

EXPERIMENTAL INVESTIGATION OF SKIN REACTIONS TO A COMBINATION OF X-RAY IRRADIATION AND PREDNISOLONE

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Administration of prednisolone to mice undergoing local fractional x-ray irradiation of the skin potentiated the harmful action of the x-rays on developing hair follicles by about 1.5-1.7 times.

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The experiments of Grigor'yan [1] undertaken in the Laboratory of Combined Methods of Treatment showed that a combination of prednisolone administration and x-ray irradiation inhibits growth of a Harding-Passy melanoma much more than the action of each of these factors separately. The next step was therefore to study possible unfavorable side effects of a combination of prednisolone and x-ray irradiation, notably any possible harmful action on the skin.

In the present investigation the harmful action of x-ray irradiation and prednisolone on hair follicles was studied in total skin preparations [2-4].

EXPERIMENTAL METHOD

Experiments were carried out on 60 F₁ hybrid (CBA×C57B1) male mice weighing 20-23 g. Hairs were plucked from the skin on the lateral surface of the thigh when in the resting period of the hair cycle [5, 6]. Eight days later, in the period of active hair growth, local fractional irradiation of the area thus prepared commenced on the RUM-7 apparatus under the following conditions: tube voltage 30 kV, current 5 mA, filter 0.48 mm Al, skin-focus distance 75 mm, dose rate 90 R/min, tube 14×24 mm. The skin of the experimental and control mice was irradiated daily for 5 days, each time in doses of 22, 33, 50, 75, 110, and 130 R, giving total doses of 110, 165, 250, 375, 550, and 650 R respectively. The mice of the experimental group received prednisolone in 0.2 ml starch mucilage by gastric tube 24 h before the first irradiation, and then daily 30 min before each session of irradiation. The dose of prednisolone given each time was 1 mg per mouse. Control mice received 0.2 ml starch mucilage by the same method. A separate group of mice received the same dose of prednisolone by the same method but were not irradiated with x-rays. Each exposure dose was given to 5 mice, both in experiments with irradiation alone and in those when it was combined with prednisolone. The mice were sacrificed 24 h after the last irradiation. The method of preparation of total skin preparations, counting the normal and damaged hair follicles, and assessing the severity of the damage was described previously [3, 4]. The only deviation from this method was that the hair follicles of types 1 and 2 were counted together, because both these types are found in undamaged skin.

EXPERIMENTAL RESULTS

During the combined action of prednisolone and x-ray irradiation, the changes in distribution of follicles in favor of those more severely damaged took place much faster than during irradiation alone. No damaged follicles were found in irradiated mice receiving a total dose of 110 R, but in those receiving combined treatment 23% of hair follicles were of type 3. After irradiation in a dose of 165 R, 71% of the

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TABLE 1. Reaction of Hair Follicles to Separate and Combined Action of X-Ray Irradiation and Prednisolone

Group No.	Number of mice	Dose of irradiation		Dose of prednisolone (in mg per mouse)	Percentage of hair follicles of different types					
		Sessional	Total		1—2	3	4	5	6	7
1	5	22	110	—	100	—	—	—	—	—
2	5	33	165	—	71	29	—	—	—	—
3	5	50	250	—	10	47	37	6	—	—
4	5	75	375	—	—	4	19	42	29	6
5	5	110	550	—	—	—	—	4	33	63
6	5	130	650	—	—	—	—	0,7	6	93,3
7	5	22	110	1×6	77	23	—	—	—	—
8	5	33	165	1×6	9	35,4	42	13	0,6	—
9	5	50	250	1×6	—	6	25	43	19	7
10	5	75	375	1×6	—	—	—	1	10	89
11	5	110	550	1×6	—	—	—	—	—	100
12	5	—	—	1×6	100	—	—	—	—	—

follicles were damaged and 29% were of type 3. After combined treatment with the same dose of irradiation, only 9% of undamaged follicles were found, and most (77.4%) belonged to types 3 and 4. A similar distribution of follicles was found after irradiation in a dose of 250 R, whereas after the combined treatment with the same dose of irradiation, no undamaged follicles whatever were found and most of the damaged follicles (68%) belonged to types 4 and 5. Comparison of the distributions of follicles by severity of damage after combined treatment with total doses of 110, 165, and 250 R with the corresponding distributions obtained with doses of 165, 250, and 375 R with irradiation alone shows that prednisolone potentiated by about 50% the radiation damage to the hair follicles. An increase in the dose of irradiation under these conditions gave a somewhat greater potentiating effect. For example, the distribution of hair follicles after irradiation in a dose of 375 R in the case of combined treatment corresponded to the distribution obtained after irradiation alone in a dose of 650 R, i.e., the damaging effect was potentiated by 1.7 times. The method used on this occasion did not reveal any damaged hair follicles in mice receiving prednisolone alone without irradiation of the skin.

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