

EFFECT OF ADRENAL FUNCTION ON CHANGES IN SERUM AMINOTRANSFERASE ACTIVITY OF ALBINO RATS WITH SHOCK PRODUCED BY CRUSHING THE SOFT TISSUES

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Aspartate-aminotransferase and alanine-aminotransferase activity was investigated in rats with shock produced by soft tissue crushing. The rats consisted of three groups: with intact adrenals, adrenalectomized, and adrenalectomized rats with autografted adrenals. The increase in aminotransferase activity was less marked in the adrenalectomized animals, with or without autografting of the adrenals, than in the rats with intact adrenals.

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There is little information in the literature concerning the effect of shock caused by compression of the soft tissues on activity of the transamination enzymes: aspartate-aminotransferase (AST; 2.6.1.1) and alanine-aminotransferase (ALT; 2.6.1.2) [5, 6]. Very little is known concerning the mechanism of the changes in transferase activity in the blood serum in this condition. It is only recently that work has been published pointing to the important role of the adrenals in the development of increased blood enzyme activity in stress [4, 7, 9, 10].

The object of the present investigation was to study AST and ALT activity in the blood serum of albino rats with shock resulting from crushing of the soft tissues of the thigh in animals with intact adrenals, adrenalectomized animals, and adrenalectomized animals with autografted adrenals.

TABLE 1. AST and ALT Activity in Blood Serum of Albino Rats with Shock Resulting from Compression of Soft Tissues in Relation to Adrenal Function (μ moles pyruvate/ml serum; incubation for 60 min at 37°)

Enzyme	Group of rats Series of ex- periments	With intact adrenals	Adrenalecto- mized	With autografted adrenals	
				after 14 days	after 30 days
AST	Control	4,1 \pm 0,10(23)	3,8 \pm 0,20(11)	4,1 \pm 0,16(10)	4,3 \pm 0,22(12)
	Vise for 4 h 3 h after removal of vise	5,4 \pm 0,23(10)	5,8 \pm 0,16(9)	6,0 \pm 0,22(13)	6,0 \pm 0,24(8)
	Control	15,9 \pm 0,29(20)	13,5 \pm 0,31(20)	13,0 \pm 0,37(21)	12,0 \pm 0,26(26)
ALT	Control	1,9 \pm 0,13(22)	1,6 \pm 0,15(11)	1,7 \pm 0,14(10)	1,8 \pm 0,11(11)
	Vise for 2 h 3 h after removal of vise	2,2 \pm 0,16(10)	2,2 \pm 0,09(9)	2,0 \pm 0,14(13)	2,3 \pm 0,24(8)
	Control	6,3 \pm 0,22(22)	4,9 \pm 0,17(20)	4,2 \pm 0,27(21)	4,4 \pm 0,20(26)

Note. Number of experiments given in parentheses.

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EXPERIMENTAL METHOD

Experiments were carried out on adult female albino rats weighing 150-200 g. Shock was produced by prolonged crushing of both hind limbs within a special vise. The animals were sacrificed by decapitation, in series I 4 h after crushing with the vise still in situ, in series II 3 h after its removal; the animals of series III acted as controls.

Adrenalectomy and autografting of the adrenals was carried out by the method described by Kulagin [3]. The rats were included in the experiment 12-14 days after adrenalectomy, and to two periods after autografting: on the 12th-14th and 29th-31st days. Throughout the postoperative period the animals received physiological saline instead of water.

Activity of the serum enzymes was determined by Yatzidis' modification [11] of the colorimetric method of Reitman and Frankel and expressed in μ moles pyruvate/ml serum/incubation time (60 min at 37°).

EXPERIMENTAL RESULTS

After application of the vise to both thighs the rats developed generalized excitation and aggressiveness, giving way after 40-60 min to general inhibition, which reached its greatest intensity toward the end of the period of crushing (4 h). After removal of the vise, the general inhibition increased progressively, edema of the traumatized tissues developed, and the body temperature fell appreciably. These signs of shock were particularly marked in the adrenalectomized animals, some of which (2 of 10) died shortly before removal of the vise.

Crushing both hind limbs for 4 h led to a moderate but significant increase in AST activity (Table 1), equal in all groups of animals ($P < 0.01$). The ALT activity was unchanged during this period.

The level of both enzymes in the serum showed a sharp increase 3 h after removal of the vise. The possibility is that the increase in aminotransferase activity in shock caused by crushing of the soft tissues takes place primarily through release of enzymes from the tissues into the blood stream as a result of changes in cellular permeability.

Another possibility is that in this pathological condition enzymes passing from the tissues into the blood are activated at the same time. With this suggestion in mind, experiments were carried out on rats undergoing adrenalectomy and autografting of the adrenals. The results of these experiments (Table 1) showed that aminotransferase activity increased by a lesser degree in these groups after removal of the vise than in animals with intact adrenals ($P < 0.01$).

After autografting the adrenal medulla is known to lose its regenerative power irreversibly, while cells of the adrenal cortex remain capable of regeneration. Mineralocorticoid activity is restored after 2 weeks and glucocorticoid function after 1-2 months [2]. It is also known that in rats chromatin tissue is present not only in the adrenals, but also in other parts of the body, so that an absolute deficiency of adrenalin and noradrenalin is not created in the body after degeneration of the adrenal medulla. Most probably, however, in stress states, such as shock resulting from crushing of the soft tissues, in adrenalectomized animals with autografted adrenals the additional chromaffin tissue does not give rise to the same excess of adrenalin as in rats with intact adrenals.

It may therefore be postulated that the more marked increase in activity of both serum aminotransferases in rats with intact adrenals 3 h after removal of the vise is due partly to activation of the enzymes in the presence of an increased quantity of adrenalin. This hypothesis is in agreement with results obtained by other workers demonstrating the activating effect of this hormone on the serum AST and ALT [1, 8].

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