

PLASMA-CELL RESPONSE IN LYMPH GLANDS AND SPLEEN OF ALBINO RATS FOLLOWING BONE TRAUMA

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After closed fractures in albino rats there is a marked decrease in the number of cells of the plasma-cell series in the lymph glands and spleen, followed by recovery on the 5th (lymph glands) or 15th (spleen) day. Throughout the period of investigation after trauma (25 days) the eosinophil response in the lymphoid organs was increased.

Lymph gland cells respond to any extremal factor [4], but few investigations have been made of differences in their response to pathological conditions of a noninfectious character. The principles governing the plasma-cell response, reflecting the hormonal background of the organism [1, 2] and its immunologic reactivity have never been studied after trauma.

The object of the present investigation was to study the plasma-cell response and to compare it with the eosinophil response in the lymphoid organs of albino rats after fracture of the leg bones of both hind limbs.

EXPERIMENTAL METHOD

Closed fractures of the leg bones were produced in albino rats weighing 150-200 g. Cytological changes in the lymph glands and spleen were determined 6-12 h, and 2, 4, 5, 10, 15, and 25 days after trauma, 10 rats being sacrificed at each of these times. Altogether 60 rats with fractures and 12 control rats were investigated. Cytological changes were determined in impressions taken from submandibular, cervical, para-aortic, inguinal, and popliteal lymph glands and the spleen. The rats were autopsied under ether anesthesia and perfused with physiological saline to remove blood from the spleen. Impression films were fixed with methyl alcohol and stained with azure 2-eosin. Cells of the plasma-cell series (blast cells, plasmablasts, immature and mature plasma cells) and eosinophils were counted in 50 fields of vision with an immersion objective.

EXPERIMENTAL RESULTS

The results given in Table 1 show that the highest number of cells of the plasma-cell series occurred in the cervical and, in particular, the submandibular lymph glands, and the lowest in the spleen. The para-aortic, inguinal, and popliteal glands contained about equal numbers of cells.

Following the fracture, changes in the plasma-cell response characteristic of stress developed in the lymphoid organs of the rats. During the first 4 days a progressive decrease in the number of cells of the plasma-cell series took place in the regional and distant lymph glands and spleen, and was presumably connected with increased production of glucocorticoid hormones [1, 2].

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TABLE 1. Plasma-Cell Response in Lymph Glands and Spleen of Albino Rats after Fracture of Leg Bones

Material investigated	Control	Time of investigation after fracture (in days)						
		6-12 h	2	4	5	10	15	25
Lymph glands								
submandibular	289±55	171±24	41±9	48±22	245±32	188±48	240±46	133±22
cervical	221±40	117±42	56±12	62±25	190±32	121±15	201±34	112±15
deep cervical	159±27	131±26	47±14	74±36	171±55	99±13	104±18	97±23
para-aortic	99±18	117±23	71±10	69±28	275±76	99±20	162±16	112±14
inguinal	84±11	73±12	43±18	81±8	172±26	84±15	105±18	83±14
popliteal	96±13	0	81±19	60±34	177±33	96±22	108±21	89±16
Spleen	64±9	61±16	24±5	12±4	29±8	28±6	56±9	39±6

Plasmolysis, part of the general lympholysis, was replaced on the 5th day by marked hyperplasia of cells of the plasma-cell series, to reach the initial level in the distant lymph glands and to exceed it in the regional glands. The exception was the spleen, where plasmolysis only ceased on the 15th day and was not followed by hyperplasia. At later periods the normal plasma-cell response was restored.

Analysis of the results in Table 1 shows that regardless of the initial number of cells in the various lymph glands it was almost equal at different phases of the response. The initial state of the gland thus had no effect on the level of its response to the fracture.

The character of the eosinophil response in the lymph glands differed from the character of the plasma-cell response. The eosinophil response was sharply increased after 6-12 h in the spleen and in all glands ($P < 0.05$) except the inguinal and popliteal. On the 2nd and 4th days, at the period of maximal plasmolysis, it was increased ($P < 0.05$) in all glands and in the spleen, and it remained high throughout the period of investigation. The opinion is held that the appearance of eosinophils is a more delicate and rapid test of changes in the antigenic composition of the tissues [3] than the appearance of plasma cells. Possibly in this case also the eosinophilia in the lymph glands was evidence of such antigenic changes.

If the phases of plasmolysis and hyperplasia are regarded as reflecting stages of increased secretion of glucocorticoid and antiinflammatory hormones of the adrenal cortex in response to trauma, i.e., the stages of shock and adaptation [1, 2], then in animals with a fracture of both legs the first stage lasts 4 days and the second ends on the 10th day.

Contrary to the assertion of Gurvich et al. [1] that the phase of plasmolysis cannot be detected in the spleen and inguinal lymph glands because of their low initial number of plasma cells, a significant decrease in the number of cells in these organs, and also in the popliteal glands, was demonstrated in the present experiments. The decrease in the number of cells in the spleen on the 5th and 10th days after trauma, when plasma cell production in all lymph glands is back to normal or exceeds normal, indicates that this decrease was due to other causes than hormonal.

The results show that trauma such as a closed fracture of the long bones, uncomplicated by detection, is accompanied by simultaneous changes, characteristic of stress, in the plasma-cell and eosinophil responses in all lymphoid organs.

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