

Ketevan Janashia (1), Alexander Tsibadze (1), Levan Tvildiani (1), Nikoloz Invia (2), Vasili Kukhianidze (3), George Ramishvili (3).

1. Heliomagnetocardiological scientific and practical center (HMCSPC), Tbilisi,Georgia;
2. Georgian Technical University (GTU), Tbilisi,Georgia;
3. National Astrophysical Observatory (Abastumani) at Ilia State University (ISU), Tbilisi,Georgia.

Elaboration of a universal test on magneto sensitivity

The aim of the ISTC project G-2094 is to design a universal clinical-technical test for the detection of magneto sensitivity (type/degree) in humans.

Were detected the autonomic nervous system regulation initial types in healthy male students – 29 volunteers, using of HRV method of ECG. Repeated determination of the HRV indices with different magnetic days were performed in 15 students: With balanced initial regulation n=8 (group I); with parasympathetic initial regulation n=6 (group II); with balanced regulation with elements of the sympathetic divisions n=2 (group III).

Table 1. The values of HRV indices (frequency) of healthy male students at rest, during quiet magnetic days and geomagnetic storms.

Table

1

Groups	Subgroups	LF%	HF%	VLF%	LF/HF%	IC
I	I-1 n=4	33,82,3	18,10,9	38,12,8	1,870,09	1,360,08
	I-2 n=4	32,12,9	20,31,1	41,93,4	1,580,08	1,240,08
	I-3 n=0	-	-	-	-	-
II	II-1 n=6	26,61,7	20,81,3	42,63,7	1,280,06	1,110,09
	II-2 n=4	24,81,09	21,32,01	40,93,5	1,160,05	1,120,07
	II-3 n=2	14,10,7	30,02,1	55,73,7	0,470,09	0,790,08
III n=2	III-1 n=2	42,43,2	13,51,2	34,12,6	3,40,07	1,630,09
	III-2 n=2	43,72,8	14,20,7	38,22,1	3,00,07	1,50,08
	III-3 n=0	-	-	-	-	-

Where:

n-number of investigated;

HF,(%) -Power in high frequency range 0,4-0,15Hz (2,5-6,5 sec); standard limits 15-25%; Relative activity level of the parasympathetic division of regulation;

LF, (%) -Power in low frequency range 0, 15-0, 04 Hz (6,5-25 sec); 1-st order vasomotor waves; standard limits - 15-40%; Relative activity level of the vasomotor centre (sympathetic division of regulation);

VLF% - Power in Very low frequency range 0,04-0,03 Hz (25-33,3 sec), 2 order vasomotor waves; standard limits -15-30% ; indices reflect an influence of higher centers of autonomic regulation on the heart rhythm.

LF/HF-Ratio LF [ms²]/HF [ms²]-the autonomic nervous system balance index;

IC = VLF+ LF /HF- Index of centralization - Parity between the central and autonomic parts of regulation.

The significant elevation of HF = 302,1% was observed in students from group II with parasympathetic initial regulation type during geomagnetic storms.

Reproduction of the disturbances in the room was carried by increasing of magnetic field inductivity step-by-step from 5 nT to 200 nT and then gradually reverting to the initial level. The exposures lasted 45 minutes, with permanent 5 five-minutes recordings of RR-intervals of ECG.

Table 2. The values of HRV indices of healthy male students (frequency) under the exposure of the modulated MF.

Groups		LF%	HF%	VLF%	LF/HF	IC
Start	I	48,662,82	25,851,77	25,44,3	1,890,08	4,80,94
Increasing inductivity of MF	I	39,44,2	15,60,76	42,91,8	2,870,77	1,280,9
Maximum level of inductivity	I	64,40,1	11,40,05	23,90,1	5,60,02	3,170,07
Decreasing inductivity of MF	I	35,80,7	26,153,8	37,94,4	1,870,96	1,60,4
The end	I	51,650,85	19,054,55	29,23,78	2,90,74	2,40,3
Start	II	36,56,6	36,68,9	22,974,2	0,930,13	4,730,34
Increasing inductivity of MF	II	48,84,2	31,93,6	20,15,2	1,540,29	4,00,46
Maximum level of inductivity	II	47,63,63	22,64,25	32,16,08	2,130,36	2,20,2
Decreasing inductivity of MF	II	31,25,6	23,85,8	36,03,8	1,710,24	1,50,23
The end	II	55,14,5	23,24,5	18,26,2	2,690,43	4,30,54
Start	III	49,26,6	15,81,35	34,97,8	3,060,23	2,660,92

Increasing inductivity of MF	III	44.95.9	37.81.75	15.86.25	1.220.06	5.230.76
Maximum level of inductivity	III	46.83.45	35.61.65	14,42,1	1.370.03	5.70.67
Decreasing inductivity of MF	III	38.12.85	35.22.25	13.21.95	0.850.38	5.63.2
The end	III	59.10.01	29.75.3	16.20.25	1.910.52	5.484.4

Where:

LF/HF ranges (2)

Balanced regulation standard limits 1.5-2.5

Parasympathetic prevalence standard limits 0.6-1.4

balanced regulation with the sympathetic elements standard limits 2.6-3.0

Sympathetic regulation standard limits 3.1-3.5

Prevalence of LF (sympathetic division) standard limits 15-40%;

Prevalence of HF (parasympathetic division) standard limits 15-25%.

The experiments revealed that during exposure of MF within the range of natural geomagnetic disturbances (5 nT - 200 nT) the autonomic nervous system balance in healthy male students is really shifted:

- In the case of initial balanced type of the autonomic nervous system regulation, the balance shift towards the sympathetic division was shown, indicating the intensification of sympathetic influence on the heart rhythm.
- In the case of initial parasympathetic type of the autonomic nervous system regulation, the shift towards the balanced regulation type was shown, indicating the intensification of sympathetic influence on the heart rhythm.
- In the case of initial balanced type regulation with elements of sympathetic divisions, the balance shift towards the balanced regulation was shown, indicating the intensification of parasympathetic influence on the heart rhythm.
- The impact of the natural geomagnetic storm in healthy individuals (group II) determines the intensification of parasympathetic influence on the heart rhythm.

Based on the above, it can be supposed that the initial variations in the functional state of the investigated stipulates different dynamics of HRV alterations during the impact of both natural and modulated geomagnetic storms.