

# Measurement Accuracy of a Stand-Alone Oscillometric Central Blood Pressure Monitor: A Validation Report for Microlife WatchBP Office Central

Hao-Min Cheng<sup>1,2,4,5</sup>, Shih-Hsien Sung<sup>3,4,6</sup>, Yuan-Ta Shih<sup>7</sup>, Shao-Yuan Chuang<sup>8</sup>, Wen-Chung Yu<sup>3,4,5</sup>, Chen-Huan Chen<sup>2,4,5,6</sup>

## BACKGROUND

The superiority of prognostic value of blood pressure (BP) measured at central aorta (CBP) over conventional brachial BP measured by cuff-based BP monitors has reignited the development of new non-invasive techniques for estimating CBP. The present study validated the accuracy of CBP measured by a newly developed stand-alone CBP monitor.

## METHODS

The CBP monitor provided readings of brachial systolic BP (SBP), brachial diastolic BP (DBP), central SBP, and central pulse pressure (PP). Brachial PP and central DBP were calculated from the relevant readings. The accuracy of the brachial and central SBP, PP, and DBP was validated against the simultaneously recorded invasively measured central aortic SBP, PP, and DBP, according to the invasive standard requirements for the noninvasive brachial BP monitors from the Association for the Advancement of Medical Instrumentation (AAMI) in 85 subjects (255 measurements; age range, 30–93 years).

## RESULTS

The mean differences of cuff BP with reference to the invasively measured central SBP, PP, and DBP were  $-2.6 \pm 9.0$ ,  $-8.6 \pm 11.2$ , and  $6.1 \pm 7.0$  mm Hg, respectively, with the former two being obviously underestimated at high CBP and overestimated at low CBP. In contrast, the corresponding differences for the central SBP, PP, and DBP measured by the CBP monitor were  $-0.6 \pm 5.5$ ,  $-0.4 \pm 7.0$ , and  $-0.2 \pm 6.5$  mm Hg, respectively, without obvious systematic bias. The distribution of measurement errors for central SBP, PP, and DBP surpassed the AAMI criteria.

## CONCLUSION

Central SBP, PP, and DBP can be measured accurately by a stand-alone automatic BP monitor.

**Keywords:** blood pressure; central pulse pressure; hypertension; oscillometric signals; pressure wave reflection; pulse volume plethysmography; pulse wave analysis.

doi:10.1093/ajh/hps021

The blood pressure (BP) amplification from central aorta to peripheral arteries, which varies substantially between subjects, causes conceivable discrepancy between central BP (CBP) and BP recorded at a person's upper arm.<sup>1–6</sup> Although mean BP and diastolic BP (DBP) are relatively constant in the conduit arteries, systolic BP (SBP) and pulse pressure (PP) measured from peripheral arteries are usually higher than those measured at the origin of the arterial tree, namely, the aortic root.<sup>3,7</sup> CBP can be estimated noninvasively, mainly by using the technique of applanation tonometry.<sup>3,8,9</sup>

Thereafter, it has been shown that the noninvasively measured CBP and the conventional brachial BP respond to anti-hypertensive medications differently.<sup>10,11</sup> Furthermore, the superior prognostic value of CBP over conventional brachial BP demonstrated in previous studies<sup>12–14</sup> has reignited the development of more convenient noninvasive methods for CBP measurements, including tonometry-based<sup>15</sup> and brachial cuff-based techniques.<sup>16,17</sup>

We have developed and validated a novel oscillometric method to estimate central SBP and PP.<sup>16,18,19</sup> Noninvasively

Correspondence: Chen-Huan Chen ([chench@vghtpe.gov.tw](mailto:chench@vghtpe.gov.tw)).

Initially submitted March 20, 2012; date of first revision 04 June, 2012; accepted for publication July 19, 2012.

<sup>1</sup>The Joanna Briggs Institute, Faculty of Health Sciences, University of Adelaide, Adelaide, Australia; <sup>2</sup>Department of Medical Research and Education, Taipei Veterans General Hospital, Taipei, Taiwan; <sup>3</sup>Department of Medicine, Taipei Veterans General Hospital, Taipei, Taiwan; <sup>4</sup>Cardiovascular Research Center, National Yang-Ming University, Taipei, Taiwan; <sup>5</sup>Department of Medicine, National Yang-Ming University, Taipei, Taiwan; <sup>6</sup>Institute of Public Health and Community Medicine Research Center, National Yang-Ming University, Taipei, Taiwan; <sup>7</sup>Department of Biomedical Engineering, Chung Yuan Christian University, Chung-Li, Taiwan; <sup>8</sup>Division of Preventive Medicine and Health Service, Research Institute of Population Health Sciences, National Health Research Institutes, Miaoli, Taiwan.

© American Journal of Hypertension, Ltd 2012. All rights reserved. For Permissions, please email: [journals.permissions@oup.com](mailto:journals.permissions@oup.com)