Monthly cosmic activity and pregnancy induced hypertension

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Summary: Monthly distribution of PIH (Pregnancy Induced Hypertension) was investigated in relation to the number of deliveries and nine specific cosmic and geomagnetic activity parameters during the years 1979-1983. PIH was observed in 3.165% of 19,843 deliveries. Significant ($p < 0.01$) inverse correlation between the PIH index and monthly geomagnetic activity level was shown. Moderately significant ($p < 0.05$) correlation with monthly maximal (noon hours) gamma-radiowave propagation was evidente as was inverse correlation with this parameter in hours of minimal (early morning) propagation.

Key words: hypertension; environmental factors; cosmic activity.

Pregnancy induced hypertension (PIH) is a common, life-threatening disorder of unclear pathogenesis with multiorgan involvement. In 1972, PIH was defined by the Committee on Terminology of the American College of Obstetricians & Gynecologists as having four criteria: (1) a sustained rise of 30 or more mm Hg in the systolic pressure; (2) a sustained rise of 15 or more mmHg in the diastolie pressure (3); a sustained systolic pressure of 140 or more; and (4) a sustained diastolic pressure of 90 or more, together with proteinuria or generalized edema, or both, after the 20th week of gestation (5). This definition has been accepted and remains in general use throughout the world. In the United States, PIH occurs in about 6% of deliveries annually, and the condition leads to 12.5% of all perinatal deaths (6). The incidence of PIH varies in other geographic locations and the cause(s) of this variation have been the subject of much speculation (7).

Vasospasm is basic to the disease process and is followed by increased pressure responses (to angiotension, and epinephrine) and impaired organ function (renal, hepatic, CNS, endocrine) (8, 9, 10, 11). Some Authors believe that environmental factors contribute to the frequency and even to the severity of PIH and its related phenomena (7).

The purpose of this investigation was to study (1): the monthly time distribution of PIH in a large university hospital in relation to the total number of deliveries, and (2) to compare PIH distribution data with a number of cosmic and geomagnetic activity parameters, since numerous parameters of human homeostasis are correla-

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ted with environmental factors including cosmic and geomagnetic activity fluctuations ([12, 13, 14]).

MATERIALS AND METHODS

Our study was based on 19,843 deliveries in the Department of Obstetrics in the Bilinson Medical Center (a 1000-bed University Hospital) during the five-year period from 1979 to 1983. Monthly birth data were analyzed and compared. Monthly and yearly PIH/total delivery ratios were studied and the PIH/delivery coefficient (PIH Index) was determined for correlation with 9 cosmic and geomagnetic activity parameters. Correlation coefficients (r), and their probabilities (p) were determined in the Department of Applied Mathematics in the Weizmann Institute of Science. (M. Shimshoni). The diagnostic criteria for PIH were based upon clinical signs: blood pressure of 140/90 mm Hg or higher in previously normotensive women or an increase above baseline levels of 30 mm Hg systolic and 15 mm Hg diastolic pressure.

The monthly cosmic activity parameters were:

1) Geomagnetic activity (K);

2,3) Monthly hours of positive (+) and negative (−) ionisation of the ionosphere;

4,5) Gamma radio-ware propagation deviation from the monthly median in the minimol (early morning) hours (foF_2 min) and maximal (noon) hours (foF_2max) (*);

6,7) Relative (W) and smoothed (R) numbers of sunspots. (Until 1981, the Zurich observatory index (Rz) was used for R; since then the International Index (Ri) has been used);

8) Number of sudden ionospheric disturbances of the ionosphere (−SD);

9) Proton Fluxes in the ionosphere (Ep).

Cosmic data were obtained from the scientific institutions of the USA (National Oceanic and Atmospheric Administration - NOAA) and USSR (Izmiran Institute of the Academy of Science of the USSR).

RESULTS

19,843 women were delivered in our department during the 5-year period (1979-1983) with yearly fluctuations from 3824 deliveries to 4118 deliveries.

Figure 1 shows the monthly birth rate (mean ± SD) in this five-year period, during which 628 cases of PIH were registered according to their month of hospitalization. The yearly incidence of PIH ranged from 2.02% to 4.45% (Table 1). Table 1 also shows the monthly and yearly distribution of PIH during this 60 month study period. During the second half of 1980, an increase in the numbers of cases was observed; this phenomenon was noticeable in other years as well. The mean rate of PIH during the study was 3,165%.

Fluctuations in the frequency of PIH were noted during various periods of the year throughout the five-year study. The yearly quaternal distribution was: January-March, 172 cases (27.38%), April-June, 114 cases (18.15%), July-September, 162 cases (25.80%), October-December, 180 cases (28.66%); the mean (± SD) 5-year PIH monthly distribution is presented in Figure 2.

PIH indices for 54 months (January, 1969-June,1983) were produced for correlation with monthly cosmic activity parameters. Table 2 shows the correlation coefficient and probability data for three parameters. These data show: 1) Significant ($p < 0.01$) inverse correlation between PIH index and monthly geomagnetic activity (K); 2) Moderately significant ($p < 0.05$) direct correlation with maximal noon hours gamma-radiowave propagation (foF_2 max) and inverse correlation with this parameter in hours of minimal early morning propagation (to foF_2 min). For another 6 parameters (W, Sd, Ep, (+), (−), R) no significant correlation was found (Table 2).

DISCUSSION

Hippocrates stated the case clearly for the effect of weather on disease in his first

(*) foF_2 – The maximum ordinary mode radiowave frequency capable of vertical reflexion from the F_2 layer of the ionosphere; F_2 region – the upper region of the ionosphere (200-600 km altitude), physically depends on the local time, solar activity, season and geomagnetic activity.

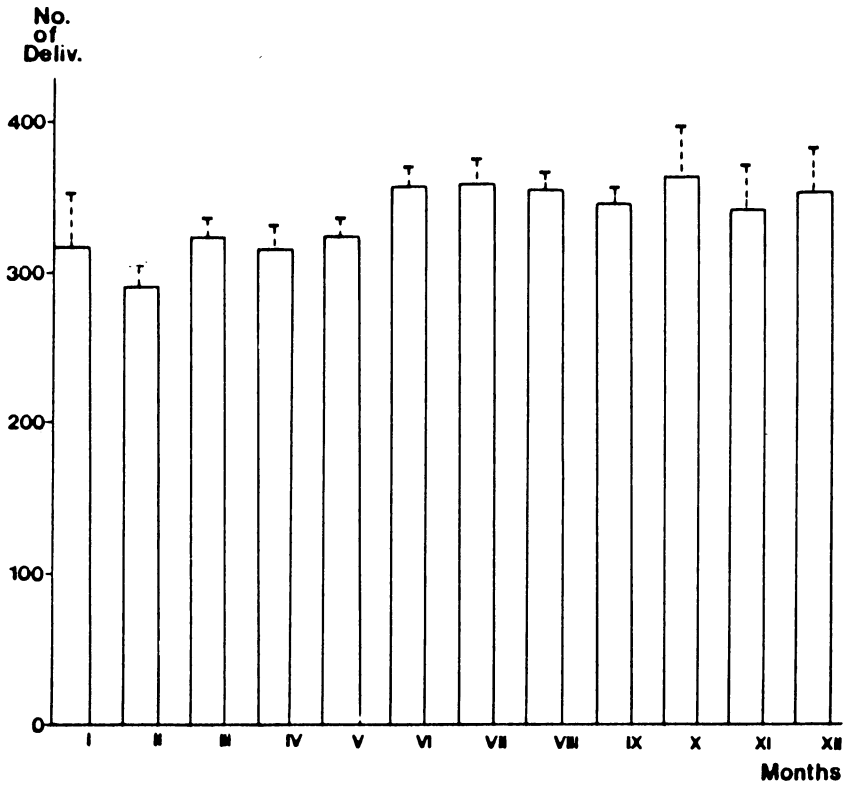

Fig. 1. — Monthly mean delivery rate - 1979-1983 (n = 19833). Beilinson Medical Center.

Aphorism in Section III of his work: "The changes of seasons monthly engender diseases, and in the same season great changes either of heat or of cold follow agreeably". In 1756 Smellie observed that the incidence of eclampsia varied greatly from year to year and that cases appeared in clusters so as to "seem to have proceeded from the constitution of the weather".

According to Chesly ([7]), the association of eclampsia and its antecedent conditions with unsettled weather has been noted by so many writers that it (this association)

Table 1. – *Monthly and yearly distribution of PIH (1979-1983) (n=628).*

No.	Year	Mont												No. Yearl.	PIH Deliv.
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
1	1979	9	12	12	8	5	10	4	9	11	7	10	13	110	2.88%
2	1980	10	10	10	12	2	12	15	15	20	25	27	17	175	4.46%
3	1981	15	11	11	6	5	8	10	10	9	8	10	7	110	2.74%
4	1982	12	12	9	7	3	5	2	8	5	2	8	10	83	2.02%
5	1983	9	17	13	5	20	6	16	15	13	15	9	12	150	3.78%

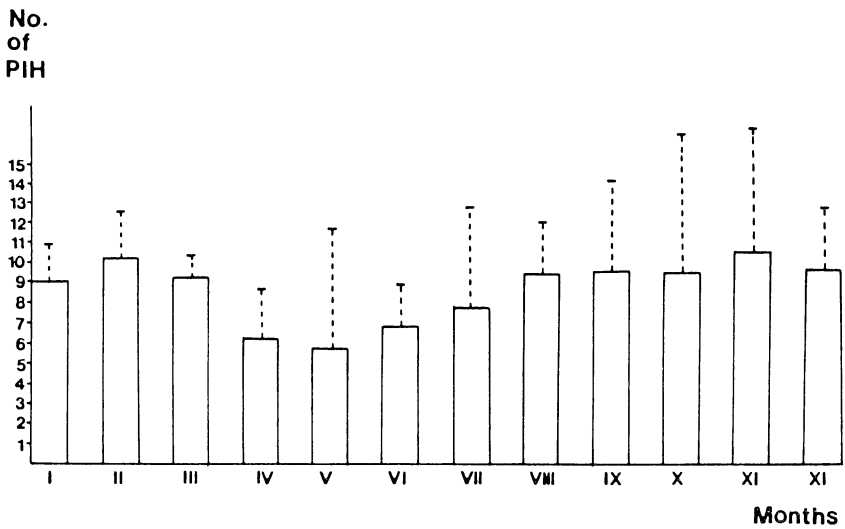

Fig. 2. — 5 Years monthly PIH distribution - 1979-1983 (n = 628). Beilinson Medical Center.

cannot be dismissed. What remains is to elucidate the specific cause which underlies these observed effects.

In the last several years, a growing body of knowledge has pointed to the fluctuation in geomagnetic activity and cosmic radiation as underlying various fluctuation in human behavior and disease states. During the 60 months included in this study, wide differences were demonstrated in the monthly rate of PIH despite small differences in the total number of deliveries.

Table 2. – *Correlation coefficient between cosmic activity and monthly distribution of pregnancy induced hypertension (PIH) index (1979, I-1983, VI)* $(n = \frac{PIH}{deliveries})$.

		(K) (*)	foF_2 (min) (**)	foF_2 (max) (***)
1	Monthly cosmic activity parameters			
2	Correlation coeficient	−0.4	−0.3	+0.3
3	Probability of the correlation (P)	0.01	0.05	0.05

(*) Monthly geomagnetic activity index.

(**) Minimal radiowave propagation deviation from the monthly median; morning hours.

(***) Maximal radiowave propagation deviation from the monthly median; noon hours.

Seasonal changes in a number of cardiovascular phenomena are well known ([1, 2, 15, 16, 17]). In addition to most comfortable meterologic conditions in the Middle East in April-June, some explanations can be included implying a linkage between PIH and some environmental differences analyzed in this study. The concept that background radiation has a definite biologic effect on man has been tested under a variety of circumstances. In one study ([18]), a strong correlation between horizontal geomagnetic flux and neonatal deaths due to congenital anomalies was found. Another study ([3]) showed that the mortality rate from anencephalus was strongly correlated with horizontal geomagnetic flux, a factor which is directly related to the intensity of cosmic radiation. It has

also been shown that growth hormone and 11-hydroxycorticosteroid were increased whereas Prolactin and 17-ketosteroid were decreased during periods with lower geomagnetic activity ([19]). A correlation between a number of cardiovascular events (hypothalamic, adrenal, hematologic phenomena, arterial blood pressure) and parameters of solar and geomagnetic activity has been published, as well as analogic experimental data considering hypothalamic activity and changes in the CNS behavior ([4, 19, 20, 21, 22, 23, 24]). Scottish investigators have shown a mono-cyclic pattern of winter-summer variation in the patterns of death from ischemic heart disease related to age put unrelated to sex. They concluded that the winter rise in the incidence of ischemic heart disease was directly or indirectly due to environmental temperature ([25]). According to Friedman and coworkers ([26]), there is a statistically significant low to marked linear relationship between the more intense periods of natural geomagnetic activity, as reflected in days of principal magnetic storm, and a gross measure of psychological disturbance, as reflected in psychiatric hospital admissions. A subsequent study ([23]) demonstrated that specific behavioral changes in a group of psychiatric patients were related to geophysical events either occurring simultaneously in time, during the previous 24 hours or during the preceding two days.

The observations cited above in no way limit the potential biological effects of electromagnetic fields and geomagnetic activity in human health and disease, as our ability to study these diverse global forces and derive correlations from these observations remains in its infancy. In this study, differences in the monthly/periodic distribution of PIH were documented with an April-June tendency to decline and August-March tendency to rise. A positive correlation was established between the monthly solar activity paramaters-maximals gamma-radiowave propagation and the monthly PIH indices ($r=0.3$, $p<0.05$). A negative correlation was shown between the monthly indices of PIH and geomagnetic activity ($r=0.4$, $p<0.01$), and the minimal gamma radiowave progagation ($r=0.3$, $p<0.05$). Observations and studies of the cosmobiologic influences should be continued and the Authors are extending these studies to other areas of obstetrics and gynecology.

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