

## CHANGES IN THE CONTENT OF ADRENALIN, NORADRENALIN, SEROTONIN, AND HISTAMINE IN THE BLOOD AND ORGANS OF RATS WITH THERMAL BURNS OF THE SKIN IN DIFFERENT DEGREES

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In rats with first and second degree burns (local lesion of the skin only) the content of serotonin in the blood, skin, and hypothalamus, of histamine in the skin and hypothalamus, and of adrenalin and noradrenalin in the hypothalamus and adrenals is disturbed by an amount which depends on the severity of the local skin lesion. In third and fourth degree burns (local lesion accompanied by death of the burned animals), considerable quantitative changes took place in the level of the biogenic amines in the rats, but these were almost identical in both cases (except for the content of noradrenalin in the adrenals and hypothalamus and the adrenalin content in the hypothalamus).

There is little information in the literature regarding the content of biogenic amines in the tissues after burns of different intensity [2, 7, 8, 10]. The role of the biogenic amines and the relationship between their content in the tissues and the severity of the lesion of the body surface in burns likewise have received little study.

The present investigation was accordingly carried out to study the changes in the content of serotonin, histamine, adrenalin, and noradrenalin in the blood and organs of rats with thermal burns of the skin of different degrees of severity.

### EXPERIMENTAL METHOD

Experiments were carried out on 200 male albino rats weighing 180-200 g divided into equal groups depending on the degree of severity of the burn. First and second degree burns measuring 3 and 30 cm<sup>2</sup> were inflicted by contact for 30 min between the lower part of the trunk on the right side and glass vessels containing water heated to 75°C. Third and fourth degree burns were produced by immersing  $\frac{1}{3}$  (up to the lumbo-sacral junction) and  $\frac{2}{3}$  (up to the shoulder girdle) of the body surface for 30 sec in hot (75°C) water.

Intact rats were used as the control.

The contact of catecholamines in the blood, skin, hypothalamus, and adrenals and of serotonin and histamine in the blood, skin, and hypothalamus was determined 1 h after burning. The animals of the control groups were decapitated at the same time as the experimental rats. Quantitative determination of the catecholamines was carried out fluorometrically by V. O. Osinskaya's method and by the method of Euler and Lishajko in Men'shikov's modification [4]. Histamine [9] and serotonin [3] were determined by fluorometric methods. The standards used were L-adrenalin hydrotartrate, L-noradrenalin-hydrotartate (Khar'kov Institute of Experimental Endocrinology), histamine dihydrochloride (British Drug Houses, Ltd.),

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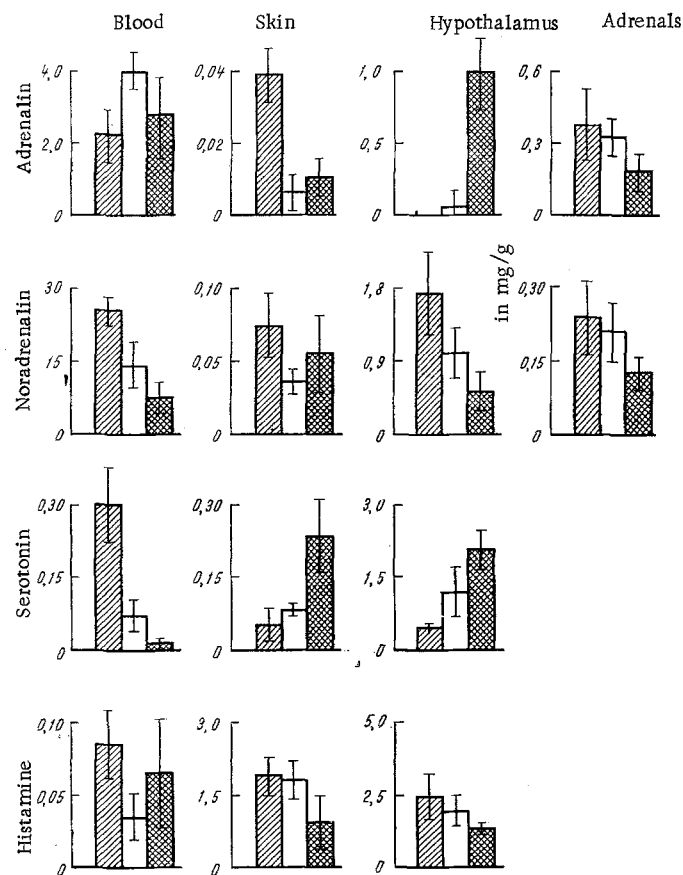


Fig. 1. Changes in content of adrenalin, noradrenalin, serotonin, and histamine in blood (in  $\mu\text{g}/\text{liter}$ ) and organs (in  $\mu\text{g}/\text{g}$ ) of rats before (obliquely shaded columns) and 1 h after first degree burn (unshaded columns), and second degree burn (cross-hatched columns). Here and in Fig. 2, vertical lines show confidence intervals.

and serotonin creatinine-sulfate (Reanal). The statistical analysis of the results was carried out by the constant method of Montsevichyute-Éringene [5].

## EXPERIMENTAL RESULTS

The results shown in Figs. 1 and 2 demonstrate regular and marked changes in the content of adrenalin, noradrenalin, serotonin, and histamine in the blood and organs of the rats after burns of different intensity. The experiments as a whole were divided into two groups. The first group included experiments with local injury confined to the skin, in the form of contact burns of the first and second degrees. The second group consisted of experiments in which burn trauma caused death of the burned animals at periods ranging from 1.5–5 h (fourth degree burn) to 48 h (third degree burn) after injury.

After the local lesion of the skin there was a well-defined relationship between the content of biogenic amines in the blood and organs and the degree of the burn. This relationship becomes apparent in the early period after burning and in some organs persisted for 24 h. A decrease in the serotonin content in the blood and an increase in its content in the skin and hypothalamus were observed 1 h after burning (Fig. 1). At this period after injury the histamine level in the skin and hypothalamus was lowered. The level of adrenalin and noradrenalin also changed parallel to the degree of burning. The adrenalin content rose considerably in the hypothalamus but fell in the adrenals, while the noradrenalin level fell significantly in the blood, hypothalamus, and adrenals.

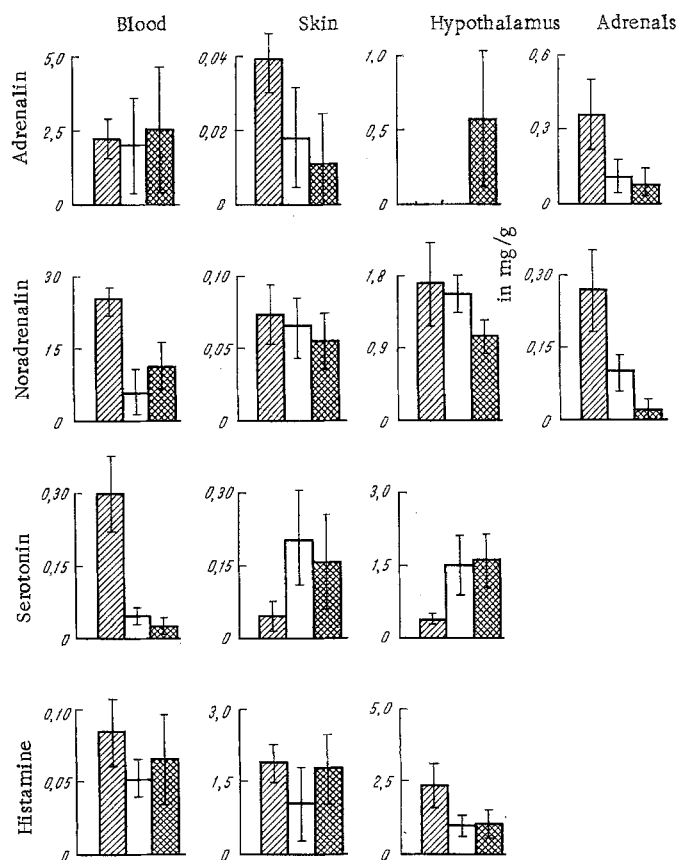


Fig. 2. Changes in content of adrenalin, noradrenalin, serotonin, and histamine in the blood (in  $\mu\text{g/liter}$ ), and organs (in  $\mu\text{g/g}$ ) of rats before (obliquely shaded columns), and 1 h after third degree (unshaded columns), and fourth degree (cross-hatched columns) burns.

The initial response of the rats to slight burning (first and second degree burns), terminating in complete recovery of the animals, was accompanied by a marked disturbance of the content of biogenic amines. An increase in the affected area of the skin was accompanied by a parallel increase in the content of biogenic amines in the organs.

In severe third and fourth degree burns, leading to death of the burned animals, more marked changes took place in the level of the biogenic amines but, as a rule, they were independent of the degree of damage to the skin (Fig. 2). The response of the rats to severe burning was a decrease in the content of serotonin in the blood and an increase in its content in the skin and hypothalamus, while the histamine content in the hypothalamus also fell. A decrease in the content of adrenalin in the skin and adrenals and of noradrenalin in the blood also was observed. Dependence of the content of noradrenalin in the hypothalamus and adrenals and of adrenalin in the hypothalamus on the degree of the burn was an exception.

The virtually complete disappearance of noradrenalin from the adrenals 1 h after the fourth degree burn, and the parallel sharp decrease in intensity of adrenalin synthesis in the adrenals in cases in which the burn trauma terminated in death, deserve particular attention. These results agree fully with the histochemical findings [1, 6] indicating a marked decrease in the number of chromaffin cells detected in the adrenal medulla after burns, and they suggest exhaustion of the adrenalin-synthesizing function of the adrenals after severe burns.

After first and second degree burns a relationship was therefore established between the changes in the level of biogenic amines in the hypothalamus and certain other organs and the severity of the local skin lesion. After severe lethal burns (third and fourth degree) no differences were observed in the degree of

the disturbances of the content of biogenic amines in the organs (with the exception of the content of nor-adrenalin in the adrenals and hypothalamus, and of adrenalin in the hypothalamus).

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