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CIRCAMULTISEPTAN ASPECT OF SUDDEN DEATH: COMPETING SOCIO-ECOLOGICAL SYNCHRONIZERS: ALCOHOL AND MAGNETICS?

MURAKAMI S.[1], CORNÉLISSEN G.[2], KATINAS G.[2], MITSUTAKE G.[1], OTSUKA K.[1], BREUS T.[3], GIGOLASHVILI M.[4], FIŠER B.[5], PAZDÍREK J.[5], SVAČINOVÁ H.[5], SIEGELOVÁ J.[5], HALBERG F.[2]

[1]Tokyo Women's Medical University, Daini Hospital, Tokyo, Japan
[2]University of Minnesota, Minneapolis, USA
[3]Space Research Institute, Moscow, Russia
[4]EK Kharadze Abastumani Astrophysical Observatory, Tbilisi, Georgia
[5]Department of Functional Diagnostics and Rehabilitation, St. Anne's Faculty Hospital, Faculty of Medicine, Masaryk University in Brno, Czech Republic

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A b s t r a c t

In order to investigate infradian aspects of sudden death, the daily incidence of 70,531 cases recorded in response to a call for an ambulance during 3 years (1979–1981) in Moscow, Russia, were re-analysed, focusing on multiseptans (components with periods of 7 days and/or multiples thereof). Apart from a prominent yearly and half-yearly variation in the daily incidence of sudden death, least squares spectra revealed the presence of about-weekly and two-weekly components. The about 15.2–day variation was validated by nonlinear least squares and shown to differ in period length from that found in the local index of geomagnetic activity, K. This result suggests that apart from any geomagnetic influence on sudden death, changes in lifestyle (such as alcohol consumption) associated with the twice-a-month salary schedule may affect the occurrence of sudden death. Such a component is not prominently seen for the incidence of other cardiovascular conditions recorded in the same database. The weekly pattern of sudden death, peaking on Saturdays, also differs from those of other cardiovascular conditions, characterized by a higher daily incidence on Mondays. The possibility to now record events in cardioverter-defibrillators offers an opportunity to explore broad chronomes of potentially lethal arrhythmia that may lead to a better understanding of underlying triggers, so that novel countermeasures may be designed and implemented.

K e y w o r d s

Sudden cardiac death, Circaseptan rhythm, Geomagnetic influence, Alcohol intake

INTRODUCTION

Different conditions leading to more or less sudden death have patterns of morbidity and mortality in time that have been explored both time-macroscopically (by

eyeballing), with perhaps a cosine fit to represent the data and an analysis of variance (ANOVA), or by time-microscopy, as reviewed earlier (*1–4*). Evidence for the ubiquity and partial endogenicity of about-weekly (circaseptan) components and multiples and/or submultiples thereof (the multiseptans) accumulates as longer and denser records become available (*5*). Often attributed to a mere response to the social schedule, circaseptan components now have been documented to characterize environmental variables related to primarily non-photic solar effects (*6*).

MATERIALS AND METHODS

Daily data on the incidence of 70,531 sudden deaths were recorded in response to calls for ambulances during 3 years of maximal solar activity from January 1, 1979, to December 31, 1981, in Moscow (*3, 6, 7*). The data consisted of a total of 6,304,032 ambulance calls and included 85,819 myocardial infarctions, 98,625 strokes, 146,445 cardiac arrhythmias, and 165,699 hypertensive crises, and of integrated daily local geomagnetic disturbance (K).

Each data series was analysed by linear-nonlinear rhythmometry (*8, 9*), and by one-way ANOVA to visualize patterns of major spectral components. Gliding spectra (*10*) of data filtered to remove low-frequency components examined changes as a function of time of components in the frequency range of one cycle per month to one cycle in 2.8 days.

RESULTS

An about 7-day pattern was documented in all data sets by cosinor and by 1-way analysis of variance (ANOVA), except for sudden deaths, where the latter method yielded a P-value of 0.105 and the cosinor P=0.016. Overall, in the infradian region examined, spectra revealed prominent yearly and half-yearly cycles as well as an about two-weekly component, *Fig. 1*. Nonlinearly, the circannual period is estimated to average 1.036 years with a 95% confidence interval (CI) extending from 0.998 to 1.074 years, overlapping the precise calendar year. Higher occurrences are found in the winter than at other calendar times, *Fig. 2*. The about 15.2-day component detected in the least squares spectrum was validated by nonlinear least squares and is visualized in *Fig. 3*. Its period is estimated to average 15.21 days (95% CI: 15.14–15.28 days), with an average amplitude of 2.46 cases per day (95% CI: 0.98–3.95). A similar component is not statistically significant for the local geomagnetic disturbance, K.

The filtered data, after removal of components with periods longer than 30 days, were scrutinized for multiseptans, exploring the spectral region extending from one cycle in 1 month to 1 cycle in 2.8 days, by gliding spectra, *Fig. 4*. Neither the multiseptan in sudden death nor that in K was consistently detected with the resolution used. Over the 3-year span, the about 14-day variation in K can be separated from the about 15.2-day component in sudden deaths. The latter matches the salary schedule, suggesting the possible influence of lifestyle (such as a likely increase in alcohol intake following pay days) on the incidence of sudden death. A possible

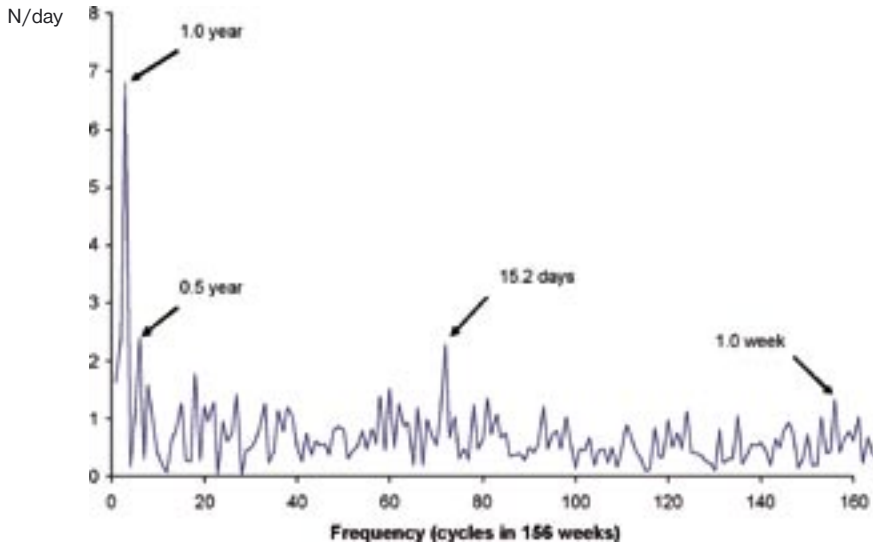

Fig. 1

Least squares spectrum of the daily incidence of sudden deaths in Moscow (1979–1981). The circaseptan component is not very prominently expressed. By comparison, the about 2-week variation has a sharper spectral peak. Yearly and half-yearly variations are also prominently detected.

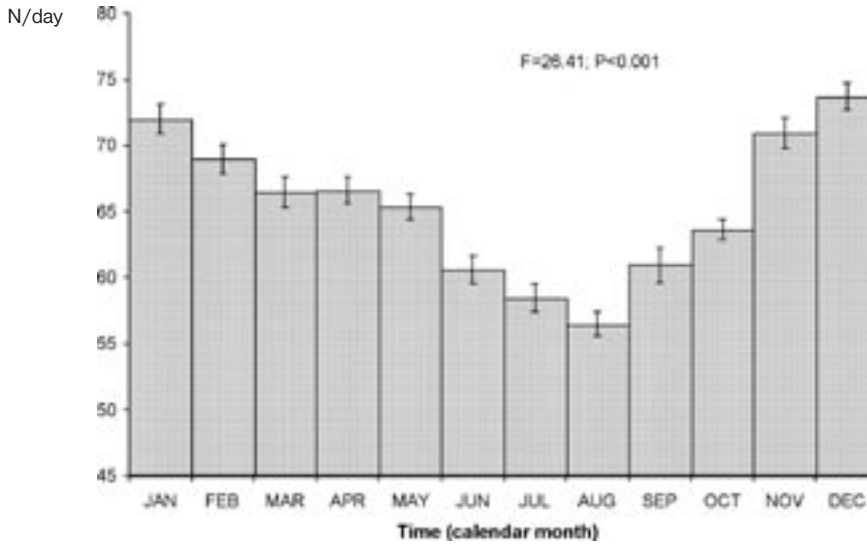

Fig.2

Circannual variation in the daily incidence of sudden deaths in Moscow (1979–1981). Sudden deaths are more likely to occur in the winter than at other calendar times.

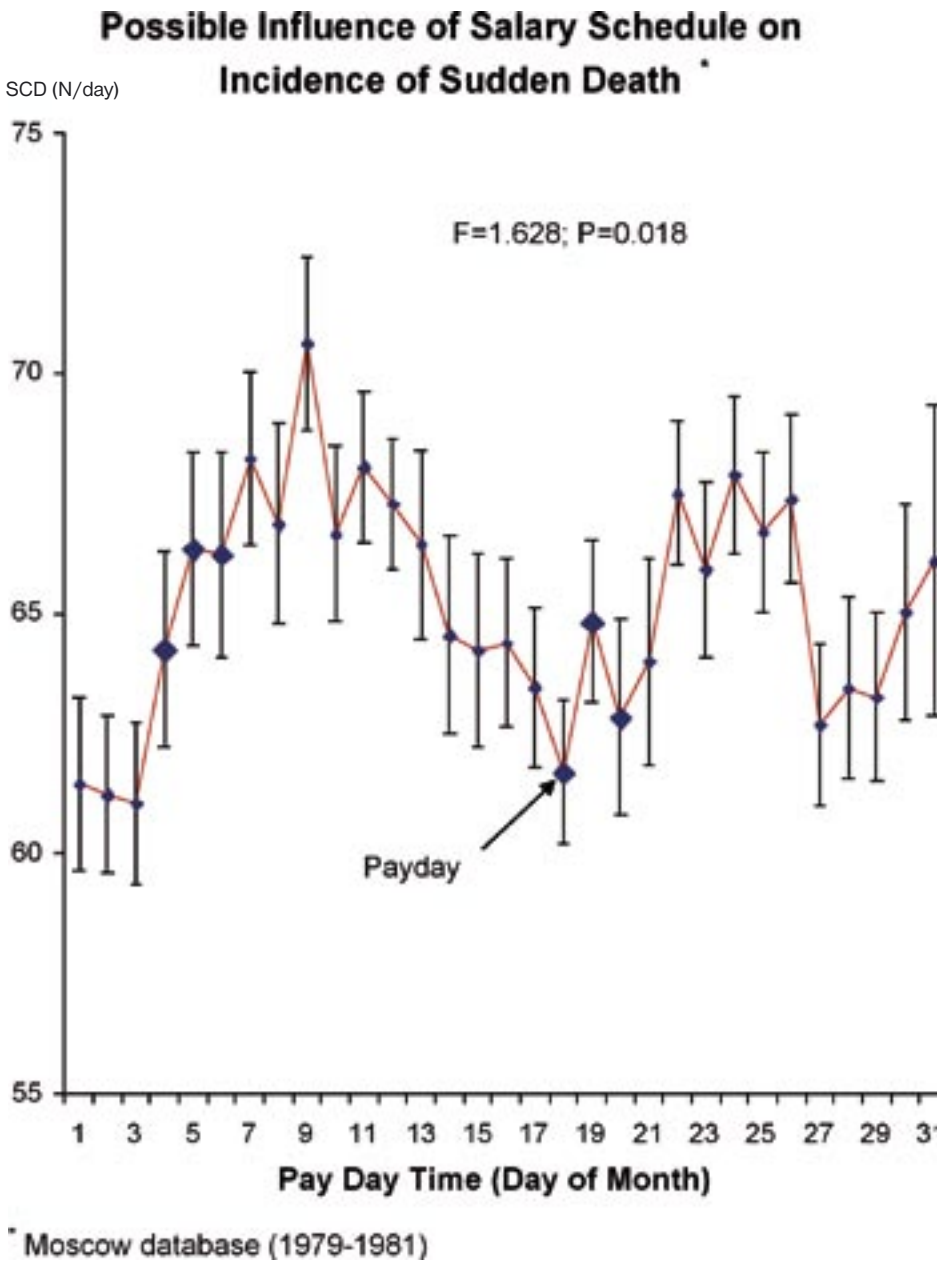

Fig. 3
An increase in sudden deaths follows days when salaries are paid, suggesting a possible influence of lifestyle (e.g., increase in alcohol intake).

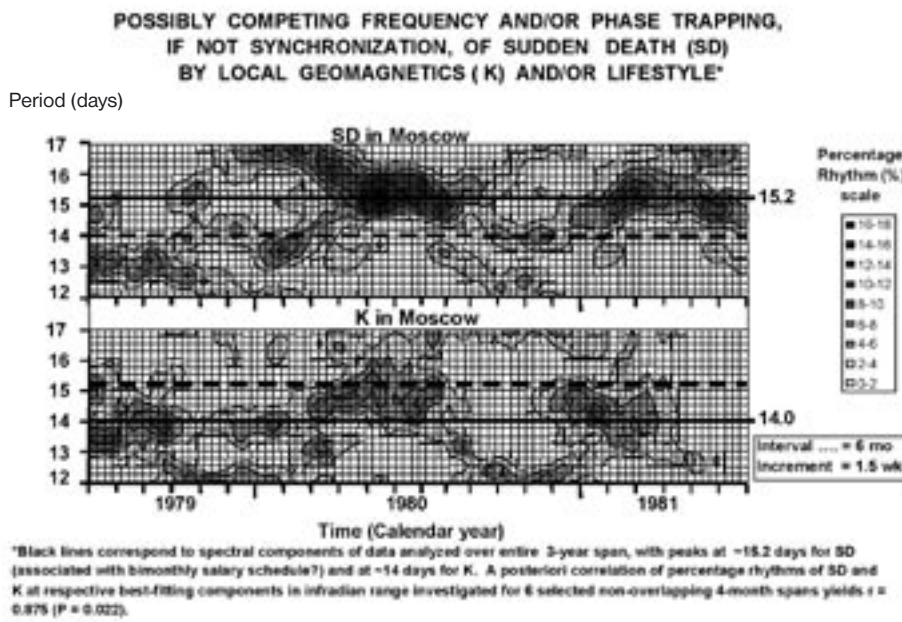

Fig. 4

Wobbliness of the about 2-week variation in sudden deaths (top) and the local index of geomagnetic activity (bottom), revealed by gliding spectra wherein data in a 6-month interval are progressively displaced by a 1.5-week interval. Note that detection of the about 2-week component is not consistent throughout the 3-year span. A possible resonance with occasional frequency trapping between the multiseptans of K and sudden death is suggested by the more prominently expressed about half-monthly variation in sudden deaths observed when this component is also detected in the spectrum of K.

resonance with occasional frequency trapping between the multiseptans of K and sudden death is suggested by the more prominently expressed about half-monthly variation in sudden deaths observed when this component is also detected in the spectrum of K, *Fig.4.*

DISCUSSION AND CONCLUSION

Magnetic storms have been associated with a decrease in heart rate variability (*11-13*). Magnetic storms have also been associated with an increase in myocardial infarctions and strokes (*14*), negative reports notwithstanding (*15, 16*). *Lipa et al.* (*16*) left open the possibility that any associations may also depend upon solar cycle stage and number, a possibility that has been supported by the authors' studies (*14, 17*), but an interaction with geographic location must also be considered. This possibility is supported by the discovery of near- and far-transyears in physics (*18, 19*) with biological counterparts (*20, 21*) and our finding such spectral components

in Minnesota and Arkansas but not in North Carolina or the Republic of Georgia (unpublished).

As compared to other cardiovascular conditions recorded in the same database showing a prominent circaseptan variation with a Monday peak, sudden deaths showed a much lesser weekly variation with a peak on Saturdays. In a prospective study, *Wolpert et al.* (*22*) evaluated the daily and weekly distributions of malignant ventricular tachyarrhythmia in different patient populations. These authors report a higher incidence of malignant ventricular tachyarrhythmia on Saturdays in patients with coronary heart disease, but on Mondays and Wednesdays for patients with diluted cardiomyopathy or non-ischemic heart disease. This result was interpreted as indicating the operation of different triggers in coronary heart disease that do not operate in diluted cardiomyopathy. The prospective diagnostic testing of data from cardioverter-defibrillators may serve as a useful tool in investigations of triggers of sudden cardiac death.

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PŘIBLIŽNĚ MULTISEPTÁNNÍ CHARAKTER NÁHLÉ SRDEČNÍ SMRTI: KOMPETITIVNÍ SOCIOEKONOMICKÉ SYNCHRONIZUJÍCÍ VLIVY: ALKOHOL NEBO MAGNETISMUS?

Souhrn

Pro analýzu infradiánních aspektů výskytu náhlé srdeční smrti byla analyzována data 70 531 případů zaznamenaných jako volání ambulance v období tří let (1979–1981) v Moskvě, Rusku. Data byla analyzována s cílem nalézt circaseptánní rytmy (komponenty s periodou 7 dní a/nebo jejich násobků). Kromě prominujícího ročního a půlročního rytmu ve výskytu náhlé srdeční smrti, spektra nejmenších čtverců odhalila přítomnost přibližně týdenní a dvoutýdenní komponenty. Přibližně 15,2denní kolísání bylo prokázáno metodou nelineárních nejmenších čtverců a byl demonstrován rozdíl oproti trvání délky periody nalezené pro lokální index geomagnetické aktivity K. Tyto výsledky ukazují, že kromě geomagnetických vlivů na náhlou srdeční smrt, změny v životním stylu (jako je konzumace alkoholu) vázané na schéma výplatních termínů dvakrát měsíčně, mohou ovlivnit výskyt náhlé smrti. Tato komponenta není významná pro výskyt jiných kardiovaskulárních příhod registrovaných ve stejné databázi. Týdenní obraz náhlé smrti s vrcholem v sobotu se také liší od ostatních kardiovaskulárních příhod s vrcholem výskytu v pondělí. Možnost nyní registrovat příhody pomocí kardioverterů/defibrilátorů představuje příležitost studovat široce chronomy potenciálně letálních arytmií, což může vést k lepšímu porozumění spouštěcích mechanismů a k vytvoření a zavedení nových protiopatření.

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