

PECULIARY ASPECTS ABOUT DEVELOPMENT OF THYMUS IN PIGS

ASPECTOS PECULIARES DO DESENVOLVIMENTO DO TIMO EM SUÍNOS

Mariana Sincai¹

Adrian Marcu²

SUMMARY

The morphometabolical development of the thymus has been studied in the pre and postnatal ontogenesis in pigs. The studies pointed that the thymus is organized early in the prenatal period, at about two months of pregnancy. The histochemical investigations pointed out an intense secretory activity for the reticuloepithelial cells and for the thymic corpuscles. The histological investigations in prenatal period revealed a massive presence of thymic corpuscles and the existence of some peculiar cells-myoid cells, whose number rises parallel to the development of the organ. At the growing age it is certain that the thymus does not experience an entire involution; part of the functions are maintained in some secretory and hematopoetical insulary cells.

Key words: thymus, reticuloepithelial cells, thymic corpuscles, myoid cells.

RESUMO

O desenvolvimento morfometabólico do timo foi estudado na ontogenia pré e pós-natal em suínos.

Os estudos indicam que o timo já está organizado muito cedo durante o período pré-natal, por volta dos dois meses de prenhez. Os estudos histoquímicos indicam uma intensa atividade secretora das células reticuloepiteliais e também dos corpúsculos tímicos. Os estudos histológicos no período pré-natal revelaram uma presença maciça de corpúsculos tímicos e a existência de algumas células mióides que aumentavam paralelamente com o desenvolvimento no timo. Quando já adulto não existe uma involução completa do timo pois parte das funções secretora e hematopoiéticas são mantidas por algumas células.

Palavras-chave: timo, suínos, células reticuloepiteliais, corpúsculos tímicos, células mióides.

INTRODUÇÃO

The thymus is a lympho epithelial organ whose organization is almost well known. The researchers of the thymus in the rabbits (ACKERMAN & HOSTELER, 1978), monkis (CHAPMAN & ALLEN, 1971), cats (HWANG et al., 1974), guinea pigs (KOHEN & WEISS, 1964), mice (PERREIRA & CLERMONT, 1971) and human being (BEARMAN et

¹Biologist, PhD, Associated Professor, Department of Cell Biology, Histology, Embriology, Faculty of Veterinary Medicine. C. Aradului, 119/A. 1900 - Timisoara, România.

²BVSc, Assistant Professor, Department of Cell Biology, Histology, Embriology, Faculty of Veterinary Medicine.

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al., 1978; JANOSSY et al., 1980) established that the thymus develops early in embryonic period from the third pharyngeal pouches. The epithelium has an endodermal origin but it is not excluded an ectodermal origin (SMITH & PARKURST, 1949). The epithelial structures become surrounded by mesenchyme which is penetrated by lymphocyte stem cells. Although it is well known that the thymus is both a lymphopoietic and endocrine gland some correlations between epithelial and mesenchymal structures and their functions are still under investigations.

Our research aims to solve some of these problems on the thymus of pigs.

MATERIAL AND METHODS

The investigations were effected on pig thymus in some stages of the prenatal (60, 90, 113 days) and postnatal periods (1, 30, 180 days). The histological studies were effected on slides from tissue stained with the trichrome Mallory method. The histochemical investigations were done through periodic acid Schiff method (carbohydrates), pyronin and methyl green method (nucleic acids), Dorfamn-Epstein method (alkaline phosphatase) and Haller-Muller method (glycosaminoglycans).

RESULTS

The histological investigations of the thymus during prenatal period of 60 days fetuses old revealed the proliferation of epithelial buds from which the thymus will develop. The epithelial bud is enclosed by a mesenchymal tissue that penetrates deeply beginning the process of lobule formation. It was also observed the beginning of lobule differentiation in the two characteristic zones: cortex and medulla.

The histological structure is similar for both zones but lymphocyte density is larger in the cortex. Beneath the capsule in the cortex the lymphocytes are large and frequently in mitosis constituting the stem cells. As the lymphocytes come to maturity they move deeper into the cortex and then into the medulla. Some of the lymphocytes are small and in varied degenerative stages. In the medulla there were observed some epithelial cells which are hypertrophic and wound upon one another in a concentric pattern. These cells form thymic corpuscles or Hassal's corpuscles.

Microscopic examination of the thymus from 90 days foetus old showed a decrease of mesenchymal tissue, an increase of the number of

thymic lobules and an expansion of the medulla. Within the cortex mitotic figures are numerous and resulting lymphocytes migrate rapidly into the medulla and from there many of them leave the thymus through blood and lymphatic vessels.

In the medulla there were observed about 10 or 15 thymic corpuscles in each lobule, some of them being swollen and even keratinized. The cells round the thymic corpuscles were hypertrophic and enclosed small lymphocytes. The central cells became swollen and necrotic with a destroyed nucleus and fragmented chromatin, scattered into the cytoplasm.

The histochemical investigations had revealed for this developmental stage of the thymus that the epithelial structures had an intense secretory activity. In the connective tissue among lobules were observed numerous mast cells. There were also observed many fibroblast detached from surrounding connective tissue which penetrated into the lobules where had become hypertrophic and marked by transverse striations because of a larger accumulation of myosin and actin. These cells are known as myoid cells and were well studied by VAN DE VELAE & FRIEDMAN (1967) and TORO et al. (1969) being frequently observed in birds, reptiles, amphibians and some mammals (cat, rat, cow and pig). The role of myoid cells is not well known. Our investigations revealed more often that myoid cells are placed near by blood vessels and thymic corpuscles.

Investigations effected on thymus from pig foetuses about 113 days showed the following aspects: an increase in the number of thymic lobules, the reduction of connective tissue between lobules, the extension of the medulla, an increase in the number of thymic corpuscles and myoid cells and the intense proliferation of lymphocytes within the cortex and their migration into medulla.

In new-born pigs the histological investigations revealed that the thymus is an organ almost entirely developed at birth able to perform all its characteristic functions until puberty when the organ begins the involutive process. The characteristic phenomena of involutive process were observed in pigs aged 180 days. The histological exam revealed an extension of the medulla, a loss of cortical lymphocytes and was epithelial cells. In the medulla the number of myoid and fat cells was increased. Most of thymic corpuscles were keratinized, necrotic or calcified. Both zones suffered, gradually, a fatty and fibrous degeneration.

The histological and histochemical studies effected on adult pigs pointed out a disorganization of thymic structure, the lobules were lost to sight and in the whole organ prevailed cellular and extracellular components of connective tissue especially collagen

fibres, fibroblasts and fat cells. But in the sclerofibrous tissue were observed some groups of active cells some with endocrine functions and others generating lymphocytes.

DISCUSSION

Our observation made on pig thymus revealed an earlier organization in prenatal stage so that at farrow the thymus is an hematopoetic central organ, completely developed, able to accomplish the secretory functions and the T-lymphocyte production.

The forming of lobules and their differentiation into cortex and medulla takes place early in the prenatal stage and is accelerated at farrow. It is remarkably the presence of thymic corpuscles early in prenatal stage from the very beginning in a great number, phenomenon that can not be correlated with stress states. The number of thymic corpuscles increase with the age. Also with time, they become larger, necrotic and then keratinized. The peripheral cells of thymic corpuscles enclose small lymphocytes in varied stage of degeneration. This phenomenon that was observed frequently had determined us to suggest for the thymic corpuscles a phagocitary function especially of those lymphocytes which could not achieve the maturation process in their way from the cortex into the medulla and could not cross the vascular barrier. The phagocitary function is well known for others epithelial cells (alveolar, vaginal, neuronal).

The histochemical studies effected on pig thymus in all ontogenic stage revealed for both epithelial cells and thymic corpuscles a secretory activity and an intense passing through membranes. Most of this thymic humoral factors are involving in the processes of proliferation, differentiation, maturation and migration of lymphocytes. Those lymphocytes which had not acquired the specific markers on their membranes were phagocytated by thymic corpuscles.

The fibroblasts loosed from connective septae and spreaded through reticuloepithelial cells take part in the synthesis of the extracellular matrix. Some of this fibroblasts augment their contractile proteins: myosin, actin and become myoid cells. Being place nearly capillaries and thymic corpuscles because of their contractile features they contribute to passing of mature lymphocytes into the blood circulation and to distruction into thymic corpuscles of imature lymphocytes. Mast cells that are present in the thymus because of their histamine production cotribute to the contraction of myoid cells. GINSBURG & SACHS (1963) and ISHIZAKA et al. (1976) had demonstrated in tissue culture of thymus the differentiation of mast cells from thymic lymphocytes. Those lymphocytes are not T cells but specially stem cells.

The process of involution started at 180 days revealed hipertrophy of pale striated myofi-broblasts, with a very little actin and myosis content, their

functions in this stage being predominant in the production of collagen fibres and other components of the extracelular matrix which fill more and more the thymus. The fibroblast take part also in fatty degeneration of the thymus being common knowledge that fibroblast have specific receptors for LDL on their membranes.

It is possible that a morphofunctional stimulation of fibroblasts, more and more increases until an involution of the thymus take place to a biostimulatory activity of tymocrescine and other humoral factors elaborated by reticuloepithelial cells.

The persistence of active cellular groups in adult thymus of animal reveal that part of the functions of the thymus are maintained although for a long time.

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