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Local earth magnetic field and ischemic heart disease: peculiarities of interconnection

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Abstract

Ischemic heart disease (IHD), in clinical practice manifesting as acute coronary syndrome (ACS), might be understood as a disruption of intracoronary blood flow decreasing oxygenated blood supply to the heart muscle. Oscillations of the local time varying magnetic field (TVMF) effects such human cardiovascular system indicators as blood pressure (BP), heart rate (HR) and its variability. This might be the foundation for magnetic activity association to increased occurrence of IHD and myocardial infarction (MI). An attempt is being made to discover new promising methods to reduce and prevent cardiovascular disease and its complications. Methods: Seven-hundred patients admitted to Cardiology Department of Hospital of Lithuanian University of Health Sciences Kaunas Clinics within 2016 due to acute coronary syndrome were retrospectively included into the study. The number of cases per week was compared with the weekly changes of the local Earth magnetic field. Results: Significant correlations between weekly occurrences of ACS cases and the average weekly TVMF strength were found. In the analyses of the whole year model two positive weak and moderate correlation coefficients in SBeta [15;32] ($r=0.06$, $p=0.65$) and SGamma [32;65] ($r=0.27$, $p=0.05$) ranges in the female group were found, respectively. In males there was no significant correlations in analyses of the whole year model. When one-year period was divided into two-time intervals, further analyses revealed that the first-half of the year had the same tendencies in the females with a single positive moderate correlation coefficient in SGamma [32;65] range ($r=0.28$, $p=0.05$) (Figure 2 A.). In males there were tendencies towards weak to moderate positive correlation coefficients ($p<0.1$) at all frequency ranges in the second half of the year, which are detailed in Figure 2 B. There were no differences between ACS cases in male and female though the second-half of the year. Conclusions: Significant correlation between acute coronary syndrome and the local Earth magnetic field changes was revealed. The acute coronary syndrome is positively correlated with the local Earth magnetic field in SGamma range in female through the year. A higher magnetic field in SBeta and SGamma ranges is associated with higher incidences of acute coronary syndrome through the year in females. The higher magnetic field in SGamma range is associated with higher incidences of acute coronary syndrome through the year in females and through the second-half of the year in males.

Introduction

Ischemic heart disease (IHD), in clinical practice manifesting as acute coronary syndrome (ACS), might be understood as a disruption of intracoronary blood flow decreasing oxygenated blood supply to the heart muscle. In pathogenesis of IHD the coronary artery narrowing due to atherosclerotic plaques formation and clotting disorders are fundamental. It is a relevant problem in Lithuania as in addition to decease of more than half citizens' annually, it affects even younger patient in recent years. It is suggested that geomagnetic activity in addition to human humoral activity regulation [1] is significantly associated with mortality from cardiac diseases and strokes. Cosmic radiation and Solar activity's correlations with suicides, transport injuries and onsets of non-cardiac diseases have been demonstrated. [2]. Oscillations of the local time varying magnetic field (TVMF) effects such human cardiovascular system indicators as blood pressure (BP) [3,4], heart rate (HR) and its variability. [5]. This might be the foundation for magnetic activity association to increased occurrence of IHD and myocardial infarction (MI). An attempt is being made to discover new promising methods to reduce and prevent cardiovascular disease and its complications.

Methods

Study population: In total 700 (425 (60,7%) male and 275 (39,3%) female) patients admitted to the Cardiology Department of Hospital of Lithuanian University of Health Sciences Kaunas Clinics due to ACS between 1 January 2016 and 31 December 2016 were included into the study. The mean age of male was 65,5 (±11,3) years and 73,1 (±9,9) years for female.

Magnetometer Data: The TVMF intensity was measured by the Global Coherence Monitoring Network magnetometer located In Lithuania. Hourly data was downloaded to a personal computer and transformed into successive thirty-second length segments for each of whom the power spectral density (PDS) was calculated. These hourly PDS segments were averaged together and the sum of them in 0-65 Hz frequency range was calculated within the study period. The local Earth's magnetic field was observed in five frequency intervals overlapping with EEG [Hz], but to stress that those frequency resonances are obtained from Schumann resonances we add S in front: SDelta [0;3,5], STheta [3,5;7], SAlpha [7;15], SBeta [15;32], SGamma [32;65]. We added [0;65] where all frequency intervals were summarised in one.

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Statistical Analysis: The statistical analysis was performed using the software package SPSS 20.0. Nonparametric Mann-Whitney U test was used for the comparison of two independent samples. Pearson correlation coefficient for the linear correlation between two variables was calculated. The level of $p< 0.05$ was considered statistically significant.

Results

Significant correlations between weekly occurrences of ACS cases and the average weekly TVMF strength were found. In the analyses of the whole year model two positive weak and moderate correlation coefficients in SBeta [15;32] (r=0.06, p=0.65) and SGamma [32;65] (r=0.27, p=0.05) ranges in the female group were found, respectively. In males there was no significant correlations in analyses of the whole year model. These correlations are presented in Figure 1.

When one-year period was divided into two-time intervals, further analyses revealed that the first-half of the year had the same tendencies in the females with a single positive moderate correlation coefficient in SGamma [32;65] range (r=0.28, p=0.05) (Figure 2A). In males there were tendencies towards weak to moderate positive correlation coefficients (p<0.1) at all frequency ranges in the second half of the year, which are detailed in Figure 2B. There were no differences between ACS cases in male and female though the second-half of the year.

Conclusion

1. Significant correlation between acute coronary syndrome and the local Earth magnetic field changes was revealed.
2. The acute coronary syndrome is positively correlated with the local Earth magnetic field in SGamma range in female through the year.
3. A higher magnetic field in SBeta and SGamma ranges is associated with higher incidences of acute coronary syndrome through the year in females.
4. The higher magnetic field in SGamma range is associated with higher incidences of acute coronary syndrome through the year in females and through the second-half of the year in males.

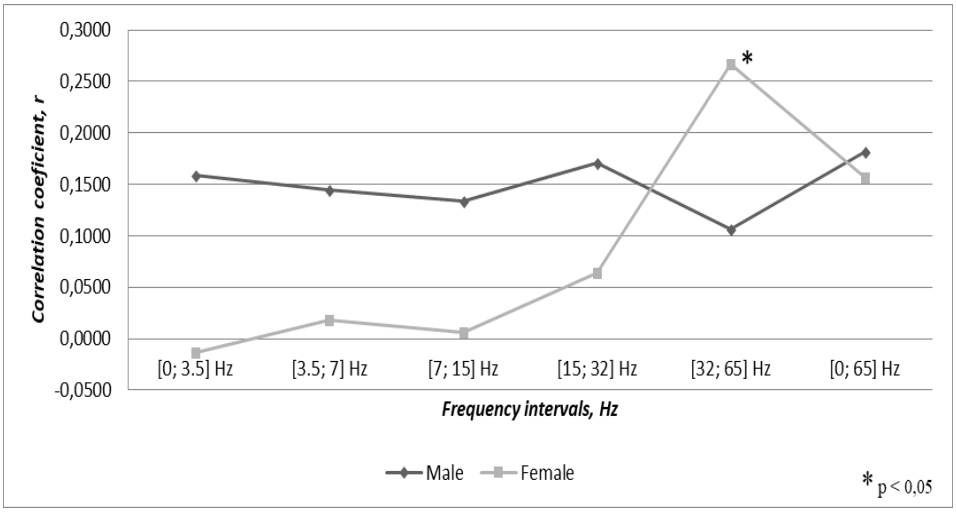

Figure 1. Correlation between gender related cases of acute coronary syndrome and the time varying magnetic field changes through the year

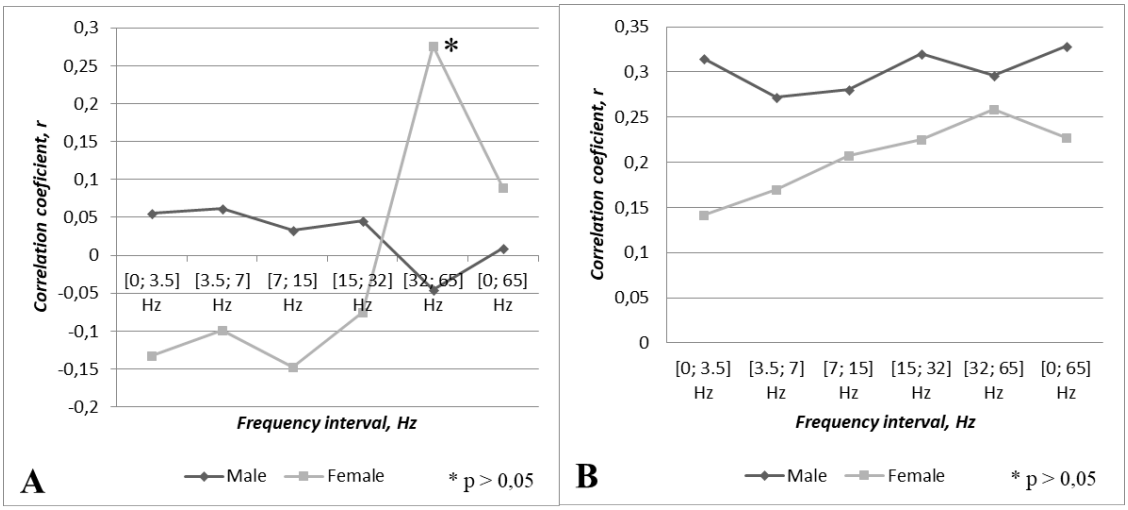

Figure 2. Correlation between gender related cases of acute coronary syndrome and the time varying magnetic field changes through the first-half of the year (A) and through the second-half of the year (B)

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