

EFFECT OF RADIATION INJURIES ON THE ACTION OF SYMPATHOMIMETIC AMINES

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The toxicity of adrenalin, adrenalone, pervitin, amphetamine, veritol, ephedrine, and sympatol for irradiated frogs and mice is more than twice that for unirradiated animals. The action of all seven amines on the reflex activity of the CNS of irradiated animals is much lower than in unirradiated animals. The awakening action of amphetamine and pervitin in irradiated mice under the influence of hexobarbital is much weaker than in unirradiated animals. Ephedrine actually potentiated the narcotic effect of hexobarbital in irradiated animals.

The sympathomimetic amines are widely used in medical practice as vascular analeptics (adrenalin, ephedrine, sympatol) and stimulants of the CNS, increasing the ability to work and abolishing the depriving effect of certain therapeutic and prophylactic preparations (pervitin, amphetamine).

The study of the response of the irradiated organism to sympathomimetic amines is of definite scientific and practical interest.

On the one hand, such investigations can lead to the more rational use of these substances and, on the other hand, they can shed light on the intimate mechanisms of the organism's response to stress-producing factors, notably ionizing radiation.

EXPERIMENTAL METHOD

Experiments were carried out on 810 winter frogs (*Rana temporaria*) of both sexes and 425 noninbred male albino mice. The animals were irradiated on a Co^{60} γ -ray apparatus (dose 200 R for frogs and 900 R for mice).

Solutions of adrenalin, adrenalone, veritol, ephedrine, sympatol, amphetamine, and pervitin were made up as required and injected on the 5th day after irradiation (into the dorsal lymph sac of the frogs

TABLE 1. Toxicity of Amines for Irradiated and Unirradiated Animals

Amine	LD ₅₀ by Kärber's method (in mg/kg)			
	frogs		mice	
	unirradiated	irradiated	unirradiated	irradiated
Adrenalin	120	50	5	2.2
Adrenalone	650	190	18	8.9
Pervitin	985	250	35	17
Amphetamine	1360	400	55	24
Veritol	1350	350	65	30
Ephedrine	1360	680	110	50
Sympatol	6100	2120	245	110

(Presented by Academician of the Academy of Medical Sciences of the USSR P. D. Gorizontov.)

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TABLE 2. Increase in Dose of Amines for Irradiated Frogs Compared with Unirradiated (number of times)

Amine	Animals		
	thalamic	spinal	intact
Pervitin	100	20	33
Amphetamine	33	10	16
Ephedrine	12	12	10
Veritol	10	10	8
Adrenalone	12	10	12
Adrenalin	5	12	5
Sympatol	5	10	5

TABLE 3. Awakening Action of Amines on Irradiated and Unirradiated Mice

Amine	Decrease (+) or increase (−) in time of anesthesia compared with control (in %)	
	unirradiated animals	irradiated animals
Pervitin	+82	+32
Amphetamine	+76	+25
Ephedrine	+41	−18

The strength and character of action of the amines on the reflexes were largely dependent on the functional state of the nervous system. For example, the percentage of responses during the action of all amines was highest in the thalamic frogs – from 100 (amphetamine) to 81 (sympatol), whereas in the intact frogs receiving the same doses of amines it was much lower – from 59 to 14.

In one-third of the intact frogs the amines reduced the latent period of the reflexes or, in other words, they had an excitatory action on the CNS.

All seven amines had a much weaker action on the spinal reflexes of the irradiated animals than on the unirradiated.

The doses of amines inducing an inhibitory effect of equal strength on the spinal reflexes (as shown by the latent period of the reflex) was several (5–100) times higher for the irradiated than for the unirradiated animals (Table 2).

It must be emphasized that in no case was excitation of the spinal reflexes observed after administration of these amines to the irradiated frogs, whereas in some cases (about 30%) excitation was observed in the unirradiated animals, or initial excitation was followed by inhibition of the reflexes.

After repeated (twice or four times) injections of pervitin, amphetamine, and ephedrine into irradiated frogs no weakening of the inhibitory action on the reflexes was observed, while in unirradiated frogs repeated injections of the amines were accompanied by weakening of the effect. In other words, the phenomenon of tachyphylaxis was not present in the irradiated frogs.

The awakening action of pervitin and amphetamine on irradiated mice anesthetized with hexobarbital was much weaker than on unirradiated mice. Ephedrine actually potentiated the anesthetic effect of hexobarbital in the irradiated animals (Table 3).

and intraperitoneally into the mice). The toxicity of the drugs (LD_{50} by Kärber's method) was determined, and the effects on reflex functions of the CNS (by the Turck–Sechenov method) were studied in frogs, and the awakening action of pervitin, amphetamine, and ephedrine was investigated on mice anesthetized with hexobarbital.

EXPERIMENTAL RESULTS

The toxicity of the seven amines for irradiated animals (both frogs and mice), assessed on the basis of their mortality in the course of 24 h, was more than twice as high as their toxicity for unirradiated animals (Table 1).

The effect of the amines on spinal reflexes was studied in frogs by the Turck–Sechenov method. Solutions of the drugs in concentrations of $1 \cdot 10^{-4}$ – $0.5 \cdot 10^{-7}$ were injected in a volume of 0.2–0.25 ml per animal into the dorsal lymph sac.

All seven amines in the experiments on the unirradiated animals (intact,* spinal, and thalamic) had a mainly inhibitory action of reflex activity of the CNS; i.e., they increased the latent period of the reflex (Table 2). Amines with no hydroxyl group in their molecule (amphetamine, pervitin) inhibited the spinal reflexes more sharply than amines containing such groups (adrenalin, sympatol).

* The brain and spinal cord were left intact.