

Pacemakers

Heart Information Series Number 15



**British Heart
Foundation**

This is one of the booklets in the *Heart Information Series*. For a complete list of booklets, see page 33.

We welcome your comments on this booklet.
Please fill in the feedback form on page 45.

We update this booklet regularly. However, you may
find more recent information on our website
bhf.org.uk

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About this booklet

This booklet is for people who are about to have, or have just had, a pacemaker fitted. It explains:

- why a pacemaker is needed
- how a pacemaker works
- how it is fitted, and
- what to do, and what not to do, to make sure that your pacemaker works well.

Although it is difficult to ignore a pacemaker completely, modern pacemakers are extremely comfortable and reliable, and you can be confident that, with appropriate and careful follow-up, very little can go wrong.

This booklet is not a substitute for the advice your doctor or cardiologist may give you based on his or her knowledge of your condition.

Why do I need a pacemaker?

If you are going to have a pacemaker fitted, it can be useful to know how a normal heart beats and how it pumps blood around your body.

A normal healthy adult heart has a regular beat. The heart normally beats between 60 and 100 times a minute. When you exercise, this may go up to 150 beats per minute, depending on your age and how fit you are.

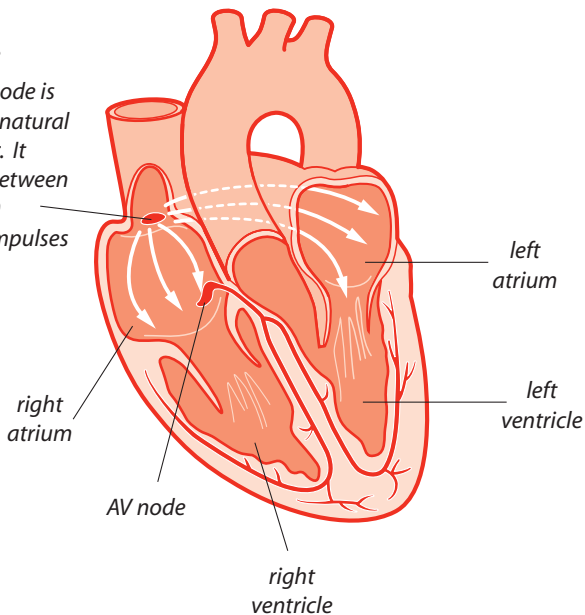
The heart has four 'chambers'. There are two upper chambers called the atria. (There is a 'right atrium' and a 'left atrium'.) The two lower chambers are called the 'right ventricle' and the 'left ventricle'. These are shown in the illustration on page 7.

The heart has its own 'natural pacemaker'. This is called the sinus node. A group of cells in the right atrium sends regular electrical impulses across the two atria. Where the atria meet the ventricles (the two larger pumping chambers), there is another group of cells called the atrio-ventricular node (or 'AV node'). This transmits the electrical impulse through to the ventricles. As the electrical impulses pass from the AV node to the ventricles, they stimulate a contraction – in other words, a heartbeat.

Normal electrical signals in the heart

sinus node

The sinus node is the heart's natural pacemaker. It produces between 60 and 100 electrical impulses a minute.



If your body's natural pacemaker is not working properly, you may need to have a pacemaker fitted. This could be because:

- you have either complete or intermittent heart block (when the electrical impulses are not being transmitted properly from the atrium to the ventricles)
- you have an irregular heart rate or heart rhythm – for example if your heart beats too rapidly (tachycardia syndrome), or too slowly (bradycardia syndrome), or irregularly
- you have a slow natural pacemaker (sinus node disease), or
- you have heart failure.

If you have heart block

Electrical impulses are sometimes slowed down or delayed by an interruption in the heart's normal electrical activity. This is known as 'heart block'. At its most advanced stage, called 'complete heart block', no electrical impulses cross to the ventricles at all.

The atria and ventricles beat independently of each other. This means that, although the atria may continue to beat normally, the ventricles may beat only about 40 times a minute or even more slowly. This slow rate reduces the blood flow and may cause breathlessness, fainting, blackouts or confusion.

Heart block is usually caused by heart disease or by the heart ageing. It may also develop after a heart operation – as either a short-term or long-term condition.

With certain types of heart block, the doctor will recommend a cardiac pacemaker to help regulate the heartbeat. Some people develop slow heart rhythms which can be life-threatening, and they may need to have a pacemaker fitted as an emergency, but others can arrange to have their pacemaker fitted at a later date.

If you have an irregular heart rate or heart rhythm

Pacemakers are sometimes recommended for people who sometimes have a slow or a fast heart rate or an irregular heart rhythm, to help maintain a steady, regular heartbeat.

‘Catheter ablation therapy’ is sometimes used to correct certain abnormal heart rhythms. If the atria are beating at too fast a rate, radio-frequency energy may be delivered via a special catheter to permanently interrupt transmissions from the atria to the ventricles. This is called AV node ablation. Most patients who have this procedure will also need to have a permanent pacemaker fitted to make sure they have a regular heart rhythm. Some people may

still have symptoms of palpitation after this, but the heart will not be beating at such a fast rate.

If you have a slow natural pacemaker (sinus node disease)

If you have sinus node disease, it means that your sinus node is not working properly. This can result in different types of abnormal heart rhythms. Sinus node disease sometimes develops into 'sick sinus syndrome' where you may have a heart rate that is sometimes very slow and sometimes very fast. If you don't have any symptoms, you may not need any treatment. However, if you have symptoms that are related to a slow heart rate, you may need a permanent implanted pacemaker. If you also have a fast heart rate, you may be given drugs to control the rate.

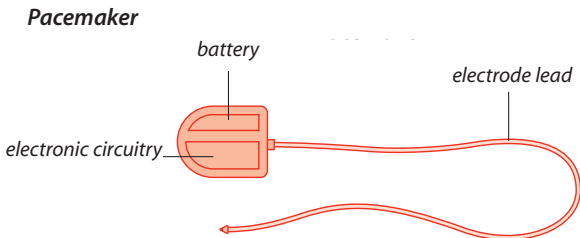
If you have heart failure

Heart failure is the term used when the heart becomes less efficient at pumping blood round the body, either while you are resting or active. A pacemaker may be fitted to synchronise the pumping chambers of your heart (the ventricles) so that they beat in time with each other. This is called resynchronisation therapy. It is a valuable treatment for some people with heart failure.

How does a pacemaker work?

A pacemaker system has a pulse generator (the actual pacemaker) and one, two or three electrode leads. Pacemakers with one lead are called single-chamber pacemakers. Pacemakers with two leads are called dual-chamber pacemakers. A pacemaker with three leads is called a bi-ventricular pacemaker.

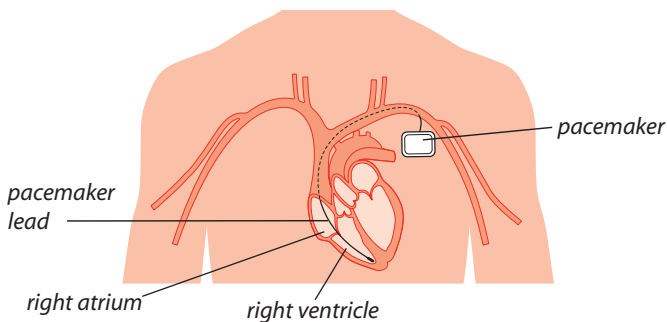
The pacemaker has two parts – the power supply (or battery) and the electronic circuit. It is sealed in metal to stop body fluids leaking in. The whole pacemaker weighs only about 20 to 50 grams (1 to 2 ounces) and is smaller than a matchbox (see the photo on the front cover). Most pacemakers are powered by a lithium battery. Pacemakers usually last between six and ten years before they need to be replaced.



Actual size = about 4 centimetres (1½ inches) by 8 millimetres (¼ inch)

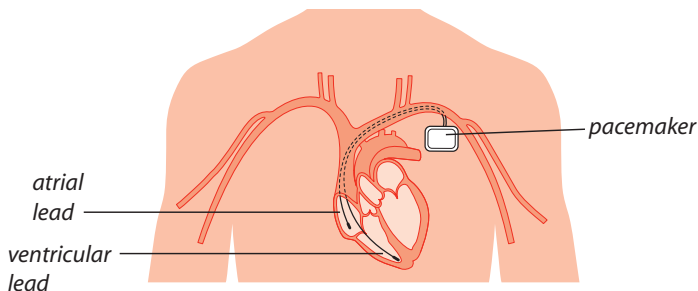
The electronic circuit in the pacemaker draws energy from the battery and turns it into electrical impulses. These are conducted down the electrode lead to the heart. Each electrical impulse sent by the pacemaker stimulates the heart to contract and produce a heartbeat. The rate at which these electrical impulses are sent out is called the 'discharge rate'.

Single-chamber pacemaker



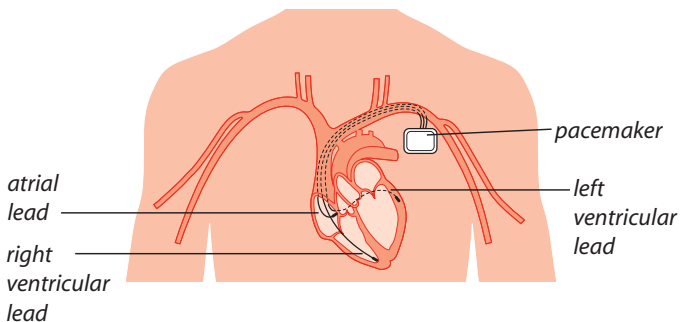
Single-chamber pacemakers have one lead which is connected either to the right atrium or to the right ventricle (as shown in this illustration).

Dual-chamber pacemaker



Dual-chamber pacemakers have two leads. One is connected to the right atrium and the other to the right ventricle.

Bi-ventricular pacemaker



In a bi-ventricular pacemaker, one lead is connected to the right atrium, one to the right ventricle and one to the left ventricle.

Some pacemakers send out electrical impulses at a fixed rate but almost all work 'on demand'. 'On demand' means that if the pacemaker senses that the heart has missed a beat, or if it is beating too slowly, it will send out electrical impulses at a steady rate. If there is no natural heartbeat, it will send out impulses continually. If the pacemaker senses that the heart is beating naturally by itself, it will not send out any electrical impulse. Most types of pacemaker speed up the rate of impulses (discharge rate) when you are active or exercising. The pacemaker does this by using a special sensor which recognises body movement or breathing rate.

Most pacemakers can be programmed to send electrical impulses to the heart at a rate that suits your particular needs. Even after the pacemaker has been fitted, it can be re-programmed if necessary by electromagnetic signals that are passed through the skin from a special programming computer at the pacemaker clinic.

Most pacemakers can also analyse and store information about your natural heart rhythms. When you have follow-up appointments at your pacemaker clinic, the technicians and doctors can retrieve this information and will use it to check

how well the pacemaker and your heart are functioning.

Some patients who are at risk of dangerous abnormal heart rhythms have a combined pacemaker and implantable cardioverter defibrillator (ICD) fitted. This device not only controls the heart rate but also delivers a controlled shock, if necessary, to change the abnormal heart rhythm back to normal. For more information on this device, see our booklet *Implantable cardioverter defibrillators (ICDs)*.

Which type of pacemaker will I need to have?

There are many different kinds of pacemaker. The best one for you depends on what type of abnormality of heart rhythm or heartbeat you have. Your cardiologist will prescribe a pacemaker for you in much the same way as your doctor prescribes a drug for you.

As a general rule, this is how the choice may be made.

- If the upper chambers of your heart (the atria) always beat irregularly (atrial fibrillation), you will probably have a single-chamber pacemaker with a lead connected to the right ventricle.
- If you have intermittent atrial fibrillation (if your heart sometimes but not always beats irregularly), you will probably have a dual-chamber pacemaker.
- If you have heart block, but your own natural pacemaker is working normally, you will probably have a dual-chamber pacemaker.
- If your own natural pacemaker does not work correctly, but you have no sign of heart block, you may have a single-chamber pacemaker with a lead connected to the right atrium.
- If your own natural pacemaker does not work

correctly and you also have heart block, you will probably have a dual-chamber pacemaker.

- Some people who have heart failure may have a bi-ventricular pacemaker. This has three leads – one to the atrium, one to the right ventricle and one to the left ventricle.

If your disturbance in heart rhythm is more complicated, you may need a different pacemaker prescription.

Your cardiologist can answer any questions you may have, and reassure you about any concerns.

How is the pacemaker fitted?

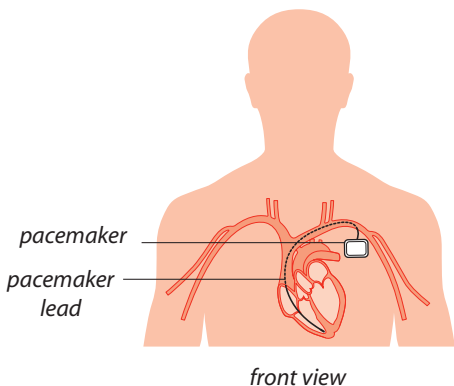
Most pacemakers are fitted by ‘transvenous implantation’. In a small number of people, ‘epicardial implantation’ may be used instead. We describe both of these methods below. When you have the pacemaker fitted, you may be given a course of antibiotics to reduce the risk of infection.

Transvenous implantation

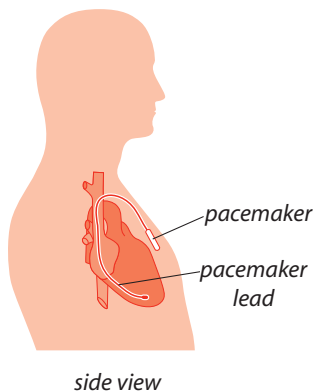
This usually takes between 30 and 60 minutes, but if you are having a bi-ventricular pacemaker it may take longer. It is normally done with a local anaesthetic so you will be awake during the procedure. You will usually need an overnight stay in hospital and a day’s rest after the procedure.

An electrode lead is inserted into a vein at the shoulder or the base of the neck. The cardiologist guides the lead into the correct chamber of the heart, checking its position on an X-ray screen, and secures it in position. The electrode lead is connected to the pacemaker and the pacemaker is then fitted into a small ‘pocket’ between the skin and the chest muscle. The amount of electrical energy needed to stimulate the heart to contract is then tested and the pacemaker is adjusted. Modern pacemakers are so small that they are almost completely hidden by the chest tissue.

Transvenous implantation



With transvenous implantation, the pacemaker is fitted between the skin and the chest muscle.

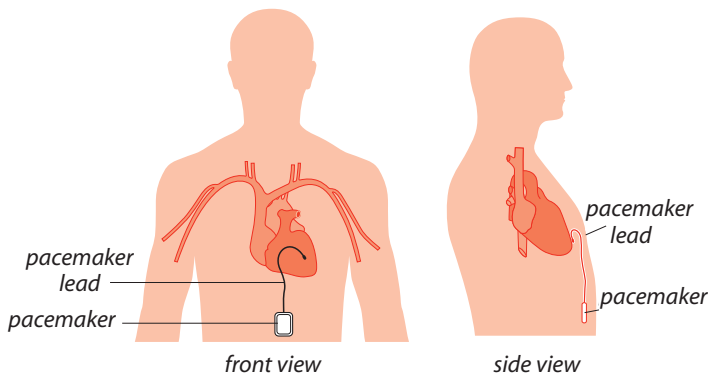


Epicardial implantation

Here, the electrode lead is attached directly onto the outer surface of the heart – the epicardium. The pacemaker box is placed under the skin of the abdomen. This method is sometimes used for people who have heart surgery at the same time as the pacemaker is implanted.

Epicardial implantation

With epicardial implantation, the pacemaker is put under the skin of the abdomen.



After the implantation and before you leave hospital

After your pacemaker has been fitted, you may feel some pain or discomfort and there may be some bruising at the site of the pacemaker but these problems usually disappear in a few days.

Your pacemaker will be checked, and chest X-rays taken, before you leave hospital. Most pacemakers are 'demand pacemakers' which means that the pacemaker does not produce a beat if the heart beats naturally. So, to check that the pacemaker is working properly, a magnet is placed on the skin over the pacemaker. The magnet 'pulls a switch' inside the pacemaker telling it to work at a particular rate. A special computer will programme it to the best settings for your condition. A technician or doctor will then measure and analyse the impulses from the pacemaker. As soon as the magnet is removed, the pacemaker goes back to its normal way of working, only producing beats when the heart misses a beat.

You may have to have stitches removed but most doctors use soluble stitches which dissolve on their own. Before you go home, you will be told what type of stitches you have.

You will probably be given a letter to give to your GP explaining that you have had a pacemaker fitted.

Possible complications

There is a small risk of getting an infection at the site where the pacemaker is fitted. If you notice redness, swelling or a discharge, or if you develop a fever, tell your doctor or contact your pacemaker clinic immediately. If you don't, the infection could spread. If that happens, the pacemaker may need to be replaced.

There is a small risk that one of the pacemaker leads might move out of position, so your doctor will advise you not to do any vigorous exercise for two or three weeks to reduce the risk of this happening. However, it is very important to keep your shoulder mobile by gently moving the arm on the side of the pacemaker.

There is also a small risk of air leaking from the lungs to the chest (a 'pneumothorax') during the procedure. The doctor will check this on your chest X-rays before you leave hospital.

Pacemaker registration card

After your pacemaker has been fitted, you will be given a pacemaker registration card. This has details of the make and model of your pacemaker. You should always carry this registration card with you in case of an emergency. You may also be given extra information produced by the pacemaker manufacturer. (For more about this, see *Hospitals and medical treatment* on page 26.)

Identity bracelets and necklaces

Some people also like to wear a MedicAlert bracelet or necklace which is engraved with their main medical conditions or important information (such as the type of pacemaker you have), a personal identity number and a 24-hour emergency phone number which health professionals anywhere in the world can call to find out your medical details. This phone service is available in over 100 languages. You can show this identity tag to any medical professional who is treating you, including doctors and dentists. (See page 35 for contact details for MedicAlert.)

Everyday life with a pacemaker

Modern pacemakers are comfortable and very reliable. Many people find that having a pacemaker allows them to get back to their normal lifestyle, and greatly improves their quality of life – especially if unpleasant symptoms such as fainting and dizziness become a thing of the past. Here are just a few things you need to know about.

Will I be able to feel the pacemaker inside me?

Most people are aware of the pacemaker, but get used to it quickly. At first your pacemaker may feel uncomfortable when you lie in certain positions, but it cannot get damaged in this way.

Driving

You are not allowed to drive for one week after your pacemaker is fitted. If you have an ordinary driving licence, you can start driving again after a week as long as:

- you do not have any symptoms such as dizziness or fainting which would affect your driving
- you have regular check-ups in the pacemaker clinic
- you have not recently had a heart attack or heart surgery, and

- you do not have any other conditions that would disqualify you from driving.

It is important that you tell the Driver and Vehicle Licensing Agency (DVLA) that you have a pacemaker. You can now let them know on-line. (For contact details see page 35.) The rules about driving can sometimes be confusing so if you need help filling in the forms, ask at your pacemaker clinic.

If you have an LGV (large goods vehicle) or PCV (passenger-carrying vehicle) licence, you are not allowed to drive these vehicles for six weeks after your pacemaker is fitted. You will be able to apply for another licence when you no longer have any symptoms that would affect your driving, such as dizziness or fainting. Your current licence will be replaced with a three-year licence and you will have to go to a pacemaker clinic regularly. The DVLA may ask your cardiologist to provide medical details before clearing you to drive.

Sports

You will be advised not to do any strenuous activity for about three to four weeks after your pacemaker has been fitted. After that, you can carry on – or take up – most activities and sports. If you play contact sports – such as football – you should take

care to avoid collisions that may damage your pacemaker. You might want to use a protective pad.

Hospitals and medical treatment

If you need any treatment or tests, whether related to your heart or not, tell the doctor or technician that you have a pacemaker – beforehand if possible. Always show your pacemaker registration card to any doctor or dentist treating you. If you have an operation of any kind, the pacemaker may need to be protected during the operation and re-programmed afterwards.

Can equipment interfere with my pacemaker?

Most pacemakers are very resistant to outside interference. The electronic circuits in the pacemaker are well protected by the outer metal case, and the pacemaker has special circuits to detect and remove unwanted electrical activity.

At home

Household devices such as shavers, hairdryers and microwave ovens will not be a problem, as long as they are well maintained. You should also be able to use your household tools such as drills, mowers and electric screwdrivers. If you are concerned

about using anything at home, check with your pacemaker clinic.

Phones

You can safely use a mobile phone or a cordless phone, but it is best to keep the phone more than 15 centimetres (6 inches) from your pacemaker. Always use the ear on the opposite side to your pacemaker, and do not put the phone in a pocket over your pacemaker.

Travelling and security systems

Airport screening systems and anti-theft systems in shops and libraries may, very rarely, cause problems with pacemakers. There is also a small chance that you may trigger the alarms. Always carry your pacemaker registration card with you. In some countries you may be asked to go through the security system. If this happens, it is important that you move quickly through the gateway. It is unlikely that your pacemaker will be affected by going through these systems but it's best not to stand close to them for too long.

At work

Some workplaces have strong electromagnetic fields which can interfere with your pacemaker.

Arc-welding is an example. If you are concerned about any equipment used at your workplace, your pacemaker clinic will be able to give you detailed advice.

In hospitals

Some hospital equipment may interfere with pacemakers. Some types of equipment used in surgery can also cause problems. So, if you are going to have an operation, your surgeon will take special precautions. Magnetic resonance imaging (MRI) scans can be dangerous if you have a pacemaker and you must not have this test unless your doctor has discussed it very carefully with you. Most other hospital tests will be fine, but always make sure that you tell whoever is treating you that you have a pacemaker.

For more information

Each pacemaker manufacturer gives detailed instructions about what sources of electromagnetic interference you should avoid. If you have any other questions about your pacemaker, or if you are ever concerned that your pacemaker is not working properly, contact your pacemaker clinic. The technician or doctor there can give you more advice.

Follow-up appointments

It is very important to have regular follow-up appointments at your pacemaker clinic to get your pacemaker checked. Appointments may be every three to twelve months, depending on the type of pacemaker you have and how well it has been working. You will have to have follow-up appointments for the rest of your life.

At each appointment, the technician or doctor will analyse the discharge rate of the pacemaker, measure the strength of the electrical impulse and record the effects of the impulse on your heart. In this way, they can find and correct any faults.

Most modern pacemakers can store information about the state of the battery and the performance of the pulse generator. At your follow-up appointment, the technician or doctor can get this information easily from electromagnetic signals transmitted from the pacemaker. And, if necessary, your pacemaker can be re-programmed to the best settings for your condition.

Your pacemaker will eventually need a new battery, although they usually last between six and ten years. This involves replacing the pacemaker box with a new unit. The original lead (or leads) can

usually be left in place. However, very occasionally there may be problems with the lead (or leads) and they may also need to be replaced. Having a new battery fitted is usually a straightforward procedure – it may be done as a day case or you may need to stay overnight in hospital.

Changes you should tell your doctor about

Most patients have no problems after their pacemaker has been fitted. However, you should contact your pacemaker clinic or your GP if you:

- feel dizzy or breathless, or have any of the symptoms you experienced before you had the pacemaker, or
- have pain, tenderness, swelling, redness or discharge around the pacemaker wound site at any time.

For more information

British Heart Foundation website

bhf.org.uk

For up-to-date information on the BHF and its services.

Heart Information Line • 08450 70 80 70

(A local rate number.)

A helpline service for the public and health professionals, providing information on a wide range of issues relating to heart health.

Publications and videos

The British Heart Foundation (BHF) also produces other educational materials that may interest you.

To find out about these or to order your

Publications and videos catalogue, please go to **bhf.org.uk/publications**, call the **BHF Orderline on 01604 640 016** or e-mail **orderline@bhf.org.uk**

You can download many of our publications from **bhf.org.uk/publications**

Our publications are free of charge, but we would welcome a donation.

Heart Information Series

This booklet is one of the booklets in the *Heart Information Series*. The other titles in the series are as follows.

- 1 Physical activity and your heart
- 2 Smoking and your heart
- 3 Reducing your blood cholesterol
- 4 Blood pressure
- 5 Eating for your heart
- 6 Angina
- 7 Heart attack and rehabilitation
- 8 Living with heart failure
- 9 Tests for heart conditions
- 10 Coronary angioplasty and coronary bypass surgery
- 11 Valvular heart disease
- 12 Having heart surgery
- 13 Heart transplantation
- 14 Palpitation
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- 16 Peripheral arterial disease
- 17 Medicines for the heart
- 18 The heart – technical terms explained
- 19 Implantable cardioverter defibrillators (ICDs)
- 20 Caring for someone with a heart problem

Heart health magazine

Heart health is a free magazine, produced by the British Heart Foundation especially for people with heart conditions. The magazine, which comes out four times a year, includes updates on treatment, medicines and research and looks at issues related to living with heart conditions, like healthy eating and physical activity. It also features articles on topics such as travel, insurance and benefits. To subscribe to this **free** magazine, call **01604 640 016**.

Heartstart UK

For information about a free, two-hour course in emergency life-support skills, contact Heartstart UK at the British Heart Foundation. The course teaches you to:

- recognise the warning signs of a heart attack
- help someone who is choking or bleeding
- deal with someone who is unconscious
- know what to do if someone collapses, and
- perform cardiopulmonary resuscitation (CPR) if someone has stopped breathing and his or her heart has stopped beating.

Other useful contacts

Driver and Vehicle Licensing Agency (DVLA)

Swansea SA99 1TU

Phone: 0870 600 0301

Website: www.dvla.gov.uk/welcome.htm

MedicAlert

1 Bridge Wharf

156 Caledonian Road

London N1 9UU

Freephone 0800 581420

MedicAlert can supply necklaces or bracelets engraved with details of your pacemaker, as described on page 23.

About the British Heart Foundation

The British Heart Foundation (BHF) is the leading national charity fighting heart and circulatory disease – the UK's biggest killer. The BHF funds research, education and life-saving equipment and helps heart patients return to a full and active way of life.

We rely on donations to continue our vital work. If you would like to make a donation, please ring our **credit card hotline on 0870 606 3399**. Or fill in the form opposite.

We need your help. Please send a donation today.

Please accept my donation of:

£50 £25 £15 £12 Other £

If you are sending a cheque, please make it payable to
British Heart Foundation.

Or, you can ring our credit card hotline on **0870 606 3399.**

I want to donate using: MasterCard Visa CAF Card

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Card number

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1/2005

Please tick if you would like us to send you a Gift Aid form to make your donation work harder at no extra cost to you.

Your personal information

The British Heart Foundation will use your personal information for administration purposes, and to provide you with services, products and any information that you have asked for.

We greatly value your support and would like to keep you informed about our work through marketing literature to help us meet our charitable aims. We may contact you by phone or post for this purpose. Please tick the box if you would prefer **not** to hear from us in this way. s

We may want to share information with other organisations that we work with and who support our aims. Please tick the box if you would prefer us **not** to share your details. MP02

Please tick this box if you **would like to** receive e-mail communications about our future activities, at the e-mail address you have provided. MP07

Thank you for your support.

**Please send your donation to:
Supporter Services, British Heart
Foundation, 14 Fitzhardinge Street,
London W1H 6DH.**

Registered Charity Number 225971

Please turn over.



Please send me information about the following.

- BHF publications**
- Giving regular donations**
Regular donations through a standing order give us the long-term support we need. Just tick for information on how to set up a standing order.
- Remembering us in your Will**
Many people choose to leave a gift to their favourite charities in their Will. We can send you a useful information pack to tell you how to go about it.
- Local fundraising activities and sponsored events**
- Payroll giving**
How you and your work colleagues can donate from your salaries before tax.
- Buying BHF Christmas cards and gifts**
- Becoming a volunteer in a British Heart Foundation shop**

Please send your form to the British Heart Foundation. The address is over the page.

Notes

Notes

Technical terms

atria	The smaller upper chambers of the heart.
atrial fibrillation	An irregular heartbeat in which the atria beat very fast, at up to 400 beats a minute.
atrium	Singular of 'atria'.
bi-ventricular	To do with the two ventricles of the heart.
bi-ventricular pacemaker	Pacemaker with three leads – one to the right atrium, one to the right ventricle and one to the left ventricle.
cardiac	To do with the heart.
cardiologist	A doctor specialising in heart disease.
discharge rate	The rate at which electrical impulses are generated.
dual-chamber pacemaker	A pacemaker with two electrical leads – one to the right atrium and one to the right ventricle.
epicardium	The outer surface of the heart.
heart block	When the electrical impulses of the heart are slowed down or delayed by an interruption in the heart's normal electrical activity.
single-chamber pacemaker	A pacemaker with one electrical lead, either to the right ventricle of the heart or to the right atrium.

transvenous	Through a vein.
ventricles	The larger, lower, pumping chambers of the heart.

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Your comments please

We would be very interested to hear your views about this booklet.
Please fill in this form and send it to:

British Heart Foundation

FREEPOST WD513

LONDON W1E 1JZ.

1 How did you get this booklet?

I got it directly from the British Heart Foundation.

My GP or practice nurse gave it to me.

I got it from a display at my GP's surgery or health centre.

A nurse or doctor at the hospital gave it to me.

I got it from a display in a hospital.

A friend or relative gave it to me.

Other (Please give details.) _____

2 Do you find this booklet...

very helpful?

helpful?

not very helpful?

not at all helpful?

3 Do you find this booklet ...

very easy to understand?

easy to understand?

not very easy to understand?

4 What do you think of the design of the booklet (how it looks, the size of the text, the front cover, the size)?

Very good

Good

Not very good

Poor



5 Are there any issues that you need to know about that are not covered in this booklet? If so, what are they?

6 Do you have any other suggestions for how we could improve this booklet?

7 Are you...

...a patient with a heart condition?

...a carer (for example, a relative or friend of someone with a heart condition)?

Other (Please give details.) _____

Acknowledgements

The British Heart Foundation would like to thank all the GPs, cardiologists and nurses who helped to develop the booklets in the *Heart Information Series*. Thanks also to all the patients who commented on the text and design.

Particular thanks for their work on this booklet are due to:

- Professor AJ Camm, and
- Sue Jones.

Edited by Wordworks.





Heart health is a free magazine produced by the British Heart Foundation especially for people with heart conditions. See page 34 for more information.

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