

ABC of Blood Pressure Measurement

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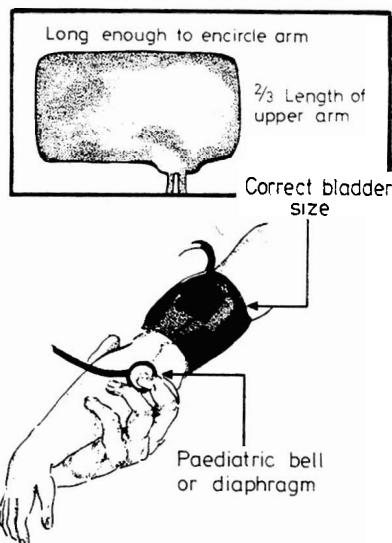
As in the adult, blood pressure measurement in children should be an indispensable part of clinical assessment—since doctors are becoming increasingly aware that hypertension may occur in childhood. If blood pressure readings in children are to be of value, however, the examiner must devote considerable care and time to his technique of measurement.

The physical stimuli affecting blood pressure—*anxiety, fear, apprehension, agitation, activity, respiration, and temperature*—are likely to be greater in children than in adults. Again, the observer may also have to allow for the effect of crying and restraint. The child must be relaxed, and in small children it may be helpful to give them a rubber teat to suck, even though sucking may itself raise the blood pressure.

It is important, particularly in infants and toddlers, to measure the blood pressure in the arms and legs. The systolic pressure in the leg is often said to be higher than in the arm, diastolic pressure being about the same, but any differences are probably due to inadequate cuff size.

There are five main methods of measuring blood pressure in children—auscultation, the flush method, visual oscillometry, palpation, and ultrasound. Impedance plethysmography has also been used, but clinical experience with the technique is limited. The auscultatory method is the commonest, but the Korotkoff sounds are softer in infants and children, so that accurate interpretation may be difficult and other techniques may be necessary.

Auscultation



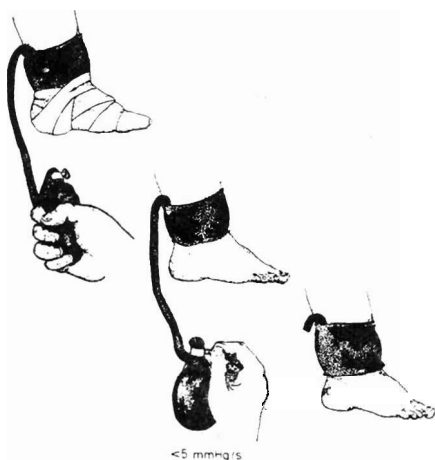
The general recommendations on blood pressure measurement in the adult also apply to the child but a few points need emphasis.

Bladder size—Because of the variation in the size of the arm in children choosing a cuff containing the correct bladder size is important. A bladder that is too narrow or too short will give an erroneously high pressure. One that is too wide or too long will have the opposite effect. An index for making a choice of the proper cuff is available but is rarely used. The bladder width should cover about two-thirds of the length of the upper arm, and it should be long enough to encircle the arm completely. The length of the bladder is more important than width and if the optimal cuff is not available it is better to err with too large rather than too small a bladder. In hospital paediatric practice, where different observers may make serial observations, it is important to indicate bladder size with the blood pressure recording.

Stethoscope—The stethoscope used for auscultation should have a paediatric bell or diaphragm.

Diastolic end-point—As with the adult, there is controversy whether muffling (phase 4) or disappearance (phase 5) of the Korotkoff sounds is the better index of diastolic pressure. Even so, the muffled rather than the silent end-point is generally recommended.

The flush method



The flush method is based on the principle that if an extremity is drained of blood by compression it will blanch and the mean arterial pressure may be detected by observing the pressure at which the extremity flushes. Although clinically cumbersome, the method is useful.

A cuff containing a 5-cm wide inflatable bladder is applied to the wrist or ankle of the recumbent infant. The extremity distal to the cuff is raised and compressed by firmly wrapping it with an elastic bandage or soft rubber drain. (Holding it in the observer's hand is not sufficient because the extremity does not drain adequately.) When compression is complete, the cuff is inflated to 200 mm Hg, the wrapping removed, and cuff pressure slowly released at a rate not exceeding 5 mm Hg per second. The *mean* arterial pressure is the point at which the blanched distal portion of the hand or foot flushes. The technique is not accurate if there is severe anaemia, oedema, or hypothermia. Flush pressure tends to be a little higher in the wrist than in the ankle in the first year of life. The method may be particularly useful in diagnosing coarctation of the aorta.

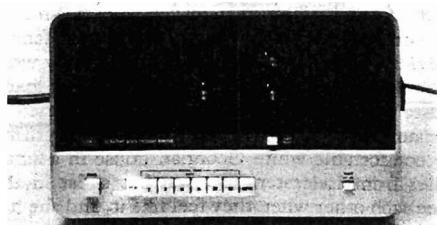
Palpation and visual oscillometry



Palpation in small children and infants of the arterial pressure distal to an occluding cuff may be the only means of obtaining an estimate of blood pressure. The systolic pressure is the point of appearance of the pulse as the pressure in the bladder is reduced. The blood pressure measured by palpation is usually 5-10 mm Hg lower than that measured by auscultation.

Visual oscillometry was popular at the turn of the century but is not much practised now. Sensitive electronic oscillometers, however, are now being developed and may become important in clinical practice. The oscillations of the arterial pulse are transmitted to a mercury column. The points at which oscillation appears and abruptly decreases as cuff pressure is lowered are taken as the systolic and diastolic pressures respectively. Maximal oscillation may represent mean arterial pressure.

Ultrasound



In small children and infants, in whom the Korotkoff sounds may be soft, methods of measuring blood pressure that depend on hearing the sounds are not satisfactory. Hence machines using ultrasound are becoming increasingly popular in paediatric hospital practice. The main drawback to using them more widely is their high cost.

The technique is based on the principle that an ultrasound wave directed towards an immobile structure such as an occluded artery will be reflected back without any change in frequency. On the other hand, a moving structure, such as the wall of a pulsating artery, will alter the reflected wave and will vary with the velocity of blood flow. The altered frequency of the reflected sounds may be amplified to produce a signal which can be detected by headphones or speakers and recorded or displayed.

The method is generally regarded as less accurate for diastolic than for systolic pressures. Even so, overall it is comparable with other indirect methods of measuring blood pressure in children.

The photograph of the Arteriosonde ultrasound machine was reproduced by kind permission of Kontron Medical and Laboratory Systems, St Albans.

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