

ABC of Blood Pressure Measurement

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TECHNIQUE



Indirect blood pressure measurement by auscultation is susceptible to several errors, which may originate with the observer, the sphygmomanometer, the patient, or a combination of these factors.

By careful attention to detail blood pressure measurement with a sphygmomanometer can give systolic and diastolic pressures within 4 mm Hg of intra-arterial pressures.

Korotkoff sounds



Shortly after Scipione Riva-Rocci had invented the sphygmomanometer a Russian surgeon, Dr N C Korotkoff (left), reported that by placing a stethoscope over the brachial artery at the antecubital fossa distal to the Riva-Rocci cuff sounds could be heard. He documented the phases, and thus introduced the indirect auscultatory method of recording blood pressure.

Although the origin of the Korotkoff sounds is still not clear, vibratory and flow phenomena are probably responsible.

The phases are:

Phase 1—The first appearance of faint clear tapping sounds which gradually increase in intensity. The systolic pressure is heard for at least two consecutive beats, and this correlates well with intra-arterial pressure.

Phase 2—The softening of sounds, which may become swishing.

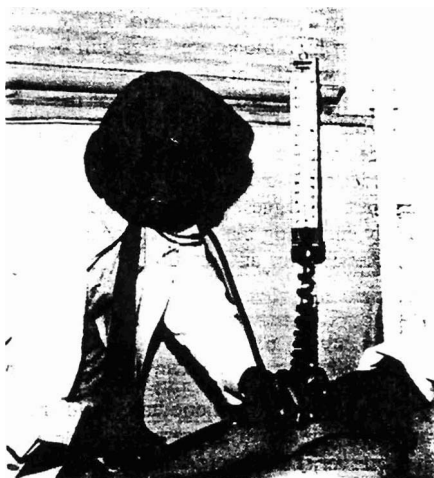
Phase 3—The return of sharper sounds, which become crisper but never fully regain the intensity of phase 1 sounds. Neither phase 2 nor phase 3 has any known clinical importance.

Phase 4—The distinct abrupt muffling of sounds, which become soft and blowing.

Phase 5—The point at which all sounds disappear completely.



Repeated measurements



Fifthly, the stethoscope should be placed over the brachial artery. A bell endpiece gives better sound reproduction, but a diaphragm is easier to secure with the fingers of one hand and covers a larger area. The stethoscope should be held firmly and evenly but without excessive pressure. Too much pressure may distort the artery, producing sounds below diastolic pressure. To avoid friction sounds the stethoscope endpiece should not touch the clothing, cuff, or rubber tubes.

Sixthly, the cuff should be inflated as fast as possible to about 30 mm Hg above the palpated systolic pressure and deflated at a rate of 2 to 3 mm Hg per heart beat or per second).

Seventhly, the appearance of sounds (phase 1) should be recorded as the systolic pressure, and the disappearance of sounds (phase 5) as the diastolic. Ideally both phases should be recorded but this is especially important if the difference between phases is over 10 mm Hg.

Finally, pressures should be recorded to the nearest 2 mm Hg. When all sounds have disappeared the cuff should be deflated rapidly and completely before repeating the measurement to prevent venous congestion of the arm.

If the blood pressure is raised on first measurement the recording should be repeated at least twice in the same arm. In patients with suspected coarctation of the aorta the blood pressure should be measured in the leg. A thigh cuff containing a large bladder (18 × 24 cm for adults) should be wrapped round the thigh of the prone patient and the Korotkoff sounds auscultated in the popliteal fossa in the usual way. The pressure in the legs is normally equal to that in the arms if the bladder is adequate in size.

At an initial examination blood pressure should be measured in both arms. If the difference between arms is more than 10 mm Hg for either systolic or diastolic pressure the arm with the higher pressure should be used for future measurements.

Except when the initial measurement is very high, indicating urgent treatment, the blood pressure should be measured on at least two separate occasions before starting treatment because as many as half the patients with raised blood pressures on initial examination will become normotensive on subsequent examination, and both systolic and diastolic pressures will be overestimated if based on a single casual estimation rather than repeated examination.

Ideally, therefore, records of blood pressure measurement should show the systolic pressure, the diastolic pressure, the endpoint used, the limb used and whether right or left, the position of the patient, and the presence of any arrhythmias or unusual circumstances such as anxiety or confinement to bed.

We thank Dr H Segall for the photograph of Korotkoff. The Blood Pressure Evaluation and Treatment Centre, The Charitable Infirmary, Dublin: Dr Eoin O'Brien is consultant physician (cardiology) and Professor Kevin O'Malley professor of clinical pharmacology at the Royal College of Surgeons in Ireland.

This is the fourth of a series of seven papers, and no reprints will be available from the authors.