EFFECT OF EMOTIONAL STRESS ON THE FREQUENCY OF CHROMOSOMAL ABERRATIONS IN MOUSE BONE MARROW CELLS

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In several publications by Yu. A. Kerkis the possible intensification of mutagenesis through a disturbance of homeostasis was postulated [3].

In view of data on neurohumoral reactions arising during emotional stress, in the investigation described below the level of chromosomal aberrations (CA) was studied in animals exposed to stress.

EXPERIMENTAL METHOD

Experiments were carried out on male C57BL/6, CBA, and BALB/c mice weighing 18-20 g. The "open field" test with flashes [2] was used as the model of emotional stress. In a separate series of experiments the animals were prevented from moving by confinement in a glass vessel.

The CA level was determined in bone marrow cells 24 h after the end of the experiment using a standard technique [4].

The stress reaction was corrected by administration of the new Soviet tranquilizer phenazepam. The drug was injected intraperitoneally in doses of 0.1, 0.3, 0.5, and 1 mg/kg 30 min before the beginning of the experiment.

The results were subjected to statistical analysis by means of Student's and Wilcoxon's criteria.

EXPERIMENTAL RESULTS

Cytogenetic analysis of metaphase plates obtained from control animals showed (Table 1) that the frequency of abnormal cells in the control was 1.3% in C57BL/6, 1.7% in CBA, and 1.8% in BALB/c mice, in agreement with data in the literature [4].

TABLE 1. Effect of Emotional Stress on CA Level in Mouse Bone Marrow

Line of mice	Number of mice	Number of cells	Gaps	Cells with CA				Abnormal cells	P
				single fragments	paired fragments	exchanges	total number of cells with CA		
C57BL/6:									
control	10	1000	8	5	—	—	5	13	—
experiment	10	1000	23	18	7	3	27	48	<0,05
CBA:									
control	10	1000	9	6	2	—	8	17	—
experiment	10	1000	21	11	2	1	14	35	<0,05
BALB/c:									
control	5	500	4	3	1	1	5	9	—
experiment	5	500	2	7	1	—	8	10	>0,05

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TABLE 2. Effect of Emotional Stress on CA Level in Bone Marrow Cells of C57BL/6 Mice after Administration of Phenazepam

Experimental conditions	Number of mice	Number of cells	Gaps	Cells with CA				Abnormal cells	P
				single fragments	paired fragments	exchanges	total number of cells with CA		
Control	10	1000	8	5	—	—	5	13	
Open field	10	1000	23	18	7	3	27	48	<0,05
Phenazepam (1.4 mg/kg)	5	500	4	3	—	—	3	7	>0,05
Phenazepam (0.1 mg/kg), open field	5	500	10	6	—	—	6	15	<0,05
Phenazepam (0.3 mg/kg), open field	5	500	7	4	—	—	4	10	>0,05
Phenazepam (0.5 mg/kg), open field	5	500	5	2	—	—	2	7	>0,05
Phenazepam (1.0 mg/kg), open field	5	500	5	2	1	—	3	8	>0,05
Open field, hypokinesia	10	1000	26	15	3	2	20	42	<0,05
Phenazepam (0.3 mg/kg), open field, hypokinesia	5	500	6	4	—	—	4	9	>0,05

After exposure to stress in the "open field" test the total number of abnormal cells in the C57BL/6 mice increased to 4.8%. The qualitative spectrum of the chromosomal aberrations changed. The number of gaps increased from 0.8 to 2.3%, the number of single fragments from 0.5 to 1.8%, and paired fragments and exchanges appeared. A similar picture was observed in the CBA mice also. Meanwhile, in animals of the BALB/c line, after the "open field" experiment no significant deviations of the CA level from control values were found (Table 1).

To confirm that the effects observed were dependent on exposure to stress, in the next series of experiments induction of CA was studied in C57BL/6 mice kept in an "open field" after preliminary administration of phenazepam.

Phenazepam, a new Soviet tranquilizer of the benzodiazepine series, is characterized by well-marked anxiety-relieving properties and it is an active antistress agent [1].

The data in Table 2 show that after administration of phenazepam in a dose of 0.1 mg/kg the number of cells with CA after the "open field" experiment was reduced from 4.8 to 3%; paired fragments and exchanges disappeared in this case. Injection of the tranquilizer in a dose of 0.3 mg/kg or above completely prevented induction of the chromosomal disturbances.

In the same series of experiments changes in the number of CA were analyzed during a combination of emotional stress induced in the "open field" and hypokinesia. In this case also, the number of abnormal cells increased significantly in the C57BL/6 mice. The qualitative and quantitative composition of the CA remained similar to changes in chromosomes arising after the experiment with unrestricted motor activity. In the case of combined exposure to stress factors phenazepam, given in a dose of 0.3 mg/kg, also prevented the mutagenic effect (Table 2).

It can thus be concluded that during emotional stress chromosomal aberrations can be induced and that this effect is genotypically dependent and can be abolished by tranquilizers.

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