 2. National achievement of QOF diabetes process measures.

Process	2004/5	2005/6	2006/7	2007/8
BMI recording	90.6%	94.1%	95.1%	94.9%
HbA_{1c} recording	94.4%	96.5%	97.1%	97.1%
BP recording	97%	98.2%	98.5%	98.5%
Total cholesterol recording	92.7%	95.4%	96.3%	96.1%

Adapted from: Gadsby (2009)

Table 3. Achievement of QOF intermediate outcome measures*.

Year	HbA_{1c} indicator	BP indicator	Cholesterol indicator	Excluded from HbA_{1c} indicator
2004/5	59.1%	70.9%	72.6%	9.4%
2005/6	61.7%	75.7%	79.8%	10.0%
2006/7	67.6%	79.6%	83.7%	9.9%
2007/8	66.7%	80.2%	83.6%	8.7%

*HbA_{1c} indicator = ≤7.5% (≤58 mmol/mol); BP indicator = ≤145/85 mmHg; Cholesterol indicator = ≤5 mmol/L.

Adapted from: Vaghela et al (2009)

Prevention and lifestyle modification

Most of the research on the benefits of lifestyle modification in lowering BP has been carried out in people without diabetes. The recommendations section on BP in the NICE (2008) guideline refers to the lifestyle recommendations of the NICE (2006) guideline on the management of hypertension in adults, which states that:

- Education about lifestyle on its own is unlikely to be effective.
- Healthy, low-calorie diets had a modest effect on BP in overweight individuals with raised BP, reducing systolic and diastolic BP on average by about 5–6 mmHg in trials. However, there was variation in the reduction in BP achieved in trials and it is unclear why. About 40% of individuals were estimated to achieve a reduction in systolic BP of 10 mmHg systolic or more in the short term, up to 1 year.
- Taking aerobic exercise (brisk walking, jogging or cycling) for 30–60 minutes, three to five times each week, had a small effect on BP, reducing systolic and diastolic BP on average by about 2–3 mmHg in trials. However, there was variation in the reduction in BP achieved in trials and it is unclear why. About 30% of individuals were estimated to achieve a reduction in systolic BP of 10 mmHg or more in the short term, up to 1 year.
- Interventions actively combining exercise and diet were shown to reduce both systolic and diastolic BP by about 4–5 mmHg in trials. About one-quarter of people receiving multiple lifestyle interventions were estimated to achieve a reduction in systolic BP of 10 mmHg systolic or more in the short term, up to 1 year.

NICE (2006) says that relaxation therapies can also reduce BP and individuals may wish to pursue these as part of their treatment. However, routine provision by primary care teams is not currently recommended. In addition, it is recommended that individuals' alcohol consumption be ascertained and encouragement

Page points

1. The QOF diabetes clinical indicators focus on three main therapeutic interventions in people with diabetes: glycaemic control, lipid lowering and blood pressure (BP) reduction.
2. Education about lifestyle on its own is unlikely to be effective.
3. NICE (2006) says that relaxation therapies can also reduce BP and individuals may wish to pursue these as part of their treatment. However, routine provision by primary care teams is not currently recommended.

Page points

1. NICE (2008) recommends starting with an angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (ARB) if side-effects of ACE-inhibitor therapy (usually cough) mean that they cannot be tolerated.
2. If full-dose ACE-inhibitor therapy does not control blood pressure (BP) to these recommended targets, NICE recommends adding a calcium-channel blocker (CCB) or diuretic (usually bendroflumethiazide 2.5 mg daily).
3. If dual therapy with an ACE inhibitor plus diuretic, or an ACE inhibitor plus CCB, does not control BP to target, the agent not used out of the three – CCB or diuretic – should be added to give a triple-agent regimen. If a fourth agent is required, NICE recommends using either an alpha-blocker, beta-blocker or a potassium-sparing diuretic.

given to reduce intake if they drink excessively, as this can reduce BP and has broader health benefits. Furthermore, excessive consumption of coffee and other caffeine-rich products should be discouraged, as excessive consumption of coffee (five or more cups per day) is associated with a small increase in BP (2/1 mmHg) in people with or without raised BP in studies of several months' duration (NICE, 2006).

Drug treatment of hypertension in diabetes and NICE guidance

The NICE (2008) clinical guideline 66 gives clear recommendations for the treatment of hypertension in people with type 2 diabetes. It recommends starting with an ACE inhibitor or angiotensin II receptor blocker (ARB) if side-effects of ACE-inhibitor therapy (usually cough) mean that they cannot be tolerated.

If full-dose ACE-inhibitor therapy does not control BP to these recommended targets, NICE recommends adding a calcium-channel blocker (CCB) or diuretic (usually bendroflumethiazide 2.5 mg daily).

People of African–Caribbean descent may be relatively resistant to ACE-inhibitor monotherapy so NICE recommends using an ACE inhibitor plus either a diuretic or CCB as initial therapy.

If dual therapy with an ACE inhibitor plus diuretic, or an ACE inhibitor plus CCB, does not control BP to target, the agent not used out of the three – CCB or diuretic – should be added to give a triple-agent regimen. If a fourth agent is required, NICE recommends using either an alpha-blocker, beta-blocker or a potassium-sparing diuretic.

NICE treatment algorithm

The NICE (2008) algorithm is based on a number of trials which have demonstrated that in addition to being good agents to lower BP, ACE inhibitors (and ARBs) also exert a renal protective effect, and may reduce CV risk (*Figure 1*).

Evidence for the beneficial effects of an ACE inhibitor on CV morbidity and mortality in diabetes came from MICRO-HOPE (Microalbuminuria, Cardiovascular, and Renal Outcomes – Heart Outcomes Prevention Evaluation), a sub-study of the HOPE study (HOPE Study Investigators, 2000). MICRO-HOPE demonstrated that treatment of people with diabetes and a history of CV disease (or at least one other CV risk factor) with the ACE-inhibitor ramipril significantly reduced the risk of myocardial infarction (MI), stroke and CV death by 25% (P=0.0004) compared with placebo. The authors stated that the observed CV benefit of ramipril was "greater than that attributable to the decrease in BP", providing strong evidence for the use of an ACE inhibitor to reduce CV morbidity and mortality in people with type 2 diabetes.

There has been some controversy concerning this conclusion, however, since there were small but significant differences in BP in favour of the ramipril group by the end of the study (systolic BP was reduced by 1.92 mmHg in the ramipril group compared with an increase of 0.55 mmHg in the placebo group, P=0.0002; diastolic BP decreased by 3.30 mmHg in the ramipril group compared with a decrease of 2.30 mmHg in the placebo group, P=0.008). However, after adjustment for these changes in BP, ramipril still had the same effects on the primary outcome.

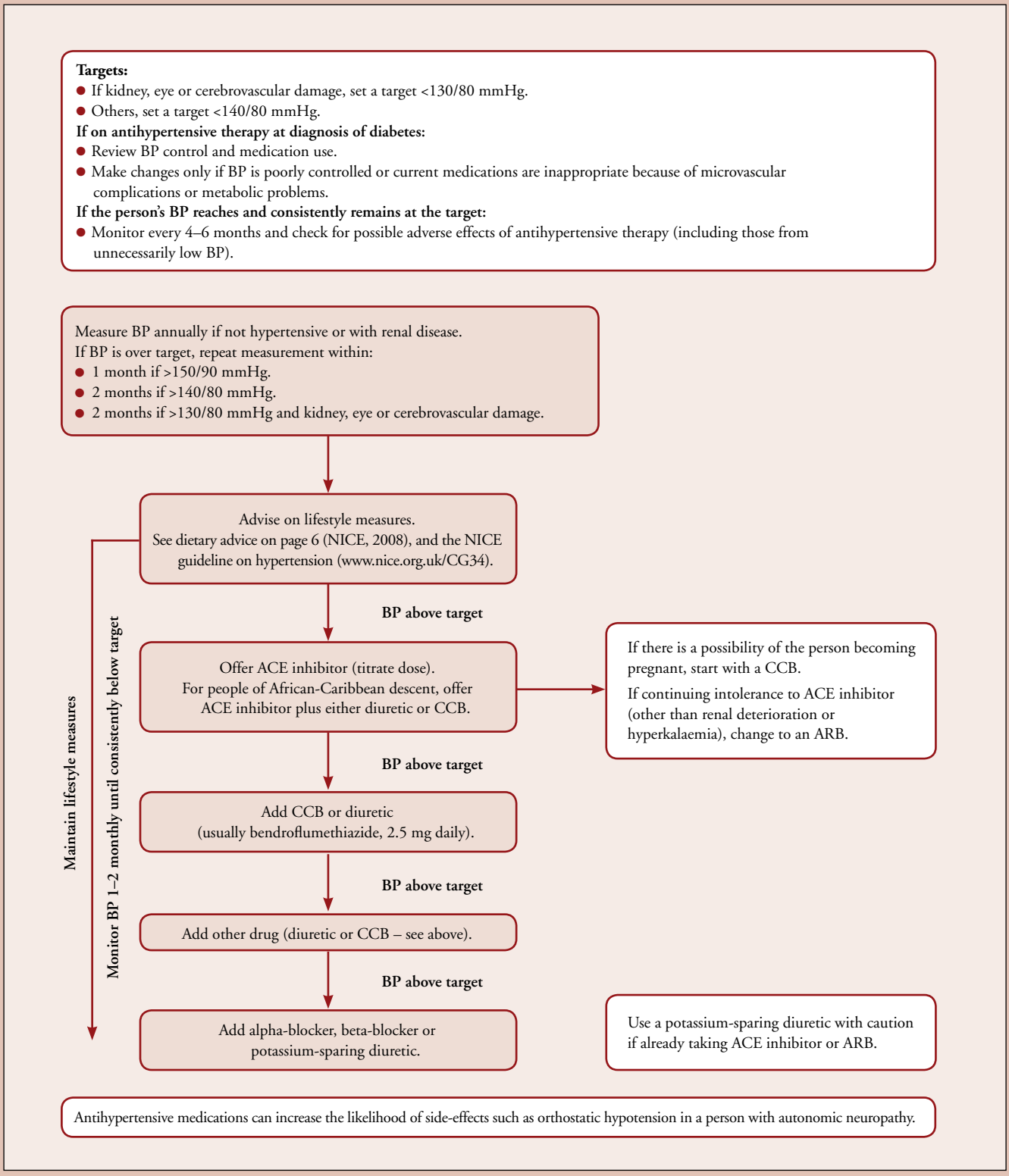
The controversy surrounding the degree to which the outcome was influenced by the BP differences between the groups polarised opinion into those who felt that it was mostly due to changes in BP and those who felt there was a specific non-BP-related benefit (Sleight et al, 2001).

Angiotensin II receptor blockers (ARBs)

ARBs have been shown to be at least as efficacious as ACE inhibitors in terms of achieving and maintaining BP control and are generally used in people who are intolerant to ACE inhibitors (Himmelmann et al, 2001).

Preventing or delaying the development of diabetic nephropathy is another major goal in the treatment of type 2 diabetes, and the IRMA-2 (Irbesartan in Patients with Type 2 Diabetes and Microalbuminuria) study investigated the effect of the ARB irbesartan on the development of diabetic nephropathy in hypertensive people with type 2 diabetes and persistent microalbuminuria (Parving et al, 2001). Treatment with irbesartan

Figure 1. NICE (2008) algorithm for blood pressure management in people with type 2 diabetes. From NICE (2008). Adapted from: CG66 Type 2 Diabetes: National Clinical Guideline for Management in Primary and Secondary Care (Update). *NICE, London. Available from: www.nice.org.uk/CG66. Reproduced with permission. ACE=angiotensin-converting enzyme; ARB=angiotensin II receptor blocker; BP=blood pressure; CCB=calcium-channel blocker.*



Page points

1. Antihypertensive agents that can prevent or delay the development of diabetic nephropathy provide a major improvement in the treatment of people with type 2 diabetes.
2. Microalbuminuria doubles the risk of a cardiovascular event in people with type 2 diabetes even after adjusting for traditional risk factors.

(300 mg/day) was associated with a 70% decrease in progression to overt diabetic nephropathy compared with placebo (P<0.001). Interestingly, the renoprotective effect of irbesartan was independent of its BP-lowering effects.

Further evidence for the beneficial effect of ARBs on reducing the rate of progression of renal disease in people with type 2 diabetes was provided in the RENAAL (Reduction of Endpoints in NIDDM [non-insulin-dependent diabetes mellitus] with the Angiotensin-II Antagonist Losartan) study (Brenner et al, 2001). People with type 2 diabetes and nephropathy receiving losartan had a 16% reduction in the combined endpoint of a doubling of serum creatinine concentration, progression to end-stage renal failure and death (P=0.02). Again, the beneficial effects of an ARB exceeded those attributable solely to a change in BP in people with type 2 diabetes and nephropathy.

Antihypertensive agents that can prevent or delay the development of diabetic nephropathy provide a major improvement in the treatment of people with type 2 diabetes. The importance of the evidence gained from IRMA-2, RENAAL and MICRO-HOPE has been reflected in the QOF – it is recommended that people with diabetes are tested for microalbuminuria, and that those with proteinuria or microalbuminuria are treated with an ACE inhibitor or an ARB (NHS Employers, 2009).

The studies described above indicate that the ACE inhibitor and ARB classes of drugs can be renoprotective in people with diabetes. It is important to remember that impaired renal function is itself a risk factor for CVD (Yuyun et al, 2005). For example, microalbuminuria doubles the risk of a CV event in people with type 2 diabetes even after adjusting for traditional risk factors (Karalliedde and Viberti, 2004).

Box 1. Case study.

Narrative

Clarence is a 56-year-old African–Caribbean man who was diagnosed with type 2 diabetes 2 years ago. He is on metformin 500 mg twice daily and simvastatin 40 mg daily. His blood pressure (BP) has been in the range of 130–140 mmHg systolic over 70–80 mmHg diastolic over the past 2 years. His estimated glomerular filtration rate is 60 mL/min/1.73 m^2, his total cholesterol is 4.0 mmol/L, his HbA_{1c} level is 6.9% (52 mmol/mol) and his weight has been steady at 14 stones over the past year (BMI 29 kg/m^2).

At his latest 6-monthly review his weight was 15 stones and his BP was 150/90 mmHg (over three readings). He has recently had an extended stay in Jamaica caring for an elderly relative and says he has over-eaten and not done any exercise.

Could Clarence, by losing weight and doing more exercise, reduce his BP without medication?

Discussion

Clarence asks if he can try to lose weight and do more exercise to see if he can get his BP lower without medication. After 6 weeks he has restarted walking 2 miles a day, has cut down on food and has lost 7 lbs. His BP is 145/85 mmHg. After a further 6 weeks his weight is back down to 14 stones and his BP is 140/80 mmHg. After a further 6 months his weight is steady but his BP has risen to 150/90 mmHg (over 3 readings). Should he now have BP-lowering therapy?

Together you agree with Clarence that now is the time to start BP-lowering therapy. What therapy should be recommended?

NICE (2008) recommends an angiotensin-converting enzyme (ACE) inhibitor plus either a diuretic or calcium-channel blocker or as first-line therapy in someone of African–Caribbean background as they may be relatively resistant to ACE inhibitors (or angiotensin II receptor blockers) alone. Clarence agrees to start amlodipine at 5 mg daily.

Controversy around beta-blocker use in people with diabetes

The ASCOT-BPLA (Anglo-Scandinavian Cardiac Outcomes Trial-Blood Pressure Lowering Arm) study was designed to compare the effects of the following treatment combinations: a beta-blocker (atenolol) with a thiazide (bendroflumethiazide) versus a CCB (amlodipine) with an ACE-inhibitor (perindopril), on the primary prevention of CVD in people with hypertension with at least three other CV risk factors (Dahlöf et al, 2005). A total of 27% of participants in each treatment arm had type 2 diabetes at baseline.

The trial did not reach its primary endpoint of non-fatal myocardial infarction (including silent myocardial infarction) and fatal coronary heart disease because it was stopped prematurely owing to the higher incidence of CV events and deaths in the beta-blocker/thiazide arm. Furthermore, there was a statistically significant 30% increase in new-onset diabetes in those allocated the atenolol-based regimen compared with the amlodipine-based regimen (P<0.001). The finding that

the amlodipine-based regimen prevented more CV events and induced less diabetes than the atenolol-based regimen led to a re-evaluation of the treatment guidelines for hypertension in diabetes and moved beta-blockers down to be one possible choice at level four when an ACE-inhibitor plus diuretic plus CCB (three agents) does not control BP to target.

CCB or diuretic first after ACE-inhibitor (or ARB) therapy?

New data to inform the debate as to whether a CCB or diuretic should be added as second-line therapy to the ACE inhibitor (or ARB) has recently been published. In the ACCOMPLISH (Avoiding Cardiovascular Events Through Combination Therapy in Patients Living with Systolic Hypertension) trial of people with hypertension and diabetes (Weber et al, 2010) an ACE inhibitor (benazepril) was used in combination with the CCB amlodipine or combined with the diuretic hydrochlorothiazide. The ACE inhibitor plus CCB combination was superior in reducing CV events.

In a recently published editorial, the role of diuretics in treating hypertension in people with diabetes was firmly endorsed (Cruickshank, 2010).

While this debate continues, the NICE (2008) recommendation that either a CCB or a thiazide diuretic be added to the ACE inhibitor (or ARB) as second-line therapy remains valid.

Conclusion

Inhibitors of the renin-angiotensin system are the first treatments of choice for hypertension in people with diabetes, based on the CV and renal benefits evidenced by current clinical trial data. When BP pressure targets are no longer achieved with monotherapy, treatment combinations should be used in line with the NICE (2008) treatment algorithm. BP-lowering agents and other therapeutic agents that have additional beneficial effects beyond those attributable to their primary function should form the basis of future best-practice management of people with type 2 diabetes to improve outcomes.

The QOF encourages healthcare professionals to not only improve glycaemic control in people with diabetes but to also provide optimal, evidence-based treatment of other risk factors. Despite current best practice, the incidence of CV morbidity and mortality is still two-fold greater in people with type 2 diabetes than in the general population (Emerging Risk Factors Collaboration et al, 2010).

Compared with microvascular complications, CVD is the biggest killer in people with type 2 diabetes, and aggressive BP-lowering approaches may confer greater benefits on CV outcomes in these individuals than in those without diabetes. Elevated BP should be treated early and intensively, following the NICE (2008) treatment recommendations, as achieving good BP control is vitally important in achieving optimal CV outcomes in people with type 2 diabetes. In the meantime, we must look to optimise our care with informed decision-making using the tools that are available to us.

Boxes 1 and *2* provide two case studies highlighting some of practical issues encountered in the management of people with diabetes and hypertension. ■

Page points

1. Inhibitors of the renin-angiotensin system are the first treatments of choice for hypertension in people with diabetes, based on the CV and renal benefits evidenced by current clinical trial data.
2. Blood pressure-lowering agents and other therapeutic agents that have additional beneficial effects beyond those attributable to their primary function should form the basis of future best-practice management of people with type 2 diabetes to improve outcomes.

Box 2. Case study.

Narrative

Margaret is 74 years old and has had type 2 diabetes for 10 years. She is on simvastatin 40 mg daily, metformin 1 g twice daily, gliclazide 160 mg twice daily, lisinopril 20 mg daily and amlodipine 10 mg daily. Her BMI is 26 kg/m^2, her estimated glomerular filtration rate is 50 mL/min/1.73 m^2, her HbA_{1c} level is 7.4% (57 mmol/mol) and her blood pressure (BP) is 160/85 mmHg (over three readings).

Margaret has some osteoarthritis of her knees and does as much physical activity as this allows. Should a further BP-lowering agent be added?

Discussion

Margaret's BP is significantly above the NICE (2008) target of <140/80 mmHg, and after discussion you both feel that another BP-lowering medication is indicated. NICE recommends that a diuretic be used in this situation; bendroflumethiazide 2.5 mg daily is therefore added to her regimen. Within 3 months her BP has dropped to 150/80 mmHg. Is a fourth agent indicated?

Her BP has dropped but it is not yet at the NICE target of <140/80 mmHg. However, Margaret says that, as she is already taking 12 tablets a day, she does not want to take any more, so together you agree to continue and monitor her BP for a further 6 months on her current triple oral BP-lowering regimen.

"Achieving good blood pressure control is vitally important in achieving optimal cardiovascular outcomes in people with type 2 diabetes."

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Online CPD activity

Visit www.diabetesandprimarycare.co.uk/cpd to record your answers and gain a certificate of participation

Participants should read the preceding article before answering the multiple choice questions below. There is ONE correct answer to each question. After submitting your answers online, you will be immediately notified of your score. A pass mark of 70% is required to obtain a certificate of successful participation; however, it is possible to take the test a maximum of three times. Before accessing your certificate, you will be given the opportunity to evaluate the activity and reflect on the module, stating how you will use what you have learned in practice.

1. Which of the following statements about cardiovascular disease (CVD) and diabetes is not true? Select ONE option only.

A. Treating hypertension reduces the risk of microvascular complications.
B. Treating hypertension reduces the risk of macrovascular complications.
C. Approximately 80% of people with diabetes die prematurely of CVD.
D. Approximately 60% of people with diabetes have hypertension (blood pressure [BP] ≥140/90 mmHg).
E. Hypertension increases the already high risk of CVD associated with diabetes.

2. Which of the following statements about BP targets in people with diabetes is not true? Select ONE option only.

A. The BP target in the Steno-2 study was ≤130/80 mmHg.
B. The QOF BP indicator is ≤140/80 mmHg.
C. The NICE target BP for people with type 2 diabetes is <140/80 mmHg if the person has no complications.
D. In the presence of microvascular complications, NICE recommends a BP target of <130/80 mmHg in people with type 2 diabetes.
E. The SIGN guideline for diabetes recommends a BP target of ≤130/80 mmHg.

3. Which of the following statements about NICE (2008) recommendations for BP in type 2 diabetes is not true? Select ONE option only.

A. Beta-blockers can be used as second-line therapy.
B. An angiotensin-converting enzyme (ACE) inhibitor should be used as initial therapy.
C. A calcium-channel blocker (CCB) can be used as second-line therapy.
D. A CCB can be used as a third-line therapy.
E. An alpha-blocking agent can be used fourth-line therapy.

4. Which of the following was the active agent in the IRMA-2 study? Select ONE option only.

A. Losartan.
B. Irbesartan.
C. Valsartan.
D. Ramipril.
E. Perindopril.

5. When considering the role of ambulatory BP measurement in type 2 diabetes and hypertension, which of the following statements is not true? Select ONE option only.

A. It may detect an absence of a nocturnal BP fall.
B. It helps detect people with end-organ damage but apparently normal BP.
C. It can be used to detect whether nocturnal BP is being controlled in those on antihypertensive therapy.
D. It may detect those people who are most likely to have "white-coat" hypertension.
E. It has been shown to be superior to home BP monitoring.

6. You are using a mercury sphygmomanometer to measure BP. How do you assure its accuracy? Select ONE option only.

A. Check it against another sphygmomanometer.
B. Get another member of staff to check and see if they get the same result.
C. Arrange service 6 monthly by the manufacturer or a specialist service.
D. You have attended training recently and know your technique is good.
E. Check that it is a British Hypertension Society validated device.

7. At which BP threshold does NICE (2004) recommend intervention in people with type 1 diabetes (without microalbuminuria or two features of the metabolic syndrome)? Select ONE option only.

A. 120/80 mmHg.
B. 130/75 mmHg.
C. 130/80 mmHg.
D. 135/85 mmHg.
E. 140/80 mmHg.

8. Mr B is 56 years old and has had type 2 diabetes for 3 years. He is obese (BMI 34 kg/m^2) and has obstructive sleep apnoea. His BP has always been around 140/80 mmHg on clinic measurement, and his HbA_{1c} level is 6.8% (51 mmol/mol). He is taking simvastatin 40 mg daily and metformin 1 g twice daily only. What action should you take? Select ONE option only.

A. Reassure him that, for him, his BP is fine and agree to review it in 12 months.
B. Explain that his BP is too high and start him on bendroflumethiazide 2.5 mg daily.
C. Recommend that ambulatory 24-hour BP monitoring be carried out to assess his BP control, and discuss diet, physical activity and weight reduction.
D. Refer immediately for bariatric surgery.
E. Explain that his BP is too high and start him on atenolol 50 mg daily.

9. Miss K is 33 years old and has had type 1 diabetes for 20 years. She was found to have microalbuminuria 6 months ago and her BP is 130/80 mmHg. Apart from her insulin regimen, Miss K is on lisinopril 20 mg daily. What action should you take? Select ONE option only.

A. Explain that her BP ought to be lower and add a CCB.
B. Explain that her BP ought to be lower and add bendroflumethiazide.
C. Explain that her BP is too low and reduce the lisinopril to 10 mg daily.
D. Refer her urgently for a nephrology opinion.
E. Explain that her BP is at a reasonable level and that it will be re-checked in 6 months.

10. Mrs N is 75 years old, has had type 2 diabetes for 12 years, and has a BMI of 27 kg/m^2. She is on metformin 1 g twice daily, and pioglitazone 45 mg, ramipril 10 mg and simvastatin 40 mg daily. She lives alone and, apart from mild Parkinson's disease (for which she is currently on no treatment), she is reasonably healthy. Her HbA_{1c} level is 7.4% (57 mmol/mol), her eGFR is 45 mL/min/1.73 m^2, her total cholesterol is 4 mmol/L and her BP is 140/80 mmHg. She presents reporting a dry, irritating cough for several weeks. On examination her chest is clear. What action should you take? Select ONE option only.

A. Refer her for a specialist opinion on her cough.
B. Explain that her BP is a little high and prescribe a CCB.
C. Take her off ramipril and substitute an ARB.
D. Explain that the cough is likely to be due to a respiratory infection and prescribe an antibiotic.
E. Explain that the cough is likely to be due to some seasonal wheeze and prescribe a salbutamol inhaler.