

Understanding  
**Blood Pressure**

Professor D.G. Beevers

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**IMPORTANT**

This book is intended not as a substitute for personal medical advice but as a supplement to that advice for the patient who wishes to understand more about his or her condition.

Before taking any form of treatment  
**YOU SHOULD ALWAYS CONSULT YOUR MEDICAL PRACTITIONER.**

In particular (without limit) you should note that advances in medical science occur rapidly and some information about drugs and treatment contained in this booklet may very soon be out of date.

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# About the author

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# Introduction

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## How common is high blood pressure?

If you are over the age of 30 and can't remember when you last had your blood pressure checked, you could be one of the seven to ten million people in this country who has high blood pressure. Doctors usually use the term 'hypertension' to describe this condition which may cause no symptoms at all for very many years, but could eventually lead to serious complications, including heart disease and strokes.

In this book, the word hypertension is used to mean a blood pressure level that has been found on several separate occasions to be above normal, and that needs to be treated to prevent complications developing in the long term.

## Who has high blood pressure?

The condition is very common (10–20 per cent of the population) in the UK and, the older you are, the more likely you are to have developed it. Whether you do so depends on a number of related factors, including:

- heredity
- your diet – and especially the amounts of salt and alcohol that you consume
- your ethnic background
- whether you have diabetes
- whether you are overweight
- whether you take regular exercise.

### How is high blood pressure diagnosed?

If all this sounds alarming, there is good news too. Hypertension can be easily diagnosed: your blood pressure can be measured quickly and painlessly at your GP's surgery or health centre. When the reading is above normal, the check can be repeated three or four times if necessary to establish that the first figure wasn't a chance finding.

### How is high blood pressure treated?

Even if you do have hypertension, you may be one of the many people who don't need drug treatment for some time (and possibly not ever), provided that you make some straightforward lifestyle changes that will not only lower your blood pressure but bring general health benefits too.

When treatment is required, there are a number of very effective drugs available, which are taken in tablet form usually once daily. Most people find that they have no problems at all with the treatment, but, if you do experience side effects from one drug, there are other, equally effective alternatives.

More modern drugs tend to have very few side effects. Research has shown that controlling hypertension with drug therapy can bring down the

risk of a stroke by 35 to 40 per cent, and the risk of coronary heart disease by 20 to 25 per cent.

### A symptomless disease

The most important message on hypertension is that you may not know that you have it until it has done you serious damage, unless you have your blood pressure checked. Even quite seriously raised blood pressure can be controlled once it is identified and, provided that you keep taking the treatment prescribed for you and have regular check-ups, your chances of developing serious and potentially life-threatening complications are dramatically reduced.

#### KEY POINTS

- Hypertension affects seven to ten million people in the UK
- Hypertension is often not diagnosed
- The treatment of hypertension saves lives

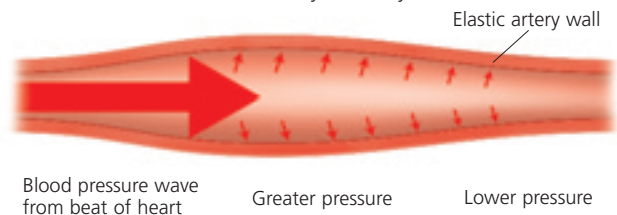
# What is blood pressure?

## Blood pressure

When doctors talk about blood pressure, what they mean is the pressure within the large blood vessels as your heart forces blood to circulate around your body. On the whole, the lower your blood pressure, the healthier you are in the long term (except in some very rare conditions in which excessively low blood pressure is part of an underlying disease).

## Blood pressure

Blood pressure is the pressure within the arteries as the heart forces blood to circulate around your body.



## The circulatory system

Blood picks up oxygen in the lungs from the air that we breathe in. This oxygenated blood enters the heart and is then pumped out to all parts of the body in blood vessels called arteries. Larger blood vessels branch into smaller and smaller ones and then to microscopic arterioles, which eventually link to tiny networks of blood vessels known as capillaries.

This network of larger arteries, medium-sized arterioles and tiny capillaries allows blood to reach every cell of the body and deposit its oxygen, which is used by the cells to make the vital energy that they need to survive.

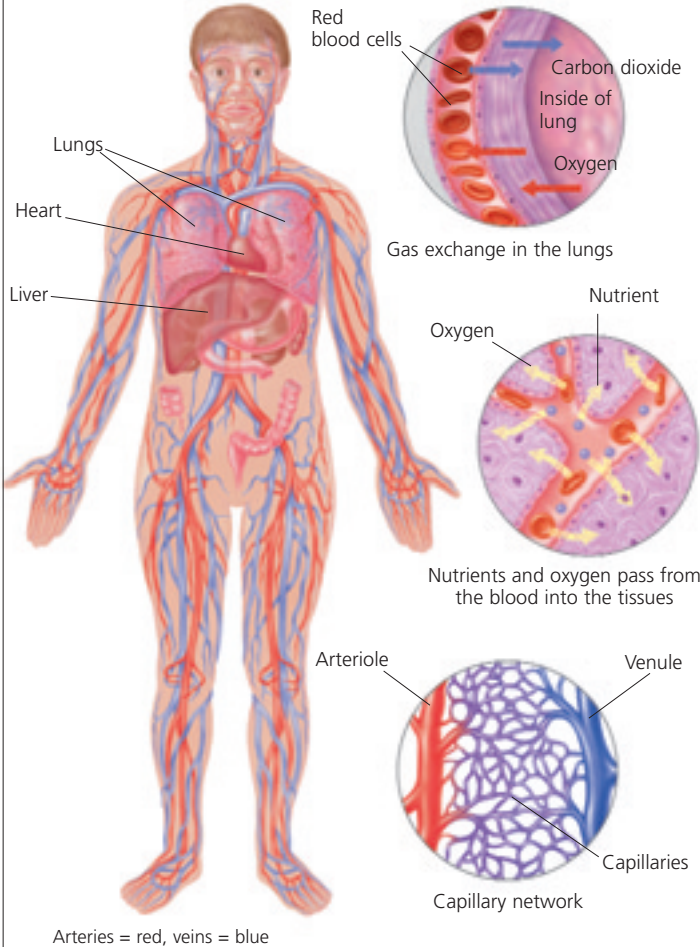
Once the blood has deposited its oxygen in the cells, the deoxygenated blood returns to the heart in veins, to be pumped back up to the lungs to pick up more oxygen.

During each heartbeat, the heart muscle contracts to push blood around the body. The pressure produced by the heart is highest when it contracts, and this is known as the systolic (higher value) pressure. Then the heart muscle relaxes before its next contraction, and the pressure is at its lowest, which is known as the diastolic (lower value) pressure. Both systolic and diastolic pressures are measured when you have your blood pressure checked.

The dividing line between a normal and an abnormal blood pressure is not easy to define. Perhaps the best definition is that level of blood pressure above which treatment has been shown to be worthwhile (see page 24).

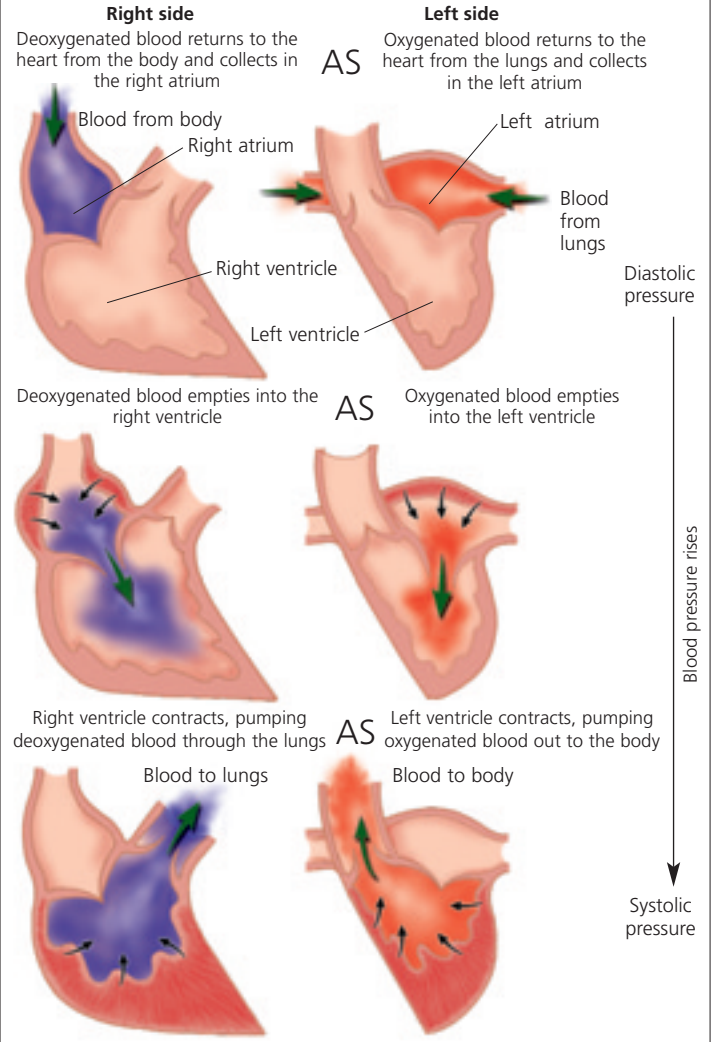
### Cardiovascular system

Diagram showing the heart and circulation with veins (blue) draining the blood back to the heart where it is pumped to the lungs and back to the rest of the body through the arteries (red). Larger blood vessels branch into smaller and smaller ones and then to tiny networks of blood vessels known as capillaries, where oxygen and nutrients are passed from the blood into the surrounding cells.



### The sequence that makes up a heartbeat

The heartbeat sequence has three phases. The timing of these phases must be accurately maintained regardless of how slowly or rapidly the heart is beating.



## What determines blood pressure?

The blood pressure is determined by:

- The pumping strength of each heartbeat – the greater the strength the higher the blood pressure
- The volume of blood in the circulation – a greater volume of blood will increase blood pressure
- The diameter of the blood vessels – narrower blood vessels raise blood pressure

## KEY POINTS

- High blood pressure is caused by a narrowing of the microscopic arterioles in all tissues
- Systolic pressure is the pressure in the larger vessels when the heart contracts
- Diastolic pressure is the pressure when the heart relaxes between beats

# Measuring your blood pressure

## How often should blood pressure be measured?

Some people will have had their blood pressure taken at least once – perhaps by the doctor or nurse at the surgery, in hospital or, in the case of a pregnant woman, at the antenatal clinic. You may possibly have opted to have it done at a pharmacy or health food shop or even have tried taking it yourself using one of the special kits that can be bought over the counter.

Around half of the adult population have, however, never had their blood pressure measured, usually because they feel entirely well and have not therefore visited their doctors. As raised blood pressure is usually a symptomless condition, many of these people will be found to have raised blood pressure if they undergo a routine check. It is now recommended that all adults should have their blood pressure checked at least once every five years. If the blood pressure is not entirely normal, more frequent checks are necessary.

## How is blood pressure measured?

Although the ideal method would be to measure the blood pressure actually inside the arteries, this is clearly not feasible on a large scale because it would involve needles. However, an accurate reflection of the pressure under which blood is being pumped can be obtained using a less invasive approach. Usually you will be asked to sit down and the person performing the check wraps a rubber-lined cuff, which is part of the pressure-measuring device known as a sphygmomanometer, around your upper arm.

## Determining systolic blood pressure

The cuff is inflated, either with a small hand pump or automatically by an electronic measuring device. This will stop the blood flow to your arm temporarily. The cuff is then deflated slowly until the pressure is low enough for blood to start to pass under the cuff. Electronic blood pressure measurement devices can detect this blood flow. Alternatively, the doctor or nurse may listen with a stethoscope over the artery just below the cuff and hear the sounds as blood starts to flow.

## Determining diastolic blood pressure

As the cuff continues to deflate turbulence occurs in the underlying artery because it is only partially blocked. Finally, the cuff will reach the pressure where there is no narrowing of the underlying artery and at this stage the electronic manometers (pressure-measuring device) can detect the absence of any turbulence. Alternatively, a doctor or nurse will note that turbulence sounds have disappeared.

The pressure where blood first starts to pass under the cuff is called the systolic blood pressure and the

pressure where there is no turbulence in the artery, because the cuff pressure is low, is called the diastolic blood pressure. The systolic blood pressure coincides with the maximum pressure within the arterial tree and the diastolic blood pressure coincides with the minimum blood pressure in the system.

## Measurement problems

This technique of measuring blood pressure is indirect but has the benefit of being easy to perform. There are, however, four sources of error when blood pressure is measured in this way.

### The patient

Falsely raised blood pressures will occur if the patient is very anxious or involved in any animated conversation. This sort of error can be minimised if blood pressure is taken in a very quiet and peaceful environment. Sometimes the first reading of blood pressure may be raised, but the second or third readings may settle considerably as the patient becomes familiar with the technique.

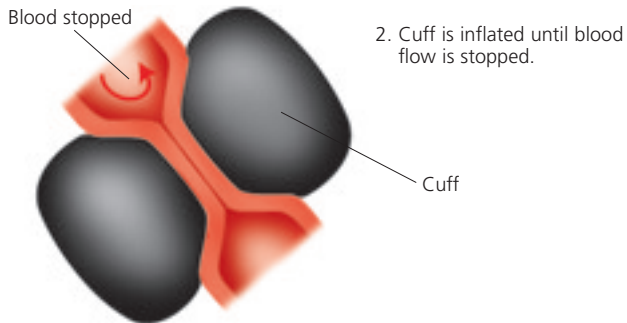
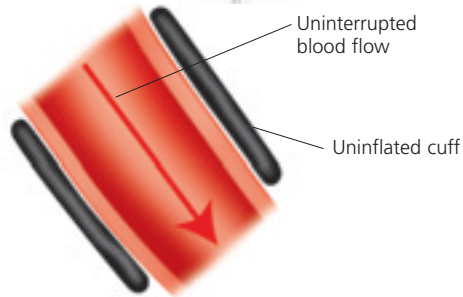
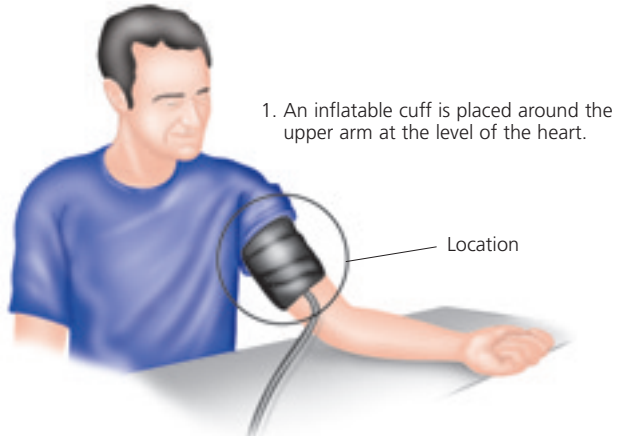
Any interaction between the patient and the observer can raise the blood pressure in the short term. In particular, a substantial rise in blood pressure can occur when it is measured either by a doctor or, to a lesser extent, by a nurse. This is sometimes called the 'white coat effect'.

### The observer

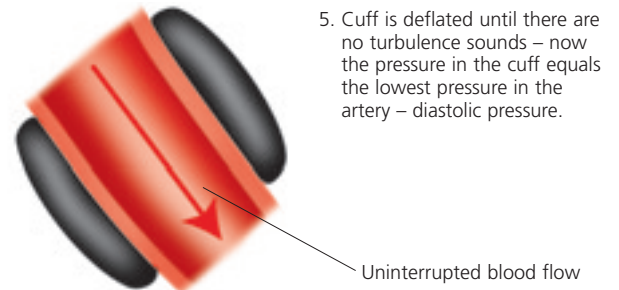
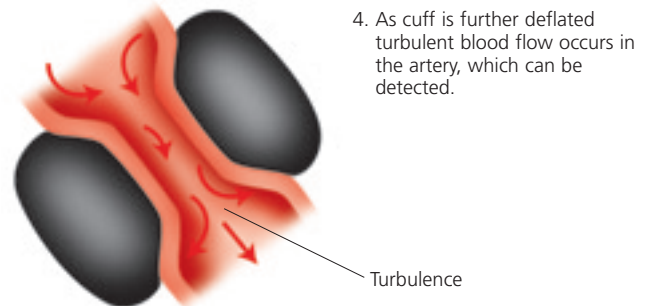
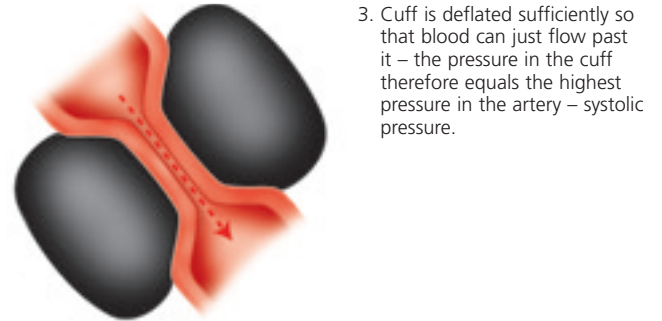
Observer error is mainly a problem with the old-fashioned method of measuring blood pressure using a stethoscope and mercury column. This is because the decision about whether the doctor or nurse can hear



## How is blood pressure measured?



## How is blood pressure measured? (contd)



the systolic and diastolic sounds is subjective and open to observer error or bias. Unfortunately the quality of measurement by some doctors and nurses is extremely poor, leading to serious overestimation of the blood pressure.

### The cuff

If the cuff is too small the blood pressure is overestimated. It is also very important that the cuff be at exactly the same level as the heart. If the cuff is above the level of the heart, the blood pressure will be underestimated, and if below the blood pressure will be overestimated.

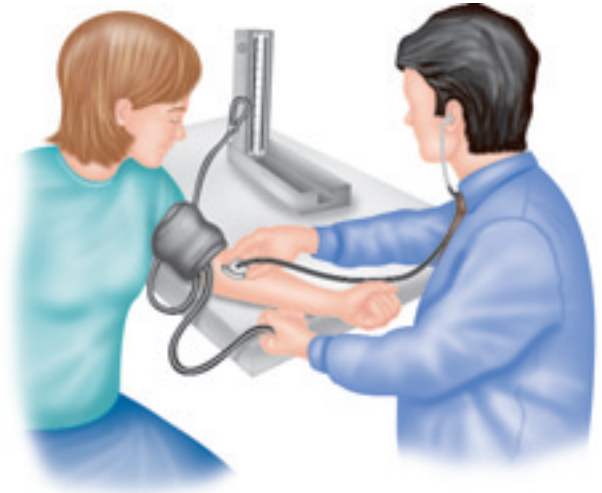
### The manometer

Both the electronic and the mercury blood pressure-measuring systems may be accurate. Most electronic machines marketed now have passed criteria laid down by the British Hypertension Society (BHS). It is important that only manometers that have been passed by the BHS are used. Mercury machines can deteriorate if they are not maintained regularly.

In a small number of patients it proves impossible to measure blood pressure using electronic blood pressure-measuring devices. Under these circumstances the doctor or nurse will have to use a mercury manometer. Measurement of blood pressure using a reliable mercury system remains the 'gold standard', but the advent of automatic and semi-automatic systems means that mercury manometers are now rarely needed. All general practitioner health centres and hospital outpatient clinics will need to have one well-maintained mercury manometer available whereas there should be semi-automatic machines in every clinical room.

### Measuring blood pressure

The mercury manometer is the traditional method for measuring blood pressure. Electronic measuring devices means that mercury manometers are now rarely needed.



An important advantage of the electronic blood pressure equipment is that the clinician can effortlessly take several readings and obtain a truer picture of the real blood pressure as the patient becomes familiar with the technique. It is increasingly felt that a single one-off blood pressure reading measured with a mercury manometer is of little clinical value. Blood pressures that are raised should be re-checked and many settle over five to ten minutes.

### Taking a blood pressure reading

Usually, you will be asked to sit down and the cuff is applied to your upper arm so that it is at the same level as your heart. It is very important that you are as relaxed as possible and that your arm is supported by