

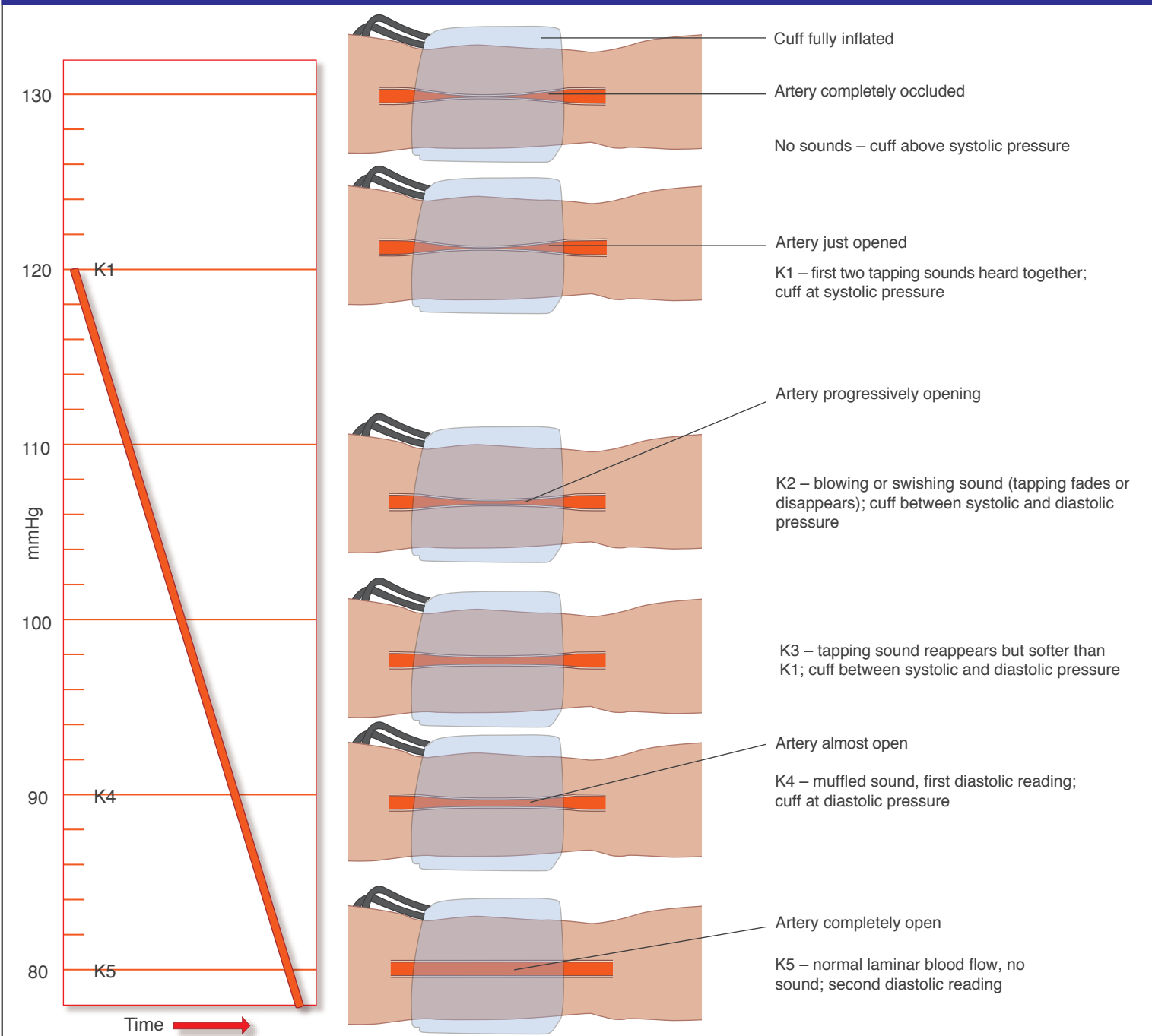
Blood pressure part 2: procedure

(using an aneroid sphygmomanometer)

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Korotkoff sounds



When measuring the arterial blood pressure with sphygmomanometry and the use of a stethoscope (auscultation), the healthcare professional occludes the brachial artery with the inflated cuff. As the pressure is slowly released, a series of characteristic sounds—the Korotkoff sounds—can be heard, and noted against the graduated scale. Mercury sphygmomanometers are accurate but are being withdrawn for health and safety reasons—primarily the hazards of dealing with mercury spillages and the disposal of mercury (UKEA, 2012). Non-mercury devices are now much more common, but you are strongly advised to check published literature regarding their accuracy. For a list of sphygmomanometers that have been validated by the British and Irish Hypertension Society (BIHS), see <https://bihsoc.org>

Do not undertake or attempt any procedure unless you are, or have supervision from, a properly trained, experienced and competent person. Always first explain the procedure to the patient and obtain their consent, in line with the policies of your employer or educational institution.

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Allow the patient to rest for at least 5 minutes



It is important to reduce any adverse effects on the blood pressure reading. Blood pressure settles on rest (Hjortskov *et al.*, 2004). Guidelines generally advise that the patient should rest for at least 5 minutes before taking a reading. Research has suggested that resting for up to 10 minutes may help to gain an accurate reading for effective management (Nikolic *et al.*, 2013).

Guide to bladder and cuff size (BIHS, 2013)

Cuff size	Bladder width x length	Arm circumference
Small adult	12 x 18 cm	< 23 cm
Standard adult	12 x 26 cm	< 33 cm
Large adult	12 x 40 cm	< 50 cm
Adult thigh cuff	20 x 42 cm	< 53 cm

Before and after measuring blood pressure, decontaminate your hands by washing with soap and water or using an alcohol-based preparation. Explain the procedure to the patient and select an appropriately sized cuff (MHRA, 2013; NICE, 2011). For guidance on choosing correct cuff size, refer to the table above and also to the manufacturer's guidance (BIHS, 2017a; BIHS, 2013). (See also part 1 of this series).

Assess the suitability of the arm

For clinical and practical reasons, blood pressure should not be taken in a patient's affected arm:

- If the patient has an arteriovenous fistula (e.g., for renal dialysis);
- If the patient has a central/long line in situ or venous cannula;
- In the presence of lymphoedema, such as that caused by a mastectomy, and/or following brachial artery surgery; (in patients who have had a bilateral mastectomy, use a leg);
- If the patient's entire arm cannot be accessed due to plaster of Paris or the presence of a sling or bandage.

Take time to assess the arm from which you intend to record the blood pressure.

Support the arm



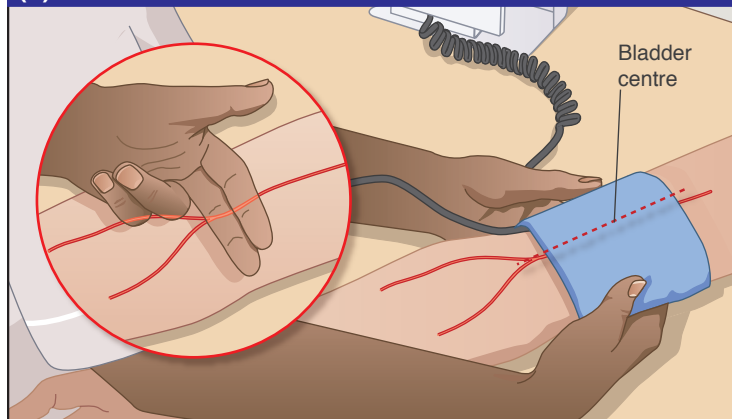
Aneroid sphygmomanometers can be used as long as they are regularly calibrated (every six months) as they tend to lose accuracy with use (BIHS, 2017b). Expose the arm and ensure that clothes do not hinder the placement of the cuff or stethoscope. Muscle contraction raises blood pressure (Frese *et al.*, 2011), so make sure the arm is supported. The device must be close enough for you to read the display. The performance of the device depends greatly on calibration (Tolonen *et al.*, 2015).

Cuff placement: (a) Palpate the brachial artery



Place the dial at eye level, and make sure you have an unobstructed view of it. Begin by palpating the brachial artery to confirm its position.

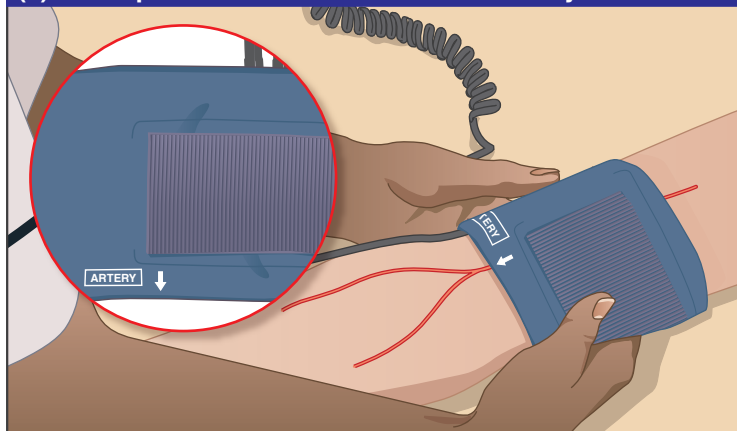
(b) Fit a cuff of suitable size



Fit a cuff of the appropriate size to the arm (Andrews *et al.*, 2011), so that the centre of the bladder lies over the artery. The cuff should be 2–3 cm (the width of two fingers—see inset) above the antecubital fossa (the area over the elbow joint). If you prefer, you can apply the cuff so that the tubes emerge from the top to avoid interference with the stethoscope (BIHS, 2017b).

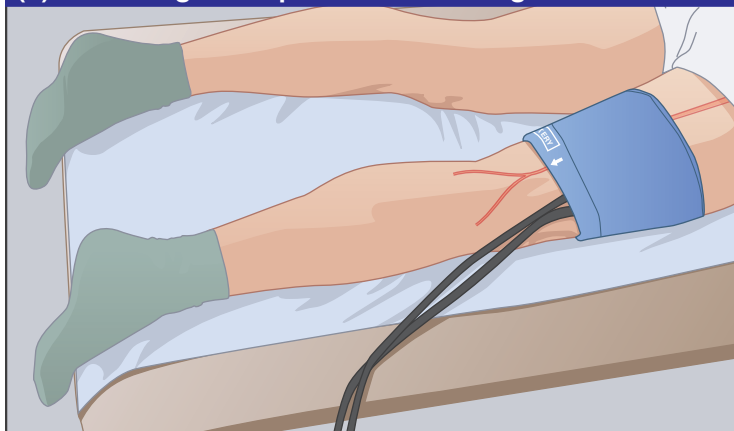
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(c) Line up the arrow with the brachial artery



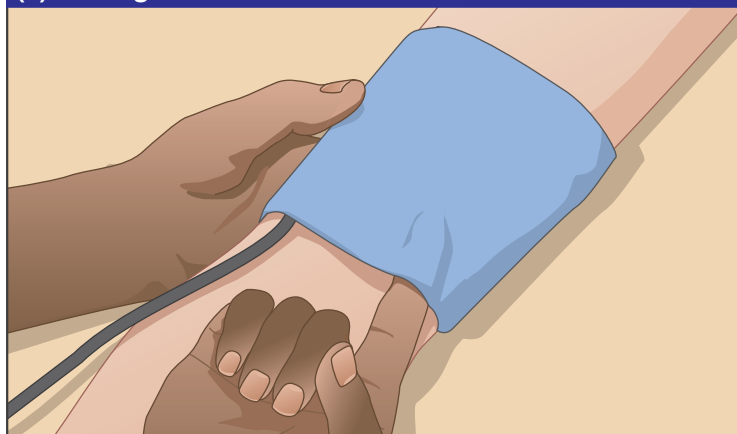
If there is an arrow on the cuff, this must line up with the brachial artery. Make sure the cuff is at the level of the heart, whatever the position of the patient (Mancia *et al.*, 2013).

(d) Measuring blood pressure in the thigh



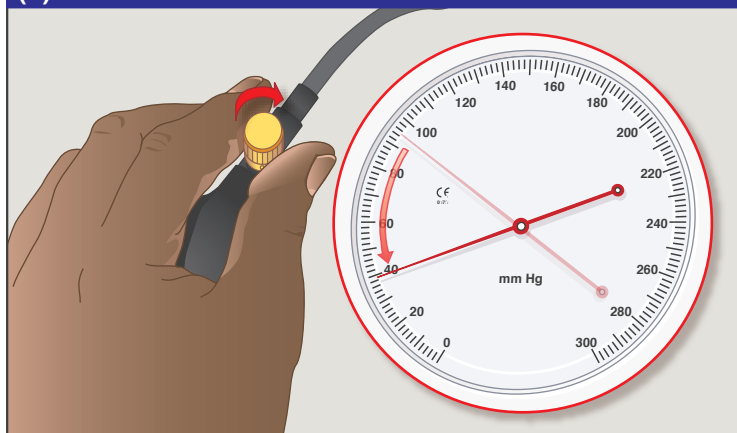
For some patients, brachial artery blood pressure measurement is inappropriate, and you may need to use a leg cuff. The popliteal pulse is utilised if using auscultation. The systolic reading in the thigh is usually 10–40 mmHg higher than in the arm, and the diastolic pressure is the same (Jarvis, 2016).

(e) Cuff tightness



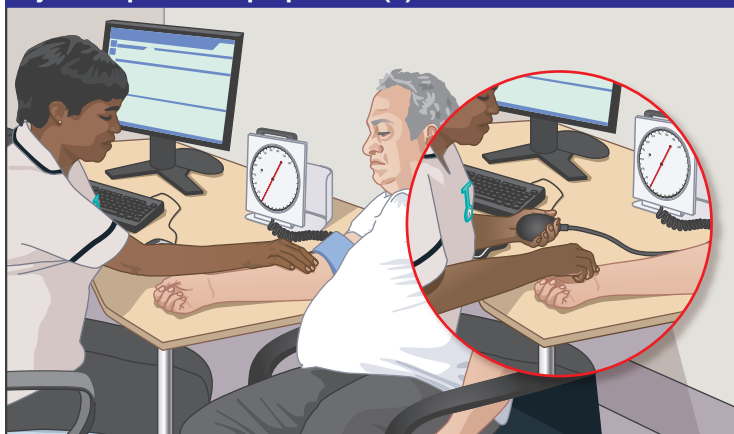
The cuff should be tight enough to allow you to insert one finger between it and the patient's arm. The cuff can also be applied so that the tubing emerges from the top edge; follow local policy.

(b)



Slowly deflate the cuff. Note the pressure where the pulse reappears; this is the approximate systolic pressure (NICE, 2011). Knowing this value will help you to locate the auscultatory gap when subsequently inflating the cuff and listening to the Korotkoff sounds, thus helping to avoid underestimation of systolic pressure by auscultation alone (NICE, 2011; see right). It also prevents unnecessarily high inflation of the cuff, which can be uncomfortable for the patient.

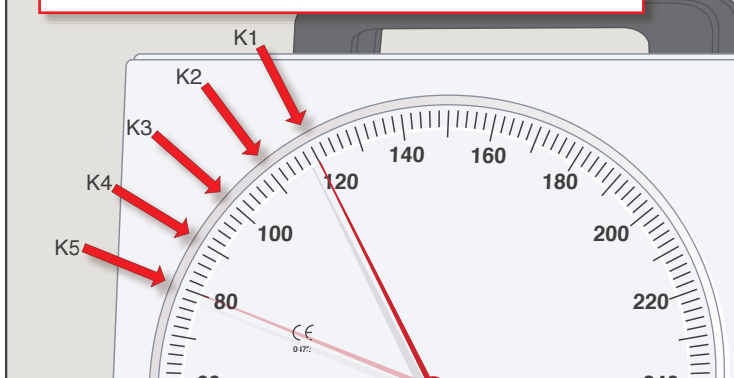
Systolic pressure palpation: (a)



Before taking the arterial blood pressure with the stethoscope, estimate the systolic pressure (NICE, 2011). Palpate the brachial artery (or the radial artery if the brachial is hard to find) and rapidly inflate the cuff to 20 mmHg above the value where the pulse disappears (NICE, 2011).

Auscultatory gap

If present, the auscultatory gap usually lies between K2 and K3



An auscultatory gap occurs in a small percentage of patients, most often in those with hypertension. The Korotkoff sounds disappear for a short time and then reappear. This gap, which usually lies between K2 and K3 (NICE, 2011), may then lead to a falsely low systolic or falsely high diastolic pressure being recorded (O'Brien *et al.*, 2003).

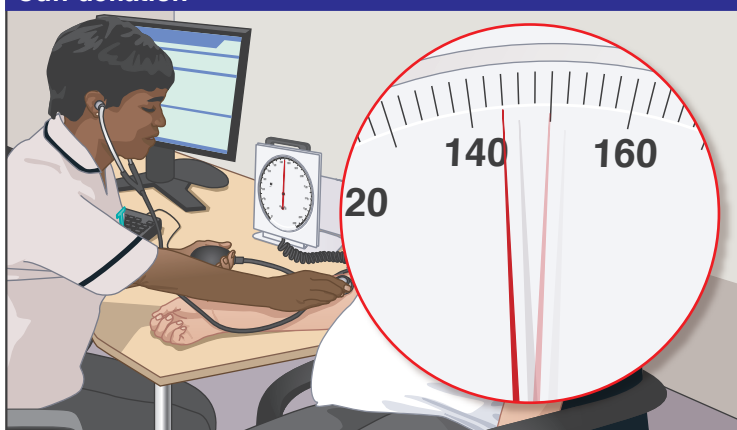
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Cuff inflation



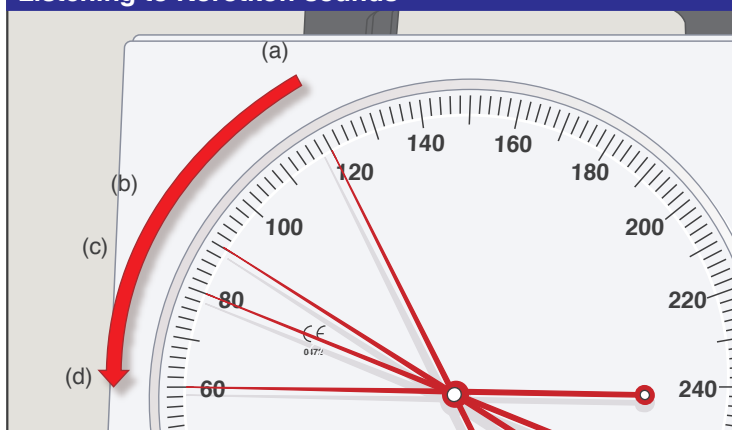
Wait at least 30 seconds before carrying on. Once you have estimated the systolic pressure through palpation, place the head of the stethoscope lightly over the brachial artery in the antecubital fossa. Do not apply pressure too firmly because this can distort the Korotkoff sounds. Inflate the cuff to a pressure of 20–30 mmHg above the estimated systolic pressure (NICE, 2011). Ensure that the ear pieces of the stethoscope are clean (see “Measuring blood pressure part 1: equipment”, p3). Clean the head of the stethoscope with an alcohol-based cleaner before and after contact with the patient’s skin.

Cuff deflation



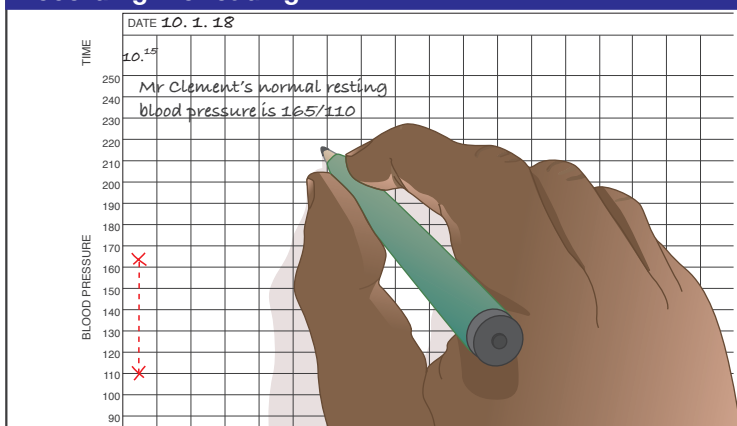
Deflate the cuff, using the valve on the bulb, at a steady rate of 2 mmHg per second, while keeping the head of the stethoscope on the antecubital fossa (NICE, 2011). You will hear the Korotkoff sounds as you slowly deflate the cuff.

Listening to Korotkoff sounds



Note the pressure when you first hear clear tapping sounds; this is the systolic pressure, K1 (a). The pressure when the sounds become muffled is K4, the first diastolic pressure (b). The point when the last sound occurs is the second diastolic sound, or K5 (c). Deflate the cuff slowly for a further 10–20 mmHg, checking that all sounds have disappeared (d). Then deflate the cuff quickly for the patient’s comfort. Repeat the procedure on the other arm (Mancia *et al.*, 2013). If there is a difference, use the higher value.

Recording the reading



All recordings of blood pressure must include the systolic and the diastolic pressures. There is now general consensus that phase 5 (K5) should be taken as the diastolic pressure (Mancia *et al.*, 2013; NICE, 2011). Note any variations, such as which arm was used, whether the patient was standing and whether the patient was anxious. Follow local policy.

Repeated readings



If the patient’s blood pressure is 140/90 mmHg or higher, a second and possibly third reading is needed (NICE, 2011). Wait for 2–3 minutes between readings; explain the reason and reassure the patient. The pause allows for venous emptying. Record the lower of the last two measurements as the clinic reading (NICE, 2011).