

A STUDY OF THE INGESTIVE FUNCTION OF THE
RETICULOENDOTHELIAL SYSTEM AFTER
ADMINISTRATION OF EXTRACTS OF BURNED SKIN

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UDC 617-001.17-092.9-07:
616.36-008-092:612.429

Experiments on noninbred albino rats showed that burn trauma induced a lasting inhibition of the ingestive function of the reticuloendothelial system (RES). This was expressed as lengthening of the time of ingestion and an increase in the percentage retention of radioactive gold Au^{198} previously injected into the bloodstream. The slowing of the rate of Au^{198} uptake from the bloodstream indicated blocking of the RES, which persisted for 7 days. Extracts of burned skin act on the ingestive function of the RES like burn trauma. The results confirm the view that the focus of thermal injury is the point of origin of burn toxemia. The depression of the ingestive activity of the reticuloendothelial cells of the liver under the influence of extracts of burned skin is a sensitive indicator of the state of the nonspecific immunologic resistance of the burned organism.

KEY WORDS: burn trauma; reticuloendothelial system (RES); ingestive function of the RES.

Among the many pathological changes arising in the body after burns, the ingestive function of the reticuloendothelial system (RES)† of the liver occupies an important place. Even slight burn trauma inhibits the phagocytic and catabolic functions of the RES for several days. The function of the RES is most sensitive to hemodynamic changes, hypoxia, and the entry of toxins and bacteria into the bloodstream [2, 7-9, 11, 12].

The results of previous experiments by the present writers and others indicate that extracts of burned skin have marked toxic properties. Injection of such extracts into mice with a blocked RES induces an almost 100% mortality [4-6, 10].

The object of this investigation was to make a comparative analysis of the ingestive function of the RES in burned and intact rats after administration of extracts of burned skin.

EXPERIMENTAL METHOD

Experiments were carried out on 70 noninbred albino rats weighing 180-200 g. The state of the ingestive function of the reticuloendothelial cells of the liver was assessed by means of a solution of radioactive colloidal gold Au^{198} , which is selectively ingested by the Kupffer cells of the liver. After ingestion

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†In 1972 an expert committee of the World Health Organization suggested a new classification of phagocytic cells, in which they were grouped together under the name of the mononuclear phagocytic system (MPS), according to which the RES, as defined by Aschoff, is a special component of the general system of macrophages. Since in this paper only the ingestive function of the Kupffer cells of the liver was studied, it seemed advisable to retain the term RES in the narrow meaning of the word.

Pathophysiological Laboratory, Central Institute of Hematology and Blood Transfusion, Ministry of Health of the USSR, Moscow. Translated from *Byulleten' Éksperimental'noi Biologii i Meditsiny*, Vol. 78, No. 9, pp. 22-24, September, 1974. Original article submitted October 29, 1973.

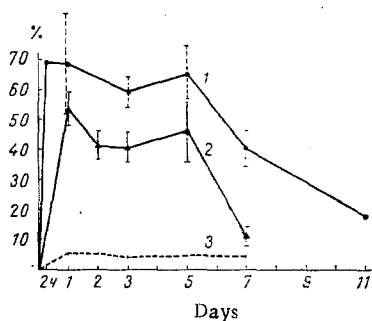


Fig. 1. Effect of burning (1) and injection of extracts of burned (2) and normal (3) skin on the dynamics of Au^{198} uptake from rats' blood. Abscissa, days of observation; ordinate, percentage retention of radioactive gold Au^{198} remaining in the bloodstream 15 min after injection.

of the isotope by the reticuloendothelial cells it is not redistributed. The Au^{198} was injected into the jugular vein in a dose of $2.5 \mu\text{Ci}$ per animal. The radioactivity of the blood sample (1 ml) taken 1–1.5 min after injection of the Au^{198} was taken as 100%. The next blood sample was taken 15 min later. Special experiments showed that in intact rats complete clearance of the colloidal gold from the blood took place after 12–15 min. The radioactivity of the blood sample taken at these times was 0.7–1.3% (mean 1%) of the dose injected. The USD detector with well-type crystal was used to determine the radioactivity.

The animals were divided into the following groups: 1) burned; 2) rats receiving extracts of burned skin; 3) control rats receiving extracts of normal skin.

A burn was inflicted with a spirit flame over an area of 20–25% of the body surface with an exposure of 30–35 sec. The tests were carried out on the 1st, 2nd, 3rd, 5th, and 7th days. Five rats were tested at each time.

The extracts of the burned and normal skin were prepared by the method developed and described by the writers previously [1].

EXPERIMENTAL RESULTS

Burn trauma inhibited the ingestive capacity of the reticuloendothelial cells of the liver. It will be clear from Fig. 1 that marked inhibition of the ingestive activity of the RES was observed 2 h after burning. The radioactivity of the blood sample taken after 15 min was considerably higher (69.8%) than normally (1%). On the 1st, 3rd, and 5th days after burning, the ingestive function of the reticuloendothelial cells of the liver remained low; not only was the rate of elimination of Au^{198} reduced, but the duration of its uptake also was increased (45–50 min).

On the 7th day after burning, the activity of cells of the RES began to increase, as reflected in an increase in the rate of elimination of Au^{198} from the bloodstream – the radioactivity of the sample was 42%. Complete restoration of the ingestive function of the RES was observed on the 19th day after burning.

Burn trauma thus induces lasting inhibition of the ingestive function of the RES of the liver.

The experiments on the animals of group 2 showed that extracts of burned skin act on the ingestive function of the RES in the liver of intact rats in a similar manner to burn trauma. The animals became lethargic and apathetic. The blocking effect of the extracts was apparent from the first day after injection. Investigation of the blood samples after the injection of Au^{198} led to considerable inhibition of the ingestive capacity of the reticuloendothelial cells of the liver. Clearance of Au^{198} from the blood was retarded and 53.3% of the injected activity was retained in the blood. The disturbance of the function of the liver RES after injection of the extracts persisted for a long time (5–7 days).

In the control animals (group 3) receiving extract of the skin of healthy rats no abnormality of the ingestive function of the liver RES was observed. The rate of elimination of Au^{198} from the bloodstream was not significantly changed. Its retention in the blood in all the animals of this group averaged 5%.

These experiments thus revealed an inhibitory action of extracts of burned skin on the functional state of the reticuloendothelial cells of the liver similar to the action of burn trauma.

The results suggest that the point of origin of burn toxemia is evidently the focus of thermal injury [3]. The accumulation of burn toxic fractions in the primary focus and their subsequent circulation in the bloodstream are among the factors forming the clinical picture of burn toxemia. Inhibition of the cellular factors of nonspecific resistance contributes to the development of local and generalized infection, a frequent complication of burns.

The inhibition of the ingestive activity of the reticuloendothelial cells of the liver by extracts of burned skin is a sensitive indicator of the state of the nonspecific immunologic resistance of the burned organism.

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