REGENERATIVE REACTIONS IN RATS AFTER MICROWAVE IRRADIATION (2400 MHz)

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During irradiation of rats by a super high-frequency (shf) field (2400 MHz) within the range of power densities (PD) of between 100 and 800 mW/cm^2, the relationship between the regenerative effect and the interval between irradiations (if PD is constant) approximates to logistic, whereas the relationship between PD and the interval between irradiation (if the level of regeneration is constant) approximates to linear.

KEY WORDS: microwave (shf) irradiation.

The quantitative characteristics of systemic reactions of animals to microwave irradiation, evaluated as adaptive, phasic, compensatory, and so on, have been published previously [1-4]. Information on the quantitative evaluation of regenerative reactions at the level of the whole organism could not be found, however, in the accessible literature.

The object of the present investigation was to study the functional relationship between the regenerative effect and the length of the interval between irradiations, at different power densities (PD) and between PD and the interval between irradiations for a constant regenerative effect.

EXPERIMENTAL METHOD

Experiments were carried out on 736 noninbred male rats with a mean weight of 200 ± 25 g. The animals were irradiated in a super high-frequency (shf) field (Parus apparatus, 2.5 kW, 2400 MHz) in an anechoic chamber with PD of 100, 200, 300, 500, and 800 mW/cm^2, and with an ambient air temperature of 22 ± 0.8°C. The irregularity of distribution of the power of the shf field did not exceed 3 dB. At each assigned PD the rats of group 1 (control) were irradiated continuously for a sufficient length of time to correspond to a survival rate of the animals of 5 ± 5%. During irradiation of the rats of the experimental groups, the time found for the control series was divided in half and the intervals between the 1st and 2nd irradiations (T) were increased until the survival rate of the animals became 90 ± 5%. The relationships between PD, the regenerative effect, and the intervals between irradiations were expressed as algebraic functions.

EXPERIMENTAL RESULTS

In the control group, in an shf field with PD of 100, 200, 300, 500, and 800 mW/cm^2 the survival rate of animals was 2.0, 2.5, 2.0, 5.0, and 1.0% for durations of irradiation of 14.3, 4.1, 2.5, 1.8, and 1.2 min respectively. With an increase in the interval between irradiations, the percentage of surviving animals also increased (Fig. 1).

The observed developmental tendency can be described sufficiently accurately by a logistic function. For each concrete empirical determination of the survival rate in relation to the interval between exposure to irradiation (at PD of 100, 200, 300, 500, and 800 mW/cm^2) the corresponding equations were obtained:

$$Y=\frac{100}{1+10^{2.9268-0.7564T}};$$

$$Y=\frac{100}{1+10^{2.6595-0.5044T}};$$

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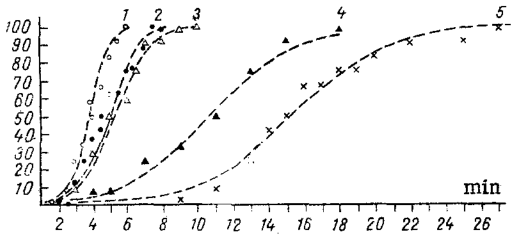

Fig. 1

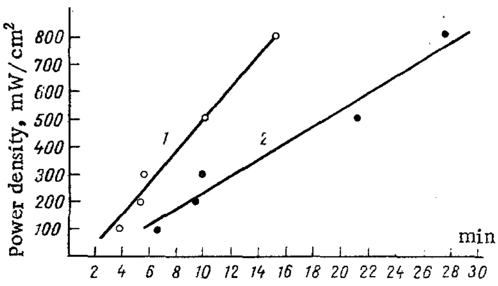

Fig. 2

Fig. 1. Dynamics of survival at different PD values. Symbols denote experimental data; 1-5) theoretical distributions at PD of 100, 200, 300, 500, and 800 mW/cm^2 respectively. Abscissa, interval between irradiations (in min); ordinate, survival rate (in %).

Fig. 2. Changes in duration of semiregeneration (1) and complete regeneration (2) as functions of PD of the shf field. Symbols denote experimental data; 1, 2) interpolated straight lines of equal effect. Abscissa, interval between irradiations (in min); ordinate, PD (in mW/cm^2).

$$Y = \frac{100}{1 + 10^{2.3090 - 0.4342T}};$$

$$Y = \frac{100}{1 + 10^{1.8709 - 0.1765T}};$$

$$Y = \frac{100}{1 + 10^{2.4862 - 0.1625T}},$$

where Y is the survival rate, in %, and T the interval between irradiations, in min.

Analysis of these equations shows the presence of regenerative processes whose speed is inversely proportional to the PD of the shf field; this indicates that the relationship between the regenerative effect and the intervals between irradiations by shf fields of different PD are expressed by qualitatively different functions.

This difference is reflected in the duration of the interval between irradiations required to attain the period of semiregeneration and complete regeneration (Fig. 2). It is interesting to note that the relationship between PD and the duration of the interval between irradiations for the period of semiregeneration and of complete regeneration approximates to an interpolated linear function: $Y = 81.36 + 57.17\ T$ and $Y = -62.54 + 29.42\ T$, respectively, where Y represents PD and T is the interval between irradiations (in min). This indicates, on the one hand, a constant rate of regenerative reactions for an assigned level of effect, and, on the other hand, an increase in the rate with a decrease in the level of the regenerative effect.

The functions representing these relationships can be used to analyze regenerative reactions following microwave irradiation of rats and also to predict effects likely to be observed in other species of animals.

LITERATURE CITED

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