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Klaipeda Cardiovascular Emergency Aid Services Correlate With 10 Cosmo-Physical Parameters by Time of Occurrence

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6,600 cardiovascular emergencies treated during 36 consecutive months at a first aid station in Klaipeda, Lithuania, were compared to monthly intensity-levels of 10 environmental cosmo-physical parameters linked to solar and geomagnetic (GMA) activity, radio wave propagation, ionisation hours of the ionosphere and high-energy (>90 MeV) space proton flux. The study checked possible correlations established in previous investigations between the occurrence and intensity of natural phenomenons and the frequency and time of deaths among hospital patients.

Myocardial infarction, angina pectoris attacks, paroxysmal tachycardia, sudden death and, to a lesser degree, stroke all exhibited highly significant correlations with environmental parameters. Rhythm disturbances were highly negatively correlated with solar and geomagnetic activities as well as with radio wave propagation and positively with proton flux (except stroke).

For most events, the numbers of cardiovascular emergencies treated at the first aid station correlate significantly with the monthly intensity-levels of solar and geomagnetic activities and of high-energy proton flux. Proton flux was inversely correlated with solar and geomagnetic activities and with radio wave propagation. A negative correlation of solar and geomagnetic activity with some of the studied factors may be attributable to the influences of high-energy space proton flux on the pathogenesis of the studied pathologies. *J Clin Basic Cardiol 2002; 5: 225–7.*

Key words: cardiovascular, angina pectoris, myocardial infarction, paroxysmal tachycardia, cosmo-physical activity

Links between the environment and human homeostasis have been subject to observation and research for as long as human civilisation exists. Exploration of space, computerized data processing and progress in the understanding of the structure of the universe now offer new opportunities for understanding interrelations between mankind and the physical state of the environment. In previous publications [1–6] we presented observations on the relationship between the intensity of cosmo-physical activities and the temporal distribution of deaths among the total population, patients admitted to hospital, and changes in laboratory and electrocardiographic parameters [3, 4, 7]. The present study checks on the correlation between the frequency of predominantly cardiovascular events in need of medical emergency attendance and some parameters of environmental physical activity.

Material and Methods

This study is based on medical data gathered during 36 consecutive months at a first aid station in the city of Klaipeda, Lithuania. 6,600 emergencies were included in this study (myocardial infarction: 472; paroxysmal tachycardia: 885; angina pectoris: 4,071; stroke: 656; sudden death: 516). The considered time-interval was randomly chosen and not intentionally selected. However, the studied time-interval yields two positive aspects: 1.) It was before the recent socio-economic changes in eastern Europe significantly affected many parameters of everyday life, health, longevity etc. 2.) For comparisons, we not only had access to the monthly cosmo-physical data from scientific institutions in the USA [8–10] but also to data from the Soviet (now Russian) Academy of Sciences [11] which, despite our efforts, became unavailable to us after 1989.

Each month, Pearson correlation coefficients (r) and their probabilities (p) were calculated for cardiovascular emergencies and 1.) month of the year (1–12), 2.) index (K) of geomagnetic activity (GMA), 3.) hours of positive (+) ionisation of the ionosphere, 4.) hours of negative (–) ionisation of the ionosphere, 5.) sunspot number (W), 6.) solar flux (2800 MGH; 10.7 cm), 7.) sudden magnetic disturbances of the ionosphere (Sd), 8.) index of minimal radio wave propagation in the early morning hours (Fof2 min.); 9.) index of maximal radio wave propagation in the noon hours (Fof2 max.) and 10.) space proton flux at an energy level > 90 MeV.

Results

The results of this correlative study are presented in Table 1, demonstrating:

(1) Monthly correlations with months 1–12 are insignificant.
(2) The monthly GMA-index K is significantly negatively correlated with anginal attacks and negatively correlated at a strong-trend level (90 % probability) with myocardial infarction.
(3) There is a definite positive correlation (86–88 %-level) between stroke and sudden death with hours of positive monthly ionisation of the ionosphere.
(4) Angina pectoris is negatively correlated at the 95 % probability-level with monthly hours of negative ionisation of the ionosphere.
(5) Save for stroke, all events analyzed in this study turned out to be negatively correlated with solar activity parameters. For myocardial infarction and paroxysmal tachycardia the results were significant, for angina pectoris and sudden death they were at the strong-trend level (94–95 % probability).
(6) Both, myocardial infarction and paroxysmal tachycardia were also inversely related to sudden magnetic disturbances of the ionosphere, the former highly significantly the latter at a strong-trend level (94.2 %).
(7) All studied events were negatively correlated with the minimal (early morning) radio wave propagation index (Fof2 min.), paroxysmal tachycardia also with the maximal (noon hours) radio wave propagation index (Fof2 max.).

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Remarkably, in a previous study conducted in a big university hospital in Israel between 1974 and 1989 (180 consecutive months), the maximal (noon hours) radio wave propagation index (Fof2 max.) was most strongly associated with hospital deaths from myocardial infarction.

(8) Excluding stroke, all other events were highly significantly correlated with monthly space proton flux at the > 90 MEV energy level.

Some emergencies were correlated with each other by the time (month) of their occurrence:

(1) Myocardial Infarction with: a) stroke (r = 0.33; p = 0.04), b) angina pectoris attacks (r = 0.61; p = 0.0001), c) sudden death (r = 0.294; p = 0.08), d) chronic disease exacerbation (r = 0.424; p = 0.0099).

(2) Sudden death with: a) myocardial infarction (r = 0.294; p = 0.08, trend), b) anginal attacks (r = 0.39; p=0.019), c) paroxysmal tachycardia (r = 0.348; p = 0.038).

(3) Angina pectoris attacks with: a) myocardial infarction (r = 0.613; p = 0.0001), b) sudden death (r= 0.39; p=0.019), c) chronic disease exacerbation (r = 0.351; p = 0.035).

(4) Paroxysmal tachycardia with: a) sudden death (r = 0.35; p = 0.038), b) chronic disease exacerbation (r = 0.292; p = 0.08, trend).

(For paroxysmal tachycardia: 1983–84.)

Discussion

It has been previously observed [14–17] that not only is the time of death from various cardiovascular events related to certain levels of physical environmental activity but also the frequency of emergency hospital calls. This data from a first aid station thus provided us with information on the actual time of onset of cardiovascular events. Unfortunately, this kind of information is usually missing in admitted patients so that we had to rely primarily on the time of death when comparing data from other investigations. Another shortcoming of most studies in this field is that there is no definite information on the exact time it takes for a given space phenomenon to make its influence felt on the surface of our planet, ie, to become biologically relevant. Most investigations, including our study, are thus confined to a comparison of clinical data with records of monthly indices of physical activity levels. A noteworthy finding of this study is the negative correlation of clinical events with solar and geomagnetic activity levels [1, 3–5, 15–18]). Negative correlations of paroxysmal atrial fibrillation, of some 24-hours registered types of cardiac arrhythmia and of sudden death [3, 6] with geomagnetic activity levels have already been observed in earlier investigations, the correlation being most conspicuous when clinical events and GMA levels [3, 16, 18] are compared on a daily basis.

Helpful in this study was the comparative data on some additional nine environmental parameters. Our results show that in all cases, except stroke related calls, the inverse correlation with phenomena related to solar and geomagnetic activities (Table 1) is highly significantly correlated with space proton flux at high energy levels (>90 MeV). In our previous studies of space proton flux and its correlation with monthly death frequencies (1991, 1997, 2000) such a relationship was confirmed for >90 MeV, but not for >60 MeV proton flux. It has also been shown that high energy level proton flux is inversely related to monthly solar activity levels (sunspot number, solar flux at 2800 MGH, 10.7 cm wavelength and monthly GMA indices) [19–21], but correlates positively to the level of cosmic rays (described as an "extremely energetic" part of space radiation [12] and "one of the major unresolved questions" in astrophysics [13, 21]).

Previous publications [3, 22] showed that the actual localisation of an acute myocardial infarction (AMI) correlates with certain levels of geomagnetic activity: anterior wall lesions – mostly caused by occlusions in the left coronary artery and regulated by both the sympathetic and the parasympathetic parts of the autonomous nervous system – are more frequent during high GMA levels; inferior wall infarctions – mostly due to right coronary artery occlusions and regulated by the parasympathetic part of the autonomous nervous system only – prevail on days of very low to zero (Io) levels of GMA. Still, in all of these studies, the correlations of myocardial infarctions with daily GMA levels were not significant. The results of this study also show such an inverse relationship on trend level without achieving significance. Besides the aspect of AMI-localisation [22], apparently, GMA levels correlate specifically with different age and gender groups. In this study, as in our study on paroxysmal atrial fibrillation [23], it is demonstrated that many signs of electrical heart instability (here united in a group of emergencies named "paroxysmal tachycardia") are more closely related to low GMA or to the concomitant high energy space proton flux (>90 MeV) – a phenom-

Table 1. Emergency aid activities and links with environmental physical activity, Klaipeda, Lithuania, 1982–1984. Correlation coefficients and their probabilities (p)/36 months data/

	Myocardial infarction	Paroxysmal tachycardia	Angina pectoris	Stroke	Sudden death
	n = 472	n = 885 (1983–84)	n = 4071	n = 656	n = 516
Month (1–12)	N.S.	N.S.	N.S.	N.S.	N.S.
Geomagnetetic activity index (K)	–0.278 p = 0.10	N.S.	–0,406 p = 0.01	N.S.	N.S.
Hours of (+) ionosphere ionisation	N.S.	N.S.	N.S.	0.26 p = 0.12	0.246 p = 0.14
Hours of (–) ionosphere ionisation	N.S.	N.S.	–0.32 p = 0.058	N.S.	N.S.
Sunspot number (W)	–0.51 p < 0.001	–0.714 p < 0.0001	–0.312 p = 0.06	N.S.	–0.319 p = 0.058
Solar flux 2800 MGH, 10.7 cm	–0.436 p = 0.008	–0.779 p < 0.0001	N.S.	N.S.	–0.29 p = 0.08
Sudden magnetic disturbances – ionosphere	–0.317 p = 0.059	–0.716 p < 0.0001	N.S.	N.S.	N.S.
Radiowave propagat. min. (Fof2 min), early morning	–0.346 p = 0.03	–0.419 p = 0.01	–0.275 p = 0.10	–0.432 p = 0.008	–0.364 p = 0.029
Radiowave propagat. max. (Fof2 max), noon	N.S.	–0.622 p < 0.0001	N.S.	N.S.	N.S.
Space proton flux > 90 MeV	0.596 p < 0.0001	0.568 p < 0.0003	0.483 p = 0.0028	N.S.	0.364 p = 0.029

enon adversely related to GMA [19, 20]. We also have to mention the relatively weak relationship between stroke and any of the analysed parameters of physical activity. Similar results in a number of studies can be explained by the various pathogenetic factors responsible for this cerebral pathology: some of these factors, like high blood pressure (in haemorrhagic stroke) or increased coagulation (in ischaemic stroke) are more closely related to high GMA levels, whereas others such as paroxysmal atrial fibrillation (resulting in cerebral embolism) correlate negatively with GMA [3, 23]. Such antagonistic influences may neutralize each other and be responsible for the rather insignificant "solated" results of the factor stroke, compared to pathogenetically more uniform cardiovascular emergencies. The same is probably true for sudden death: underlying diseases, age, gender, and agony time all may affect the relationship of sudden death with the environment [5, 7]. Also, it remains unclear if the observed negative correlation of cardiovascular emergencies with solar activity and their positive correlation with increased proton flux are actually a direct phenomenon or if these correlations rather have to be attributed to other physical events controlled by these two environmental parameters (sunspot number, solar flux, magnetic disturbances of the ionosphere, radio wave propagation etc.). This study, like so many others during the last decades, confirms the existence of significant links between acute cardiovascular events and environmental physical activity. In addition to the possible role of such "old players" of clinical cosmobiology as solar or geomagnetic activity [1–3, 14, 16, 17], it focuses on new additional factors like proton flux and other sorts of cosmic radiation and on their influence on the natural history of human homeostasis and pathology by time of occurrence.

Conclusion

This study checks on the correlation between the frequency of predominantly cardiovascular events in need of medical emergency attendance and some parameters of environmental physical activity.

(1) The numbers of cardiovascular emergencies in need of medical first aid – mostly ischaemic heart events and arrhythmias – correlate with monthly intensity-levels of environmental physical activity.

(2) All investigated pathologies were negatively correlated with radio wave propagation in the early morning hours and, save for stroke, all were found to be highly significantly correlated with space proton flux at high energy (>90 MeV) levels and negatively correlated with solar activity. A significant negative correlation with monthly geomagnetic activity was ascertained for angina pectoris attacks only.

(3) Although the mechanisms of the cosmo-biological effects of solar and geomagnetic activity are widely discussed in the literature, further studies are required on the possible effects of space proton flux.

(4) This study cannot exclude the possibility that the negative correlation with solar and geomagnetic activities exhibited by some medical events is actually the result of the negative correlation of these parameters with space proton flux at high energy levels, which thus probably plays a part in the regulation of general and – in particular – cardiovascular homeostasis.

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