Accuracy of QRS complex and T wave derived synthesized 18-lead electrocardiogram. — K. Takarada, Y. Yazaki, Y. Goseki, A. Yamashina *(Tokyo Medical University Hospital, Tokyo, JP)*

Background. Synthesized 18-lead ECG derives waveforms of right chest leads and back leads from standard 12-lead ECG data. However, some derived waveforms were dissociated from the actual waveforms. Purpose: We assessed a correlation between derived waveforms and actual waveforms on QRS complex and T wave, and revealed the reason why the differences occur between both waveforms.

Methods. We derived 6 leads (V3R, V4R, V5R, V7, V8, V9) using Synthesized 18-lead ECG, and actually recorded right chest leads and back leads at the same time. In all waves, the amplitude of Q, R, S and T wave were measured automatically by the ECG, and we compared the derived waveform with the actual waveform in each lead. When the difference of amplitude was 100 μV or more, we defined there was a waveform difference. We analyzed the effect of bradycardia, tachycardia, right bundle branch block, left bundle branch block and atrial fibrillation/flutter contributed to the waveform difference using logistic regression.

Results. Derived wave amplitude adequately correlated with actual amplitude for each Q, R, S and T waves (median Pearson r correlation = 0.801, 0.781, 0.826 and 0.921, range 0.690 to 0.911, 0.726 to 0.889, 0.710 to 0.888, and 0.816 to 0.953). The binomial logistic analysis for the waveform differences revealed that atrial fibrillation/flutter had a risk of waveform difference on R wave in V4R (odds ratio, 3.74; 95% CI, 1.45-9.63; $P = 0.006$) and V3R (odds ratio, 3.51; 95% CI, 1.43-8.59; $P = 0.006$), and S wave in V8 (odds ratio, 4.17; 95% CI, 1.37-12.74; $P = 0.012$) and V9 (odds ratio, 4.87; 95% CI, 1.75-13.58; $P = 0.002$).

Conclusion. Derived waveforms of QRS complex and T wave were well correlated with the actual waveforms. However, an atrial fibrillation or atrial flutter may vary the derived waveforms.

Clinical validation of CardiMoni, a smartphone application that detects atrial fibrillation. — F. Lenaerts[1,2], L. Drijkoningen[1,2], J. Van der Auwera[1,2], C. Smeets[1,2], V. Storms[1,2], D. Nuyens[3], P. Vandervoort[1,3], L. Grieten[1,3] *([1]Mobile health unit, Hasselt University, Hasselt, B, [2]Faculty of medicine and life sciences, Hasselt University, Hasselt, B, [3]Department of cardiology, Hospital East-Limburg, Genk, B)*

Objectives. The aim of this study was to develop and validate a smartphone application (app) that can detect the presence of atrial fibrillation (afib) with a high sensitivity and specificity.

Methods. A smartphone app was developed to record a photoplethysmogram (PPG) of the patient's left index finger using only the built-in camera and LED flash. After a recording of 60 seconds, a proprietary algorithm detects the beats and determines the rate and the rhythm. Heart rate analysis and rhythm (AF, flutter, sinus) was compared to a reference electrocardiogram (ECG) using Bland-Altman analysis and clinical evaluation respectively. 120 Consecutive afib patients scheduled for cardioversion at the Hospital East-Limburg in Genk from November 2013 till May 2014 were included. In total 3 recordings prior to reconversion and 3 recordings post reconversion were made. An additional 112 healthy volunteers were included as a negative control group.

Results. The mean age of the afib population was 71 (±12) years with a mean body mass index (BMI) of 30 (±2). 62% was male and 60% had received cardioversion in the past, but was unable to maintain a sinus rhythm. The healthy population was younger (56 ± 16) and mostly female (60%) with a BMI of 26 (±2).There was a high correlation of 96% for the heart rate from an ECG and the smartphone-derived PPG and Bland-Altman revealed no significant bias between the smartphone and ECG data. For afib analysis a receiver operating characteristic curve indicated an optimal cut-off value for the rhythm score with a sensitivity and specificity of 93% and 90%, respectively. Repeated measurements within a short timeframe yielded little benefit as indicated by an intraobserver correlation coefficient of 86%. Of the healthy population 93% were accurately diagnosed by the algorithm as having a sinus rhythm. The app failed in the remaining 7% due to poor signal quality rather than misdetection of the algorithm.

Conclusion. The smartphone is a powerful tool to collect high quality data and possesses plenty of computing power to diagnose the user's heart rate and rhythm without the need of external devices. In a cohort of 120 patients undergoing cardioversion, the app was able to detect afib in 1 minute with high sensitivity and specificity. This tool is now engaged in home monitoring applications for afib follow up and can provide a useful tool for screening purposes.

Prolonged right ventricular ejection delay identifies high risk patients in Brugada Syndrome. Tissue velocity imaging rechallenges risk stratification. — S.C.H. Van Malderen, D.A.M.J. Theuns, C. Weytjens, D. Kerkhove, S. Droogmans, K. Tanaka, P. Brugada, G. Van Camp *(UZ Brussel, Brussels, B)*

Objectives. Right ventricular (RV) conduction delay has been proposed as the underlying pathophysiological mechanism in Brugada syndrome (BS). In the present study