The AMPS Insider

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Executive Overview

Computer Assisted Patient Monitoring. Computerized automated algorithm-based analyses of digitized paper ECGs in Brugada syndrome. Effects of a cool classroom microclimate on cardiac autonomic control and cognitive performances in undergraduate students. Product News.

Editorial

As many of you know, AMPS has a long history of participation in research projects, and that AMPS tools are consistently in use by scientists and researchers from various disciplines. In this **The AMPS Insider**, we feature three different and interesting papers published in the past quarter. The subjects are patient monitoring, the automation of ECG analysis for Brugada patients, and the analysis of cardiac autonomic control and cognitive performances (where AMPS technology played a pivotal role). To all our readers, stay safe, enjoy the holidays, and best wishes for a better 2022 from the AMPS team!

Computer Assisted Patient Monitoring: Associated Patient, Clinical and ECG Characteristics and Strategy to Minimize False Alarms.

By Michele M. Pelter, David Mortara and Fabio Badilini

The Abstract reads:

This chapter is a review of studies that have examined false arrhythmia alarms during in-hospital electrocardiographic (ECG) monitoring in the intensive care unit. In addition, we de-scribe an annotation effort being conducted at the UCSF School of Nursing, Center for Physiologic Research designed to improve algorithms for lethal arrhythmias (i.e., asystole, ventricular fibrillation, and ventricular tachycardia). Background: Alarm fatigue is a serious patient safety hazard among hospitalized patients. Data from the past five years, showed that alarm fatigue was responsible for over 650 deaths, which is likely lower than the actual number due to under-reporting. Arrhythmia alarms are a common source of false alarms and 90% are false. While clinical scientists have implemented a number of interventions to reduce these types of alarms (e.g., customized alarm settings; daily skin electrode changes; disposable vs. non-disposable lead wires; and education), only minor improvements have been made. This is likely as these interventions do not address the primary problem of false arrhythmia alarms, namely deficient and outdated arrhythmia algorithms. In this chapter we will describe a number of ECG features associated with false arrhythmia alarms. In addition, we briefly discuss an annotation effort our group has undertaken to improve lethal arrhythmia algorithms.

The full article can be found here:

Hearts 2021, 2, 459–471.
https://doi.org/10.3390/hearts2040036

Computerized automated algorithm-based analyses of digitized paper ECGs in Brugada syndrome

By Fabrice Extramiana, Pierre-Léo Laporte, Martino Vaglio, Isabelle Denjoy, Pierre Maison-Blanche, Fabio Badilini, Antoine Leenhardt.

The Abstract reads:

Brugada syndrome is a rare inherited arrhythmic syndrome with a coved type 1 ST-segment eleva-tion on ECG and an increased risk of sudden death. Many studies have evaluated risk stratification performance based on ECG-derived parameters. However, since historical Brugada patient cohorts included mostly paper ECGs, most studies have been based on manual ECG parameter measurements.
We hypothesized that it would be possible to run automated algorithm-based analysis of paper ECGs.

We aimed: 1) to validate the digitization process for paper ECGs in Brugada patients; and 2) to quantify the acute class I antiarrhythmic drug effect on relevant ECG parameters in Brugada syndrome.
Methods: A total of 176 patients (30% female, 43 ± 13 years old) with induced type 1 Brugada syndrome ECG were included in the study. All of the patients had paper ECGs before and during class I antiarrhythmic drug challenge. Twenty patients also had a digital ECG, in whom printouts were used to validate the digitization process.
Paper ECGs were scanned and then digitized using ECGScan software, version 3.4.0 (AMPS, LLC, New York NY, USA) to obtain FDA HL7 XML format ECGs. Measurements were automatically performed using the Bravo (AMPS, LLC, New York, NY, USA) and Glasgow algorithms.
Results: ECG parameters obtained from digital and digitized ECGs were closely correlated (r = 0.96 ± 0.07, R2 = 0.93 ± 0.12). Class I antiarrhythmic drugs significantly increased the global QRS duration (from 113 ± 20 to 138 ± 23, $p < 0.0001$). On lead V2, class I antiarrhythmic drugs increased ST-segment eleva-tion (from 110 ± 84 to 338 ± 227 μV, $p < 0.0001$), decreased the ST slope (from 14.9 ± 23.3 to−27.4 ± 28.5, $p < 0.0001$) and increased the TpTe interval (from 88 ± 18 to 104 ± 33, $p < 0.0001$). Conclusions: Automated algorithm-based measurements of depolarization and repolarization parameters from digitized paper ECGs are reliable and could quantify the acute effects of class 1 antiarrhythmic drug challenge in Brugada patients. Our results support using computerized automated algorithm-based analyses from digitized paper ECGs to establish risk stratification decision trees in Brugada syndrome.

The full article can be found here:
https://doi.org/10.1016/j.jelectrocard.2021.09.009

Effects of a cool classroom microclimate on cardiac autonomic control and cognitive performances in undergraduate students

By Franca Barbic, Maura Minonzio, Beatrice Cairo, Dana Shiffer, Luca Cerina, Paolo Verzeletti, Fabio Badilini, Martino Vaglio, Alberto Porta, Marco Santambrogio, Roberto Gatti, Stefano Rigo, Andrea Bisoglio, Raffaello Furlan.

The Abstract reads:

An inverted U-shape relationship between cognitive performance and indoor temperature with best performance peaking at 21.6 °C was previously described. Little is known on classroom temperature reduction effects on cognitive performances and cardiac autonomic profile, during the cold season.
Fifteen students underwent electrocardiogram recording during a lecture in two days in December when classroom temperatures were set as neutral (NEUTRAL, 20–22 °C) and cool (COOL, 16–18 °C). Cognitive performance (memory, verbal ability, reasoning, overall cognitive C-score) was assessed by Cambridge Brain Science cognitive evaluation tool. Cardiac autonomic control was evaluated via the analysis of spontaneous fluctuations of heart period, as the temporal distance between two successive R-wave peaks (RR). Spectral analysis provided the power in the high frequency (HF, 0.15–0.40 Hz) and low frequency (LF, 0.04–0.15 Hz) bands of RR variability. Sympatho-vagal interaction was assessed by LF to HF ratio (LF/HF). Symbolic analysis provided the fraction of RR patterns composed by three heart periods with no variation (0 V%) and two variations (2 V%), taken as markers of cardiac sympathetic and vagal modulations, respectively. The students' thermal comfort was assessed during NEUTRAL and COOL trials. Classroom temperatures were 21.5 ± 0.8 °C and 18.4 ± 0.4 °C during NEUTRAL and COOL. Memory, verbal ability, C-Score were greater during COOL (13.01 ± 3.43, 12.32 ± 2.58, 14.29 ± 2.90) compared to NEUTRAL (9.98 ± 2.26, $p = 0.002$; 8.57 ± 1.07, $p = 0.001$ and 10.35 ± 3.20, $p = 0.001$). LF/HF (2.4 ± 1.7) and 0 V% (23.2 ± 11.1%) were lower during COOL compared to NEUTRAL (3.7 ± 2.8, $p = 0.042$; 28.1 ± 12.2.1%, $p = 0.031$). During COOL, 2 V%was greater (30.5 ± 10.9%) compared to NEUTRAL (26.2 ± 11.3, $p = 0.047$). The students' thermal comfort was slightly reduced during COOL compared to NEUTRAL trial.
During cold season, a better cognitive performance was obtained in a cooler indoor setting enabling therefore energy saving too.

The full article can be found here:

http://dx.doi.org/10.1016/j.scitotenv.2021.152005

Products News

We expect CE and FDA clearance for the new release of CER-S (v4.3) in early 2022. CER-S (v4.3) improvements include optimized multi-day reporting, increased limit for standard analysis on long recordings, and superimposition display. A new version of Antares (2.21) was released this last quarter and now includes the capability to extract strips from continuous ECG recordings with less than 12 channels, e.g. produced by single-lead patches.

Looking forward

We are already at work on a new version of CER-S (v.4.4.0). Here are some of the most notable additional features:

- Merge Multiday analysis to Standard Analysis
- Add beat-to-beat Beat Measures, in addition to family-based Beat Measures
- Automatize Rhythm Analysis
- Modify Report strips to display/highlight Rhythm annotations present in the strip
- Add daily-HR report for record above 36H
- New option for identification of Min/Max RR/HR
- Add easier options for strip deletion
- Option to print Report with larger font size
- Allow possibility to display HR in addition of RR