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Correlation of Geomagnetic Activity with Hospital Admissions of Heart Cases in Hyderabad*

B J Srivastava, D S Bhaskara Rao & Subhash Saxena
National Geophysical Research Institute, Hyderabad 500 007

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Results of an investigation on the correlation of daily hospital admissions of heart cases and the daily K-sums of geomagnetic activity in Hyderabad for the period 1967-72, are presented and discussed. The correlation coefficient works out to be $+ 0{\cdot}761 \pm 0{\cdot}015$, which is statistically significant at 95% confidence level. It is found that coronary thrombosis (heart attack) cases generally occur in rapid fluctuations and pulsations during geomagnetic disturbances caused by enhanced solar activity. The pulse rate and blood pressure for coronary cases appear to be directly related to the corresponding 3-hr range geomagnetic activity index K. It is concluded that all individuals are not equally influenced by geomagnetic disturbances. People with imperfect nervous and cardio-vascular systems (which are now recognized to be electrical in character) appear to react adversely to such disturbances under a trigger action, while those in excellent health remain unaffected.

1. Introduction

Collo[1] pointed out that the French Academy of Medicine had established that the incidence of coronary thrombosis was connected with the sunspot activity. Friedman *et al.*[2] found that psychiatric and nervous disturbances in human beings were associated with geomagnetic disturbances. Bhaskara Rao and Srivastava[3] found a good correlation between geomagnetic activity and road accidents in Hyderabad during 1965-69, and ascribed it to the erratic behaviour of the electrical system of the human brain in the case of mentally weak people with subnormal reflexes, driving vehicles during magnetic storms when rapid geomagnetic fluctuations and pulsations generally abound. Correlation of solar and geomagnetic indices with medical data on cardio-vascular and cerebral diseases and deaths has been reported for a number of towns in the USSR in recent years. It has been pointed out that geomagnetic disturbances have a bad effect only on sick people, where they aggravate a basic illness, acting as a trigger.[4] Volinski and Vladimirski have also carried out laboratory experiments in the Crimea, USSR, on the behaviour of dogs and rabbits under artificial fluctuating electromagnetic fields, and found that the cardiovascular and nervous systems of the animals subjected to such fields are greatly affected. Another interesting observation was reported by Mironov[5] regarding geomagnetic activity and mass approaches of fish to seashores. Mironov found that during calm magnetic conditions, fish appear in shallow water, but with increasing activity they move off to deep water, under the influence of electro-taxis (induced electric currents), swimming against the induced electric currents in sea water. Rokityanskii,[6] however, pointed out that the telluric currents do not guide but irritate the fish in shallow sea water near the coast where they are intense, and drive them to deep water where they have smaller amplitudes.

Again, Srivastava and Bhaskara Rao[7] have examined some of the biological consequences of the unusual magnetic activity during 4-10 Aug. 1972 and found that road accidents and hospital admissions of heart cases in Hyderabad increased by 100% during those days as against the rest of the month.

It may be mentioned that conditions in the Indian cities, like Hyderabad, are more favourable for carrying out correlation studies of geomagnetic disturbances with road accidents, hospital admissions of heart cases, psychiatric cases, etc., because the general pattern of life of people here is not so fast as in the cities of advanced western countries having a lot of background noise.

In this paper, the results of an investigation on the correlation of the data of daily admissions of heart cases in the two main hospitals of the twin cities of Hyderabad and Secunderabad with daily sum of K indices of geomagnetic activity as reported by the Hyderabad magnetic observatory, are presented and discussed. A few interesting heart attack case histories are also discussed against the prevailing geomagnetic activity.

2. Data and Analysis

The data of daily admissions of heart cases (people suffering from various heart diseases including heart attacks) were taken from the records of the

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cardiac/thoracic wards of the two main hospitals in the twin cities of Hyderabad and Secunderabad—the Osmania General Hospital, Hyderabad, and the Gandhi Hospital, Secunderabad—for the years 1967-72. Almost all the heart cases in the twin cities are admitted to these two hospitals excepting only a few that are treated privately (which we have not considered in this study). The total daily admissions of heart cases in the two hospitals were examined against the corresponding daily sum of geomagnetic K indices, as reported by the Hyderabad magnetic observatory. These K indices are 3-hr range indices of geomagnetic activity on a scale of 0, 1, 2 to 9, based on a quasi-logarithmic scale of ranges in gammas. The K index 9 at Hyderabad represents a range of more than 300 gammas in the horizontal intensity H, over a 3-hr interval. There are thus eight K indices per day (0 to 24 hrs UT), which when summed up give a measure of daily disturbance level at the station. If the daily K-sum is less than 10, the day is regarded as magnetically very calm. For a daily K-sum upto 30, the day is considered moderately disturbed, and above that it becomes severely disturbed at Hyderabad.

2 and 3 Aug. were magnetically calm days, the daily K-sums being 8 and 12. A magnetic storm commenced suddenly on 4 Aug. at 0119 hrs UT, followed by another very severe storm commencing suddenly on 4 Aug. at 2054 hrs UT. The sudden commencement amplitude and the range of the second storm in the horizontal component H at Hyderabad were 99 and 363 gammas, respectively (1 gamma $=10^{-5}$ gauss $=1$ nanotesla). The storm was long drawn-out and ended only on 7 Aug. at 1100 hrs UT. The highest K index over a 3 hr interval observed during the storm was 9, and the daily K-sums on 4, 5 and 6 Aug. were 46, 51 and 34, respectively. The storm was characterized by rapid oscillations and pulsations of the geomagnetic field over periods of seconds and minutes, which seems to influence the nervous and cardio-vascular systems of human beings.[7]

The total number of daily admissions of heart cases in the two hospitals were plotted against the daily K-sums for the corresponding days during 1967-72 (Fig. 1). There were 329 days on which there were either no admissions of heart cases or no magnetic records which were omitted. The data of total admissions for each daily K-sum figure for the 6-yr period (1861 days), were also put on a graph paper, to see the frequency distribution, which turned out to be normal. The line of best fit to the whole data given in Fig. 1 has also been determined by the method of least squares as

$$y = 0{\cdot}188\ x - 0{\cdot}144$$

where y is the daily admission of heart cases and x the daily K-sum at Hyderabad. The mean daily admissions and their standard deviations corresponding to daily K-sum figures of 5,10,15,...40, for the whole data were also computed and shown in Fig. 1. The standard errors in x and y worked out to be 0·13-1·10 and 0·06-1·00, respectively.

Fig. 1, at once suggests a positive linear correlation between the hospital admissions of heart cases and the corresponding daily K-sum figures of magnetic activity. This correlation coefficient has been wor-

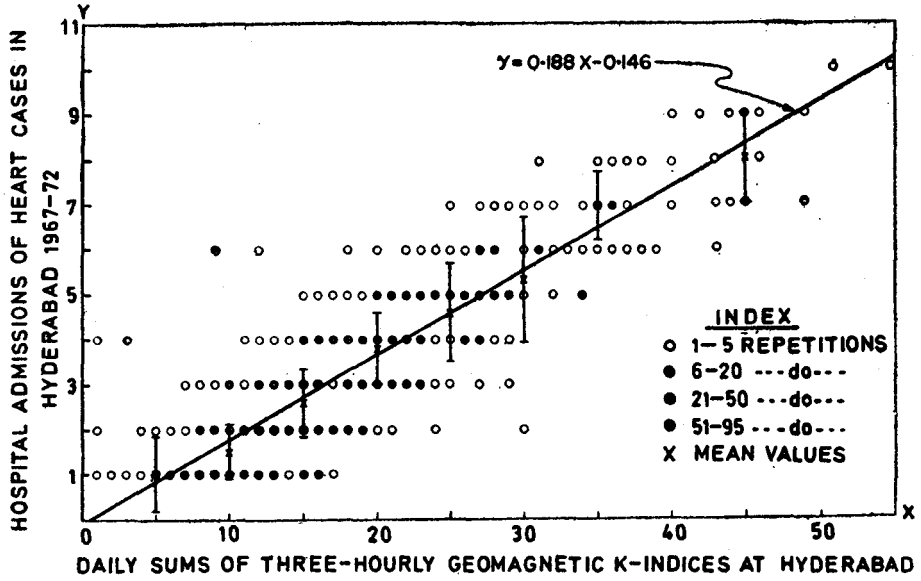

Fig. 1—Total number of daily admissions of heart cases in the two main hospitals of Hyderabad-Secunderabad (Osmania and Gandhi), plotted against the corresponding daily K-sums of geomagnetic activity as measured at the Hyderabad Magnetic Observatory during 1967-72, showing a positive linear correlation

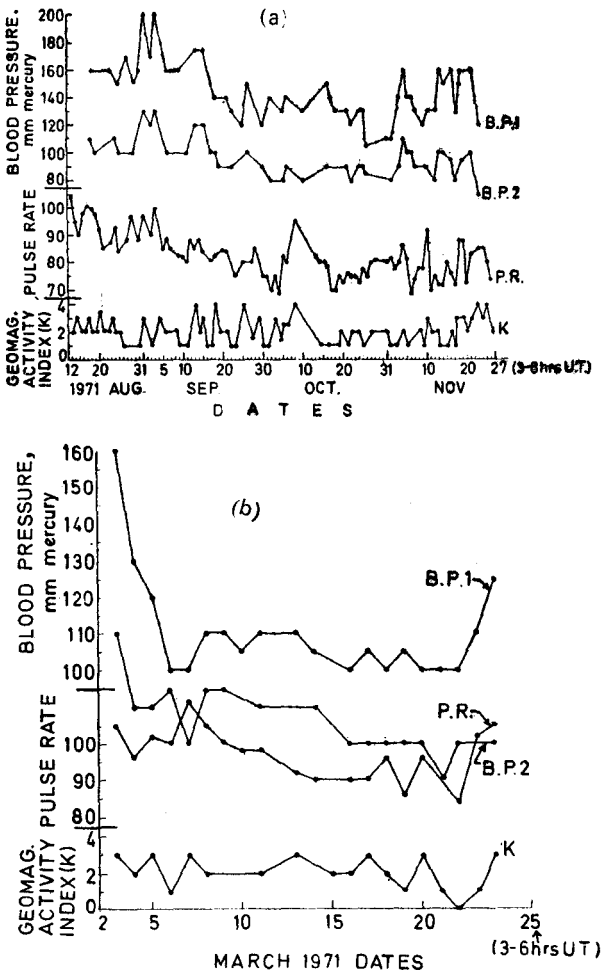

Fig. 2—Daily data on pulse rate (P.R.) and blood pressure (B.P.) for two coronary thrombosis (heart attack) cases A and B treated in the Osmania hospital for 105 [Fig. 2 (a)] and 20 days [Fig. 2 (a)], respectively, in 1971, plotted against the corresponding geomagnetic disturbance index K (0300-0600 hrs UT), bringing out a direct relationship

ked out as $0{\cdot}761 \pm 0{\cdot}015$. Apart from this correlation, six case histories of heart attacks were studied in some detail with data on pulse rate and blood pressure against the geomagnetic activity (K-index) including very rapid fluctuations of the geomagnetic field known as pulsations having periods of seconds and minutes.

The daily data on pulse rate and blood pressure for two cases (105 days and 20 days, respectively) were studied against the K-index for the interval 0300-0600 hrs UT on each day when the pulse rate and blood pressure measurements are usually taken in the hospitals. The data are graphically presented in Fig. 2 (a) and (b).

Five one-day heart attack cases which proved fatal were also randomly selected from five categories of people (a labourer, a psychic case, a diabetic case, a politician and a doctor), and studied against the geomagnetic activity.

3. Discussion

It may be remarked that solar corpuscular radiations (enhanced solar wind) accompanying solar flares and other solar activity phenomena take 1 to 2 days to travel the distance between the sun and the outer reaches of the earth with a speed of 1,000-3,000 km/sec, and then generate geomagnetic storms having rapid fluctuations and enhanced pulsation activity. The quiet day solar magnetic variations and solar flare effects are caused by the solar wave radiation (ultra violet light and X-rays) and the lunar daily variations by the lunar tides in the upper atmosphere. These smooth variations are not taken into account while scaling the K indices from the records of an observatory. K indices measure geomagnetic disturbances caused by solar corpuscular radiation.

The frequency distribution of the hospital admissions of heart cases against the daily K-sum at Hyderabad for the entire period of six years (1967-72) has been identified as normal. The correlation coefficient $+ 0{\cdot}761 \pm 0{\cdot}015$, has been found to be statistically significant at 95% confidence level by the Student's test. It will also be seen from the equation to the best-fitting (regression) line that for a value of x (daily K-sum) upto 10, the hospital admission of heart cases in Hyderabad is less than 1.

Fig. 2 shows that the day-to-day blood pressure and the pulse rate of the two heart attack cases A and B appear to correlate with the corresponding K-index of geomagnetic activity. Two more heart attack cases in the age group 25-30 years hospitalized for 45 and 20 days, respectively, were also studied. Their daily pulse rate data did not, however, reveal any significant change with the corresponding K index. Five additional heart attack cases picked up from different categories of people which proved fatal within a day of their admissions were also examined against the geomagnetic background. In one case, a patient aged 70 years and known to be diabetic, suffered the very first stroke during the recovery phase of a magnetic storm with rapid fluctuations and pulsations and died under calm magnetic conditions. A psychic case aged 50 got three attacks in seven years. The third attack in 1966 came under slightly disturbed magnetic conditions (perturbations and pulsations) and the patient could not recover from that. A labourer aged 25, got the very first attack under geomagnetically perturbed conditions full of pulsations, and yielded in a day of disturbance. A politician aged 50 got a stroke for the first time during disturbed magnetic conditions (mainly pulsation activity) and yielded to the strain within a day. A doctor aged 40, already a heart patient, got an attack for the second time in 1973 during rapid fluctuations and pulsations

of the geomagnetic field and died within a day. It is thus clear from the study of the nine randomly selected coronary thrombosis (heart attack) cases that geomagnetic disturbances especially the short-period fluctuations and pulsations, bring about heart attacks in those cases that are already somewhat afflicted by diseases of the heart. The magnetic activity simply hastens the attack. In the same manner, geomagnetic disturbances upset the nervous system and reflexes of automobile drivers having sub-normal reflexes and psychiatric complaints, and lead to increased road accidents due to errors of judgement.[3]

4. Conclusions

A strong positive correlation is found to exist between the disturbances of the earth's magnetic field (daily *K*-sum) and daily hospital admissions of heart cases in Hyderabad during 1967-72. The correlation coefficient works out as $+ 0{\cdot}761 \pm 0{\cdot}015$, which is statistically significant at 95% confidence level.

It is also observed that coronary thrombosis (heart attack) cases generally occur during geomagnetic disturbances showing rapid fluctuations and pulsations. The pulse rate and the blood pressure for such cases are directly related to the magnetic activity index *K*.

Enhanced short-period geomagnetic fluctuations and pulsations during magnetic disturbances, thus appear to upset the normal functioning of the brain, the nervous system, and the cardio-vascular system of human beings, which have been well recognized to be electrical in character. When the magnetic disturbances and pulsations react with the human heart or brain electrical potentials, they trigger off heart attacks or psychiatric disturbances in such cases as are not otherwise in perfect shape and condition. All individuals will not respond similarly to geomagnetic disturbances. Sick people and imperfect human organs seem to yield under the influence of these disturbances, while those in excellent health bear the strain without any difficulty. It should, however, be clearly noted that geomagnetic disturbances are not the direct causes of cardiac or nervous diseases or death as such. However, for a better understanding of the influence of geomagnetic disturbances on the nervous and cardio-vascular systems of human beings, the importance of laboratory experiments on animals under varying electro-magnetic fields supported by biophysical and biochemical investigations cannot be over-emphasized.

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