

How Accurate are ECG Parameters in Wearable Single-lead ECG System for 24-hours Monitoring?

Zhipeng Cai¹, Jianqing Li^{1,2}, Xiangyu Zhang¹, Qin Shen³, Alan Murray⁴ and Chengyu Liu¹

¹School of Instrument Science and Engineering, Southeast University, China

²School of Biomedical Engineering and Informatics, Nanjing Medical University, China

³First Affiliated Hospital of Nanjing Medical University, China

⁴School of Engineering, Newcastle University, UK

Wearable electrocardiogram (ECG) devices have been quickly developed for remote, continuous and convenient long-term monitoring. Actually, the accuracy of long-term wearable ECG analysis has not been strictly verified. This study addressed this point and used a wearable ECG device to record 24-hours long-term ECGs simultaneously with a Holter monitor, from 10 volunteers. Offline signal processing was performed for signal quality assessment, QRS complex detection and classification. Clinical parameters were derived from the wearable ECGs, and were compared with the reports from the Holter monitor. Specifically, ECG parameters of recording total time, total beat number, minimum heart rate (HR), mean HR, maximum HR, beat numbers of tachycardia and bradycardias, heart rate variability (HRV) parameters of SDNN, SDANN, RMSSD, PNN50, as well as the detection of premature atrial contraction (PAC) and premature ventricular contraction (PVC), were analyzed and compared. Mean relative errors (MREs) of ECG parameters between the wearable ECG analysis and Holter report were all less than 10% except the times of bradycardias (13.97%). MREs for HRV parameters were all less than 14%, and MREs for counting premature atrial contraction (PAC) and premature ventricular contraction (PVC) were 61.60% and 395.95%, respectively. The results showed that ECG and HRV parameters from wearable ECGs were comparable to the Holter monitor, while there was large bias for PAC and PVC detection.

