PERSPECTIVES IN HYPERTENSION

Nighttime blood pressure measurement: Why, what, and how?

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The "non-dipper" and "night-time blood pressure" concepts

In 1988, Eoin O'Brien introduced the concept of non-dippers.[1] At that time, he highlighted than non-dippers "may be at higher risk of cerebrovascular complications" and that "we need to determine the prognostic and therapeutic implications of this finding".[1] In 1999, Jan Staessen et al. reported results from the Systolic Hypertension in Europe (Syst-Eur) trial and showed that an increase in night-to-day systolic ambulatory blood pressure (ABP) ratio was associated with increased risk of cardiovascular disease (CVD) endpoints independently of average 24h ABP.[2]

Outcome studies showed nighttime blood pressure (BP) to be the most important aspect of the BP profile.[3,4] In the Pressioni Arteriose Monitorate E Loro Associazioni (PAMELA) study in Italy,[3] nighttime systolic ABP presented the strongest association with the risk of total mortality, compared to office, home, and daytime ABP. In the same line, a recent analysis of the Spanish ABP registry including 59,124 patients followed for an average of 9.7 years showed nighttime BP to be more closely associated with all-cause and CVD mortality than office, daytime, or 24h ABP.[4] Interestingly, even isolated nighttime hypertension (normal office and daytime ABP) appears to predict independently CVD outcome.[5]

Today we know that the non-dipping pattern is much more common - and probably more important - in high-risk patients, e.g., patients with diabetes, chronic kidney disease, CVD, etc.[6] However, it is amazing that 36 years after the landmark observation by Eoin O'Brien, we confirmed his finding regarding the prognostic relevance of non-dipping, but we are still uncertain about its pathophysiology[7] and in answering the important question he posed regarding its therapeutic implications.[1]

Non-dipping versus night-time hypertension

As discussed above, both non-dipping and nighttime hypertension are associated with an adverse CVD prognosis. However, the relative prognostic contribution of each of these nocturnal BP phenotypes remains uncertain. In general, the evidence on the prognostic role of nighttime hypertension appears to be more consistent than of the dipping status.[8] Several studies have shown that the prognostic ability of the non-dipping pattern is attenuated or even lost if adjusted for the average nighttime BP levels. Non-dipping depends on daytime BP and presents only moderate reproducibility.[8] Moreover, the prognostic value of the dipping status depends on the population characteristics, i.e. a U-shaped relationship between nocturnal dipping and adverse outcome is present in individuals older than 70 years.[9] The recent Japan ABP Monitoring Prospective (JAMP) study showed that higher nighttime systolic BP was associated with higher CVD risk than the dipping status.[10] However, for endpoints such as coronary artery disease and

heart failure, the risk was highest in individuals with a riser pattern and higher nighttime systolic ABP.[10] Data from the Spanish ABP monitoring registry also showed higher CVD mortality hazard ratios with abnormal nighttime systolic BP than with abnormal dipping, but highest when both abnormalities were present.[11]

Non-dipping and night-time BP assessed by home monitors

ABP monitoring is the reference method for the evaluation of the nighttime BP and dipping. In the last few years, low-cost devices for self-home BP monitoring have been developed, allowing automated nighttime BP measurements during sleep.[12] Studies comparing with reference nighttime ABP monitoring suggested that nighttime home BP monitoring is feasible, and these methods present similar BP values, have reasonable agreement in detecting nighttime hypertension and non-dipping, as well as comparable relationship with indices of preclinical organ damage.[13] More importantly, recent prospective outcome data in Japan showed that nighttime systolic BP and uncontrolled nighttime hypertension detected by home monitors independently predict CVD.[14,15] A different schedule for nighttime BP evaluation is used by home monitors, and 3 hourly measurements per night for 3 consequent nights appears to be the minimum reliable schedule.[16]

What for now and in the future

Undoubtfully, nighttime hypertension and non-dipping are important for prognosis. Why nighttime BP is so important is not clear. Maybe the daytime measurements are polluted by variability in behaviour, mental and physical activity, whereas nighttime BP, despite obtaining fewer measurements, is standardised in terms of body position and activity, revealing thereby the true BP level of the individual.

However, the evaluation of nighttime hypertension and the dipping pattern in individual patients in clinical practice is problematic. First, the availability of devices for nighttime BP monitoring (ABP or home monitors) is limited. Second, the reproducibility of these diagnoses is far from perfect, and more than a single 24h ABP recording is required. Third, there is no evidence that targeting nighttime BP with bedtime dosing of drugs would be beneficial in improving prognosis.[6]

At the present time elevated nighttime BP should alarm the clinician to consider (i) poor sleep quality, (ii) obstructive sleep apnea, (iii) uncontrolled 24h BP, (iv) increased CVD risk. Although the diagnostic and prognostic consequences of this information are clear, its therapeutic implications for clinical practice remain uncertain. A reasonable consensus at the present time might be that optimal control of BP should be achieved, which can be best assessed by employing complementary measurement methods, in the office, at home and with 24h ABP monitoring.

In the future, if and when accurate cuffless wearable BP monitors become available, they are expected to obtain 24h BP information for days, weeks or months, providing thereby complete and accurate information on the individual's BP profile and behaviour. Moreover, prospective outcome studies in patients with nocturnal hypertension and/or non-dipping are needed to verify whether targeting selectively nighttime BP can improve prognosis further to standard care.

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