Glossary and Factsheets
Richard Maddison

This glossary explains many terms related to heart issues. Our aim is to help inform readers of the meanings and uses of various terms. **The contents are not advice,** and the BCPA and the author cannot accept any responsibility. The choices of what terms are included are somewhat arbitrary – including terms on prevention, diagnosis, symptoms, treatment, rehabilitation, and research.

For ease of English style, we have sometimes used **'you'** to mean the patient or carer, as well as the reader.

Medical Records

You have a right of access to your health records. The Data Protection Act 1998 allows you to have access to information about you held by a hospital or doctor. You are entitled, upon making a written request, to be supplied with a copy of any personal data held about you. For information on how to apply and the charges contact the appropriate manager – eg of patient services at the hospital.

Navigation

Click on any link with an **asterisk** to go to that ***Factsheet***.
Click on any other link to go to that place alphabetically in the ***Glossary***.
Then scroll, and/or use Page_up, Page_down, or the arrow keys.
Alt+Left_arrow goes back; Alt+Right_arrow goes forward again.
The Factsheets have links to the Glossary in them, and vice versa.

Click here for Copyright.

1/7 = one day, or one day each week.
1/52 = one week or one week each year. 3/12 = 3 months. 12/12 = all of a year.
< means less than and not equal to.
> means greater than, ie more than and not equal to.
≤ and <= both mean less than or equal to.
≥ and >= both mean greater than or equal to.
| means or.
* sometimes means multiply.

Ablation is a general term with three meanings.
1 The surgical removal of an organ, structure, or a part of such. This can apply to any part of the body – it is not heart-related.
2 The melting or wearing away of an expendable part – eg of the heat shield of a spacecraft during reentry.
3 The wearing away of part of a rock or glacier.

See ablation for AF under Atrial Fibrillation.

Radiofrequency Ablation of Atrial Flutter is a treatment to correct an abnormal heart rhythm. Through a vein in the groin at the top of a patient's right leg and/or a vein under a collarbone, wires are passed to the heart. These are used to ablate, ie burn away, the exact pathway in the heart that is causing the atrial flutter.

Access to medical records. You have a right of access to your health records. The Data Protection Act 1998 allows you to have access to information about you held by a hospital or doctor. You are entitled, upon making a written request, to be supplied with a copy of any personal data held about you. For information on how to apply, and the charges, contact the appropriate manager – eg of patient services at the hospital.

ACE inhibitor stands for Angiotensin converting enzyme inhibitor.

AED stands for automatic external defibrillator.

Acetone is a chemical with formula CH_3COCH_3; a colourless, volatile, liquid; used in the manufacture of some other chemicals; and also used as a solvent & thinner for paints, varnishes and lacquers.

AICD stands for automatic implantable cardioverter defibrillator.

Acid. See acid under protein.

Acute Coronary Syndrome, **ACS**, is a general term for unstable angina with related conditions.

Addiction means compulsive use of a drug and/or continual craving, usually leading to physical and/or psychological dependence – eg for a particular drug, nicotine by smoking, or caffeine in coffee and/or tea.

Adjuvant is a drug that enhances the effect of another drug. Eg aluminium is added to some vaccines to increase the immune response, so increasing the protection.

Adrenocorticotrophin. See under Stress.

Adrenaline is a hormone produced in the medulla (innermost centre part) of the adrenal glands in response to stress. It increases the heart rate and blood pressure; and raises the levels of glucose and lipids. See Epinephrine and under Stress.

The two **adrenal glands** are at the anterior end of each kidney.

Adverse effect means an unwanted side effect. **Adverse reaction** means the same.

AED. See Automatic external defibrillator.

AICD See Automatic implantable cardioverter defibrillator.

Alkali. See alkali under protein.

Alcohol unit. An **alcohol unit** is roughly* the alcohol in half a pint of beer or lager, or roughly* a glass of wine, or roughly* a single measure of spirits. *Here 'roughly' means that some pub measures are more than one unit – particularly of wines and spirits, because the volumes of the measures and/or glasses have increased, and also because different alcoholic drinks differ in their alcohol content.

Men should not to have more than 21 alcohol units per week, and women not more than 14. Preferably have about 3 to 4 units per week.

A large amount of alcohol any evening may significantly raise your blood pressure the following day.

Some experts believe that for adults one glass of a chardonnay or of red wine every day or two – but not more alcohol than that – reduces the risk of coronary heart disease.

See also red wine under apple.

A research trial finished in 2004 compared various groups of people who drank different amounts of alcohol, and the analysis found the following to be statistically significant.

(a) Men who drink three or more units every day and/or are binge drinkers are more likely to have a stroke than non-drinkers.

(b) Men who are at lowest risk of stroke were men who drank *one or two* units *three or four times per week*. They had slightly lower risk both than non-drinkers and than those who drank one or two units of alcohol every day.

(c) Men with the lowest total risk for any or all three of CHD, strokes and diabetes taken together are those whose alcohol consumption was limited to one drink unit, or at most two, about every other day, with little benefit shown above three or four drinking days per week.

Although this research was only based on analysis of *men*, experts expect the patterns for women are likely to be similar. See also Stroke.

Another research trial in 2004 compared two groups of men and women aged from 30 to 74. One group drank 300 ml of red wine, which is just over one unit, daily for four weeks; and as a control group for comparisons the others drank red grape extract or water.

- In the red wine group the HDL of each person typically increased by 11% to 16% of its value at the start. No significant HDL difference was observed in the control group.
- In the red wine group the amount of fibrinogen of each person typically decreased by 8% to 15%. No significant fibrinogen difference was observed in the control group.

Other research trials have shown that moderate* red wine and/or white wine such as chardonnay is protective against CHD, but other forms of alcohol are not. However the explanations may lie in other factors such as differences in the lifestyles and habits of the people who prefer the different kinds of drinks. *The term moderate here implies about one unit per day or two, from three to seven units per week, but not more.

Excess alcoholic drinks every day gradually affect the liver, and once liver damage has happened it is not reversible.

Also beers and similar drinks contain energy – far more than drinks of wine with the same alcohol content. So drinking beers and similar drinks tends to lead to becoming overweight. Drinking wine instead is preferable as regards avoiding being overweight.

***Alcohol* – Hospital alcohol gel** for rubbing on hands does *not* prevent *C diff*. But it does prevent MRSA.

Allergy. An allergy is when a substance triggers an undesirable or over-reaction in the immune system. An **allergic reaction** means the same, particularly when the reaction does not occur on the first exposure but appears on a later one. See ambulance for when to call an ambulance.

The immune system protects the body by eliminating foreign substances that it does not recognize – eg microorganisms such as bacteria or viruses. It produces antibodies.

When the body first gets a new foreign substance, one kind of white blood cell – called lymphocytes – produces the antibodies. These attach themselves to a second kind of white blood cell – called **mast cells**.

If the body gets the same foreign substance again, the mast cells release chemicals called **mediators**, eg histamine. This can produce a rash, swelling, narrowing of airways, and/or a drop in blood pressure. The antibodies and mediators protect against infections; but unfortunately may be triggered inappropriately – which is then an allergy.

When it is impossible for the patient to avoid the substance triggering the allergy, treatment is usually by antihistamines and/or corticosteroids, and/or drugs that minimize the symptoms.

Alphablockers block nerve signals that would trigger narrowing of blood vessels. Several alphablockers are available.

Doxazosin	Brand name Cardura, Doxadura
Indoramin	
Prazosin	
Terazosin	

Ambulance. Some people advise that in general one should call an ambulance without delay if someone has any of the following life-threatening conditions.

- Not breathing/cardiac arrest
- Severe chest pain – such as unexpectedly, or a heart attack, or angina that continues after initial treatment
- Difficulty in breathing
- Loss of consciousness
- Severe loss of blood
- Severe burns and scalds
- Choking
- Fitting/convulsions
- Drowning, and/or
- Severe allergic reactions.

At a road traffic accident, as soon as you know how many casualties and the severity of their injuries – eg whether conscious or unconscious, and whether likely to be stretcher cases – get someone to phone for an ambulance and tell them a brief description of the injuries.

If the patient's condition does not fall into the list above it may still be that an ambulance is required. Such patients are classified as having a serious condition but not immediately life-threatening.

A good example is a lower limb fracture. This is a stretcher case and definitely requires an ambulance. But the call would not be classified as immediately life-threatening unless the patient was for example also unconscious or bleeding severely. So the ambulance service need a brief but accurate description of the condition of the patient so they can classify it correctly.

This is important for two reasons.

- Resources are allocated to calls based on how serious they are rather than when the call was received. So if an ambulance is on its way to a broken leg but a chest pain call comes in nearby it will be sent to the chest pain call with another vehicle from further away being sent to the broken leg.
- If an ambulance is more than 8 minutes away then whenever possible Community Responders or off-duty ambulance staff will be deployed to 'immediately life-threatening calls' but not normally to other calls.

The rule for an Automatic external defibrillator (for a lay person) is that it should only be attached to a patient who is *both not responding and not breathing*. Lay people should not check for a pulse – it will waste time and may be incorrect. Provided the patient is both unresponsive and not breathing the AED can be relied upon to deliver a shock only if necessary.

Paramedics have AED equipment in ambulances to restart a patient's heart. They have oxygen, and have facilities to insert a cannula into a vein and administer appropriate injections. They also have ECG monitoring and recording equipment.

These facilities have improved over recent decades, and increased the chance of survival and recovery from heart attacks and other conditions. Because a first aider generally does not have these facilities, an ambulance should be called as soon as possible.

Before the provision of any AEDs, sadly only 2-3% of UK cardiac arrest casualties survived. But AEDs and better first aid training have increased the survival rate.

Anaemia is a deficiency of red blood cells and/or in their haemoglobin content. Haemoglobin combines reversibly with oxygen and so is important for transporting oxygen in the blood to tissues. Symptoms of anaemia include breathlessness – short of breath, pallid complexion, fatigue, and general lack of energy. These are all caused by the lungs, heart, and/or blood circulation not supplying enough oxygen.

Vitamin B12 is needed to avoid anaemia. Folic acid, iron, potassium, and cobalt are also needed.

Pernicious anaemia symptoms are a feeling of weakness and eg: lesions of the spinal cord, sore tongue, numbness in arms and legs, and/or diarrhoea – all caused by the deficiency of red blood cells and of haemoglobin, and hence not enough oxygen being carried.

Anaesthetic. An anaesthetic is a drug that produces either a local loss of sensations of touch or pain over a small part of the body, or temporary unconsciousness – such as for an operation or some other procedure that would otherwise be painful.

An **anaesthetist** is a doctor specializing in **anaesthetics**, which is the science of such drugs.

Analgesia is the inability to feel pain. It also means relieving pain by drugs.

Analgesic. An **analgesic** is a chemical that reduces pain – a painkiller. Pain is a symptom, not a disease. Longterm relief therefore needs treatment of the underlying cause. If the underlying cause cannot be cured, longterm analgesic treatment, eg by drugs, may be needed.

Nerve endings detect damage to body tissues from disease or injury, and send signals to the brain. The brain's interpretation of these signals may depend on the patient's psychological state, eg may be worse with anxiety or fear. Support and reassuring explanation may help the patient to bear the pain and/or may relieve it.

Analgesics divide into opioids – the strongest pain relievers, and non-opioids.

Non-opioids = NSAIDs and non-NSAIDs. The non-opioids divide into Non steroidal anti-inflammatory drugs, NSAIDs, eg aspirin; and non-NSAIDs eg paracetamol.

NSAIDs relieve pain, inflammation, and/or swelling – usually of joints and/or muscles and reduce fever.

Non-opioids block the production of prostaglandins, so the nerve endings that would send pain messages to the brain are prevented from being stimulated. Thus eg paracetamol relieves pain and inflammation.

Pain-relief products named **Co-** – eg Co-codamol, Co-codaprin, Co-proxamol – contain both an opioid and a non-opioid; the non-opioid part may be either paracetamol or another NSAID. But codeine is just an opioid analgesic.

Analysis, **analysing** means examining in detail, breaking down into parts or components, finding out about each component, and understanding how the parts work together.

Anaphylaxis is a severe allergic reaction. The symptoms are swelling of the throat or tongue, hives, and/or trouble breathing. When it strikes, life is at risk. So time is critical. It may cause shock.

Many people carry a lifesaving device that gives an easy-to-use injection of Epinephrine. See also under shock for symptoms and treatment of shock.

Aneurysm. See Aortic aneurysm.

Angina See separate factsheet on angina.

Angina is a chest pain – an uncomfortable feeling in the chest that is usually brought on by exercise or emotional upset. For some people it is hardly a pain at all, but for others it can be severe. The commonest complaint is of a heaviness or tightness in the middle of the chest. The pain may spread to the left shoulder, left arm and hand; neck, throat, jaw, back and/or stomach. The patient may be temporarily short of breath, and/or feel weak and/or anxious. Also called **angina pectoris**.

Angina is a built-in warning device, telling you that your heart is trying to do too much and that you must take it easier.

Angina is most often caused by the gradual narrowing of the arteries of the heart by materials being deposited in their walls. Over many years, these deposits increase until they reach a size where they actually restrict the flow of blood through the arteries.

When a patient's body is at rest and the heart is beating at its normal resting rate, sufficient blood passes into the heart muscle to nourish it. Under exercise or strong emotion the heart is put under strain by being made to beat faster and a point is reached when the flow of blood and the oxygen it carries is insufficient to meet the increased demand of the heart muscle. Those muscles are starved of oxygen so cannot function properly, and this produces pain.

Anyone who unexpectedly gets such pain or symptoms should rest immediately and call an ambulance if either:

- it is not stable angina; or
- if both it is stable angina that the patient has had before and understands, and it does not respond within a few minutes to rest.

Angiography, **angiogram**. Cardiologists often recommend an angiogram for patients with angina. Under local anaesthetic, a fine catheter tube is introduced into a femoral artery in the groin and passed along the body's arteries to the Coronary arteries. A dye is injected to give an X-ray picture of the blood flow and arteries. This will show both where and how much the coronary arteries are narrowed.

Nowadays the whole procedure can be done in a day. The results are stored in a computer system without the need for Xray film. The surgeon and staff can control the frequency of the images – eg having far fewer images per second than used to be needed with Xray film, and the Xray dose is much lower than ten or 20 years ago. The process takes about 30 to 45 minutes. With improved methods of treating the femoral artery wound – eg Angio-seal®, the patient typically needs only a couple of hours afterwards in the hospital.

Angioplasty means passing a catheter along an artery to the heart. The angioplasty entry is often made into the femoral artery at the patient's groin, or sometimes in the arm or wrist. A local anaesthetic is usual.

An **angioplasty catheter** is a long, flexible, slender or very-fine hair-like hollow guide wire that can be fed along an artery – eg the femoral artery. It is used either to help place a balloon or stent in position, or to inject a dye. The cardiologist guides the wire by viewing an X-ray picture. The wire may be made so its natural shape near the end is a slight curve, so by rotating it when an artery junction is reached, it can be guided into the correct route. See Balloon angioplasty, Cardiac catheterisation, and Coronary angioplasty and stent insertion.

Angio-Seal® is a vascular closure device fitted to a femoral artery wound. Its parts are absorbed within 90 days. It has an anchor that goes inside the artery hole, a suture that comes towards the skin, and a collagen sponge around the suture that is pushed to the outside of the artery to block the hole. There is no latex and it is MRI compatible.

Angiotensin converting enzyme inhibitors, **ACE inhibitors**. ACE inhibitors are drugs used to reduce high blood pressure and/or to help the heart to pump more efficiently and effectively. They act on enzymes and dilate blood vessels throughout the body, thus reducing the blood pressure by lowering the pressure against which the heart has to pump. ACE inhibitors are beneficial where the heart failure is due to abnormalities in how well the left ventricle pumps. They also prolong life. Many different ACE inhibitors are available.

- Captopril — Brand name Capoten
- Enalapril — Brand name Innovace
- Lisinopril — Brand names Carace, Zestril
- Ramipril — Brand name Titrace

If you are taking the dose once a day, it is best to take it in the morning. If you are taking more than one dose per day, then space them out evenly through the day.

When you first start taking ACE inhibitors or if your doctor increases the dose, you may experience a dizzy or faint feeling until your body adjusts to the dose. This should soon pass if you sit or lie down for a while. However, if this happens you should inform your doctor.

Some ACE inhibitors, eg **perindopril**, have anti-blood-clotting properties and restore the smooth lining of the arteries, stopping the build-up of fats in the artery walls.

A new drug, **valsartan**, was trialed internationally about 2003 – involving 15,000 patients in 54 hospitals. It was found to be as effective as other ACE inhibitors in reducing the risk of second or third heart attacks, but without giving patients a dry cough. Previously there was nothing to give to such patients. Brand name Diovan. It is an angiotensin II blocker, and is used to treat hypertension. It may also be used after a heart attack to reduce the risk of further complications.

Side effects of ACE inhibitors are relatively rare. They include dizziness, headache, fatigue, diarrhoea, muscle or joint pains, dry cough (see above) and rash or skin itch. If you experience any side effects, contact your doctor.

Angiotensin II blocker. Angiotensin II is a powerful hormone that constricts blood vessels. An Angiotensin II blocker blocks that action, so relaxes the blood vessels. This makes the arteries and veins slightly larger calibre, reducing the heart workload and lowering blood pressure.

Antagonist means having the opposite effect, eg a drug that blocks something.

Anterior means situated at or towards the front of the body. Opposite of posterior.

Antibiotic means a substance that kills particular bacteria or fungi.

Antibodies are chemicals produced and used by the **lymphocytes** (a particular kind of white blood cell in the) immune system to help the body to overcome infection, disease, allergy, or unwanted foreign substances – viruses and bacteria. They are blood proteins. **Anti-** means against.

Anticoagulant. Anticoagulants are drugs to reduce or prevent blood coagulating or clotting in blood vessels, or to prevent a thrombosis or embolus causing trouble in the bloodstream.

Heparin is an anticoagulant that is used to prevent blood clots forming, and/or to prevent existing clots getting bigger or breaking and producing an embolus.

Warfarin is an anticoagulant drug, and is named after Wisconsin Alumni Research Foundation and Coumarin. **Coumarin** is an anticoagulant. Warfarin is usually taken by mouth.

Antihistamine. See Antihistamines under Histamine, Corticosteroids.

Antihypertensive. An antihypertensive is a chemical that reduces high blood pressure, and may be taken longterm to maintain lower blood pressure.

Antihypertensive drugs work in various ways – acting on different parts of the body to reduce blood pressure.

Alphablockers block nerve signals that would trigger narrowing of blood vessels.

Centrally- acting antihypertensives affect the brain mechanism that controls blood vessel size.

Betablockers that are heart related reduce the force / pressure at each heartbeat.

Diuretics cause the kidneys to reduce blood volume.

ACE inhibitors, Angiotensin converting enzyme inhibitors, act on enzymes and dilate blood vessels.

Vasodilators and calcium channel blockers act on the muscles of the walls of arteries to prevent narrowing.

Antioxidant. An antioxidant is a chemical that protects against damage by free radicals. Equivalently, an antioxidant retards deterioration by oxidation – especially of fats, oils, foods, petroleum products, and rubber.

A **free radical** is an atom or group of atoms containing at least one unpaired electron and existing for a brief period of time before reacting to produce a stable molecule.

Vitamin E is an antioxidant.

Antiperspirant is a substance applied to the skin to reduce sweating. They reduce the processes in sweat glands and/or block ducts that carry the sweat to the skin surface.

Antiplatelet drugs help prevent platelets sticking together to form blood clots. Usually they are taken regularly. Such drugs are also given after heart surgery to prevent clots forming. Aspirin is the most widely used antiplatelet drug. See International Normalized Ratio.

Antipyretic is a drug that reduces fever – eg paracetamol under analgesic, aspirin.

Aorta is the large artery that emerges from the heart's left ventricle, and carries blood towards the rest of the body.

Aortic aneurysm is a sac and/or dilation at some place in the aorta where the aorta artery wall may be weakened or damaged.

Aortic stenosis. Stenosis of the aorta.

Aortic valve is the valve between the left ventricle and the aorta, which allows blood to flow out to the rest of the body but not backwards. See Valve.

An **apple** a day. Flavonoids in the diet lower heart disease risk. Quercetin and epicatechin are the major flavonoids in our diet – their main sources being red wine, cocoa, onions, tea, and (particularly) apples – **ROTA**.

There is increasing evidence that diets rich in fruits and vegetables are associated with a reduced risk of chronic disease such as cardiovascular disease. This may be due to the abundance of phytochemicals (plant chemicals) known as polyphenols that occur in these foods. The Institute of Food Research staff are researching protective effects of a particular class of polyphenols occurring naturally in apples against vascular disease.

Arrhythmia means an abnormal rhythm of the heart. This may be from a birth defect, coronary heart disease, other heart disorders, overactive thyroid gland, caffeine, and/or drugs for Parkinsonism or incontinence. See Atrial fibrillation, Supraventricular tachycardia and Arrhythmogenic right ventricular cardiomyopathy under cardiomyopathy.

Artery. An artery is a blood vessel in which blood flows from the heart to part of the rest of the body. The main artery from the lower left ventricle of the heart is the aorta. The tubes from the lower right of the heart to the lungs are also called arteries. Compare Vein. See Coronary arteries, Coronary artery bypass graft, Internal mammary artery.

The ***risk factors*** that cause narrowing and/or blockage of the arteries are:

- smoking
- high blood pressure
- high cholesterol
- being overweight
- lack of exercise
- history of heart disease in the family
- if you are male
- if you are diabetic
- if you suffer with stress.

These risk factors do not make it certain that a person will have heart trouble. Some people develop angina without having any of these risk factors.

Arthritis is an inflammation of joints, causing pain and stiffness. See Arthritis under NSAIDs.

Artificial pacemaker. An artificial pacemaker is an electronic device fitted under the chest skin, and that can generate a pulse to control heart rate. It is usually fitted to patients that have a slow heartbeat. Compare Implantable cardio-defibrillator.

Aspirin in **low doses** helps to prevent blood clots and to reduce the viscosity of a patient's blood, thus making it flow better, and thus reducing the need for higher blood pressure to pump it round the body – see Antiplatelet. This decreases the risk of a heart attack or stroke. It is important to take the correct dose, usually 75-150 mg daily, as higher doses will not have the desired effect on the blood or heart.

Aspirin is a** non-steroidal anti-inflammatory drug **(NSAID). Aspirin also reduces inflammation, and in the correct low dosage prevents abnormal blood clotting, but normal doses irritate the stomach lining. Soluble or dispersible aspirin in water is absorbed into the bloodstream faster than tablets would be, but still irritates the stomach lining.

Aspirin has been used as a pain reliever since about 1920, and is present in many medicines for colds, flu, headaches, and other pains. Aspirin tablets as such generally have higher doses, eg 300 mg.

Higher doses than 75-150 mg may injure the stomach lining, and cause stomach ulcers* and intestinal bleeding. This has been known since the 1950s or perhaps earlier. Thus generally, people should not take aspirin as a pain reliever. Preferably take paracetamol or ibuprofen or whatever a doctor recommends. Aspirin can also trigger asthma attacks. As regards stomach ulcers, aspirin is an NSAID: See under NSAID.

Aspirin as a drug. A daily low dose of 75-150 mg of aspirin is to reduce the stickiness of the patient's blood, thus decreasing the chance of a heart attack or stroke. Aspirin should be taken at the same time every day. Take aspirin with or immediately after food as this reduces the risk of stomach irritation. Most people take soluble or dispersible aspirin, which are white tablets that should be completely dispersed in a small glass of water.

Aspirin side effects are rare, as the dose of aspirin is very low. Occasionally aspirin may cause stomach upsets or indigestion pain, but this should be prevented if the dose is taken with food or milk. If you, the patient, still suffer stomach pains then you should contact your doctor. Aspirin occasionally causes wheeziness due to an allergic reaction – if you experience this you should contact your doctor.

If you require medication as a painkiller, you should take one that does not contain any aspirin, such as paracetamol.

Many cold remedies may also contain aspirin as well as other ingredients and these remedies should be avoided to keep the aspirin dosage correct. Ask your pharmacist for advice if you are not sure. It is helpful to keep a list of all the medication you are currently taking and their dosages with you whenever you visit a doctor or hospital.

***Aspirin* Reye's syndrome**. Experts advise that one should never give aspirin to anyone under 16, because of the risk of a rare but sometimes-fatal liver and brain disorder called **Reye's syndrome**.

Assertion. Assertion has two meanings. In ordinary usage it refers to a positive statement – perhaps made without any evidence or justification.

In science and medical research, an assertion is a proposition that may be true or false, and carefully worded so that its assumptions and meaning are clear. Usually the intention is to state exactly what is to be tested, eg a particular null hypothesis, as explained under Statistically significant.

Atheroma is the term for the fatty material that builds up on the inside walls of arteries, particularly the coronary arteries. This usually leads to angina pain. Similar build-up in arteries supplying the brain may lead to a stroke.

Atherosclerosis means the fatty deposits on artery walls due to the build-up of cholesterol and other cells; with related thickening of the walls, so the narrowing reduces the blood flow.

The term also means the narrowing and thickening of the arteries. Where this occurs in coronary arteries, it reduces the blood and oxygen reaching the heart muscle, so less blood can be pumped around.

Atherosclerosis is the leading cause of cardiovascular disease (CVD) mortality, and is an inflammatory disease.

Atherothrombosis means plaque tearing. The fragments may lead to blood clots forming and thus the furring up or blocking of arteries.

Atrial fibrillation is a very common abnormality of heart rhythm – about 10% of people over the age of 70 have it. When this occurs, the top chambers of the heart – the **atria** – beat in a chaotic fashion, called **fibrillation**. It may be treated with drugs.

See separate factsheet on Atrial Fibrillation.

Atrioventricular node. The A-v node is the conduction pathway between the upper and lower chambers of the heart.

Atrium. The right atrium RA is the upper right chamber of the heart, where blood from the body enters before flowing to the right ventricle. Similarly the left atrium LA is the upper left chamber, where oxygenated blood from the lungs enters and then flows to the left ventricle and thus to the rest of the body. The plural is **Atria**.

Automatic external defibrillator, AED. An AED is a machine that gives a controlled electric shock to restart the patient's heart. Ambulances carry an AED. Never give such an electric shock to a patient that has a pulse.

For a reasonable chance of survival this is needed within 8-10 minutes of a patient's collapse, hence the urgency to call 999.

The rule for an Automatic external defibrillator (for a lay person) is that it should only be attached to a patient who is *both not responding and not breathing*. Lay people should not check for a pulse – it will waste time and may be incorrect. Provided the patient is both unresponsive and not breathing the AED can be relied upon to deliver a shock only if necessary.

See also ambulance.

Public Access Defibrillators (PAD) are available eg in shopping centres, entertainment venues, and other public places. Once opened, the machine gives instructions through its computer and loudspeaker.

Automatic implantable cardioverter defibrillator, AICD. An AICD is a device implanted to monitor the heart and that will if needed automatically deliver a controlled electric shock to restart the heart.

Average. The word 'average' means whichever is appropriate of three different calculations on a set of values. Usually the average is taken to be the mean unless the context implies otherwise.

The **mean** is the total divided by how many. Eg the set of five values 7, 7, 12, 12, 12 has mean 10 = (7+7+12+12+12)/5. Also see Standard deviation.

The **mode** is the value that occurs most. Eg the mode of 1, 1, 2, 14, and 15 is 1. This is useful where some consequence depends on the commonest case.

The **median** is the central value of an odd number of values, or is the mean of the central two if there are an even number. Eg the median of 1, 3, 5, 16, and 17 is 5; and of 1, 4, 6, and 17 is also 5. Essentially, half the values are above it, and half are below it.

AVPU see consciousness.

AVR = Aortic valve replacement. See Valve surgery.

Balanced diet. See Balanced diet under diet.

Balloon angioplasty. This is a procedure where an angioplasty catheter is used to place a tiny balloon at a blocked or partially blocked place in an artery. This is then inflated to about 3 mm diameter and it flattens the fatty tissue that was blocking the artery against the artery wall. Usually, a stent is inserted to keep the artery open. The balloon is deflated, and the catheter is withdrawn.

Basal metabolic rate. See basal metabolic rate under Metabolism.

BCPA J means BCPA Journal.

bd (= bpd) = twice per day. Also see od = once a day, tds = three times, qds = four times. om = every morning.

Beating heart transplant. On 22nd May 2006 a team at Papworth hospital performed the first 'beating' heart transplant in the UK. The recipient - a 58-year old man - was two weeks later doing extremely well and had already left hospital.

A donor heart will deteriorate without a blood supply outside the body and the current method of preserving its function is a high dose of potassium to stop it beating, and then cooling to maintain it during transport. Unfortunately despite the above measures the heart slowly deteriorates and there is a safe time limit of about 5 hours between removal from the donor and implantation to the recipient.

In the new system, developed by TransMedics in the USA, the heart is transported in an Organ Care System with conditions as close as possible to the human body; it has warm oxygenated, nutrient-rich blood flowing through it and thus continues to beat. The new technique should mean that the heart is in better condition at the time of the transplant. The organ care system may also allow the time interval before transplantation to be extended and possibly allow drug treatment to be used to improve hearts prior to transplantation. The latter will increase the number of donor hearts that can be used for transplantation, which would be a major benefit.

Beats per minute = Heart rate.

Betablocker = **beta-adrenergic blocker**. Betablockers slow the heartbeat, and are used to: relieve angina, reduce high blood pressure, reduce the risk of a further heart attack, and/or regulate the heart rhythm. Some betablockers also relax the blood vessels.

They interrupt the transmission of stimuli through the body's beta receptors. Thus they nullify the stimulating action of norepinephrine (= noradrenaline), which is the main fight-or-flight hormone. The beta receptors in different parts of the body produce a variety of benefits and/or side effects – the benefits or otherwise depend on what conditions and/or diseases the patient has. The main effects of beta blockers follow.

- Heart rate is slowed and the force / pressure in the outflowing blood at each heartbeat is reduced – the reduced heart workload helps prevent angina and/or abnormal heart rhythms. Unfortunately this may increase the risk of heart failure.
- Blood pressure is lowered since the heart rate and the heart's force / pressure is reduced.
- Blood vessels are narrowed, which may cause the hands or feet to feel cold from reduced blood flow.
- Overactivity of the thyroid gland is reduced – so muscles may tremor from that or from anxiety.

- Narrowing of airways to the lungs may cause breathlessness.
- Dilating blood vessels surrounding the brain is inhibited (= prevented).

In summary they are effective because they slow the heart rate, reduce the workload of the heart, and lower the blood pressure.

Betablockers are prescribed for a number of conditions.

- Relieve angina chest pain, as they reduce the frequency and/or severity of angina.
- Reduce high blood pressure
- Reduce the risk of a further heart attack
- Regulate the heart rhythm.

Many different betablockers are available. Some mainly affect the heart; others are not aimed at the heart. The following mainly aim at the heart, eg to stop the heart from beating too fast.

Acebutolol	
Atenolol	brand names Antipressan, Atenix, Tenormin
Betaxolol	
Bisoprolol	brand names Bipranix, Cardicor, Emcor, Monocor, Soloc, Vivacor
Celiprolol	
Metoprolol	brand names Betaloc, Lopresor
Nebrivolol	

The following are mainly not aimed at the heart.

Carvediol	
Labetalol	
Nadolol	
Oxprenolol	
Pindolol	
Propranolol	brand name Inderal
Timolol	brand names Betim, Glau-opt, Nyogel, Timoptol

If you, the patient, are taking the dose once a day it is best to take it in the morning. If you are taking more than one dose a day, then space them out evenly through the day. The tablets, particularly the slow-release SR variety, should be swallowed whole with a glass of water and never crushed or chewed.

It is important never to stop taking betablockers suddenly without consulting your doctor.

Betablockers side effects are relatively rare. Occasionally people suffer with cold hands and feet. Make sure you keep warm in the cold. You may feel tired when you first start taking betablockers. This usually passes within a few days, as your body adjusts to a slower pulse rate. A minority of people may suffer wheeziness or breathlessness when taking betablockers. People with asthma should not normally take Betablockers. Very rarely, men may suffer from impotence whilst taking betablockers. If you notice any of the above side effects, you should contact your doctor.

Bile is a greenish to golden brown liquid produced by the liver and stored in the gall bladder. During digestion of food it is released into small intestine via the bile duct to aid digestion. It is also discharged into the duodenum where it helps the emulsifying of and absorption of fats. See Cholesterol, lipid-lowering drugs.

Bilirubin. See under jaundice.

The **Biotechnology and Biological Sciences Research Council**, **BBSRC**, is the UK funding agency for research in the life sciences. Sponsored by the government, with a budget of £370 million in 2007, it supports industrial stakeholders in the agricultural, food, chemical, healthcare, and pharmaceutical sectors. See also Institute of Food Research.

Blocker. See antagonist.

Blood contains red cells, white cells, plasma, and platelets and other agents that are active in the clotting of blood. Plasma is the clear or yellowish fluid in which corpuscles and cells are suspended; including water, dissolved proteins, salts, sugars, fats, minerals, and vitamins. Red cells have haemoglobin for carrying oxygen. Antibodies for various diseases are proteins in the blood that render the toxins harmless.

Blood analysis measures the amounts of particular substances in a blood sample in a blood test.

The equipment is called a **blood analyser**. In 2004 the BCPA bought seven for Papworth Hospital, costing over £15,000. Each could measure the clotting properties, INR, and other variables in a few minutes from a drop on a slide. The previous equipment needed a tube full of blood and took hours.

Blood cholesterol test. A blood cholesterol test measures the amount of cholesterol and other fatty substances in a blood sample.

Blood clot. A blood clot is an unwanted lump of blood platelets creating a blockage in an artery or vein. A part of such a clot may break away – called an embolus, and if it flows to some other place it may cause further problems there. Deep vein thrombosis means a blood clot in a leg.

Blood pressure, **BP**, measures the systolic (highest) and diastolic (lowest) pressure during each heartbeat. For **high blood pressure** see hypertension. It is normal for blood pressure to rise with exercise, stress, and exertion.

Systolic is the maximum blood pressure during each heartbeat, eg the 130 of 130/80, measured in mm of mercury (Hg).

Diastolic is the minimum blood pressure during each heartbeat, ie the 80 of 130/80.

Blood test. A blood test is an analysis of a small sample of blood to measure the amounts of various chemicals and/or trace elements (see under Minerals) in the blood. Eg patients with unknown cholesterol, or with deep vein thrombosis, or taking Warfarin, are tested to determine the amounts of particular chemicals so that appropriate treatment may be given. The Glucose level is measured to check for diabetes. See also blood analysis, Troponins.

Body mass index, **BMI**, is the weight in kilograms divided by the square of the person's height in metres. Eg weight 75 kg and height 1.73 m gives 75/(1.73*1.73) equals 25.

Excluding people training for sports or ill the following are the relevant ranges. But for all these terms in detail it also depends on whether the person has a small, medium or large frame, and whether they are training for a sport.

For most adults a BMI between 20 and 25 is **normal BMI**, ie healthy and good.

- Under either 18.5 or 20 is normally regarded as **underweight**
- 25 to under 30 is **overweight**
- Over 30 is **obese**. See Obesity eg for risks.

Some people think Waist-to-hip ratio is a better measure.

Body salts are minerals present in body fluids such as blood, urine, sweat, or within cells.

Bones. The human body has 208 bones. The arms, wrists, & hands have 60. The legs, ankles, & feet have 60. The backbone has 26 vertebrae; there are 12 vertebral ribs each side, (a few people have 11 and are missing the lowest rib on each side). The skull has 22 bones. The ears have three each, and the throat has one. The collar & shoulder blades have four, the sternum (breastbone) has three, & the pelvic girdle has two.

The bones give rigidity, support, and shape to the body – including the ability of joints to move with muscles attached at appropriate places. They also give protection to certain parts – eg the skull & ribs protect. The inside of a bone is hollow and holds the systems that make blood cells and also make calcium. Bones are 33% water.

When they start growing they are solid, developing the hollow centres later. They also have the ability to repair themselves eg after a fracture – even a complete fracture broken right through. At a fracture the blood vessels also are damaged, so blood escapes as internal bleeding, and this blood clots into a hard mass to help the healing processes.

Bones can have various diseases. Congenital = hereditary diseases are rare and usually not curable, eg dwarfism, deformities. Biochemically caused bone diseases are where the body's functions have not worked properly to control the bones, eg rickets, weak bones. Bones can be infected by bacteria, eg osteomyelitis. They can also have tumours, eg a lump on the skull; and malignant growth such as cancer spreading from somewhere else. Osteoarthritis and rheumatoid arthritis first affect the lining of joints and the cartilage space between bones, and then affect the bones themselves.

BP stands for blood pressure.

Brachial means of the arm. **Brachium** means the arm, **brachia** being the plural.

Bradycardia is an abnormally slow heart rate, usually below 60 beats per minute. Compare Tachycardia.

Brand name = trade name = name for a particular product manufactured and marketed by a commercial company – a name chosen by the manufacturer. Contrast with generic name.

The different brands each contain the same generic substance. The differences between the brands may be slight – eg rate of absorption, convenience, and digestibility.

A particular drug may be available in generic form, in one or more brand forms, or both.

Some brand named products contain more than one, ie several, generic drugs.

Generic names are normally not spelt with an initial capital; but brand names normally have an initial capital.

Breastbone means the same as sternum.

Breathing. Being **breathless**, short of breath, may indicate a heart-related condition – eg angina; or perhaps anaemia. There are other possibilities.

See ambulance for when to call an ambulance.

Breathlessness can be caused by some heart- related condition that affects the flows of blood round the body and/or to and/or from the lungs.

British Heart Foundation, **BHF**, is a registered charity that plays a leading role in the fight against heart and circulatory diseases. It sponsors research and has produced many booklets. The BCPA and the BHF co-operate.
Tel 020 7935 0185, Website www.bhf.org.uk (This is not a link.)

British Heart Foundation National Centre for Physical Activity and Health, BHFNC, is at Loughborough.

They found that 37% of CHD deaths are related to inactivity; as compared to only 19% of CHD deaths being related to smoking.

See BHFNC under Exercise.

Bruce cycle. See Bruce Treadmill Test under Exercise stress test.

CABG stands for Coronary artery bypass graft. Pronounced 'cabbage'.

Calcium channel blockers are drugs used to relieve angina, reduce high blood pressure, and/or slow the heart rate. They act on the muscles of the walls of arteries to prevent narrowing. See Antihypertensive. They are prescribed for various conditions.

- Relieve angina
- Reduce high blood pressure
- Slow the heart rate.

Several calcium channel blockers are available.

Amlodipine	brand name Istin
Diltiazem	brand names Adizem, Tildiem
Felodipine	brand names Cardioplen, Felotens, Keloc, Neloc, Plendil, Vascalpha
Nicardipine	brand name Cardene
Nifedipine	brand names Adalat, Coracten, Nifensar
Verapamil	brand names Cordilox, Securon, Univer

These differ in their possible sites of action and their side effects. It is very important never to stop taking a calcium channel blocker without consulting your doctor.

Side effects of Calcium Channel Blockers. Occasionally people suffer with headaches and facial flushing, which usually stops after a few days as the body adjusts to the medicine. Those taking Verapamil may suffer constipation. Calcium Channel Blockers may cause dizziness. Again this should pass as your body adjusts to them. If you notice any side effects, you should contact your doctor, so that he or she may change your medication if these side effects become intolerable.

Calibre. The calibre of an artery is its internal diameter. Where there is plaque the partial blockage effectively reduces the calibre.

Calorie. A **calorie** is a unit of quantity of heat or energy. For measuring the amount of energy in foods, people use kilocalories, **kcal**, which is 1000 calories, which should be written **Calories** with a capital C to indicate kilocalories. People typically need 1800 to 2500 kcal per day. They use about 75 to 80 kcal per hour when resting in bed; and 80 to 90 when sitting and not doing any significant physical activity. During exercise the rate may double.

A **Joule** is a measure of heat or energy, being one Watt for one second. The conversion is 4.2 Joules per calorie, or 4.2 kJ per kcal. A slice of bread gives about 300 to 350 kJ, ie 70 to 80 kcal.

Campylobacter is the UK's commonest form of food poisoning – 42,226 cases and about 70 deaths in 2006. The true number of cases may be higher as many people might not go to see their GP. In vulnerable groups it may cause other complications. Some chicken flocks are carriers, leading to food poisoning.

Capillaries are the tiniest thin-walled blood vessels that arteries divide into, and where oxygen and other nutrients in the blood pass to muscles and other tissues.

Carbohydrates are an important source of energy as food. They are organic compounds containing carbon, hydrogen, and oxygen, usually with the hydrogen and oxygen in about the same ratio as in water. They include sugars – such as sucrose; and polysaccharides – such as cellulose, glycogen, starch, and various forms of glucose including dextrose. See also under Sugar, Diet, and Glycaemic Index.

Carcinoma. A carcinoma is a malignant tumour, or another name for a malignant cancer.

Cardiac means relating to the heart. A cardiac patient has a heart disorder; and a cardiac drug is one that stimulates heart muscles.

Cardiac arrest means the heart has suddenly stopped beating. **Cardiopulmonary arrest** means the same.

There is no pulse or breathing. The commonest cause is a chaotic electrical pattern caused by a ventricle or heart muscles being damaged or starved of oxygen. Causes include heart attack, severe blood loss, suffocation, electric shock, anaphylactic shock, drug overdose, and hypothermia.

Treatment: See ambulance for when to call an ambulance. CPR and resuscitation, defibrillation.

Cardiac catheterisation is a procedure where a catheter is passed along arteries to reach a particular coronary artery, and an X-ray video is recorded while a harmless dye is injected, causing the blood flow during each heartbeat to show on the X-ray. This helps detailed diagnosis, pinpointing the sites of blockages, and assessing the seriousness.

Cardiac ultrasound See Echocardiogram.

Cardiology is the branch of medicine of the heart and its diseases.

Cardiomyopathy has two related meanings. Firstly, it means the **cause** of the patient's heart damage, which sometimes is initially not clear.

Secondly, **cardiomyopathy** is a heart-muscle disease that makes heart muscle flabby and weak. The heart then becomes bigger as the heart muscle wall expands under the strain. The cause is not understood.

Dilated cardiomyopathy means the heart is enlarged – and pumps less strongly. This means enlarged chambers.

Hypertrophic **cardiomyopathy** is heart muscle being thicker than normal. In some patients the muscle becomes thicker and can partially block the flow of blood out of the left ventricle to the rest of the body.

Restrictive cardiomyopathy is a heart-muscle disorder where the walls of the ventricles become stiff, but not necessarily thickened, so they resist normal filling with blood. The heart muscle is stiff and doesn't relax properly.

Arrhythmogenic right ventricular cardiomyopathy is an inherited heart-muscle disorder where damaged heart muscle is gradually replaced by scar tissue and fat.

Cardiomyopathy Association CMA. The Cardiomyopathy Association, Registered Charity 803262, helps people and their families affected by the heart muscle condition cardiomyopathy.

The CMA provide support and easy-to-understand information on the different types of cardiomyopathy. The Cardiomyopathy Association meets a need unfulfilled by any other organisation and is supported solely by public donation.

As well as information on their website www.cardiomyopathy.org (This is not a link), they provide booklets on the three main types of cardiomyopathy – hypertrophic cardiomyopathy, dilated cardiomyopathy, and arrhythmogenic right ventricular cardiomyopathy. They also have videos and CD ROMs on hypertrophic and dilated cardiomyopathy. They have support groups around the UK where members can learn more about the condition and share experiences. They have a network of people affected by the condition who can offer one-to-one support on the telephone. They hold regional information days around the country at which cardiologists experienced in dealing with cardiomyopathy give presentations on the condition, latest treatments and research, and answer members' questions.

The CMA has a long-established link with the Specialist Inherited Cardiovascular Disease Clinic run by Professor William J McKenna, a world expert in cardiomyopathy, at the Heart Hospital, London.

The association's work is recognised and supported by The BCPA, The British Heart Foundation, and The British Cardiac Society. Their freephone helpline is 0800 018 1024, 8.30am to 4.30pm on weekdays.

Cardio-pulmonary resuscitation CPR is a first aid technique using chest compression and artificial ventilation, used till an ambulance arrives. It gives some oxygen supply and is the best that can be done. Unfortunately CPR alone may not always start the heart beating again properly. CPR is unlikely to bring a casualty back to life, but can prevent damage to vital organs, thereby giving the casualty a fighting chance of eventual full recovery by the treatment the emergency services will give.

Some people have extended the meaning to include defibrillation with an automatic external defibrillator.

Cardiopulmonary arrest means the same as cardiac arrest, though the term implies breathing has stopped. In practice, if the heart is not beating the patient will also not be breathing.

Cardiovascular means relating to the heart and its associated blood vessels, and the circulation of blood.

Cardiovascular disease (CVD) includes coronary heart disease, stroke, and peripheral vascular conditions.

Cardioversion. See DC cardioversion.

Catalyst. A catalyst speeds up a chemical process, but usually does not itself get used up or changed chemically. Vitamin B6 is a catalyst for various body metabolism processes.

Catheter means a tube that is inserted into an artery and passes along the artery to the heart. See Angioplasty catheter, Valvuloplasty.

Cerebrovascular means of or relating to the blood vessels of the brain and the blood supply to the brain. **Cerebrovascular disease** means disease of these, eg stroke.

CHD stands for Coronary heart disease.

Cheese – See factsheet on Fat content of cheeses.

Chelating agent means a chemical used to treat a poison – eg metals such as arsenic, iron, lead, and mercury. It works by converting the poison to something less harmful, and/or causing the body to get rid of the original eg in urine. Penicillamine is a chelating agent.

Chemistry terms are explained under Proteins.

Chemotherapy is drug treatment of cancer.

Chest pain – *causes other than heart attack* It may be helpful to be able to distinguish the following different causes of chest pain, some of which are not heart related.

The italics below are symptoms or a possible question a first aider or carer might ask.

- *Does your chest hurt when you **physically exert** yourself, and/or do you feel **tightness in your chest**, and/or does the pain sometimes also seem to be in your **left arm**, **left shoulder** or **neck**?*

If so, this may be a heart-related issue. If such a pain starts suddenly and is severe this may be a heart attack, so send for an ambulance and do as above.

If the pattern has occurred several times, but perhaps mildly so there seemed no need for any treatment, contact your doctor – it may be angina from not enough blood reaching the heart muscles.

● *Does your chest hurt when you **move**, **cough** and/or **sneeze**?*

If so, the cause may come from the chest muscles, bones, or joints, or from an injury. Preferably avoid strenuous activity and take an anti-inflammatory pain reliever such as ibuprofen or paracetamol.

● *Do you feel that your chest pain **constricts your chest**, and/or is the **pain below the left breast**?*

If so, this may be due to anxiety or stress. So try to relax, take deep breaths, and try to do something about the reason for the stress.

● *Does your chest hurt when you have **food** and/or hot **drink**, alcohol, and/or when **lying down**?*

If so, this may be heartburn, which nothing to do with the heart.

● *Do you have any **red spots**, **rash,** or **blistering** on your chest?*

If so, this may be **shingles**, a disease affecting the tissues between the ribs, and caused by a reactivation of chickenpox. See your doctor, and if it is shingles, since anyone who has not had chickenpox could catch it from your shingles, please avoid contact with pregnant women.

Also, it may be meningitis – (test by pressing with a glass tumbler and if the red spots do not disappear when pressed on it is likely to be meningitis and hospital treatment is urgently needed), or Weil's disease if they have been near a river, lake, seaside, or sewage works.

● *Is the pain worse when you take a **deep breath**?*

If so, this may be an inflammation of the pleura, which are the membranes that cover the lungs and linings of the chest cavity. It may be caused by a chest infection. Various causes have similar symptoms, so see a doctor.

Cholesterol is a white or pale yellow almost insoluble waxy chemical in animal tissue, blood, bile, and animal fats. It is naturally occurring in the body and needed for normal growth and health. The level of cholesterol can be measured in a blood test.

Cholesterol is the single greatest risk factor for the nation's biggest killer – coronary heart disease. Cholesterol is also a significant risk factor for cardiovascular disease, which includes coronary heart disease, stroke, and peripheral vascular conditions.

Cholesterol is produced by the body as well as absorbed from food and it is an essential component in every cell in our bodies. Cholesterol is only a problem if we have too much of it. Unfortunately, almost every one of us does – and many of us dangerously so. The real tragedy is that most people could avoid unhealthy levels of cholesterol because the most common cause of high cholesterol is excess saturated fat in the diet.

Too high cholesterol increases the likelihood of depositing it on the inside walls of blood vessels, leading to narrowing or blocking of them. This increases the risks of heart attacks, stroke, and/or other cardiovascular disease. If it is too high the patient will be advised to cut down on fats generally and especially saturated fats – found in dairy products and fatty meats; and where appropriate stop smoking, and/or lose weight. See Fats.

The components of cholesterol are high-density lipoprotein, HDL; and low-density lipoprotein, LDL.

HDL is good and should be at least a fifth* of the total: it is vital in protecting against coronary heart disease.

But too high **LDL** is believed to be bad and makes the risk of coronary heart disease higher.

In the years 2003-5 the recommendations changed slightly. After 2005 (still the same in 2008), various cardiologists and doctors recommend whichever is appropriate of the following criteria.

- The total HDL plus LDL should be less than 5.0.
- The total should be less than 4.8, or preferably even less particularly for patients who have had serious heart conditions and are thus at increased risk.
- The thing that matters is the LDL more than the total, and the LDL should be less than or equal to 3.0 to 4.0 for those at increased CHD risk.
- The ratio of HDL to the total should be at least one fifth; but some experts say at least a quarter, which has been the previous recommendation for many years.

See also Statin. **Statins** work by reducing cholesterol production by blocking an enzyme found in the liver. Thus they slow the progression of heart disease.

Cholesterol UK is a joint initiative of H·E·A·R·T UK and the British Cardiac Patients Association (BCPA). The charities came together in 2002 to address a mutual concern at the low level of cholesterol awareness among the British population, the lack of focus on primary prevention, and the implications of high cholesterol levels as a serious risk factor for cardiovascular disease.

Cholesterol UK aims to improve public understanding of cholesterol through education to raise awareness of how diet and lifestyle change can significantly reduce cholesterol levels. Cholesterol UK is lobbying government and related organisations, such as the Department of Health and the Food Standards Agency (FSA), for a national awareness campaign on fat and cholesterol and for greater access to high quality cardiovascular risk testing, which includes cholesterol testing, to enable better understanding of personal risk factors.

Cholesterol UK is currently (2007) supported by ALPRO Ltd, Merck Sharp & Dohme Ltd and Schering Plough Ltd (joint partners), and Unilever Ltd. Cholesterol UK believes it is important to work in partnership with a broad representation of organisations to help achieve its objectives and seeks to encourage new Cholesterol UK partners.

Circadian rhythm. The normal body temperature varies slightly each 24 hours, rising in the evening and having a minimum about 5am – called circadian rhythm. About six hours or more after getting up, ie in the early to mid afternoon, a second slight lowering and minimum occurs, but the temperature does not go as low as at 5am.

The heart rate ie pulse rate, the breathing, and the general level of activity and alertness also vary similarly – being slightly lower at the times that the temperature is lower. Here we are ignoring the effects of deliberate activity, stress, illness, or rest.

The circadian rhythm is reset to keep in phase with each day by the light of morning and getting up. The rhythm is controlled by the production of the hormone melatonin – normally slightly more is produced in the evening and slightly less at the low times. The bright light of morning reduces the amount of melatonin produced then and thus resets the rhythm.

Some people have done experiments in which a subject person stayed in a place that had no information about the real time of day, and generally they gradually settled into a longer circadian rhythm – typically up to 28 hours instead of 24 per cycle of sleep, meals and activities.

The body temperature and level of activity is also related to the level of thyroxine, which is produced by the thyroid gland. Thyroxine can also be prescribed. See also the related research under double-blind trial, and basal metabolic rate under metabolism.

Because of the way the circadian rhythm works, people should not do physical exercises *immediately* before going to sleep, as this may tend to trigger increased temperature, heart rate, breathing and brain activity, and keep them awake.

Cis. See cis under Fats.

Clavicle. A clavicle is a bone that connects the shoulder blades with the upper part of the sternum / breastbone. There is one each side.

Clopidogrel is an antiplatelet drug used to prevent blood clots from forming. So it is taken:

- to stop blood cells sticking together in your arteries, ie prevent blood clots forming, thus decreasing the chance of a heart attack or stroke
- as it may be suitable for patients who cannot take aspirin for its antiplatelet effects. It reduces the tendency of platelets to stick together when blood flow is disrupted. It can lead to abnormal bleeding.
- by some patients who have had a stent inserted into a coronary artery. For such patients it is usually given only for a short period – usually four weeks.
- by some patients with acute coronary syndrome or unstable angina, and then taken for up to a year. Such patients probably need to continue taking aspirin as well whilst on Clopidogrel. It increases the effect of the aspirin.
- by some patients who have a true allergy to aspirin, and therefore Clopidogrel may be given as an alternative.

It is typically prescribed to patients who have had a tendency for clots forming in the coronary arteries, or have or have had any of:

- a stroke
- a heart attack
- angina, particularly unstable angina.

The brand name is Plavix.

Clopidogrel is similar to aspirin, but works differently, and is only used for certain groups of patients. It is prescribed to patients who have a tendency to form clots in the fast-flowing blood of the coronary arteries, and/or who have had a stroke or a heart attack.

It is taken as tablets, 75mg once a day. It may be taken with water and either with or without food. The effects start after an hour and last 24 hours. If you miss a dose, take it as soon as you remember. If in doubt, contact you pharmacist or doctor for advice. Never double your dose or take extra. If by error you take too many contact your doctor or local hospital. The tablets should be kept in a closed container in a cool, dry place out of the reach of children.

Side effects of Clopidogrel are relatively rare, but some people may experience:

- bleeding and bruising, which are the main adverse effects of Clopidogrel. These may include nosebleeds, bleeding from a stomach ulcer, or blood in the urine. If you get these contact your doctor without delay.
- abdominal pain, nausea, and/or vomiting. If you experience these you should take your tablet with or after food.
- skin rash or itching, in which case contact your doctor but it is not urgent
- a sore throat, in which case stop taking the drug and contact your doctor immediately.

Clopidogrel interacts with aspirin, increasing the effect of the aspirin on platelets, and possibly increasing the risk of gastrointestinal bleeding. It also increases the coagulant effect of warfarin when both are taken.

Clostridium difficile. In 2006 there were 55,681 reported cases of patients over 65 with *Clostridium difficile, C diff* – up 8% on 2005, and taking 23,346,850 bed-days. In 2005 there were 51,767 cases; and in 2004 44,314 cases.

In England & Wales in 2005, 3807 death certificates mentioned *Clostridium difficile*.

C diff infection is the most important cause of hospital-acquired diarrhoea. It is a bacterium (bug) found naturally in the gut of 3% of healthy adults and 66% of infants, and people may have it harmlessly on their skin. It rarely causes problems in children or healthy adults – as other normal 'good' bacteria in the intestine keep it in check.

Unfortunately some antibiotics kill these 'good' bacteria, making *C diff* more likely. *C diff* disease occurs when certain broad antibiotics (given to treat MRSA) disturb the normal healthy intestinal bacteria. This allows *C diff* to flourish, producing a toxin that causes diarrhoea.

The *C diff* diarrhoea may be a mild disturbance for a few days or a very severe illness with bleeding from the colon (colitis), and perforation of the intestine leading to peritonitis, which can be fatal. The treatment is usually to stop the broad antibiotic and/or change to a different antibiotic.

Hand washing and room cleaning help prevent spread of *C diff*. Wash hands and arms up to the elbows for at least 30 seconds.

Hospital alcohol gel for rubbing on hands does *not* prevent *C diff*.

Clotting factors are chemicals in the blood that help to stop bleeding from a cut or injury. See Anticoagulant.

Co-. Pain-relief products named '**Co-**' – eg Co-codamol, Co-codaprin, Co-proxamol – contain both an opioid and a non-opioid. The non-opioid part may be either paracetamol or another NSAID. But codeine is just an opioid analgesic.

Co-codamol is a generic product containing codeine and paracetamol.

Co-codaprin is a generic product containing aspirin and codeine.

Codeine is an opioid analgesic. Used as a cough suppressant and/or antidiarrhoea.

Collagen is a fibrous scleroprotein that is rich in glycine and praline and that yields gelatin on boiling, and with two meanings.

1 Natural connective tissues and/or bones.

2 An artificial manufactured similar material eg for the stem of an Angio-Seal®.

Collateral has several meanings, including the following.

1 a person, animal or plant descended from a common ancestor but through a different line.

2 side by side.

3 supporting and/or corroborating.

By extension, where a coronary artery has a blockage, the branching smaller coronary arteries further on would not normally get any blood flow. But if one or more of these smaller ones join to other small arteries that are normally reached through a different coronary artery, they may get blood from there. This is collateral flow. Some of the branching smaller arteries will have blood flowing in the opposite direction to normal.

Coma is an unconscious state where the casualty does not respond to external stimuli such as noise or pain. See levels of consciousness.

Compression stockings fit tightly to help keep the blood circulation in the legs normal and to help prevent clots and/or an embolus.

Congenital means a non-hereditary condition existing at birth, usually an abnormality. A congenital heart defect is an abnormality of a heart chamber or valve, which may increase the risk of heart failure.

Consciousness. There are four levels of consciousness. A casualty may be any of **AVPU.**

alert eg can talk but maybe drowsy

responding to **voice**, simple commands or questions

responsive to **pain**, eg react by making a noise if you pinch the back of their hand – always say what you are doing

unresponsive, no response at all. Coma means an unconscious state where the casualty does not respond to noise or pain.

See ambulance for when to call an ambulance.

Consent. See separate factsheet on Consent.

See also Refusal.

The general legal and ethical principle is that valid consent must **'usually'** be obtained before starting treatment or physical investigation or providing personal care for a patient. This principle reflects the right of a patient to determine what happens to his or her own body and is a fundamental part of good medical practice. Case law has established that touching a patient without valid consent may constitute a civil or criminal offence. Poor handling of the consent process may lead to complaints from a patient.

My use of **'usually'** above means there are exceptions. These include grounds of necessity, where the patient is unconscious or cannot communicate, and others.

Contraindication means something in a patient's current condition and/or medical history and/or genetics that increases the risk of an adverse effect of a particular drug.

Contralateral means opposite side. Lateral means side, eg one side of the body. Contra means against, opposing, opposite.

Control group means a group of patients used as a control in a statistical research experiment or trial eg of a drug or new treatment. They do not receive anything useful but are needed for comparisons. Usually in the trial they receive either a placebo or the standard quantity of an existing standard drug. So the effects of the new alternative drug or treatment on another group of patients can be determined from the comparisons and differences between the observed results of the other group and of the control group. See Double-blind trial.

Co-proxamol is a generic name containing paracetamol and an opioid analgesic dextropropoxyphene. See co- under analgesic.

Coronary means the blood vessels, nerves and ligaments surrounding a heart.

It is also used in the sense of a person having a coronary – short for a coronary thrombosis, essentially meaning the same as having a heart attack.

The terms **coronary**, **coronary thrombosis**, **infarct**, and **myocardial infarction**, **MI**, mean the same thing as heart attack. A **thrombus** is a blood clot mainly made up of platelets.

Coronary angiography. This is a procedure for helping diagnosis of possible blockages in coronary arteries or in veins or arteries of a past bypass.

See separate factsheet on Coronary Angiography and Angioplasty.

Under local anaesthetic, a fine tube is passed into a femoral artery in the groin and along the body's arteries to the coronary arteries. A dye is injected to give an X-ray picture of the blood flow and arteries, indicating any narrowing.

Nowadays (2008) this can be done in a single day – so the patient is a day patient and normally is able to return home perhaps a couple of hours after the operation for recuperation and treatment in the hospital cardiac day ward.

Coronary angioplasty and stent insertion involves inflating a balloon inside the narrowed section of a coronary artery to enlarge or open it to improve the blood flow to the heart muscle. Usually also, a stent is inserted to keep the artery open.

If you, the patient, have a blocked or narrowed coronary artery, or have had previous bypass graft surgery and your graft has become narrowed, it may thus be possible to correct the problem without major heart surgery.

See separate factsheet on Coronary Angiography and Angioplasty.

Coronary arteries are the system of arteries and their branches that supply the heart muscles. The blood flow to these comes off the aorta and divides into three main arteries.

- **left anterior descending** LAD at front left
- **right coronary artery** RCA
- **left circumflex** LCX at the back left.

Each of these then subdivides through branches to capillaries to feed blood to the heart muscle.

For **coronary artery disease** see Coronary heart disease, artery risk factors and artery.

Coronary artery bypass graft, **CABG**, pronounced 'cabbage', is an operation that connects and replumbs coronary arteries to bypass their blocked part or parts. It uses an artery and/or vein from elsewhere in the patient's body, such as a mammary artery and/or a leg vein.

See separate factsheet on CABG.

Co-proxamol. In January 2005 a decision was taken to withdraw **co-proxamol** gradually over the next 18 months.

It was only available on prescription. It was widely used for the relief of mild to moderate pain, and contains a mild opioid analgesic – dextropropoxyphene, combined with paracetamol. It was withdrawn as both it has a high overdose danger rating and research does not show that it is any more effective than paracetamol alone.

The co-proxamol brand names affected are Cosalgesic and Distalgesic. The issue is that although co-proxamol is safe as long as the recommended number of tablets per 24 hours is not exceeded, a small overdose is dangerous. The maximum is two tablets every six hours, ie eight per 24 hours. But taking just ten in 24 hours is dangerous: it may lead to unconsciousness or even death. The instructions also say that doses must never be taken less than 4 hours apart. The co-proxamol overdose symptoms include irregular breathing, drowsiness, or unconsciousness. Hence the following **caution.** Doses of co-proxamol must never be taken less than 4 hours apart.

A patient who usually takes two co-proxamol tablets every six hours, and forgets to take a dose, will probably take the missed dose when he or she remembers. This could be say three hours late, and then they would take the next dose on time. This seems so reasonable.

Yet it means the two co-proxamol doses are only three hours apart, breaking the 4-hour rule. That is known to be dangerous. So co-proxamol has a high danger of overdose. Incidentally so also do some other drugs.

In 2003-4 there were over 300 UK deaths a year from co-proxamol overdoses, though some may have been suicides.

Coronary heart disease, **CHD**, means any combination of disorders of the heart or heart muscles or blood flows.

Coronary heart disease is also known as **coronary artery disease**, and ischaemic heart disease.

Coronary heart disease is narrowing (stenosis) of the coronary arteries by atherosclerosis – fatty deposits of plaque. This causes too little supply of oxygen to the heart muscle.

CHD may affect one or more arteries, which may be of different diameters (calibre). Each narrowing of an artery may be partial or total.

The narrowing may have no symptoms; or may lead to angina – chest pain that may be severe enough to restrict or prevent exertion. A critical reduction of the blood supply to the heart may result in myocardial infarction or death.

CHD is a major cause of disability and premature death in the UK.

Factors increasing the risks of CHD include:

lack of exercise – 37% of CHD deaths are related to inactivity
smoking – 19% of CHD deaths are related to smoking
unsatisfactory diet, eg:
- not enough fish, poultry or meat, green vegetables and fruit
- too much salt, saturated fats, and/or excess alcohol

increased weight or obesity – see BMI
too high cholesterol LDL
hypertension ie high blood pressure
diabetes
stress.

Of **avoidable risk factors** and lifestyle issues, the most important are lack of regular exercise, and smoking. Others include unsatisfactory diet, excess alcohol, obesity, and high cholesterol.

Coronary revascularisation means treating blocked coronary arteries by either balloon angioplasty or coronary artery bypass graft.

Coronary thrombosis is a thrombus in a coronary artery, roughly the same as a heart attack.

Corticosteroids are explained under Allergy. **Corticosteroids**, often called **steroids**, are formed naturally in the adrenal glands – on each kidney, and their release is controlled by the pituitary gland, which is near the base of the brain.

Cortisol. See under Stress.

Coumarin. See under Anticoagulant.

COX. See COX under NSAIDs.

CPR stands for Cardio-pulmonary resuscitation.

CVD stands for Cardiovascular disease.

CVS = **Cardiovascular system**. See Cardiovascular, System.

Cyanocobalamin is Vitamin B12, a complex red compound, occurring in liver. It is formed from carbon, hydrogen, oxygen, nitrogen, phosphorus, and cobalt. It is needed to form haemoglobin for red blood cells to carry oxygen. Shortage gives anaemia. See B12 under Vitamin for foods.

Danger. See Danger under First Aid.

Death rates. CHD and strokes are the major causes of disability and premature deaths in the UK. For examples of advances in knowledge see Take both aspirin and a statin under Statin, and BHFNC under Exercise.

Deaths from circulatory diseases per 100,000 UK population have dropped slightly in recent years. The figures in the table are 2002.

Deaths per 100,000 population	Males 1996	Males 2002	Females 1996	Females 2002
From all causes	1045	975	1099	1034
From all circulatory diseases	442	385	465	404
From Ischaemic heart disease eg CHD	273	218	220	170
From Cerebrovascular disease eg stroke	86	87	141	135

The other causes not included in the table are, in decreasing order: All malignant neoplasms eg cancers, Pneumonia, Bronchitis and allied conditions, Chronic liver disease and cirrhosis, All accidents and adverse effects, Suicide, and Diabetes mellitus. Source: Department of Health.

DC cardioversion uses a small electrical current through the front of the chest and thereby through the heart, which will hopefully bring the heartbeat pattern back to normal. **DC** means direct current.

In **DC cardioversion** a small amount of electricity is given through the front of the chest and thereby through the heart, which will hopefully spin it back to normal.

The procedure is very safe indeed. The commonest problem is minor irritation of the skin following the procedure. There is a very rare chance that any clot that may have previously formed within the heart could be dislodged by this procedure. Taking warfarin before the procedure minimizes this risk.

Everything is done as a day case and you will be allowed to go home in the evening, although you will not be allowed to drive. You should have someone to escort you home. See Atrial fibrillation treatment.

Deep vein thrombosis, **DVT**, means a blood clot in a leg. This can occur after surgery, long bed rest, or pregnancy; or may arise from genetic disorders. It also commonly occurs while or after sitting in a cramped situation and/or where unable to move around – especially on long flights or long car journeys.

One danger is that a blood clot produces an embolus that flows with the blood to the lungs or heart – producing a pulmonary embolism or blockage of a coronary artery and unfortunate death. The risk may continue for up to a fortnight after the flight or whatever. About 1 patient in 100 who develop DVT dies – a total of 500 to 1000 UK people per year. Patients who develop a swollen leg and go to see a doctor or hospital should tell the doctor if they have been flying in the previous fortnight, to alert the doctor to the situation.

Research showed that patients taking low-dose aspirin and who developed DVT were less likely to develop a dangerous pulmonary embolism.

Defibrillator. See Automatic external defibrillator.

Dependence means physical or psychological dependence on a substance, eg addiction.

Physical dependence means getting physical withdrawal symptoms such as sweating, abdominal pain, or convulsions if without the drug. **Psychological dependence** means mental craving if without the drug.

Dermatitis is a skin inflammation. Vitamin H prevents it and also helps avoid loss of hair.

DES means drug-eluting stent, explained under Stent.

Diabetes, in full **Diabetes mellitus**, is a common condition where the glucose in the blood is too high because the body cannot use it correctly. It is a disorder of the carbohydrate metabolism giving excessive thirst, and producing urine with an excess of sugar. Healthy people have no sugar in their urine.

Type 1 diabetes, insulin dependent diabetes, is when the body does not produce insulin because the pancreas cells that make it have been destroyed. It develops over a few weeks; and is treated by insulin injections, regular exercise, and diet. In the UK there are about 350 000 Type 1 diabetics (2002 figure).

Type 2 diabetes, non-insulin dependent diabetes, is when the body produces some insulin but not enough. It develops slowly; is less severe than Type 1; and is treated by diet, exercise, tablets, and/or insulin. In the UK there are about 1 million Type 2 diabetics (2002 figure). Until recently Type 2 diabetes was found only in people over 40, or among younger people with a genetic risk such as Asians.

Diabetes produces increased thirst, abnormally large amounts of urine, tiredness, weight loss, itching, and/or blurred vision.

Diabetics have a higher risk of developing heart disease, stroke, high blood pressure, circulation problems, and/or damage to nerves, kidneys and eyes. The risks are very high for those who are overweight, smoke, and/or are not physically active. See Glucose, and Insulin.

If untreated, diabetes may lead to heart disease, stroke, and/or kidney disease.

A urine test detects glucose in the urine. There should be none. If diagnosed early, Type 2 diabetes can be reversed through lifestyle changes, and/or controlled by drugs and diet.

Diastolic. See Blood pressure.

Diet.

See separate factsheet on diet.

The recommendations are aimed at preventing or reducing the risks of heart disease. They do not apply to children under five years old or to people training for sports or who are ill.

Dilate, dilation, means to make or become larger or widened or enlarged.

Dipyridamole is a drug developed in the 1970s as an anti-angina to help people to exercise. More effective drugs for that have been developed since; but it is still prescribed as an antiplatelet. Dipyridamole acts by thinning the blood, reducing the risk of a clot forming eg in an artery – useful for patients who have had a stroke or transient ischaemic attacks, TIAs or have had a heart vale replaced. It is usually given with other drugs such as warfarin or aspirin. As side effects it may cause stomach upset, nausea, and/or headache. Rarely it may cause diarrhoea, dizziness, fainting, rash, or breathing difficulties. It may interact with anticoagulants and increase their effect – giving increased risk of bleeding. It may also interact with antacids which may reduce its effectiveness. See also under MIBI.

Disability. See Disability under Impairment.

Disease means any poor working of a body function, eg a change from normal caused by an infection, stress, illness or sickness.

Donor means a person whose organs may be or are being or have been donated for a transplant to another person. The patient receiving the organ is the **recipient**.

There are not enough donor hearts to offer a lifeline to all those who need them. In 2004/05, 115 heart transplants were done in the UK; but 15 patients died while waiting for a donor heart. At 31 March 2007, 7,234 patients were listed as actively waiting for a transplant.

In the UK between 1 April 2006 and 31 March 2007:

- 3,086 organ transplants were carried out, thanks to the generosity of 1,495 donors.
- 949 lives were saved in the UK through a heart, lung, liver, or combined heart/lungs, liver/kidney, liver/pancreas, or heart/kidney transplant.
- 2,137 patients received a kidney, pancreas or combined kidney/pancreas transplant.
- 2,402 people had their sight restored through a cornea transplant.
- A record number of non-heartbeating donor kidney transplants took place and accounted for one in seven of all kidney transplants.

● 164 combined kidney / pancreas transplants took place (representing a 53% increase on 2005-2006).

Living donor kidney transplants are increasing – 461 in 2003-2004, 475 in 2004-2005, 589 in 2005-2006, and 690 in 2006-2007; and now represent more than one in four of all kidney transplants.

Donor register. The **Donor Register** is a means for individuals to express their wishes to donate organs and tissue for transplantation and give critically ill people the opportunity of a longer and better life. The benefits of transplantation are available for all to see – just go to the Transplant Games, held annually around the UK, and see the new lives that recipients are living.

At any time in the UK about 8,000 patients are waiting for a transplant. Eg in early June 2006 this included 104 UK people including 9 children registered waiting for a heart transplant.

Because of the shortage of donors only about 3000 transplants are done in the UK per year. Each year about 1000 patients die while waiting for a transplant (2006-7 figures, see details below).

About a million more people pledged to help others after their death by registering their wishes on the NHS Organ Donor Register, bringing the total from 13.2 in March 2006 to 14,201,229 at 31 March 2007.

The UK has an **opt-in** position – ie if a person is willing after their death for their organs to be used for transplants to others they can get that recorded by adding themselves to the Donor Register. This can be done online through the Bristol-based charity **Transplants in Mind** at www.transplantsinmind.org.uk (this is not a link to click on). If during their lifetime they have not opted in, after their death it is initially assumed that their organs cannot be used – their relatives may be consulted and may give that consent.

For many years some people have been in favour of the alternative, **opt-out** – where it is assumed that everyone is willing for their organs to be donated after death unless they were to indicate otherwise by opt-out during their lifetime. This would make far more organs available, saving the lives of many who are waiting for a transplant.

Related issues include the following.

● Some people are willing to donate a kidney – which some people can do without affecting their own future health

● Some people want to leave their bodies including most organs for medical research and/or teaching eg for three years after death; but eg their cornea could be transplanted

● How to ensure the accuracy, privacy, and security of centrally held databases while making access widely available quickly to those who need the information immediately after the death

● Preferably people should not have continuously to carry a card or other indicator of their wishes throughout their lives. This is inconvenient, requires effort, and in some situations is impossible or unreasonable.

Dorsal means towards or relating to the back or spine. Opposite of Ventral. Also see Posterior.

Double-blind trial. In a double-blind trial patients who have a particular set of conditions are randomly allocated to one of several alternative treatments. One treatment is a placebo – that is a tablet that has no active ingredient, thus giving a control group.

The term **double blind** applies because *neither the medics nor the patient knows* whether that patient is receiving the drug, or which of several drugs at what dose, or a placebo. Usually the trial is randomized, so each patient selected to be included in the trial is randomly allocated to one of the various alternatives. The results after the trial period are then compared to look for statistically significant differences between the alternative groups.

Eg in a trial of prescribing thyroxine for hypothermia and low basal metabolic rate, the team selected all those patients – about 100, who: attended an old people's clinic regularly every six weeks, were aged over 50, had temperature lower than 96 F, (35.5C) at 10am, and consented to being in the trial. A drug manufacturer was asked to make packs of 42 tablets of six colours – with some colours having the standard dose of thyroxine and others being placebos. The 100 patients were randomly allocated to the colours.

At a 'first' checkup, called A, each patient had his or her head and shoulders photo taken under standard conditions, and was given 42 coloured tablets to be taken daily. At the next checkup, B, exactly six weeks later, each was again photographed and got another 42 tablets. At the third checkup, C, their photo was again taken.

Any who had a hospital appointment in their 12 weeks or did not complete the whole were excluded, leaving 87. A panel of seven doctors who had never had any contact with any of the patients was assembled. They were shown the photos in a properly randomized order, and each doctor recorded a mark for the wellbeing of the patient as judged solely from the photo.

In the analysis the means and standard deviations of the A photos, the B photos, and the C photos were calculated for each colour. Then for each colour the statistical significances of the differences of B from A, C from B, and C from A were calculated. For three colours the C-A differences were (highly) significant at 1%, and the B-A and C-B differences either significant at 5% or significant at 1%. For the other colours no significant differences occurred. Similar patterns applied to men and women patients separately.

In this research trial even the people doing the statistical analysis did not know which colours were what, nor how many of the colours had thyroxine!

The team then wrote to the drug company, and they replied that those three colours were the ones with thyroxine, and that the others were placebos.

Thus over six to 12 weeks the wellbeing of a patient with low temperature will probably improve if prescribed thyroxine. This research was done in the 1960s.

Drip means the same as intravenous infusion – a slow injection of a fluid into a vein.

Drug. A drug is any substance used as an active chemical in the composition of a medicine.

Inert substances – inactive ingredients that do not have any significant biochemical effect – may be added to create a desired volume, taste, consistency, colour, or other properties.

Each drug has a generic name, brand names for marketing by different companies, a usual recommended dosage or pattern, how soon it takes effect, and how long it remains active. It may have associated advice on diet, storage, and/or missed doses. The drug may produce side effects or adverse affects, may interact with certain other drugs, may need special precautions, and/or may lead to longterm effects so monitoring may be advised.

Before buying medicines over the counter tell your pharmacist what medication you are taking, to avoid accidentally buying a drug that interacts with some drug you are already taking. This is important for medication for indigestion, coughs, colds, headache, sinus problems, or hay fever.

It is helpful to keep a list of all medication you are currently taking.

Finding drugs

See glossary entries for any of: ACE inhibitor, Alphablockers, analgesic, anticoagulant, aspirin, Aspirin is an NSAID, Betablocker, Calcium channel blockers, clopidogrel, Co-codamol, co-proxamol, drug-eluting stent, Glyceryl trinitrate, ISMO, Medicines – taking and storing, nitrates, non-opioids NSAIDs and non NSAIDs, opioids, paracetamol, Potassium channel activator, Side effect, Slow release, statin, thyroxine, valsartan, Warfarin.

The generic and/or brand names of many other drugs occur in the Glossary text – try doing a Find on the name.

Drug-eluting stent. See under Stent.

Echocardiogram or **echocardiography**, also called **cardiac ultrasound**, uses ultrasound waves to give a picture of the inside of the heart, its chambers, valves, and main arteries.

See separate factsheet on Echocardiogram.

An echocardiogram is a painless procedure that uses ultrasound to produce a moving image of the inside of your heart. It is a useful test for checking the structure of your heart and to see how well it is functioning– eg look at its chambers, valves, and main arteries, but not the coronary arteries, which are too small. Your care will be adapted to meet your individual needs and may differ from what is described here.

An echocardiogram uses an ultrasound probe, which is run over your chest to get a moving picture of your heart. Harmless high-frequency sounds are produced near the skin. You will not feel anything and the sound waves will not affect your body in any way. They go through the skin, bounce back from part of the heart, and produce an echo that comes back to the probe. The procedure is carried out in hospital by a cardiologist or a technician trained in the procedure. Possible reasons why you may have an echocardiogram include the following.

- to check whether your heart doesn't pump as well as it should
- to check for complications after a heart attack
- to look for damage to the heart valves if you have symptoms of heart valve disease
- to check for heart disease in newborn babies and young children
- to look for heart defects in unborn babies – fetal echocardiogram

When you are reclining comfortably a clear gel is applied to the skin on the left side of your chest. The probe, called a transducer, emits ultrasound waves. The sound waves are reflected back from the surfaces outside and inside your heart. It reveals any abnormalities of your heart valves and shows the size and shape of the chambers of your heart. Echocardiography also shows up any abnormal communications between two heart chambers. This is especially important for diagnosing babies and children. Ultrasound scanning can be used on fetuses in a womb before a baby is born.

Economy class syndrome means deep vein thrombosis caused by travel in a cramped position, particularly on a long flight.

EF = **ejection fraction**, the percentage of the maximum full volume of a ventricle that is being pumped out at each heartbeat.

Elective means not compulsory, ie by choice – eg elective surgery.

Electrocardiogram ECG. An electrocardiogram or electrocardiograph records the rhythm and electrical impulses that your heart produces every time it beats, obtained from electrodes connected to the chest.

See separate factsheet on ECG.

You may need to have an ECG if you have a problem with your heart – such as palpitations, dizziness or chest pain – to find out what the problem is. The test can detect whether you have an abnormal heart rhythm, whether you have had a heart attack, and/or if your heart is working under strain.

If you are about to have an operation, you may have an ECG beforehand to check how well your heart is functioning. You may have an ECG after surgery to help decide how much exercise

you can do. An ECG can also form part of a routine health check-up. GPs are often able to do the ECG in their surgery; but sometimes you will need to be referred to a hospital.

The ECG results indicate whether or not the heartbeats are normal; abnormalities such as damage to heart muscle from a past heart attack; and/or that some part is enlarged, damaged, or working under strain – eg from high blood pressure.

ECG Procedure

Small metal adhesive discs – called electrodes – will be stuck onto your skin – one on each arm and/or leg and several on the front of your chest. The tiny voltages at each electrode are amplified and either connected to a pen producing a wavy line on paper, or the same pattern on a screen.

The procedure is completely painless and the machine will not give you an electric shock or affect your heart in any way. It is your own heart that produces the electrical signals. The machine merely records them.

To specialists the graphs indicate whether or not the heartbeats are normal; abnormalities such as damage to heart muscle from a past heart attack; and/or that the left ventricle is enlarged, damaged, and/or working under strain – eg from high blood pressure.

Other tests

For some patients, full diagnosis may need other tests as well. The ECG is a valuable diagnostic tool, but the standard test with the patient resting has some limitations. Some so-called abnormalities indicated by an ECG can have a trivial and innocent cause. On the other hand, a patient can have a normal ECG and still be suffering from some form of heart disease.

Better information is gained by recording the ECG with the patient under exertion – called an Exercise stress test. The patient walks at varying speeds on the level and then on an upward slope while the recording is taken. See also Event monitor, Finometer tilt testing, MIBI. An Echocardiogram and ECG may be done together.

Electrode. In pacemaking, an electrode is the electrically active portion of the lead that delivers a stimulus to the heart to get the heart beating properly.

For an electrocardiogram, an electrode is an electrical connection patch touching the skin that detects the heart's electrical signals.

Electrolyte. See Body salts.

Element. See trace elements needed under Minerals, or the chemistry Element under Proteins.

Elixir is a clear sweetened liquid forming the base of eg cough medicine. It often contains some alcohol.

Eluting, **elution**, means chemical purification or separation by washing. See under Stent.

Embolus. An embolus or **embolism** is a part of a blood clot that breaks away and flows in the blood to somewhere else. A pulmonary embolism is such a clot that flows to and stops in a pulmonary artery near the lungs. See Blood clot.

Emetic is something to make a patient vomit. It irritates the stomach lining and/or stimulates the part of the brain that controls vomiting.

Emulsion is a mixture of two liquids that don't normally mix but in the presence of a third substance (an emulsifying agent) can be mixed. The final mixture may behave as drops of one liquid in the other if shaken.

Endocarditis is inflammation around the heart and heart valves. Such patients may be unable to take some antithrombotic medicines.

Endocrine gland. The **endocrine glands**, also called ductless glands, secrete the hormones directly into the blood. They include pituitary, pineal, thyroid, parathyroid, adrenal, testes, ovaries, and the islets of Langerhans in the pancreas that produce insulin. See under hormone.

Endorphin is a natural painkiller released from the brain.

Endothelial tissue is tissue lining the blood vessels, heart, and some other cavities.

Enteric coating means a drug has a coating so after being taken by mouth it passes through the stomach without affecting the stomach, and affects the intestine.

Enzyme is a protein that controls the rate of some chemical process in the body. Each type of cell produces a particular group of enzymes – so a person's body has thousands of enzymes. Eg cells in the liver have enzymes that control the breakdown of various body nutrients.

Epinephrine is a neurotransmitter produced in the medulla (innermost centre) of the adrenal glands, hence its original name adrenaline. Synthetic drugs have been made since 1990. Brand names are: Ana-Guard, Ana-Kit, Anapen, EpiPen, and Minijet.

The drug is given in an emergency to stimulate heart activity and raise low blood pressure. It narrows blood vessels in the skin and intestine. Epinephrine is injected to counteract cardiac arrest or to relieve severe allergic reactions (anaphylaxis) to drugs, food, or insect stings.

When anaphylaxis strikes, life is at risk. So time is critical. Patients at risk of anaphylaxis should carry a prefilled syringe for immediate self-injection at the start of an attack – the syringe dose is 0.3ml. The onset of the effect of the injected dose is within about five minutes, and lasts up to about four hours.

As epinephrine narrows blood vessels it can also be used to control bleeding and/or to slow the dispersal of local anaesthetics – and so prolong their effect.

Erythropoietin is a hormone needed for red blood cell production. See Kidney.

Esters. An **ester** is any of a group of compounds produced by a reaction between acids and alcohols and with elimination of water. Fats are solid esters. See under Lipids.

Event monitor. An **event monitor** takes a continuous recording of the electrical impulses produced by the patient's heart – like an ECG over 24 hours or a week. Holter monitor means the same.

A patient can wear the monitor all day and night, and walk about unhindered. It typically has three or four electrodes picking up signals from the chest and a small portable recorder for recording the signals – eg a box clipped to your clothing. It is usually done as an outpatient procedure and is particularly useful if you have symptoms that only occur intermittently – such as palpitations, dizzy spells or faints.

See separate factsheet on Event Monitoring.

It gives a record of how your heart behaves as you go about your normal daily life. Recording your ECG in this way is very valuable as it may show that you would benefit from a heart pacemaker, or from drug therapy, or from some other further treatment.

The technician will stick electrodes to your chest in the same way as for a simple ECG, and connect the wires to the recorder.

Before you leave the hospital you will be given a diary and asked to use it to note down the time of day when any symptoms occur. Your entries in this log will draw attention to the times when you have experienced symptoms.

You should come back to the hospital as arranged so that the technician can remove the recorder, and you hand in your diary.

The recording can be played back at up to 60 times speed – eg an hour played back each minute. The playback can be even faster if the operator knows from your diary when to concentrate on and can skip playback of your sleeping hours for example.

Newer event monitors available since 2001 or 2002 use better computer technology and can run for up to a week. They are much smaller and lighter than earlier monitors.

Exercise. See also under Stress, Exercise stress test, and Exercise plan after a heart attack.

In April 2004 the UK Chief Medical Officer, Sir Liam Donaldson, said that most* adults should take at least 30 minutes of moderate** physical exercise on five or more days per week, and children should take 60 minutes of moderate physical activity every day.

*Here 'most' obviously excludes those training for a sport and those who are ill or not fit enough to take such exercise.

**Moderate physical activity here means causing an increase in breathing rate, higher pulse rate, and feeling warm. The increases may be slight and should be easily within what the person can do without any breathlessness or pain.

This does not mean going to a gym. The adult quota can be achieved by eg three ten-minute bouts such as vacuuming or mowing a lawn. Even dusting and ironing need about twice the rate of physical energy that sitting needs. See also Walking.

Two-thirds of UK men and three-quarters of UK women are not active enough to benefit their health. Exercising cuts the risk of premature death by a third.

Because of the way the circadian rhythm works, people should not do physical exercises *immediately* before going to sleep, as this may tend to trigger increased temperature, heart rate, breathing and brain activity, and keep one awake.

The British Heart Foundation National Centre for Physical Activity and Health, BHFNC, has found the following.

- 37% of CHD deaths are related to inactivity; as compared to only 19% of CHD deaths being related to smoking.
- Inactivity is the most prevalent risk factor for CHD, with 70% of women and 60% of UK men not active enough to achieve the health benefits from physical activity.
- 9% of UK deaths from CHD could be avoided if people who are currently sedentary or have a light level of physical activity increased their activity to a moderate level.

Exercise plan after a heart attack – Do's and don'ts

When you are recovering in the first four to six weeks after a heart attack, you should not do anything that requires **lifting**, **pulling**, **pushing**, or a **sudden burst of energy**. If you are unsure about an activity, ask.

It is **OK** to do: light housework, dusting, cooking, washing dishes, making tea, light hand washing, shopping (but someone else should carry heavy loads), light gardening (weeding, planting out, trimming, watering with a hose).

It is **OK** to experience: slight breathlessness, feeling your muscles working, slight sweating, and/or tiredness that soon passes.

Avoid: heavy housework, vacuuming, scrubbing, sweeping, washing windows, driving a car, running upstairs or for a bus, lifting heavy items, painting and decorating, heavy gardening, mowing, digging, watering involving carrying a heavy can.

Stop immediately if you experience any of the following warning signs: pains in the chest, sickness or nausea, excessive sweating, excessive shortness of breath.

If these symptoms are not quickly relieved, do not hesitate to seek medical advice.

Walking is an ideal exercise for your rehabilitation. It is relaxing, non-strenuous exercise – free, easy, and safe.

To build up your stamina follow these five stages. Remain in each stage until you can complete it comfortably – at least three days. Move on to the next stage only when you feel ready.

Stage 1. Climb stairs and take a short walk 2 to 3 times a day

Stage 2. Take a continuous walk for ten minutes each day

Stage 3. Increase walking time to 20 minutes

Stage 4. Increase walking time to 45 minutes

Stage 5. Keeping the same distance, try to do it in less time while still feeling comfortable.

Exercise stress test. This is performed to assess how the patient's heart copes when exercising – walking at increasing speeds and perhaps jogging on a treadmill simulating level ground and/or going uphill. During this, an electrocardiogram monitors the heart. Any symptoms experienced will be recorded and your blood pressure and pulse will be monitored. These help diagnose angina, distinguish stable angina from unstable angina, and diagnose other CHD.

The **Bruce Treadmill Test**, also called the **Bruce cycle**, is an exercise stress test on a treadmill with a standard pattern of speeds and slopes at 3-minute intervals. The patient starts walking at 2.74km/hr on a slope upwards of 10%. After 3 minutes the slope and speed are increased to 4.02 at12%. There are a total of ten such 3-minute stages taking it up to 12.07 at 28% starting after 27 minutes. Even a fit athlete is not expected to be able to do all stages so the test stops when the athlete cannot continue.

For heart patients, as an aid to diagnosis, the test is conducted with a doctor and/or other medic present for safety, and continuous recording of the patient's electrocardiogram ECG.

Fitness can be measured by the volume of oxygen an athlete can consume while exercising at maximum capacity.

VO2 max is the maximum amount of oxygen in millilitres used in one minute per kilogram of body weight. Those who are more fit have higher VO2 max values and can exercise more intensely. One can increase one's VO2 max by working out at an intensity that raises one's heart rate to 65% to 85% of one's heart rate maximum for at least 20 minutes three to five times a week. The original research paper is by Bruce, RA: *Multi-stage treadmill test of maximal and sub maximal exercise* (1972).

Fats. People need some fat for health; else their systems could not process the fat-soluble vitamins A, D, E and K.

The recommendations below are aimed at preventing or reducing the risks of heart disease. They do not apply to children under five years old or to people training for sports or who are ill. See also reducing undesirable fats under Diet. See also Fat content of cheeses.

Fatty acids are compounds of carbon, hydrogen and oxygen that form part of a lipid molecule. Many derivatives are formed by modifying the chain of carbon and other atoms in each molecule.

Monounsaturated fat is found in olive oil, groundnut oil, and rapeseed oil – and is believed to be good.

In monounsaturated spreads derived from these, the oil is changed from a liquid into a spread by adding hydrogen atoms at appropriate places on the fatty acid molecules, called **hydrogenation**. The resulting margarine, which may be called **reduced-fat spread** or **hydrogenated vegetable oil**, is claimed to be fairly good for health; but is not as good as the original unprocessed olive oil, groundnut oil, or rapeseed oil, because some cis may have been changed to trans by the heating.

Mono, Olivio, Olive Gold, and Blue Band are such margarines. **Mono-** means one.

Polyunsaturated fat is believed to be good for health. It is found in corn oil, sunflower oil, safflower oil, sesame, and soya oil and oily fish. **Poly-** means many. Polyunsaturated molecules have long carbon chains with many double bonds, such as omega-3, cis, and trans below.

Saturated fat is in dairy fat, red meat fat, coconut oil, and palm oil. These are mainly hard at room temperature, and come from animal sources – eg butter, lard, fat on meat, or cream. These are believed to be generally bad for people with any heart related disease or risk of it.

More generally, because they are believed to be bad for all adults, saturated fats should be eaten only occasionally or in small quantities. Some vegetable fats are also high in saturates – eg many hard margarines, and non-dairy cream.

Low-fat spreads usually contain half or less fat than butter or ordinary margarine, and therefore fewer calories. They may contain saturated or polyunsaturated fats – check the label.

Omega-3 are a group of long-chain fatty acids, and known to reduce the risk of heart disease. They are lipid-regulating; and they lower the level of triglycerides; so after a heart attack they reduce the risk of further heart attacks and increase overall survival.

The main food sources are *fresh or frozen* oily fish: salmon, pilchards, tuna, sardines, trout, mackerel, and herring. Unfortunately, *tins* of fish of these kinds contain less omega-3, since the processes of preparing the tinned products remove or change some of the omega-3. Several manufacturers produce Omega-3 as capsules.

Since the 1960s or earlier some people have known that eating oily fish once or twice per week helps prevent narrowing of the arteries and CHD.

The claimed beneficial effects of omega-3, as well as those above, include: lowering blood pressure, inhibiting breast cancer, reducing inflammation in rheumatoid arthritis, and improving bone growth.

Cis and trans. Cis is healthy, trans is not.

Cis. The natural form of double bond between two carbon atoms in a fat is a **cis structure**. Generally fatty acids with a cis structure are believed to be ***good*** for people. To imagine a **cis structure**: form a horizontal V with the index and middle finger of each hand, and touch corresponding fingertips together. Tuck in your third and fourth fingers – making fists except for the touching fingers, and extend your thumbs towards your chest so the tips of your thumbs are as far apart as possible. Each fist represents a carbon atom, joined together by a double bond – your touching fingers. Your thumbs each represent a bond, and each such bond goes to a group of atoms in an unsaturated compound. Imagine also a bond to a hydrogen atom coming off the back of each hand. This is a cis structure. Here **cis** means the two unsaturated compound groups of atoms are both on the *same* side of the double bond – the same side as your body.

But ***trans*** fatty acids are generally believed to be ***bad*** for health.

Trans-fatty acids, also called **trans fats**, are unsaturated fatty acids with at least one double bond that is a trans structure molecular configuration.

They occur naturally *in small amounts* in dairy products and meat. The food label may say **hydrogenated vegetable oil**. **Trans-fatty acids** occur in *some*: margarines, cakes, biscuits, pastries, and fast foods. The amounts in different makes and types of similar foods such as margarines vary substantially.

Trans fatty acids are also formed by **hydrogenation** of vegetable oils – a process that converts vegetable oils into semisolid fats – sometimes done to extend the shelf life of processed foods. **Trans fatty acids** are formed when vegetable oils are artificially hardened, ie processed into a solid fat by heating. The main sources are blocks of hard vegetable margarines and bought cakes and pastries. They should be limited – especially if your blood cholesterol is high.

For a **trans structure**: keep your left hand where it was for cis, and turn over just your right hand – palm away from your body, so each index finger now touches the opposite middle finger tip, and your right thumb points away from your chest. The **trans** has the two compound groups of atoms on *opposite* sides of the double bond – the left one is towards your body and the right one away from you. **Trans** means across, on the other side, through, or beyond.

A 2004 research study compared people that ate foods with more trans-fatty acids with others in a control group who ate foods with less trans-fatty acids. The study found that people who ate more trans-fatty acids generally had: higher LDL, lower HDL, higher risk of thrombosis, and more heart disease – all these are undesirable!

Femoral artery. Each femoral artery is a main artery for blood flow to a leg. It comes near the skin at the crease at the groin.

Fibrillation is a local uncontrollable twitching of the heart wall fibres or parts of muscles, and/or irregular beating. See Atrial fibrillation, and Ventricular fibrillation.

Fibrinogen is a blood-clotting agent. In research trials high levels were found to be statistically associated with an increased risk of adverse heart conditions such as CHD.

Finometer tilt testing. Hospital staff investigate a patient who has blacked out and where the cause cannot be diagnosed by other tests. They try to make it happen again under controlled conditions.

The patient lies settled in a darkened room on a bed tilted say 45º, while blood pressure, ECG, and perhaps other variables are continuously recorded – giving the changing trends on a beat-by-beat basis. Eg when the patient is tilted the patient's BP changes before he or she feels unwell.

The BCPA in 2003 bought a Finometer machine costing over £15,000 for Papworth Hospital. This was then the only such machine in East Anglia that can do full blood tests with continuous monitoring, so doctors and other hospitals send such patients to Papworth.

First aid is the first help given by the first person at the scene or incident. It is not complicated and does not need much equipment. **First Response** means essentially the minimum knowledge as a short course of up to about four hours.

Carers and relatives of people who may need help should do a short first aid course if possible, giving the knowledge and confidence to deal with likely situations.

It is not feasible to explain first aid fully here. People need to go on a short course.

See ambulance for when to call an ambulance.

First aid course. A four-hour first aid course includes training and practice at dealing with a variety of casualty situations, including doing CPR on a dummy. These skills may help prevent further injuries, help recovery, and save lives.

To attend a course, enquire locally at St. John Ambulance, St. Andrew's Ambulance Association, or the British Red Cross. A telephone directory usually gives the number.

On eight occasions over the last 30 years, I have been the first or nearly the first person to reach a casualty or stop at a road traffic accident. Most of these accidents involved a casualty needing first aid and an ambulance to hospital. One was a heart attack – the patient was taken to hospital and recovered.

The three first aid principles are to **PPP**

Preserve life

Prevent deterioration – by treating any life-threatening conditions such as shock and bleeding

Promote recovery – by preventing danger, reassuring each casualty, putting them in an appropriate position, and eg protecting them from cold, wet, and wind.

The carer or first aider should continually say to the patient what you are doing, aware that the patient may hear and see even if they are not responding.

The first person to arrive at an accident or emergency should do an initial survey – **danger, response, airway, and breathing** – **DRAB**.

Avoid **danger** – check the safety of everyone, make the situation safe, not rush in until sure that it is safe to approach – eg gas, electricity, fumes, traffic, spilt fluids eg poisons, fire, dangerous building, rocks that might fall, tide, and/or people who might make it worse.

Don't move a casualty unless they are in some danger.

Assess the situation – prioritise if there are several casualties, get bystanders to help as appropriate, get help, ask the casualty questions eg whether they have pain and where, listen to what they say.

At a road traffic accident, as soon as you know how many casualties and the severity of their injuries – eg whether conscious or unconscious, and whether likely to be stretcher cases – get someone to phone for an ambulance and tell them a brief description of the injuries. See ambulance for when to call an ambulance. They should come back to say they have done it.

If the casualty does not immediately speak or cry, speak loudly into each of their ears, eg 'Are you all right?' and gently shake their shoulders. Maybe say your first name, eg 'I'm ...'

If no response to that, check the casualty's level of **response.** Shout a command such as 'open your eyes' into each ear in case they are deaf. If no response, check whether they are **breathing** by putting your cheek near their mouth & nose to feel their breath, listening, and watching their chest and abdomen for movements.

If not breathing, open their **airway** by tilting the head back, and check for breathing again.

If not breathing, call 999 for an ambulance as above and do Cardiopulmonary resuscitation.

If they are breathing, but not responding to voice, say what you are doing in case they can hear you though unable to speak, look for signs such as fractures or other injuries or conditions, maybe put them in the recovery position.

Also see levels of consciousness. See ambulance for when to call an ambulance.

Fish. See oily fish under diet.

Flavin has three meanings:

1 another name for quercetin.
2 a heterocyclic ketone, formula $C_{10}H_6N_4O_2$, that forms the nucleus of some natural yellow pigments, eg riboflavin.
3 any yellow pigment based on meaning 2.

Flavone has two meanings:

1 a crystalline compound occurring in plants, with formula $C_{15}H_{10}O_2$.
2 any of a class of pigments derived from meaning 1.

Flavonoid. There are six classes of flavonoids: flavonols, flavones, isoflavones, flavanones, flavan-3-ols and anthocyanins.

Quercetin and epicatechin are the major flavonoids in our diet – their main sources being red wine, cocoa, onions, tea, (and particularly) apples – **ROTA**. Quercetin is metabolised very quickly by the intestine and liver, and is not actually found in human blood.

Flavonoids in the diet lower heart disease risk. See an apple a day.

Folic acid is an essential vitamin needed to avoid anaemia and to control homocysteine.

Formula in chemistry means the chemicals in a molecule of a compound expressed in symbols (that are abbreviations for elements and/or simple structures), numbers (how many such), and implying the structure. Plural **formulae**.

The atoms are denoted by single or double letters – eg H is hydrogen, C is carbon, N is nitrogen, O is oxygen, Na is sodium, Cl is chlorine.

Also – represents a single bond, and = represents a double bond.

So eg NaCl is sodium chloride, which is common salt. Also H_2O has two hydrogen atoms and one oxygen atom, and is water. The oxygen atom has two bonds and each hydrogen has one bond. So it is structurally like H–O–H but always written H_2O.

Also, –OH is a shorthand for –O–H, which means an oxygen atom and a hydrogen atom; and the oxygen has two bonds, one to the rest of the molecule and the other to the hydrogen which has one bond.

In many formulae most of the bonds are omitted, and people trained in chemistry understand.

Formulary is a book giving the details of drugs and other health products – eg for pharmacists, medics, dentists, and manufacturers.

Free radical. See Antioxidant.

Generic name. The generic name eg of a drug or chemical is the general English language name. Contrast with brand name = trade name = name for a particular product manufactured and marketed by a commercial company.

About 83% (2007 figure) of NHS prescriptions by doctors in the UK are written using the generic name, so the prescribing pharmacist may provide the patient with the cheapest version of the required product. Sometimes doctors prescribe a particular brand, giving the brand name, eg if there is some reason why the patient should have that particular form of the drug.

Generic names are normally not spelt with an initial capital; but brand names normally have an initial capital.

The **chemical name** for a drug essentially describes its chemical composition and is normally not used by medics, pharmacists or patients.

GI stands for Glycaemic Index.

Gland. The endocrine system has various glands in different places around the body. They produce hormones and release them into the bloodstream. Each endocrine gland produces one or more hormones. Each hormone governs a particular body function. These functions include growth, repair of tissues, sexual development, reproductive functions, and response to stress.

Glucose is the type of sugar in the blood – giving energy for muscles and metabolism; and in bread, pasta, potatoes, rice, pulses, whole grains, and cereals. It is obtained from sweet foods, and from starchy foods such as bread and potatoes. After a meal the blood glucose level rises and insulin is released into the blood. When the blood glucose falls again during activity, the insulin level also falls. Insulin stops the blood glucose getting too high. Formula $C_6H_{12}O_6$.

See Insulin and Diabetes.

Glycaemic Index, GI. Beneficial low-GI foods are digested slowly and therefore release glucose gradually into the blood. People thus feel full for longer, maintaining their energy level and metabolism, not feeling so hungry or tired, and hence feeling fewer urges to eat snacks between meals.

The **GI** of each food is from 0 to 100, being the rate of digesting and converting the food into glucose in the blood. Low GI is 0 to 55, medium GI 56 to 69, and high GI 70 or over.

Essentially, this means eating less sugar and foods with sugar as an ingredient; and instead having carbohydrates and other foods that are digested slowly so the body gets the energy gradually over a longer time.

Foods without any carbohydrate have **zero GI** – meat, fish, cheese, and eggs. Sausages have some carbohydrate so have a low GI.

Low-GI foods are beneficial: all fruit & green vegetables (fresh, raw or lightly cooked), salad (use low-fat dressing or no dressing), peanuts, yoghurt, porridge, pasta.

Low GI foods 0 to 55

apple juice 40	kiwi fruit 52	peanuts roasted salted 14
apples 38	lentils red 26	pearl barley 25
baked beans 48	macaroni 45	pears 38
banana 55	milk chocolate 49	peas 48
butter beans 31	milk skimmed 32	porridge 42
carrots boiled 49	milk whole milk 27	soup lentil soup 44
cherries 22	noodles 40	soup tomato soup 38
crisps 54	orange juice 46	spaghetti white 41
dried apricots 31	oranges 44	spaghetti wholemeal 37
grapefruit 25	pasta 32	sweetcorn 55
green grapes 46	peaches 42	yoghurt low-fat fruit 33

Medium-GI foods include: wholemeal bread, orange juice, bananas, basmati rice, porridge, new potatoes, ice cream, and pineapple.

Medium GI foods 56 to 69

apricots tinned 64	croissant 67	pizza 60
biscuit 59-64	crumpet 69	potatoes boiled 56
bread pitta 57	honey 58	potatoes new 62
bread rye 65	ice cream 61	raisins 64
bread wholemeal 69	melon 67	rice basmati 58
coca cola 63	muesli 56	shredded wheat 67
couscous 65	pineapple fresh or tinned 66	sultanas 56

High-GI foods produce glucose fast, so the person may feel hungry before the next meal is due, and if they don't use the glucose when it is produced it contributes to making them fat and overweight. High-GI foods include: white bread, short-grain white rice, french fries, doughnuts, cornflakes, baked / mashed / jacket potatoes, many processed products and generally anything with sugar – eg sugar-rich drinks, cakes, chocolate, crisps, cornflakes, pies, sweet pastries, croissants, and doughnuts.

However, if high-GI foods are eaten with low ones, the low-GI foods may partially slow the absorption of the sugars in the high-GI foods.

High GI foods 70 to 99

bagel 72	chocolate 68	potato mashed 70, jacket 85
baguette 95	cornflakes 84	puffed wheat 89

bread white 70	french fries 75	rice cakes 82
cheerios 74	jelly beans 80	rice short-grain white 98
chips 75	parsnips 97	swede 72

Research studies have shown the following, all of which are beneficial for health and/or heart risks, (though it was not clear whether each finding was statistically significant).

● Women who ate the low-GI types of carbohydrates as above had: higher HDL, lower LDL level, and lower triglycerides.

● Lower levels of homocysteine, which is an amino acid (explained under Proteins), were observed in some Koreans who changed from high-GI rice to low-GI rice for six weeks. Lower levels of homocysteine reduces risk of CHD and of Alzheimer's disease.

● People who had eaten high-GI foods were found to lack calcium, iron, and zinc – which the body needs traces of. Some children who normally had high-GI diets had on average lower IQ (intelligence quotient) than those who ate a low-GI diet; but this may be because refined foods generally have reduced levels of other desirable nutrients such as the three mentioned above, and/or because of lifestyle or environment.

● Since glucose and Vitamin C are absorbed and enter cells in the same way:

* those eating a low-GI diet had increased levels of Vitamin C absorbed from their foods.

* if there is too much glucose, from a high-GI diet including sugar and foods containing sugar, then less Vitamin C is absorbed.

Glycine is a white sweet crystalline amino acid that occurs in most proteins. Also called aminoacetic acid. Formula CH_2NH_2COOH.

Glyceryl trinitrate. See Glyceryl trinitrate under Nitrates.

Graft. A graft is a piece of tissue, artery, vein, or organ that is transplanted to a place where it is really needed from elsewhere in the patient's body or from a donor. It also means the operation of such transplanting and joining. See Coronary artery bypass graft.

Haematology means the study of blood, blood tissues, and blood diseases, including taking blood samples and analysing them.

Haemoglobin is the component of blood that carries oxygen from the lungs to other tissues. It combines with oxygen in the lungs where the oxygen concentration is high, and releases it to tissues where the concentration is low. Shortage gives anaemia.

Half-life is the time for a drug concentration in blood to drop to half its initial concentration. More widely in science it is the time for half of a gradual physical or chemical process to occur – eg for half of a quantity of a radioactive substance to change. After a further equal amount of time there will be a quarter of the original still unchanged. An equal time later there will remain one eighth.

Slow release tablets are arranged so they have an appropriate half-life – eg the surface has something that controls the rate. Hence patients can take the tablets at regular intervals and get an appropriate concentration of the drug in their body.

Handicap. See Handicap under Impairment.

HDL. See Cholesterol HDL under Cholesterol.

Health. ***Ten steps to a healthier heart***. The recommendations below are aimed at preventing or reducing the risks of heart disease. The diet items do not apply to children under five years old or to people training for sports.

1 If you smoke – stop.

2 Eat at least five portions of fruit and/or vegetables each day.

3 Reduce or keep down total fat consumption, and in particular intake of saturated fat. Replace saturated fat with polyunsaturated and/or mono-unsaturated fats. For example try a cholesterol-lowering product such as Flora pro.activ® or Benecol®. This is available as: a low-fat spread, a milk drink, or a yogurt. You should aim for three portions per day.

4 Plan meals in advance and check nutrition labels. These can sometimes be surprising.

5 Include fresh or frozen oily fish in your diet at least twice a week. The main sources of omega-3 are *fresh or frozen*: salmon, pilchards, tuna, sardines, mackerel, and similar fish.

6 Eat plenty of foods rich in carbohydrate like bread, pasta, rice and potatoes. Avoid or reduce sugar, cakes and biscuits. See GI.

7 Minimize your salt intake.

8 Moderate levels of alcohol provide protective cardiac health benefits, particularly to those at risk from coronary heart disease. Chardonnay and red wines are suggested.

9 Make sure you have a balanced diet and include an intake of essential vitamins, minerals and proteins.

10 Achieve and maintain a healthy body weight.

Healthcare Commission. This is the independent inspection body for the NHS and the private and voluntary healthcare sectors in England & Wales. It aims to ensure quality and promote improvements. It has a legal obligation to report to the Secretary of State significant failings and recommendation for special measures. Special measures are produce improvements where other normal methods have failed or are considered likely to fail.

Heart. The heart is the organ that pumps blood round the body. It is about the size of a fist, behind the breastbone / sternum, and nearly central but slightly to the left. It has four chambers, four valves to prevent flows in the wrong direction, and muscles. See Atrium, Ventricle, Valve, and Coronary arteries.

The heart muscles are supplied with blood through three arteries – the back left, the front left and the right. Each of the three branch into a network of smaller arteries and capillaries. This system of arteries and branches is called the Coronary arteries. All three are fed as branches coming off the **aorta**, which is the main artery carrying blood from the left ventricle to the rest of the body.

The commonest cause of damage to the heart is a heart attack. Damage can also be due to high blood pressure, hardening of the coronary arteries, narrow or leaking valves, and/or excess alcohol drunk over several years.

High blood cholesterol may also cause narrowing of and deposits in the arteries, including the coronary arteries. Atherosclerosis means narrowing and thickening of arteries due to the build-up of cholesterol and other cells.

Heart attack. The following terms essentially mean the same thing as heart attack**: coronary**, **coronary thrombosis**, **infarct**; and **myocardial infarction** MI (which really means destruction of an area of heart muscle as a result of obstruction of a coronary artery).

See separate factsheet on Heart Attack, and Exercise plan after a heart attack.

A **heart attack** is the effect of an artery becoming blocked or significantly narrowed by a clot forming in a coronary artery – one of the arteries supplying the heart. The clot interrupts blood flow to the heart muscles, so an area of heart muscle is deprived of adequate blood. This may cause permanent scarring and damage to an area of the heart muscle.

This causes a lack of oxygen in a part of the heart, which then becomes less able to work effectively and scarred – possibly permanent scarring in the affected area. Adverse chemicals build up, and pain is felt. The rest of the patient's heart now has to work harder to get used to the extra workload.

This clot may occur suddenly. The patient feels a persistent vice-like central chest pain, which may spread to the left arm and/or the neck and jaw; is breathless; may suddenly faint or collapse; and has rapid or weakening pulse. Unlike stable angina the pain does not ease when the patient is at rest. Some people have a 'silent' heart attack in which they feel no pain.

In a **heart attack** the patient's heart does *not* usually completely stop beating. The heart attack may cause permanent scarring and damage to an area of the heart muscle.

Each year over 200 000 people in the UK have heart attacks. In the UK, heart and circulatory diseases are the biggest killer. About 110 000 to 120 000 people die from coronary heart disease per year in the UK. Coronary heart disease is the commonest cause of premature death in the UK. Many deaths are preventable.

Many heart attacks occur away from hospitals. Many occur within the first few minutes of the symptoms. Prompt access to the right treatment can mean the difference between living and dying. This means CPR, defibrillation and immediate transfer to hospital.

Each year about 20 000 people in the UK develop angina for the first time.

Most women imagine that heart disease affects men only. In fact, one in four women die through heart disease. Heart disease here means damage to the heart caused by narrowing of the coronary arteries. At first there may not be any noticeable symptoms. As it progresses it can lead to angina chest pain; and if an artery becomes blocked then part of the heart dies, leading to a heart attack.

Heartbeat. The word heartbeat means either an individual beat of the heart, or the heart rate.

Heartblock is a condition in which the electrical impulses from the atria – upper chambers of the heart are not transmitted correctly to the ventricles – lower chambers of the heart, causing a slow heart rhythm. Some patients do not need much treatment; some have dizziness and/or fainting; and some need drugs or a pacemaker.

Heartburn is a burning acrid feeling in the throat, and nothing to do with the heart. This may occur during pregnancy or to people who are overweight and/or smoke. Preferably do not eat late into the evening just before going to bed, reduce alcohol if any, reduce spicy foods if any, and at night prop oneself up with pillows. Maybe try any medicine for excess stomach acidity – ask a pharmacist.

Heart condition is a very general term for any heart-related condition, disease, disorder, or abnormality.

Heart disease is a general term for any undesirable heart condition such as Coronary heart disease.

At least 2.7 million UK people face severe disability through the irreversible effects of heart disease.

Heart failure means that the heart muscles cannot pump enough blood efficiently to meet the body's needs. It does *not* mean that the heart has stopped. Most cases are due to coronary heart disease, but about one-third of cases are due to high blood pressure. With mild severity, there will be almost no symptoms, whereas more severe cases may have breathlessness, swelling of the ankles and general tiredness. With appropriate treatment patients can adjust to their condition and live with it.

It was estimated that about 650,000 people in the UK have some form of heart failure (in 2004). These cost the NHS about £625 million a year. Many have mild severity, almost no symptoms, and hence are not seeing a doctor.

Heart rate means the number of beats per minute. Pulse means the same, from to take the pulse meaning to measure it.

The normal adult rate is about 60 to 80 beats per minute. It is higher in babies and children, and rises during exercise.

The ***heart rate maximum*** for a very fit healthy adult when exercising is about 220 minus age; but most non-sports people are advised to restrict their maximum exercise to somewhat lower than that – say 65% of that or perhaps to 180 minus age. Some sports people have trained so well that their exercise heart rate does not increase as much as those that are not so fit.

The heart rate may also increase with fear, stress, blood loss, injury, and/or some illnesses. It may decrease with hypothermia, low thyroxine, fainting, emotional shock, and/or some heart conditions.

Heart UK is a charity formed on 27 June 2002 by a merger of the Family Heart Association and the British Hyperlipidaemia Association. It regards itself as The Cholesterol Society.

About 1 in 500 people have inherited high cholesterol, ie their genetic condition causes their liver to produce too much cholesterol; and Heart UK aims to help them. Like the BHF and the BCPA, they publish various information sheets. The BCPA and Heart UK co-operate. Tel 01628 628 638, www.heartuk.org.uk. (This is not a link.)

Heparin. See Anticoagulant.

High blood pressure. See Hypertension.

High-density lipoprotein, HDL. See HDL under Cholesterol.

Histamine is an amine formed from histidine that is released by body tissues in allergic reactions that cause irritation. It dilates blood vessels, contracts smooth muscle, and stimulates gastric secretions. Formula $C_5H_9N_3$.

Antihistamines are treatments for all kinds of allergic reactions. They are subdivided according to their chemical structure – so each subgroup has different actions and/or characteristics. Topical creams applied to the skin mainly act on the muscles surrounding the small blood vessels that supply the skin and mucous membranes – eg brand name Anthisan. Other antihistamines act on airways in the lungs thus reducing congestion and breathlessness; or on the brain giving a sedative effect and suppressing the coughing and vomiting mechanisms.

Antihistamines block the action of histamine on H1 receptors, which are in various body tissues eg the small blood vessels in the skin, nose and eyes. The antihistamines help to prevent the dilation of the vessels – thus reducing swelling, watering, and redness. Antihistamines also reduce the secretions from tear glands and nasal passages.

Antihistamines may cause drowsiness – affecting coordination, and hence cause clumsiness; and may have side effects such as dry mouth, blurred vision, and difficulty passing urine. So it may be advisable to avoid driving. They also increase or cause similar effects to alcohol, sleeping drugs, opioids, and anti-anxiety drugs.

Histidine is a sweet-tasting crystalline amino acid that occurs in most proteins – a precursor of histamine. Formula $C_3H_3N_2CH_2CH(NH_2)COOH$.

Hives is a non-technical name for Urticaria.

Holter monitor means Event monitor.

Homocysteine is an amino acid, which is explained under Proteins.

Patients with too high level of it in their blood are at increased risk of having a stroke. Eating more fruit and vegetables and/or taking folic acid supplements reduces the level and cuts the risk of a stroke. A patient's level of homocysteine can be determined from a blood test.

Lower levels of homocysteine are statistically linked to reduced risk of CHD and of Alzheimer's disease.

Hormone. A hormone is a chemical produced in an endocrine gland and transported in the blood to a particular tissue where it exerts a particular effect.

The main drug groups are Corticosteroids; and drugs for diabetes, pituitary, sex hormone, and thyroid disorders.

HRI is an abbreviation for the *Heart Related Information* documents previously available from the BCPA, but now all out of print.

Human Nutrition Unit HNU is next to the Institute of Food Research on Norwich Research Park. It does nutrition studies on human volunteers. Tel 01603 255000.

Hydrogenation. See under monounsaturated fats.

Hyper- means too much, in excess; or above, over. Contrast with hypo-

Hyperlipidaemia means too high cholesterol, usually too high LDL. See Cholesterol.

Hypertension HT is commonly called **high blood pressure**, nowadays defined as above 140/85 mm Hg; or over 135/80 if one is diabetic.

About 38% of UK adults have hypertension. Correct treatment of hypertension reduces the risk of a heart attack by about 20% and reduces the risk of stroke by about 40%. Most people with hypertension need tablets to lower their blood pressure. Advice and treatment includes exercise, lifestyle changes, and/or diet changes, as well as drugs.

See separate factsheet on Hypertension – High Blood Pressure.

Hypertrophic, **hypertrophy**, is enlargement of an organ or part of an organ resulting from an increase in the size of the cells. Eg see cardiomyopathy

Hyperventilation is increased breathing rate, duration, depth, and/or volume. This may cause cramp or dizziness.

Hypo- means too little, less than enough; or under, beneath, below. Contrast with hyper-.

Hypothermia is too low body temperature, eg below about 35 C (95 F). This can develop slowly over several days in a cold building in winter. Outdoors this is usually from cold, wet and/or wind. Otherwise, eg in older people, it may be related to metabolic rate and/or thyroxine deficiency, as explained under Metabolism. Older people are less able to compensate for temperature changes, and being less sensitive to cold may not initially respond to a slight drop in temperature. The elderly are at risk if they have poor heating or do not switch it on, are thin or frail, have arthritis and/or are not able to get about, are tired, and/or are ill.

Hypothermia has several stages. See also consciousness.

- Feeling slightly cold, perhaps shivering, possibly with cold pale dry skin – people put more clothing on and recover quickly, and this is normal
- Deteriorating performance, which others usually notice before the subject himself or herself does; perhaps with not responding normally to questions, apathy, irrational behaviour, or arguing; and the elderly may delay preparing and eating food
- Serious, where the shivering stops, slowness, lethargy, little or no participation in activities, not even responding to commands, slow or shallow breathing, slow and weak pulse, just lying down
- Lapsing into unconsciousness, perhaps eventually leading to a heart attack or cardiac arrest.

The body systems react by trying to preserve life – keeping the heart, brain and essential functions working, and reducing the blood flow to the extremities by narrowing the arteries.

Hypothermia Treatment: in serious cases always call a doctor or ambulance or take the patient to hospital, as the hypothermia may hinder recognition of a heart attack or stroke.

If a patient at home got cold slowly and is in the early not serious stages, warm them slowly. Rapid warming such as in a hot bath would be wrong, as initially it would cause the skin blood vessels to dilate; and blood would flow to the extremities, rather than to the central organs that are vital for survival and life. It would also initially cause more cold blood than previously flowing to return from the extremities back to the heart, and thus tend to cool the brain and other vital organs.

For healthy people who have got very cold outdoors: remove the patient from the cold, wet and wind eg to a building or tent; put on dry clothing; let them lie down in a bed with extra duvet or blankets or in a sleeping bag and survival bag; and/or they can have a hot bath.

Hypothesis. See Statistically significant.

Hypothyroidism and **Hyperthyroidism**. See under thyroxine.

Idiosyncratic reaction. An unexpected adverse effect that occurs at the first use of a particular drug by a particular patient, and unrelated to the amount of the dose. People vary (eg genetically and/or having or not having a particular enzyme) so it can occur for one patient and not another.

IHD. See Ischaemic heart disease.

Immune system. The immune system is the body mechanism that produces antibodies when any foreign substance has been detected – eg from taste, touch, breathing, injury, or injection. The result may show as skin reddening, swelling, itching, and/or other allergic reactions.

Immunisation is a process to produce immunity as a preventive. See vaccine.

Impairment. People have an implicit belief that impairment causes disability. **Impairment** is the extent of the damage or disease – eg damage to the heart muscle or blockage in the arteries.

Disability is the difference from age-adjusted 'normal' – eg amount of angina, loss of mobility, quality of life.

Handicap is societal effects – eg driving licence, insurance.

Many people wrongly think that impairment is proportional to disability. *For heart disease* there is often little or no relationship between the amount of blockage in the coronary arteries and the patient's symptoms.

Implantable cardio-defibrillator, **ICD**. An ICD is a small electronic device implanted under the skin that continuously monitors the heart beats, and automatically reverts the heartbeat to a normal rhythm and/or does defibrillation whenever needed. The wire to electrically control the heart may be routed through a vein. This device is often fitted to patients with very fast heart rate, which could cause them to faint or cause their heart to stop beating. Compare Artificial pacemaker.

Incision means a cut. Eg a small cut in the skin to insert a catheter into a femoral artery; or a cut through the sternum for heart surgery.

Inert. See Inert under Drug.

Infarct means roughly the same as a heart attack. Strictly it means a localised area of dead tissue resulting from obstruction of the blood supply to the relevant part, especially by an embolus.

Inferior means lower in quality or value; or situated beneath or lower in position. Opposite of Superior.

Inflammation is the reaction of living tissue to infection and/or injury – giving redness, swelling and/or pain.

Institute of Food Research, **IFR**. They research issues relevant to food and human health – working to provide the underpinning science for consumers, policy makers, food industry, and academia. They have researched the benefits of An apple a day. They are funded by BBSRC. Next to Human Nutrition Unit on Norwich Research Park. Press Office tel is 01603 251490.

Interact. Interaction between pairs of drugs and/or medicines may occur. This means one does not work or produce its desired effects when in the presence of the other; and/or when taken together they have undesirable side effects.

Insulin is a protein hormone made in the pancreas, which is on the left at about waist level. It controls the concentration of glucose in the blood and helps glucose enter cells for use as fuel. It helps convert sugars in carbohydrates into fuel for the body, and helps convert excess sugars into fat. Deficiency of insulin produces diabetes mellitus. Some diabetics may need insulin, which can be as an injection.

Intercostal muscles and tissues are those between the ribs.

Internal mammary artery. An artery in the chest, to supply blood to the breast. You have two – left and right – LIMA, RIMA. May be used in a Coronary artery bypass graft. See artery.

International Normalized Ratio, **INR**, is a measure of the clotting property and viscosity of blood – in the sense that thick sticky blood is more likely to clot, and thin blood to bleed more. The measure helps decide how much anticoagulant may be needed. It measures the time taken for the blood to clot. The norm value is 1 for a healthy person not on an anticoagulant.

Intravenous infusion, also called a drip, is a slow injection of a fluid into a vein.

Ischaemic heart disease, **IHD**, means an inadequate supply of blood to the heart or a part of the heart muscles, usually from obstructed blood flow. Strictly, **ischaemia** (or ischemia) means an inadequate supply of blood to an organ or part. IHD is used as the generic term in death statistics. For IHD see coronary heart disease.

Isosorbide mononitrate, **ISMO**. See Isosorbide mononitrate under Nitrates.

iv = intravenous. See Intravenous infusion.

IVC. See Vena cava.

Jaundice is caused by an accumulation in the blood of bilirubin, a yellow-brown bile pigment. The skin and whites of the eyes look yellowish. It is a disorder of the liver.

Joule. See under Calorie.

Jugular vein. A jugular vein is one of the three veins in the neck that return blood from the head to the heart.

Ketone means any of a class of compounds with the general formula R'COR, where R' and R are usually alkyl or aryl groups. See also acetone.

Kidney. The body has two kidneys, one each side at about waist level. They produce erythropoietin, which is a hormone needed for red blood cell production. Patients with kidney failure lack this hormone and become anaemic.

LA = left atrium.

Lateral means side, eg one side of the body. Contralateral means opposite side.

LDL. See Cholesterol LDL under Cholesterol.

Left anterior descending LAD. See Coronary arteries.

Left circumflex LCX. See Coronary arteries.

Libido is the desire for sex.

Lipid. Lipids are any of a group of organic compounds that are **esters** of fatty acids or closely related substances. Generally they do not dissolve in water. but are soluble in some other organic solvents.

An **ester** is any of a group of compounds produced by a reaction between acids and alcohols and with elimination of water. Fats are solid esters.

Lipid-lowering agent means a drug that reduces raised cholesterol. The longterm aim is to reduce the Cholesterol LDL, as explained under Cholesterol, Lipids, and statins.

They reduce the amounts of various fats in the blood – either by interfering with the absorption of bile salts in the bowel, or by altering the way the liver converts fatty acids in the blood into various different lipids.

Some lipid-lowering drugs bind to bile salts in the intestine and prevent them from being reabsorbed. This reduces the bile salts in the blood and triggers the liver to convert more cholesterol into bile salts – thus reducing the level of cholesterol.

Living will. This is a statement made by a person before their health deteriorates badly, about what they would like or not like as regards treatment and/or care if their health were to deteriorate. See Consent and Refusal.

Lotion is a liquid to apply to the skin.

Low-density lipoprotein, LDL. See Cholesterol LDL under Cholesterol and see statins.

Lymphocytes. See Antibodies.

Magnetic resonance imaging MRI. This can be used eg to see whether the heart muscles are working properly, and if not then is whatever is wrong reversible.

Mammary artery. There are two mammary arteries in the breast area – left and right, and one may be diverted to make a coronary artery bypass as in a coronary artery bypass graft.

Mast cells. See mast cells under Allergy.

Mean. See mean under Average, Standard deviation.

Median. See median under Average.

Mediators. See mediators under Allergy.

Medicines – taking and storing. Patients often need assistance, with emphasis on:

- why particular medicines have been prescribed
- how to take them
- who to contact if there are any concerns.

Suggestions and recommendations include the following.

Understand what each medicine and/or drug is for. Follow the directions and instructions, including any special warnings.

Keep medicines out of direct sunlight and away from children.

Try not to miss any dose. Unless told otherwise, if you miss a dose, take it as soon as you remember if that is well before half the time till the next dose is due. But if you do not remember till the next dose is due or nearly due just take it then and regard it as taking that next dose early. Never take a double dose. If in doubt contact your doctor or pharmacist.

Do not stop taking any medicine unless instructed by your doctor, unless exceptionally it is producing some undesirable side effect and you are unable to contact your doctor. Some drugs need a gradual reduction of dose, as stopping abruptly may cause withdrawal symptoms and/or a recurrence of whatever the original trouble was.

When buying over-the-counter remedies, inform your pharmacist of any prescribed medicines that you are taking, so the pharmacist can verify that the medicines do not interact in some undesirable way.

Make sure you never run out of any medication. If you will be travelling or going on holiday, particularly abroad, get a repeat prescription covering the holiday period.

Only get a repeat prescription for the medicines that you are currently taking.

Always keep medicine in its original labelled container.

If going to stay in a hospital, take your medication from home with you.

Keep a list of all the medicines that you are taking – including vitamins, herbal remedies, over the counter remedies, eye drops, inhalers; and have it with you whenever it might be needed.

Never share medicines with anyone else.

Do not store unwanted medicines at home; return them to your pharmacy for disposal.

If you have any problem about your medicines, do not hesitate to ask your pharmacist or doctor. Also see the caution warning under co-proxamol under Analgesic, where it would seem reasonable yet be dangerous after missing a dose to take it three hours late and also take the following dose on time only three hours after that.

Medulla means the innermost centre part. Eg see Adrenaline, Epinephrine.

Melatonin is a hormone produced in the pineal gland. See melatonin under Circadian rhythm.

Meningitis or **meningococcal disease** can come on very fast – often in a few hours or can be as long as 14 days. It can occur in people of any age from below one year upwards, and can occur in patients who have a heart condition. It has some or all of the following symptoms, with mnemonic THE FARM VioLiNs.

Temperature
Headache – Severe headache and sore eyes when looking at light are important symptoms
Eyes sore
Fever
Appetite loss
Rash or red spots that do not disappear when pressure is applied, eg by a glass tumbler
Muscular pain
Violent vomiting, or nausea – feeling about to vomit
Light aversion, wanting to lie down in the dark, or not look at light
Neck stiff – an important symptom, caused by inflammation around the brain or along the spinal cord.

Take the patient to A&E without delay. Tell the doctor / nurse that he or she has a rash that does not disappear, as a medic might not think of Meningitis or Weil's disease. Delay could be fatal.

The symptoms are similar to Weil's disease. In meningitis the spots may or may not disappear when pressure applied.

There are **two types of meningitis** – viral and bacterial.

The **viral meningitis** is more common and also less dangerous.

The **bacterial meningitis** type has two forms.

- The less common bacterial type is sudden with severe headache, shock, rash that looks like bruises, and can lead to death in a very short time.
- The other, more common, bacterial type is more like a cold, with severe headache, vomiting, and rash; and usually lasts about two days.

Metabolism is the sum total of the chemical processes occurring in the body. This includes all body functions – brain, heart, breathing, circulation, digestion, growth, recovery from injury, availability of energy and the right chemicals for everything needing them, and elimination or removal of waste materials and products; as well as usual everyday functions and activities that you might initially think of.

Metabolise means to do the whole of these chemical processes.

The **basal metabolism** is the amount of energy per unit time that the patient's body needs when *resting* – for breathing, heart, brain, and other body functions.

The **basal metabolic rate** is the rate at which the patient's body is actually producing energy or heat when *resting*. Measuring core body temperature when a patient is sitting at rest about mid-morning gives a good indication of basal metabolic rate.

Thyroxine increases metabolism. Lower body temperature and reduced activity go with lower thyroxine. See Circadian rhythm, and an example under Double-blind trial.

Methicillin Resistant Staphylococcus Aureus, **MRSA**, is also often used to mean any s*taphylococcus* that is resistant to an antibiotic. **SA** = **Staphylococcus Aureus**.

Staphylococcus is a bacterium that is common on skin and can cause disease when there is opportunity to enter the human body. Skin, wound, urinary-tract, and blood-stream infections may then develop.

Staphylococci are often present in boils and infected cuts; and grow if transferred to food. This causes food poisoning – usually with abdominal pain, vomiting, retching, and maybe diarrhoea, typically starting six to 24 hours after infection and lasting many days.

MRSA is a common bacterium found in many people's noses and/or on their skin. Normally, healthy people suffer no harm. MRSA is believed to be spread mostly through contact such as people's hands. MRSA is a type of common germ that is resistant to methicillin and other antibiotics usually used to treat staphylococcus aureus.

Unfortunately, MRSA **cases and deaths are increasing**. Deaths in England and Wales with MRSA mentioned or being the underlying cause given on the death certificate have increased from 487 in 1999, to 800 in 2002, and 955 in 2003. Deaths in England and Wales mentioning any kind of staphylococcus aureus have gone from 964 in 1999, to 1221 in 2002, and 1403 in 2003.

However, though MRSA deaths increased 19% from 2002 to 2003, laboratory reports of MRSA only increased by 7% over the same period. This indicates that some of the increase in mentions of MRSA on death certificates may be due to increased reporting, possibly from the increased public profile of the disease.

In 2004 the UK had 7600 MRSA cases; and MRSA accounted for 44% of hospital-acquired infections, which were affecting about 100,000 people a year. About 5000 deaths a year come from hospital infections. These figures are higher than was occurring several years earlier.

In England & Wales in 2005, 455 death certificates mentioned *SA*, and 1629 MRSA.

Poor hygiene, eg wound infections and unclean hands, are blamed for SA/MRSA. That is why people should thoroughly wash their hands before touching food. Hospital alcohol gel prevents *Staphylococcus*, (though not *C diff*).

To **avoid it spreading**, hospital staff wear aprons and gloves, wash their hands thoroughly, and/or use an alcohol gel. Patients may be prescribed antibacterial drugs such as ointment for the nose; and/or lotion, soap and shampoo for the skin. Visitors should wash their hands and/or use the gel, and not touch anyone who may be infected. Clothing, towels, and bed linen can be laundered as usual.

Two strains of MRSA, MRSA15 and MRSA16, are contagious and are the commonest strains. In early 2005 some people suggested that the procedures above – such as washing hands, gel, ointment, barrier nursing and isolation, while needed, are not the only issues. With the changing patterns of increasing numbers of hospital day cases and outpatient consultations, high patterns of use of beds, and shorter stays by inpatients, infection control becomes harder. Costs, staffing, buildings and other resources are limited.

Conflicts arise between:

- planning for some spare capacity such as not using all beds all the time – allowing better cleaning and disinfecting both at scheduled times and between patients; isolating patients until the results of tests to find whether of not they are infected; which all costs more per patient and increases patients' waiting times; versus
- higher bed occupancy patterns and throughput, giving shorter waiting times, and being less expensive per patient provided they do not become infected and do not have to stay longer or get other treatment, but perhaps leading to more patients infected.

Methoxyisobutylisonitrile = MIBI. See below.

mg = milligram = 1/1000 of a gram.

MI means myocardial infarction, essentially the same as a Heart attack.

MIBI scan. MIBI = **Methoxyisobutylisonitrile**. Also known as a **Myocardial perfusion** scan.

A MIBI scan is a nuclear medicine procedure. The MIBI scan is in two parts, done on separate days. Each takes 2 to 2½ hours.

Before each part you, the patient, must not have any caffeine for 24 hours; and nothing to eat for six hours before it. You may drink water, fruit juices, and/or squash during the six hours. If you are diabetic you may have a light meal during the six hours.

If you are taking dipyridamole (brand name Persantin) you should discontinue that for the 24 hours. You should not stop any other prescribed medication unless asked by your doctor to so do.

The MIBI scan staff will also need a complete list of whatever medications you are taking.

In the **first part** you have a stress test. You are given an injection into a vein in your arm of a drug that increases the blood flow to the heart – producing a stress on the heart like exercise would but safely, while an ECG recording is made. A safe radioactive tracer is also injected. Then you are asked to have something to eat and drink, and return later.

When you return your heart will be scanned using a gamma camera. You lie on a couch with your arms and hands up above or behind your head. The camera rotates slowly around your chest for about 15 minutes. You will be asked to wait a short time while the staff check the scan.

The **second part** is a rest test. You will again be given an injection into a vein of the safe radioactive tracer, but without the drug that increases the heart stress. Then you have something to eat and drink and return for the scan using the gamma camera as before.

After the two scans, the results of the two scans are compared, and may show for example: left ventricle enlarged, how much of its volume of blood is being pumped out per heartbeat, ischaemia – ie heart muscles are / are not short of blood through newly-blocked arteries, and other conditions indicating what treatment you may need.

Minerals are elements – explained under Proteins.

A balanced diet as available in the UK contains all the various minerals needed, and in the UK diseases caused by mineral deficiencies are nowadays rare. Healthy people's bodies can get rid of excess amounts without conscious effort or thought.

The usual minimum daily requirements are based on the Reference Nutrient Intake. Several minerals, known as ***trace elements***, are needed but only in tiny amounts for metabolism and health.

Patients only need diet supplements when a doctor has diagnosed a particular deficiency, and/or as a prevention or treatment for a disease or disorder. Some patients have intestinal disorders that prevent absorption of minerals from the diet, so need supplements. Patients with some heart diseases may need their levels of certain minerals to be measured to ensure appropriate treatments.

The minerals in the table are needed. Most of them are needed for growth, so pregnant and breast-feeding mothers and children need relatively more of them. Adults also require most of them for metabolism and body processes, including healing and continual growth and replacement of tissues.

Oily fish twice per week, **poultry** twice per week (and/or dairy products), and five helpings daily of **green vegetables** and/or **fruit** together give enough of all of them!

In the table ● means a good source, * is not as good.

Mineral	Oily fish	Poultry	Red meat	Liver kidney	Milk	Cheese	Butter marg	Eggs	Cereals bread	Green veg	Root veg	Pulses	Nuts	Fruit
calcium, bones, teeth, cell function	*				●	●				●		●	●	
chromium, balances blood sugar		*	●			●			●	●				
cobalt, B12		●	●	●	●									
copper, process oxygen, nerves	●	●	●	●					●	●		●	●	
fluorine	●													
iodine	●				●	●			●					
iron, haemoglobin, carry oxygen	●	●	●	●				●	●	●				
magnesium, bones, teeth, nerves	●				●				●	●		●	●	
phosphorus, B12, bones, teeth	●	●	●	●	●	●		●	●	●	●	●	●	●
potassium, alternative salt									●	●		●		●
selenium	●		●	●	●				●					
sodium, salt	●	●	●	●	●	●	●	●	●	●	●	●	●	●
zinc, growth, taste, smell	●		●			●			●			●		

Mini heart attack. This usually means an attack of unstable angina.

Mitral valve. The mitral valve is between the left atrium and the left ventricle, to allow blood flow into the ventricle but not back. See MR = mitral regurgitation, Valve.

ml = millilitre(s) = 1/1000 of a litre. **ml/hr** = ml per hour.
mm = millimetre(s) = 1/1000 of a metre. **mmHg** = mm of mercury.
Mode. See mode under Average.
Molecule. See molecule under Minerals.
MND = motor neurone disease.
Monounsaturated fat. See Monounsaturated under Fats.
Mortality amenable to healthcare is how many deaths per year the NHS could plausibly have averted. A Taxpayers' Alliance report says for 2004 (the latest year for which data is available) there could have been 17,157 fewer deaths if the UK's performance had been as good as the average of other European countries studied.
MR = **mitral regurgitation**, blood flowing backwards the wrong way through the mitral valve.
MRI = magnetic resonance imaging. This can be used eg to see whether the heart muscles are working properly, and if not then is whatever is wrong reversible. Thus it does something slightly different from MIBI and angiography.
MRSA stands for Methicillin Resistant Staphylococcus Aureus.
MS = mitral stenosis.
Myocardial infarction, **MI**, means roughly the same as heart attack. Strictly it means destruction of an area of heart muscle as a result of obstruction of a coronary artery.
Myocardial ischaemia is another term for where the heart muscle is deprived of oxygen due to poor blood circulation. See Ischaemic heart disease.
Myocardial perfusion scan. See MIBI.
Narcotic generally means a potent and abused drug. Some narcotics are derived from poppies, and typically cause numbness, stupor, and/or abnormal behaviour.
National Institute for health and Clinical Excellence, **NICE**, is a group of experts who make recommendations on the uses of drugs and procedures, bearing in mind research findings, costs and benefits.
Nausea, nauseous means a feeling of perhaps being likely to be sick – to vomit. In the absence of food poisoning and illnesses, nausea may indicate some heart related condition. See Supraventricular tachycardia, and under shock.
Nebuliser is an aerosol form of a drug so it can be given within a facemask, to affect the lungs and airways. A hand-operated or electric pump mixes a small amount of the drug (from a suitable container with the drug as a liquid) as a mist with the oxygen to breathe.
Nerves are fibres that transmit sensory impulses. Sensory nerves transmit impulses representing eg touch, heat, taste, smell, or pain to the spinal chord or brain. Motor nerves transmit impulses representing movement to muscles.
Some movements are **voluntary** – ie you can consciously control them, eg movements of arms, legs and other parts of your body. Some movements are **involuntary** – ie you cannot consciously control them, eg heartbeats and digestion. Some normally continue without conscious thought but can be controlled, eg breathing.
Nitrates are a group of drugs used to increase the blood supply to the heart muscle, and reduce the number of angina chest pain attacks. Nitrates are available in several forms:

- **GTN tablets or spray** are put under the tongue to give immediate relief of pain. Both tablets and spray can be brought over the counter without a prescription. Tablets deteriorate once opened – typically they only keep for eight weeks. A spray canister may keep three years.
- **GTN patches** are available for prevention of angina – worn during the day and removed overnight for maximum benefit.
- ISMO.

***Nitrates* – Glyceryl trinitrate**, **GTN**, as a spray, tablets, or a patch, is the commonest drug used for relieving stable angina chest pain. Preferably carry some with you at all times if you are likely to get angina or have a heart attack. You can use it before doing anything you know will bring on your chest pain. Do not suddenly stop using nitrates unless advised to do so by your doctor.
GTN is usually sucked as a tablet or sprayed under the tongue, and can stop such an angina attack quickly.

- One or two tablets or spray should relieve the pain within 5 minutes. Bite tablets into pieces. Do not swallow the tablet – it will not work. Sit down if possible. Once the pain is gone spit out the remainder of a tablet.
  With a spray, remove the top, hold the spray upright with your finger on the button, and press the button firmly to spray one puff of medicine under your tongue. Close your mouth immediately. Never leave the pressurized container in the sun or a hot place. Do not damage or burn the can. Normal shelf life of GTN spray is 3 years, with a use by date.
- If the first tablet or spray have not relieved the pain after 5 minutes then repeat the dose, and again at 10 minutes.
- If the pain continues longer than 15 minutes, contact a doctor, or take the patient to A&E.

Keep tablets in their original bottle, & close the lid tightly. Store in a cool dark place. Do not carry the bottle close to your body – keep in a handbag or coat pocket.

Discard GTN tablets eight weeks after the date of opening, even if you have only used a few tablets, as GTN tablets only keep that long after opening. They can be bought over the counter without a prescription.

Slight overdose of nitrates may unfortunately produce dizziness, headache, and drowsiness as a side effect due to the reduced blood pressure and reduced blood flow. This normally ceases after a few days as your body adjusts to the medicine.

An overdose can occur eg if a nurse starts the 4-hourly medicine rounds at alternate ends of the ward. Then a patient at one end of the ward gets the drug after 2 ½ or 3 hours and then 5 ½ or 6 hours alternately. After the two close doses the level of ISMO becomes too high, producing dizziness and headache. Indeed the patient may need oxygen until he or she recovers. This has actually happened.

***Nitrates* – Isosorbide mononitrate, ISMO**, is a slow release tablet to prevent angina. ISMO (brand names Monit or Elantan), Isosorbide dinitrate (Cedocard, Isordil), and Isosorbide mononitrate slow release (IMDUR) tablets are taken regularly to prevent angina attacks occurring. They dilate the coronary arteries and so increase the blood supply to the heart muscle. The tablets should be swallowed whole with a glass of water and never crushed or chewed. If you, the patient, forget to take a dose, take it as soon as you remember. However if the next scheduled dose is due within 2 hours, or due within 6 hours for slow-release tablets, then skip the missed dose and take the next dose at the correct time. Do not take double doses.

Non-opioids = NSAIDs and non-NSAIDs. The non-opioids divide into **NSAIDs** eg aspirin, and **non-NSAIDs** eg paracetamol.

Non-opioids block the production of prostaglandins, so the nerve endings that would send pain messages to the brain are prevented from being stimulated. That is how eg paracetamol relieves pain and inflammation.

Paracetamol and nefopam are non-opioid non-NSAIDs.

Non-steroidal anti-inflammatory drugs, NSAIDs, relieve pain, inflammation, and/or swelling – usually of joints and/or muscles and reduce fever. This can happen after surgery.

They are called **non-steroidal** to distinguish them from corticosteroid drugs that are used to relieve inflammation.

Over 20 NSAIDs are available – eg aspirin, diclofenac, ibuprofen, naproxen. They are widely used for osteoarthritis and rheumatoid arthritis – reducing inflammation and thus relieving pain and swelling, but do not affect the progress of a disease. Other NSAIDs include: etodolac, fenbufen, fenoprofen, indometacin, ketoprufen, meloxicam, mefenamic acid, naproxen, and piroxicam.

Many NSAIDs interact with a wide range of other drugs including other NSAIDs, anticoagulants, & corticosteroids, and may increase the risk of bleeding and peptic ulcers.

The NSAIDs block the action of an enzyme called cyclo-oxygenase, **COX**. Research has shown that they block two types of COX: blocking COX-1 leads to the stomach irritation of NSAIDs; and blocking COX-2 leads to the anti-inflammatory effect.

A new class of NSAIDs, called **COX-2 inhibitors**, has been developed that block COX-2 but not COX-1, thus giving the benefits without the risk of stomach pain, peptic ulcers or intestinal bleeding.

One of the COX-2 inhibitors, with generic name rofecoxib, and with brand name Viaxx, was withdrawn in September 2004 – as soon as a research trial showed that it had twice the risk of triggering coronary heart disease than a dummy placebo. Dr David Graham, of the US Food and Drug Administration, discovered this; and estimated that between 88,000 and 140,000 Americans died or had heart attacks or strokes as a result of taking Viaxx since its launch in 1999 till 2006.

In September 2004 the European regulators launched a safety review of other arthritis drugs. ***Arthritis*** is an inflammation of joints, causing pain and stiffness. In December 2004 the UK Medicines and Healthcare products Regulatory Agency, MRHA, advised that some UK patients with heart disease or at risk of a stroke and taking certain arthritis drugs should change their medication.

Noradrenaline is a hormone secreted by the adrenal medulla. Like adrenaline it increases the heart rate and blood pressure, and it helps the endings of nerves to transmit impulses.

Here **nor-** means a chemical compound derived from some other compound by removal of a group. See under Stress.

Norfolk Zipper Club is a charity similar to the BCPA for people in Norfolk, and it raises money to buy equipment particularly for Papworth Hospital. The BCPA and NZC co-operate.
Tel 01603 898551 Email: norfolkzipperclub@tinyonline.co.uk (This is not a link.)

Normal distribution. A normal distribution is a standard mathematical pattern that usually fits the collection of observed values of some variable for a group of patients. Eg the heights, or the systolic blood pressures, of a set of healthy adults of a particular age fit that pattern. It is a typical pattern with known properties. See mean under Average, and Standard deviation.

By contrast, the pattern of lengths of voice telephone calls – excluding email, internet and other computer connections – is *not* a normal distribution as there are many short calls and occasional very long ones.

Suppose many patients' results for something have been measured, and suppose the mean is 100 and the SD is calculated to be 15, and suppose the observations fit a normal distribution.

● One SD below the mean is the value 85, and one SD above the mean is 115. The maths for a normal distribution gives that 34% – remembered as one-third – of the observed values will be from 85 to 100, and another 34% will be from 100 to 115. So about one-third of the observed patients will be within one SD on one side of the mean, and another 1/3 within one SD on the other side.

● Two SDs below the mean is the value 70, and two SDs above the mean is 130. The maths gives that 2.30% – remembered as nearly 2.5% – will be under 70, and similarly nearly 2.5% will be over 130. The probability of the next such patient being more than 2 SDs from the mean and on a particular side, eg over 130, is nearly 2.5% ie about 1 in 40.

NSAID. See Non-steroidal anti-inflammatory drugs.

Nuclear medicine. See also MIBI. Nuclear medicine is the medical use of radioactive substances for diagnosis. By injection into a vein, a patient is given a small quantity of a radioisotope or radionuclide. As its atoms or molecules decay they give off gamma rays that can be detected by a gamma camera with two screens at right angles. The computer system can calculate the exact position of the source, and thus build up images of the heart and other body organs.

The procedure is not dangerous – dosage is similar to other xray examinations. The value of the information gained far outweighs any risk. However, it is preferable not to perform radioactive scans during a pregnancy, nor when a mother is breast feeding as traces of the substance may pass into the breast milk and so to the baby.

Null hypothesis. See under Statistically significant.

Obesity means being overweight for one's height and build. Thus the heart has to pump harder for the required blood flow for the increased body tissues, increasing the risk of heart failure.

In 2001, about 22% of UK adults were obese. This percentage has increased since.

Obesity increases the risks of: high blood pressure, diabetes, high cholesterol, heart attack, stroke, gallbladder disease, osteoarthritis, endometrial cancer, depression, and fertility problems; and shortens life expectancy.

Obese people risk getting Type 2 diabetes, which then increases the risk of heart disease. Until a few years ago Type 2 diabetes was found only in people over 40, or among younger people with a genetic risk such as Asians. But in the two years 2003-4 cases of Type 2 diabetes have occurred among obese children. One in four children in England is overweight or so fat that it threatens their health.

See Body mass index, Waist to hip ratio.

Try to eat sensibly – a low-fat, high-fibre diet. You need not aim for a model figure just to be within a healthy range for your height. Reduce or avoid butter, cheese, full fat milk, fried food, cakes, snacks, biscuits, chocolate, and fatty meat.

od = once a day. **bd** (= bpd) = twice daily, **tds** = three times, **qds** = four times.

om = every morning, **on** = every night.

Omega-3 fatty acids. See omega-3 under Fats.

OPD = Outpatient department.

Opioids are analgesics related to opium, which is extracted from poppy seeds, and have similar properties to other drugs derived from opium – eg morphine.

They act on sites in the central nervous system that are involved in pain perception, and block or reduce the pain signals. Normally brain cells pass pain signals to other cells that interpret them. Opioids combine with receptors on brain cells to block the passing of the pain signals.

This blocking can occur both in the brain as above and also in the spinal cord. Compare non-opioids.

Opioids are the strongest analgesics and so are used to relieve the pain from surgery, serious injuries and cancer. They also help the patient to relax and relieve the stress associated with pain.

Organic chemistry is the chemistry involving carbon compounds, including particularly compounds of or produced by living organisms, and nowadays also including similar manufactured substances such as plastics and drugs.

The following explains in summary some of the terms and concepts of the relevant organic chemistry, gradually building up the explanations.

An ***organism*** is any animal or plant, including any bacterium or virus, or anything resembling a living creature in structure and behaviour.

An ***atom*** is the smallest quantity of an element that can take part in a chemical reaction. An atom can be thought of as a very tiny amount with a heavy central nucleus and with light electrons in orbits around.

The ***nucleus*** is the core of the atom, consisting of ***protons*** – which have a positive electrical charge, and ***neutrons*** – which are electrically neutral. Protons have a mass about 1836 times the mass of an electron; neutrons have about 1839 times. Each ***electron*** has a negative electrical charge and can be thought of as in an orbit around the nucleus. The number of electrons equals the number of protons in the nucleus so the totality has an equal number of positive and of negative electrical charges.

An ***element*** is any of the substances such as listed below. The nucleus of each atom has the same number of protons. Eg each oxygen atom nucleus has 8 protons.

Where two ***isotopes*** of the same element exist, they have the same number of protons but different numbers of neutrons in their nuclei. Over 110 elements are known, including (from lightest to heaviest in atomic number order): hydrogen, helium, carbon, nitrogen, oxygen, fluorine, neon, sodium, magnesium, aluminium, silicon, phosphorus, sulphur, chlorine, potassium, calcium, chromium, iron, cobalt, nickel, copper, zinc, selenium, silver, tin, iodine, gold, mercury, lead, uranium, plutonium. ***Isotopes*** have the same number of protons; isotones have the same number of neutrons.

See Minerals for those elements needed for health.

Each element has an ***atomic number***, which is the number of protons in the nucleus of an atom of the element. Some of the light elements have the same number of neutrons as protons; heavy elements generally have more neutrons than protons.

Each element has an ***atomic weight***, which is its atomic mass relative to other elements; and is about equal to the number of protons plus the number of neutrons in its nucleus.

A ***molecule*** consists of two or more atoms held together by chemical bonds.

A ***compound*** is a chemical structure with atoms of *two or more different* elements held together by chemical bonds. The structure is represented by a formula – with some conventions explained there including that in what follows here: H is hydrogen, C is carbon, N is nitrogen, O is oxygen, – represents a single bond, and = represents a double bond.

Molecular weight is the sum of the atomic weights (the relative atomic masses) of the atoms in a molecule or compound. High molecular weight implies a big structure.

An ***acid*** is a substance that dissociates in water and gives a sour taste or corrosive solution, having hydrogen ions.

An ***ion*** is an atom or group of atoms that has lost or gained one or more electrons, so is electrically charged. An electron is negatively charged.

An ***alkali*** is a base that is soluble in water.

A ***base*** is a metal oxide (a metal and oxygen only) or involves an –OH or similar structure.

The potential of hydrogen, written pH, measures how acid or alkaline a liquid is. Pure water has a pH value of 7; acids are less than 7; and alkalines are more than 7.

An ***amino acid*** is a compound that contains an amino group of atoms of the form $–NH_2$ and also contains one or more carboxyl groups of the form –COOH.

The $–NH_2$ is an ***amino group*** and represents an N with three bonds: one to the rest of the compound, and the other two each to an H. Each H has one bond.

The ***carboxyl*** –COOH is a shorthand representation for a structure that is common in organic acids. Each O has two bonds; and the C has four bonds: one to the rest of the compound, two to an oxygen =O, and one to –OH.

A ***peptide*** is a compound consisting of two or more amino acids linked by chemical bonding between their respective carboxyl and amino groups.

A ***peptide bond*** is a chemical linkage written =CHCONHCH= formed by the condensation of the amino group of one amino acid with the carboxyl group of the other.

Thus we have built up to the following.

A protein is any of a group of organic compounds that contain carbon, oxygen and nitrogen, that are of high molecular weight, and that are essential constituents of all living organisms. They have one or more amino acids linked by peptide bonds and are folded into a specific three-dimensional shape that is held together by further chemical bonding.

Outpatient department **OPD** is the hospital area for clinics and treatments where the patients do not stay as inpatients – ie they do not stay overnight in the hospital.

PA = Pulmonary artery. **PAP** = pulmonary artery pressure.

PAC = Pre-admission clinic, ie an outpatient appointment before being admitted as an in-patient.

Paced beat is a heartbeat initiated by a pacemaker.

Pacemaker. A pacemaker is a system with a pulse generator and one or more electrode leads for electric impulses to stimulate the heart to contract and produce a heartbeat. A permanent pacemaker is inserted under the patient's skin just above the breast tissue. When the heart needs a signal the pacemaker sends electrical impulses along an electrode lead to stimulate the heart to contract and produce a heartbeat.

See separate factsheet on Pacemaker.

PAD See Public Access Defibrillator under Automatic external defibrillator.

Pain is a sensation of hurting or discomfort resulting from illness, injury, heat, an allergic reaction, or something being wrong in some part of the body. It forms part of the body's warning system intended to prevent further discomfort or injury, and generally to alert the person to the need to do something about it.

Pain is important since otherwise parts of our bodies could be damaged or injured without one being aware of it. The pain signals start eg at the skin and are transmitted through nerves and the spinal chord to the brain, where the brain cells interpret the pain. If the signals did not reach the brain then no pain would be felt. Angina is an example.

Chronic pain means longterm, continually recurring, intractable pain – difficult to deal with, prevent or influence. Such pain needs analgesics or other treatments – such as TENS or even permanently stopping signals from reaching the brain.

The body has its own natural pain-control mechanism that releases its own pain easers called **beta endomorphins**.

Patients who have had heart operations for example get pains, so need appropriate treatments to manage the pains.

For pain relieving drugs see eg analgesic, co-proxamol, paracetamol.

Some medics ask a patient to describe his or her pain using words such as sharp, dull, …

An alternative is to ask him or her to say how severe the pain feels on a scale from 0 to 10: with 0 for no pain, 10 for the worst pain he or she ever had or could imagine, and where 4 or more corresponds to wanting some pain reliever or treatment.

A pain may also be **continuous** – all the time, **continual** – recurring frequently but not quite all the time, **intermittent** – on and off, and/or **varying** in intensity, duration and/or frequency.

A **referred pain** feels to the patient as though it is at a particular place in their body, but the cause may be somewhere else. Pain in an arm or the neck from angina is an example.

Palpitation is a feeling resulting from an erratic heartbeat, often felt in the chest or stomach. See under Atrial fibrillation.

Paracetamol is a non-opioid analgesic (= pain reliever), and not an NSAID.

Paracetamol works by reducing the production of chemicals called prostaglandins in the brain. It does not affect the production of prostaglandins in the rest of the body, so does not reduce inflammation though it may reduce fever. So it can be used for aches and pains including headaches, joint pains, and other pains. It is safe when taken correctly, it does not irritate the stomach, and allergic reactions are rare; so it is used widely.

Any overdose can cause severe liver and/or kidney damage, which can be fatal. Paracetamol is available without prescription, but pharmacies take care when it is being purchased, as care must be taken not to exceed the safe dose of paracetamol. For adults the safe dose is two tablets not less than 6 hours since the previous such; and not more than 3 such sets of two tablets in any 24 hours. For children under 12 lower doses are specified.

Passive smoking. See Passive smoking under Smoking.

Patient Advice and Liaison Service, **PALS**, is a hospital service that provides confidential advice, help and support to patients and their families to sort out any concerns or queries. If you have some problem or something seems to be wrong, they are people to talk to.

PCI see Percutaneous coronary intervention.

Penicillamine is a chelating agent.

Peptic ulcers are lesions in the stomach lining.

Percutaneous coronary intervention, PCI, is an operation going through the skin to access and do something to the heart. **Percutaneous** means through the skin – eg the absorption of an ointment; or surgery using an angioplasty catheter. **Intervention** implies using a decisive role or action to change something.

Perindopril. See under Angiotensin converting enzyme inhibitors.

Persantin is a brand name for dipyridamole.

pH stands for **potential of hydrogen**, which is a measure of how acid or alkaline a liquid is. Pure water has a pH value of 7; acids are less than 7; and alkalines are more than 7. See also under acid under organic chemistry.

Pharmacist is an appropriate registered scientist (chemist) concerned with the preparation and dispensing of drugs.

Pharmacology is the science of the biochemistry and use of drugs.

Phenol. A **phenol** is a compound containing a benzene ring.

A **benzene ring** is a hexagonal (six sides and six vertices) compound of bonded carbon atoms in a benzene molecule or its derivatives.

Benzene has the formula C_6H_6. It is a colourless aromatic liquid used: in the manufacture of phenols, as a solvent for fats & resins, and as an insecticide.

Eg **phenobarbitone** is a phenol, with formula $C_{12}H_{12}N_2O_3$, a derivative of barbituric acid, and used as a sedative for treating insomnia and epilepsy.

A **polyphenol** is a compound with many phenols, ie with many benzene rings. Polyphenols are beneficial chemicals that help stave off heart disease and cancers.

Physical and/or **psychological dependence**. See dependence.

Pituitary gland is a gland at the base of the brain. It regulates growth, and sexual and reproductive development. It also stimulates other endocrine glands.

Placebo. A placebo is a medicine, tablet or treatment that has *no active* ingredient, typically given to a control group in a trial of a drug, so each patient does not know what he or she is receiving.

Also, it means a medicine given to a patient who insists on receiving a treatment, and where the medic or first aider thinks the patient might benefit by the psychological deception and thinks no medicine is needed.

Plaque is a deposit of fatty substances on the inside of an artery wall.

Plaques may become unstable and rupture or breakup, causing damage to the blood vessel wall. The body responds to the breakup by making platelets clump together to producing a clot, a thrombus, and this may cause a partial or complete blockage.

Plasma is a constituent of blood. Plasma is the clear or yellowish fluid in which corpuscles and cells are suspended; including water, dissolved proteins, salts, sugars, fats, minerals, and vitamins.

Platelet. Platelets are small disc-shaped blood structures that are involved in blood clotting. They stick together to form the clot. See Thrombosis and antiplatelet drug.

Plavix. A brand name for clopidogrel.

poly- means many ...

Polyphenol. A polyphenol is a compound with many phenols, ie with many benzene rings. Polyphenols are beneficial chemicals that help stave off heart disease and cancers.

Polyunsaturated. See polyunsaturated under Fat.

Posterior means situated at or towards the back of the body. Opposite of Anterior. Also see Dorsal.

Potassium. See under Salt.

Potassium channel activators are used to treat angina. They relax ie widen both the arteries and veins, reducing the work of the heart. They also relax small arteries in the heart to help improve the blood supply to the heart. This should relieve angina attacks, making them less frequent, and reduce the risk of a heart attack.

The generic name is Nicorandil, brand name Ikorel. It was first introduced in 1994. It is taken as tablets, usually twice daily. The effects start about an hour after taking it and last 12 hours. Store the drug in a closed container in a cool dry place out of reach of children.

Possible side effects may include: headache, dizziness on standing up, nausea and/or vomiting, and flushing of the face. Most of these side effects are usually minor if they occur at all, and should pass as your body adjusts to it. If you notice any side effects consult your doctor so that he/she may change your medication if these side effects become intolerable.

Pre-admission clinic is an outpatient appointment before being admitted as an in-patient.

Prescription is a written form giving details to a Pharmacist – from a doctor, dentist or other appropriate medic – of what drug(s) in what quantity, how often, and with what instructions to provide to the patient.

Primary prevention means preventing a disease before it happens. Compare Secondary prevention.

Prophylactic is a drug or procedure to prevent disease.

Proposition. A proposition is a proposal or statement made for consideration, particularly a statement that affirms or denies something.

Prostaglandins are chemicals in the body, including the brain. See under non-opioids = NSAIDs and non-NSAIDs, and paracetamol.

Proteins are amino acids (explained under organic chemistry) essential for life, health, and brain function. Meat, fish, dairy products, and some other foods contain proteins of various kinds.

Some experts believe that your body's mechanisms that signal to the brain that you feel hungry or full are *partly or mainly* detecting the absence or presence of enough proteins. Feelings of hunger or of having had sufficient food and drink also depend on how full the stomach is and the quantities and types of foods / nutrients in the digestive system.

There are eight essential proteins / amino acids.

Complete proteins supply all eight. Adults in good health will get enough of all of them if they eat / drink two servings daily of **meat, fish, eggs, cheese, milk**, and/or **yoghurt**. Here milk means ½ pint = 250ml daily of any of whole, semi-skimmed, or skimmed.

Incomplete proteins only supply some of the eight – eg grains, legumes / green vegetables, nuts, seeds. So to get all eight proteins these need to be combined, and/or possibly with other foods.

Proteins are any of a group of organic compounds that contain carbon, oxygen and nitrogen, that are of high molecular weight, and that are essential constituents of all living organisms. They have one or more amino acids linked by peptide bonds and are folded into a specific three-dimensional shape that is held together by further chemical bonding.

PUFA. See polyunsaturated fatty acid under Fat.

Pulmonary means associated with the lungs.

Pulmonary arteries PA are the two arteries that take low-oxygen blood from the right ventricle to the lungs. One goes to each lung.

Pulmonary embolism means a blood clot on the lungs, which can be a cause of death. See Embolus.

Pulmonary valve. See Valve.

Pulmonary vein. The pulmonary veins take oxygen-rich blood from the lungs to the heart.

Pulse. This has two meanings.

1 The number of heartbeats per minute – the Heart rate.

2 To take the pulse means to measure, count, and record it, and perhaps note its strength – whether strong or weak, and whether the rhythm is regular or slightly irregular.

Each heartbeat makes a wave of blood of increased pressure flow along the arteries. This can be felt as a pulse where an artery is close to the skin and above a bone – such as in the slight hollow on the thumb side of the wrist, or at the neck or groin. The pulse should be felt with fingers – not the thumb, since the thumb has a pulse.

Public Access Defibrillator (PAD) See Public Access Defibrillator under Automatic external defibrillator.

qds = four times a day. od = once a day, bd (= bpd) = twice per day. tds = three times a day.

Quercetin is a yellowish crystalline pigment, found naturally as its glycosides in the rind and bark of many plants. It is used medically to treat fragile capillaries. Formula $C_{15}H_{10}O_7$, melting point 316C. Also sometimes called flavin.

Quercetin is a flavonol, and is the major flavonoid in the diet – its main sources being tea, onions, apples, and red wine. Quercetin is metabolised very quickly by the intestine and liver, and is not actually found in human blood.

RA = right atrium.

Radical. For free radical see Antioxidant.

Radiofrequency Ablation of Atrial Flutter. See Radiofrequency Ablation of Atrial Flutter under Ablation.

Randomised. See Double-blind trial.

Range. The range of a variable means either the set of allowable values; or the set of values actually occurring, observed, or calculated.

RCA = Right coronary artery. See Coronary arteries.

Recipient. See recipient under Donor.

Reference Nutrient Intake, RNI. The RNI gives for each* vitamin and mineral the recommended amount for different ages from babies to adults; and – where appropriate – the different amounts for eg pregnant or nursing mothers. This is the amount of each nutrient that is adequate to prevent deficiencies in 97.5% of the UK population. *For some vitamins and minerals no recommendation is needed or given. The source is Department of Health.

Refusal. A patient may refuse a particular treatment, and/or make a living will. Certain conditions apply. Medics, first aiders, and carers must then comply with the refusal. See under Consent.

Regurgitation. See Valve.

Rehabilitation means discussion; guided exercise; getting social support; understanding of the illness, treatment, and symptoms; and knowing what to do – lifestyle issues, why and how to exercise, and diet.

It helps to improve health for those who have had any of: heart attack, angioplasty, bypass surgery, stable angina, or heart failure.

After a heart attack, correct rehabilitation reduces the risk of early death by 20%.

It helps to improve health for those who have had a heart attack, and for those who have had angioplasty or bypass surgery, stable angina or heart failure.

It includes greater understanding of the illness and treatment, symptoms and what to do, lifestyle issues, exercise, diet, and getting social support.

Research trial. See Double blind trial, Statistically significant.

Respiratory means concerning breathing.

Response. See Response under First Aid.

Restenosis means becoming stenosed again after treatment such as a stent being fitted.

Resuscitation means to revive and/or restore to consciousness. See Cardio-pulmonary resuscitation.

Revascularisation means making the blood vessels wider and/or replacing or bypassing blocked arteries with grafts. Revascularisation treatments include:

- coronary angioplasty, normally with insertion of a stent or stents, which may be drug-eluting stents
- coronary artery bypass grafts
- other forms of heart surgery and transplants.

Reye's syndrome. See Reye's syndrome under Aspirin.

Right coronary artery RCA. See Coronary arteries.

Right internal mammary artery, RIMA. See artery. May be used in a Coronary artery bypass graft.

Risk is a calculated probability or chance of some future result or outcome. The calculation is usually based on the observed pattern of many past patients.

Assertions such as 'People with X have increased risk of Y' are usually based on the results of a research trial. Some people with X were compared with some people who did not have X and otherwise were similar so could be statistically compared.

For a yes/no situation example: if 90 patients of 900 previously treated have afterwards had a particular pain, the risk or chance that the next patient will have the pain is about 1 in 10 = 10%.

Observables such as height have a spread.

* Suppose some researchers found that more very tall people develop Y than the population as a whole; then they might assert that tall people have increased risk of developing Y. This may apply to eg weight, blood pressure, or similar variables.

* Eg if the mean of some result for past patients was 100 and their standard deviation, SD, was 15, the chance of the next patient being 2 SDs or more from the mean and in a particular direction such as over 130, is about 2.5% = 1 in 40. See under Standard deviation for why.

RTA = Road traffic accident.

RV = Right ventricle.

Sac is a pouch, bag, or pouch-like part.

Salt has two main meanings.

1 The usual food meaning is sodium chloride, used for seasoning and/or preserving.

2 Sodium chloride and potassium chloride are examples of a salt in chemistry. A **salt** is a compound formed from, or regarded as formed from, an acid and a base by replacing one or more of the hydrogen atoms in the acid molecules by positive ions from the base. See under Protein for explanation of the chemistry.

Most fresh food contains very little salt. Most of the salt people eat is in processed foods or salt added to food while cooking or at the table. Look at the labels on the food that you buy – if it says sodium chloride, sodium benzoate or monosodium glutamate then you may be getting extra salt without noticing. Do not add salt to food at the table.

Here we first explain sodium-based salt issues, then the potassium-based alternative, then reduction of the amount of salt consumed.

Salt – Sodium-based salt issues

The recommended daily allowance or limit for adults in the UK as advised by the Food Standards Agency is 6 g. Some experts suggest 5 g instead for women. For boys and girls aged 7 to 10 the recommendation is 5 g.

During exercise or on hot days people sweat a mixture that includes salt, so they may need more then. To maintain the body's amount of salt, they may need to intake some salt – and not just drink water.

Most UK adults and most older children are eating too much salt each day. Average adult consumption was 9.5 g a day (in 2004).

Nowadays, foods have labels giving the sodium content: some also give the salt. To convert sodium to salt, multiply by 2.5. Eg 0.4 g sodium has 1 g salt. Giving the sodium on the package labels is legally required.

Diets too rich in salt are statistically significantly linked to increased risk of heart disease and stroke. The excess salt raises blood pressure and leads to strain on other body functions.

High salt consumption is implicated in 220,000 deaths in the UK a year (2003-4 rate), mainly from increased risk of strokes associated with high blood pressure.

Since the 1950s or earlier, some medics and others have known both that many UK adults consume far more sodium-based salt than needed, and that it was bad for health. The sodium-based salt may cause or contribute to: strokes, heart conditions, and high blood pressure as above; and also to kidney problems, and possibly to cause excess fluid retention.

To some extent the kidneys and body generally can tolerate and get rid of some excess salt. Fully healthy people can dispose of excess salt. But people with high blood pressure may find a low-sodium salt diet beneficial.

In all the above, salt means **sodium chloride**, where the issue is the amount of ***sodium***. The mechanism is believed to be that excessive sodium-based salt tends to cause high blood pressure and to make high blood pressure worse, and that this increases the stroke and heart risks as above. This leads on to the alternative below.

Salt – Potassium-based salt alternative. Experts believe that *potassium*-based salt does not have the same bad effects as sodium chloride.

For many years the BCPA and some other organizations have suggested that people with heart related conditions and/or high blood pressure should change to a product such as LoSalt®, which has 66% **potassium-chloride** salt and 33.3% sodium-chloride salt. These two figures do not add to 100 since an anti-caking agent is added to ensure the product keeps. Such alternative products are often recommended for patients with diabetes, and/or kidney disorders, as well as for heart conditions, and/or high blood pressure.

Salt – Reduction of sodium-based salt

Statistical research and extrapolation has shown that if all UK adults could reduce their sodium-based salt intake to the recommended 6 g a day, it would save 35,000 UK deaths per year (2004 figure).

The Food Standards Agency has a campaign to encourage people to reduce their salt intake and has asked manufacturers to reduce the salt in various foods.

Unfortunately most **bread** is manufactured with a rather high sodium salt content. Typically an average slice has 0.2 g sodium = 0.5 g salt (in 2004). On average adults eat five slices per day, giving 2.5 g salt, which is 42% of the recommended salt intake of 6 g. Eg Hovis white extra thick square cut has 1 g sodium-based salt per slice, so five slices gives 5 g – that alone is all or nearly all the recommended daily amount!

Crisps usually have too much salt, and are also bad for people in other ways.

Soups and **sauces** are an issue. At the end of 2004, the five soups highest in salt still contained 2.9 to 2.1 g per 200 g serving, while the lowest five had 1.0 to 1.2. Some are cup a soups, others tinned.

Unfortunately manufacturers cannot suddenly change the salt content because consumers expect the taste not to noticeably change, so changes can only be made gradually over years.

The Food and Drink Federation in 2005 said that the industry has reduced the sodium in processed foods. The salt in soups and sauces was reduced by 10% in 2003 and a further 10% in 2004 – giving the new range from 2.9 to 1.0 above.

Saphena. A saphena is either of the two large veins of a leg that are near the surface. The plural is saphenae, from Latin. Eg a saphenous vein graft is a CABG using a vein from a leg.

SARS stands for Severe Acute Respiratory Syndrome.

Saturated. See saturated fat under Fats.

Scleroprotein is any of a group of stable and insoluble proteins such as collagen, elastin, and keratin.

SD. See Standard deviation.

Secondary prevention. Once a patient has a disease he or she and/or others can try to stop it getting worse, or at least slow down its progress – called **secondary prevention**. Compare Primary prevention.

Sedative is a drug to reduce the activity of the central nervous system, making the patient somewhat sleepy.

Septicaemia is a bacterial infection that causes the immune system to go wrong and start to attack the body instead of giving protection. With 37,000 UK deaths per year, it is one of the commoner causes of death – after heart diseases, stroke, and cancer. It can enter the body through a wound.

Unfortunately the symptoms are hard for doctors, nurses and others to recognise. If the window of opportunity for successful treatment is missed, the bacteria in the blood cause many body functions to fail, and death follows. The symptoms include vomiting, diarrhoea, high temperature, fever, and unfortunately can be mistaken for flu.

The treatment is – and these six need to be given sufficiently early – oxygen, antibiotics, fluids, taking blood cultures to identify the specific bacteria involved, monitoring blood characteristics, and checking urine.

Experts think that if all medics and the general public always recognised the symptoms, and if patients got to hospital sufficiently early by ambulance, the death rate could be halved.

Septum. A septum is a dividing or separating wall between two organs of the body. **Septal** is the adjective, eg in VSD = Ventricular septal defect.

Shock is a serious condition, caused by illness and/or injuries. (We are not discussing electric shock or bad news here.) The main **causes** are:

- bleeding, fluid loss, including internal bleeding
- the heart being unable to pump enough blood around the body – eg in a heart attack
- an allergic reaction – called **anaphylaxis**.

The **effect** is not enough oxygen reaching vital organs – eg brain, heart muscles, lungs, kidneys. The body attempts to reduce the blood flow to other areas – eg skin, extremities, and less important organs – by narrowing arteries and capillaries.

The **symptoms** of shock are:

- pale and clammy skin
- increased and/or weak pulse / heartbeat rate, and/or increased breathing rate
- the patient may feel cold, dry-mouthed, nauseous (as though about to be sick); and be anxious, confused, irrational; with dropping level of consciousness and alertness.

Treatment includes:

- Reassure the patient. If possible deal with the cause of the shock.
- Let him / her lie down, or (if heart attack, chest injuries, breathing difficulties) sit in a half-sitting position with knees slightly bent and supported
- Keep him / her warm, eg with a blanket.
- If he / she is going to hospital and/or may need an anaesthetic, don't give food or drink – just moisten the lips if they feel thirsty.

Side effect. Many medicines may produce undesirable side effects (adverse effects). If you notice any undesirable side effects, you should contact your doctor.

Side effects include: drowsiness, dizziness eg on standing up, muddled thinking, unsteadiness eg leading to a fall, confusion, hangover in a morning, slurred speech, headaches, and/or pains.

Some of these effects, eg drowsiness, usually occur when a patient both drinks alcoholic drinks and takes a particular medicine, though the effects would not occur from either the alcohol or the medicine alone.

Some pairs of drugs and/or medicines interact when both are being taken. One doesn't work when in the presence of the other; and/or producing undesirable side effects such as those above.

The effects can often be avoided – eg by adjusting the dose, by following the instructions and regular timing accurately, by avoiding pairs of drugs that interact with each other, and by not taking other unprescribed medicines as well as the prescribed ones. Eg see Isosorbide mononitrate under Nitrates.

Significant. See Statistically significant.

Signs. See signs under symptoms.

Sino-atrial node. The sino-atrial node is the place in the heart where the electrical impulses for each beat begin. They spread through the heart causing it to contract so that blood is pumped to the lungs and the rest of the body.

Sinus rhythm is the normal heart rhythm.

Slow release. See under half-life.

Smoking removes oxygen from the blood, excites the heart, and makes blood cells stick together. This often leads to high blood pressure, heart and/or lung diseases, stroke, and/or earlier death.

See separate factsheet on Benefits of stopping smoking.

Passive smoking – breathing the smoke from other people – affects both adults and children, giving them increased risk of heart disease, lung disease, stroke, and/or earlier death.

The British Heart Foundation National Centre for Physical Activity and Health at Loughborough, BHFNC, found that 19% of CHD deaths are related to smoking.

22% of the UK population over 16 smoke (2007 figure). This percentage has been dropping gradually over many years. The ban on smoking in public places helped many people to stop.

SOB = Shortness of breath. See Breathlessness. **SOBOE** = Shortness of breath on exertion.

Sodium. See under salt and minerals.

Spirometry is measuring the volume of air capacity of the lungs. The instrument is a **spirometer**.

SpR = Specialist Registrar, eg specialising in cardiology.

Stable angina. See Angina.

Standard deviation, **SD**, is a measure of how far a set of observed values spread on either side of their mean. Eg the set of five values 79, 89, 100, 111, 121 has mean 100, and the SD is calculated to be 15. The SD calculation depends on differences of the values from the mean – eg 79 and 89 are roughly 15 below 100, and 111 and 121 are roughly 15 above. See normal distribution.

Statin. Statins are lipid-regulating medicines – lipid-lowering tablets. Statins work by reducing cholesterol production by blocking an enzyme found in the liver. Thus they slow the progression of heart disease. They are used to:

- reduce too-high cholesterol in the blood
- reduce the risk of a heart attack
- reduce the risk of stroke
- lower the triglycerides in the blood.

They are used when a low-fat diet and other non-medical treatments such as exercise and changes to life style have not been sufficient or have failed. Some experts say they are the most effective drugs for lowering the LDL. Various statins are available.

- Atorvastatin Brand name Lipitor
- Fluvastatin Brand name Lescol
- Simvastatin Brand name Zocor
- Pravastatin Brand name Lipostat
- Cerivastatin Brand name Lipobay
- Rosuvastatin Brand name Crestor

Statins are normally taken once a day, with the dose taken in the evening or at night. Exceptionally Atorvastatin is taken in the morning as it can cause insomnia if taken later in the day. You should swallow the tablets whole with a drink of water. These tablets are used in combination with a diet that is low in saturated fat. You can get dietary advice from a dietician or cardiac nurse or from leaflets.

Some statins, eg atorvastatin and rosuvastatin, may also reverse the build-up of deposits in the arteries. About a million UK adults take statins (2002 figure).

Other research suggests from statistical analysis that patients who had taken statins had lower risks of colon cancer and of prostate cancer than patients who had taken other cholesterol-lowering drugs or neither. But researchers do not yet (2004) know how they could have this effect.

Side effects of statins are rare, but occasionally people may:

- suffer headaches or stomach problems – such as heartburn, nausea, constipation, or diarrhoea and flatulence.
- experience muscle inflammation although this is extremely rare. You should tell your doctor if you have any unexpected muscle pain, tenderness or weakness.

Do not stop taking statins suddenly unless advised to do so by your doctor.

Take both aspirin and a statin. Five major US trials involving 140,000 people showed the following.

- The risk of a heart attack was reduced by 31% when pravastatin was taken daily with aspirin, as compared with those taking aspirin alone.
- Also the risk of a heart attack was reduced by 26% by taking both as compared with taking pravastatin alone.
- Also, strokes that resulted from fatty cholesterol deposits lining the walls of the arteries in the brain were about 30% less among those taking both than in the groups taking only aspirin or only a statin.

These results strongly support current advice for the treatment of CHD and of cerebrovascular disease to **take both aspirin and a statin**. This advice is likely to prevent thousands of premature deaths. See death rates statistics.

Statistically significant. In a research trial, or from observations of many patients who differ in some way, statisticians can calculate the probability of a null hypothesis.

A **null hypothesis** is an assertion that there is no association between certain observable and/or measurable factors or variables – particularly where experts expect that there is an association and their research aim is to investigate.

Eg a null hypothesis might be that smoking during pregnancy does not affect baby weight at birth, excluding twins, triplets, quads, and births before 28 weeks – so the baby weights of smokers and non-smokers with the same duration of pregnancy would be equal.

The mean of a set of observed values may be very different from what would be expected under the null hypothesis. Or the pattern of observed values in a table with rows and columns corresponding to two variables may be different from what would be expected values under the null hypothesis. Or the difference between the means of two groups may be significant, as below.

If the probability P of the observed values occurring by chance is small, then that finding is regarded as **statistically significant** – strongly suggesting that the null hypothesis is false.

To some statisticians: P less than 0.05 = 5% is called **significant** and denoted by *; less than 0.01 = 1% is **highly significant** and denoted by **; and less than 0.1% = 1 in 1000 is even higher and denoted by *** as below. Others sometimes use these terms slightly differently. The criterion of what probability is regarded as significant is ultimately arbitrary. It is preferable for the actual percentage to be given in research results.

A phrase such as **research does not show** or **no significant difference was observed** typically means that this was properly investigated and the probability P of the observations occurring by chance was not statistically significant – eg greater than 5%.

From the results of about 2200 pregnancies, the differences of the means of the baby weights of smokers and of non-smokers for various durations of pregnancy were as follows. The smokers' babies were less weight in all cases. Twins and births before 28 weeks were excluded, and every cell was the mean of at least 50 babies.

- For 28 to under 36 weeks 3.9 oz (not statistically significant)
- For 36 to under 38 weeks 6.2 oz * (P less than 0.05, significant)
- For 38- weeks 7.0 oz *** (P less than 0.001, highly significant; being 112.5± v 105.5±18.3)
- For 40- weeks 5.9 oz *** (P less than 0.001, highly significant; being 122.2±16.8 v 116.3±17.0)
- For 42 and over weeks 2.5 oz (not statistically significant).

The above findings alone are not enough to deduce much.

Researchers normally investigate further. Similar results were found when boys and girls are considered separately. Also, similar results occur when excluding various combinations of: diabetics, mothers less than 5 feet tall, coloured women, mothers whose partners belonged to the lowest social class, and/or mothers whose fathers belonged to the lowest social class. In every comparison the smokers had smaller weight babies. Also, the smoking mothers were divided into groups. For example occasional smokers and regular of about than five a day taken together, were compared with 10-a-day, and 20-a-day or heavier smokers taken together. Comparing these different smoking patterns, there was little difference between the baby weights – so whether the mother smoked at all is more important than how heavily. The team researched the medical reasons for the differences between these groups, and the effects of all the various factors mentioned in this paragraph.

The research team spent several years investigating many other factors not mentioned above before fully concluding that maternal smoking during pregnancy may damage a baby's health.

Stenosed means restricted or narrowed, eg a narrowed artery or valve. See Restenosis, Artery and/or Valve.

Stenosis, its effects and treatment are under Coronary heart disease.

Stent. In some patients with a blocked artery, surgery may be avoided by inserting a stent, which is rather like a small, coiled, stainless steel spring. It is placed, using an angioplasty catheter, in the blocked or collapsed section of the artery. When it is released from the catheter, the spring expands and holds the artery open.

Unfortunately, after angioplasty and a **bare-metal stent BMS**, such as widely used up to about 2003, about 30% of patients develop renarrowing of the artery – called Restenosis.

A **drug-eluting stent**, **DES**, has a coating of a drug on the stent. It prevents or reduces the occurrence of restenosis; ie gives lower risk of the artery renarrowing. In a clinical trial of a drug-eluting stent, no patient (0%) had renarrowing within two years. By 2004 to 2007 research had showed that patients with a DES had about a quarter or less chance of needing restenosis as compared with patients with BMS. DESs cost about £600 and BMSs about £300 (2007-8 prices). See Coronary angioplasty – Success.

DESs are particularly useful where the Coronary arteries are very small, or where there are long sections of the coronary artery that need to be covered with the stent.

The National Institute for Clinical Excellence in February 2008 recommended that DESs be used in percutaneous coronary intervention only if both

- the artery to be treated has less than 3mm calibre or the lesion is longer than 15 mm; and
- the price difference between DES and BMS is no more than £300.

Sternum. The sternum is the breastbone, the long flat vertical bone at the front of the chest to which the collarbone and the upper-seven pairs of ribs join.

Steroids are explained under Allergy. **Steroid** is another name for corticosteroid.

Stokes-Adams attack. A Stokes-Adams attack is a fainting spell resulting from a temporary decrease in blood flow to the brain, usually associated with heartblock.

Storing medicines. See Medicines – taking and storing.

Stress. Stress occurs when the physical, emotional, health/disease, or mental pressures on a person exceed what he or she can cope with.

The body responds by a natural survival mechanism – releasing the hormones adrenaline, noradrenaline, cortisol, and/or adrenocorticotrophin. These prepare the heart, brain, and body to do whatever may be needed – eg raise heart rate, breathe faster deeper, widen pupils, increase sweating, mind alertness, more blood flow to muscles, and/or increased blood sugar/glucose. The body becomes prepared for physical exertion. If the body did not so respond the result might be damaging to health.

If the cause is not health/disease, taking slow deep breaths may help one to calm down and think and deal better with the situation.

If the stress continues over some time, eg from stress at work or after a heart attack, the person may feel irritable, aggressive, or angry, or not sleep well – particularly where he or she cannot or does not take regular exercise. In exercise the muscles release the effects of the body's response. Normal physical and daily activities, walking, and talking to people all help rehabilitation and recovery.

Slight stress can be good for a person if he or she allows the body's natural responses to be relieved by activity. Unfortunately, adrenocorticotrophin slows down production of white blood cells, thus reducing one's ability to fight infection.

See also Epinephrine which describes that drug given in an emergency to stimulate heart activity and raise low blood pressure

Stroke. A stroke is when the blood supply to part of the brain is suddenly and seriously impaired by a blood clot or damage to an artery. The patient may have a sudden severe headache; be in a confused emotional state; seem to be drunk; gradually or suddenly go unconscious; and/or have weakness, drooping, dribbling mouth, slurred speech, loss of movement, unequal size pupils, and/or loss of bladder or bowel control.

People who have had a heart attack have increased risk of having a stroke; and vice versa.

Treatment: If unconscious: open the airway; check breathing; loosen clothing if needed; 999 for ambulance; resuscitate if necessary; and record breathing and pulse every ten minutes.

If conscious: ask for consent if needed; lay down perhaps with head and shoulders slightly raised; 999 for ambulance; put a cloth or towel to absorb any dribbling; do not give food or drink.

Each year about 130,000 UK people suffer a stroke. About 10,000 of these are under retirement age. If binge drinking leads to a stroke it could mean a longterm disability or even death, according to The Stroke Association.

Subclavian (applied to an artery or vein) means situated below a clavicle. A clavicle is a bone that connects the shoulder blades with the upper part of the sternum / breastbone. There is one each side.

Subcutaneous means under the skin – eg injecting through the skin.

Sublingual means under the tongue.

Sugar is a general term for various types of sweet-tasting carbohydrate. For rate of digestion see Glycaemic Index.

- Glucose is the type of sugar in the blood – giving energy for muscles and metabolism; and in bread, pasta, potatoes, rice, pulses, whole grains, and cereals. Formula $C_6H_{12}O_6$.
- ***Starch*** is a form of glucose occurring in plants – eg rice and potatoes.
- ***Fructose*** is the sugar in fruit and honey.
- ***Lactose*** is the form of sugar in milk.
- ***Sucrose*** is the common form of sugar – granulated and caster; and used in drinks, cakes, and confectionery. It is extracted from sugar cane and/or beet.

Superior means either greater quantity or quality; or situated higher up, above or upper in position. Opposite of Inferior.

Supraventricular tachycardia, **SVT**, means the heart is beating too fast and irregularly. Instead of the normal heart rate of about 60 to 80 beats per minute, it is from 140 to 200. It may be caused by too much stress, coffee, smoking, or alcohol; or by viral infections. It may occur spontaneously, or may occur by the rate not returning to normal when resting after exercise.

The symptoms include any of: breathlessness, sweating, chest pain, and the high pulse; possibly with nausea, faintness or dizziness. It may be like atrial fibrillation, atrial flutter, or nodal tachycardia.

Surgeons should not be chosen on published patient death rates or even on the rates of whole cardiac departments, as the raw data fails to allow for risk – some surgeons operate on severe cases where patients have greater chances of dying.

Surgery is the branch of medicine involving treating disease or injuries by operations involving incisions, eg cutting into the body. It also means the performance of such operations by a surgeon.

The term is also used for a place where a doctor or dentist sees patients.

Suture has several meanings.

1 A surgical seam formed after joining two surfaces.

2 A thread to sew together two surfaces with stitches – made from catgut, silk thread, or a collagen that is gradually absorbed over say three months.

3 A kind of immovable joint – eg between the three skull bones that fuse together after birth.

4 To join together as any of the above.

Sweat is salt and other body salts in water, produced by sweat glands under the skin and carried to the surface by sweat ducts. As sweat evaporates it cools the skin and thus reduces body temperature by the blood flowing near being cooled. As the mixture includes salt, on hot days people may need more salt then – see Salt – Sodium-based salt issues.

SVC. See Vena cava.

SVT. See Supraventricular tachycardia.

Symbols.

1/7 = one day, or one day each week.

1/52 = one week or one week each year. 3/12 = 3 months. 12/12 = all of a year.

< means less than and not equal to.

> means greater than, ie more than and not equal to.

≤ and <= both mean less than or equal to.

≥ and >= both mean greater than or equal to.

| means or.

* sometimes means multiply.

Symptom. The **symptoms** of an injury or disease are the sensations that the patient experiences and can describe..

Signs are issues about the patient that a medic, first aider or carer can see, feel, hear, or smell – either being obvious or observed from examination or tests.

Sometimes, particularly where the difference is not relevant, the term **symptoms** is used to cover both.

System. The systems approach to understanding how things work is based on two ideas.

1 The real world can be thought of as having purposeful human activity systems that are of interest. These systems interact with each other and with the natural, economic, political, social, and other environments in which they are embedded. Each system can adapt to external changes.

2 A system may be viewed as having several parts or components. Each part contributes to the purpose of the whole. So the whole would be affected if a part were to leave the system. Each part has interfaces to other parts and/or external systems, and can adapt to changes external to itself. The parts are subsystems.

Thus a **system** is an assembly of parts or components connected together in an organized way. The parts are affected by being in the system and the behaviour of the system is changed if they leave it. This organized assembly of parts does something; and is regarded as being of particular interest. The subsystems contribute to the purpose, interact and can adapt.

The systems and subsystems are constructs of human minds that perceive them as of interest. Different people looking at the same things will often see quite different systems and quite different purposes.

Systolic. See Blood pressure.

Tachycardia is an abnormally high heart rate, usually over 100 beats per minute. An overactive thyroid may also cause it. See Supraventricular tachycardia. Compare Bradycardia.

Taking medicines. See Medicines - taking and storing.

tds = three times a day. bd (= bpd) = twice per day. od = once a day, qds = four times.

Tea. Brew tea five minutes.

Leaving tea to infuse in the pot five minutes or more gives 60% more of the polyphenols – beneficial chemicals that help stave off heart disease and cancers – in the blood of male volunteers. Whether or not milk or sugar was added made no difference. The teapot should be stirred immediately after adding the boiling water.

In 2007 Dr Garry Duthie, Professor of Molecular Nutrition at the Rowett Research Institute in Aberdeen, tested the blood of male volunteers who drank black tea or tea with milk that had infused for varying times up to ten minutes.

Those who had tea infused for five minutes had 60% more of the good polyphenols than those who drank tea after one minute of infusion. Longer than five minutes, up to ten, gave no further benefit. Three minutes gave only 30%.

So people who just dunk a tea bag and drink the tea almost immediately are not getting the benefit.

Scientists at Harvard Medical School, Massachusetts, claim that drinking tea can reduce the risk of some cancers, heart disease, strokes, and diabetes. In a study, people who had drunk five or more cups of green or black tea per day had lower risk of heart disease and even had longer life.

Drinking two or more cups of green or black tea daily reduced the risk of skin cancer. This is because both green and black teas are rich in antioxidants, which are known to help fight cancer cells.

The 60 million UK population drink on average 165 million cups per day (in 2007) and are the world's second heaviest tea drinkers – second to the Irish.

Thorax. This is the part of the body enclosed by the ribs.

Trace element. See Trace element under Mineral.

Trade name = brand name = name for a particular product manufactured and marketed by a commercial company. Contrast with generic name.

Transcutaneous Electrical Nerve Stimulation, **TENS**, is an electronic device for relief of pain. It is used for the symptomatic relief and management of chronic pain and of post-surgical and post-traumatic acute pain problems. TENS means transmitting small electrical pulses through the skin to the underlying peripheral nerves.

It works in two ways. Its high-frequency continuous mild electrical signals may block the pain signal from travelling along the nerves to the brain. Also, it gives low-frequency short bursts of mild electrical signals that may stimulate the body's own natural pain-control mechanism to release its own pain easers called beta endomorphins.

Its use is solely to suppress the pain mechanism from pain at or near the skin. It will not help cure any injury or illness, nor relieve headache, for example. It should not be used until the cause of a pain has been established and treated.

TENS must not be used by patients with a pacemaker, interferes with ECG; and must not be used near the eyes; nor the neck area where it might interfere with normal signals from the brain to the heart. Safety for use during pregnancy has not been established.

TENS should only be used under the continued supervision of a doctor.

Thrombocyte is another name for platelet.

Thrombocytopenia means a shortage of the kind of blood cells that make blood clot.

Thrombosis means the formation or presence of a **thrombus**, which is a solid lump of platelets forming a clot. It can also informally mean a coronary thrombosis. See Deep vein thrombosis.

A thrombus that has formed at the site of a plaque that is in a coronary artery and that has ruptured can gradually grow until it restricts or even stops the blood flow to the heart muscle beyond, causing a heart attack and/or unstable angina.

Thyroxine, thyroid gland. The thyroid gland near the base of the neck produces hormones such as thyroxine that control metabolism and body growth.

Hypothyroidism means deficiency of this natural thyroxine – leading to slow body functions and possibly puffiness of the face. During childhood thyroxine is essential for normal growth and physical and mental development. **Hyperthyroidism** means too much thyroxine.

Patients who are have thyroid deficiency may be prescribed a drug that supplies thyroxine. See example under double-blind trial. Sometimes the dose has to be increased slowly, eg after 3-4 weeks.

Particular care is needed when treating patients who have heart problems such as angina.

TIA = Transient ischaemic attack.

Topical means applied to the skin (or ear, nose for nasal passage, anus, vagina) to affect something at that place on the body.

Toxic reaction is an unpleasant reaction eg to an overdose of a drug. A **toxin** is a poison, eg the effect of a harmful bacteria.

Trans. See trans under Fats.

Transducer. See under Ultrasound. A transducer is a probe that emits sound waves and can also detect the echo or reflected sound that comes back – eg reflected back from the surfaces outside and inside the heart.

Transient ischaemic attack TIA is a mini stroke, temporary loss of blood flow to the brain.

Transplant means taking an organ, tissue or part of a body from one place to another place – eg from one person to another person; or from one place in a person's body to another place in that person – as a graft. The term **Transplant** is also used to mean the surgical operation.

Transplants in Mind is a Bristol-based charity promoting organ and tissue donation for transplantation. See Donor.

Traumatic means arising from any injury or wound to the body.

Tricuspid. See under valve.

Triglycerides are relatively harmful fatty substances in the blood. Most natural fats and oils contain these. The amount can be measured in a blood test.

Troponins. When a heart attack is suspected, blood tests measure various substances including troponins. Troponins of patients with CHD are also measured. Troponins are released into the blood by damaged muscles, they remain in the blood for several days, and their alternative structures distinguish between cardiac or skeletal muscle origins. So if cardiac troponins are present, the patient has had a heart attack and has heart muscle damage.

Tumour. A tumour is any abnormal swelling or a mass of tissue formed by a new growth of cells, normally independent of the surrounding structures.

Ultrasound. Ultrasound is sound waves above the highest frequency that can be heard by a human ear, about 20 kHz – ie ultrasonic waves. Ultrasound has two applications.

1 **Ultrasonic imaging** is a method of checking for blood clots or other diagnosis by high-frequency sound waves and the echoes that come back forming a picture – see factsheet on Echocardiogram.

2 Ultrasound is used as a treatment, producing a high-frequency massage, eg for chest pain following heart surgery where the cartilage between the sternum and a rib has not recovered.

A **piezoelectric transducer** is a crystal – eg quartz – that converts alternating electric voltage and current into sound. The opposite also occurs, so a crystal vibrated by reflected sound produces an electric voltage – ie a detector. These effects are biggest when the frequency equals the natural resonance frequency of the crystal.

The frequencies used in diagnosis and treatment are from 1 to 15 MHz. (Hz = Hertz = beats per second, M = million) Lower frequencies go deeper into body tissues. After a coronary artery bypass graft, the treatment of chest tissues to heal wounds and relieve pain coming from where the ribs join the sternum might be at 1 MHz and 1 Watt per sq cm – producing high-frequency massage of the cartilage. Sometimes the reflected pulse that is detected is a harmonic, ie a multiple frequency, of the transmitted pulse – eg transmit 1.7MHz, detect received 3.4MHz.

For producing an image the pulse repetition frequency is typically a few kHz – low enough for all the reflected echoes from one pulse to be received before the next pulse. A line of 100 transducers triggered one after another gives an image. Beam width affects lateral resolution. Pulse duration affects axial resolution. The advantages are: non-invasive, safe (less than 0.1 W per sq m for diagnosis), and more effective than X-rays. Gas and soft tissue reflect 99.9% of ultrasound energy, so structures on the far side of lungs cannot be imaged. Bone is not easily penetrated by ultrasound.

Unstable angina. See Angina.

Urticaria is a skin condition with itchy reddish or whitish raised patches, usually caused by an allergy. **Urtication** is a burning or itching sensation; or another name for urticaria; or an obsolete way of beating the skin with nettles to produce a counter-irritation. To **urticate** is to perform urtication.

Vaccine is a substance to cause active immunity against a specific infectious disease.

Valsartan. See valsartan under Angiotensin converting enzyme inhibitors.

Valve. A human heart has four valves, two on the right and two on the left.

The two on the right side of the heart are called the **tricuspid** and **pulmonary valves** and govern the flow of blood through the heart to the lungs. In adults it is rare for these valves to need operations.

The two valves on the left side of the heart are the mitral valve and aortic valve. These govern the flow of blood through the heart and out to the rest of the body. Usually these are the two valves that become narrow or restricted – called **stenosed**, or start to leak significantly – **regurgitation**, and that may need to be repaired or replaced.

Valve surgery. If your cardiologist has established that your symptoms of breathlessness, chest pain, dizziness or faintness are due to a malfunctioning heart valve, you may need an operation to repair or replace the affected valves. After the operation you will notice a significant improvement in your symptoms. Valve surgery may also reduce or prevent changes associated with long-term heart muscle strain.

See separate factsheet on Valve Surgery and Valvuloplasty.

Valvuloplasty involves inflating a balloon inside a valve to widen it. Compare Balloon angioplasty. Valvuloplasty is a painless procedure and is carried out under local anaesthetic. You may have to stay in hospital about three or four days.

See separate factsheet on Valve Surgery and Valvuloplasty.

Variable has several meanings. A variable is something that can be observed, measured or calculated for every patient in a selected group. It may also apply to a quantity that has a range of possible values. Variable can also mean liable to change. It may also apply to something liable to vary from the established type or pattern. It also applies to something that can be varied but in a controlled way.

An **independent variable** in an equation or assertion is a variable or argument that is free to take any valid value. In maths it is often denoted by *x*. Extending this idea, any patient identifier – such as hospital number – can be regarded as an independent variable, since for a particular value of that identifier there will be observed values of other variables.

A **dependent variable**, denoted typically by *y*, is one that can be calculated from – or is related through equations to – the independent one. By extension, something that has an observed value for each patient can be treated like a dependent variable.

Vascular means relating to or having vessels that circulate fluids.

Vascular disease means disease of the blood vessels – the cause of heart attacks, most strokes, angina, and other related conditions. See Cardiovascular.

Vasodilators and calcium channel blockers act on the muscles of the walls of arteries to prevent narrowing. See Antihypertensive.

Vein. A vein is a blood vessel in which blood flows towards the heart from part of the rest of the body.

Vena cava. A vena cava is either one of the two large veins that carry low-oxygen blood back to the heart. They are the **inferior vena cava**, IVC, and the **superior vena cava**, SVC.

Venogram. A venogram is an X-ray of the leg veins to observe blood clots, usually with a trace of a dye that shows up on the X-ray. It helps diagnosis of deep vein thrombosis.

Ventral means towards or relating to the front of the body or towards the belly. Opposite of dorsal. Also see Anterior.

Ventricle. The right ventricle RV is the lower-right chamber of the heart. Similarly the left ventricle LV is the lower-left chamber. Blood is pumped from the left ventricle to the rest of the body along arteries, and from the right ventricle to the lungs.

Ventricular fibrillation is an irregular twitching of the heart muscle wall, interfering with the normal rhythm of the ventricles. The electrical impulses may become chaotic, so the heart muscles do not respond correctly. It is often corrected by early use of a defibrillator. See Cardiac arrest, Automatic external defibrillator, and Supraventricular tachycardia.

Viscosity. Viscosity is a measure of the extent to which a liquid such as blood does not flow easily – its stickiness. Eg syrup or treacle is more viscous than water. See International Normalized Ratio.

Vitamins are natural substances that are essential for life, health growth and metabolism.

Generally, processed and overcooked foods have less vitamins than fresh, raw, or lightly cooked foods.

People should not normally* take more than the recommended quantity of each – particularly of fat-soluble vitamins that may accumulate in the body. *Here 'normally' means that patients severely deficient in a particular vitamin will need more and be under medical supervision. Overdose does not help and may cause serious harm.

Most people *may* take supplementary vitamin tablets without risk, but should not need such.

Vitamins are any of a group of compounds that are essential in small quantities for the body's normal metabolism. They cannot be synthesized in the body, but they occur naturally in various foods.

Under diet it is suggested that people cannot correctly absorb and/or process some vitamins unless certain proteins and/or other vitamins are already present, eg from oily fish, poultry and other foods.

Insufficient supply of a particular vitamin typically results in a deficiency disease. The usual minimum daily requirements are based on the Reference Nutrient Intake. People with deficiency of a vitamin may need higher quantities, as can be determined by a doctor.

The following table summarizes the main vitamins, why needed, and food sources. Different sources of such information give slightly differing foods for some vitamins. In the table * means not as good a source as ● and in some cases the best sources are given in words.

Vitamin	Oily fish	Poultry	Red meat	Liver kidney	Milk	Cheese	Butter marg	Eggs	Cereals bread	Green veg	Root veg	Pulses	Nuts	Fruit
A; protect skin & internal tissues, acne, night vision; in ●carrots, halibut oil				●	●	*	*	●		●	*			●
folic acid; neural defects, anaemia				●				●		●				●
B1 thiamine; metabolism; in ●rice			●	●					●			●	●	
B2 riboflavin; metabolism	*			●	●	●		●	●			●	●	●
B3 niacin; lipid-lowering, reduce LDL	●	●	●	●					●			●	●	
B5 pantothenic acid; cell growth	●			●					●					
B6 pyridoxine; metabolism catalyst	●	●	●	●				●	●					

Vitamin	Oily fish	Poultry	Red meat	Liver kidney	Milk	Cheese	Butter marg	Eggs	Cereals bread	Green veg	Root veg	Pulses	Nuts	Fruit
B12 cyanocobalamin; carry oxygen	●		●	●	●	●		●						
C ascorbic acid; anaemia; ●citrus fruit, tomatoes, green veg, *see below*										●	*			●
D calciferol; bone disorders, rickets					●			●						
E tocopherol; reproduction, antioxidant							●	●	●	●		●	●	
H biotin; dermatitis, hair				●				●				●	●	
K prothrombin; blood plasma clotting										●	*			
P regulates flow in capillaries; ● in citrus fruit, blackcurrants, rose hip														●

Vitamin C prevents scurvy, which shows as anaemia, spongy gums, and bleeding from beneath the skin. In infants shortage of Vitamin C causes badly formed teeth and bones.

Research has shown that people with high levels of Vitamin C in their blood live on average six years longer than others with low Vitamin C. But this may partly be due to other factors such as lifestyle, environment and wealth. Those eating a low-GI diet had increased levels of Vitamin C absorbed from their foods – see under High GI.

Waist-to-hip ratio, WHR, has been found to be a better guide to risk of atherosclerosis and/or other heart disease than Body Mass Index BMI, or waist or hip measurements. Atherosclerosis here means the fatty deposits on artery walls, with related thickening, so the narrowing reduces the blood flow.

- While standing and breathing normally, measure around your **waist** – about level with or just above your belly button, half way between the bottom of your rib cage and the top of your hips; without pulling the tape measure tight.
- Measure around the widest part of your **hips**, over your buttocks, similarly.
- Divide the waist measurement by the hip measurement to get the **WHR**.

Women with a ratio of 0.85 or over, and men with 0.95 or over are said to have **raised WHR**. This is found to be a predictor of atherosclerosis and/or other heart disease – a much better predictor of heart disease than BMI.

To get your BMI, divide your weight in kilograms by the square of your height in metres. BMI under 18.5 is underweight, 18.5 to 25 healthy, 25 to 30 overweight, and over 30 obese.

Obesity increases the risks of: high blood pressure, diabetes, high cholesterol, heart attack, stroke, gallbladder disease, osteoarthritis, endometrial cancer, depression, and fertility problems; and shortens life expectancy.

Research at the University of Texas had found that men over 37 inches (94cm) waist, and women over 32 inches (81.3cm) had an increased heart disease risk. The sample was 2744 people.

Walking can help one to:

- feel good, sleep better, reduce stress, keep heart healthy, reduce blood pressure; and lose weight;
- reduce risks of CHD, strokes, diabetes, and bowel cancer;
- maintain independence longer when older; and
- live longer and in better health.

See also Exercise.

Warfarin. **Warfarin** is named after Wisconsin Alumni Research Foundation and Coumarin. Coumarin is an anticoagulant. See under Anticoagulant, under ablation for AF, and under Valve surgery.

Weil's disease is typically caused by the water of a lake or river entering the body eg through a wound not covered by a waterproof dressing, or by swallowing. It is carried by water rats. It can come on in 0 to 19 days. The symptoms, with mnemonic THE FARM VioLiNs, are:

Temperature
Headache
Eyes sore
Fever
Appetite loss

Rash or red spots that may or may not disappear when pressure is applied, eg by a glass tumbler. In meningitis the spots disappear when pressure applied.

Muscular pain

Violent vomiting
Light aversion, wanting to be in the dark
Neck stiff.

These THE FARM VioLiNs are similar to meningitis.

Take the patient to A&E without delay. Tell the doctor / nurse that he or she has been in a lake or whatever, as Weil's disease is rare and a medic might not think of this or meningitis. Delay could be fatal.

In the UK there are less than or up to about 100 cases per year, mostly sewage workers. But occasionally a canoeist, dinghy sailor, or swimmer who was in contact with a lake, river water, or seaside gets it.

Prevention is by covering any skin injury with a waterproof dressing, and not allowing any such water to enter the body – eg by mouth or nose. Then have a bath or shower before bedtime that day.

Copyright

Authors, sources and acknowledgements

The main sources are *BCPA Journal* published articles, other information from authors, and publicly available documents and websites. We hope we have thanked everyone.
Richard Maddison

Angina

Angina is a chest pain – an uncomfortable feeling in the chest that is usually brought on by exercise or emotional upset. For some people it is hardly a pain at all, but for others it can be severe. The commonest complaint is of a heaviness or tightness in the middle of the chest.

The pain may spread to the left shoulder, left arm and hand; neck, throat, jaw, back and/or stomach. The patient may be temporarily short of breath, and/or feel weak and/or anxious. Also called **angina pectoris**.

Angina is a built-in warning device, telling you that your heart is trying to do too much and that you must take it easier.

Each year about 20 000 people in the UK develop angina for the first time.

Many women wrongly imagine that heart disease affects men only. In fact, one in four ***women*** die through heart disease.

Heart disease here means damage to the heart caused by narrowing of the coronary arteries. At first there may not be any noticeable symptoms. As it progresses it can lead to angina chest pain; and if an artery becomes blocked then part of the heart dies, leading to a heart attack.

Cause

Angina is most often caused by the gradual narrowing of the arteries of the heart by materials being deposited in their walls. Over many years, these deposits increase until they reach a size where they actually restrict the flow of blood through the arteries.

When a patient's body is at rest and the heart is beating at its normal resting rate, sufficient blood passes into the heart muscle to nourish it. Under exercise or strong emotion the heart is put under strain by being made to beat faster and a point is reached when the flow of blood and the oxygen it carries is insufficient to meet the increased demand of the heart muscle. Those muscles are starved of oxygen so cannot function properly, and this produces pain.

What to do

Anyone who unexpectedly gets such pain or symptoms should rest immediately and call an ambulance if either:

- it is not stable angina (explained below); or
- if both it is stable angina that the patient has had before and understands, and it does not respond within a few minutes to rest.

The doctor can usually tell if it is angina from what you say the pain feels like, where it is, and what brings it on. He or she may also order some other tests. Usually the diagnosis is confirmed by an electrocardiograph while the patient does an exercise stress test on a treadmill. The ECG pattern is often normal for patients who *sometimes* have angina, but the pattern can become abnormal when angina occurs. From a blood sample the amount of cholesterol and other fatty substances in the blood can be checked.

The main drugs for the treatment of angina are low-dose aspirin, and clopidogrel, which is an antiplatelet drug. Patients may need Coronary angiography.

Angina risk factors are given under artery in the Glossary.

Angina may take either of two forms.

Stable angina occurs with exercise and subsides after a few minutes of rest.

Unstable angina is unpredictable, coming and going even when the patient is resting. Both forms of angina typically produce similar chest pain as above.

The difference is that stable angina responds immediately to a few minutes rest.

Stable angina is an uncomfortable feeling in the chest that is usually brought on by exercise or emotional upset. It results from a temporary shortage of oxygen available to the heart muscle. Stable angina is more likely when you, the patient, are walking quickly, walking uphill, when you are carrying a heavy weight, or when you are upset. It is more likely after a meal, in cold weather, or when you are excited. Stable angina pain usually passes off within minutes after stopping exercise, and there is no lasting damage done to the heart muscle.

Unstable angina is severe and unpredictable angina *unrelated to exercise*. This is much more serious than stable angina. Unstable angina occurs when the patient is *resting* and a clot has formed in a heart blood vessel. Unstable angina is usually the result of a plaque in a coronary artery breaking up when the artery becomes partially or completely blocked by the formation of a clot. The blood clot is called a thrombus. This medical emergency may indicate an acute life-threatening event and should be taken as seriously as a heart attack. Public awareness of unstable angina is low. People do not realise the severity. In 2000, only 22% of a sample of people correctly knew that it might lead to a heart attack or death. Unstable angina is more common than breast cancer, or than Multiple Sclerosis. The term **Mini heart attack** is sometimes used to mean an attack of unstable angina.

The differences between angina, heart attack, and heart failure

With a **heart attack** the pain is more severe and lasts longer and it does not decrease on rest. The patient frequently perspires and may feel sick. A heart attack is the effect of an artery becoming blocked or significantly narrowed by a clot forming in a coronary artery – one of the arteries supplying the heart. The clot interrupts blood flow to the heart muscles, so an area of heart muscle is deprived of adequate blood. This may cause permanent scarring and damage to an area of the heart muscle.

Heart failure means that the heart muscles cannot pump enough blood efficiently to meet the body's needs.

Prevention and drug treatment of angina

In *some* people having the following correct is enough: weight, alcohol, cholesterol, regular exercise, avoiding stress, and not smoking. But most patients need drugs. Drugs can help by either increasing the blood supply to the heart or reducing the work it has to do.

Aspirin helps to reduce the stickiness of the blood, decreasing the chance of a heart attack or stroke.

Glyceryl trinitrate GTN is the commonest drug used for angina. It is usually sucked as a tablet or sprayed under the tongue, and can stop an anginal attack quickly. You should always carry your tablets and/or spray with you and use them if you think an attack is likely to come on.

If you get angina pain you should stop whatever you are doing and sit down. If the first GTN does not relieve the pain after 5 minutes, you should repeat the dose, and again at 10 minutes. If you still have angina pain after 15 minutes, you should contact a doctor.

Both tablets and spray can be brought over the counter without a prescription. Tablets deteriorate once opened – typically they only keep for eight weeks. A spray canister may keep three years and hold about 200 spray doses.

Prevention

Preventing a disease before it happens is called primary prevention.

Once a patient has a disease he or she and others can try to stop it getting worse, or at least slow down its progress, called secondary prevention.

For angina, the methods of primary and secondary prevention are much the same.

Don't smoke. Cigarettes remove oxygen from the blood. They excite the heart, and make the blood cells stick together. If someone stops smoking, after five years their risk of a heart attack falls to about the same as non-smokers. See factsheet on benefits of stopping smoking.

Lowering high blood pressure High blood pressure makes the heart work harder. So blood pressure needs to be controlled.

Weight reduction. Keeping close to the recommended weight for your height and age will keep your blood pressure down and reduce the workload on your heart.

Lowering blood cholesterol. If your blood cholesterol is too high you will be given statins and advised on diet, eg.

Cut down on saturated fats – in dairy products and fatty meats. Eat lean meats, use little or no butter, and switch to skimmed or semi-skimmed milk. Grill food rather than frying it.

- Polyunsaturated fat is in corn oil, sunflower oil, safflower oil, and soya oil – and is **good**.
- Monounsaturated fat is in olive oil, groundnut oil, and rape oil – and is **good**.
- Eat plenty of fresh fruit and vegetables – five fruits & vegetables a day.

Reduce *stress*. If you have angina then you should learn to relax more. Some hobbies will help you relax, but the important thing is to find out the stresses at home or work that you cannot cope with. Try to avoid activities that cause mental and emotional turmoil.

Everyday life with angina

After treatment most people with angina can get back to a normal life. However, many people with angina have previously been living excessively busy and stressful lives. You have a good reason to cut down on your commitments, if you want to.

Exercise will help to keep your weight down – most people feel better generally when they are fit. Walking, swimming, and cycling are all good for the body's systems. You should take 30 minutes of exercise 3 to 5 times a week.

But weight lifting and press-ups are types of intense exercise that are not recommended. Highly competitive exercise such as squash may be dangerous if you have a heart condition.

Sexual intercourse. The combination of physical activity and sexual excitement may bring on an angina attack. You do not need to avoid sexual activity, unless it produces angina. Taking a GTN tablet or spray beforehand will usually help. A useful rule is that if you can climb two flights of stairs without pain you can safely manage sexual intercourse. Sex is a normal part of life, if symptoms occur ask for advice. Do not avoid sex as this may lead to unnecessary frustration and reduce your enjoyment of life.

Driving. Do not drive if you get angina while driving. If angina only occurs on exercise and is stable, driving is permitted and notification to DVLA is not needed.

Holidays and travel are important and are recommended. You should organize your journey to allow plenty of time. Avoid carrying heavy pieces of luggage. Air travel should be no problem in modern pressurized aircraft. At an airport, take a rest in the departure lounge, so that an angina attack is less likely when you walk to the departure gate. You should avoid high mountains, though if you have mild or moderate angina you should be all right at heights up to about 2000 metres or 6600 feet.

Alcohol. See *Alcohol*. In small amounts, eg about 3 or 4 units per week, certainly less than one a day, alcohol will not harm your heart. In fact it might help to relieve tension, but you must be very careful of the effect of alcohol on your weight. The recommended guidelines are: up to 21 units per week for men, up to 14 units per week for women. These should be spread through the week, preferably with at least two alcohol-free days each week. One alcohol unit is a half-pint of beer, 1 measure of spirits, or one small glass of wine.

Contact your doctor if your angina attacks become more frequent or more severe. This is especially important if your angina develops at rest or on minimal exertion, or if GTN seems to become less effective. If the angina is worsening, or occurs on only slight exertion or at rest, your doctor is likely to suggest referral to a cardiologist.

First published in this form 2002, and updated 2005, 2007, 2008.

Atrial Fibrillation

Atrial fibrillation is a very common abnormality of heart rhythm – about 10% of people over the age of 70 have it. When this occurs, the top chambers of the heart – the **atria** – beat in a chaotic fashion, called **fibrillation**. It may be treated with drugs.

The electrical signals sent from there to the main pumping chambers, the **ventricles**, are erratic. The resulting heartbeat can be felt as an irregular beating – often in the chest or stomach. The feeling is called **palpitation**.

Some people are completely unaware of the irregularity when it occurs and it is only detected when a doctor feels the pulse. In some people it may be unpleasant and associated with chest discomfort, sweating, shortness of breath or light-headedness.

Atrial fibrillation – Causes. Atrial fibrillation is associated with any structural heart abnormality, generalized infections such as pneumonia, an over-active thyroid gland, blood chemical abnormalities, high blood pressure, and drinking excess alcohol.

It frequently occurs unexpectedly for no reason, in which case it is called **lone atrial fibrillation**.

Atrial fibrillation – Problems caused by it

1 The palpitation itself may be unpleasant.

2 If the heartbeat is fast the heart chambers may not pump so effectively and fluid may build up on the lungs or in the legs – causing shortness of breath or swelling of the legs.

3 If the rhythm persists for a prolonged period of time there is a small risk of a clot building up within the heart. This may break free from the heart and lodge within the arteries to the brain – causing a stroke, or in arteries to the limbs starving them of blood. Although the risk of a clot forming in the heart is small, it is the main reason doctors attempt to return the heart beat back to normal.

Atrial fibrillation – Treatment

See also ablation for AF below.

When atrial fibrillation occurs the doctor will try to find a cause for it and treat the cause.

If it has been present for over 2 years, it is unlikely that treatment can restore normal heart rhythm. In this case the fast rates of the atrial fibrillation can be controlled with drugs such as digoxin, verapamil or atenolol.

To minimize the risk of any clot forming in the heart, aspirin or warfarin may be given. Both agents thin the blood but in different ways. Warfarin is more effective than aspirin at doing this but bleeding problems are more common with it. For this reason, the doctor will assess the likelihood of a clot developing and the risk of bleeding if you take warfarin and make a decision as to which agent is best for you.

If atrial fibrillation is of recent onset, it may be possible to restore normal heart rhythm. This can be done by giving drugs or by giving an electric shock to the heart, called **DC cardioversion**. DC cardioversion is much more successful but requires a patient to have a light anaesthetic so that they will not be awake during the procedure, and to be admitted to the hospital for the day.

Some drugs may be given to maintain the normal rhythm when it has been established eg flecainide, amiodarone or sotalol. These are powerful drugs and have potential side effects.

Treatment of atrial fibrillation varies from one person to another. Your doctor will tailor your treatment to suit you. The treatment may need to be adjusted from time to time depending on the response to treatment.

Ablation for AF

Sir Terence English (TE), our President, had a heart operation done in May 2006 by Mr Steven Hunter (SH), Consultant Cardiothoracic Surgeon at James Cook University Hospital, Middlesborough.

The operation aims to rectify intermittent atrial fibrillation, where the atria contract too fast or quiver – producing fast, uncoordinated heartbeats. Steve operated through six small keyholes in the chest, instead of more major surgery and needing TE to take Warfarin longterm.

The following summarises the case (in 2007) for the video-assisted thorascopic maze operation. Atrial fibrillation (AF) is a cardiac arrhythmia (abnormal heart rhythm) that 1.15% of the general population have. Prevalence is increasing and people with AF are 5-7 times more likely to have a stroke, twice as likely to die, and they make significant use of healthcare resources compared to people with no AF. We need more effective ways of managing AF in order to contribute to meeting mortality and health gain targets, and to reduce costs.

Conservative treatment options for AF have inherent problems. Firstly, antiarrhythmic drugs do not deliver much better rates of sinus rhythm than controls. Secondly, the drugs are associated with a high level of toxicity and serious complications, so tolerance and uptake are poor. Thirdly, the drugs efficacy reduces over time. Finally, for many patients drug management becomes expensive when the duration of treatment; the cost of monitoring and treating adverse effects of drugs; the costs of repeated cardioversions, A&E visits, and emergency admissions are taken into account.

Ablation, ie modified Maze procedure for AF in conjunction with mitral valve repair, promises to be better in meeting all the primary goals of treatment for AF. It reverses the risk factors that cause atrial fibrillation – slowing the heart rate, preventing strokes, getting AF back to normal heart rhythm, and preventing recurrence. Patients' response to treatment appears to last over time – with low rates of reoccurrence and less dependence on pharmacological therapies.

Although concomitant surgery for AF will increase the cost of mitral valve repair above tariff, the investment should be more than offset by predicted savings against drug costs, admissions, defibrillation, and the incidence of repeat procedures. Patients undergoing concomitant ablation have lower cost of care in both year one and in the first five years after surgery than other invasive treatments.

First published in this form 2002, and updated 2005, 2007, 2008.

Consent

The general legal and ethical principle is that valid consent must **'usually'** be obtained before starting treatment or physical investigation or providing personal care for a patient. This principle reflects the right of a patient to determine what happens to his or her own body and is a fundamental part of good medical practice. Case law has established that touching a patient without valid consent may constitute a civil or criminal offence. Poor handling of the consent process may lead to complaints from a patient.

My use of **'usually'** above means there are exceptions. These include grounds of necessity, where the patient is unconscious or cannot communicate, and others.

Consent – Asking for and giving consent

Before a doctor, nurse or health-care professional or health-care student (hereafter called **'medic'**) can examine or treat a patient, they 'usually' need his or her **consent**, given **voluntarily**. Here **'voluntarily'** means given freely, without pressure or undue influence from anyone.

For consent, the patient must **understand** what is involved – including the nature and purpose of the procedures, the consequences / risks of having or not having the intervention, and including using and weighing this information in the decision-making process.

Seeking consent is usually a process, with appropriate information and explanations being given in discussion, not a one-off event. Acquiescence where the patient does not know what the intervention entails is not 'consent'. The patient must have the **capacity** to comprehend and retain the relevant information.

If the patient has some ability to understand and think things over, he or she should be encouraged to decide for himself or herself. It may not be a decision that a 'friend' agrees with, but that is not the key test. What the 'friend' and the 'medic' need to ask is: *can the patient understand and weigh up the information provided?*

Where the patient understands:

- if ***over 18***, only he or she can give consent or refusal. A husband, wife, partner, relative, carer or friend (here called **'friend'**) cannot give that consent.
- if aged ***16-17***, he or she can give consent similarly. But their refusal can be over-ridden by a 'parent' on the grounds of 'welfare' – avoiding risk of grave irreversible mental or physical harm, or in a life-threatening emergency.
- if ***under 16***, and with sufficient intelligence and understanding of the issues, he or she can similarly give consent.

Consent need ***not*** be in writing: written consent is only useful as a record or evidence of it.

If a patient is ***unconscious***, or ***cannot communicate*** their wishes, or is too bewildered to make decisions – eg from stroke, panic, shock, fatigue, then he or she is not in a position to give consent. Then 'medics' are allowed to do what they believe is in the patient's **'best interests'** – meaning taking into account the patient's general well-being and what he or she is known to believe in.

Intervention is also legally justified on the grounds of **necessity**. In circumstances where a split-second decision needs to be made, eg at a car crash or where a patient becomes unconscious or unable to communicate consent, intervention would be justified legally on grounds of necessity. There is not time to do a 'best interests' evaluation, albeit one might conclude that the chance of saving the patient's life must be in their best interests.

'Friends' cannot make decisions on behalf of patients who cannot decide for themselves. However, they may be able to tell the 'medics' about the patient's opinions, views, and beliefs – eg whether the patient has ever accepted or refused certain kinds of treatments. This will help the medics make better decisions in the patient's 'best interests'.

Living wills

Sometimes a person may decide how he or she would want to be treated in the case of a future incapacity – if something happened to them in the future and they were no longer capable of refusing consent – called a **living will**.

A patient may ***refuse*** a particular treatment, and/or make a living will. Certain conditions apply. Medics, first aiders, and carers must then comply with the refusal.

'Friends' should tell 'medics' about such past decisions and preferably give the 'medics' a copy of the document.

Advance **refusals** are **normally** legally binding on medics, even if the 'friend' disagrees with it/them. It is only advance ***refusals*** (as opposed to other advance directives) that must be respected and are legally binding, where valid and applicable to the subsequent circumstances in which the patient lacks capacity. '**Normally**' here means there are some exceptions.

'Friends' should never be asked to sign a consent form on behalf of a patient. However, they may sign a form to say that they have been consulted.

Consent – for carers and first aiders

The legal position in the UK of **first aiders and carers** is *similar to* that for 'medics' as above. I have put 'similar to' not 'the same as' since first aiders and carers may not have all the relevant medical knowledge and skills. They must take care and be careful not to be negligent.

For a conscious communicating patient they should ask for consent before intervening, examining and/or treating. Where a patient is unconscious or there is not time to ask for consent, they should act as for medics as above. This includes doing what they believe is in the patient's 'best interests'. In a life-threatening emergency, doubt should be resolved in favour of preserving life.

Finally, these few paragraphs do not give the full legal position on consent. I have tried to summarize and explain the more common situations, but have not covered everything. Most of the currently available heart disease and first aid literature does not mention consent at all. It has become more of an issue in recent years. Most Department of Health (DH) literature on consent is dated 2001 or later.

First published in this form 2002, and updated 2005, 2007, 2008.

Coronary Angiography and Angioplasty

Coronary angiography is a procedure for helping diagnosis of possible blockages in coronary arteries or in veins or arteries of a past bypass.

Under local anaesthetic, a fine tube is passed into a femoral artery in the groin and along the body's arteries to the coronary arteries. A dye is injected to give an X-ray picture of the blood flow and arteries, indicating any narrowing.

Nowadays (2008) this can be done in a single day – so the patient is a day patient and able to return home perhaps a couple of hours after the operation for recuperation and treatment in the hospital cardiac day ward.

Coronary angioplasty and stent insertion

This involves inflating a balloon inside the narrowed section of a coronary artery to enlarge or open it to improve the blood flow to the heart muscle. Usually also, a stent is inserted to keep the artery open.

If you, the patient, have a blocked or narrowed coronary artery, or have had previous bypass graft surgery and your graft has become narrowed, it may thus be possible to correct the problem without major heart surgery.

The balloon is sausage-shaped and very small. It is attached to the end of a very fine catheter, known as the angioplasty catheter. The consultant uses a guide catheter and a fine hair-like guide wire to help place the angioplasty catheter in position. A local anaesthetic is usual.

The consultant inserts the guide catheter into a femoral artery in your groin, or sometimes an artery in the arm or wrist. He /she moves it up to the heart under X-ray guidance. When the guide wire is in place across the blockage or narrowing, the balloon is threaded along until in the correct position, and inflated to stretch the artery and/or squeeze and disrupt the material blocking it.

You may feel some pain when the consultant inflates the balloon because this temporarily blocks the blood flow through your artery. This pain should ease as soon as the balloon is deflated again.

After this has been performed once it is normal to insert a stent. This is like a small, coiled spring that is placed using the angioplasty catheter in the blocked or collapsed section of the artery. When it is released from the catheter, the spring expands and holds the artery open.

Since 2002 it became almost universal to use some form of stent in every procedure performed. Since then, only in rare cases do the consultants perform only an angioplasty.

Coronary angioplasty – Success

Angioplasty is successful in 95% of patients. Normally you will have to stay in hospital 12 to 24 hours following the procedure; or you may be able to go home at the end of a long day as a day patient. By contrast, in the late 1990s success was about 90% and a stay of one to two days was typical.

In about one in every 100 cases the artery may become blocked and threaten serious damage to the heart. An emergency CABG operation may then be recommended.

Occasionally angioplasty fails to achieve the desired result but no damage is done. If this is the case the patient will often be referred for surgery, but will not need an immediate operation.

The table compares the success of stents and coronary artery bypass grafts (CABG) for past patients. The risks are higher for patients treated urgently – in emergencies and/or to save life.

	CABG	Angioplasty & bare metal stent	Angioplasty & drug eluting stent
Anaesthetic type	General anaesthetic	Local anaesthetic	Local anaesthetic
How long in hospital	5 to 10 days	1 to 2 days	12 to 24 hours
How many patients needed a repeat later	5% to 10%	25% to 30%	0% to 5%

First published in this form 2002, and updated 2005, 2007, 2008.

Coronary Artery Bypass Graft – CABG

Coronary artery bypass graft, **CABG**, pronounced 'cabbage', is an operation that connects and replumbs coronary arteries to bypass their blocked part or parts. It uses an artery and/or vein from elsewhere in the patient's body – such as a mammary artery from the upper part of the chest, and/or a leg vein.

Coronary angiography may have shown that the nature of the narrowing or blockage in your arteries makes you unsuitable for angioplasty.

The solution is to **bypass** the narrowing or blockage. Blood will then be able to flow more freely down your arteries using the bypass, and the blood supply to your heart muscles will be improved. This will alleviate or abolish symptoms such as angina. It may also prevent or delay heart attacks and may prolong your life.

About 70-80% of patients experience no further angina symptoms after their operation and usually you can expect to return to a normal life. Many hospitals now have Pre-operative Clinics where you can meet other patients and discuss your concerns with nursing staff before you come into hospital for your operation. You may also have the opportunity to donate some of your own blood for use in the blood transfusions you will need when you have surgery. Use of your own blood will reduce your risk of cross-infection. Your bypass operation will, of course, be performed under general anaesthetic.

The surgeon will make an incision, a cut, down the length of your **sternum** – the breastbone – to expose your heart. You will be connected to a **heart-lung machine**. Large tubes will be connected to the veins and the aorta artery near the heart, and the other ends connected to the machine. It takes over from your heart and pumps the blood around your body while the surgeon operates on your coronary arteries.

In order to bypass the narrowing or blockages in your coronary arteries, the surgeon may remove lengths of vein from one of your legs, usually the left.

One end of the vein will be inserted into your **aorta**. This is the large artery that emerges from your heart and carries the blood that circulates around your body. The other end of the vein will be inserted into your coronary artery below – i.e. beyond – the narrowing or blockage. This completes the bypass. Sometimes the surgeon will use arteries from just under your chest wall – called the **internal mammary arteries** – instead of, or as well as, veins to construct your bypass.

CABG – Afterwards

Usually you will have to stay in an intensive care ward or high dependency unit for the first 24-48 hours after your operation. However, recovery will normally be quick, and you should expect to be out of hospital in about 7 days. The wound in your chest and the incision made in your leg, to harvest the veins for your bypass, may be painful for a few months. You will, of course, be given pain relief during this period.

It is possible that you will be left with a permanent sensation of numbness or mild tingling on the skin of your chest wall or near your ankle.

The CABG operation has a high success rate, but rarely it may prove fatal. The risk is greater if the patient's heart muscle has already been severely damaged or if the patient has another serious disease – specifically chest or kidney disease. Your cardiac surgeon will discuss these risks fully with you before you decide to go ahead with the operation.

Many people find it valuable to follow a rehabilitation course of discussion and guided exercise after they are discharged from hospital. You should be aware that your bypass operation might have to be repeated at some time in the future. Most commonly, this will be after about ten years, but in a minority of cases re-operation will be necessary sooner.

First published in this form 2002, and updated 2005, 2007, 2008.

Chesses – fat content

Cheeses are here divided into three classes by fat content.

Low-fat cheeses, which can be eaten freely – no limit, are Cottage cheese, Quark, Reduced fat cottage cheese, Reduced fat cheese spread, Reduced fat Edam, Ricotta.

Medium-fat cheeses – up to 180g (6oz) per week (if no high fat cheese) are Brie, Camembert, Cheese spread, Danish blue, Edam, Emmental, Feta, Goats milk soft cheese, Medium fat soft cheese, Mozzarella, processed cheese, Reduced fat Cheddar, Reduced fat Cheshire, Smoked processed cheese, Soya cheese.

High-fat cheeses, which should be limited to 120g (4oz) per week (if no medium fat cheese), are Caerphilly, Cheddar, Cheshire, Cream cheese, Derby, Double Gloucester, Full fat soft cheese, Gouda, Gruyere, Lancashire, Leicester, Lymeswold, Mascarpone, Parmesan, Red Windsor, Roquefort, Stilton, Vegetarian cheese, Wensleydale.

Medium and high fat cheeses should be eaten only in moderation.

Either up to 180g (6oz) per week of the medium-fat cheeses,
or up to 120g (4oz) per week of the high-fat cheeses.

First published in this form 2002, and updated 2005, 2007, 2008.

Diet

The recommendations below are aimed at preventing or reducing the risks of heart disease. They do not apply to children under five years old or to people training for sports or who are ill. Also, some people have personal, religious, medical, taste, smell, or other reasons for their beliefs, choices and preferences; so may not fully agree with or want to follow these suggestions.

Have a **balanced diet** including vitamins, minerals and proteins. A balanced diet has roughly

- **one third carbohydrates** – some at each main meal, preferably mostly low GI or medium GI, and minimise sugar and salt
- **one third vegetables and fruit** – five portions with a variety of types & colours
- **one third everything else** – meat, fish, eggs, cheese, milk (a pint a day or eg 1/3 pint milk, small yoghourt, and portion of cheese), yoghourt, nuts, pulses (beans & lentils), fats (minimise saturated fats), and enough to drink.

In more detail

One third carbohydrates Eat sufficient carbohydrate foods like porridge, wholemeal bread, pasta, wholegrain rice, and potatoes for your energy needs; but not too much which may make one obese. Reduce or avoid refined carbohydrates like foods containing sugar.

Preferably have low Glycaemic Index foods – eg apple, carrot, green vegetables, porridge, spaghetti, yoghurt, wholegrain / basmati rice. Minimise high GI foods – eg chocolate, mashed or jacket potato, cornflakes, ice cream, short-grain white rice.

Minimize your sodium-based salt intake, explained under Salt.

One third vegetables and fruit Eat at least ***five portions of fruit and/or vegetables*** each day, preferably aboveground vegetables; as these contain essential minerals and compounds that one's body needs in small or trace quantities. Frozen, chilled, tinned, and dried fruit all count as fresh fruit and vegetables.

One third everything else Have fresh or frozen **fish** twice a week. This includes ***oily fish*** at least once a week – eg salmon, pilchards, tuna, sardines, trout, mackerel, or herring. Fresh and frozen fish are slightly more beneficial than canned, as the process removes some of the beneficial omega-3.

Also at least twice a week have some meat, preferably ***poultry*** – chicken, turkey or similar. See Some meat and fish weekly below for why. Preferably cut off and do not eat the animal fat or skin, which are saturated fats.

Of **fats**, omega-3, polyunsaturated and monounsaturated fats are healthy, but saturated fats and trans fats are unhealthy. So reduce or keep down total fat consumption, and in particular reduce the intake of saturated fat – see Reducing the undesirable fats in diet below. Replace saturated fat with polyunsaturated and/or monounsaturated fats.

Moderate levels of appropriate forms of alcohol (as explained there) provide protective cardiac health benefits, particularly to those at risk from coronary heart disease.

Plan meals in advance and check food labels. The information can sometimes be surprising.

Diet – Some meat and fish weekly. Research in the 1950s and early 1960s showed that older* people with deteriorations in health and with multiple deficiencies of proteins, vitamins, minerals, and/or other compounds had to have some fish and some meat each week before their body systems could again get correct the other deteriorations and deficiencies. For some reason not understood, where a person did not have any fish or meat or some other source of certain essential** things, their body eventually could not absorb and/or produce the correct levels of various other compounds needed for health.

*This research was only on older people, over 50, but probably applies to adults of all ages.

**Unfortunately, the actual relevant essential things could not then be determined, and this is still not known, but are probably proteins. The researchers found that those older people who had cut down on meat, fish, and cooking – perhaps to save money and work – had gradually developed many other deteriorations and became frail – a vicious circle. But these older people's health slowly improved again after appropriate changes.

Reducing the undesirable fats in diet by the following.

Reduce total fat consumption, and in particular reduce the intake of saturated fat. Remove the skin from meat. Cut excess fat off meat before cooking. Drain excess fat off after cooking.

Have white meats such as poultry – chicken or turkey; rather than red meats – beef, lamb, pork, bacon, ham, or similar.

Have about two servings of fish, including at least one serving of oily fish per week.

Minimize the pork or beef sausages, burgers, pasties, pies, and similar foods that typically contain animal fats and/or saturated fats.

Try semi-skimmed or skimmed milk. Reduce or avoid full cream milk.

Reduce the butter or margarine on bread or toast, jacket potatoes, mashed potatoes, and vegetables; and/or change to a cholesterol-lowering spread – eg a cholesterol-lowering product such as Flora pro.activ® or Benecol®. This is available as: a low-fat spread, a milk drink, or a yogurt. You should aim for three portions per day.

When having something moist such as baked beans or egg on toast, reduce or try omitting the butter or margarine completely.

Grill foods rather than frying them. Cut down on fried foods – preferably to not more than once per week. Do not keep fat used for frying for reuse, as reheating turns cis bonds in the fat into trans.

Use less oil in salad dressings, or use fat free dressings.

Try low-fat cheese. As explained in the separate factsheet on Cheeses fat content, the following low-fat cheeses can be eaten freely: cottage cheese, Quark, reduced fat cottage cheese, reduced fat cheese spread, reduced fat Edam, Ricotta.

Reduce or avoid crisps, dumplings, Yorkshire puddings, pastry, cakes, biscuits, and cream. Some of these also have undesirable excess salt and/or sugar.

If you cut down on the undesirable fats as above, you may need slightly more carbohydrate like porridge, wholemeal bread, pasta, wholegrain rice, and/or potatoes.

First published in this form 2002, and updated 2005, 2007, 2008.

Echocardiogram

This factsheet is for people having an echocardiogram. An echocardiogram is a painless procedure that uses ultrasound to produce a moving image of the inside of your heart. It is a useful test for checking the structure of your heart and to see how well it is functioning– eg look at its chambers, valves, and main arteries; but not the coronary arteries, which are too small. Your care will be adapted to meet your individual needs and may differ from what is described here.

An echocardiogram uses an ultrasound probe, which is run over your chest to get a moving picture of your heart. Harmless high-frequency sounds are produced near the skin. You will not feel anything and the sound waves will not affect your body in any way. They go through the skin, bounce back from part of the heart, and produce an echo that comes back to the probe. The procedure is carried out in hospital by a cardiologist or a technician trained in the procedure. Possible reasons why you may have an echocardiogram include the following.

- to check whether your heart doesn't pump as well as it should
- to check for complications after a heart attack
- to look for damage to the heart valves if you have symptoms of heart valve disease
- to check for heart disease in newborn babies and young children
- to look for heart defects in unborn babies – fetal echocardiogram

When you are reclining comfortably a clear gel is applied to the skin on the left side of your chest. The probe, called a **transducer,** emits ultrasound waves. The sound waves are reflected back from the surfaces outside and inside your heart. It reveals any abnormalities of your heart valves and shows the size and shape of the chambers of your heart. Echocardiography also shows up any abnormal communications between two heart chambers. This is especially important for diagnosing babies and children. Ultrasound scanning can be used on fetuses in a womb before a baby is born.

Types of echocardiogram

The standard echocardiogram test uses an ultrasound probe that is run over your chest.

There are also some other types of echocardiogram.

In a transoesophageal echocardiogram (TOE), images of your heart are taken from a probe inside your gullet (oesophagus), which lies just behind your heart. This means that your ribcage and lungs won't interfere with the images, and doctors can get a clearer view of your heart valves. For this procedure, you will be asked to swallow a small probe, which is mounted on the end of a flexible tube. You may have a local anaesthetic, which means you will stay awake but all feeling from the gullet will be blocked. Or you may have a sedative that relieves anxiety and causes temporary relaxation, without putting you to sleep.

A stress echocardiogram takes an image of your heart while or after it's been put under stress (normally following exercise – such as walking on a treadmill). If you're unable to exercise, you may be given medicine to stimulate the stress on your heart instead. This test can be useful in diagnosing coronary heart disease.

A Doppler echocardiography measures how fast blood is flowing through different parts of your heart, and how well the heart valves are working.

Alternative tests

Doctors can use various tests to look at your heart. An echocardiogram is just one such test, and you may also have others. If your doctor thinks you may have heart failure for example, you will probably have an electrocardiogram (ECG), a chest X-ray, and/or blood and urine tests before having the echocardiogram.

Other tests include a radionuclide test or magnetic resonance imaging MRI.

A radionuclide test involves injecting you with a small amount of a harmless, radioactive substance either while you are exercising or after giving you something safe that makes your heart act similarly. A special camera picks up the rays sent out by the substance as it travels through your heart. See MIBI.

An MRI uses magnets and radiowaves to produce images of the inside of your heart.

However, doctors use echocardiograms more often than these alternatives, especially in children and babies, as it is safe, doesn't hurt and is easy to do.

About the procedure

If you are not already in hospital, you will need to go in on the day of the echocardiogram procedure.

Ultrasound machines can either be hand-held or on wheels and can be wheeled to your bedside.

Before the test is begun, the doctor or technician will rub a clear gel over the left side of your chest. This is to make sure there will be a good, airtight contact between your skin and the probe. The probe is put in position on your skin. When the ultrasound machine is switched on, the probe gives out harmless ultrasound waves that you won't be able to feel. As the probe is moved across your chest, the ultrasound waves will pass into your body and bounce off the different structures in your heart, and back into the probe. The echocardiogram machine can detect the ultrasound waves that have bounced back, creating a moving image of your heart on a screen. Your doctor will be able to see straight away how your heart is functioning and whether there is any structural abnormality or blood clots present.

The test normally takes between 15 and 45 minutes, but can sometimes take up to an hour.

Afterwards

When the cardiologist has seen your echocardiogram results, he or she will be able to advise you on the most appropriate course of action for you. It could be that your symptoms are not caused by a problem with your heart or that you need further tests. If the echocardiogram has identified a problem with your heart, your doctor may advise medication or surgery to treat you.

Fetal echocardiogram

A fetal echocardiogram is used to get a very detailed picture of your baby's heart, before your baby is born. It is used to check whether your developing baby has a heart defect.

You will be referred for a fetal echocardiogram if your obstetrician (the doctor who cares for you during pregnancy and childbirth) thinks there is a risk of your baby having a heart defect. This may be because you have a family history of congenital heart disease, because an abnormality has been detected during a routine ultrasound scan or because there are other problems with the development of your baby.

If there's a problem with your baby's heart, it's often first noticed when you have your routine 20-week ultrasound scan. However, doctors can only get quite a limited view of your heart from an ultrasound; an echocardiogram is much more detailed.

A fetal echocardiogram can show up abnormalities in the structure or function of the heart and problems with the heart rhythm. However, some heart problems can't be detected until your baby is born.

It can be a worrying time if you have been told you need a fetal echocardiogram. However, the best advice is to wait until your echocardiogram is done and you can discuss the results with a specialist – in some cases, the doctor will be able to reassure you that there is no problem.

Knowledge gained

The echocardiogram can produce a very detailed picture of the structures inside your heart (but not the details of the coronary arteries), allowing the doctor to identify if there are any problems.

The echocardiogram can be used to assess the size and function of the left ventricle – one of the lower chambers of the heart, which is responsible for pumping oxygenated blood around the body. Measuring how big the left ventricle is and looking at it's pumping action can allow doctors to see whether you have heart failure.

Echocardiograms can also uncover problems with your heart valves – structures that help to control the way blood flows through the heart. Doctors will look at the shape of the valves, how they are moving and whether they are calcified (have a build up of calcium deposits), in order to see whether you have a heart valve disease.

Other abnormalities in the structure of your heart can also be picked up on an echocardiogram.

Harmless and safe

Echocardiography is very safe. There are no known risks from the procedure.

An echocardiogram is a non-invasive procedure, which means it is done entirely outside the body and doesn't involve putting anything inside you. Because of this, it isn't painful and you won't feel any discomfort during the procedure.

Echocardiography uses ultrasound waves to get an image of the heart. This means you will not be exposed to any ionising radiation – which is used in some other tests, like X-rays and CT (computerised tomography) scans. There are no known risks associated with the use of ultrasound.

There are also no known risks of a fetal echocardiogram to the mother or her baby.

First published in this form 2002, and updated 2005, 2007, 2008.

Electrocardiogram - ECG

This factsheet is for people having an electrocardiogram, ECG. An electrocardiogram records the rhythm and electrical activity of your heart.

You may need to have an ECG if you have a problem with your heart – such as palpitations, dizziness or chest pain – to find out what the problem is. The ECG can detect whether you have an abnormal heart rhythm, whether you have had a heart attack, and/or if your heart is working under strain.

If you are about to have an operation, you may have an ECG beforehand to check how well your heart is functioning. You may have an ECG after surgery to help decide how much exercise you can do. An ECG can also form part of a routine health check-up.

GPs are often able to do the ECG in their surgery; but sometimes you will need to be referred to a hospital.

About the ECG

Small metal adhesive discs – called electrodes – will be stuck onto your skin – one on each arm and/or leg and several on the front of your chest. The **electrocardiogram** or **electrocardiograph** is a record of the electrical impulses that your heart produces every time it beats, obtained from electrodes connected to the chest.

The procedure is completely painless, harmless and safe. The machine does not generate any signals on your skin. It only records the changing small voltages at the electrodes. It cannot give you an electric shock or affect your heart in any way. It is just your own heart that produces the electrical signals.

The tiny voltages at each electrode are amplified and either connected to a pen producing a wavy line on paper, or produce the same pattern on a screen.

The ECG results indicate whether or not the heartbeats are normal; abnormalities such as damage to heart muscle from a past heart attack; and/or that some part is enlarged, damaged, or working under strain – eg from high blood pressure.

Types of ECG

The standard ECG test, sometimes called a **resting ECG**, is taken while you are not doing any activity. There are also other types of ECG your doctor may suggest you have, if a standard resting ECG won't provide all the necessary information. These tests are normally done in a hospital, so your GP will need to refer you.

An implantable loop recorder (or ILR) is a small, slim device that is inserted just under your skin in the front of your chest (you will have a local anaesthetic for this, so won't feel any pain). The device can continuously monitor your heartbeat and can be activated whenever you experience symptoms – such as dizziness or a blackout.

Resting ECG

The standard, resting ECG, is very simple and only takes a few minutes – you'll be able to sit or lie down while having it. You will have a number of small metal plates or sticky patches called electrodes stuck or strapped to you (one on each arm and leg and six on your chest). The electrodes are attached to a recording machine by wires. When your heart beats, it produces electrical signals that are picked up by the electrodes and transmitted to the recording machine. The machine then prints out your heartbeat onto a paper strip.

Exercise ECG

An exercise ECG (also known as an exercise stress test or treadmill test) involves taking the ECG while you are carrying out some form of exercise – such as walking on a treadmill or cycling on a stationary exercise bike. The test can help to diagnose coronary heart disease and assess how severe it is.

If you have an exercise ECG, electrodes from the recording machine will be connected to you with wires in the same way as a standard ECG. You will then be asked to exercise – either by walking on a treadmill or cycling on a stationary exercise bike.

The test will last between a few minutes and 15 minutes. The exercise will be very easy to start with, and may gradually be made harder (eg, by increasing the speed or the slope of the treadmill). You'll be able to ask to stop if you need to. A doctor or technician will monitor your ECG reading while you are exercising.

Event monitoring

Event monitoring or ambulatory ECG, records your ECG over 24 hours or up to a week. You wear a portable electronic recorder in a pocket or clipped to a belt for 24 hours or a week, and make a note of when you feel any symptoms, such as palpitations or dizziness during the period. This test is useful in detecting whether you have an irregular heartbeat (arrhythmia), and for getting a recording if you have something happen occasionally.

You go home and carry out your normal activities. You are asked to keep a diary of what you do throughout the day, noting any times when you feel symptoms. At the end of the period, you return to the hospital to have the monitor taken off and the results analysed.

Some machines have a switch so you can switch on to record your ECG just when you are having symptoms.

In addition, if your symptoms don't happen often enough to be picked up on a 24-hour or week recording, there are other devices doctors can use to record your heart's activity over a longer period of time.

Afterwards

Your doctor will be able to advise you on the best course of action after looking at your ECG results.

If your ECG is normal, your doctor may suggest other tests to explain what is causing your symptoms. While a normal ECG can sometimes mean that there isn't anything wrong with your heart, it's also possible for heart disease not to show up on an ECG. That's why other tests may also be needed.

On the other hand, if your ECG is abnormal, it doesn't necessarily mean that you definitely have a problem with your heart. You may need other tests. Although an ECG is useful and simple to do, it does have limitations in what it can show. There are a number of different tests that doctors can do to get more information on the structure of your heart and how it's functioning. These include:

- an echocardiogram – this uses ultrasound to create a moving image of your heart
- a chest X-ray
- a cardiac magnetic resonance imaging MRI scan, which uses magnets and radiowaves to produce images of your heart.

Knowledge gained

Problems with the heart often show up on the ECG display or printout, which shows the electrical activity in your heart as it beats. An ECG recording looks like a wavy line, with a series of bumps and spikes that relate to the different phases of your heartbeat. Everyone's normal heartbeat pattern is similar.

However if you have a problem with your heart, the bumps and spikes may look abnormal. They may be too big or too small; too close together or too far apart; or some of the bumps may be missing. How the spikes look depends on what exactly is wrong with your heart.

The ECG recording gives some idea of how your heart is functioning and what seems to be the problem. You may need further tests to confirm this.

Abnormal ECG

You may have nothing wrong with you, even if you have an abnormal ECG. An abnormal ECG can also be a sign of a number of different heart conditions. Various things can cause an abnormal ECG, including certain heart conditions and other factors. These include:

- abnormal heart rhythms (arrhythmias), such as atrial fibrillation, atrial flutter, ventricular tachycardia and heart block
- heart valve disease
- heart failure or coronary heart disease – causing the heart to work under strain
- diseases of the heart muscle (cardiomyopathy)
- certain drugs, including beta-blockers and digoxin.

However, remember that having an abnormal ECG doesn't necessarily mean you have a heart disease. It's possible to have an abnormal ECG recording when there's actually nothing wrong with you.

Harmless and safe

An ECG is a very simple procedure, is completely painless, and cannot be harmful.

It is a non-invasive procedure, which means it is done entirely outside the body and doesn't involve putting anything inside you. This means you won't feel any discomfort during the test. The recording machine cannot give you an electric shock or affect your heart in any way.

An exercise stress test ECG might make you feel uncomfortable as the exercise is gradually made harder – by increasing the speed and/or slope slightly every three minutes. However, it shouldn't be too much for you, and you can ask to stop the test if you don't feel able to carry on.

First published in this form 2002, and updated 2005, 2007, 2008.

Event Monitoring

Event monitoring or **Ambulatory ECG**, records your ECG over 24 hours or up to a week. **Holter monitoring** means the same, Holter being the name of a manufacturer.

You wear a portable electronic recorder in a pocket or clipped to a belt for the 24 hours or the week. Fitting it is usually done as an outpatient procedure. You are asked to make a note of when you feel any symptoms such as palpitations, dizzy spells, or faints.

This can detect whether you have an irregular heartbeat (arrhythmia). It gets an ECG recording if you have something that happens occasionally – particularly useful if you have symptoms that only occur unexpectedly and/or intermittently. It may show whether you would benefit from a heart pacemaker, or from drug therapy; or from some other further treatment.

An **event monitor** takes a continuous recording of the electrical impulses produced by your heart – like an ECG over 24 hours or a week. It typically has three or four electrodes picking up signals from the chest and a small portable recorder for recording the signals – eg a box clipped to your clothing. It gives a record of how your heart behaves as you go about your normal daily life.

Some machines have a switch so you can switch on to record your ECG just when you are having symptoms.

Normal activities

You go home and carry out your normal activities. You can wear the monitor all day and night, and walk about unhindered. But you must keep it dry – eg not have a bath. You are asked to keep a diary of any times when you feel symptoms.

At the end of the period you return to the hospital to have the monitor taken off. The recording can be played back at up to 60 times speed – eg an hour played back each minute. The playback can be even faster if the operator knows from your diary when to concentrate on and can skip playback of your sleeping hours for example.

If your symptoms don't happen often enough to be picked up on a 24-hour or week recording, there are other devices doctors can use to record your heart's activity over a longer period of time.

Newer event monitors available since 2001 or 2002 use better computer technology and can run for up to a week. They are much smaller and lighter than earlier monitors that had heavier batteries and ran for only a day.

First published in this form 2002, and updated 2005, 2007, 2008.

Heart Attacks and Exercise afterwards

Heart attack

The following terms essentially mean the same thing as heart attack**: coronary**, **coronary thrombosis**, **infarct**, and **myocardial infarction** MI (which really means destruction of an area of heart muscle as a result of obstruction of a coronary artery).

A **heart attack** is the effect of an artery becoming blocked or significantly narrowed by a clot forming in a coronary artery – one of the arteries supplying the heart. The clot interrupts blood flow to the heart muscles, so an area of heart muscle is deprived of adequate blood. This may cause permanent scarring and damage to an area of the heart muscle.

This causes a lack of oxygen in a part of the heart, which then becomes less able to work effectively and scarred – possibly permanent scarring in the affected area. Adverse chemicals build up, and pain is felt. The rest of the patient's heart now has to work harder to get used to the extra workload.

This clot may occur suddenly. The patient feels a persistent vice-like central chest pain, which may spread to the left arm and/or the neck and jaw; is breathless; may suddenly faint or collapse; and has rapid or weakening pulse. Unlike stable angina the pain does not ease when the patient is at rest. Some people have a 'silent' heart attack in which they feel no pain.

In a **heart attack** the patient's heart does *not* usually completely stop beating. The heart attack may cause permanent scarring and damage to an area of the heart muscle.

The warnings of a possible heart attack are:

- chest pain
- breathlessness
- palpitation – irregular heart beating
- blackouts – momentary fainting or sudden collapse
- People may feel washed out, or that things are an effort, or their legs feel heavy.

However, some of these symptoms often have other causes, which a doctor can distinguish and diagnose.

Heart attack first aid treatment

Do the appropriate first aid if you have done a course. Otherwise do as follows.

- If the casualty is unconscious: call 999 for ambulance saying urgent; do Cardiopulmonary resuscitation without delay.
- If he or she is conscious: ask for consent if needed; help the patient into a comfortable position; help with glyceryl trinitrate – GTN – if they have some; call 999 for ambulance; do not give food or drink.

Heart attack – While in hospital

Suppose you have been admitted to hospital with a suspected heart attack. In the Coronary Care Unit you will be attached to a monitor for a few days so that the staff can keep check on your heart from the nurses' desk.

You may be in hospital for five to seven days and during this time you will be advised how to gradually increase your level of activity. Every individual is different and the nurses will advise you each day as to how much you can do. You should also have an opportunity to see a consultant cardiologist.

Your visitors may be restricted while you are in the Coronary Care Unit, so that you do not become overtired or overexcited. It is sensible to continue this when you first get home.

On day 1 you will be advised to stay in bed and encouraged to rest until your chest pain and/or shortness of breath has subsided. It is essential to rest in order to let your heart recover from the original shock of the heart attack.

On day 2 strict inactivity is still advised. You may be able to sit out for brief periods of 2-3 hours twice a day and perform mild activities – such as washing and gentle exercises of the feet, ankles and legs. Otherwise you should try to rest and relax. If you are pain free and the nurse advises, you may be able to walk to the toilet.

On day 3 if you have had no pain you should be able gradually to increase your mobilization, walking to the toilet and washroom and around the bed area. You may be able to sit out in the chair for longer periods of up to 3 or more hours twice a day. You should be able to have a full wash with assistance if required. It is advisable to rest after washing and meals.

After the minimum time in the Coronary Care Unit for your essential care, you may be moved to another ward to free the CCU beds for other patients.

On day 4 if you have no pain you should be able to walk around the bay and take a gentle walk down the main ward corridor to the day room, resting there before you return to the bay.

On and after day 5 you should be able to walk to the day room and freely around the ward with no pain or shortness of breath. If you have stairs at home, you should try and climb some under the supervision of a nurse or physiotherapist before you are discharged home.

Discharge from hospital and medication

On leaving hospital you will be given a supply of your medication.

Patients sometimes have angina chest pain after a heart attack. You may be given a supply of glyceryl trinitrate GTN tablets or spray, which you should carry with you at all times.

Before you leave hospital you should understand when and how to take your medication. If you are unsure, please ask the nurse to explain. You will be given a letter to give to your GP. Repeat prescriptions can be obtained from him or her. It is important not to stop taking your medication without first consulting your doctor.

If you require a sickness certificate this can be obtained from the nurse in charge on your day of discharge at the hospital. Thereafter your GP will give you follow on certificates.

During the first three days at home walk about the house and garden for the same amount of time as on your last day in hospital. Climb one flight of stairs slowly only two or three times a day if you feel able.

After the third day walk outside the house 100 yards at first. Increase each subsequent walk by 100 yards provided no chest pain or shortness of breath results. Do not go out on cold or windy days. Delay walking for 30 minutes after eating a meal.

During the second week take up light household chores, eg drying up or peeling vegetables. It may help you not to over-tire yourself if you sit down to perform such tasks. You should refrain from any chores involving lifting, pushing, pulling or stretching.

Sexual intercourse is probably best avoided during the first two weeks after discharge but thereafter, as you return to physical health, no restriction is usually necessary. Intercourse is a normal part of life, do not avoid sex as this may lead to unnecessary frustration and reduce your enjoyment of life. If you have chest pain during sexual intercourse you should consult your doctor.

You should be able gradually to increase your level of activity over the next six to ten weeks until you get back to normal. During the third and subsequent weeks expect to be able to walk a reasonable distance at a steady pace without difficulty. Gradually increase the level of exercise if you feel able. It is beneficial to continue to take regular exercise.

If you are employed you will be off work typically for eight to twelve weeks. When you first return to work it is advisable to do so on a part-time basis to give yourself a chance to get used to your increased level of activity. If your work involves heavy lifting you may need to stay off work longer. You can ask the advice of your GP or of the doctor at your outpatient appointment.

The DVLC medical advisers state that after a heart attack or heart operation people should not drive for at least one month. According to their recommendation, you may keep your ordinary driving licence unless:

- you have angina at rest or when driving, or
- you have sudden and disabling attacks of dizziness, falling, loss of awareness, confusion or fainting.

People with heart conditions are legally required to inform the DVLC at Swansea if their condition worsens or if they develop another medical condition that affects their ability to drive safely. Different rules apply to HGV licence holders. The DVLC can supply further information on request.

Patients who have had a heart attack are usually advised not to fly in a commercial aircraft or take long car or train journeys for six to eight weeks after leaving hospital.

If travelling abroad, take two sets of medicines – one in your hand luggage and the other in the main luggage. Also take first aid items.

By the end of the second month most patients are able to do exercise much as they did prior to their heart attack. However, if your sport is particularly strenuous, ask for advice from your GP or the doctor at your outpatient appointment. When your heart has fully recovered it is important to keep fit and take regular exercise.

After a heart attack you should aim to lead as normal a life as possible and remain fit and well. An obvious question is ‘Is it likely to happen again?’ Your consultant will be thinking of this from day one and will be assessing you in order to minimize the risk of further events. The exercise stress test during your convalescence is an important part of this assessment.

If you have more chest pain you should stop whatever you a doing, sit down and rest. Your mobilization programme may need to be reviewed. Chest pain is your heart's way of telling your body to slow down. Be patient and don't worry. You should gradually get back to your normal level of activity, but it will take time.

Heart attacks – Outpatient appointment

Most patients are seen again as an outpatient four to six weeks after leaving hospital. You may be given an appointment on discharge or it may be posted to you. If you have any medical problems before this appointment you should contact your GP. If you have any questions that are not urgent it is sensible to make a list of them so that you do not forget any during your appointment.

Usually no particular diet is indicated. During convalescence, rest for 15 to 30 minutes after each meal. It is advisable to avoid large meals as these may cause indigestion. Eat plenty of fruit and vegetables and cut down on salt. If you are overweight you may need to reduce the amount of calories you eat. If your cholesterol levels are high a dietician will see you. If you would like further advice on any of these points please ask to see a dietician.

It is important to get plenty of rest and relaxation during convalescence. You should try to get 7 to 8 hours sleep a night, or whatever is your normal amount, so as not to become overtired.

Prevention of heart attacks

You may be able to reduce risks by appropriate attitudes about the following:

- ***cigarette smoking*** – the most important avoidable cause of CHD, coronary heart disease. If you are a smoker, the most important decision you can make is to give it up. It's never too late. If you stop smoking you will greatly reduce your chances of having another heart attack. Various leaflets are available to help you give up. If you are not confident, ask for advice from the nursing staff, who will be happy to help you.
- ***alcohol***, which, if consumed above the recommended amounts per week, adversely affects blood pressure, weight, and some blood fats. Alcohol drunk to excess will cause you to put on weight and your blood pressure to go up, and it may also cause liver damage. The recommended maximum weekly intake of alcohol is 21 units for a man and 14 for a woman.
- ***exercise***, lack of which may cause weight increase and high blood pressure.
- ***high blood pressure***, which if untreated may cause strokes, and heart disease
- ***cholesterol*** level in the blood from unhealthy diet – higher LDL cholesterol makes the risk of CHD higher
- ***obesity***, which is associated with CHD risk, and contributes to other risks such as diabetes, high LDL, and high blood pressure
- ***stress***, which may temporarily increase blood pressure.

Each year over 200 000 people in the UK have heart attacks. In the UK, heart and circulatory diseases are the biggest killers. About 110 000 to 120 000 people die from coronary heart disease per year in the UK. Coronary heart disease is the commonest cause of premature death in the UK. Many deaths are preventable.

Many heart attacks occur away from hospitals. Many occur within the first few minutes of the symptoms. Prompt access to the right treatment can mean the difference between living and dying. This means CPR, defibrillation and immediate transfer to hospital.

Each year about 20 000 people in the UK develop angina for the first time.

Most women imagine that heart disease affects men only. In fact, one in four women die through heart disease. Heart disease here means damage to the heart caused by narrowing of the coronary arteries. At first there may not be any noticeable symptoms. As it progresses it can lead to angina chest pain; and if an artery becomes blocked then part of the heart dies, leading to a heart attack.

Exercise plan after a heart attack – Do's and don'ts

When you are recovering in the first four to six weeks after a heart attack, you should not do anything that requires **lifting**, **pulling**, **pushing**, or a **sudden burst of energy**. If you are unsure about an activity, ask.

It is **OK** to do: light housework, dusting, cooking, washing dishes, making tea, light hand washing, shopping (but someone else should carry heavy loads), light gardening (weeding, planting out, trimming, watering with a hose).

It is **OK** to experience: slight breathlessness, feeling your muscles working, slight sweating, and/or tiredness that soon pass.

Avoid: heavy housework, vacuuming, scrubbing, sweeping, washing windows, driving a car, running upstairs or for a bus, lifting heavy items, painting and decorating, heavy gardening, mowing, digging, watering involving carrying a heavy can.

Stop immediately if you experience any of the following warning signs: pains in the chest, sickness or nausea, excessive sweating, excessive shortness of breath.

If these symptoms are not quickly relieved, do not hesitate to seek medical advice.

Walking is an ideal exercise for your rehabilitation. It is relaxing, non-strenuous exercise – free, easy, and safe.

To build up your stamina follow these five stages. Remain in each stage until you can complete it comfortably – at least three days. Move on to the next stage only when you feel ready.

Stage 1. Climb stairs and take a short walk 2 to 3 times a day
Stage 2. Take a continuous walk for ten minutes each day
Stage 3. Increase walking time to 20 minutes
Stage 4. Increase walking time to 45 minutes
Stage 5. Keeping the same distance, try to do it in less time while still feeling comfortable.

First published in this form 2002, and updated 2005, 2007, 2008.

High Blood Pressure – Hypertension

Hypertension HT is commonly called **high blood pressure**, nowadays (2005 on) defined as above 140/85 mm Hg; or if one is diabetic over 135/80.

About 38% of UK adults have hypertension. Correct treatment of hypertension reduces the risk of a heart attack by about 20% and reduces the risk of stroke by about 40%. Most people with hypertension need tablets to lower their blood pressure. Advice and treatment includes exercise, lifestyle changes, and/or diet changes, as well as drugs.

Possibly as many as 16 million UK people have high blood pressure; and the proportion of the population is slowly increasing over the years. About 5% have an obvious underlying cause such as kidney disease. Most of the rest have no single obvious cause. Associated factors include: being obese, too much alcohol, too much salt, stress, lack of exercise, poor diet, too little potassium, and family history of relatives with hypertension.

Oily fish with omega-3 fatty acids are protective against high blood pressure and heart disease.

Hypertension – Why worry if you feel OK

High blood pressure does not necessarily make someone feel unwell, however if untreated it tends to cause damage to blood vessels and the heart. The link between hypertension and coronary heart disease and stroke is very well established.

Correct treatment of hypertension reduces the risk of a heart attack by about 20% and reduces the risk of stroke by about 40%. Here risk is based on the observed reduced occurrences in treated past patients. The purpose of treating hypertension is to prevent this damage to blood vessels and the heart from occurring and so help to prevent these illnesses.

Most people with hypertension need tablets to lower their blood pressure. Usually, they need to continue them for life. These tablets are very successful at preventing heart attacks and strokes and have very few side effects.

The majority of people do not have a *single* identifiable cause. Some have a genetic component, with hypertension tending to run in families. In addition there are environmental and lifestyle factors. The most important causes are: being overweight; too much salt in the diet, too much alcohol; and smoking.

Five self-help measures are suggested.

- Avoid being overweight.
- Reduce salt intake.
- Keep alcohol down.
- Exercise can reduce your blood pressure and help to keep your weight down. Start slowly and build up, walking is excellent. Aim for 20 to 30 minutes activity at least three times a week. Or even better, walk for half an hour five times per week, which is better than more intense exercise for a shorter time.
- Don't smoke.

First published in this form 2002, and updated 2005, 2007, 2008.

Pacemaker

Pacemaker. A pacemaker is a system with a pulse generator and one or more electrode leads for electric impulses to stimulate the heart to contract and produce a heartbeat. A permanent pacemaker is inserted under the patient's skin just above the breast tissue. When the heart needs a signal the pacemaker sends electrical impulses along an electrode lead to stimulate the heart to contract and produce a heartbeat.

Pacemakers were first successfully implanted in the 1950s and since then nearly a million people with disturbed heart rhythm have benefited from them. Pacemakers have enabled them to live normal lives.

In a **normally functioning heart**, each heartbeat begins at the **sino-atrial node** – a small group of specialized cells that form the heart's natural pacemaker. The electrical impulses spread through the heart causing it to contract so that blood is pumped to the lungs and the rest of the body. If there is a malfunction in the conduction system or if the natural pathway of the electrical impulses is blocked, the heart rate may become slow, very fast, or irregular. This may result in dizziness, drowsiness, shortness of breath, and/or fainting.

Implantation of the pacemaker takes about one hour and is usually performed under local anaesthetic without pain or discomfort. The surgeon places the pacemaker in a small pocket formed between the skin and muscle of your upper chest, near your right or left shoulder – depending whether you are left- or right-handed. A wire lead goes into your heart through a vein, and the electrode at the end of the lead delivers impulses to your heart when required.

Today's pacemakers are small, thin and lightweight, and once implanted are usually barely visible from the outside. At first the pacemaker may feel a little heavy, and you may be aware of it, but you will soon become accustomed to it and it will seem like a normal part of your body.

After implantation of the pacemaker you will usually be in hospital for one day. Before leaving hospital your pacemaker will be checked by a cardiac technician. You will be left with a few small stitches in the skin, which are removed after 10 days. Until your wound is fully healed avoid wearing anything that will rub it, such as a bra or braces. You should avoid getting the wound wet until your stitches are removed. Your GP or the nurse will remove the stitches after about 10 days.

You should avoid reaching up high on the side of the operation for 4 weeks – do not lift things off high shelves or hang out washing. It is also important to retain movement in the arm to prevent a frozen shoulder. You will be given or sent a card to carry with you at all times, stating that you have a pacemaker. Four weeks after implantation, your pacemaker will be checked in the clinic. If all is well you will only need to have your pacemaker checked every 6 to 12 months. After four weeks you should have returned to a full normal life. If all is well you may then start to drive but you should inform the DVLC and your insurance company that you have a pacemaker. However, there are some limitations – you should avoid anything that may damage your pacemaker – eg contact sports such as rugby or boxing.

The pacemaker batteries should last perhaps 10 years. When your pacemaker batteries need changing you will only need a day visit to the hospital.

Ordinary household electrical equipment will not affect your pacemaker. This includes microwave ovens as long as they are in good working order. If your job means that you come into contact with strong electrical fields – eg arc welding, diathermy, high power radio or TV transmitters, or direct contact with car ignition systems, then you should take advice from the pacemaker technician before returning to work.

Current pacemakers are extremely sophisticated. Some require two leads and monitor both the left and right sides of the heart. Some automatically adjust the pacing rate to respond to the exertion of the heart.

First published in this form 2002, and updated 2005, 2007, 2008.

Smoking – Benefits of stopping

Smoking removes oxygen from the blood excites the heart, and makes blood cells stick together. This often leads to high blood pressure, heart and/or lung diseases, stroke, and/or earlier death.

Passive smoking – breathing the smoke from other people – affects both adults and children, giving them increased risk of heart disease, lung disease, stroke, and/or earlier death.

The British Heart Foundation National Centre for Physical Activity and Health at Loughborough, BHFNC, found that 19% of CHD deaths are related to smoking.

22% of the UK population over 16 smoke (2007 figure). This percentage has been dropping gradually over many years. The ban on smoking in public places helped many people to stop.

Stopping smoking is not easy. Do not be afraid to ask for help from your doctor of pharmacist. Nicotine is addictive. People who got advice and help more often succeeded in stopping.

The NHS Smoking helpline is 0800 169 0169. Advice and various leaflets on how to go about trying to stop smoking are available. For example enquire at a doctor's surgery or a pharmacy.

Tobacco smoke produces carbon monoxide, which is a poisonous gas that combines with haemoglobin in the blood. This reduces the blood's ability to carry oxygen around the body, putting a strain on the heart and making breathing more difficult.

The chemicals in tobacco smoke are carried from the lungs to vital organs such as the eyes, mouth, nose, throat, skin, stomach, brain, teeth, and nervous system. This increases the risks of heart attack, cancer, stroke, dental troubles, and peptic ulcers.

If you are a smoker and stop, the benefits include the following.

Within about two hours of stopping there is no more nicotine in your blood system. However it may take two days for nicotine by-products to leave your body.

Within 8 hours the oxygen level in the blood rises to normal, the heart rate slows down. Blood pressure drops slightly, but it may take from 3 to 30 days for blood pressure to return to normal level.

Between 12 and 24 hours carbon monoxide is excreted from your body. Lung efficiency begins to improve. You will be less short of breath when you exert yourself and your staying power will improve.

Within a couple of days you'll start to feel and smell fresher. Your taste buds will come alive and your sense of smell will return. You may also experience euphoria after achieving something you thought impossible.

Within days accumulated phlegm loosens in your lungs and you'll cough it up over the next few weeks. **Cilia**, the body's natural cleaning mechanism, begin to recover. It may take up to three months before cilia completely recover to sweep clean your lung passages efficiently.

Within three weeks your lungs are working better. Exercising is easier.

Within two months blood flow to limbs is improved. You'll have more energy and feel a sense of pride and satisfaction.

After three months your lungs' cleaning mechanism, cilia, will be working normally. Male's sperm will become more normal and the number increase.

Gradually over several months circulation improves, and blood components and cells lining your lungs return to normal. This may take a long time.

After 12 months the risk of sudden death from heart attack is almost half that of continuing smokers.

In four to five years the risk of heart disease has dropped to the same as that of non-smokers.

After five to ten years, the risk of lung cancer is about half that of smokers. After 10 to 20 years it becomes the same as that of non-smokers.

After 15 years the risk of sudden death from a heart attack is almost identical to that of non-smokers.

First published in this form 2002, and updated 2005, 2007, 2008.

Valve Surgery and Valvuloplasty

Valve surgery

If your cardiologist has established that your symptoms of breathlessness, chest pain, dizziness or faintness are due to a malfunctioning heart valve, you may need an operation to repair or replace the affected valves. After the operation you will notice a significant improvement in your symptoms. Valve surgery may also reduce or prevent changes associated with long-term heart muscle strain.

If your valves are narrow – stenosed – they will usually be replaced by an artificial valve. Most valves are made from a combination of metal and plastic materials. A leaking valve can also be replaced by an artificial valve. Occasionally a leaking mitral valve will not be replaced but may be repaired by stitching, using sutures.

Valve surgery is performed under general anaesthetic. The surgeon makes an incision down the length of your breastbone – the **sternum** – to expose your heart. It may be necessary to use a bypass machine to pump the blood around your body during your operation – the same machine as in a coronary artery bypass graft.

After the operation you will usually stay in hospital about a week. After your operation you will always need antibiotics if you require dental or other surgical procedures. Tell your dentist that you have had valve surgery. You may need to take an **anticoagulant** – warfarin – for the rest of your life to prevent your blood clotting.

Valve surgery has a high success rate but rarely it may be fatal. The risk is greater if your heart muscle has already been severely damaged or if you have another serious disease, eg chest or kidney disease. Occasionally a valve that has been widened using this technique can start to leak later on. The procedure may provide only a temporary improvement in the case of an aortic valve, as these valves often become restricted again. Surgery may be recommended should the symptoms recur. Your cardiac surgeon will discuss these risks fully with you before you decide to go ahead with the operation.

Valvuloplasty

This involves inflating a balloon inside a valve to widen it. Compare Balloon angioplasty. Valvuloplasty is a painless procedure and is carried out under local anaesthetic. You may have to stay in hospital about three or four days.

If the valves in your heart have become restricted – **stenosed**, it may be possible to correct the problem without major heart surgery. **Valvuloplasty** involves inflating a balloon inside the valve to widen it. The balloon is on the end of a catheter that looks similar to the balloon catheter used for coronary angioplasty. However, this balloon is much longer and wider.

The valves usually considered for valvuloplasty are: the pulmonary valves in children; and the mitral valve in adults. The procedure cannot be used if the patient's valve has become thickened and rigid with deposits of calcium as the balloon will simply not be strong enough to break these deposits – as is sometimes the case in adults.

The cardiologist inserts a guide catheter through a small incision into the femoral artery in your groin and moves it up to your heart. A guide wire is then inserted through the guide catheter and across the narrowed valve. With the guide wire in place, the balloon catheter is threaded along it until the balloon is in the correct position. A small portion of the balloon is then inflated and passed across your valve. Once this has been done, the balloon will be locked in position by inflating it a little bit more. The main balloon will then be inflated and deflated until the opening of the leaflets of your valve has been significantly improved. The catheters and guide wire are then removed.

In most patients valvuloplasty is successful. However, a restricted valve can become blocked and threaten serious damage to your heart. This is rare, but if it does occur immediate valve surgery may be needed. It is important that you understand this and are prepared for it.

First published in this form 2002, and updated 2005, 2007, 2008.