Influence of finger movement on the stability of the oscillometric pulse waveform for blood pressure measurement

Jian Liu[1], Alan Murray[2], Jianqing Li[1], Chengyu Liu[1] *

[1] School of Instrument Science and Engineering, Southeast University, Nanjing, China
[2] Medical Faculty and Engineering School, Newcastle University, Newcastle upon Tyne, UK

* Corresponding author: chengyu@seu.edu.cn

The importance of accurate blood pressure (BP) measurement is without doubt. In medical clinics the oscillometric automated sphygmomanometer is widely used. However, there are few studies to quantify the influence of the oscillometric pulse waveform stability on the accuracy of BP values. This study addresses this issue.

Cuff pressure signals during the slow deflation phase were measured from 20 healthy normotensive subjects with a deflation rate of 2-3mmHg per second. For each subject, measurements were performed with the normal quiet and still body condition, and also when subjects moved their fingers. Oscillometric pulse waveforms were filtered from the cuff pressure signals. Mean arterial pressure (MAP) was determined from the peak of the second-order Gaussian envelope fitted to the peaks of all heart beats on the oscillometric pulse waveform. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were derived from the cuff pressures at defined ratios to MAP on the oscillometric envelope. The root mean square error (RMSE) between the fitted curve and the pulse amplitudes was used to assess the smoothness of the oscillometric pulse waveform characteristics.

Compared to the quiet condition, finger movement increased the RMSE by 0.28 [mean ± standard deviation (SD): 0.43 ± 0.21 vs. 0.15 ± 0.04, $P<0.01$]. Finger movement also resulted in a significant increase of SBP by 7.2 mmHg and DBP by 9.2 mmHg (both $P<0.01$).

This study quantitatively showed the effect on BP and oscillometric waveform stability of subjects not following the requirement to stay still.