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Pulse wave velocity measurement in the human radial artery

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Motivation and Aim: The evaluation of pulse wave velocity (PWV) provides information about the elastic properties of arterial system and some other physiological attributes of the organism. At present, the "gold standard" in the PWV studies is a carotid-femoral measurement [1]. A brachial-ankle configuration is also popular and usable [2]. Nevertheless, as it is noted in [3], the PWV estimation remains a challenge for the engineers and clinicians. In this contribution, a simple and robust novel approach helping to solve the problem in question is presented. In addition, some valuable results obtained in humans using the described new method are demonstrated.
Methods and Algorithms: Two originally framed midget microphones were attached to the wrist and upper-limb bend of elbow and served as the pulse wave-induced pressure transducers. Biopac MP 100 system was used to receive and digitize the microphone signals with 200 Hz temporal discretization. An original computer-controlled brachial cuff inflation system was used for both the acoustic signal enhancement and the arterial pressure automated measurement. The latter was realized during inflation and deflation in the same diagnostic cycle. The method was tested in humans of different ages.
Results: The measured pulse pressure waveforms were quite similar in appearance that increased the accuracy in the determination of the time lag between acoustic signals. The problem of the pulse wave path length definition was fallen away because the distance between the signal sources (two microphones) was certainly the length of the forearm that could be measured easily. It has been found that the radial artery (RA) PWV may be appreciably influenced by the proximal artery transient cross-clamping. The PWV measurement results combined with the diagnostic manifestations synchronously observed using infrared thermography [4] are also presented.
Conclusion: A simple and feasible novel method aimed at the RA PWV measurement has been presented. It is suitable to the scientific research and clinical routines. The RA PWV may be influenced by a proximal artery transient cross-clamping or occlusion.
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