Editorials

Blood pressure measurement:

a call to arms

Our hard-pressed workforce may view the linked article by Clark and colleagues with a mixture of interest and trepidation.[1] Their systematic review builds on earlier work to estimate the prevalence of inter-arm difference (IAD) in blood pressure (BP) in populations relevant to primary care. Pooled estimates of prevalence for systolic IAD of ≥10 mmHg were 11% in patients with hypertension, 7% for those with diabetes, and just under 4% in the general adult population.

GPs are masters of distilling from their training and experience the shortest route to a clinical decision. This does not generally involve checking BP in both arms.[1] Yet, paradoxically, this new evidence could reduce workload, because accurate identification of IAD in a minority of patients, and the exclusion of this condition in the majority, might inform a more rational and streamlined approach to blood pressure management in both groups.

HOW SHOULD WE MEASURE IAD?

Many studies investigating IAD have used sequential measurements, that is, using the same manometer in first one then the other arm. An important finding in Clark and colleagues' systematic review was that prevalence of IAD is overestimated threefold by sequential measurement compared with the repeated simultaneous blood pressure measurement protocol from which the headline prevalences were derived.[1]

Recommendations for simultaneous measurement of IAD may seem at odds with the consistent finding of a relationship between an apparent IAD — using the sequential approach — and cardiovascular events.[1,2] Interestingly, the work of Sheppard and colleagues suggests that variation across consecutive blood pressure measurements during a single clinic visit is neither random nor meaningless. They show that a large decrease in blood pressure across multiple readings is predictive of the white-coat effect (lower out-of-office pressure), whereas an increase in pressure is likely to indicate the converse, so-called masked hypertension (higher out-of-office pressure).[3,4] Future work might elucidate whether marked within-visit variability is itself a cardiovascular risk factor, which would then explain why the perhaps over-inclusive sequential method of establishing an IAD identifies populations with increased cardiovascular morbidity.

The alternative approach to IAD detection, simultaneous use of two manometers (whether aneroid or automated), defines a narrower population. However, a newly purchased validated manometer is accurate to +/– 3 mmHg, so use of two different seemingly accurate manometers could theoretically give an apparent 6 mmHg IAD. This could obscure or amplify a true IAD. In failing or faulty manometers the potential for error is even greater.[5] Using two manometers is cumbersome in a 10-minute consultation and real-world practice might not match study protocols.

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How many pairs of measurements to perform is more easily answered. A single sequential pair of measurements can rule out an IAD of ≥10 mmHg with a high negative predictive value but yields high prevalences of IADs, with potential confounding by BP variability.[1,2] Therefore, an apparent IAD should be confirmed by repeated sequential measures or, better still, by repeated simultaneous measures.[1,2]

IN WHOM SHOULD WE MEASURE IAD?

An assessment of IAD should occur early on in the management of conditions such as hypertension, diabetes, or renal disease where absolute values or serial measurements influence management. The lower prevalence of IAD in populations with low absolute BP levels might render the yield in such contexts as monitoring of combined oral contraception unlikely to justify the effort.

The patients in whom IAD evaluation is most worthwhile — on a single occasion — are the very people in whom BP measurements and prescribing decisions are most common. The authors suggest that, in a population with a 10% prevalence of IAD, not checking risks a significantly incorrect decision 1 in 20 times. Even IADs of <10 mmHg, which are, unsurprisingly, even more common, could impair follow-up of lifestyle and medication changes, which individually have an impact on blood pressure in the range of 3–15 mmHg.[2]

Some groups of patients should be excluded from the routine measurement of IAD. These include patients with dialysis fistulae who are specifically advised to stop anyone taking a BP in the affected arm. Patients' reports of trauma-related deformity or arm pain should also be heeded. Post-stroke patients may or may not be aware that prescribing decisions should not be based on a hemiparetic limb's BP. Women who have had a sentinel node biopsy or axillary clearance are often advised not to have a BP measurement taken in the affected arm, although there is no evidence for this recommendation.[6] Handedness neither predicts nor determines IAD but atrial fibrillation can impede assessment.[2]

A confirmed, significant IAD in blood pressure could be stored prominently on the electronic health record using, for instance, the Read code 'Unequal blood pressure in arms' (246k) both to inform clinical management and to enable later searches, audit, and research.

HOW SHOULD IAD MEASUREMENT CHANGE MANAGEMENT?

In the absence of an IAD, the patient can be advised that either arm can be used for BP measurement. But, given the need to reduce pressure on appointments, inconvenience to patients, burden of treatment, and ultimately cardiovascular morbidity and mortality, inter-arm anarchy should be avoided unless a significant IAD has been excluded. Perhaps one of the reasons for the improved BP control in hypertensive patients who self-monitor is consistency of arm usage.[7] Recognition of an IAD will not remove all the BP variability that bedevils follow-up and to which so many factors contribute. It would, however, remove one source of error in the interpretation of serial measurements, so assisting management of the hypertensive patient.

Because IAD prevalences rise with the baseline vascular risk of the population it is argued that IADs can be markers of peripheral arterial disease.[1,2] An IAD of ≥10 mmHg could therefore be a pointer towards the need for secondary prevention measures and also vulnerability to precipitous

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creatinine elevation with renin angiotensin system drugs. Guidelines advise specialist assessment for an IAD of ≥20 mmHg. If followed, the frequency of this requirement can be judged from the prevalences of 1.2%, 0.4%, and 0.3% (respectively) in hypertension, in diabetes, and in populations without those two conditions.[1]

IMPLICATIONS FOR ORGANISATION OF CARE

That IADs may cause confusion follows from the organisation of care, which often involves follow-up by different health professionals working in different rooms. Correct BP measurement requires arm support, often provided by the clinician's desk. Follow-up in a room with a different layout therefore introduces yet another blood pressure variable. Not many health centres would boast that their continuity of care takes account of furniture configuration, although chairs with suitable armrests could get round this. GP readings are systematically higher than nurse readings due to a greater white-coat effect.[8] Talking to patients can also affect the accuracy of BP measurement, although it is unclear whether this impacts on the assessment of IAD.[9] Understanding of the factors that complicate interpretation of office BPs reinforces the case for self-monitoring, at least in the management of hypertension.[10] Recommendations for home monitoring with clear instructions and a flexible schedule may be welcomed by patients.[11]

NEW TECHNOLOGIES NEEDED?

Clark and colleagues' analysis[1] included studies using recently developed devices able to measure two or four limbs simultaneously, also useful for streamlining assessment of the ankle-brachial index. The scarcity of such devices reflects limited demand outside of the research field (Andrew Webb, Managing Director, PMS Healthcare Ltd, personal communication, 2016). Yet low uptake of longstanding recommendations to check the BP in both arms seems unlikely to change until clinicians are provided with practical, accurate, and affordable technology. Perhaps the synthesis of evidence reported in this issue will increase demand.

There are precedents in the hypertension field for technological developments promoting implementation of evidence. For example, the widespread availability of inexpensive validated automated manometers for use in self-monitoring at home by patients has been a game-changer in the uptake of National Institute for Health and Care Excellence guidelines regarding diagnosis of hypertension, as evidenced by an internet survey of 300 GPs. The authors found the proportion of GPs using self-monitoring to diagnose hypertension had grown from 37% in 2011 to 58% in 2015.[12]

FUTURE RESEARCH

The evidence to date raises questions that would benefit from further empirical studies such as how frequently should we test for IAD? How does the association between BP and cardiovascular morbidity change when management of the highest or lowest arm BP is used to define clinic BP? Will new technologies for IAD detection benefit patient outcomes and clinician workload? Additionally, what would be the impact of treating IAD with secondary prevention measures?

Christine A'Court,
Research Fellow, Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford.

James Sheppard,
MRC Research Fellow, Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford.

Trisha Greenhalgh,
Professor of Primary Care Health Sciences, Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford.

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ADDRESS FOR CORRESPONDENCE

Christine A'Court
Nuffield Department of Primary Care Health Sciences, University of Oxford, Radcliffe Primary Care Building, Radcliffe Observatory Quarter, Woodstock Road, Oxford, OX2 6GG, UK.

E-mail: christine.acourt@btinternet.com

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