

## A STUDY OF SOME HISTOMORPHOLOGICAL CHANGES IN THE LYMPHORETICULAR APPARATUS OF ADULT RATS FOLLOWING THYMECTOMY

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The thymus is the chief lymphoid organ at the time of birth. It is formed earlier as compared to peripheral lymph nodes and spleen, and contributes to their development in the embryonal and early postnatal period (J. Miller et al, 196<sup>o</sup>; J. Miller, P. Ducor, 1967).

Removal of the thymus in the embryonal and early postnatal period of life leads to serious derangements within the organism (Z. Kemileva 1966; J. Miller, P. Ducor, 1967). It has been demonstrated that lymphocytes play an essential role in the immune reactions of the organism (J. Cowans, 1965), and also that the thymus and its analogues control the immunological competence of lymphocytes (Metcalf, Bumby, 1967; Warner, 1967; Burnet, 1968).

Histomorphological studies in newborn thymectomized mice and rats have shown a strong reduction of the number of small lymphocytes in all tissues (J. Miller, 1961, 1962; Waksman et al, 1962). In congenital thymus hypoplasia no T-lymphocytes are produced, and this conditions the occurrence of disorders in cell mediated immunity (I. Valkov, 1975).

No literature data are available concerning the influence of thymectomy on peripheral lymphoid organs in adult animals, which fact led us to undertake the present research.

### Material and methods

Forty-eight adult male white rats of the Wistar line, weighing 150—200 g were used in the experiment. The animals were divided up in two groups: A — experimental group, thymectomized, 30 rats; B — control, nonthymectomized, 18 rats. Fifteen days after thymectomy, 5 experimental and 3 control animals each were sacrificed at 7-day intervals. Material for histomorphological investigation was obtained from the following organs: lymph nodes, spleen, liver. After fixation in 10 per cent neutral formol, pieces of the mentioned above organs were treated with the paraffin method. The sections were stained with hematoxylin-eosin, after Gomori for reticular fibers, with azan for connective tissues, and toluidine blue for acid mucopolysaccharides. The size of lymph follicles was measured with micrometer.

### Results

The size and form of the lymph nodes and spleen in the test animals, killed fifteen days after thymectomy, do not differ from those in the controls. The histomorphological study disclosed preserved structure of the lymphoid organs: the lymph nodes are with clearly outlined cortical and medul-

lary parts. Their lymph follicles are round or ellipsoid, with cleared embryonal centers, built up of lymphoblasts and peripherally situated dark rings of mature lymphocytes. Mitotic activity within the embryonal centers is slightly reduced. Histiocytes, monocytes and isolated plasmacytes are seen between the lymph follicles and within the medullary zone; the

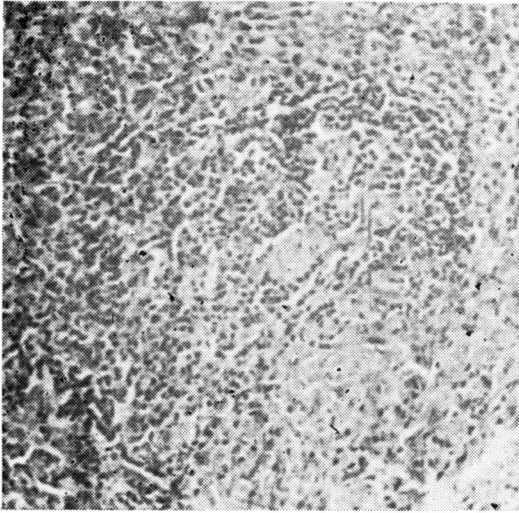


Fig. 1: Reduced mitotic activity and presence of macrophages in the lymph follicles; magnif.  $10\times 10$ , st. hemalaun-eosin.

spleen of thymectomized rats has a preserved follicular structure. The number, size and structure of its lymphatic follicles are intact. The reticuloendothelial elements similarly show no variations from the normal picture.

Among animals killed 22 and 29 days after thymectomy, similarly no appreciable morphological differences in the lymphoid organs are established by comparison with those in the controls.

In animals sacrificed on the 36th, 43rd and 50th post-thymectomy day, clearcut changes in the lymphoid organs are discovered, intensifying parallel with the time elapsing after thymectomy. At about 50 days, the size of the lymph nodes and spleen decreases by nearly 25—30 per cent. The embryonal

centers of the lymph follicles lack clear cut differentiation, whilst the mitotic activity of histiocytes and reticuloendothelial cells disappears almost completely. Within the atrophic embryonal centers macrophages, as well as isolated immature lymphocytes occur (Fig. 1). The peripheral ring of the lymph follicles, built up of small lymphocytes, undergoes marked reduction and narrowing. Plasmacytes show a considerable decrease, and in some preparations they are altogether absent. Within the medullary zones' sinuses of lymph nodes swelling and hyperchromatism of the reticuloendothelial cells is established. The histomorphological structure of the spleen in thymectomized animals is preserved intact till the end of the experiment, but the lymph follicles within them are reduced in size and amount. Also reduced is the number of mature lymphocytes whose size and staining capacity remain within normal limits. The quantity of mature plasmacytes is small.

Dystrophic changes, manifested in a varying degree, are observed in the liver of all thymectomized rats, regardless of the post-thymectomy period. Here the reticuloendothelial cells, the Kupfer's cells in particular, are augmented in number and size, displaying marked hyperchromatism of the nuclei (Fig. 2).

The number of lymphocytes in the peripheral blood decreases progressively throughout the experimental period. In the control animals no changes in the histological structure of lymphoid organs and in the peripheral blood lymphocytes are established.

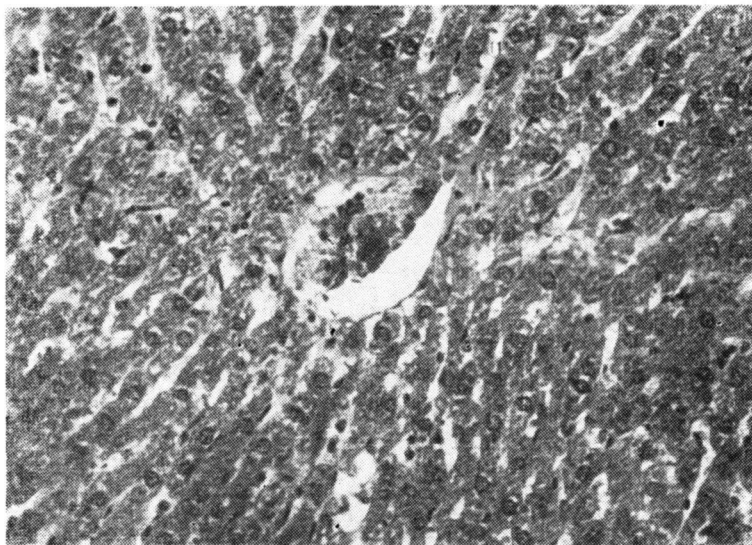


Fig. 2: Liver with heavy parenchymatous dystrophy and activation of reticuloendothelial cells; magnif.  $10\times 20$ , st. hemalaun-eosin.

### Discussion

Our study proves that thymectomy in adult animals exerts no essential effect on the general condition and behaviour of animals, so characteristic of thymectomy performed in newborns (D. Miller, P. Ducor, 1967). Thymectomy in adult white rats does not lead to a complete reorganization of the structure of lymph nodes and spleen. A gradual reduction in the number of small lymphocytes within the lymphoid organs is noted. The embryonal centers of the lymph follicles in the lymph nodes decrease or virtually disappear, the size and number of follicles in the spleen decrease, whereas the size and number of Kupffer's cells in the liver is noticeably augmented. Hence, thymectomy exerts a marked inhibitory effect on the development of peripheral lymphoid organs, and impairs regeneration and differentiation of the cell elements.

J. Miller, P. Ducor (1967) explain such influence by the following mechanisms: 1) the small lymphocytes or their precursors, derived from the thymus, "settle" within the peripheral lymphoid organs; 2) the formation and maturation of peripheral lymphocytes is induced and controlled by certain thymus-produced acellular factors. The fact that transplantation of thymus to young thymectomized animals of the same line precludes the occurrence of immunological disorders is in support of the mechanisms outlined above. It is presumed that the thymus cells penetrate the peripheral lymphoid organs, and thereby give rise to a new generation of lymphocytes.

To demonstrate the hormonal influence of thymus exerted on the lymphoid organs, D. Osoba and J. Miller (1964) implanted thymus tissue in a special microporous chamber, impermeable for thymus cells, and observed restoration of the impaired immunological reactions in thymectomized animals. Our results give us sufficient reason to accept the thesis proposed by the authors cited above.

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**НЕКОТОРЫЕ ГИСТОМОРФОЛОГИЧЕСКИЕ ИЗМЕНЕНИЯ  
В ЛИМФОРЕТИКУЛЯРНОМ АППАРАТЕ ВЗРОСЛЫХ  
КРЫС ПОСЛЕ ТИМЭКТОМИИ**

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РЕЗЮМЕ

Проведены гистоморфологические исследования у 44 взрослых крыс мужского пола, породы «Вистар», разделенных на две основные группы: А — контрольная, нетимэктомированные, и Б — опытная, тимэктомированные.

При гистоморфологическом исследовании обнаружено уменьшение величины лимфатических фолликулов лимфатических узлов, а также селезенки у тимэктомированных животных. Их структура менее ясная, а также неясна и граница с окружающей тканью. Число лимфоцитов умеренно уменьшено. На месте зародишных центров обнаруживаются ретикулоэндотелиальные клетки, гистиоциты, макрофаги, накопление клеточного детрита и гемосидерина.

В печени наблюдается увеличение числа и величины ретикулоэндотелиальных клеток и, прежде всего, купферовских клеток.

Полученные результаты дают основание принять, что тимэктомия у взрослых крыс оказывает подавляющее влияние на периферические лимфоидные органы.