American Journal of Advanced Scientific Research (AJASR)
ISSN: 2195-1381
Vol. 2 Issue 9, January – 2024, Pages: 38-40

Age-Related Involution Of The Thymus

Kiyomov Ikhtiyor Ergashevich, assistant

Islamov Shavkat Erjigitovich, DSc, Associate Professor

Samarkand state medical university, Samarkand, Uzbekistan

E-mail: shavkat.islamov.1972@mail.ru

Abstract. The article is devoted to age-related involution of the thymus. It has been established that with pronounced atrophy, the thymus still performs its function and supports the differentiation of T cells. Apparently, age-related involution is a quantitative, not a qualitative process, since there is evidence of full-fledged proliferation of thymocytes and rearrangement of TcR in the aging thymus. In addition, from a histological point of view, the residual zones of the cortex and medulla look normal and remain immunocompetent, and the role of the thymus in the renewal of the peripheral pool of T lymphocytes after antiretroviral therapy, chemotherapy and transplantation of hematopoietic stem cells in adults has been noted.

Key words: thymus, age-related involution, influencing factors, characteristic features.

INTRODUCTION.

A characteristic feature of the thymus is age-related involution. Age-related involution results in an increase in the incidence of infectious and autoimmune diseases, as well as a decrease in the effectiveness of vaccination in old age. Age-related involution is an irreversible and normal physiological process, just like the aging process. During involution, the percentage of fats and collagen increases, and water decreases. The size of the organ as a whole also decreases. Thymus involution is characteristic not only of mammals, but also, for example, of fish - involution after puberty has been shown in zebrafish [2,3].

The thymus has its maximum weight in relation to other organs in humans at the age of 1 year. And if we talk about the absolute maximum weight, it is observed at the age of 12 - 14 years. Presumably, this is associated with puberty, since it has been established that sex hormones can cause organ atrophy. After this time, there is a constant decrease in the mass of the thymus by approximately 3% annually [4,5].

The cause has not yet been determined, but there is evidence that mice undergo several cycles of involution and then restoration of the thymus before puberty. Frogs and marmots experience involution of the thymus during hibernation, followed by regeneration upon awakening [6].

First of all, involution affects the cortex – it becomes thinner. The number of thymocytes decreases and the secretory activity of the thymus epithelial cells decreases. In parallel with this, a decrease in the pool of T-lymphocytes on the periphery is observed. By the age of 23-25, changes occur in the medulla. All this leads to changes in the structure of the organ; sometimes it becomes impossible to determine a clear boundary between the cortex and the medulla. Changes in the corticomedullary zone lead to weakening of the barrier function of the corticomedullary border, as a result of which B-lymphocytes and plasma cells penetrate into the thymus cortex. These cells form follicles. Adipose tissue replaces lymphoid tissue mainly in the area of the connective capsule and septa. Significant differences in the ratio between fibroblasts and epithelial cells decrease. The number

of epithelial cells increases. In addition, the number of Hassall's corpuscles decreases with age [8,9].

Normal thymopoiesis is possible only if the thymus stroma is preserved. Age-related involution is primarily associated with its changes. There is an assumption that sex hormones initiate age-related involution, since a clear connection between puberty and thymus involution is observed. Such an effect of hormones on the thymus is possible due to the presence of estrogen receptors on the surface of stromal and lymphoid cells. Obvious immunomodulatory properties, in particular, the initiation of thymus atrophy, are characteristic of B-estradiol. Steroid hormones in general and glucocorticoid hormones in particular affect lymphoid tissue, and the type of effect depends on the hormone dose and the stage of cell differentiation. The same hormone in different doses can cause both apoptosis and proliferation of thymocytes [10].

In one experiment, a significant reduction in the volume of the medulla and cortex, and accordingly the entire organ, was achieved by introducing a β-adrenoreceptor antagonist, propanolol, into the body of a young rat. If the same substances are introduced into mature rats, then no significant reduction in organ mass occurs. This confirms a possible decrease in the expression of β-adrenoreceptors under the influence of sex hormones. These experiments showed how much sex hormones affect the expression of β-adrenoreceptors [7].

However, it is not advisable to unequivocally link involution only with the influence of hormones, since it has been experimentally proven that thymus involution depends to a greater or lesser extent on various factors [12].

For example, with zinc deficiency, regardless of other conditions, thymus atrophy is observed, and at any age. Bearing in mind that such a metal as zinc is needed for the normal functioning of not only lymphoid, but also any other tissue, and with age the amount of zinc in the body decreases, we can say that this also contributes to the age-related involution of the thymus. At the same time, with zinc deficiency, there is constant stimulation of the secretion of glucocorticoid hormones, which have a suppressive effect on lymphoid tissue. A serious argument in favor of the multifactorial nature of the involution process is the presence of age-related involution in mice castrated at the age of 35 days, which, of course, slows down this process, but does not eliminate it completely. Perhaps genetic factors play a role in the involution of the thymus, for example, in Buffalo rats no involution is observed at all [1].

Age-related thymus involution is associated with a decrease in the number of precursors from the bone marrow, and with the death of stromal cells, and with changes in hormonal levels, even with the concentration of cytokines and growth factors inside the thymus, not to mention the effectiveness of T-cell receptor rearrangement, but the specific mechanisms causing age-related involution have not yet been determined [11].

Conclusion. However, even with pronounced atrophy, the thymus still performs its function and supports T-cell differentiation. Apparently, age-related involution is a quantitative rather than a qualitative process, since there is evidence of full-fledged thymocyte proliferation and TcR rearrangement in the aging thymus. In addition, from a histological point of view, the residual zones of the cortex and medulla appear normal and remain immunocompetent, and a role for the thymus in the restoration of the peripheral T-lymphocyte pool after antiretroviral therapy, chemotherapy, and hematopoietic stem cell transplantation in adults has been noted.

References.

1. Adaybaev T.A. et al. Morphology of the thymus gland in early ontogenesis in white rats // Bulletin of the Kyrgyz-Russian Slavic University. - 2020. - Vol. 20. - №9. - P. 154-156

2. Breusenko D.V., Dimov I.D., Klimenko E.S., Karelina N.R. Modern concepts of thymus morphology // Pediatr. - 2017. - Vol. 8. - №5. - P. 91-95. doi: 10.17816/PED8591-95

3.Veremeyenko D. Stopping human aging. Immunity begins to age already at 12-14 years / D. Veremeyenko. URL: http: // nestarenie.ru / starenie-immuniteto.html. 12/30/2014.

4. Vychugzhanina E.Yu., Koledaeva E.V. On the influence of thymus hyperplasia on the development of young children // Vyatka Medical Bulletin. - 2015. - №2. - P. 33-34.

5. Grigorieva E. A., Grigoriev S. V., Skakovsky E. R. Morphology of the human thymus in the early postnatal period of ontogenesis // Web of Scholar. - 2018. - Vol. 2. - №5. - P. 11-15.

6. Zasseeva M. D. Changes in the histological structure of the mouse thymus and mitotic activity of thymocytes during accidental transformation and immune response. Abstract of Cand. Sci. (Biol.) Dissertation, St. Petersburg, 2015, 24 p.

7. Kvaratskhelia A.G., Klochkova S.V., Nikityuk D.B., Alekseeva N.T. Morphological characteristics of the thymus and spleen under the influence of factors of various origins // Journal of Anatomy and Histopathology. - 2016. - Vol. 5, №3. - P.77-83

8. Kotyolkina A.A. et al. Morphology of accidental thymus involution in experimental carcinogenesis // Morphological statements. - 2019. - Vol.27. - Issue 1. - P.30-34.

9.Ansari A.R., Liu H. Acute thymic involution and mechanisms for recovery Arch //Immunol Ther Exp (Warsz). – 2017. - № 65(5). – P. 401-420. DOI: 10.1007/s00005-017-0462-x.

10.Chaudhry M.S., Velardi E., Dudakov J.A., van den Brink M.R. Thymus: the next (re) generation. //Immunol. Rev. - 2016. - Vol. 271, № 1. - P. 56-71.

11.Cowan J.E., Takahama Y., Bhandoola A., Ohigashi I. Postnatal involution and counter-involution of the thymus. //Front Immunol. – 2020. - №11: 897. DOI: 10.3389/fimmu.2020.00897.

12.Yan F., Mo X., Liu J., Ye S., Zeng X., Che D. Thymic function in the regulation of T-cells, and molecular mechanisms under lying the modulation of cytokines and stress signaling (Review). //Mol Med Rep. – 2017. - №16(5). – P. 7175-7184. DOI: 10.3892/ mmr.2017.7525