Asymmetrical Oscillometric Pulse Waveform Envelopes in Normotensive and Hypertensive Subjects

Dingchang Zheng*, Roberto Giovannini and Alan Murray

Regional Medical Physics Department, Newcastle University, Newcatle upon Tyne, United Kingdom

Blood pressures in automated oscillometric measurement devices are determined by analysing different features from the oscillometric waveform. This study investigated the symmetry of the oscillometric waveform shape in normotensive and hypertensive subjects.

Ten normotensive (SBP$<$140 mmHg) and ten hypertensive subjects (SBP140 mmHg) were studied with three repeat measurements. The oscillometric cuff pressure was deflated linearly and recorded digitally. Auscultatory SBP and DBP were obtained during cuff deflation. The oscillometric waveform envelope was related to cuff pressure and constructed from the sequential peaks of the oscillometric pulses extracted from the recorded cuff pressure. The cuff pressure corresponding to the maximum oscillometric pulse amplitude was taken as the automated MAP. The cuff pressures corresponding to 30%, 50% and 70% of the maximum oscillometric pulse amplitude in each envelope were measured for both the high and low pressure regions. At each amplitude level, the cuff pressure widths (absolute difference to the automated MAP) in the high and low pressure regions were compared. The average pressure widths from the three repeat measurements were used as the reference value for that subject.

For the normotensive group, the overall mean$\pm$SD of the cuff pressure widths in the high and low pressure regions for the normalised amplitude levels of 30%, 50% and 70% were 43$\pm$6 vs 36$\pm$9 mmHg, 29$\pm$6 vs 17$\pm$7 mmHg, and 22$\pm$5 vs 10$\pm$4 mmHg respectively. For the hypertensive group, the corresponding values were 52$\pm$10 vs 47$\pm$10 mmHg, 40$\pm$9 vs 28$\pm$10 mmHg, and 28$\pm$8 vs 19$\pm$8 mmHg. For both groups, the cuff pressure widths in the high pressure region were significantly larger than in the low pressure region at the normalised amplitude levels of 50% and 70% (all P$<$0.01).

In conclusion, the asymmetrical feature of the oscillometric waveform envelope has been confirmed in both normotensive and hypertensive groups.