‘Let’s Do It Well’

Nurse Learning Pack
Reviewed and agreed by the British Hypertension Society (BHS) and the Nurses’ Hypertension Association (NHA)

HIT is an independent group of clinicians, nurses and patient groups. The objective of HIT is to raise the current sub-optimal management of hypertension through primary care awareness and education campaigns in line with the recent NSF and BHS guidelines. HIT is committed to providing practical tools for health care professionals. To date, HIT has produced a primary care audit tool, a summary of the NSF for CHD and a nurse training video. This basic skills nurse distance learning pack in conjunction with the BHS and a cost and burden analysis of hypertension support the earlier materials. This initiative is funded by an unrestricted educational grant from Bristol-Myers Squibb.

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Introduction

Coronary heart disease (CHD) is the leading cause of mortality in the UK.\textsuperscript{1,2} Every year, more than 1.4 million people endure angina and 300,000 suffer a heart attack, while 140,000 die from CHD.\textsuperscript{2} Over the years, many studies have linked several factors to an increased risk of CHD. However, high blood pressure (hypertension) is one of the best established and one of the most common risk factors; around a fifth of adults are hypertensive.\textsuperscript{2} Indeed, CHD is twice as common in hypertensive patients compared to those with normal blood pressure.\textsuperscript{3} However, despite being common and clinically serious and the availability of several drug and lifestyle treatments, hypertension management remains suboptimal.\textsuperscript{4} In part this reflects the fact that hypertension is a silent disease. Hypertension increases the risk that a patient will die from CHD or a stroke,\textsuperscript{5} as well as contributing to the risk of renal failure\textsuperscript{6} and peripheral vascular disease.\textsuperscript{7} However, few patients develop consequences of their hypertension (e.g. stroke and left ventricular hypertrophy) until a very late stage.

As a result, detection and management of hypertension are among the most important primary care health interventions.\textsuperscript{1} Nevertheless, the harsh reality is that current detection, diagnosis, treatment and blood pressure control is inadequate.\textsuperscript{2} From the recent Health Survey for England, the parameters of patient awareness of their hypertension, treatment of hypertension and control of hypertension were measured.\textsuperscript{8} In this survey it was apparent that, while the prevalence of hypertension in patients with a greater than 15% risk for CHD was 76.5%, only 42.7% of patients were aware of their hypertension, only 27.3% were being treated and of these only 9% of patients were controlled to the target blood pressure of less than 140 mmHg systolic and less than 85 mmHg diastolic.\textsuperscript{8} An earlier study using a slightly higher threshold also indicated that the proportion of patients whose blood pressure was controlled was poor – just 6% of patients.\textsuperscript{4} These figures compare with France where 24% of patients have their blood pressure controlled to less than 140/90 mmHg.\textsuperscript{9}

Against this background, the recently published National Service Framework (NSF) established standards in CHD for primary care groups. Implementing the NSF could have far-reaching implications for your practice. For example, achieving the new blood pressure treatment goals will create a management challenge for every GP and nurse. Moreover, once high blood pressure is identified and treated, the NSF proposes a structured follow-up programme including audit, which will increase demands on our time during increasing pressure on primary care. However, we need to rise to the challenge; assessing and improving our performance allows us to deliver the best care for our patients with hypertension.

This Nurse Learning Pack aims to enhance primary care hypertension management. The Pack is part of the Hypertension Influence Team (HIT) initiative set up in January 2000. This interdisciplinary task force aims to raise awareness of hypertension as a treatable CHD risk factor and improve diagnosis, management and follow-up in the community. As such, HIT hope that this Pack (which is supported by an educational grant from Bristol-Myers Squibb) could help reduce the human, clinical and economic toll imposed by hypertension.
**Learning objectives**

This Distance Learning Pack aims to cover key issues in the primary care detection and management of patients with hypertension. After completing the course you should understand:

- the causes of hypertension and clinical consequences
- the patient pathway from diagnosis and assessment to treatment, follow-up and referral
- the importance of effective treatment
- the importance of a multidisciplinary approach
- how to structure hypertension care using registers, computerised recall systems, shared care protocols and practice screening
- how rigorous audit drives improved care.

You can use the pack in several ways. For instance, you can test yourself using the self assessment. Alternatively, you can use it as part of a practice based learning exercise with your GP colleagues. (The pack should satisfy some of your Post-Registration Education and Practice – PREP – requirements.)

Finally, the references and resources can both address weaknesses revealed by the self assessment or audit, as well as offering further information if you wish to explore a particular topic in more depth.
1. Background

**Learning objectives**

At the end of this section you should be able to:

1.1 define hypertension  
1.2 know the causes of hypertension  
1.3 know the prevalence of hypertension  
1.4 know the importance of hypertension as a risk factor  
1.5 know the cost and burden of hypertension in the UK  
1.6 know the key points for the National Service Framework (NSF) document for CHD.

**Activities**

- obtain and read references of interest  
- complete self assessment.
1.1 What is hypertension?

Blood pressure is the pressure the blood exerts on artery walls, and it rises and falls as the heart contracts and relaxes. The highest pressure occurs when blood is propelled through the arterial circulation by the contraction of the heart. This is known as the ‘systolic’ blood pressure (SBP). When the heart relaxes between beats, the pressure in the arterial circulation falls to its lowest level, and this is known as the ‘diastolic’ blood pressure (DBP).

Blood pressure is expressed in millimetres of mercury (mmHg), and is always quoted as the SBP over the DBP, for example, 124/82 mmHg. While both pressures are clinically significant, the latest evidence from research indicates the SBP to be the more important of the two in the management of hypertension, and raised SBP appears to correlate more strongly with renal failure than raised DBP.

Blood pressure increases when larger blood vessels begin to lose their elasticity and the smaller vessels start to constrict, causing the heart to try to pump the same volume of blood through vessels with a smaller internal diameter. A patient is considered to be hypertensive if blood pressure is equal to or greater than 140 mmHg systolic, or over 85 mmHg diastolic.

Hypertension is usually asymptomatic. The exception is a condition called malignant hypertension usually characterised by a sustained DBP equal to or more than 120 mmHg, with kidney damage, retinal haemorrhages, infarcts and optic nerve swelling. In this situation, many patients present to their doctor with renal failure, heart failure or a stroke. Most of these patients have proteinuria and left ventricular hypertrophy. You should regard malignant hypertension as a medical emergency and immediately refer patients to hospital. Without effective treatment, less than 20% of patients survive for 1 year.

1.2 Causes

The majority of patients have essential hypertension. In other words, there is no identifiable underlying cause. The remainder suffer from secondary hypertension whereby the raised blood pressure arises from an identifiable disease (Table 1), usually renal disease. Moreover, 15–30% of patients have ‘white coat hypertension’. This is a phenomenon where their blood pressure is normal outside the practice, but increases when measured in the surgery. Home monitoring or ambulatory blood pressure monitoring (ABPM) (see section 2.2) can help diagnose white coat hypertension. However, some patients with white coat hypertension develop target organ damage and all require close follow-up.

Table 1. Causes of secondary hypertension.

- Renal and renovascular disease (e.g. diabetic nephropathy, obstructive uropathy, chronic pyelonephritis, polycystic kidneys, renal artery stenosis and glomerulonephritis) – proteinuria almost always present, serum creatinine may be raised
- Phaeochromocytoma – associated with tachycardia and paroxysmal symptoms
- Conn’s syndrome or primary aldosteronism – with decreased serum potassium or high serum sodium (very rare)
- Coarctation of the aorta – absent or delayed femoral pulse

cont/
1.3 Prevalence

Blood is under pressure to ensure that it reaches and adequately perfuses all parts of the body. However, blood pressures vary widely within the population and tend to rise with advancing age (Figure 1). Moreover, certain ethnic groups – Afro-Caribbean people, for example – and women are more likely to have raised blood pressure than Whites/Asians and men, respectively.

Figure 1. Blood pressure increases with age.

Hypertension is common – 18% of men and 20% of women aged over 16 years have hypertension of 160/95 mmHg. However, the prevalence (the number of cases) rises with advancing age. Some 52% of men and 57% of women aged between 65 and 74 years are hypertensive. Among over-75-year-olds, this increases to 52% and 67%, respectively. In other words, if you consider GP list of 2000 patients about 20% (400 patients) will have hypertension.
1.3.1 Elderly patients

The elderly are at higher risk of CHD and stroke as well as being more likely than younger people to be hypertensive; half the population over 65 years of age shows raised blood pressure (defined as >160/90 mmHg).10 As a result, the cost benefit for treating an elderly person with hypertension is greater than that for younger patients.10 Moreover, treating elderly patients with hypertension may also reduce heart failure.17

While the elderly are more likely than younger people to show isolated systolic hypertension, the threshold and targets remain the same, at least up to 80 years of age.10 Antihypertensive therapy is indicated and clearly beneficial in people aged 60 years or more when blood pressure averages are greater than 160 mmHg systolic and greater than 90 mmHg diastolic.10

1.3.2 Patients with diabetes

People with diabetes are at increased risk of stroke, CHD and have an increased prevalence of hypertension; approximately 30–80% of patients with Type 2 diabetes are also hypertensive.18 Against this background, the United Kingdom Prospective Diabetes Study (UKPDS) compared outcomes in patients with Type 2 diabetes with tight (mean 144/82 mmHg) and less tight blood pressure control (average 154/87 mmHg) over a median of 8.7 years. The former were 44% less likely to suffer a stroke as well as showing a 47% reduction in retinopathy.19 The Hypertension Optimal Treatment (HOT) study20 demonstrated that a diabetic cohort in the study also achieved a substantial reduction in cardiovascular events as a consequence of reduced blood pressure. These major trials support a lower target (140/80 mmHg) among patients with diabetes (see section 1.4.1), or lower if proteinuria is present.

1.3.3 Different ethnic groups

The prevalence of cardiovascular disease, diabetes and hypertension is higher among Asian patients compared to the general population. Similarly, hypertension is very common among Afro-Caribbeans — affecting half of those aged 40 years and over.10 Partly as a result of these factors, these ethnic groups are at high risk of stroke and renal failure. Therefore, aggressive therapy is warranted to reduce blood pressure to recognised targets.

1.4 Importance of hypertension as a risk factor

1.4.1 Evidence base for hypertension treatment

A large and growing evidence base now shows that hypertension is a risk factor for CHD, stroke and other diseases, and that effective antihypertensive treatment reduces morbidity and mortality.2
Several important studies have contributed to this evidence base:

- The MRC (Medical Research Council) Working Study\textsuperscript{21} was designed to determine whether antihypertensive therapy for patients with ‘mild’ hypertension reduced morbidity and mortality associated with strokes and CHD. The study enrolled over 17,000 patients aged 35–64 years with DBP of 90–109 mmHg. Sustaining DBP to 90 mmHg in 850 hypertensive patients for 1 year prevented one stroke.

- The Syst-Eur (Systolic Hypertension – Europe) trial\textsuperscript{22} was designed to investigate whether antihypertensive treatment in elderly patients with isolated systolic hypertension (ISH) (SBP >160 mmHg and DBP ≤90 mmHg) resulted in a significant reduction in stroke morbidity and mortality. The study recruited 941 patients and it was found that treating ISH in patients aged 60 years and over reduced non-fatal strokes by 44% and all fatal and non-fatal cardiac endpoints by 26% compared to placebo.

- The SHEP (Systolic Hypertension in the Elderly Program) trial,\textsuperscript{17} like Syst-Eur, assessed the ability of antihypertensive treatment to reduce the risk of non-fatal and fatal stroke in ISH. In the trial more than 4700 patients with ISH (SBP 160–219 mmHg, DBP<90 mmHg) aged 60 years or over were treated. The average follow-up was 4.5 years. A small difference in blood pressure (11.1 mmHg SBP and 3.4 mmHg DBP) reduced the number of fatal strokes and all cardiovascular events by 36% and 32%, respectively, compared to placebo.

- The UKPDS (United Kingdom Prospective Diabetes Study)\textsuperscript{19} was designed to determine whether improved blood pressure control and tight glycaemic control would prevent and reduce the morbidity and mortality that patients with Type 2 diabetes face (e.g. renal failure). The study showed that aggressive treatment of hypertension in diabetic patients reduced the risk of stroke and CHD. Patients with diabetes are at markedly increased risk of CHD. Hypertension further increases this risk, and the overall conclusion indicated that hypertension management in patients with Type 2 diabetes is more important than tight glycaemic control.

- The HOT study\textsuperscript{20} was devised to investigate the relationship between major coronary events, such as myocardial infarction (MI), with three target DBPs (<90 mmHg, <85 mmHg and <80 mmHg) as well as the DBP actually achieved with therapy. The trial also assessed the benefits of low-dose aspirin. In this trial nearly 19,000 patients aged 50–80 years with DBP of 100–115 mmHg were treated. Some 6,264 patients were randomly assigned to target pressures of less than or equal to 90 mmHg, 85 mmHg or 80 mmHg. Felodipine was given as baseline therapy with the addition of other agents according to a five-step regimen. HOT demonstrated the benefits of lowering blood pressure to 140/85 mmHg or lower. For example, reducing DBP from a mean of 105 mmHg to 83 mmHg reduced cardiovascular events by 30%. In patients with diabetes mellitus there was a 51% reduction in major cardiovascular events in the target group 80 mmHg or lower compared with the 90 mmHg or lower group (p=0.005).

These and other studies demonstrate that treating hypertension reduces morbidity and mortality from stroke and CHD. Indeed, reducing DBP by 5–6 mmHg and SBP by 10–12 mmHg can reduce stroke risk by more than a third. Similarly, reducing DBP by 5–6 mmHg can reduce CHD risk by 16%.\textsuperscript{4}
1.5 Cost and burden of hypertension

1.5.1 Implications for PCOs

The burden of hypertension falls on many parts of society, called stakeholders; these members include patients, the NHS, families and carers as well as society. In order to estimate the true cost of hypertension and its ultimate burden to society, all relevant cost components must be taken into consideration. Costs for disease are borne either directly or indirectly. Most direct costs (e.g. cost of drugs, intervention and clinician time) will be borne by the NHS, other government agencies such as social services (e.g. community care), the treasury (incapacity benefit) and also patients (over-the-counter medicines). Indirect costs of hypertension are estimated to be substantial because of the secondary events it causes, such as MI, heart failure and stroke, that lead to death and disability. These indirect costs take the form of lost productivity and potentially lost revenue to society. The final cost to patients and their families is one that cannot be counted in pounds and pence, and that is quality of life, which although intangible, carries a considerable burden.

Hypertension continues to be a major problem for healthcare providers. In England, for example, only around 20% of hypertensive men and 30% of hypertensive women receive treatment for their condition. This means that a staggering two-thirds with the condition remain hypertensive. It is not surprising, therefore, that the British Hypertension Society concluded in their recent guidelines that “the management of hypertension in the United Kingdom remains suboptimal”.

Improving the current situation will undoubtedly save lives. Reducing blood pressure to an optimal level (Table 2) has been estimated to reduce the 10-year risk of CHD by 22.57% in an otherwise average man and 33.47% in an otherwise average woman. Of course, CHD is not the only potential outcome of untreated hypertension. Cerebrovascular disease, for example, is also strongly associated with high blood pressure; a long-term reduction in DBP of 5–6 mmHg has been demonstrated to correlate with a 35–40% reduction in risk of stroke.

Table 2. Blood pressure targets for those receiving antihypertension therapy. Both systolic and diastolic targets should be attained. Reproduced with permission.

<table>
<thead>
<tr>
<th>Clinic blood pressure</th>
<th>No diabetes</th>
<th>Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal blood pressure</td>
<td>&lt;140/85 mmHg</td>
<td>&lt;140/80 mmHg</td>
</tr>
<tr>
<td>Audit standard (i.e. minimal levels of blood pressure control)</td>
<td>&lt;150/90 mmHg</td>
<td>&lt;140/85 mmHg</td>
</tr>
</tbody>
</table>

1.5.2 Impact of hypertension

So why should we place so much attention on hypertension? Firstly, hypertension is easy to determine in the surgery or clinic. Secondly, a wide range of effective antihypertension drugs are available, as well as non-pharmacological interventions that are supported by a wealth of trial data. Thirdly, but perhaps most importantly, reducing blood pressure to an optimal level has a dramatic effect on a person’s risk of having a serious, potentially fatal cardiovascular event.

So what is the current impact of hypertension? It has long been known that hypertension leads to MI and stroke, but it has been difficult to distinguish the costs associated with MIs and strokes that occur as a direct result of high blood pressure. A recent analysis has been completed that...
investigates the costs of a hypertension-attributable MI or stroke. This economic analysis has been complex, but the data demonstrate how treating hypertension to recognised targets can save the nation money in the long term.\textsuperscript{23}

Performing an economic analysis within the confines of the available data puts the annual hospital and surgical costs of MIs and strokes resulting from hypertension in England at £974 million, and this is a highly conservative estimate. To put a human perspective on the results, an estimated 43,625 people die each year from a hypertension-attributable MI or stroke, while 57,487 suffer a non-fatal event.\textsuperscript{25} Clearly, the burden of hypertension is considerable (Table 3).

Table 3. Some economic facts about hypertension.

- Only around 20\% of men and 30\% of women with hypertension receive treatment for their condition.\textsuperscript{2}
- Reducing blood pressure to an optimal level has a dramatic effect on a person’s risk of having a serious, potentially fatal, cardiovascular event.\textsuperscript{24}
- 43,625 people die from a hypertension-attributable myocardial infarction (MI) or stroke in England, each year.\textsuperscript{23}
- An estimated 22,601 first MIs and at least 78,000 strokes could be prevented by reducing blood pressure to optimal levels.\textsuperscript{23}
- Hypertension-attributable MIs and strokes are estimated to account for £974.4 million per year in hospital and surgical costs.\textsuperscript{23}
- The costs of increasing efforts to identify and treat hypertension effectively are likely to be comparable with the current costs of hypertension and its complications.

The number of MIs that occur as a direct result of hypertension are estimated to be 12,118 (total number of MIs annually = 103,897) and for stroke the number is at least 78,000 (total number of strokes = 139,799 \textsuperscript{24}). Of these MIs, half are fatal and the other 50\% of patients go on to recover, some quickly and others very slowly. Similarly, with stroke a third of patients die and the rest recover, although approximately 20\% of those who recover will have long-term disability.

The cost of caring for a survivor of a CHD event is high – these patients need a high level of post-event care, and beds in the intensive care and cardiac care units are generally considered to be the most expensive in a hospital. Similarly, stroke victims require intensive inpatient and outpatient care, often for protracted periods of time. Furthermore, there are the indirect costs associated with premature mortality and morbidity – lost productivity, increased state dependence and cost of informal care.

The breakdown of costs for these hypertension-attributable events, notably MI and stroke, are shown in Table 4 and the costs to treat hypertension are shown in Table 5.\textsuperscript{23} Costs can also be broken down depending on whether or not an event is fatal (Figure 2). These do not include incapacity costs (benefit costs taken from DSS data) which are estimated to be over £1 billion, but cannot be directly associated with hypertension-attributable events and so are not included in the analysis. Obviously, if these figures could be included the true cost would be immense. Also, the analysis only examined MI and stroke, but we know that hypertension also causes heart failure peripheral artery disease renal disease and is implicated in dementia. If all these secondary events were taken into account the true cost of hypertension would be much higher.
Table 4. The costs incurred from hypertension-attributable MIs and strokes.

<table>
<thead>
<tr>
<th></th>
<th>MI (£ million)</th>
<th>Stroke (£ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carer costs</td>
<td>–</td>
<td>10</td>
</tr>
<tr>
<td>Hospital and surgical costs</td>
<td>75</td>
<td>900</td>
</tr>
<tr>
<td>Loss of productivity (earnings)</td>
<td>130</td>
<td>180</td>
</tr>
<tr>
<td>Total</td>
<td>205</td>
<td>1090</td>
</tr>
</tbody>
</table>

Table 5. The current costs for treating hypertension.

<table>
<thead>
<tr>
<th></th>
<th>Cost (£ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug costs for hypertension</td>
<td>393</td>
</tr>
<tr>
<td>Primary care costs for hypertension</td>
<td>177</td>
</tr>
<tr>
<td>Total</td>
<td>570</td>
</tr>
</tbody>
</table>

From Tables 4 and 5 it is possible to see how much hypertension-attributable MIs and strokes cost the nation, and this amounts to at least a staggering £1.8 billion every year. It is likely that even this huge cost is a conservative estimate, given that incapacity costs (estimated at over £1 billion every year) and costs due to hypertension-attributable heart failure and peripheral artery disease are not included. If all patients with hypertension were identified and treated to goal the true cost would be considerable.

Figure 2. NHS costs for hypertension-attributable MI and stroke.
1.6 The National Service Framework for Coronary Heart Disease

Key points from the National Service Framework (NSF) document for CHD are presented below.

1.6.1 What is the National Service Framework for Coronary Heart Disease?

This NSF is a blueprint for tackling CHD, providing a new vision for management of cardiovascular disease. It has been prepared by an independent expert group led by Professor Sir George Alberti, President of the Royal College of Physicians. The document is intended to transform the prevention, diagnosis and treatment of CHD and to help professionals provide better, fairer and faster care everywhere to everyone who needs it. This NSF is a practical, evidence-based and flexible approach to tackling heart disease.

- It sets out the standards and services which should be available throughout England.
- It recognises the importance of prevention and the role of primary care as well as the contribution of the more specialised services.
- It describes wide-ranging actions to help people reduce mortality and morbidity of cardiovascular disease.
- It sets out the high-quality treatment and care which CHD sufferers should have – early diagnosis, prompt and effective ambulance and emergency services, high-quality medical, surgical and nursing care, and specialist services, including heart surgery and rehabilitation.

The NSF is a nationally co-ordinated programme of work. Each NHS region will form a regional CHD implementation team to ensure that all local health communities and all key players are involved. Locally, Local Implementation Teams (LITs) will be established. Local Networks of Cardiac Care (LNCCs) are based on the population served by a tertiary centre and involve PCO Trusts and Health Authorities. A National CHD Implementation Group will provide the overall leadership for the NSF.

1.6.2 Why tackle heart disease?

The reasons for tackling heart disease are compelling.

- CHD is among the biggest killers in this country
- More than 1.4 million people suffer from angina
- Every year 300,000 people have heart attacks and more than 110,000 die from heart problems
- The effects of heart disease are unequal – rates vary according to social circumstances, gender and ethnicity
- Among unskilled men, for example, the death rate is almost three times higher than among professionals
- Heart disease is much more common in deprived areas, yet treatment and care is often better in more prosperous areas
- Hypertension is a key contributory factor in CHD
- Some of the risk factors for hypertension (e.g. being overweight and lack of exercise) are potentially preventable.
1.6.3 What are the aims of the document?

The aims of the NSF are to:

- specify interventions that are known to be effective
- identify, where possible, models of care that deliver those interventions reliably
- provide the means to implement improved systems of care
- develop audit tools and performance indicators to help ensure services are being delivered to an acceptable standard
- indicate milestones and goals by which the NHS can monitor progress towards delivery
- identify gaps in knowledge or standards to inform the research and other agendas.
- institute a system for reviewing and updating the contents of the NSF in line with medical developments.

1.6.4 What are the specific goals for primary care of the NSF?

The following goals of the NSF should be demonstrated by clinical audit data no more than 12 months old where appropriate.

- There should be a contribution to the target reduction in deaths from circulatory diseases, as outlined in 'Saving lives: our healthier nation',26 of up to 200,000 lives in total by 2010
- Every practice should offer advice about each of the specified interventions to those in whom they are indicated
- Everyone meeting the NSF criteria for angiography and revascularisation is identified and treated within the agreed waiting times to the standards set out in the NSF
- Every primary care team should ensure that all those with heart failure are receiving a full package of appropriate investigation and treatment
- Regarding waiting time goals, the referral by GP to specialist assessment/consultant appointment for new onset angina should occur within 2 weeks. Also, prompt investigation and, for those for whom it is indicated, revascularisation should occur within 3 months of the decision to operate.

1.6.5 What are the key directives in the document?

- National standards – for preventing and treating CHD, 12 national service standards cover each of seven areas in the NSF:
  - reducing heart disease in the population (standards 1 and 2)
  - preventing CHD in high-risk patients (standards 3 and 4)
  - heart attack and other acute coronary syndromes (standards 5, 6 and 7)
  - stable angina (standard 8)
  - revascularisation (standards 9 and 10)
  - heart failure (standard 11)
  - cardiac rehabilitation (standard 12).

High-risk patients are defined as patients with established occlusive vascular disease as well as those without diagnosed CHD, but with a CHD risk greater than or equal to 30% over 10 years. Initial efforts should be targeted to help individuals with established CHD. These are the people who are at highest risk, and standard 3 addresses the identification and management of this
group. Primary care can help reduce the morbidity and mortality of patients with CHD and other occlusive vascular disease using various proven interventions. These interventions include appropriate drugs, such as low-dose aspirin, statins to lower serum cholesterol, angiotensin converting enzyme (ACE) inhibitors for patients who also have left ventricular dysfunction, beta blockers for patients who have also had an MI within 12 months, and anticoagulants/aspirin for individuals aged over 60 years who also have atrial fibrillation. Such secondary prevention is the first and highest priority. Within primary prevention – aimed at people deemed to be at significant risk of developing CHD, but who have not yet developed symptoms – the highest-risk patients are likely to be found in the diabetic and hypertensive population.

For those patients with established cardiovascular disease, prevention and continued care from primary care sources include advice and treatment to maintain blood pressure at the optimal target recommended by the British Hypertension Society (<140/85 mmHg; audit standard <150/90 mmHg), as well as risk factor advice about smoking cessation, physical activity, diet, alcohol consumption, weight and diabetes and advice about other risk factors, such as raised cholesterol.10

Service models – the service and organisational models required to deliver the standards are set out in detail for each of the seven areas covered by the national service standards. One possible service model is the development of cardiac prevention clinics in primary care, which would be nurse-run and doctor-supported and serve the patients of several practices.

Milestones and goals – the NSF identifies some immediate priorities. These are important improvements that should be achieved quickly and make a notable difference from the start. Initial milestones for each standard have been identified to help mark the progress towards specified goals resulting in improved services. The first milestone in primary care is for clinical teams to meet at least every quarter to plan and discuss the results of clinical audit and to discuss clinical issues. The initial milestone in hospitals involves the formation of effective means for agreeing, with the primary care groups and teams that together form a Local Network of Cardiac Care (LNCC), an integrated system for quality assessment and quality improvement.

Performance indicators – The NSF proposes a range of CHD performance indicators. These are to track performance against the standards and milestones and to identify issues that need further work. Clinical audit criteria are identified to enable staff to monitor the effectiveness of the services they deliver.

Practical tools – a number of practical tools that are already available to help with implementation are described in the NSF document.

Role of personnel – The NSF discusses the implications to clinicians of the proposed agenda for NHS organisations (especially primary care, hospital trusts and ambulance trusts), and defines the contribution required by the wide range of people working in areas that will influence CHD. Primary care will have to correctly identify, appropriately treat and follow-up patients with CHD. The role of the nurse will be pivotal in monitoring blood pressure and other evaluations, administering advice on modifiable risk factors and influencing appropriate prescribing by clinicians.

Local delivery – The NSF discusses the key areas and logistics for effective local delivery of the proposed standards and service models. The ownership and commitment of all local partners will be essential if local milestones are to be achieved.
Summary

CHD is a major and significant cause of morbidity and mortality. Hypertension as an important risk factor is of prime importance for primary care. The incidence and prevalence of hypertension differs with age, gender, ethnicity and underlying pathology (e.g. diabetes). Hypertension and CHD need to move up the healthcare agenda to proactively improve health outcomes. Many studies have already shown that effective blood pressure control can significantly improve outcome, and the NSF document illustrates the need to put this evidence into practice.
Self Assessment: Section 1

Multiple choice questions and answers

Use the following Multiple Choice Questions (MCQs) to test your understanding of the material in the pack. If you find an area difficult, return to the relevant sections in the text. Each MCQ consists of either a statement or a question and asks you to identify the correct response(s) of the five given.

Self-assessment total score

To obtain your percentage, divide your score by 17 then multiply by 100.

75–100% correct: You have mastered the principles of hypertension well
60–75% correct: A good score. Revise any particular areas you found difficult
50–65% correct: Worth further reading around the subject
<40% correct: You need to work on the pack again

Self Assessment: Section 1

1. Hypertension is more common in:
   a. Men
   b. Afro-Caribbeans
   c. The elderly
   d. Patients with diabetes
   e. Patients with asthma

2. The following is true of hypertension:
   a. Most patients will have no identifiable cause for their hypertension
   b. The prevalence in the UK is about 3% of middle-aged adults
   c. Most patients present with symptoms, like headache, during routine consultations
   d. Patients treated for hypertension have a poorer prognosis than their normotensive counterparts
   e. There is insufficient evidence for hypertension as a risk factor for stroke

3. White coat hypertension:
   a. Occurs in about 15–30% of patients
   b. Is diagnosed by taking readings in the non-surgery setting
   c. If suspected may be an indication for 24-hour ambulatory blood pressure monitoring
   d. Once diagnosed, removes the necessity for follow-up of the patient
   e. Is only found in patients of European descent

4. From the following statements about malignant hypertension, which are not true?
   a. It is characterised by a sustained diastolic blood pressure above 120 mmHg
   b. It is associated with retinal damage and kidney damage
   c. It does not need to be regarded as serious unless it is prolonged
   d. Patient survival if treated appropriately is greater than 50%
   e. Most patients present to their doctors with stroke or heart failure
5. The causes of secondary hypertension include:
   a. Phaeochromocytoma
   b. Cushing’s syndrome
   c. Hypoparathyroidism
   d. Conn’s syndrome
   e. Reye’s syndrome

6. Which of the following is a true statement about the prevalence of hypertension?
   a. Hypertension occurs more frequently in men under the age of 16 years
   b. 20% of men and 18% of women aged more than 16 years have hypertension
   c. 70% of all elderly patients (aged 65–74 years) have hypertension
   d. 18% of men and 20% of women aged over 16 years have hypertension
   e. In the very elderly (more than 75 years) 67% of women have hypertension

7. For patients with Type 2 diabetes and hypertension which statements are false?
   a. 30–80% of patients with Type 2 diabetes also have hypertension
   b. Tight blood pressure control has no influence in patients with Type 2 diabetes with respect to reducing stroke
   c. Tight blood pressure control correlates strongly with reductions in stroke for patients with Type 2 diabetes
   d. The HOT study showed that the target for blood pressure control in patients with Type 2 diabetes should be 140/90 mmHg
   e. Patients with Type 2 diabetes are at an increased risk of developing a stroke or CHD
Learning objectives

At the end of this section you should be able to:

2.1 correctly measure blood pressure
2.2 know the rationale for ambulatory blood pressure monitoring and home monitoring
2.3 assess the level of severity of hypertension according to the British Hypertension Society guidelines
   – categorise the degree of severity
   – gauge the level of total cardiovascular risk to the patient
2.4 know and use diagnostic tests which should be performed.

Activities

- watch blood pressure management video
- obtain and read references that are of interest
- complete self assessment.
2.1 Technique of measuring blood pressure

Measuring blood pressure is routine. However, it is worth regularly brushing up your technique—it is easy to slip into bad habits. Remember to:

- Use a regularly calibrated device
- Seat the patient for a minimum of 3 minutes before measuring blood pressure
- Ask the patient to remove tight arm clothing
- Support the patient’s arm at heart level with his or her hand relaxed—arm to be supported (e.g. on a table) and the cuff to be placed in the middle of the upper arm
- Encircle the rubber bladder around at least three-quarters of the arm circumference
- Use a correct sized cuff. For a smaller adult arm (circumference up to 33 cm) use a cuff 12 cm x 23 cm. For most adults (circumference up to 42 cm) use a cuff 13 cm x 35 cm. Children require cuffs of 7.5–8.0 cm x 22.5–23.5 cm
- Feel for the brachial artery and inflate to 20–30 mmHg above the estimated SBP (the pulse will disappear)
- Place the stethoscope gently on the brachial artery
- Deflate the cuff at 2–3 mm/sec, recording when the sounds first appear (the SBP) and when they finally disappear (the DBP). Record the pressure that muffles sounds only if they continue until zero and document. Record to the nearest 2 mmHg
- Take at least two readings, the second reading 2 or 3 minutes after the first. If the readings show a large discrepancy (5 mmHg or more) take a third
- In the elderly and patients with diabetes measure seated and standing blood pressure. Postural hypotension (>20 mmHg) is more common in these patients.

Errors in blood pressure measurement can arise for several reasons:

- Defective equipment (e.g. leaky tubing or valve)
- Not ensuring the mercury column reads 0 mmHg at rest
- Too rapid deflation of the cuff
- Using the wrong size cuff
- Cuff not at the same level as the heart
- Not reading the mercury level properly—your eye should be level with the top of the mercury column
- Poor technique (e.g. failing to note when the sounds disappear)
- Digit preference, rounding up to a 5 or 10 mmHg
- Observer bias—such as expecting a young patient’s blood pressure to be normal.

Electronic sphygmomanometers will soon replace standard mercury sphygmomanometers (industrial mercury is an environmental hazard) and these will overcome observer bias. Electronic sphygmomanometers display blood pressure as a digital readout. Currently, several machines have been approved by the British Hypertension Society including the Omron HEM 705 CP, the Omron M4 and the Omron MX2 for self-management. Other machines have been approved for 24-hour ABPM and details of all these machines can be found on the British Hypertension Society’s website (www.hyp.ac.uk/bhs).
2.2 Ambulatory blood pressure monitoring

As the total blood pressure load determines risk, taking several measurements at different times during the day correlate higher with target organ damage than single office readings. ABPM offers one way to take serial readings. Table 6 lists ABPM’s indications to ensure cost-effective use.

Table 6. Indications for 24-hour ambulatory blood pressure monitoring.

- Blood pressure readings that fluctuate widely
- Multiple therapies failing to reach the blood pressure target
- When symptoms suggest possibility of hypotension
- White coat hypertension

When interpreting ABPM readings, consider the average daytime blood pressure rather than the average 24-hour pressure. Furthermore, blood pressure measured by ABPM is lower in everyone than those from surgery or clinic readings, so you should be aware of ‘white coat’ hypertension. Therefore, it is recommended to add 12/7 mmHg to ABPM measurements when setting targets. Target mean daytime ABPM should be less than 130/80 and less than 130/75 mmHg in people without diabetes and those with diabetes, respectively. If you and the GP decide not to treat, the patient still needs close follow-up.

2.2.1 Home monitoring

Home monitoring is less expensive and more convenient for patients than ABPM but is not so well validated. Repeated measurements help make diagnosis and monitor effects of prescribing, therefore saving primary care time. It may encourage compliance and, therefore, meet treatment targets. However, the target should be lowered in the same way as in ABPM. It is worth investing in one or two of the British Hypertension Society approved Omron 705CP automatic blood pressure monitors for loan to patients who cannot afford their own.

2.3 Assessing the patient

2.3.1 Degree of hypertension

The British Hypertension Society working party suggests stratifying patients as follows:

- Blood pressure equal to or greater than 220/120 mmHg: treat immediately
- Blood pressure 200–219/110–119 mmHg: confirm with three readings over 1–2 weeks then treat
- Blood pressure 160–199/100–109 mmHg: if there are complications, target organ damage or if the patient has diabetes, confirm with three readings over 3–4 weeks then treat. Otherwise, give non-pharmacological advice, remeasure weekly and then start pharmacological treatment if blood pressure remains elevated over 4–12 weeks.
blood pressure 140–159/90–99 mmHg: if there are cardiovascular complications or diabetes, confirm within 6–8 weeks and treat. If not, institute lifestyle measures and record the blood pressure monthly for at least 3–4 months. If blood pressure remains elevated, assess total CHD risk using the Joint British Societies Coronary Risk Prediction Chart.10 Treat with drugs if the 10-year CHD risk is at least 15%. This is equivalent to a 10-year total cardiovascular risk (i.e. including stroke) of 20%. Similarly, the NSF recommends that patients should be treated if total risk of CHD is 30% or greater.1

2.3.2 CHD risk factors

While hypertension is a significant risk factor, it should be considered against the background of each patient’s total cardiovascular risk. For example, a history of smoking and raised cholesterol predicts mortality risk irrespective of blood pressure.31 Therefore, you should take the major risk factors for CHD (Table 7) into account when considering treatment. The Joint British Societies Coronary Risk Prediction Chart10 includes the major risk factors and simplifies the assessment (Figure 3).

Table 7. Main risk factors for CHD in patients with hypertension.

- Age – CHD incidence increases with age
- Gender – men have a higher incidence than pre-menopausal women
- Ethnic origin
- Smoking
- Obesity
- Raised cholesterol: high-density lipoprotein (HDL) cholesterol ratio
- Family history of CHD
- Diabetes mellitus
Figure 3. Joint British Societies Coronary Risk Prediction Charts for patients without diabetes (A) and with diabetes (B).

(A)
Hypertension Assessment

CHD risk <15% over next 10 years
CHD risk 15-30% over next 10 years
CHD risk >30% over next 10 years

SEP = systolic blood pressure (mm Hg)
TC : HDL = serum total cholesterol to HDL cholesterol ratio.

MEN

WOMEN

AGE 35 - 44 YEARS

AGE 45 - 54 YEARS

AGE 55 - 64 YEARS

AGE 65 - 74 YEARS
2.4 Other tests

Assessing a patient with hypertension aims to establish whether there is underlying disease, target organ damage and other risk factors. Therefore, you need to ask about family or personal history of hypertension, CHD disease or diabetes as well as smoking, diet, alcohol intake and current medication. You should also calculate body mass index (BMI) – weight/height² (kg/m²).

Patients showing symptoms of heart failure (e.g. breathlessness or ankle swelling) or peripheral vascular disease (cold peripheries, pain in the legs on walking) should undergo a more thorough examination by the GP. Nevertheless, all patients should undergo several routine investigations.¹⁰

- Urine tests: Proteinuria may indicate renal disease; glycosuria may indicate diabetes; while haematuria may indicate renal pathology and, sometimes, malignant hypertension. Patients with proteinuria or haematuria should undergo further investigation to assess potential renal disease.

- Measure serum urea, creatinine and electrolytes: Renal disease can cause hypertension. However, chronic hypertension can impair renal function. Therefore, patients with raised creatinine or urea should undergo further investigation. Patients taking ACE inhibitors and angiotensin II antagonists should undergo regular renal function tests. You should also assess potassium levels before patients start treatment with ACE inhibitors, angiotensin II receptor antagonists (AIIRAs) or diuretics, which may affect levels of this electrolyte. ACE inhibitors and AIIRAs can increase and diuretics can reduce serum potassium levels.

- Blood glucose: Diabetes and hypertension are independent and synergistic risk factors for CHD and stroke. Around a third of patients with newly diagnosed Type 2 diabetes will have hypertension,³² and hypertensive patients are at greater risk of developing diabetes over 5 years.³³

- ECG: An ECG may show arhythmias (e.g. atrial fibrillation, heart block) and ischaemic changes. However, over half of angina patients have a normal resting ECG. An ECG may also highlight the presence of left ventricular hypertrophy which is a strong risk factor for CHD and stroke.³⁴

- Lipid profile: Ideally all patients with hypertension should have their lipid profile assessed. About 37% of men and 34% of women have blood cholesterol levels above 6.5 mmol/litre. These levels are high by international standards.² Check the protocol in your practice.

Summary

Blood pressure is measured routinely and hypertension can be diagnosed simply and cost effectively. Using blood pressure with other risk factors, a complete picture of cardiovascular risk can be made. Targets for blood pressure have been set by the British Hypertension Society and the NSF for CHD, and these will help you to determine thresholds for treatment.
### Blood pressure measurement – assessment form

*Patients with known hypertension*

<table>
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<th>Patient code no.</th>
<th>Date of diagnosis</th>
<th>10-year total cardiovascular risk</th>
<th>Last recorded BP e.g. 160/90 mmHg</th>
<th>1st reading in notes</th>
<th>2nd reading SBP/DBP</th>
<th>3rd reading SBP/DBP</th>
<th>Action</th>
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Blood pressure measurement – assessment form

*Patients without a previous diagnosis of hypertension*

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<th>10-year total cardiovascular risk</th>
<th>Last recorded BP e.g. 160/90 mmHg</th>
<th>1st reading in notes</th>
<th>2nd reading SBP/DBP</th>
<th>3rd reading SBP/DBP</th>
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Self Assessment: Section 2

Multiple choice questions and answers

Use the following Multiple Choice Questions (MCQs) to test your understanding of the material in the pack. If you find an area difficult, return to the relevant sections in the text. Each MCQ consists of either a statement or a question and asks you to identify the correct response(s) of the five given.

Self-assessment total score

To obtain your percentage, divide your score by 6 then multiply by 100.

75–100% correct: You have mastered the principles of hypertension well
60–75% correct: A good score. Revise any particular areas you found difficult
50–65% correct: Worth further reading around the subject
<40% correct: You need to work on the pack again

Self assessment: section 2

1. The following are routine investigations appropriate for all newly diagnosed with hypertension in primary care:
   a. Urinalysis for protein, and blood
   b. Serum creatinine
   c. Total and HDL cholesterol estimation
   d. Thyroid function tests
   e. An ECG

2. Left ventricular hypertrophy:
   a. Is a cause of hypertension
   b. Greatly increases the risk of heart failure
   c. Can best be detected by palpating the chest wall
   d. Can be suspected from an ECG tracing
   e. Would favour treatment with a beta blocker

3. When measuring BP in a patient:
   a. Use a smaller cuff for larger arms
   b. Support the patient’s arm at heart level
   c. Take at least two readings
   d. Read to the nearest 5 mmHg
   e. Record sitting and standing blood pressure in the elderly and those with diabetes

4. Systolic blood pressure:
   a. Is less predictive of risk than diastolic
   b. If raised should only be treated if the diastolic is also elevated
   c. Is in the normal range up to 180 mmHg
   d. Is commonly raised in the elderly
   e. Is not an independent risk factor for stroke
5. With regard to 24-hour ambulatory blood pressure monitoring (ABPM):
   a. The average adjusted daytime BP should be used to decide treatment
   b. Widely fluctuating BP may be an indication for ABPM
   c. BP recorded by ABPM is lower than surgery readings
   d. BP targets to achieve are the same as for surgery readings
   e. ABPM correlates better with target organ damage than surgery readings

6. The following are risks for hypertension:
   a. Smoking
   b. Pregnancy
   c. Obesity
   d. Type 2 diabetes
   e. Young age
3 Treating Hypertension

**Learning objectives**

By the end of this section you should be able to:

3.1 *recommend appropriate lifestyle changes for patients with hypertension*
3.2 *know blood pressure targets and thresholds for treatment*
3.3 *know the types of drugs used in the management of hypertension*
3.4 *know the principles of tailoring treatment for patients.*

**Activities**

- obtain and read references that are of interest
- complete self assessment
- complete a list of antihypertensive therapy currently used in your practice.
### 3.1 Non-pharmacological advice

You should offer every patient lifestyle advice (Table 8). Patients with mild hypertension and who are free of cardiovascular complications or target organ damage should undergo lifestyle measures alone for 3–6 months, which may be sufficient to reduce blood pressure. Patients taking drugs should also use lifestyle measures to reduce the need for antihypertensive therapy, additional therapy or higher dosages.

**Table 8. Lifestyle measures to reduce blood pressure.**

- Weight reduction if overweight
- Reduction in salt intake
- Reduction in excess alcohol intake
- Regular exercise
- Diet high in fruit and vegetables
- Quit smoking

#### 3.1.1 Reducing weight

Overweight individuals have an increased risk of CHD. About 45% of men and 33% of women are overweight (have a BMI of 25–30 kg/m²) in England, and a further 17% of men and 20% of women are obese (a BMI of more than 30 kg/m²). Losing 1 kg reduces blood pressure by 2.5/1.5 mmHg.

#### 3.1.2 Reducing salt intake

Reducing salt intake from 10g (2 teaspoons) to 5g (one teaspoon) a day lowers blood pressure by about 5/3 mmHg. However, the benefit is more marked in the elderly and Afro-Caribbeans, who seem to be salt sensitive. The British Hypertension Society publishes a leaflet on reducing dietary salt, which includes avoiding adding salt to meals and avoiding eating salty foods such as processed meat products, pâté, ready-prepared meals, tinned/packet soups, crisps and smoked fish. Some 80% of our salt intake comes from prepared food. While the true value of salt reduction in hypertension is controversial, it should form part of lifestyle management.

#### 3.1.3 Reducing excess alcohol intake

An alcohol intake of 2 units/day may protect against heart disease, but higher intakes increase blood pressure. Patients with hypertension should restrict their alcohol intake to less than 21 units/week for men and less than 14 units/week for women, according to British Hypertension Society guidelines. Binge drinking increases stroke risk.

#### 3.1.4 Taking regular exercise

Regular exercise lowers the risk of CHD. You should encourage 20–30 minutes exercise daily (or at least three times per week), such as brisk walking, jogging, cycling, dancing or swimming.

#### 3.1.5 Eating a healthy diet

A diet high in fruit and vegetables when combined with an increase in low-fat dairy products and a reduction of saturated fat can contribute to blood pressure falls, sometimes as large as 11/6 mmHg. Cardiologists increasingly recognise the value of a high potassium diet in hypertensive patients (Table 9). However, while you should counsel patients about a healthy diet, which includes lowering fat consumption, it is usually ineffective at reducing cholesterol. In one study,
even when patients complied and restricted total fat intake to less than 25–30% of calories, total cholesterol was found to decline by a maximum of just 1.9%.37 Within this total reduction of cholesterol, there were minor increases in high-density lipoprotein (HDL) and reductions in low-density lipoprotein (LDL), although triglyceride levels were unchanged. The authors of the study suggest that while little effect was observed in the patients, it is likely that more intensive intervention with patients, particularly very motivated patients, might have a greater effect.

Table 9. Examples of high potassium foods.

- Baked potato and sweet potato
- Peaches
- Prunes
- Tomato juice
- Soya beans
- Apricots
- Orange juice
- Bananas
- Almonds
- Spinach

On the other hand, a diet high in oily fish reduces mortality in the 2 years following a MI by 29%.38 Oily fish are rich in omega-3 fatty acids, which may partly explain why the ‘Mediterranean diet’ prevents coronary events. However, antioxidants (e.g. vitamins C and E) slow arteriosclerosis and may also play a role. The message is clear – fresh fruit, vegetables, oily fish and an adequate dietary supply of vitamins help prevent CHD. However, if there is one simple message we can give to our patients, it is to eat five or more portions of fruit and vegetables each day.

3.1.6. Stopping smoking

Smoking increases the risk of CHD. It is estimated that approximately 20% of deaths from CHD in men and 17% of deaths in women are due to smoking.2 Risk scores that have been developed, such as the Sheffield Tables and those from the Joint British Societies (see page 22), demonstrate that stopping smoking can reduce a patient’s overall risk for developing CHD in the future.39 For example, a 50-year-old non-smoking woman with a blood pressure of 170/100 mmHg, a total cholesterol of 6.0 mmol/litre and HDL cholesterol of 1.2 mmol/litre has about a 6% risk of suffering a major cardiovascular event in the next 5 years (e.g. stroke, MI). However, a 60-year-old man who smokes 40 cigarettes a day with the same blood pressure and total cholesterol profile, but with an HDL cholesterol of 1 mmol/litre has a greatly increased risk of 30% of suffering a major cardiovascular event.40 So encouraging patients to stop smoking will have visible benefits.

The Government in a White Paper called ‘Smoking kills’ have outlined their action plan to reduce smoking by banning advertising, keeping cigarette tax ahead of inflation and providing those people who want to stop smoking with the tools to do so with smoking cessation clinics and the availability of nicotine replacement therapy on prescription.41 The Government has set a target of reducing the prevalence of smoking from 28% (as it was in 1996) to 26% by 2005 and a further 2% reduction by 2010, and it is thought that these targets are achievable.2 Smoking cessation is also a key element of the NSF for CHD, and as these guidelines are being implemented at a local level with £60 million of Government funds it should be feasible to realise benefits for patients in your clinic.42

3.2 Targets for treatment

As we have mentioned several times, primary care hypertension management is suboptimal.4 Only 6% of hypertensive patients are adequately treated based on targets of 140/90 mmHg.7 As a result, most patients with hypertension have a poor prognosis. Hypertension is the major cause of stroke and
renal failure as well as increasing the risk of heart failure by six-fold (Table 10). Moreover, a fifth of patients with mild hypertension and half of those with moderate hypertension show left ventricular hypertrophy – which increases CHD risk between five- and seven-fold and heart failure risk 17-fold.10

Table 10. Serious complications and target organ damage from hypertension.

| ▼ | Stroke and transient ischaemic attacks |
| ▼ | Left ventricular hypertrophy and heart failure |
| ▼ | myocardial infarction (MI) |
| ▼ | Angina |
| ▼ | Renal impairment |

3.2.1 Thresholds for treatment

To reduce this burden, practices should follow the British Hypertension Society’s treatment thresholds in line with the recently published NSF for CHD,1,10 which represent the evidence-based current consensus of best practice. These guidelines emphasise the value of thresholds and blood pressure targets during antihypertensive treatment, thus a threshold to treat (the audit standard) of 150/90 mmHg means a SBP of 150 mmHg or 90 mmHg DBP. However, an optimal blood pressure target of less than 140/85 mmHg means that less than 140 mmHg for SBP and less than 85 mmHg for DBP should be set as the goal.10 This is particularly relevant given the growing body of evidence indicating that SBP is the more important determinant for morbidity and mortality because of cardiovascular disease, and reductions in SBP can significantly reduce the number of cardio-vascular events (e.g. MI).10 As such, you should use these targets to develop practice or PCO guidelines or protocols. Recommendations from these guidelines are set out below.

▼ Patients should be considered as hypertensive if their blood pressure exceeds 140/85 mmHg, and this is the blood pressure target that should be aimed for following intervention (either non-pharmacological or pharmacological)

▼ Patients with average blood pressure of 140–159/90–99 mmHg should be offered antihypertensive drug therapy if one of the following applies:
  – there is any complication of hypertension, target organ damage (e.g. kidneys) or diabetes
  – the 10-year CHD risk (as evaluated from the risk assessment chart; see page 22) is 15% or greater despite non-pharmacological advice (e.g. stopping smoking)

For patients that you decide not to treat because their blood pressure is currently below these thresholds, you should continue to monitor their blood pressure as it will rise above target in 10-15% of patients, and within 5 years drug therapy will be required. During the monitoring period, patients should be encouraged to continue with non-pharmacological measures.

The British Hypertension Society guidelines suggest that treatment should aim to lower blood pressure to 140/85 mmHg or less for patients without diabetes and 140/80 mmHg or less for patients with diabetes. (If using ABPM or home monitoring the targets should be <130/80 mmHg and <130/75 mmHg, respectively). However, patients with diabetes who also have nephropathy, renal disease and proteinuria may need tighter targets (<125/75 mmHg). Finally, the guidelines10 suggest that the minimum acceptable level of control (audit standard) is less than 140/85 and less than 150/90 mmHg for patients with and without diabetes respectively. Hitting these targets means reducing both SBP and DBP.
3.3 Drug treatment

If lifestyle measures fail to adequately control blood pressure or the patient needs immediate treatment, GPs can choose between several classes of antihypertensive drugs (Table 11). These show similar efficacy. However, differences in pharmacological profile mean that each has its own pros and cons allowing clinicians to tailor treatment to the patient. Nevertheless, these are only guidelines. A recent study found that patients vary in their response and only a minority are controlled on the first-choice antihypertensive. Antihypertensive therapy has been shown to be effective and in patients with diabetes antihypertensives can improve microvascular outcomes as well as blood pressure. Table 11 summarises examples of the main classes and their side effects. The next section addresses mode of action and clinical role of these agents.

3.3 Tailoring the treatment to the patient

- **Thiazide diuretics** inhibit salt re-absorption in the kidney. As a result, the patient excretes more fluid to maintain normal blood electrolyte concentration. This lowers blood pressure. Serum potassium levels, especially for those taking concurrent digoxin, need to be monitored.

- **Calcium antagonists** lower blood pressure through vasodilation. They do not adversely affect lipids, blood glucose or renal function.

- **Beta blockers** lower blood pressure by slowing heart rate and reducing the force of contraction, although they may have other actions.

- **ACE inhibitors** inhibit angiotensin converting enzyme (ACE), which converts angiotensin I to angiotensin II. As angiotensin II is a powerful vasoconstrictor and promotes sodium and fluid retention, blocking its production lowers blood pressure. ACE inhibitors do not affect either lipid or glucose metabolism. These are less effective if patients have a high salt intake.

- **Angiotensin II receptor antagonists (AIIRAs)** block one of the receptors for angiotensin II. As the mode of action is very specific, the side effect profile is comparable to placebo. As with ACE inhibitors, the maximum effect of AIIRAs may take 3–6 weeks to develop.

- **Alpha blockers** lower blood pressure by inducing vasodilation. They do not affect glucose metabolism or electrolytes and may increase HDL cholesterol and lower total cholesterol. They also improve urinary outflow obstruction due to prostatic hypertrophy in men.

- **Centrally acting drugs** include moxonidine, methyldopa and clonidine.
Table 11. Examples of the main classes of antihypertensive drugs and their side effects.

<table>
<thead>
<tr>
<th>Hypertensive class</th>
<th>Examples</th>
<th>Side effects</th>
<th>Suitable patient type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thiazide diuretics</strong></td>
<td>Bendrofluazide, chlorthalidone, hydrochlorothiazide, cyclopenthiazide, indapamide, metolazone, polythiazide, xipamide</td>
<td>Diabetes, Gout, Hyperlipidaemia, Impotence, Hypokalaemia</td>
<td>• Elderly patients with isolated systolic hypertension (ISH)</td>
</tr>
<tr>
<td><strong>Calcium antagonists (calcium channel blockers)</strong></td>
<td>Dihydropyridines: amlodipine, felodipine, isradipine, lacidipine, lercanidipine, nicardipine, nifedipine, nisoldipine, nimodipine Phenyalkylamines: verapamil Benzothiazepines: diltiazem</td>
<td>Dihydropyridines (especially short acting): Headache, flushing, palpitations, Ankle oedema, Verapamil: constipation</td>
<td>• Patients with asthma, diabetes, renal disease, ISH angina • Afro Caribbean patients</td>
</tr>
<tr>
<td><strong>Beta blockers</strong></td>
<td>Cardioselective: acebutolol, atenolol, bisoprolol, celiprolol, metoprolol, nebivolol, timolol, betaxolol Non-cardioselective: propanolol, timolol, nadolol, carvedilol, oxprenolol, pindolol, propranolol</td>
<td>Bronchospasm, Impotence, Insomnia, Vivid dreams, Cold hands and feet, Increase triglycerides, Decrease HDL cholesterol, Bradycardia, Tiredness, Reduced exercise tolerance, Weight gain</td>
<td>• Following a myocardial infarction (MI) • Patients with angina • Some patients with heart failure NOT suitable for patients with asthma, peripheral vascular disease or Raynaud’s infarction (MI) disease, heart block • Patients with heart failure left ventricular hypertrophy post MI patients with diabetes • Less suitable for Afro Caribbean patients or the elderly</td>
</tr>
<tr>
<td><strong>ACE inhibitors</strong></td>
<td>Captopril, clazapril, enalapril, fosinopril, irapril, lisinopril, moexipril, perindopril, quinapril, ramipril, trandolapril</td>
<td>Dry cough, Angio-oedema, Rash, Renal impairment</td>
<td>• Patients with heart failure left ventricular hypertrophy post MI patients with diabetes • Less suitable for Afro Caribbean patients or the elderly</td>
</tr>
<tr>
<td><strong>Angiotensin II receptor antagonists</strong></td>
<td>Candesartan, eprosartan, irbesartan, losartan, telmisartan, valsartan</td>
<td>Placebo level</td>
<td>• Suitable for a broad range of patients • Patients with heart failure intolerant of ACE inhibitors</td>
</tr>
<tr>
<td><strong>Alpha blockers</strong></td>
<td>Doxazosin, indoramin, prazosin, terazosin</td>
<td>Postural hypotension, Urinary incontinence (women)</td>
<td>• Patients with prostatism hyperlipidaemia</td>
</tr>
<tr>
<td><strong>Centrally acting</strong></td>
<td>Moxonidine, methyl dopa, clonidine</td>
<td>Headache, Depression, Dry mouth, Dizziness</td>
<td>• Pregnant patients (methyl dopa only) • If other classes have failed</td>
</tr>
</tbody>
</table>
To date, most long-term outcome trials used beta blockers and thiazide diuretics. However, the ongoing ASCOT (Anglo-Scandinavian Cardiac Outcomes Trial) study will provide data on two combinations of antihypertensive regimen and, in addition, evaluate cholesterol lowering.

The ASCOT results will be helpful because most patients need more than one drug to reach their target blood pressure.10 Before combining therapy it is important to allow at least 4 weeks to assess a response to a drug. If after this time blood pressure control is inadequate, consider the following combinations:

- thiazide diuretic with a beta blocker, ACE inhibitor or angiotensin II antagonist
- beta blocker with a dihydropyridine calcium channel blocker
- ACE inhibitor or angiotensin II antagonist with a dihydropyridine calcium channel blocker.

Doxazosin (an alpha blocker) or moxonidine can be added to the above combinations.

Furthermore, the HOT study20 showed that in patients being treated for hypertension and aged over 50 years, 75 mg aspirin reduced cardiovascular events by 15% and MI by 36%; however major bleeds were increased. Only the following hypertensive patients should be supplied with 75 mg aspirin daily for primary prevention:

- those whose blood pressure is controlled to less than 150/90 mmHg
- aged 50 years or more
- target organ damage or cardiovascular complications (e.g. left ventricular hypertrophy)
- those with a 10-year CHD risk of at least 15% (using the Joint British Societies Coronary Risk Prediction Chart)
- those with Type 2 diabetes.

### Summary

From the above discussion, the general principles of treating hypertension are:

- establish the diagnosis before treatment
- treat the elderly
- aim to reach a target of 140/85 mmHg or less (140/80 mmHg in those with diabetes)
- most patients need more than one drug
- systolic is probably more important than diastolic pressure
- treat isolated systolic hypertension
- all hypertensive patients should be fully assessed for an underlying cause, target organ damage and other CHD risk factors, which may need treatment
- all hypertensive patients should receive advice about, and implement lifestyle changes
- hypertension treatment should be tailored to the patient
- aim for 24-hour control of blood pressure. The morning rise in blood pressure correlates with the peak incidence of cardiovascular events.
**Drug classes used in our practice**

*Find examples of the following classes of antihypertensive drugs used in your practice*

<table>
<thead>
<tr>
<th>Drug class</th>
<th>Drug name (generic and brand name)</th>
<th>Cost per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiazide diuretics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium antagonists</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta blockers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alpha blockers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angiotensin II receptor antagonists</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACE inhibitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centrally acting antihypertensives</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Self Assessment: Section 3

Multiple choice questions and answers

Use the following Multiple Choice Questions (MCQs) to test your understanding of the material in the pack. If you find an area difficult, return to the relevant sections in the text. Each MCQ consists of either a statement or a question and asks you to identify the correct response(s) of the five given.

Self-assessment total score

To obtain your percentage, divide your score by 24 and multiply by 100.

75–100% correct: You have mastered the principles of hypertension well
60–75% correct: A good score. Revise any particular areas you found difficult
50–65% correct: Worth further reading around the subject
<40% correct: You need to work on the pack again.

Self assessment: section 3

1. The following patients require drug treatment for hypertension:
   a. A patient with a sustained diastolic BP of 102 mmHg
   b. A patient with a sustained systolic BP of 164 mmHg
   c. A diabetic patient with a sustained BP of 148/96 mmHg
   d. A 75-year-old patient with a stroke and a BP of 160/94 mmHg
   e. A 44-year-old otherwise well female smoker with a BP of 138/88 mmHg and a normal total cholesterol: HDL cholesterol

2. The target for blood pressure treatment should be:
   a. Less than or equal to 160/90 mmHg for those with diabetes
   b. Less than or equal to 140/80 mmHg for those with diabetes
   c. Less than or equal to 160/100 mmHg for those without diabetes
   d. Less than or equal to 140/85 mmHg for the non-diabetic
   e. Less than or equal to 200/90 mmHg for the elderly (age >65 years)

3. The following lifestyle measures can reduce BP:
   a. Weight reduction if overweight
   b. Reducing excess alcohol consumption
   c. Regular exercise
   d. Decreasing the potassium intake in your food
   e. Eating a diet high in fruit and vegetables

4. Regarding drug treatment for hypertension:
   a. Patients taking antihypertensives do not need to adhere to lifestyle measures in order to reduce BP
   b. Beta blockers have been shown to be more effective than all other classes of antihypertensive
   c. Aspirin is only of use in hypertensives who have had a stroke
   d. It is better to accept poor control than be forced to use combination therapy
   e. It is important to aim for 24-hour control
5. When matching a drug to a patient type:
   a. Beta blockers are useful post MI
   b. Thiazides are useful to treat systolic hypertension in the elderly
   c. ACE inhibitors may be useful in those with Type I diabetes with proteinuria
   d. ACE inhibitors are especially effective in Afro-Caribbean patients
   e. Alpha blockers are useful in women with urinary incontinence

6. The following are side effects of the relevant drugs:
   a. Hyperkalaemia can be a side effect of thiazide use
   b. Ankle swelling can be a side effect of dihydropyridine calcium channel blocker use
   c. Cold hands and feet can result from beta blocker use
   d. Cough is a common side effect when using an angiotensin II antagonist
   e. Postural hypotension may be a side effect limiting alpha blocker use

7. If combination therapy is required, the following are particularly useful and logical combinations to treat hypertension:
   a. A thiazide and a beta blocker
   b. An ACE inhibitor and a beta blocker
   c. A thiazide and an ACE inhibitor
   d. An ACE inhibitor and a dihydropyridine calcium channel blocker
   e. Verapamil and a beta blocker

8. Screening for hypertension:
   a. Is well validated, fulfilling WHO criteria for a good screening programme
   b. Is not necessary in the elderly
   c. Is the province of primary rather than secondary care
   d. Will be facilitated by an age-sex register
   e. Will include diabetic patients as a priority group
Learning objectives

At the end of this section you should be able to:

4.1 know the rationale for screening for hypertension
4.2 construct a hypertension register
4.3 identify and use the appropriate 'Read codes' in your day-to-day practice
4.4 identify the criteria essential to include on a patient record
4.5 use the primary care toolkit in your practice for detecting and managing hypertension
4.6 know the necessary components for patient education.

Activities

- obtain and read references of interest
- complete self assessment
- review current hypertension register in your practice
- complete audit protocol for your patients with known hypertension
- complete the clinical governance checklist
- complete case histories
- identify resources useful to your practice from the resources page provided in this Learning Pack.
4.1 Developing effective screening

Hypertension screening fulfils the WHO criteria for an effective screening programme. Hypertension is a common, serious condition with a well-understood natural history. The screening test is easy to perform, cost effective and produces little physical and psychological harm. Hypertension can be effectively treated. Indeed, hypertension screening is an element of the health promotion system and attracts payment. Identification and management of hypertension is a commendable starting point and gateway to the further management of CHD. You need, therefore, an effective screening system for measuring blood pressure of all patients aged 15–80 years. The target ages in the health promotion payment system are 15–74 years, but this should be extended. You can develop an effective screening system by:

- recording blood pressure at the New Registration Check
- using the age-sex register to send appointments to patients and check attendance
- adopting ‘case finding’. The notes or computer records identify the need for a blood pressure check, which is taken opportunistically; record 5-yearly
- recording blood pressure at the over-75 annual check. Most practices screen up until the age of 80 years. However, screen based on biological rather than chronological age
- using records to identify high-risk patients, such as those with diabetes, existing heart disease, angina or a history of MI, stroke or transient ischaemic attack.
- ensuring that patients with renal failure are under specialist supervision. These patient groups are screening priorities.

4.2 Constructing a hypertension register

Constructing a practice hypertension register facilitates screening, audit and follow-up as well as being an objective for health promotion banding payments. Many strategies can help you construct a hypertension register, including:

- using current data, held as Read codes (see below) or summary cards in the medical records
- downloading names of patients currently taking antihypertensives
- searching other registers (e.g. for CHD or diabetes) for hypertensive patients
- looking for patients referred to the hospital for hypertension. You could ask the hospital if they have a list of hypertensive patients under their care
- ensuring all new or established hypertensives are added to the register at the New Registration Check and as they attend clinics for CHD, stroke, diabetes or ‘Well Person’ and blood pressure checks
- adding elderly patients at their over-75 check
- ensuring all practice staff are aware of the need to add a patient to (or check if already on) the hypertension register.
4.3 Use of computers

It is worthwhile knowing some common Read codes, to help recording and data collection:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Read code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>G2</td>
</tr>
<tr>
<td>Stroke and cerebrovascular accident</td>
<td>G66</td>
</tr>
<tr>
<td>Transient cerebral ischaemia</td>
<td>G65</td>
</tr>
<tr>
<td>Angina pectoris</td>
<td>G33</td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
<td>G3</td>
</tr>
<tr>
<td>Acute myocardial infarction (MI)</td>
<td>G30</td>
</tr>
<tr>
<td>Left ventricular failure</td>
<td>G581</td>
</tr>
</tbody>
</table>

4.4 Using patient record cards

Record cards help ensure structured care for hypertension, which should include:

- age and sex
- date of diagnosis, including pre-treatment readings
- relevant past medical history and family history
- details of examination at diagnosis
- investigations
- record of non-pharmacological advice
- CHD risk factors
- current and previous therapy
- follow-up recordings of blood pressures and renal function tests.

4.5 Setting up a practice hypertension programme

Setting up a practice-based hypertension programme is a large task involving:

- designing protocols
- constructing hypertension registers
- instituting call and recall systems
- staff training
- identifying referral criteria
- providing patient information material
- access to investigations
- availability of equipment, including home monitors and ABPM
- audit.

Some practices already offer many of these elements. However, PCOs will develop and support such initiatives to achieve consistently high-quality care throughout the community.
4.5.1 Detection and management of hypertension in primary care

**First stage – screening**: All patients aged 16–85 years should have a blood pressure reading recorded in the previous 5 years. Blood pressure should be measured in the sitting position, after the patient has been resting for 5 minutes, using the appropriate cuff size. Diastolic should be phase 5 (sounds disappear), and blood pressure should be read to the nearest 2 mmHg. It should be taken two to three times at each visit.

**Second stage – creating and maintaining an accurate disease register**: All patients who have been diagnosed with persistently raised blood pressure (patients who have had a blood pressure reading of \( \geq 140/85 \) mmHg on four separate occasions) should be recorded on an accurate hypertension register capable of interrogation to ensure that they are offered the minimum of an annual review. The register should be updated on an ongoing basis. Many of these patients will require 'watchful waiting' and non-pharmacological and general lifestyle advice on cardiovascular risk rather than immediate drug treatment for their persistently raised blood pressure (Figure 4). Those with a blood pressure below 140/85 mmHg should be reassessed in 5 years.

Methods of identification are:

- as patients consult
- based on a search of repeat prescriptions
- from knowledge of primary care team members
- searching on the computer by diagnosis.

All patients with hypertension should have comprehensive risk assessment as part of their treatment. A risk score tool such as the Cardiac Risk Assessor on the British Hypertension Society website (http://www.hyp.ac.uk/bhs/risk.xls) is recommended. The decision to offer treatment should be based on an absolute CHD risk of 15% over 10 years. High risk patients are defined in the NSF for CHD as patients with established disease as well as those who are disease free but have a CHD risk greater than 30% over 10 years.

**Third stage – investigation and treatment**: All hypertensive patients should have a thorough clinical assessment and limited investigations:

- urine strip test for blood and protein
- blood electrolytes and creatinine
- blood glucose
- serum total: HDL cholesterol ratio
- 12-lead electrocardiograph.

In considering thresholds for initiating treatment, it is important to consider SBP as well as DBP as a predictor of cardiovascular disease. Figure 4 provides a guide to intervention which takes account of systolic and diastolic thresholds.

The main elements of non-pharmacological advice include weight reduction, regular physical activity, limiting alcohol and salt intake and increasing the consumption of fruit and vegetables. Cardiovascular risk may be further reduced by stopping smoking, reducing total intake of saturated fat and increasing consumption of oily fish.

In the absence of contraindications or compelling indications for other antihypertensive agents, low-dose thiazide diuretics or beta blockers are preferred as first-line treatment for the majority of people with hypertension. Full consideration of drug therapy for hypertension is discussed in section 3.
Criteria for referral

In all types of patients, it will be important in some instances to refer them to the GP or hypertension specialist for further consultation (Table 12). It may not be necessary or feasible to perform ABPM in all hypertensive patients. It is not indicated in patients at high risk of CHD or cerebrovascular disease. ABPM may also be unnecessary in patients with mild hypertension (140–159/90–99 mmHg) with no target organ damage, no cardiovascular complications and an estimated 10-year CHD risk of less than 15%. However, these individuals must be followed up, at least annually. ABPM may alter management where the average clinic blood pressure is 160/100 mmHg or more, there is no target organ damage or cardiovascular complications and the estimated 10-year CHD risk is less than 15%. Here, elevated blood pressure is the only indication of high CHD or cerebrovascular disease risk and the need for treatment. A normal ABPM may influence that decision.
Table 12. Criteria for referral to a hypertension specialist.

<table>
<thead>
<tr>
<th>Urgent treatment for specific conditions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▼ Accelerated (malignant) hypertension (hypertension that advances rapidly with increasing blood pressure and worsening symptoms, may also be associated with kidney and retinal damage)</td>
<td>▼ Severe hypertension (e.g. &gt;220/120 mmHg)</td>
</tr>
<tr>
<td>▼ Impending complications (e.g. transient ischaemic attacks, left ventricular failure)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Underlying secondary causes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▼ Clue in history or examination (e.g. headaches, sweating and palpitations for phaeochromocytoma)</td>
<td>▼ Hypokalaemia/increased plasma sodium (although very rare) or severe cardiovascular family history</td>
</tr>
<tr>
<td>▼ Abnormal urine sediment (proteinuria and/or haematuria) and/or raised serum creatinine</td>
<td>▼ Recent onset or worsening of hypertension (especially in a smoker, atheromatous renal artery stenosis)</td>
</tr>
<tr>
<td>▼ Resistance to three-drug regimen</td>
<td>▼ Young age (any patient aged &lt;20 years with blood pressure &gt;140/85 mmHg needing treatment; any patient less than &lt;30 years whose blood pressure is above the British Hypertension Society thresholds to treat)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Therapeutic problems</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▼ Treatment resistance</td>
<td>▼ Multiple drug intolerance</td>
</tr>
<tr>
<td>▼ Multiple drug contraindication (e.g. asthma, heart failure)</td>
<td>▼ Persistent non-compliance</td>
</tr>
<tr>
<td>▼ Treatment declined</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ambulatory blood pressure monitoring should be considered in the following patients</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▼ When blood pressure shows unusual variability</td>
<td>▼ In hypertension resistant to drug therapy, defined as blood pressure &gt;150/90 mmHg on a regimen of three or more antihypertensive drugs</td>
</tr>
<tr>
<td>▼ When symptoms suggest the possibility of hypotension</td>
<td>▼ To diagnose white coat hypertension</td>
</tr>
</tbody>
</table>

You will need to find out what the referral procedure is in your area as they can vary. When a patient is referred it is valuable to consider the following points:

|  |
|----------------------------|-----------------------------------------------|
| ▼ mutually agreed protocols between primary and secondary care | ▼ referral requirements from primary to secondary care |
| ▼ how patients will be discharged effectively from the secondary care clinic back to primary care and how this can be achieved smoothly with the appropriate information communicated. |  |
These important issues should be the subject of local discussion and service agreements, and should be discussed within your practice, so that the referral process is as smooth and effective as possible to save you time and improve care for your patients.

Close links between the primary care team and the secondary services can benefit patients, and circumstances where benefits can be seen include:

- support (advice and education) in the interpretation of cardiovascular risk and its implementation
- support for decision making around introductions of therapies, such as statins and aspirin, in patients with hypertension
- a review process for difficult-to-control hypertension, thus enabling primary care to deliver audit standards
- an advisory service to support the introduction of non-pharmacological approaches, to avoid medication in certain population groups to enhance efficacy of medication in others
- to ensure an effective team approach in the issue of concordance, empowering patients and releasing the full potential of other professionals (i.e. nurses and pharmacists).

Fourth stage – audit: The key to monitoring the practice’s performance in the detection and control of hypertension depends on the accurate recording of the following elements of the care programme annually:

- screening
- diagnosis
- review
- control.

Table 13 provides a framework for collecting data relating to these four elements of the programme.
Hypertension in pregnancy

Pregnant women need particular consideration during investigation and treatment. From a practical point of view, there are four syndromes of hypertension in pregnancy:

- **Chronic hypertension in pregnancy**: It is usually assumed that if the blood pressure exceeds 140/90 mmHg before 20 weeks of gestation, then it is due to chronic (essential or secondary) hypertension. In about 50% of these women there is no available blood pressure measurement prior to pregnancy.

- **Pre-eclampsia**: any rise in blood pressure to above 140/90 developing after 20 weeks of gestation is now thought to be due to mild, moderate or severe pre-eclampsia with or without proteinuria. This syndrome complicates about 5% of previously normotensive pregnancies, being more common in young primiparous women and in older high-risk (e.g. patients with diabetes) multiparous or obese women.

- **Pre-eclampsia complicating chronic hypertension**: pre-eclampsia develops in about 15% of patients with chronic hypertension. The clinical features are a sharp rise in blood pressure and/or the de novo development of proteinuria.

- **Severe pre-eclampsia and eclampsia**: these are life-threatening obstetric emergencies characterised by severe hypertension with proteinuria and headache, facial swelling, hyper-reflexia and in extreme cases convulsions and retinopathy resembling that seen in malignant hypertension. The mother is at risk from hepato-renal failure, stroke and haemorrhage, while the foetus is at risk of growth retardation and intra-uterine death.

Most women of child-bearing age are at a very low cardiovascular risk so they should only be given antihypertensive drugs if their blood pressure consistently exceeds 160/100 mmHg (unless there are other risk factors). Women with any level of hypertension in pregnancy should be referred to a specialist ante-natal hypertension clinic. The decision to start antihypertensive drug therapy should usually only be made at consultant or specialist level. There is no evidence that treating chronic mild hypertension in pregnancy or early mild pre-eclampsia causes any reduction in the development of severe proteinuria, pre-eclampsia, intra-uterine growth retardation or intra-uterine death. Antihypertensive drugs that can and cannot be used in pregnancy are outlined below.

- Methyldopa is safe in pregnancy and should be used as first-line therapy.

- Labetalol is safe, and is used intravenously in severe hypertension, but may be relatively ineffective in mothers of African origin.

- Thiazide diuretics are theoretically harmful as they may further reduce utero-placental blood flow in women with pre-eclampsia.

- Beta blockers are effective in the third trimester and may be used under close supervision.

- ACE inhibitors and angiotensin receptor antagonists are absolutely contraindicated in pregnancy and are best not given to women of child-bearing potential without full discussion and contraceptive advice.

- Calcium antagonists are unlicensed in pregnancy but may be used in severe or resistant cases.

Women who have had any of the syndromes of hypertension in pregnancy are probably at risk of developing hypertension later in life, and annual blood pressure checks are recommended. A high proportion of these women have a family history of hypertension. Extreme dietary manipulation may be harmful, but a high salt diet and excessive weight gain should be avoided. The most effective way to treat pre-eclampsia if pregnancy is beyond 34–36 weeks is delivery of the child. However, antihypertensive treatment may be required if the stage of pregnancy is earlier to prevent complications of hypertension.
Table 13. Audit parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Goal</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening</td>
<td>Blood pressure measurement recorded for the practice population aged 16–85 years inclusive in the previous 5 years</td>
<td>All patients aged 16–85 years of age should have a blood pressure reading recorded in the previous 5 years</td>
<td>Percentage of target population screened</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Blood pressure reading of ≥140/85 on four separate occasions</td>
<td>All patients who have a blood pressure reading of ≥140/85 on four separate occasions should be included on the hypertension register*</td>
<td>Percentage of target population included in diagnostic register</td>
</tr>
<tr>
<td>Review</td>
<td>Patients diagnosed with hypertension have had their blood pressure measured in the previous 12 months</td>
<td>All patients fulfilling the criteria for diagnosis of hypertension should have a blood pressure measurement recorded at least once in the previous 12 months</td>
<td>Percentage of those with hypertension reviewed in previous 12 months</td>
</tr>
<tr>
<td>Control</td>
<td>Patients diagnosed with hypertension whose last blood pressure measurement in previous 12 months showed a reading of &lt;140 systolic and &lt;85 diastolic for those without diabetes and &lt;80 diastolic for those with diabetes</td>
<td>All patients fulfilling the criteria for diagnosis of hypertension should have their blood pressure controlled</td>
<td>Percentage of those with hypertension with a blood pressure reading in the previous 12 months &lt;140 systolic and &lt;85 diastolic</td>
</tr>
</tbody>
</table>

*Suggested Read codes

<table>
<thead>
<tr>
<th>4 Byte</th>
<th>5 Byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential hypertension diagnosis</td>
<td>G31. plus value</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>2469/246A plus values</td>
</tr>
</tbody>
</table>

It may not be possible to attain this level in some treated patients; hence control of the target population is likely to fall short of 100%. 10

Having completed the data collection phase (see Appendix, page 48) and analysed the results, the findings for the current and previous years’ audits should be discussed by the practice team. Changes in the organisation and delivery of the hypertension programme in the practice should be considered in order to:

- improve the completeness of recording data on patient care
- improve performance in meeting the goals
- prepare for re-audit the following year to determine whether performance has improved in measuring each parameter and in reaching the defined goals (agree within your practice a realistic set of standards before the re-audit)
- use the clinical governance check list (see Appendix, page 49) to track progress in developing the hypertension programme in preparation for next year’s audit.
4.6 Patient education

Involving patients in diagnosis and management is essential to achieve our goals. This involves:

- a campaign (practice or PCO led) on the value of having blood pressure recorded
- offering leaflets and education material about ‘blood pressure’. ‘Know your number’ is a useful catchphrase. Most patients are unaware of their blood pressure and a ‘know your number’ campaign is a good first step in any community programme
- producing leaflets offering lifestyle advice
- information material, posters and notes added to prescriptions help compliance (e.g. ‘Hypertension is for Life’ stickers – see the resources page provided in this Learning Pack).

Summary

PCOs should develop hypertension programmes that address issues such as:

- criteria for diagnosis and treatment
- standardisation of blood pressure recording within the PCO
- facilities for implementing lifestyle advice (dieticians, patient information leaflets, exercise programmes, anti-smoking clinics)
- standardised record card or computerised record
- computerised call and recall systems as well as hypertension registers
- suitable equipment
- defined referral criteria
- development of a treatment protocol – this should be a key agenda item for every PCO
- training initiatives within a single or several PCOs.

In summary, hypertension is a common and potentially deadly condition that rarely produces symptoms. As a result, hypertension is under diagnosed and under treated, despite the availability of a large number of drugs that could reduce the morbidity and mortality arising from high blood pressure. Against this background, managerial improvements, such as practice protocols, patient education and so on, backed by audit should help ease the clinical, human and economic toll imposed by hypertension.
Appendix 1: Audit and Governance

CLINICAL AUDIT OF HYPERTENSION

DATA COLLECTION FORM

PRACTICE NAME ..........................................................

PRACTICE STAMP ....................................................

\[
\begin{align*}
\text{Practice population aged 16–84 years inclusive} & \quad a = \\
\text{Screening} & \quad b = \% \text{ population screened in the previous 5 years} \\
& \quad \frac{b}{a} \times 100 = \ldots \% \\
\text{Diagnosis} & \quad c = \% \text{ practice population with known diagnosis of hypertension} \\
& \quad \frac{c}{a} \times 100 = \ldots \% \\
\text{Review} & \quad d = \% \text{ hypertensive population with BP measured in the previous 12 months} \\
& \quad \frac{d}{c} \times 100 = \ldots \% \\
\text{Control} & \quad e = \% \text{ hypertensive population with BP reading in past 12 months} \\
& \quad <140 \text{ systolic and } <85 \text{ diastolic} \\
& \quad \frac{*e}{c} \times 100 = \ldots \%
\end{align*}
\]

*Control relates to % of TOTAL population with hypertension, not just those reviewed in last 12 months
### Appendix 2: Clinical Governance Checklist

<table>
<thead>
<tr>
<th>What needs to be done?</th>
<th>Who should do it?</th>
<th>Who needs to know it has been done?</th>
<th>When should it be done by?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure that all team members have an opportunity to study and discuss the findings of the hypertension audit</td>
<td></td>
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</tr>
<tr>
<td>Compare results in relation to those from the previous years and consider reasons for changes in performance (either better or worse)</td>
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</tr>
<tr>
<td>Ensure that these findings are discussed at a primary care team meeting.</td>
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<tr>
<td>Develop an action plan which includes the following areas and takes account of methods which have proved beneficial in bringing about change in previous years:</td>
<td></td>
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<tr>
<td>Ø Strengthening disease registers</td>
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<td></td>
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<tr>
<td>Ø Improving data recording and data quality against agreed targets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ø Steps to improve clinical performance against agreed targets</td>
<td></td>
<td></td>
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<tr>
<td>Ø Workforce issues – are the most appropriate people involved at each stage?</td>
<td></td>
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<tr>
<td>Ø Training needs for the primary care team</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ø Resource implications of action plan including impact on prescribing</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Set up regular review meetings to consider progress, record the methods used to collect this year’s data and plan next year’s data collection</td>
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</tr>
<tr>
<td>Ensure that, prior to submitting the data collection form, the practice is confident that the information represents the current performance in each disease area.</td>
<td></td>
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<tr>
<td>If the practice is not taking part in all programmes, identify and discuss barriers to participation, e.g.:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>◦ Incomplete disease register</td>
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<td></td>
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<tr>
<td>◦ Patchy data capture/data quality/lack of template</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>◦ Problems extracting information from computer</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>◦ Time constraint</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Contact your clinical governance leader/manager for sources of help and support</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Self Assessment: Section 4

Multiple choice questions and answers

Use the following Multiple Choice Questions (MCQs) to test your understanding of the material in the pack. If you find an area difficult, return to the relevant sections in the text. Each MCQ consists of a statement or a question and asks you to identify either the correct response(s) of the five given or the single TRUE or FALSE response.

Self-assessment total score

To obtain your percentage, divide your score by 12 then multiply by 100.

75–100% correct: You have mastered the principles of hypertension well
60–75% correct: A good score. Revise any particular areas you found difficult
50–65% correct: Worth further reading around the subject
<40% correct: You need to work on the pack again

Self assessment: section 4

1. Audit is:
   a. A process of setting up a register to find out how many hypertensive patients there are in your practice
   b. Not as applicable to hypertension as to diabetes care
   c. Only possible in a large practice
   d. Unlikely to improve your care of patients with hypertension
   e. Completed when you have identified your deficiencies

2. Which of the following will not help you to construct a hypertension register?
   a. Screening all patients for hypertension opportunistically
   b. Searching other registers (e.g. diabetes for patients with hypertension)
   c. Asking for a list from your hospital of patients with hypertension who are currently under their care
   d. Ensuring all practice staff are aware of the need to add patients to the hypertension register
   e. Adding all patients identified from the annual over-75 check

3. Which of the following statements is not true for effective screening
   a. Screen identified patients from the age-sex register and send them appointments
   b. Record blood pressure opportunistically if records indicate this has not been done in the last 5 years
   c. Use records to identify ‘at risk’ patients
   d. Screen all patients over the age of 12 years
   e. Record blood pressure at every New Registration Check

4. All patients with blood pressure >150/90 mmHg on 4 separate occasions should be included in the hypertension register. TRUE or FALSE?
5. Patients on the hypertension register should:
   a. Always receive drug therapy as a first choice
   b. Receive lifestyle advice (e.g. giving up smoking)
   c. Have their blood pressure measured every 6 months
   d. Not always receive drug therapy as a first choice
   e. Have their blood pressure measured annually
Case Histories
Case Histories

Case history I: Alan – a retired grocer

Alan is a 76-year-old retired grocer who attends for an over-75 check in the surgery. He has been healthy all his life, but has always been overweight. He loves his food (and his alcohol), but has never smoked and his father lived to 96, dying of pneumonia. His notes revealed only an appendicectomy at age 21 and a suspected duodenal ulcer at age 40 (but never fully investigated), making his notes one of the thinnest in the practice. He is active in the local community, being treasurer of the bowls club and a voluntary helper at many charitable functions. A year ago, Alan had a recorded blood pressure of 176/90 mmHg and there was a note in the records advising a recheck in a further month, which had not taken place. You record Alan’s blood pressure today at 168/90 mmHg. His urinalysis is negative for blood and protein.

Questions

1. Is Alan hypertensive and what would you do next?
2. How would you manage Alan?
3. If you consider he needs drug treatment, what drugs might be a suitable choice?
4. What follow-up might be appropriate for Alan?

Answers

1. It would be worth checking his blood pressure a few times over the next 2–3 months, address his obesity and, one suspects, his alcohol intake (which should be more precisely defined). Alan’s high SBP is indicative of isolated systolic hypertension, a condition common in the elderly. It is important to treat isolated systolic hypertension, which will reduce Alan’s chances of a stroke by about a third. His age is a risk factor and this case emphasises that being over 75 years should not prevent diagnosis and treatment.

2. As with every patient, Alan needs his cardiovascular risk factors documented and standard investigations made of urea, creatinine, electrolytes, blood glucose and ECG. His urinalysis has been negative for blood and protein. We need to look for any other evidence of target organ damage – has he a history suggesting cardiovascular problems? Is there a family history of cardiovascular disease or hypertension? The ECG may reveal signs of left ventricular hypertrophy, ischaemia, an irregular pulse or suggest atrial fibrillation. One could argue against a routine serum cholesterol as, in primary prevention, he would probably not merit statin treatment. However, he is otherwise fit and we are more concerned with biological than chronological age. If he had any undiagnosed cardiovascular disease/target organ damage, one would consider taking a fasting lipid profile to more accurately gauge risk. There is evidence that patients such as Alan benefit from a low salt diet, avoiding the need for antihypertensive drugs. Other lifestyle measures of diet, exercise and reducing salt and alcohol intake need to be promoted. Dietary advice would include losing weight, reducing saturated and total fat as well as increase fruit and vegetable consumption.

3. The elderly respond well to diuretics and calcium antagonists as first-line therapy.

4. Alan might be checked fortnightly to begin with, to highlight stress risk factors, discuss investigation results and watch for treatment side effects as well as monitor blood pressure. If blood pressure remains above 140/85 mmHg after 3 months you should add in therapy, assuming compliance has been excellent. Once stable, Alan can be followed up every 3 months.
Case history 2: John after his heart attack

John, 66 years old, is newly registering with the practice, having come to live with his daughter only 4 weeks after suffering an MI. An ex-miner and a lifelong heavy smoker, his wife died of breast cancer some 3 years previously. He is slightly overweight and despite his smoking history had never been diagnosed as having any lung disease. He was, however, taking Co-codamol for osteoarthritis of his knees. You don’t have any of his past records, but he says it was years since he had his blood pressure taken, he can never remember having a cholesterol test and before his heart attack hadn’t seen a doctor for chest pain, although he had had some warning pain about a week before he was admitted. You record his blood pressure as 156/94 mmHg and his urinalysis is negative for blood and protein.

Questions

1. What are your main objectives in managing John?
2. How would you manage John?
3. What drug therapy might be appropriate?

Answers

1. Your main objectives in managing John are:
   - to reduce known cardiovascular risk factors, particularly smoking
   - to identify further cardiovascular risk factors. You need to monitor blood pressure in order to achieve a target of 140/85 mmHg or less. Serum cholesterol levels will need to be monitored.
   - to ensure he complies with a rehabilitation programme, although exercise may be difficult due to his knee osteoarthritis (although Arthritis Care do a booklet with specific exercises for people who cannot exercise properly and may even need to exercise from an armchair)
   - to ensure he receives the drugs known to be effective in preventing MI – aspirin 75 mg or a beta blocker and a statin. Ideally he should have had, or be due to have, his left ventricular function assessed. Poor function would benefit from ACE inhibitor.

2. John needs his cardiovascular risk factors fully assessed and interventions to reduce blood pressure to 140/85 mmHg and total serum cholesterol to 5 mmol/litre. His obesity needs addressing with dietary advice, his alcohol intake needs to be assessed and, most importantly, he needs help to quit smoking. Post-infarction cholesterol levels can be falsely low, so the GP will need to check total cholesterol and HDL cholesterol 3 months after the heart attack and 1 month later if elevated (in this context defined as a total cholesterol >5 mmol/litre). A cholesterol-lowering diet yields only marginal results, so it is likely he will need a statin. His blood pressure needs estimating on two or three more occasions to obtain an average, but it will need to be lowered to achieve the target. He would have had an ECG in hospital. Remember diabetes is a major risk factor; measure a random blood glucose, if not checked already. It will be worth checking through any hospital discharge summary to see what has been documented and the treatment recommendations. Having already sustained cardiovascular damage, John is a high priority for intervention.

3 Aspirin and a beta blocker will be given as part of his post MI treatment and, hopefully, the beta blocker will be enough to reduce the blood pressure to 140/85 mmHg. It will be essential to reduce his total serum cholesterol to 5 mmol/litre or less and this will probably require statin therapy.
**Case history 3: Anxious Ann**

Ann is a 38-year-old unmarried fashion designer, living in the fast lane of life. She does not smoke, drinks socially at business engagements and exercises regularly at a gym. She ‘lives on her nerves’ and has been intermittently prescribed psychotropic drugs over the years to help her cope with her anxiety and bouts of depression. She is of normal height and build and, if anything, under rather than overweight. She attends for a cervical smear. You note she has not had her blood pressure measured for about 10 years and take it before you perform the smear, recording it at 168/94 mmHg. She was quite anxious at having the smear taken as she ‘hates anything medical’. You manage to persuade her to come back to the surgery 2 weeks later for a further blood pressure check, although she takes a lot of encouragement to do so! She attends in a distressed state, actually trembling while you take the pressure, recorded at 162/90 mmHg. She has, however, recently had her blood pressure measured at home by a friend who is a nurse and she was told it was normal. You suggest she brings in this measurement and it proves to be 148/84 mmHg.

**Questions**

1. Does Ann have hypertension?
2. How would you proceed?
3. What problems in treatment and follow-up do patients like Ann pose?

**Answers**

1. These data do not indicate that Ann has hypertension. The diagnosis of mild hypertension requires several consistent readings documenting a sustained elevated blood pressure. You will need to take further readings. Based on the above history, it seems likely there will be a ‘white coat’ effect with Ann.

2. You need to adopt a rational approach to Ann, her blood pressure and cardiovascular risk. It would be prudent to enquire about contraception – without your knowledge she could be taking the combined pill, causing some elevation of her blood pressure. You could also ask if she has ever had a previously high blood pressure reading, when using the contraceptive pill at a younger age, for example. Although there are no other obvious cardiovascular risk factors, a family history would be important. Is there a family history of hypertension? It may be that sisters, brothers or parents had hypertension at an early age. The obvious answer is to obtain some further readings outside the surgery. The loan of a blood pressure monitor such as an Omron 705CP would be appropriate. If there is a wide variation of readings, you might consider referring for 24-hour ABPM monitoring.

3. You do not need to rush to make a diagnosis – it is probable that Ann's average readings outside the surgery will be substantially lower and she may not need treatment. Remember the lower criteria for diagnosing hypertension based on home monitoring readings (see section 2.2). While Ann may not currently need treatment, she must be kept under regular review. Her blood pressure can rise on an occasion and this response makes her at risk of cardiovascular problems and hypertension in the long term. Assuming she does not need treatment, she can continue her home readings and see you again in 3 months.
References


19. UK Prospective Diabetes Study Group. www.dtu.ox.ac.uk/ukpds/results.html


27. British Hypertension Society Information Service. www.bhsayp.ac.uk/bhsinfo/


33. Target Diabetes ABPI 1999.


35. He FJ, Markandu ND, Sagnella GA, MacGregor GA. Importance of the renin system in determining blood pressure fall with salt restriction in black and white hypertensives. Hypertension 1998;32:820-824.


42. NHS heart surgery gets £60 million boost. Department of Health HSC1999/087. www.doh.gov.uk


Resources

Equipment

Accurate monitoring equipment is essential. Access to a practice blood pressure monitor, such as an Omron 705CP, would be a definite advantage for individual practices and at least at PCO level. Many practices already own ECGs, which is essential for estimating cardiovascular risk. The practice nurse should be trained in recording ECGs. Echocardiography will be valuable in patients in whom the ECG suggests left ventricular hypertrophy, but the patient has only borderline hypertension, and in heart failure. Therefore, PCOs should have access to echocardiography.

Documents

For information about the NSF for cardiovascular disease please go to the following website:

http://www.doh.gov.uk/nsf/coronary.htm

Organisations

British Hypertension Society (BHS)
http://www.hyp.ac.uk/bhs/
Meetings and administrative secretary: (Enquiries about meetings, membership etc.)
Mrs Gerry McCarthy
Hampton Medical Conferences Ltd
127 High Street
Twickenham
Middlesex TW11 8HH
Tel: 020 8977 0011
Fax: 020 8977 0055
e-mail: hmc@hamptonmedical.com

British Hypertension Society (BHS)
Information Service
(Enquiries about information on high blood pressure)
BHS Information Service
Blood Pressure Unit
Department of Physiological Medicine
St George's Hospital Medical School
Cranmer Terrace
London SW17 ORE.
Tel: 020 8725 3412
Fax: 020 8725 2959
e-mail: bhsis@sghms.ac.uk

British Heart Foundation (BHF)
http://www.bhf.org.uk/
14 Fitzhardinge Street
London W1H 4DH
Tel: 020 7935 0185
Fax: 020 7486 5820

Hypertension Influence Team
HIT Secretariat
Godstow Court
5 West Way
Oxford
OX2 0JB
e-mail: HIT@4dcomm.co.uk

Diabetes UK Central Office
10 Queen Anne Street
London
W1G 9LH
Tel: 020 7323 1531
Fax 020 7637 3644
e-mail: info@diabetes.org.uk

Nurses Hypertension Association
Chair
Bernie Stirling
CHD & Diabetes National Service Framework Manager
Medical Directorate
University Hospitals of Leicester
NHS Trust
Leicester Royal Infirmary
Leicester
LE1 5WW
Tel: 0116 258 5971
e-mail: bstribling@uhl.trent.nhs.uk

British Cardiac Society (BCS)
http://www.bcs.com/
9 Fitzroy Square
London W1P 5AH
Tel: 020 7383 3687
Fax: 020 7388 903

British Cardiac Patient Association (Bcpa)
www.cardiac-bcpa.co.uk
Heart Information Centre
100 Anerley Road
Crystal Palace
London SE19 2AN
Tel: 020 8289 5591
Fax: 020 8289 5592
e-mail: bcpa@easynet.co.uk

Primary Care Cardiovascular Society
36 Berrymede Road
LONDON W4 5JD
Tel: 020 8994 8775
Fax: 020 8742 2130
e-mail: office@pccs.org.uk
Answers to Self Assessments

Section 1

1. a. False  b. True  c. True  d. True  e. False
2. a. True  b. False  c. False  d. True  e. False
3. a. True  b. True  c. True  d. False  e. False
4. a. True  b. True  c. False  d. False  e. True
5. a. True  b. True  c. False  d. True  e. False
6. a. True  b. False  c. False  d. True  e. False
7. a. True  b. False  c. True  d. False  e. True

Section 2

1. a. True  b. True  c. True  d. False  e. True
2. a. False  b. True  c. False  d. True  e. False
3. a. False  b. True  c. True  d. False  e. True
4. a. False  b. False  c. False  d. True  e. False
5. a. True  b. True  c. True  d. False  e. True
6. a. True  b. False  c. True  d. True  e. False

Section 3

1. a. True  b. True  c. True  d. True  e. False
2. a. False  b. True  c. False  d. True  e. False
3. a. True  b. True  c. True  d. False  e. True
4. a. False  b. False  c. False  d. False  e. True
5. a. True  b. True  c. True  d. False  e. False
6. a. False  b. True  c. True  d. False  e. True
7. a. True  b. False  c. True  d. True  e. False
8. a. True  b. False  c. True  d. True  e. True

Section 4

1. a. False  b. False  c. False  d. False  e. False
2. a. False  b. True  c. True  d. True  e. True
3. a. True  b. True  c. True  d. False  e. True
4. False
5. a. False  b. True  c. False  d. True  e. True
Glossary
**Glossary**

ACE inhibitors – A group of antihypertensive medications that work by inhibiting an enzyme (angiotensin converting enzyme) that is important in the regulation of blood pressure.

Acromegaly – A condition that results from the excess production of growth hormone in the anterior lobe of the pituitary gland. Acromegaly is characterised by enlarged facial features, enlarged jaw, enlarged frontal bone of skull, widely spaced teeth and enlargement of the bones of the extremities.

AllIRAs – angiotensin II receptor antagonists. Antihypertensive drugs that bind to the angiotensin II receptor. High blood pressure adds to the workload of the heart and arteries. If it continues for a long time, the heart and arteries may not function properly. Angiotensin II receptor antagonists work by blocking the action of a substance in the body that causes blood vessels to tighten. As a result, this relaxes blood vessels and lowers blood pressure.

Arteriosclerosis – Imprecise term for various disorders of arteries, particularly hardening due to fibrosis or calcium deposition, often used as a synonym for atherosclerosis.

BMI – Body mass index, a measure of obesity measured as: weight in kilogrammes / (Height in metres)$^2$

Chronic pyelonephritis – Inflammation of the kidney and its pelvis, beginning in the interstitium and rapidly extending to involve the tubules, glomeruli and blood vessels, due to bacterial infection.

Coarctation of the aorta – A congenital heart defect that results in the narrowing of the aorta. The narrowing occurs most often distal to the origin of the left subclavian artery. Coarctation occurs in approximately 7% of patients with congenital heart disease and is twice as common in males. Surgical correction is most often required. Symptoms include headaches, dizziness, fainting, nosebleeds, diminished pulses in lower extremities and muscle cramps in legs with activity. There may be no symptoms in some individuals.

Conn’s syndrome – Overproduction of the hormone aldosterone by a tumour containing tissue like that in the outer portion (cortex) of the adrenal gland. The excess aldosterone (pronounced al’do-ster-one) results in low potassium levels (hypokalaemia), underacidity of the body (alkalosis), muscle weakness, excess thirst (polydipsia), excess urination (polyuria), and high blood pressure (hypertension). Also called primary aldosteronism and hyperaldosteronism. Named after the American physician Jerome W. Conn.

Creatinine – A component of urine and the last product of creatine catabolism. A measurement of the serum creatinine level is often used to evaluate kidney function. Urine creatinine levels can be used as a screening test to evaluate kidney function, or can be part of the creatinine clearance test. Creatinine is a breakdown product of creatine, which is an important constituent of muscle. By far the most important source of energy inside cells are the high-energy phosphate bonds of the ATP molecule. When one of these bonds is broken, energy is released and ATP becomes ADP. Creatine phosphate represents a backup energy source for ATP because it can quickly re-convert ADP back to ATP. The creatine molecule gradually degrades to creatinine with time. Creatinine is a waste product, that is, it cannot be used by cells for any constructive purpose. The daily production of creatine and subsequently creatinine, depends on muscle mass, which fluctuates very little. Creatinine is excreted from the body entirely by the kidneys. With normal kidney function, the serum (blood) creatinine level should remain constant and normal.
**Cushing’s syndrome** – An increased concentration of glucocorticoid hormone (ACTH) in the bloodstream that is being produced by an adrenal gland tumour (adenoma). Ectopic Cushing syndrome refers to the production of ACTH in a location other than the pituitary gland or adrenal gland. Examples of ectopic sites include thymoma, medullary carcinoma of the thyroid, pheochromocytoma, islet cell tumours of the pancreas and oat cell carcinoma of the lung. Symptoms include weight gain, central obesity, moon face, weakness, fatigue, backache, headache, increased thirst, increased urination, impotence, mental status changes and muscle atrophy. Treatment varies with cause. If an ACTH secreting tumour is involved then it must be removed surgically.

**Diabetic nephropathy** – Kidney disease and resultant kidney function impairment due to the long standing effects of diabetes on the microvasulature (glomerus) of the kidney. Features include increased urine protein and declining kidney function.

**Diuretics** – Agents that promote the excretion of urine through their effects on kidney function, reducing the workload of the heart.

**Electrolytes** – Substances that dissociate into two or more ions, to some extent, in water, for example sodium chloride and can conduct electricity. Electrolytes exist in the blood as acids, bases, and salts (such as sodium, calcium, potassium, chlorine, magnesium, and bicarbonate) and can be measured by laboratory studies of the serum.

**Glomerulonephritis** – A variety of nephritis characterised by inflammation of the capillary loops in the glomeruli of the kidney. It occurs in acute, subacute and chronic forms and may be secondary to haemolytic streptococcal infection. Evidence also supports possible immune or autoimmune mechanisms.

**Glycosuria** – The presence of glucose in the urine, especially the excretion of an abnormally large amount of sugar (glucose) in the urine, i.e. more than 1 gram in 24 hours. Glucose is freely filtered in the kidney but is usually completely reabsorbed. However the reabsorptive capacity of the kidney has an upper limit which is equal to a blood glucose level of approximately 11 mmol/l. This is called the renal threshold. Usually glucose in the urine means that blood glucose levels are above 11 mmol/l but occasionally some patients excrete glucose at lower blood levels. Such patients are classified as having a low renal threshold. Anyone with glycosuria should also have their blood glucose levels checked.

**Haematuria** – The finding of blood in the urine.

**Hyperparathyroidism** – The over production of parathyroid hormone by the parathyroid glands. Usually secondary to an adenoma (an unregulated glandular tumour that produces parathormone in an increased quantity). Laboratory studies show an elevated calcium in the blood. Most patients are without symptoms. Symptoms in more advanced cases include lethargy, confusion, nausea, bone pain and weakness. Findings include hypertension and slow heart rate. Complications include pancreatitis, peptic ulcer disease and kidney stones.

**Hypokalaemia** – Abnormally low potassium concentration in the blood, it may result from potassium loss by renal secretion due to renal disease or drug actions or by gastrointestinal loss due to vomiting or diarrhoea. It may be manifested clinically by neuromuscular disorders ranging from weakness to paralysis, by electrocardiographic abnormalities (depression of the T wave and elevation of the U wave). Severe hypokalaemia can result in cardiac arrhythmias and death.

**Left ventricular hypertrophy** – Enlargement of the left side of the heart.
Lipoproteins – Any of the lipid-protein complexes in which lipids are transported in the blood. Cholesterol is an important normal constituent of the body. It is part of the structure of cell membranes, bile acids, and steroid hormones. Since cholesterol is water insoluble, most cholesterol is carried in the blood by lipoproteins (large protein-like molecules, including chylomicrons, very low density lipoprotein – VLDL, low density lipoprotein – LDL, and high density lipoprotein – HDL). Chylomicrons are lipoproteins that are present shortly after a meal, but disappear within about 2 hours in “normal” people. The main function of LDL seems to be to carry cholesterol to various tissues throughout the body. The laboratory actually measures the cholesterol portion of the LDL molecule, rather than the actual concentration of LDL in the blood. This is also true for HDL and VLDL. The total cholesterol level is the sum of LDL, HDL, and VLDL cholesterol. Excess cholesterol in the blood has been correlated with cardiovascular disease. LDL is sometimes referred to as “bad” cholesterol because elevated levels of LDL correlate most directly with coronary heart disease. Lipoprotein particles consist of a spherical hydrophobic core of triglycerides or cholesteryl esters surrounded by an amphipathic monolayer of phospholipids, cholesterol, and apolipoproteins.

MRC – Medical Research Council

Obstructive uropathy – A sudden disorder which results in the complete blockage of urine flow out of the bladder and/or urethra. Pressure rises in the urinary track causing a backward pressure on the kidneys. Bilateral hydronephrosis (kidney enlargement), hypertension and damage to the kidneys (acute renal failure) will occur if the obstruction is not relieved. Causes include prostate disease, tumours and cystocele.

Peripheral vascular disease – A term used to describe progressive occlusive disease of the arteries that supply the extremities. Risk factors include atherosclerosis and diabetes.

Phaeochromocytoma – A normally non-malignant neoplasia (neuroblastoma) of the chromaffin tissue of the adrenal medulla. In culture, the cells secrete enormous quantities of catecholamines and can be induced to form neuron like cells on addition of for example) cyclic AMP or nerve growth factor. Excessive production of adrenaline and noradrenaline leads to secondary hypertension, sometimes paroxysmal.

Polycystic kidneys – A rare inherited condition in which the kidney are composed of multiple cysts. Kidney cysts are associated with an increased incidence of cerebral aneurysm. Symptoms appear later (if they do at all) and include blood in the urine, flank pain, excessive urination at night and abdominal pain. Individuals may also have elevated blood pressure. Chronic (end-stage renal disease) renal failure is the most common result in the 5th to 6th decades of life.

Pre-eclampsia – A toxaemia of late pregnancy characterised by hypertension, oedema and proteinuria, when convulsions and coma are associated, it is called eclampsia. It occurs after the 20th week of gestation, but it may develop before this time in the presence of trophoblastic disease.

Primary Aldosteronism – Principle disorder of excessive aldosterone secretion. Aldosterone is a hormone released by the adrenal glands. It is part of the complex mechanism used by the body to regulate blood pressure. Aldosterone increases the reabsorption of sodium and the excretion of potassium in the distal tubules of the kidneys. The reabsorption of sodium is accompanied by the reabsorption of water, which raises blood pressure.

Renal artery stenosis – A narrowing of the renal artery or one of its main branches accounts for 2 to 5% of cases of hypertension.
SHEP – Systolic Hypertension in Elderly Program

Syst-Eur – Systolic Hypertension – Europe

Triglyceride – Storage fats of animal adipose tissue where they are largely glycerol esters of saturated fatty acids. Also found in the bloodstream with normal blood levels between 10-150 milligrams per decilitre. Elevations of the triglyceride level (particularly in association with elevated cholesterol) have been correlated with the development of atherosclerosis, the underlying cause of heart disease and stroke.

UKPDS – United Kingdom Prospective Diabetes Study
