ENZYME ACTIVITY IN THE ORGANS OF ANIMALS WITH BURN SHOCK

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A decrease in malate dehydrogenase activity and a considerable increase in lactate dehydrogenase, leucine aminopeptidase, and cathepsin activity were found in the serum of rabbits during the first few hours of burn shock. No changes in enzyme activity were found in the liver, kidneys, and skeletal and cardiac muscle at this period of burn shock.

Increased protein breakdown after burns has attracted the attention of many investigators to the study of proteolytic enzymes in the organs and tissues of the burned organism. Increased proteolytic and peptidase activity has been found in the fluid from burn blisters [4, 5], in the blood [5], lymph [10], liver, kidneys, and skeletal muscle [1], in the urine [7] and skin [8]. The time of appearance of excess proteolytic and peptidase activity in the blood and organs and the origin of these enzymes are still matters for discussion.

The object of this investigation was to study the activity of proteolytic enzymes in the blood and tissues during the first few hours after burns in rabbits.

EXPERIMENTAL METHOD

Experiments were carried out on 25 rabbits on which a third degree thermal burn occupying 15-20% of the body surface was inflicted. All the animals died 5-6 h after burning in a state of severe shock. The investigation was carried out 30 and 210 min after burning. Activity of cathepsins [3], leucine aminopeptidase (LAP) [6], lactate dehydrogenase (LDH), and malate dehydrogenase (MDH) [2] was determined in the blood serum and in glycerol and saline extracts of the organs.

EXPERIMENTAL RESULTS AND DISCUSSION

Analysis of the results (Figs. 1 and 2) shows that 30 min after burning activity of the cathepsins in the blood serum was increased considerably (+100%) and there were smaller increases in LAP and LDH activity (+ 42 and + 57%, respectively). A further increase in cathepsin and LAP activity and a slight increase in LDH activity were observed 210 min after burning in the rabbits' serum. Immediately after burning the activity of several blood serum enzymes is thus increased. The decrease in MDH activity (Fig. 2) observed at this time indicates the selectivity of the enzymic changes.

Tests carried out at the same time showed no significant changes in cathepsin and LAP activity in the liver, kidneys, and cardiac and skeletal muscle.

The increase in the activity of the serum proteolytic enzymes and its stability in the internal organs may be the result of liberation of enzymes into the blood stream from the injured tissues. In extensive burns this zone of injury includes large areas of skin. Activity of the cathepsins, LAP, LDH, and MDH was therefore studied in the burned and intact skin of the burned animal. Activity of the enzymes in the skin is

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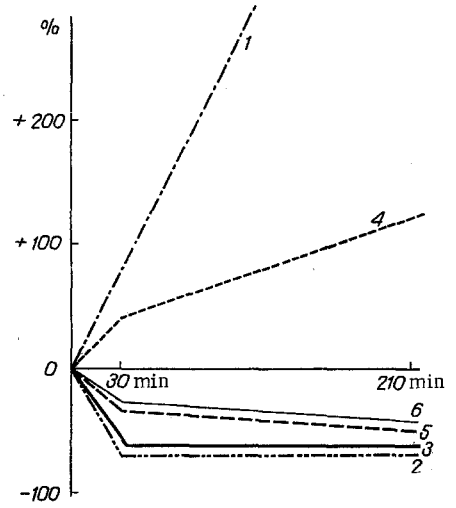

Fig. 1

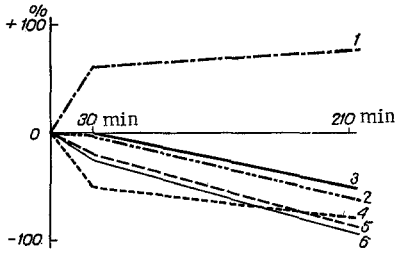

Fig. 2

Fig. 1. Activity of cathepsins and LAP in serum and skin of rabbits after thermal burns: 1, 2, 3) cathepsins of serum and burned and intact skin, respectively; 4, 5, 6) LAP of serum and burned and intact skin, respectively. Abscissa, time (in min); ordinate, changes in enzyme activity (in %); activity of enzymes of intact rabbits taken as the origin.

Fig. 2. LDH and MDH activity in serum and skin of rabbits after thermal burns: 1, 2, 3) LDH of serum and burned and intact skin respectively; 4, 5, 6) MDH of serum and burned and intact skin, respectively. Abscissa and ordinate: as in Fig. 1.

compared in Figs. 1 and 2 with their activity in the serum. Clearly 30 min after burning the activity of cathepsins and LAP in the burned skin was considerably reduced (Fig. 1), and the LDH and MDH activity was considerably reduced 210 min after burning. An increase in enzyme activity, however, was observed in the blood serum at this time. The decrease in enzyme activity in the burned skin could be the result of inactivation of the enzymes by the high temperature of the burning agent. However, since the activity of these enzymes was reduced by the same degree in the intact skin of the burned rabbits, which was not exposed to the high temperature, presumably the enzymes in the skin were not only inactivated but also redistributed. After burning the enzymes may perhaps pass into the blood stream both from cells destroyed by burning and also from cells of the intact skin. The skin as a whole thus gives a reflex response as an organ to local thermal trauma during the first few hours after burning.

It is evident that there are also thermolabile enzymes which do not pass into the blood stream. For instance, the MDH activity fell, both in the skin and in the serum, immediately after burning.

During the first few hours after burning changes thus took place in enzyme activity in the blood and the skin; these changes can be attributed both to the direct effect of the high temperature and to complex nervous reflex mechanisms.

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