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## Dipping Comes of Age The Importance of Nocturnal Blood Pressure

Eoin O'Brien

It is now just 21 years since the dipping phenomenon was described in a letter to *The Lancet*.<sup>1</sup> In a cohort of 123 consecutive patients who had ambulatory blood pressure (BP) measurement (ABPM) performed, the majority (83%) were dippers on the basis of having a difference of  $\geq 10/5$  mm Hg between day and nighttime BPs, with 17% being nondippers. The nondippers had a significantly higher frequency of stroke than dippers, and the concluding challenge that research should turn its attention to the prognostic and therapeutic implications of this finding was taken up with an alacrity that has resulted in much debate over 2 decades.

The reproducibility of the dipping phenomenon,<sup>2</sup> how it should best be defined,<sup>3</sup> its hemodynamic physiology,<sup>4</sup> its relationship to daytime activity<sup>5</sup> and to the quality of sleep,<sup>6</sup> and its relationship to other surrogate end points, such as arterial stiffness,<sup>7</sup> have all been the subject of considerable research that continues apace. However, the 2 topics of greatest interest to clinical practice are the importance of the dipping phenomena as markers of future outcome<sup>8</sup> and the therapeutic implications of 24-hour BP control.<sup>9</sup> The importance of these issues is now well recognized, and it follows, therefore, that managing hypertension without ABPM is no longer acceptable. This being so, the next logical step in the debate is the implementation of ABPM in primary care and an analysis of the benefits of such an approach to hypertension management.<sup>10</sup>

In this regard, we must be grateful to our Spanish colleagues for taking the bull by the horn (no pun intended!). In this issue, the latest results in a series of informative analyses from the Spanish Society of Hypertension ABPM Registry are presented.<sup>11</sup> This study of ABPM in primary care was founded in 2004 on the basis that there was considerable evidence to show that BP levels measured conventionally in primary care were substantially higher than levels recorded using ABPM and that this discrepancy was likely to lead to erroneous decisions in the management of hypertension and to be a major factor in the poor rates of BP control being achieved in virtually all countries of the world.

The opinions expressed in this editorial are not necessarily those of the editors or of the American Heart Association.

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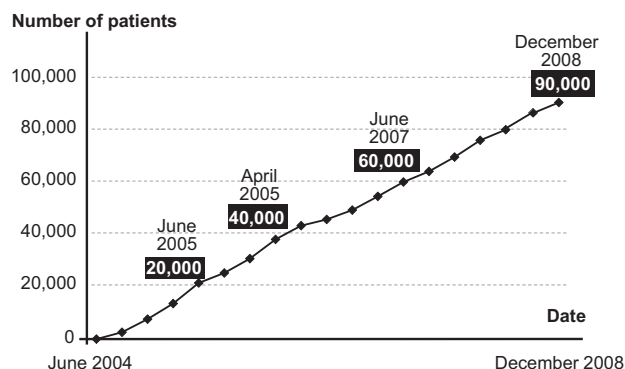
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To date, the Spanish Society of Hypertension ABPM Registry has performed ABPM in >90 000 patients in >500 primary care practices across the country (see the Figure). The study has shown previously that, although the burden of poorly treated hypertension is remarkably high, BP control in the community is nearly twice as good when judged by ABPM as compared with office BP, that high-risk patients had the most unfavorable ABPM levels when compared with low-to-moderate-risk patients in spite of receiving much more antihypertensive treatment, and that high-risk hypertensive patients showed a high prevalence of a nondipping pattern.

Now the study investigators have performed a detailed analysis of the prevalence of the dipping pattern in 42 947 hypertensive patients of whom 8384 were previously untreated and 34 563 were on treatment. The aims of the study were to determine the prevalence of circadian BP patterns and to assess clinical characteristics that might be associated with a nondipping status and to determine whether treatment influenced any associations. Patients were categorized according to their nocturnal BP behavior as dippers (normal) when the reduction in the average systolic BP during the night period was >10% of mean systolic BP during the day, as extreme dippers when this reduction was >20%, as nondippers when the reduction was <10%, and as risers when the mean night systolic BP was higher than the day systolic BP. Dippers accounted for 50.2% (untreated) and 40.0% (treated), extreme dippers for 9.0% (untreated) and 7.0% (treated), nondippers for 35.0% (untreated) and 40.0% (treated), and risers for 6.0% (untreated) and 13.5% (treated). The dipping phenomenon (dippers and extreme dippers) was 59.0% and 41.0% in untreated and treated patients, respectively, and the nondipping phenomenon (nondippers and risers) was present in 47.2% and 52.8% of treated patients,



**Figure.** Patient recruitment from primary care practices in the Spanish Society of Hypertension ABPM Registry Study.

respectively. Put another way, treated patients were more likely to show a nondipping pattern.

In both groups, a history of previous cardiovascular or renal disease, advanced age, obesity, diabetes mellitus, or overt cardiovascular or renal disease was associated with a blunted nocturnal BP decline. In treated patients, nondipping was associated with the use of a higher number of antihypertensive drugs but not with the time of the day at which antihypertensive drugs were administered, which would seem to run against the argument that the time of drug administration influences nocturnal BP. It may be that the need for more drugs in the nondipping patients is a reflection of the severity of hypertension and an indication that such patients will not only be difficult to treat but will require more medication to achieve control. It follows that, if they are at higher risk, control is imperative and ABPM is mandatory in assuring that 24-hour reduction of daytime and nighttime BP is achieved.

The Spanish study confirms that nondipping is common in primary care and in keeping with other studies shows that nocturnal BP is superior to all other measurements in predicting cardiovascular outcome. For example, in the Dublin Outcome Study, for each 10-mm Hg increase in mean nighttime systolic BP, the mortality risk increased by 21%.<sup>8</sup>

So what are the messages for clinical practice from the Spanish study? First, ABPM is feasible in primary care, and with new methods of software analysis that provide interpretive reports of ABPM data and the facility for online storage of data and central analysis, the previous difficulties that beset ABPM (cost, training of staff, implementation, etc) should be laid to rest in the face of the valuable information provided by the technique.<sup>10</sup> Second, the true state of the burden of hypertension facing a nation can be accurately calculated and the societal and financial measures necessary to combat the problem can be assessed. Third, BP control can be doubled using ABPM rather than clinic BP monitoring, from which it may be concluded that the cardiovascular consequences of badly controlled hypertension will be greatly reduced. Fourth, the importance of nondipping nocturnal hypertension has been confirmed not alone as a serious risk in its own right but as a marker for a poor future prognosis that calls for more aggressive management of hypertension than in patients with a dipping pattern. Fourth, and importantly, the management of hypertension in primary care can be monitored and guided by evidence and by collaboration with centers of excellence with every prospect of greatly improving the nationwide management of hypertension. Fifth, as I have argued on many occasions,<sup>10</sup> there can no longer be justification for managing hypertension without ABPM, and

to do so is ignoring the abundant evidence in the literature that will sooner or later rebound on clinical practice in the medicolegal arena.

Finally, it is worthy of comment that national governmental agencies responsible for health care delivery have failed to act on the evidence-based information showing ABPM to be a methodology capable of dramatically reducing the growing burden of stroke in aging populations and that the Spanish study would not have become reality without the energetic participation of the Spanish Society of Hypertension and funding from the pharmaceutical industry. It will not be long, I predict, before this prescient enthusiasm is rewarded by a reduction in cardiovascular events.

### Disclosures

E.O. contributed financially to the development of the dabl ABPM software program and is a member of the Board of dabl Limited, Dublin, Ireland ([www.dabl.ie](http://www.dabl.ie)).

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