ejection wave by reflected waves in the peripheral arterial tree. The central hemodynamic load is thus more accurately measured by ceABP and is superior to pABP in predicting organ damage and outcomes. The 2013 European Society of Hypertension and European Society of Cardiology guidelines for the management of arterial hypertension indicate uncertainty regarding the significance of isolated systolic hypertension in young persons when measured peripherally [Protogerou AD et al. *J Hypertens* 2013], especially since ceABP is frequently normal or low in the same patients [O'Rourke MF, Adji A. *J Hypertens* 2013]. No current data show unfavorable outcomes in young patients with isolated systolic hypertension, so there is no evidence to suggest that treatment is necessary. The purpose of this study was to describe the potential relationships between 24-hour ceABP and pABP with preclinical target organ damage in young patients.

In this cross-sectional study, 44 apparently healthy people aged 12 to 25 years who were healthy volunteers or referred for elevated BP (but untreated) were assessed by somatometrics, BP, echocardiogram for LVMI, and cIMT. Measurements of ceABP and pABP were evaluated during routine work or school days at 20-minute intervals for 24 hours via a Mobil-O-Graph 24-hour pulse wave velocity (PWV) monitor.

At baseline, half the participants were less than 19 years of age. The mean age of the study group was 18.8 years; 73% were male; and the mean body mass index was 24.1 kg/m^2. High ambulatory BP—defined as the 24-hour BP >95th percentile or >130/80 mm Hg—was present in 18% of participants. High-normal ambulatory BP—defined as a 24-hour BP >90th percentile or >125/75 mm Hg—was present in 21%.

Mean 24-hour ceABP was ~13 mm Hg lower than pABP ($p<0.01$). In addition, there was a high correlation between systolic pABP and systolic ceABP ($r=0.94$; $p<0.01$). Systolic BP amplification was higher in males than in females, with a difference of 4.3 mm Hg ($p<0.01$). There was no difference in systolic BP (SBP) amplification among normotensives, high-normal, and hypertensives. Increasing age was associated with a decrease in SBP amplification ($r=-0.44$; $p<0.01$). Both 24-hour ceABP ($r=0.51$; $p<0.01$) and pABP ($r=0.43$; $p<0.01$) were associated with LVMI; 24-hour ceABP ($r=0.42$; $p=0.005$) and pABP ($r=0.38$; $p=0.01$) were also associated with common cIMT. Similarly, there was a strong correlation between 24-hour PWV and ceABP and pABP ($r=0.94$ and $r=0.92$, respectively; $p<0.01$ for both).

Dr. Ntineri concluded that data from this study confirmed that the difference in ceABP and pABP can be quite large. Prospective studies are needed to investigate the role of ceABP in young patients.

High Morning SBP Linked to Cerebrovascular Events

Written by Emma Hitt Nichols, PhD

Morning systolic blood pressure (SBP) is associated with increased risk of cerebrovascular events, even if clinic SBP is low. Kazuomi Kario, MD, PhD, Jichi Medical University School of Medicine, Shimotsuke, Japan, presented data from the Home Blood Pressure Measurement With Olmesartan Naive Patients to Establish Standard Target Blood Pressure study [HONEST; UMIN000002567; Saito I et al. *Hypertens Res* 2013].

Home blood pressure (BP) monitoring is the first step in achieving 24-hour BP control [Shimamoto K et al. *Hypertens Res* 2014]. Morning hypertension—defined as BP ≥135/85 mm Hg in the morning—is a recommended target in clinical practice, by having patients take their antihypertensive medication in the morning [Kario K. *Am J Hypertens* 2005]. The purpose of the HONEST study was to determine the effect of home BP, clinic BP, and the occurrence of cardiovascular events.

In the large prospective observational HONEST study, 21,591 olmesartan-naïve patients with essential hypertension who had data for 2 days of morning home and clinic BP were followed for 2 years. At baseline, the mean age was 65 years, the body mass index was 24 kg/m^2, and 50% of participants had previously used antihypertensive therapy. All patients received olmesartan at baseline (mean dose, 18.2 mg), and 83% continued its use by the end of the study (mean dose, 20 mg). The primary end points included cerebrovascular event, cardiac event, and sudden death.

Morning home SBP and clinic SBP were significantly associated with reaching the primary end point at 18 months ($p=0.015$ and $p=0.0005$, respectively) and 24 months ($p\leq0.0001$ for both). According to a spline regression analysis, the minimum risk for morning home SBP and clinic SBP was 124 mm Hg and 131 mm Hg, respectively. Patients with morning home SBP ≥145 mm Hg and clinic SBP ≥150 mm Hg had the greatest risk of reaching the primary end point (HR, 3.92; $p<0.0001$), with patients having morning home SBP ≥145 mm Hg and clinic SBP <130 mm Hg also having significant risk for reaching the primary end point (HR, 2.47; $p=0.014$).

There were no significant differences between morning home SBP and clinic SBP and between morning home diastolic BP (DBP) and clinic DBP, over the 2 years of follow-up. In addition, morning home and clinic BPs decreased by 20 and 10 mm Hg, respectively, at 2 years. The incidence of the primary end point was

6.46 (95% CI, 5.75 to 7.27), with a stroke incidence of 2.92 (95% CI, 2.46 to 3.48). In addition, the incidence of cardiac events was 3.85 (95% CI, 3.30 to 4.48), including a myocardial infarction incidence of 1.03 (95% CI, 0.77 to 1.38). The incidence for sudden death was 0.80 (95% CI, 0.58 to 1.12).

Dr. Kario concluded that data from the HONEST study suggest that on-treatment morning home SBP >145 mm Hg is associated with an increase in risk of cardiovascular events at 2 years. In addition, the risk is high for patients who have masked hypertension (ie, those patients who have high home BP but low clinic BP).

Nighttime SBP Linked to CVEs

Written by Emma Hitt Nichols, PhD

Nighttime systolic blood pressure (SBP) predicts future cardiovascular events (CVEs) independent of other SBP measures, whereas ambulatory daytime SBP and clinic SBP do not, on the basis of a meta-analysis of 9 international cohorts presented by George C. Roush, MD, St. Vincent's Medical Center, Bridgeport, Connecticut, USA.

Current data are unclear as to which type of SBP—daytime ambulatory, nighttime, or clinic—is most predictive of CVEs. Potential limitations of these studies include inadequate sample size, imprecise classification of daytime versus nighttime SBP, and failure to adjust for all 3 types of SBP. The present study addressed these problems.

This systematic review of PubMed and OVID citations included 9 cohorts with a combined sample size of 13,844 patients diagnosed with hypertension, with ≥1 year of follow-up, and with CVEs as outcomes. Meta-analyses provided hazard ratios (HRs) adjusted for sex, age, smoking status, diabetes mellitus, and baseline BP treatment. Dispersion was measured as the coefficient of variation (standard deviation/mean).

Greater dispersion in nighttime SBP was observed in all 9 cohorts compared with daytime SBP (p=0.004). In addition, although clinic, daytime, and nighttime SBP each predicted CVEs when considered individually, after simultaneous adjustment for all 3 SBP measures, only nighttime SBP retained its ability to predict risk (HR, 1.27; 95% CI, 1.20 to 1.34), whereas daytime (HR, 1.01; 95% CI, 0.91 to 1.11) and clinic (HR, 1.00; 95% CI, 0.97 to 1.04) SBP did not (Table 1). Patterns were similar for the 6 cohorts of the highest quality and when considering coronary artery disease and stroke as outcomes.

Although this was a cohort-level analysis rather than an individual-level analysis, it was nonetheless unbiased. The strengths of this study included a large sample size, the ability to evaluate relationships in different populations, the inclusion of high-quality cohorts, and patient-specific night-day classification of SBP.

Why is the greater dispersion for nighttime SBP important? To answer this, consider that modest variations within the "normal" range in blood pressure can result in substantial increments in cardiovascular risk [Vasan RS et al. *N Engl J Med* 2001]. Dr. Roush suggested that nighttime SBP may be critical for several reasons, including the possibility that the decreased arteriolar tone at night might leave target organs such as the heart and brain vulnerable to elevated pressures in large and medium-sized arteries.

In conclusion, this meta-analysis demonstrated that nighttime SBP has greater dispersion than the 2 other types of SBP measurements and that, after simultaneous adjustment for all 3 SBP measures, nighttime SBP retains its ability to predict risk, whereas clinic and daytime ambulatory SBP lose this ability entirely.

Table 1. Prognostication of Nighttime, Daytime, and Clinic Systolic Blood Pressure[a]

	No Simultaneous Adjustment	Simultaneous Adjustment	Simultaneous Adjustment (6 Highest Quality Cohorts)
Type of SBP Measure		**HR for CVEs (95% CI)**	
Night	1.25 (1.22–1.29)	1.26 (1.20–1.31)	1.27 (1.20–1.34)
Day	1.20 (1.15–1.26)	1.01 (0.94–1.08)	1.01 (0.91–1.11)
Clinic	1.11 (1.06–1.16)	1.00 (0.95–1.05)	1.00 (0.97–1.04)

CVEs= cardiovascular events; SBP=systolic blood pressure.

[a]HR values based on a 10 mm Hg increase in nighttime, daytime, and clinic SBP.