

was treated unevenly with a drug-eluting balloon angioplasty. Three severely stenosed external carotid arteries (ECAs) occluded at CAS; ECA patency rate was 97.0% post CAS and at 30 days, and 97% at 12 months. At 12 months, in-stent velocities were normal (PSV 0.81 ± 0.3 ; EDV 0.21 ± 0.3 m/s).

Conclusions: The PARADIGM study 12-month clinical and DUS data are consistent with normal healing and sustained safety and cerebral embolism prevention efficacy of the CGuard™ stent used routinely for stroke prevention in symptomatic and increased-stroke-risk asymptomatic subjects with carotid stenosis. This indicates a paradigm shift in carotid revascularization for stroke prevention.

Acknowledgement/Funding: Jagiellonian University Medical College and 'For the Heart' Foundation

BEST POSTERS IN m-HEALTH TECHNOLOGY AND APPLICATION

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Beat-to-beat validation of PPG as a tool to detect regular and irregular heartbeats

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Background: Photoplethysmography (PPG) is a proven way to measure heart rate (HR). This technology uses the smartphone camera as a sensor to detect color changes in the fingertip. From these color variations the heart rate can be derived. Recently, literature and applications are demonstrating its use in detecting arrhythmias such as atrial fibrillation. In this work we demonstrate the use of PPG as a method to detect regular and irregular heartbeats in a beat-to-beat comparison with ECG. Given the widespread availability of smartphones, this research provides relevant insight of an accurate digital screening tool for irregular heartbeats.

Objective: To investigate the clinical accuracy between a camera based PPG smartphone application versus a simultaneous single-lead ECG.

Methods: For the PPG application a study camera application was used in a non-randomized, prospective study. The camera application was compared to a clinical validated wearable single-lead ECG patch during measurement sessions of 60 seconds. A broad range of heartbeats were included from healthy subjects and patients with atrial fibrillation. Beat-to-beat intervals of simultaneously recorded PPG and ECG were extracted and compared. The technical accuracy was evaluated based on supervised peak-annotation.

Results: In total, 237 measurements of ECG-derived RR intervals (RRI) and PPG-derived PP intervals (PPI) from 229 subjects were analysed. This resulted in a 20.298 beat-to-beat intervals. An average interval of 758 ms for both RRI and PPI was observed. A positive correlation of 0.985 for resting HR (40–100 bpm) and 0.956 for high HR (100–170 bpm) was found between the PPI from the camera application and the RRI from the wearable ECG. This result complies with the correlation criteria of 0.90 for the validation of heart rate monitors. Results show no significant difference for low HR (0.76) or high HR (0.69).

Conclusion: The validation of the camera application represents a very high correlation between the camera obtained PPG and the single-lead ECG. This result supports the case that the camera application could be used to monitor and record regular and irregular HR. Therefore, smartphone applications have the potential to become a digital tool for screening and event recording.

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Cardiac strength deconditioning after the 60-days head-down bed-rest assessed by heart kinetic energy wearable monitoring

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Head-down tilt bed-rest (HDBR) simulates cardiac deconditioning that occur during long duration space flight. The effects of 60-days HDBR were assessed by a novel non-invasive wearable heart kinetic (HK) cardiac monitoring method based on calibrated combination of multi-dimensional Ballistocardiography (BCG) and Seismocardiography (SCG). Results were compared to phase-contrast (PC) MRI-derived stroke volume (SV). Our hypothesis was that lower stroke volume (SV) would be associated with lower HK as a marker of cardiac contractility.

HK was measured during the ESA-RSL-BR study in a controlled breathing (CB) protocol (7.5 breath per minute) performed before (PRE) and after 58-days (HDT58) of BR on 24 healthy males (mean age 28 ± 6). Aortic PC-MRI was performed and blood velocities were integrated over the aortic lumen area to compute SV. During CB, we recorded ECG, ICG, respiration, SCG, and overall linear (lin) and angular (rot) accelerations in 6-degrees of freedom with a miniature accelerometer placed in the lumbar region. Newtonian equations of kinematics were used to compute total heart kinetic energy (HKtot), the sum of HKrot and HKlin, the energy transferred to the body by each cardiac contraction and a marker of cardiac contractility.

Comparison between HDT58 and PRE showed a significant ($p < .05$, paired t-test)

decrease in SV (22%) and a decrease in HKtot (27%) and HKrot (30%) but not in HKlin.

Results from MRI and the HK monitoring

	PRE	HDT58	% change
RR MRI (ms)	988±114	846±113*	-14
SV MRI (ml)	115±18	90±9*	-22
RR (ms)	932±105	958±54	NS
LVET (ms)	191±12	169±30*	-11
Fmax (N)	1.77±0.01	1.51±0.01*	-15
HKlin (mJ)	4.1±0.1	3.2±0.1	NS
HKrot (mJ)	9.6±0.6	6.8±0.6*	-30
HKtot (mJ)	13.7±0.9	10.0±0.7*	-27

* $p < 0.05$, paired t-test, NS: Non Significant. MRI: parameters from the PC-MRI protocol; others: parameters computed from the HK monitoring; PRE: baseline recordings; HDT58: recordings after 58 days of head down tilt.

This is the first study using HK together with PC-MRI and showing a decreased cardiac contractility and SV after HDBR deconditioning. Decrease in HKtot was mainly due to a decrease in rotational twist of the heart. As uni-dimensional and linear BCG were not changed, this suggests the great advantage of total HK for cardiac functional monitoring and its great potential for clinical trials.

Acknowledgement/Funding: This work was supported by the Belgian Federal Science Policy Office (BELSPO) via the European Space Agency PRODEX program.

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Help China, a randomised trial evaluating the effect of a smart phone-based patient support tool on treatment duration in patients prescribed rosuvastatin in China

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Introduction: Statins reduce low-density lipoprotein cholesterol (LDL-C) and thereby cardiovascular (CV) risk. However, in many countries, disease awareness, access to treatment and patient adherence are low, and treatment duration is often less than 3 months. Patient-focussed mobile health (mHealth) technology using smart phone apps has the potential to provide support to large numbers of patients at a cost that is sustainable over a long time. However, limited data exist on the impact of these tools. This is the first study to assess the impact of a mHealth tool on statin treatment duration and is an important step towards generation of evidence for patient focused mHealth.

Purpose: A randomised, two-arm, open-label exploratory study to evaluate if a smart phone-based patient support tool prolongs statin treatment duration in patients at high CV risk.

Methods: Patients newly prescribed a statin in China were randomised (1:1) to an Active group, which received the smart phone-based patient support tool or to a Control group, which received only a control app. Both groups completed a questionnaire specifically developed to evaluate adherence via their smart phone. The primary outcome was duration of statin treatment (time from randomisation to last patient-reported visit to a doctor for prescription renewal plus the number of days of the last prescription). Secondary outcomes were percentage of fully adherent patients, treatment adherence and percent change in LDL-C at Week 24.

Results: At baseline, mean age was 55 years, 63% were men, BMI was 26 kg/m², 30% were smokers and LDL-C was 139 mg/dL, with no difference between groups. Primary outcome data were available for 431 patients in the Active group and 423 in the Control group. There was a trend, though not statistically significant, toward a longer mean duration of treatment in the Active group (105 days) vs the Control group (99 days) ($p=0.097$). For secondary outcomes, there were more patients who rated themselves as fully adherent in the Control group (9.9%, $n=42$) than in the Active group (4.4%, $n=19$) ($p=0.002$). Treatment adherence in terms of patient reported number of pills taken divided by the total number of patient reported days in the study varied and depended on response rate. There was no statistically significant difference in reduction of LDL-C between the two groups at Week 24. None of the reported 43 adverse events were considered to depend on the app or on rosuvastatin.

Conclusions: This innovative study shows a trend towards prolongation of duration of statin treatment with a smart phone-based patient support tool, although not statistically significant. mHealth will have a future to educate and motivate patients to be more adherent, in China and other countries. Further studies to evaluate similar support tools and technology are needed.

Acknowledgement/Funding: This study was funded by AstraZeneca. Medical writing support was provided by Kerren Davenport, Prime, funded by AstraZeneca.