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Pseudogout: Timing of attacks and the cosmogeophysical environment

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Objective

To search for a time parallelism between lunar and solar rotation cycles and calendar dates of attacks of pseudogout chondrocalcinosis articularis (pyrophosphate arthropathy).

Methods

Seventy-four documented attacks with known calendar dates of onset recorded in 16 patients of one family cluster between 1955 and 1995 were examined in this study. Their daily frequencies during the given time span (chronogram) were transformed into frequencies pertaining to separate days of the corresponding cycle (plexogram). The latter data were processed by the cosinor analysis to test the presence of a priori supposed periodicities.

Results

The most pronounced time parallelism was found with the Bartels solar rotation cycle, covering a period of 27 days. The cosinor regression explained 95% of the total variance in the data. The plexogram of the attacks displayed 4 clear peaks and 4 troughs. Besides the 27-day cycling, its 2nd, 3rd, 4th and 5th harmonics, i.e. approximately 14-, 9-, 7and 5day rhythms were also statistically significant. Some periodic changes were also found during lunar cycles. The maximum frequency was encountered shortly after the full moon and after the moon perigee.

Conclusion

A causal connection between fluctuations of the geomagnetic field, such as that during solar rotation and perhaps also lunar cycles, and the occurrence of pseudogout attacks could exist and should be studied more extensively.

Introduction

Articular chondrocalcinosis, or pyrophosphate arthropathy (1) was originally described in Slovakia (2). An inborn defect results in the production and deposition of crystals of calcium pyrophosphate dihydrate directly in the affected articular cartilage. This is why the term 'pseudogout' has been coined (3). There is some data available concerning internal and external factors responsible for the sudden manifestation of the disease. A putative influence of the moon on nature, man and his health has formed a part of folk tradition since ancient times. Some lunar phenomena, e.g. the ebb and flow of the tide along the seashore in biology (4), constitute a regular part of serious science. The first exact study of attacks of human disease in relation to the moon was published by Svante Arrhenius (5). His study was concerned with epileptic attacks and the tropic lunar cycle. The issue remains controversial, however. Links between medicine and the moon have often been rejected and even dismissed, e.g. with the statement that "Nobel Prize winners can also be wrong" (6).

Our experience with acute emergencies (7-11) speaks in favour of the Arrhenius approach. Recently, a significant time parallelism between the phases of the moon and gout attacks was described (12). In contrast to many authors, we use mathematical-statistical methods based on time series analysis, particularly cosinor analysis (13). The aim of the present paper was to search for a possible lunar and solar background in the timing of pseudogout attacks.

Patients and methods

This was a retrospective study: the calendar dates of onset of 74 pseudogout attacks recorded between the years 1955 to 1995 were obtained from the clinical records of the Research Institute of Rheumatic Diseases. The corresponding 16 patients (10 males, 6 females, the difference being not significant at alpha = 0.05 by the sign test) are members of a Hungarian family cluster from the village of Vel'ká Maca in South Slovakia. This locality served many years ago to establish this clinical and pathological entity (2). The results of this follow-up study were recently reviewed (14). The attacks were defined by sudden occurrence of an arthritic syndrome. All of those occurring in this familial population during the given time span were, to the best of our knowledge, duly recorded. They did not substantially differ in severity from one another.

The first step in the data processing was the construction of synodic lunar, anomalistic lunar and solar rotation plexograms. The synodic lunar cycle extends from one new moon over the full moon to another new moon. On average this

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period is 29.53 days long. The anomalistic lunar cycle is that from the perigee (the shortest distance of the moon from the earth) to the apogee (the longest one) and to the next perigee. The average is 27.55 days with broad variations. The Bartels solar rotation cycle is exactly 27 days long; it is cited in geomagnetic activity reports as the reference time, with day zero arbitrarily chosen for cycle number 1 as February 7, 1832. Thus, for example, the 2,240th cycle started on August 14, 1997, and the next one (the 2,241st) on September 10, 1997. The plexogram is based on the summing up of the frequency of attacks on the corresponding days of a given cycle. This procedure makes it possible to eliminate periodicities with period lengths other than those studied in the present paper. The second step was the transformation of the sums of the frequencies for each day of an ideal cycle by the technique of moving averages, from 3 successive observations each. This manoeuver should eliminate random day-to-day variations. The last step - cosinor analysis - tested the presence of period lengths, suggested a priori, i.e. those of the synodic lunar, anomalistic lunar and solar rotation cycles, and of their 2nd to 6th harmonics. The level of statistical significance was set at alpha = 0.05. The period length of an m-th harmonic to a period length tau is tau/m.

Results

The results are shown in Figures 1, 2 and 3 as plexograms for separate cycles. The most pronounced cycling was found for the solar rotation cycle (Fig. 3) - Bartels' rotation with the period length of exactly 27 days. The frequency of the cases approaches even zero on the 8th day of the cycle. The plexogram displays 4 quite distinct sharp peaks. Thus, besides others, the 4th as well as the 5th harmonics are significant. They correspond with the period lengths of 6.75 and 5.4 days, i.e. with those of circaseptans described originally by Derer (15). The lunar plexograms show 5 to 6 peaks, more regularly for the synodic lunar cycle (Fig. 1). The latter has 2 peaks located shortly before and particularly after the full moon and, to a lesser extent, before and after the new moon - a pattern seen in

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Fig. 1. Attacks of chondrocalcinosis during the synodic lunar cycle. The daily frequency of cases as moving averages (f3) plotted versus days (d) of the lunar cycle. N: sample size; **CD**: coefficient of determination, showing the ratio of the variance explained by the regression. Both the 95% confidence (narrower) and 95% tolerance corridors are displayed.



Fig. 2. Analogous figure showing the anomalistic lunar cycle. Time zero corresponds to the perigee when the Earth - Moon distance is minimal.



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some other acute conditions (8, 10, 11). Accordingly, under the full and new moons, i.e. at the point of maximal lunisolar gravitation, there is a depression in the occurrence of attacks. This agrees with the depression of frequencies in the perigee phase of the anomalistic lunar cycle (Fig. 2).

Discussion

No study analogous to this one has come to our attention. There are not many papers devoted to the mechanisms provoking acute attacks in chondrocalcinosis (14). Despite the relatively low sample size in the present analysis, there can be little doubt about the real existence of the time parallelisms described. This is justified by the long timespan of the observation - over 40 years. Thus, the objection sometimes raised against such studies with approximately 7-day rhythms, i. e. that the periodicity may be due to the social week, can be readily rejected: the interference of the 7-day long social week with the fourth harmonics of the synodic, anomalistic lunar or solar rotation cycles decreased any putative amplitude of the social week cycling practically to zero as data from so many cycles (42 times 52, i.e. 2,184 weeks) were taken into account.

We are unable to offer any explanation of the hypothetical effects of the sun and moon on disease flares. Since the fluctuation of geomagnetic activity during the solar rotation cycle is known to geophysicists, its potential influence on the process of crystallisation of phosphate may represent a plausible starting point towards the experimental study of the problem.

In conclusion, some links appear to exist between the periods of cycling in the occurrence of pseudogout attacks, the cyclic rotation of the sun and the moon's revolution. The conspicuous plexogram for the solar rotation cycle could indirectly speak in favour of geomagnetic versus gravitational influences on the pathologic process. Repeated analyses of analogous data from other geographical sources will be necessary to advance our knowledge in this enigmatic field of rheumatology and science.

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