

Cardiology

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Summary

This article describes recent developments in cardiology and cardiovascular disease that are likely to be relevant to primary healthcare professionals and their patients. The following subject areas are covered:

- Primary prevention: recent developments in pharmacological interventions, drug interactions, and drugs that are likely to cause harm; cardiovascular risk estimation and shared decision making with patients; and new developments in 24-hour ambulatory blood pressure monitoring.
- Secondary prevention: new models of care, including nurse-led care for the provision of hypertension and secondary prevention clinics; new drugs for the treatment of angina and myocardial infarction; ambulatory electrocardiography for the diagnosis of arrhythmias in primary care; and new developments in the treatment of atrial fibrillation — direct thrombin inhibitors and implantable devices.
- Tertiary prevention: recent developments in cardiac rehabilitation; recent evidence concerning revascularisation procedures and appropriateness criteria for referral; and implantable defibrillators.

Primary prevention

Pharmacological interventions, drug interactions, and drugs likely to cause harm

The effect of hormone replacement therapy (HRT) on cardiovascular disease has become much clearer in recent years. Combined therapy, oestrogen, and progestogen have an adverse effect on the risk of breast cancer, coronary heart disease, stroke, and venous thromboembolism.^{1,2} These increased risks are counterbalanced by the reduction in the risk of hip fracture and colon cancer. In terms of the overall balance of risks and benefits, HRT results in two serious adverse events per 1000 women treated for 1 year. After 5 years the risk of one serious adverse risk increases to one per 100 women treated.¹

The currently agreed recommendation is that HRT is effective

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This text is based on a chapter in the forthcoming RCGP book due to be published in 2004: Charlton R and Lakhani M (eds). *Recent advances in primary care*.

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Submitted: 27 March 2003; Editor's response: 22 June 2004; final acceptance: 1 July 2004.

© *British Journal of General Practice*, 2004, 54, 696-703.

- Hormone replacement therapy can no longer be recommended for the prevention of cardiovascular disease
- There is potential for an antagonistic interaction between aspirin and ibuprofen; caution concerning co-prescribing of these drugs is required

Box 1. Key points for pharmacological interventions, drug interactions, and drugs that are likely to cause harm.

for reducing vasomotor symptoms at the time of the menopause. It does not have any effect on quality of life in older women without menopausal symptoms.^{1,3} In addition, it does not have any effect on symptoms of depression, insomnia, sexual functioning, or cognition.¹ HRT can no longer be recommended for prevention of cardiovascular disease; indeed, current evidence suggests that there is a small but significant increase in cardiovascular risk.⁴

There is some evidence from laboratory studies that ibuprofen, a non-aspirin, non-steroidal anti-inflammatory drug (NSAID), can inhibit the antiplatelet effect of aspirin. Such an interaction is of significant public health importance because of the widespread use of NSAIDs.⁵ Pharmacoepidemiology studies have neither fully confirmed nor refuted such an interaction. One recent study using a dispensed prescribing database, found that the rates of all-cause mortality and cardiovascular mortality were higher among patients with cardiovascular disease who were taking ibuprofen and aspirin compared with those taking aspirin alone.⁶ These findings, however, were not confirmed in a different study that examined prescription data for aspirin or ibuprofen after discharge from hospital.⁷ At present, the current level of evidence is not sufficient to make definitive recommendations for or against the concomitant use of ibuprofen with aspirin. Further studies are ongoing to clarify this issue, but until then relative caution should be given to the co-prescribing of these drugs and alternative NSAIDs or analgesics should be used if possible.⁵

Key points for pharmacological interventions, drug interactions, and drugs likely to cause harm are summarised in Box 1.

Cardiovascular risk estimation

Estimation of cardiovascular risk is now seen as the starting point when discussing the risks and benefits of pharmacological and non-pharmacological therapy for cardiovascular disease prevention with patients. All current United Kingdom (UK) guidelines, including the joint risk tables and Sheffield risk score,^{8,9} require calculation of absolute risk by means of confirming and combining cardiovascular risk factors — age, sex, blood pressure, total:high-density lipoprotein cholesterol ratio, smoking status, and presence of diabetes. Nearly all risk scores have been based on the Framingham risk equation. However, there is growing

unease that risk assessment in general, and the Framingham risk equation in particular, do not provide an accurate assessment of an individual's cardiovascular risk.¹⁰ In the British Regional Heart Study cohort (a representative sample from 24 UK general practices), Framingham overestimates risk of fatal or non-fatal coronary heart disease by 57%. Furthermore, there is regional variation in the extent of overestimation, with overestimation greatest in areas of the UK where the mortality rate from coronary heart disease (CHD) is lowest; for example, the south of England (overestimation by 71%), and lowest in areas of the UK where the mortality rate from CHD is highest; for example, Scotland (overestimation 28%).¹¹

There are several reasons why risk scoring is not as accurate as might be hoped:

- variation in cardiovascular mortality between and within countries,
- a secular decline in the rate of CHD,
- use of risk factors that have been only measured on one occasion only,
- the 'risk-paradox' of risk-reducing treatments such as blood pressure-lowering drugs and statin therapy, and
- the fact that some ethnic groups at higher cardiovascular risk are not represented in the cohorts of patients upon which cardiovascular risk scores are based.¹⁰

The most important reason for inaccuracy relates to basing primary prevention of cardiovascular disease and drug treatment on 'thresholds' of risk. For example, a recent study examined the predictive ability of the Framingham risk equation in a representative sample of 24 general practices selected to represent the range of cardiovascular disease mortality in the UK — the British Regional Heart Study. In this prospective study, 7735 men, aged 40–59 years at entry (1978–1980) were randomly selected from the age–sex registers in each of the 24 participating general practices.¹¹ The Framingham risk equation was applied to all these individuals when they entered the study and they were followed-up over a 20-year period and their cardiovascular outcome was ascertained. When the threshold of >30% over 10-year risk of coronary heart disease risk was assessed (consistent with the recommended threshold from the joint risk tables and the National service framework for coronary heart disease¹²), around 84% of the disease events occurred in the 'low-risk' group — people who might potentially be reassured by the decision that treatment was not indicated for their level of risk.¹¹ When the threshold was lowered to >15%, this false negative rate fell to 25%, but the number identified as being at high risk who did not have a cardiac event rose from 6% to 45%.¹¹

- Combining overall cardiovascular risk is the starting point for primary prevention of cardiovascular disease
- Risk-scoring tools are by no means perfect at predicting true cardiovascular risk
- Newer methods, including modifications of current risk-scoring tools, are being developed and evaluated

Box 2. Key points for cardiovascular risk estimation.

The reason why risk scoring appears to perform so poorly as a screening tool is because individual risk factors have a continuous relationship with cardiovascular disease; the best predictors of cardiovascular risk are those risk factors that cannot be altered; for example, age and sex.¹³ This has led some commentators to suggest that age alone may be the best way to identify 'high-risk' individuals who are at greater risk of cardiovascular disease.¹³ Alternative solutions have been proposed to enable risk scores to function more accurately. Re-calibration of the Framingham risk function to reflect regional rates or the different rates of cardiovascular disease in different ethnic groups has been proposed, and it appears to work well in UK and North American populations.^{11,14}

An alternative to re-calibration has been the approach adopted by the systemic coronary risk evaluation (SCORE) investigators, who pooled data from 12 European cohorts, and have provided risk-assessment charts for high- and low-risk countries.¹⁵ Unfortunately the SCORE approach is limited by the use of cardiovascular death as its end point, and it does not include a variable that takes into account treatment effects.¹⁰ Additionally, the SCORE algorithm cannot be used in many inner-city general practices, where the majority of the patients live in areas of socioeconomic deprivation or are from black and minority ethnic groups.¹⁰ Thus, both approaches — re-calibration and the SCORE approach — represent valuable modifications but do not alter the underlying challenges of using risk scoring as a screening tool for primary prevention.

Key points for cardiovascular risk estimation are summarised in Box 2.

Shared decision making in cardiovascular disease

Eliciting patients' preferences should be viewed as an essential element of cardiovascular risk assessment when deciding on whether cardiovascular treatments are necessary. It is important to elicit patients' preferences, as they are likely to differ from a clinician's. For example, patients with high blood pressure often disagree with guidelines and health professionals over the level of cardiovascular risk they are prepared to accept as either safe or hazardous.¹⁶ In patients with atrial fibrillation, willingness to accept treatment with warfarin or aspirin has been shown to be difficult to predict on an individual basis, and to vary in direction and magnitude in terms of willingness to take preventative treatment and 'risk aversion' to the side effects of treatment.¹⁷

In order that shared decision making can be facilitated between patients and health professionals, several decision aids have been developed for conditions such as atrial fibrillation and hypertension.^{18,19} These decision aids have been shown to increase patients' knowledge of their condition, improve their decisional conflict (a composite measure of how uncertain, unclear, uninformed, and unsupported a patient feels about the decision they have to make), while not adversely affecting their anxiety levels.^{18,19} It is likely that more of these types of decision aids are going to become available in the future, possibly over the Internet.

Key points for shared decision making in cardiovascular disease are summarised in Box 3.

- Shared decision making is important in cardiovascular disease, particularly in primary prevention where the risks and benefits of treatment may be quite similar
- Decision aids improve knowledge and decisional conflict; they are being developed for a wide variety of cardiovascular conditions

Box 3. Key points for shared decision making.

24-hour ambulatory blood pressure monitoring

There is new evidence from a recent prospective cohort study that cardiovascular outcomes in treated patients with high blood pressure are better predicted by ambulatory blood pressure than by conventional blood pressure measurements in general practice.²⁰ The most striking finding of this study was that individuals on blood pressure-lowering medication whose mean 24-hour systolic blood pressure was 135 mmHg or higher were almost twice as likely to suffer a cardiovascular event than those with a mean 24-hour systolic blood pressure of less than 135 mmHg. This finding was regardless of their blood pressure readings taken by a health professional. There is good evidence that 'white coat' hypertension in general practice is more widespread than previously assumed. A comparison of different blood pressure measurements in primary care — readings made by general practitioners, nurses, technicians, and self-measurement by patients — showed that readings made by doctors were higher, demonstrating that 'white coat' hypertension is common, occurring in up to a fifth of patients.

If ambulatory blood pressure measurements are not possible, repeated measurements by a nurse or by the patients themselves will result in much less unnecessary treatment or a change in drug treatment.²¹ In terms of patient acceptability, there is a trade-off between getting the most accurate readings and patients' acceptability — patients are least tolerant of ambulatory blood pressure monitoring when compared with other measurement methods.²² It seems that self-measurements by patients are the best-tolerated method, and provide accurate measurements when obtaining an accurate blood pressure record.²²

The role of ambulatory blood pressure monitoring in primary care is changing, with increasing numbers of patients using self-monitoring devices to record their readings, so that drug treatment can be optimised. Self-monitoring of blood pressure at home can help to discover discrepancies between surgery and home measurements.²¹ Ambulatory monitoring should be considered in situations where hypertension appears 'resistant' to blood pressure-lowering drugs. A raised ambulatory blood pressure of more than 130/80 mmHg would support an increase or change in blood pressure-lowering medication, whereas readings below this threshold would back continuation with current therapy and follow-up with ambulatory blood pressure readings every 1–2 years. Evidence concerning the role of self-monitoring as a means by which patients can manage and titrate their own hypertension drugs is not fully established, although some randomised trials have shown that this is a promising development.²³

- Ambulatory blood pressure is a better predictor of cardiovascular outcomes than conventional blood pressure measurement
- Ambulatory blood pressure measurement should be considered if there is a discrepancy between home blood pressure readings and readings taken in primary care
- An effective alternative to ambulatory monitoring is self-measurement at home which can be used in both diagnosis and management of hypertension

Box 4. Key points for 24-hour ambulatory blood pressure monitoring.

Key points for 24-hour ambulatory blood pressure monitoring are summarised in Box 4.

Secondary prevention

New models of care, including nurse-led care

The increase in the availability of nurse practitioners in general practice may lead to higher levels of patient satisfaction and quality of care. A recent systematic review by Horrocks and colleagues on whether nurse practitioners working in primary care can provide equivalent care to doctors, included 11 trials and 23 observational studies.²⁴ This review showed that patients were more satisfied with the care by a nurse practitioner, although the effect size was relatively small. Nurse practitioners were found to give longer consultations and requested more investigations. This study found no differences in prescriptions, return consultations, or referrals.

Although nurse-led care appears to be effective in many areas of primary care, there is little evidence to suggest that it is effective in the management of hypertension. Oakeshott and colleagues reviewed 10 studies of nurse-led management of high blood pressure that were all of generally high methodological quality in terms of randomisation, blinding, and reports of losses to follow-up.²⁵ This review found that nurse-led hypertension management and cardiovascular health promotion without a change in prescribing had little or no effect on blood pressure. Only one of the included trials, in which patients with blood pressure levels above certain cut-off points were referred to their GPs for drug treatment, showed an important difference.²⁶ This review concluded that the most important advantages of nurse-led care included improved antihypertensive prescribing, better adherence to treatment, and better follow-up due to rigorous application of national guidelines. The authors identified a need for randomised controlled trials based in primary care to further evaluate the effectiveness of nurse-led care by practice nurses who have been specially trained in improving blood pressure control.

In terms of secondary prevention of cardiovascular disease, effective implementation can be achieved through nurse-led clinics. Improvements have been demonstrated in terms of the process of care — the prescribing of effective drug therapies and risk-factor modification — as well as improvement in health status and quality of life.²⁷ Furthermore, these changes translate into improved lifestyle and medical change at 5-year follow-up, with associated improvements in all-cause mortality and coronary events.²⁸

- Patients are satisfied with nurse-led care
- There is some evidence of the effectiveness of nurse-led care in secondary prevention clinics for cardiovascular disease, but more evidence is needed for hypertension treatment and management

Box 5. Key points for models of care.

Key points for models of care are summarised in Box 5.

New drugs for the treatment of angina and myocardial infarction

Aspirin continues to be the standard antiplatelet drug therapy, but provides only partial protection in people with stable cardiovascular disease, as it affects only one of many pathways leading to platelet activation, with up to 45% of the population being 'resistant' to aspirin. Clopidogrel (Plavix® [Bristol-Myers Squibb]) has replaced its predecessor, ticlopidine, because it has a better safety profile, with no significant risk of haematological toxicity and infrequent gastrointestinal adverse effects. A number of large randomised trials (for example, the CAPRIE²⁹ and CURE³⁰ trials) have provided good evidence for the effectiveness of clopidogrel. This is now indicated as an alternative antiplatelet agent for secondary prevention in individuals who do not tolerate aspirin, or for use in acute non-ST elevation acute coronary syndromes. There is some evidence to suggest that 1 year of clopidogrel therapy following percutaneous coronary intervention is more effective than 1 month of clopidogrel therapy.³¹

In a systematic review of five randomised trials of secondary prevention, it has been shown that combinations of pravastatin and aspirin have additive effects on cardiovascular mortality. Taking both drugs produced a relative reduction in fatal and non-fatal myocardial infarction of about a quarter to a third when compared to taking either of these drugs alone.³² These findings emphasise that secondary prevention of coronary heart disease requires combination drug therapy to produce the greatest benefits for patients.

Key points for new drug treatment of angina and myocardial infarction are summarised in Box 6.

Ambulatory electrocardiography for the diagnosis of arrhythmias in primary care

Ambulatory electrocardiography (ECG) can be useful to detect and classify episodes of abnormal electrical activity of the heart in daily life. Because some abnormalities may only occur while a patient is asleep or under emotional or physical stress, recording an ECG over a longer period of time can be useful. These recordings can be continuous (typically 24 or 48 hours) or intermittent, with some intermittent recorders incorporating a memory loop that allows the capture of fleeting symptoms, the onset of a cardiac arrhythmia, or infrequent syncopes.³³ Based on results from a recent randomised trial, loop recorders have a higher diagnostic yield for patients with syncope or presyncope compared with continuous monitors, but their use may be limited because some patients find them more difficult to operate.³⁴ Loop devices are particularly useful in the diagnosis of symptomatic arrhythmias, and for mon-

- Aspirin continues to be the main standard antiplatelet drug
- Clopidogrel is a similarly effective alternative to aspirin for preventing ischaemic events in people with stable cerebrovascular, cardiovascular and peripheral vascular disease
- Adding clopidogrel to aspirin in people with non-ST segment elevation acute coronary syndrome can reduce further ischaemic events
- There is some evidence that each drug has 'additive' effects on reducing the risk of cardiovascular disease

Box 6. Key points for new drug treatment of angina and myocardial infarction.

- Ambulatory electrocardiography (ECG) can be useful for linking ECG findings to patient symptoms
- Interpretation can be difficult and should be performed by a trained health professional

Box 7. Key points for ambulatory electrocardiography.

itoring the effectiveness and safety of antiarrhythmic medications.³⁵

The most recent recommendations on the use of ambulatory ECG were provided by the American College of Cardiology and the American Heart Association in collaboration with the North American Society for Pacing and Electrophysiology, who published their guidelines in 1999.³⁶ These guidelines give advice on how to evaluate symptoms of cardiac arrhythmias, assess risk in patients with a previous myocardial infarction, evaluate antiarrhythmic therapy, assess pacemaker or implantable cardioverter defibrillator function, or evaluate possible myocardial ischaemia.

The main indication for ambulatory ECG is to determine the association of a patient's symptoms with cardiac arrhythmias, where an ECG recording is needed at exactly the time when the symptoms occur. Clinicians who have received the appropriate training and have gained the necessary skills should perform the assessment of recordings from ambulatory ECG.³³

Other currently available technologies, such as home-monitoring systems that allow transmission of patient ECG data, as well as information on blood pressure and pulse oximetry by telephone or through a wireless system are not yet widely used, but may facilitate the ambulatory titration of antiarrhythmic medication or the management of heart failure in the future.³⁵

Key points for ambulatory electrocardiography are summarised in Box 7.

Treatment of atrial fibrillation — direct thrombin inhibitors and implantable devices

Atrial fibrillation commonly causes symptoms such as palpitations and shortness of breath, but is also associated with stroke, heart failure, increased hospital admissions, and death.³⁷ Proper risk stratification is an essential prerequisite for rational management of atrial fibrillation. Recent evidence shows that, irrespective of age, patients with atrial fibrillation and no additional risk factors (no previous history of stroke or transient ischaemic attack, no treated hypertension or a

systolic blood pressure of 140 mmHg, no symptomatic coronary artery disease, and no diabetes) who take aspirin have stroke rates similar to those of age-matched individuals. Therefore the risks of oral anticoagulation therapy outweigh the benefits.³⁸

Management of atrial fibrillation most commonly consists of strategies to control rate or rhythm. Two recent randomised trials compared these two strategies of rate control: — allowing atrial fibrillation to persist but giving patients oral anticoagulant drugs and antiarrhythmic agents — or rhythm control — giving serial cardioversion so as to try to convert back to sinus rhythm, as well as oral anticoagulants, antiarrhythmic agents.^{39,40} Both studies showed that attempts at cardioversion to produce sinus rhythm did not produce any benefit in terms of quality of life, risk of stroke, and overall mortality. These studies show that rate control allied to effective oral anticoagulation is the over-riding priority in the management of patients with atrial fibrillation.⁴¹

Oral anticoagulants, usually in the form of warfarin, block the vitamin K-dependent liver production of the clotting factors II (prothrombin), VII, IX, and X. However, warfarin has a narrow therapeutic window and requires close monitoring of the INR. Recently, direct oral thrombin inhibitors have been introduced and compared to warfarin in terms of effectiveness when treating non-valvular atrial fibrillation. Randomised trials have shown that direct thrombin inhibitors such as ximelagatran, are equivalent in terms of preventing stroke, and the side-effect profile was marginally better in the ximelagatran group; major bleeding was the same but minor bleeding occurred more often in the warfarin group.⁴² As direct thrombin inhibitors do not require regular blood monitoring and have a better safety profile than warfarin, treatment of atrial fibrillation may well change. Ongoing studies of clopidogrel are due to report shortly. A further outstanding issue relates to the longer-term safety of ximelagatran, which is associated with abnormalities in liver enzyme function.⁴³

Implantable devices have also been developed to provide an additional therapeutic option in patients with atrial fibrillation.⁴⁴ Ventricular pacing during atrial fibrillation is ineffective, but dual chamber pacing has been shown in some studies to be superior to ventricular pacing in reducing both the incidence of atrial fibrillation as well as the progression to chronic atrial fibrillation, although these effects were not seen until 2 years after the pacemakers had been implanted.⁴⁵ Implantable pacemakers and defibrillators are undergoing further development. Their use may become more frequent in the future for decreasing the incidence of atrial fibrillation and to improve patients' quality of life, particularly in combination with other treatments.

Key points in the treatment of atrial fibrillation are summarised in Box 8.

Tertiary prevention

Recent developments in cardiac rehabilitation

There is good evidence to suggest that exercise-based cardiac rehabilitation is effective in reducing deaths from heart disease (total cardiac mortality reduced by 31%; 95% confidence interval = 49 to 6), although it remains unclear

- Patients with atrial fibrillation and no other risk factors who take aspirin do not benefit from oral anticoagulation therapy
- Rate control with effective oral anticoagulation is the priority over rhythm control with cardioversion
- Direct thrombin inhibitors appear to have equivalent effectiveness to warfarin, a better safety profile, and do not require blood monitoring
- Devices used to treat atrial fibrillation include: atrial defibrillator; overdrive atrial pacing; atrial pacing; dual site pacing; ventricular pacing

Box 8. Key points for the treatment of atrial fibrillation.

- Exercise-based cardiac rehabilitation can reduce cardiac deaths
- Cardiac rehabilitation should involve a multidisciplinary team

Box 9. Key points for cardiac rehabilitation.

whether exercise alone or a more comprehensive intervention of cardiac rehabilitation is better.⁴⁶

Cardiac rehabilitation is indicated in patients who have suffered a myocardial infarction, suffer from unstable angina, or who have undergone coronary revascularisation.⁴⁷ It aims to maintain optimal physical and psychosocial health in patients with heart disease by means of a multidisciplinary team. Health professionals from different backgrounds are encouraged to work together to provide comprehensive cardiac rehabilitation consisting of:

- exercise training,
- change in health-related behaviour,
- patient education and psychological support,
- helping patients to return to their normal daily activities, and
- reducing the risk of future cardiac events.

Patients with comorbidity, such as diabetes, require particular attention and a more aggressive approach to risk-factor management, since these individuals tend to have a greater adverse risk profile in terms of body mass index, hypertension, lipid profile, and fitness levels.⁴⁸

The Scottish Intercollegiate Guidelines Network (www.sign.ac.uk) promotes an approach in four phases. After a full evaluation and patient education in hospital (phase 1), many patients may still feel isolated and insecure in the early discharge period and may require psychological and emotional support through home visiting or telephone follow-up (phase 2). The role of the primary healthcare team consists of a tailored approach to encourage structured exercise training together with providing educational and psychological support (phase 3), along with long-term maintenance of physical activity and lifestyle change (phase 4).

Specific educational and behavioural goals should include the reduction of misconceptions around heart disease, smoking cessation advice, weight reduction, and help with returning to work, which might involve different health professionals including psychologists, cardiologists, or exercise physiologists. Owing to the often individually tailored approach to cardiac rehabilitation (patients receive

care according to their need), there is limited information about the cost-effectiveness of these interventions within different patient groups.

Key points for cardiac rehabilitation are summarised in Box 9.

Recent evidence concerning revascularisation

There continues to be a dilemma as to how to treat patients with multi-vessel disease who are suitable for treatment using coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI), since both procedures are similar in terms of rates of death and other cardiovascular morbidity.⁴⁹ The risk of repeat revascularisation is lower for CABG, but PCI is not as invasive and less costly. Patients' views, as well as local facilities, are therefore important factors in the decision-making process. In patients with severe left main stem disease, CABG is often more appropriate, whereas single vessel coronary artery disease will mostly be treated with PCI.

Intravenous thrombolysis is used for most patients presenting with myocardial infarction, since it is widely available and reduces mortality, as demonstrated in randomised controlled trials. Mortality is reduced by 30 patients per 1000 presenting within 0–6 hours and by about 20 per 1000 for those presenting within 7–12 hours from onset of symptoms. To be effective, it is important that thrombolysis is given quickly. The National Service Framework's standard six states that thrombolysis should be given within 60 minutes of calling for professional help ('call to needle time').¹² The care delivered for heart attacks is independently audited by the Myocardial Infarction National Audit Project (MINAP). Since the inception of MINAP in 2000 the percentage of heart attack patients in England receiving thrombolysis within 30 minutes of arrival at hospital has doubled (from 40% to 81%). A recent Cochrane review suggests that for patients in whom thrombolysis is contraindicated, or who are prone to occlusion or re-occlusion of the artery responsible for the infarct, primary percutaneous transluminal coronary angioplasty (PTCA) may be superior to thrombolysis in the short term but may not be sustained.⁵⁰ PTCA may be preferred if it is available in experienced centres, but optimal thrombolytic therapy is still an excellent approach. There has been much debate about whether patients with unstable angina or non-ST elevation myocardial infarction should be treated with an invasive or conservative approach.

A recent trial by the British Heart Foundation found that an interventional strategy (routine angiography followed by revascularisation) was more effective than a conservative approach for unstable coronary artery disease. This is because it halves the number of angina episodes requiring hospital admission and the need for revascularisation or repeated revascularisation, without an increase in risk of death or myocardial infarction.⁵¹ It is likely that in the future, drug-eluting stents will be more commonly used despite their high initial cost, since these devices reduce the need for revascularisation.⁵²

Only a proportion of patients undergoing revascularisation, however, will be free from angina in the longer term. A Swedish study showed that fewer than half of all women and two-thirds of men who underwent revascularisation were free

- Primary percutaneous angioplasty may be superior to thrombolysis in the short term in patients who are prone to occlusion or re-occlusion of the artery responsible for an infarction
- Routine angiography followed by revascularisation is more effective than a purely conservative approach in unstable coronary artery disease

Box 10. Key points for revascularisation.

- Implantable cardioverter defibrillators are effective for secondary and primary prevention of cardiac arrest
- Careful clinical decision making should precede their use

Box 11. Key points for the use of implantable defibrillators.

from angina after 4 years.⁵³ At 4 years, three-fifths of patients with chronic stable angina did not suffer from angina and had a similar quality of life compared with the general Swedish population. These findings may help practitioners in counselling patients who undergo revascularisation to form realistic expectations about the effects of the procedure.

Key points for revascularisation are summarised in Box 10.

Implantable defibrillators

Despite advances in emergency treatment and resuscitation techniques, sudden death due to cardiac arrest continues to be a public health problem. Implantable cardioverter defibrillator therapy has been shown to prevent sudden cardiac deaths and increase survival in high-risk patients.⁵⁴ There is now good evidence that automatic implantable cardioverter defibrillators reduce mortality in high-risk patients with a history of myocardial infarction more than 30 days earlier and left ventricular dysfunction with an ejection fraction of less than 30%.⁵⁵ The National Institute for Clinical Excellence recommends the use of implantable cardioverter defibrillators for secondary and primary prevention of cardiac arrest.

Secondary prevention is indicated in patients who have had:

- either a cardiac arrest due to ventricular tachycardia or ventricular fibrillation,
- spontaneous sustained ventricular fibrillation leading to syncope or significant haemodynamic compromise, or
- sustained ventricular tachycardia without syncope or cardiac arrest but with a reduced ejection fraction of less than 35% and no significant heart failure.

Primary prevention is indicated in patients with:

- a history of myocardial infarction in addition to non-sustained ventricular tachycardia on 24-hour ECG monitoring,
- inducible ventricular tachycardia on electrophysiological testing, or
- left ventricular dysfunction with an ejection fraction of less than 35% and no worse than class III heart failure.

In cases where spontaneous sustained ventricular tachycardia is associated with minimal symptoms and good

Key messages

- Hormone replacement should no longer be used for the prevention of cardiovascular disease
- Cardiovascular risk estimation should always be the starting point for primary prevention of cardiovascular disease
- Shared decision making is important in the management of cardiovascular disease
- Exercise-based cardiac rehabilitation can reduce cardiac death

Recent advances

- Ambulatory blood pressure monitoring is better at predicting cardiovascular outcomes than conventional blood pressure measurements
- Clopidogrel is an effective alternative to aspirin for preventing ischaemic events in people with stable cerebrovascular, cardiovascular and peripheral vascular disease
- Direct thrombin inhibitors appear to be equivalent to warfarin in terms of effectiveness
- A number of electronic devices are now available to treat atrial fibrillation
- Percutaneous angioplasty may be superior to thrombolysis in the short term for patients who are prone to occlusion or re-occlusion of the artery responsible for an infarction
- Implantable cardioverter defibrillators are effective for secondary and primary prevention of cardiac arrest

Box 12. Summary of key messages and recent advances.

cardiac function or those with syncope of unknown cause with no previous history of myocardial infarction, implantable cardioverter defibrillators should not be considered routinely. These devices are expensive and not without complications, and careful decision making by patients and clinicians is important.⁵⁴

Key points for the use of implantable defibrillators are summarised in Box 11.

Conclusions

There have been quite a number of developments in the primary, secondary and tertiary management of cardiovascular disease. Primary prevention should be focused on estimation of cardiovascular risk enabling an informed discussion about the risks and benefits of preventative treatments with patients. New drugs and interventions have altered the immediate and longer term management of post-myocardial infarction patients. The key messages and developments are listed in Box 12. Further information sources are listed in Box 13.

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Box 13. Further reading, contact organisations and websites.

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