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J Am Coll Cardiol. 2015 September 22; 66(12): 1408–1409. doi:10.1016/j.jacc.2015.05.083.**Ambulatory Blood Pressure Control and Subclinical Left Ventricular Dysfunction in Treated Hypertensive Subjects****Fusako Sera, MD^{*}, Zhezhen Jin, PhD[†], Cesare Russo, MD^{*}, Edward S. Lee, MD^{*}, Joseph E. Schwartz, PhD^{*,‡}, Tatjana Rundek, MD, PhD[§], Mitchell S.V. Elkind, MD, MS^{||}, Shunichi Homma, MD^{*}, Ralph L. Sacco, MD, MS^{§,¶}, and Marco R. Di Tullio, MD^{*}**^{*}Department of Medicine, Columbia University, New York, NY, USA[†]Department of Biostatistics, Columbia University, New York, NY, USA[‡]Department of Psychiatry, Stony Brook University, Stony Brook, NY, USA[§]Departments of Neurology and Public Health Sciences, University of Miami, Miami, FL, USA^{||}Departments of Neurology and Epidemiology, Columbia University, New York, NY, USA[¶]Department of Human Genetics, University of Miami, Miami, FL, USA

Blood pressure (BP) control in hypertensive patients is crucial for reducing the risk of heart failure (HF) development, and may be of particular importance in the elderly, who have especially high prevalence of hypertension and risk of HF⁽¹⁾. Left ventricular (LV) global longitudinal strain (GLS) is an echocardiographic measure of LV systolic function that can be an indicator of early subclinical cardiac dysfunction, even when LV ejection fraction (LVEF) is normal. The association of BP control with early subclinical LV dysfunction by GLS has not been extensively studied, and it is also unknown whether assessing BP control with ambulatory BP (ABP) monitoring may be superior to using office BP measurements in this regard. Therefore, we investigated the association of BP control with GLS using ABP and office BP criteria in a community-based, predominantly elderly cohort with normal LVEF.

The study cohort consisted of 394 treated hypertensive subjects (mean age 72±9 years; 63% women) with LVEF ≥ 50% from the Cardiac Abnormalities and Brain Lesion (CABL) study who underwent transthoracic echocardiography and ABP monitoring. Uncontrolled office BP was defined as office systolic BP (SBP) ≥ 140 mmHg and/or diastolic BP (DBP) ≥ 90 mmHg; uncontrolled 24-hour ABP as mean 24-hour SBP ≥ 130 mmHg and/or DBP ≥ 80 mmHg; uncontrolled daytime ABP as mean daytime SBP ≥ 135 mmHg and/or DBP ≥ 85 mmHg; uncontrolled nighttime ABP as mean nighttime SBP ≥ 120 mmHg and/or DBP ≥ 70 mmHg⁽²⁾.

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Speckle-tracking analysis was performed on digital echocardiographic images using commercially available software (QLAB Advanced Quantification Software version 8.1, Philips, Andover, MA). GLS was calculated by averaging the negative peak of longitudinal strain of 12 LV segments from the apical four-chamber and two-chamber views. Abnormal GLS was defined as a GLS \leq -14.7%, which is the 95th percentile of the GLS distribution in the healthy normotensive subjects from the CABL cohort ⁽³⁾.

Seventy-seven subjects (19.5%) had abnormal GLS. Office BP was uncontrolled in 188 subjects (47.7%), while 24-hour ABP was uncontrolled in 162 (41.1%). Concordant classification of BP control between office BP and 24-hour ABP was identified only in 230 subjects (58.4%; kappa=0.16, 95% CI, 0.06–0.26). Uncontrolled daytime and nighttime ABP was identified in 36.6% and 53.0% of participants, respectively.

In univariable logistic regression analyses, uncontrolled 24-hour ABP was significantly associated with abnormal GLS (odds ratio [OR] = 2.95; 95% confidence interval [CI], 1.76 to 4.93; $p < 0.0001$), whereas uncontrolled office BP was not (OR=1.41; 95% CI, 0.85 to 2.32; $p = 0.18$). After adjustment for age, diabetes mellitus, coronary artery disease, and LV mass index, uncontrolled 24-hour ABP remained significantly associated with abnormal GLS (Figure 1). A significant association with abnormal GLS was also found using either daytime or nighttime criteria (Figure 1).

We demonstrate for the first time the superiority of ABP control over office BP control for the risk stratification of treated hypertensive subjects for presence of subclinical LV systolic dysfunction. In a hypertensive animal model, impairment of GLS occurred in parallel with the accumulation of fibrosis induced by pressure overload in the LV subendocardium in the early stage of hypertensive HF ⁽⁴⁾. Therefore, we speculate that consistent reduction of LV pressure overload throughout the 24 hours by antihypertensive medications might be important to delay the progression of LV systolic dysfunction, and that ABP control might be a better indicator of the effective reduction of LV pressure overload than office BP control. Of note, inadequate ABP control was more frequent at night than during the day in this cohort, further underlining how office BP does not provide an adequate representation of BP values in a critical period of the day.

Evaluating BP control by ABP monitoring, but not by office BP, may identify hypertensive patients at higher risk of early LV systolic dysfunction. Whether achieving BP control by ABP criteria may help decrease the risk of developing subclinical LV systolic dysfunction, and possibly slow its progression to clinical HF, is a hypothesis that deserves further investigation.

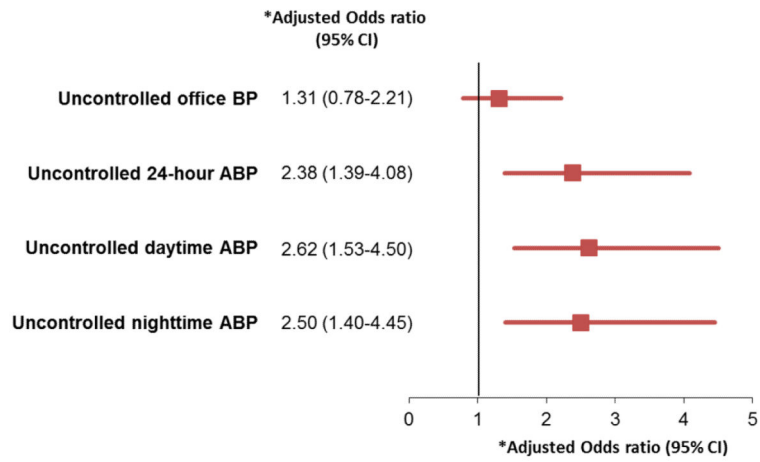
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References

1. Go AS, Mozaffarian D, Roger VL, et al. Heart disease and stroke statistics--2014 update: a report from the American Heart Association. *Circulation*. 2014; 129:e28–e292. [PubMed: 24352519]

2. Pickering TG, Hall JE, Appel LJ, et al. Recommendations for blood pressure measurement in humans and experimental animals: Part 1: blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research. *Hypertension*. 2005; 45:142–61. [PubMed: 15611362]
3. Russo C, Jin Z, Elkind MS, et al. Prevalence and prognostic value of subclinical left ventricular systolic dysfunction by global longitudinal strain in a community-based cohort. *Eur J Heart Fail*. 2014; 16:1301–9. [PubMed: 25211239]
4. Ishizu T, Seo Y, Kameda Y, et al. Left ventricular strain and transmural distribution of structural remodeling in hypertensive heart disease. *Hypertension*. 2014; 63:500–6. [PubMed: 24396022]



*Adjusted for age, diabetes mellitus, coronary artery disease, and LV mass index.

Figure 1. Association of Uncontrolled Office and Ambulatory BP with Abnormal GLS
BP indicates blood pressure; ABP, ambulatory BP; GLS, global longitudinal strain.

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