Blood pressure measurement in hypertension research. A workshop of the European Society of Hypertension

Eoin O'Brien

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Correspondence and requests for reprints to Eoin O'Brien, Chairman, European Society of Hypertension Working Group on Blood Pressure Monitoring & Professor of Cardiovascular Pharmacology, The ADAPT Centre and Blood Pressure Unit, Beaumont Hospital, Dublin, Ireland.
E-mail: eobrien@iol.ie

A Workshop on *Blood Pressure Measurement in Hypertension Research* was held in Milan in June 2003 at the 13th European Meeting on Hypertension of the European Society of Hypertension. Following publication of the Working Group *Recommendations for conventional, ambulatory and home blood pressure measurement* [1], attention is now being focused by the Working Group on the measurement of blood pressure in hypertension research. There is ample evidence that blood pressure measurement in clinical practice is often extremely inaccurate, but inaccurate measurement in research has even more serious consequences in that management strategies for clinical practice may be recommended on the basis of flawed research [2]. The Milan workshop was a first step in attempting to examine the weaknesses of measurement in research in the hope of ultimately being able to establish the best methodologies for measuring blood pressure in the many different areas of hypertension research.

With the ever-increasing improvements in facilities for transferring and sharing data between centres and countries, the handling of such data has become an issue of importance. The Beaumont Hospital group in Dublin describe the difficulties of overcoming the problem of identifying mortality outcome in a large database of nearly 15 000 subjects in the absence of an unique national identifier. With detailed data on different measures of blood pressure (BP) in nearly 800 cardiovascular deaths, this study should provide important information on the predictive value of ambulatory blood pressure on cardiovascular outcome [3].

Data from the Dublin database will later be incorporated in an international database of prospective studies of ambulatory blood pressure measurement, established by Pickering and his colleagues in 2001. The goals are to enable analyses that cannot be made reliably from the individual studies, such as the predictive value of different measures of blood pressure (e.g., the morning surge and blood pressure variability), the ability to look at the prediction of specific endpoints (e.g., stroke versus myocardial infarction), and also to look at differences between populations. The international database presently consists of databases from New York (NYPEAP—New York Prognostic Effects of Ambulatory [Blood] Pressure), Perugia (PIUMA—Progetto Ipertensione Umbria Monitoraggio Ambulatoriale), and Ohasama and Jichi in Japan, but it is hoped that at least seven other groups will be added in the near future to give a population in excess of 10 000, thus enabling several new analyses to be performed, such as an assessment of the prognosis in masked hypertension, and a comparison of stroke prediction in Japanese and Caucasians [4].

Staessen and his colleagues in Leuven emphasize the crucial importance of standardizing the blood pressure measurement phenotype in genetic studies. To what extent the conditions and techniques of BP measurement might influence the phenotype–genotype relationships in genetic studies have not yet been widely investigated. In a study of the association between various blood pressure phenotypes and the β-adducin *C1797T* polymorphism, they show that phenotype–genotype associations involving blood pressure are influenced by the technique and conditions of blood pressure measurements as well as by the overall ecogenetic context [5].

Blood pressure measurement in research is characterized by continuous fluctuations, including fast changes lasting a few seconds only, as well as slower and more prolonged variations, with a time constant of minutes or hours. Parati and his colleagues in Milan assess the relative contribution of these different components to overall blood pressure variance using a number of mathematical approaches, either in the time or in the frequency domain (spectral analysis). Due to its complex nature, a precise and detailed assessment of blood pressure variability can be obtained only from the analysis of continuous, beat-by-beat, blood pressure recordings. Some information, however, can be derived also from analysis of discontinuous blood pressure tracings, such as those commonly performed in a clinical setting, but this requires careful attention to both the quality of the measurements and to the selection of proper analytic methods for assessing different blood pressure variability components [6].

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There are several methods available for determining the duration of action of anti-hypertensive drug effect. Traditional approaches involve measurements of blood pressure at the end of the dosing interval (trough). Myers from Toronto shows that ambulatory BP monitoring could be used to obtain additional information on the time course and magnitude of the decrease in blood pressure over a standard dosing interval. Use of the 'missed dose' technique makes it possible to demonstrate persistent reductions in blood pressure beyond 24 h for drugs given on a once-daily basis. Thus, 24- h ambulatory blood pressure recordings can be used to assess anti-hypertensive efficacy for periods up to 72 h after the last dose of medication has been taken [7].

The terms 'self blood pressure' and 'home blood pressure' are often used interchangeably to describe measurements of blood pressure taken by patients at home. However, as Stergiou from Athens points out, home measurements are not always self-measurements, because measurements are often taken by the patients' relatives, and on the basis of evidence from the literature he argues that the term 'self blood pressure' seems to be a misnomer, whereas the term 'home blood pressure' represents a more appropriate term for home measurements taken by patients or their relatives [8].

Mengden and his colleagues from Bonn examine the relative values of clinic, self and ambulatory measuring techniques in assessing and comparing the efficacy of anti-hypertensive drugs. They conclude that self-measurement and ambulatory 24-h measurement are both superior to clinic blood pressure and should be regarded as complementary, with both techniques giving useful and additive information in pharmacological studies [9].

Staessen and his colleagues in Leuven reiterate this message for ambulatory blood pressure measurement by showing that in both the THOP and APTH studies, ambulatory blood pressure measurement was superior to conventional measurement with electrocardiographic and echocardiographic left ventricular mass at baseline being more strongly correlated with ambulatory than conventional measurement [10].

Consumers are faced with an ever-increasing array of blood pressure measuring devices, whether for use in hypertension research, clinical management or for use by individuals anxious to measure their own blood pressure. The results of validation studies of blood pressure measuring devices are not readily accessible to the public and to health care authorities with responsibility for purchasing blood pressure measuring equipment for use in clinical medicine, and the results of published validation studies are often flawed because of protocol violations and the conclusions may not be valid. These considerations have been the stimulus for the establishment of an independent non-profit website, which will provide quarterly updates on the accuracy and performance of blood pressure measuring devices on the market as well as an expert assessment of the validation procedures on which recommendations are based. The website, which is based in Dublin, will be launched in September 2003 [11].

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