Reproducibility of ST- and ventricular gradient vectors

Roderick Treskes[1], C. Cato ter Haar[1], Sum-Che Man[1], Marjolein de Jongh[1], Maurits van der Heide[1], Arie Maan[1], Martin-Jan Schalij[1], Cees Swenne[1]
[1]Deparment of Cardiology, Leiden University Medical Center, Leiden, The Netherlands

Background: The current guidelines state that patients presenting with acute coronary syndrome (ACS) should be referred to either a PCI or a non-PCI center, depending on whether ST-elevation is present on the electrocardiogram (ECG). Resent research (e.g. by Sarafoff et al.) proved that this test isn't sensitive or specific enough for ACS triage. Ter Haar et al. suggested that serial ECG analysis, in which an ACS-ECG is compared to a non-ischemic referenceECG, is a possible solution to improve ischemia detection. In this approach, both the difference in ST vectors (ΔST) and VG vectors (ΔVG) between the acute and reference ECG are calculated. However, before this can be implemented into clinical practice we need to know if a single ECG is sufficient to serve as a reference ECG.

Aim of the study was to analyze the reproducibility of the ΔST and ΔVG in serial ECG analysis in patients without ischemia.

Methods: Since 1986, digital ECGs have been kept in the LUMC database, which consists now of over 800,000 ECGs. For our study, we selected patients of whom 4 ECGs had been stored in the database for which ECGs 1 and 2, and ECGs 3 and 4 differed between 1 and 2 weeks in time, and ECGs 2 and 3 differed between 1 and 2 years in time. We excluded patients with either acute ischemia, or with less than 7 seconds of analyzable data, obvious electrode misplacements or any ECGs with no visible P waves. Also, we removed in each patient the ECG with the lowest quality, this leaving three ECGs per patient for analysis. Heart rate (HR), and the ST (J+60) and VG vectors and the spatial QRS-T angle, SA, were calculated using the LEADS program. Futhermore, within patients, ΔST, ΔVG, ΔHR and ΔSA were calculated.

Results: The results presented at MALT 2014 will be preliminary. We analyzed 318 ECGs from 106 patients. Patients had a mean age of 57,8. 74,5% was male. The mean Body Mass Index was 26,5 kg/m^2 and the mean heart rate was 73,9 beats per minute. 40,5% of the observed population had a ΔST of more than the proposed threshold of 50 μV, while 15,1% had a ΔST of more than 100 μV. Futhermore, in the corresponding ΔVGs of 16,2 ms $\cdot$ mV, 68,2% had a larger number. 31,1% had a VG of more than 31,1% (the value corresponding with 100 μV).

Conclusion: There are some remarkable differences between ECGs considering ΔVG and ΔST. Straightforward application of ΔST and ΔVG thresholds would yield a considerable amount of false-positive ischemia diagnoses. Heart rate differences may be important to explain large ΔST and/or ΔVG values. Next step will be the investigation of the clinical events and medication changes between ECGs to futher explain observed ΔVG and ΔST differences.

References:

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2. Ter Haar CC, Maan AC, Warren SG et al. Difference vectors to describe dynamics of the ST segment and the ventricular gradient in acute ischemia. J Electrocardiol. 2013 Jul-Aug;46(4):302-11.