The Effect of Growth or Retrogression of a Transplantable Lymphosarcoma of the Rat on the Lymphoid Organs and the Adrenals of the Hosts

James B. Murphy, M.D., and Ernest Sturm

(From the Laboratories of The Rockefeller Institute for Medical Research, New York 21, N. Y.)

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The material used in this investigation was a rapidly growing, transplantable lymphosarcoma of the rat, which has been propagated in this laboratory since 1940 (2). The cells of this tumor inoculated intraperitoneally give rise to typical leukemia, but if inoculated into the subcutaneous tissue of the groin, a localized sarcoma develops that may metastasize to regional lymph nodes but rarely progress to generalized disease. At present, the tumor takes in from 60 to 70 per cent of the inoculated animals and, when progressive, grows rapidly to a very large size, causing death in about 20 days. In the routine autopsies on the inoculated rats, considerable variations were noted in the size of the lymphoid organs. An analysis of these observations follows.

OBSERVATIONS

The weights of the thymus, pooled cervical and axillary lymph nodes, spleen, and adrenals were taken on these organs from 159 rats made up of the following groups: (a) 53 rats with actively growing tumors, (b) 71 rats with tumors in various stages of retrogression, and (c) 35 normal rats of the same strain, age, and average weight, which had been kept under the same laboratory conditions as the inoculated animals.

The average weights of the organs from the three groups are given in Table I and the percentage variation from the normal is shown graphically in Fig. 1. It will be noted that the most pronounced difference is between the weight of the lymphoid organs of the rats with progressing tumors and those with retrogressing tumors. The average thymus weight of the group with progressing tumors, in the 31 of the 53 rats which showed detectable thymus tissue, was only 38 per cent of the average weight of the normal thymus. The average weight of this organ from animals with retrogressing tumors was increased by 49 per cent over the normal. The spleen showed a comparable loss of weight in rats with growing tumors but in animals with retrogressing tumors the increase in the size of the spleen over the normal was not so pronounced as was that shown by the thymus and nodes. The organs from one group of animals are illustrated in Fig. 2.

In light of the previously reported indications (3, 4) that the adrenals and cortical hormones have an influence on the animal’s resistance to this transplanted disease, the variations in average weights of these organs has an added interest. The glands from both the groups, one with growing tumors and the other with retrogressing tumors, showed a definite hypertrophy. In the former the increase in weight of the adrenals was 26.4 per cent over the normal, while in the latter the increase was 36.5 per cent. The average weights of adrenals from 16 rats in which the tumors had completely retrogressed were 55 per cent over the normal. Further analyses of the weights of adrenals from rats with retrogressing tumors show that those from animals killed 15 days after inoculation averaged 37.3 mgm. (22 rats) while those from animals killed from 25 to 29 days after averaged 49 mgm. (26 rats), an increase over the normal of 53 per cent.

DISCUSSION

The marked loss in weight of the principal lymphoid organs in animals with a rapidly growing lymphosarcoma may be the result of an uneven competition between the malignant and normal lymphoid cells for some essential nutritional factor. The definite hypertrophy of these organs, particularly the thymus and lymph nodes in rats with retrogressing lymphoid tumors, is not immediately explainable. In a previous study of the lymphoid organs in mice resistant to inoculated carcinoma, it was noted that there was a hyperactivity in the lymphoid tissues manifested by increase in mitoses, size of germinal centers, and numbers of cells in the circulation, but there was no consistent increase in weight of the lymphoid organs (1). Excessive amounts of adrenal cortical hormone

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may reduce the size of lymphoid organs to as great an extent as that which occurs in the animals with rapidly growing lymphosarcoma. Even though such animals have some hypertrophy of the adrenals it is doubtful whether this is sufficient to account for the extent of the change. An even greater hypertrophy of the gland in rats with retrogressing tumors is not sufficient to prevent the great increase in weight of thymus and nodes found in such animals. In fact, the extent of this increase in thymus and nodes is similar to that observed to follow the complete removal of the adrenals.

**SUMMARY**

The weight of thymus, lymph nodes, and spleen from rats with actively growing transplanted lymphosarcoma are much reduced from the normal weights of these organs, the thymus by 62 per cent, nodes by 56 per cent, and the spleen by 55 per cent. Conversely, these organs are definitely increased in weight in rats bearing tumors in the process of retrogression. The lymph nodes show an increase of 89 per cent, the thymus 49 per cent and the spleen 21 per cent over the normal. The adrenals of rats with progressing tumors were found to average 25 per cent above the normal weights of these organs, while those from animals with retrogressing tumors had an increase of over 30 per cent. In the latter group the degree of hypertrophy was more marked when complete retrogression of the tumors had taken place (53 per cent).

**REFERENCES**

1. Murphy, J. B. The Lymphocyte in Resistance to Tissue Grafting, Malignant Disease and Tuberculous Infection. Monograph No. 21, of The Rockefeller Institute for Medical Research. 1926.


Figure 1
Percentage Variations from the Normal in Weights of Lymphoid Organs and Adrenals from Rats with Lymphosarcoma

- from normal rats
- with progressing tumor
- with retrogressing tumor
FIG. 2

<table>
<thead>
<tr>
<th>Tumor size</th>
<th>Spleen</th>
<th>Thymus Mgm.</th>
<th>Spleen</th>
<th>Thymus</th>
<th>Mgm.</th>
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<td>287.8</td>
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