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Routine measurement of blood pressure in schoolchildren

Undergraduate and postgraduate medical students learn that the measurement of blood pressure is part of routine clinical examination. This would seem a reasonable assertion; however, as will be shown in this article, it requires a thorough understanding of the factors involved in the production of a valid measurement in order to interpret blood pressure meaningfully in children.

Apart from research purposes, the endpoint of measuring blood pressure must be to identify some pathology. That pathology may be a disease causing secondary hypertension, in which case it is important that the clinician should know how to deal efficiently with abnormal findings, probably referring those with severe hypertension to tertiary centres.[1] Otherwise it may be perhaps a more subtle tendency towards essential hypertension, in which case there should be provision for long term follow up, including the difficult period around adolescence, and later, when transfer to adult care is necessary. In both cases, it is important neither to miss a treatable condition nor create unnecessary anxiety to parents and child by failing to recognise normality. This article addresses some of the factors leading to valid assessment of blood pressure.

When to measure blood pressure

The most important hurdle to overcome in relation to blood pressure measurement in children concerns the decision actually to take the blood pressure. The recent working party of the British Hypertension Society did not recommend the routine screening of the paediatric population for blood pressure.[2] Blood pressure in children is very variable,[3] and so regression to the mean, which has long been a problem in trials of antihypertensive treatments in adults,[4] is likely to cause even greater problems in children. Thus although the phenomenon of 'tracking' of blood pressure allows some prediction of later hypertension,[5] the correlation coefficients between initial and follow up blood pressure measurements in a number of studies are relatively low and insufficiently consistent to allow predictions of future blood pressure levels from initial recordings, especially in young children.[6 7]

The situation becomes more unclear when considering the child with a family history of hypertension. While it would seem prudent to follow up a child with a strongly positive family history, the power of observations made before adolescence is debatable.[8] The position may be different during adolescence when there is probably greater overall predictive value, but traditionally this is a period when medical input is at a minimum.

At the other end of the range, there seems little doubt that blood pressure should be measured in all children presenting to clinicians when ill or when illness is suspected. This would be expected practice in adults, and there is no reason why it should not be applied to children. The following groups of children should also have regular routine blood pressure measurements because of the known association between certain pathological states and hypertension: those with any form of renal or cardiovascular disease, urological abnormalities, meningomyelocoele, diabetes mellitus, and neurofibromatosis. Also those with headaches, visual

symptoms, facial palsy, acute neurological disease, hypercalcaemia, lead poisoning, and acute hypovolaemia. Drug treatment with steroids, sympathomimetics, the contraceptive pill, and intravenous administration of blood products or saline must be monitored by blood pressure recordings.[9]

Circumstances of measurement

The blood pressure should be taken in a situation which produces least anxiety. The phenomenon of 'white coat' hypertension in adulthood is clearly applicable to children.[10] Some explanation of the procedure, appropriate to the child's age, is certainly advisable as in younger children the non-invasive nature of the experience is not always appreciated, and the procedure can actually be perceived as quite painful, even if performed properly. The room must be at a reasonable ambient temperature,[11] and the child should have been sitting quietly for a few minutes (for example, the recording should not be performed directly after the assessment of power in all four limbs!).

The technique that is most practicable for widespread clinical application is that using a conventional, well maintained mercury sphygmomanometer. The frustration caused to clinician and client alike of hunting around the room, or building, to find a suitable cuff size, or rubber tubing which does not leak, not only makes measurement an embarrassment, but is unlikely to yield a useful result after all the trouble involved. Therefore it is better to limit cuffs to three or four familiar sizes than to provide a plethora of unreliable equipment. A minimum of four cuff sizes are necessary to cover the school age population: suitable bladder sizes are 4×13 cm, 8×18 cm, 12×24 cm (adult cuff), and 14×33 cm (large adult size).[2 12 13] In any individual the cuff should be the widest one that can be applied to the upper arm without obstructing the antecubital fossa, and with an inflation bladder covering at least two thirds of the circumference of the arm. The use of Velcro fastening cuffs is popular, but not all types of cuff guarantee secure fastening.[12] Ideally these recordings should be made at one minute intervals with the forearm supported at chest level. The averages of the second and third readings should be utilised. Systolic pressure is easier to define than diastolic,[14] but it is important to pump up the cuff sufficiently not to be mistaken by a silent phase which can occur when the pulse pressure is high. The fourth Korotkoff sound, corresponding to the point of muffling rather than the disappearance of sounds as the cuff is deflated, is the better estimate of diastolic pressure.[15 16] This is of academic interest, however, in most individual school aged subjects in the clinical setting.

Measurement therefore requires training and experience, and, as in many situations, a well trained nurse may be a more consistent and accurate technician than a doctor. In any assessment of an unexpected blood pressure result, however, it is always worth ascertaining the circumstances of the measurement and the identity of the examiner. Further action should not be based on single results only, and a few good measurements separated in time and space are more valuable than multiple readings performed on one occasion.[17] Although outside the scope of this article in that it is not yet routine, in the older child particularly, in whom there is concern that blood pressure may be raised, the use of ambulatory monitoring if available may become useful in further assessment before making a decision.[18 19]

Interpretation

With the provisos noted above, the child with obvious hypertension provides the clinician with a clear message. Most children who cause worry, however, will have less severely raised blood pressure necessitating reference to an appropriate normal range of values. Blood pressure clearly increases with age, although not dramatically so in the school age group until puberty, and all the available charts make reference to age, either directly or indirectly.

The charts currently most used in the English speaking world are those produced by the Second Task Force on Blood Pressure Control in Children from Bethesda, in the United States,[13] which relate blood pressure directly to age. Despite stressing the importance of multiple measurements the charts are based, for reasons of study design, on first readings only and this makes interpretation difficult.[20] These data make some allowance for the size of the individual, which is important as most children with raised blood pressure with respect to age will be obese[21] and further management will be altered accordingly. It may be more appropriate altogether, in view of the known influences of body size on blood pressure, to relate blood pressure to height directly[16] and charts exist for this.[22] Which ever charts are used, it is probably valuable to have 'normograms' available in the clinical setting.

In conclusion, the chances of achieving valid and efficient blood pressure measurements are improved if the sources of error are actively taken into account. In particular, there should be adequate facilities available appropriate to the situation and, perhaps most importantly, the attitude of the clinician must be one in which there is a high expectation that the results achieved reflect a true picture, so that further action can be taken with confidence.

P N HOUTMAN
M J DILLON

Hospital for Sick Children,
Great Ormond Street,
London WC1N 3JH

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