SOME ULTRASTRUCTURAL PECULIARITIES OF THE NUCLEI OF THYMUS EPITHELIAL CELLS

Tz. Marinova, E. Boshnakova

Thymus humoral factors with exclusively important biological activity are synthesized in thymus epithelial cells. That is why these cells have been always the object of numerous investigations. However, as a matter of fact, there are no certain data of their cytological bases and functional activity. Thorough study of the fine structure of epithelial cells (including their nuclei) is obligatory for the detailed histological analysis. Until now we have ultrastructural information only for the size, form and number (10, 11, 13, 14, 17). Therefore, our investigation aims further study by electron-microscope technique.

Material and methods

Thymus particles taken of 13 killed four-month old conventional mice (Swiss-race) were prepared for electron-microscope study by using the standard method: prefixation in 5% glutaraldehyde, postfixation in 1% osmium tetraoxide, dehydration in ascendant alcohols and incorporation in Durcupan ACM. Double contrast with uranyl acetate and plumbum nitrate was applied to ultrathin cuts. Electron-microscope JEM 7A was used in our study.

Results and discussion

Nuclei of epithelial cells from the three regions of a thymus lobe (core, cortico-medullar and medulla) were investigated. All of them possess certain common features. Their size is relatively large. The form is usually irregular: star-like in cortical epithelial cells or rounded and ellipse in medullar cells. One cell possesses (as a rule) one nucleus. The light (shining) appearance of the nucleus is due to the dispersed chromatin (euchromatin) in greater number of epithelial cells, whereas the compact chromatin (heterochromatin) is a scantily located thin layer-stripe near to the inner surface of nuclear membrane.

Considerable electron-microscope differences are registered simultaneously with the aforementioned ones, mainly refering to the characteristics of some non-chromatin nuclear structures, outlines and width of perinuclear space. Their combination makes us suggest 2 basic groups of nuclei. First group nuclei are: with 1 or more reticular spotted nucleoli showing well outlined fibrillar and granular components (fig. 1a, 1b). They have as an exception nucleoli with variable morphology (compact and reticular). Nuclear bodies (sphere-like) are often detected. They are scarce inordered fibriles surrounded by a halo. Some of them are just near to the nucleolus and connected to the perinuclear chromatin. More rare the special componenfs of the nuclear corpuscles are grouped in a definite order. The nuclear membrane of some epithelial cells forms surface or deeper invaginations. The perinuclear space is wider and communicates with broad cisterns of granular endoplasmatic reticulum. The

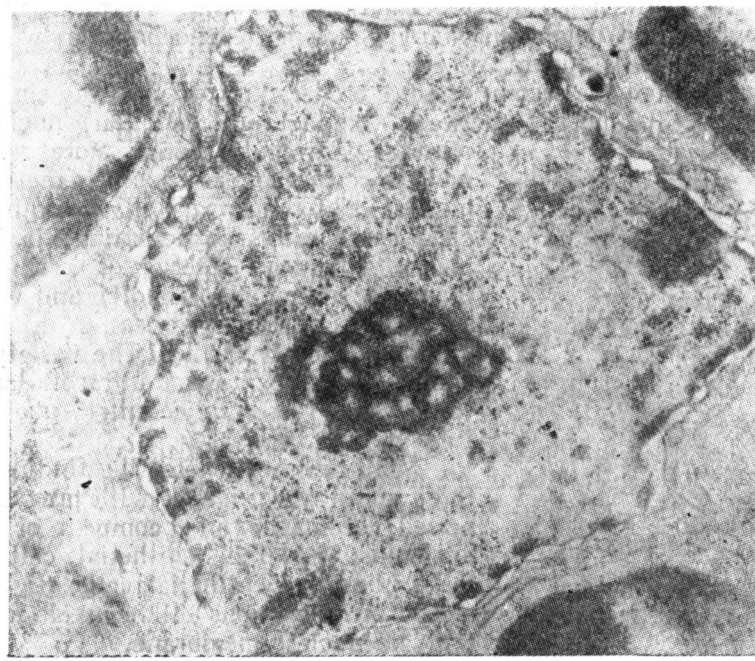

Fig. 1-a: Nucleus of cortical epithelial cell with spotted nucleolus and widened perinuclear space

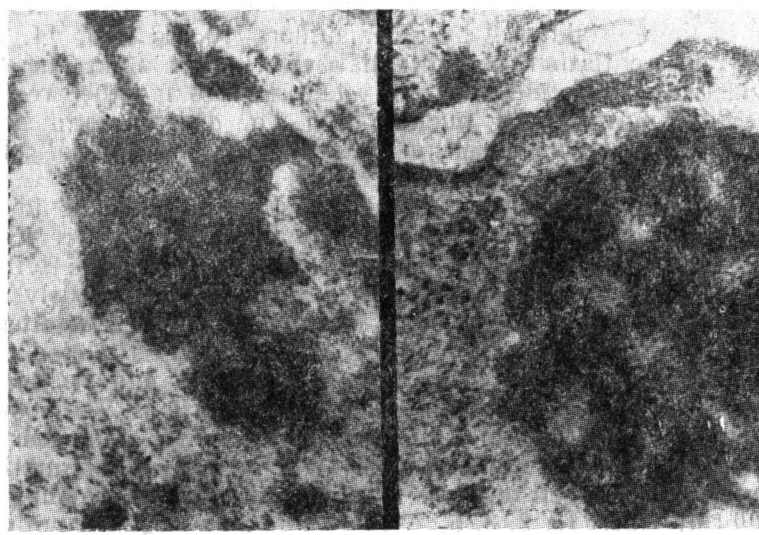

Fig. 1-b: Part of reticular and mixed-type (compact and reticular) nucleolus

latter involve greater part of cytoplasma, often possess electron-lighter homogeneous content and neighbour many polysomes, mitochondria, well formed and developed Goldji apparatus, etc.

The nuclei from the second group are characterized with the single or numerous compact temporary (between compact and reticular) nucleoli with rounded or irregular form. More rare single nuclear corpuscles are found sometimes. The nuclear contours are usually smooth. Perinuclear space shows no deviation; it is combined with narrow cisterns of granular endoplasmatic reticulum, vacuollar and well formed Goldji complex, excess of mitochondria and secondary lysosomes. The variety of vacuollas and the present intracellular cysts is the possible reason of eccentric nuclear location in these cells.

Fig. 2: Part of bi-nuclear epithelial cell

More rare but interesting findings in all three zones were: nuclei with prevailing dispersed chromatin and compact or ring-like nucleolus; nuclei of epithelial cells in mitosis; binuclear epithelial cells (fig. 2); nuclear incorporations like myelo-formations with no nuclear membrane.

Our results show that the nuclei of epithelial cells in every zone of the thymus have common ultrastructural features: they are single, large and light. These peculiarities are similar to those estabiliched by other authors (10, 11, 13, 14, 17) and support the differentiation of epithelial cells apart from mesenchymal reticular and lymphoidal cells. We also established some other regional features concerning most of all nuclear form. The different form corresponds to the total construction of the cell reticulum formed by epithelial cells in the core and medulla of the thymus lobe.

Certain interest arouses the presence of some peculiarities in the fine structure of the nuclei whose combination, similar in all three regions of the thymus, is an important key to the question of the functional activity of epithelial cells. Thus, the nuclei of first group show a homogeneously dispersed chromatin combined with a presence of a reticular nucleolus, also often several nuclear corpuscles in a microscope cut (the morphology is related to type I or «simple» nuclear corpuscles after Dupuy-Coin, A. M. and M. Bouteille — 1972), widened perinuclear space and nuclear invaginations. The combination of these features is regarded to a certain cytologic sign of nuclear activity (1, 7, 8) and due to the exclusively developed granular endoplasmatic reticulum and excess of other cell organels it shows an intensive protein synthesis, mainly for a cell export (1, 2, 3, 6, 7, 15). These data, together with the fact that all thymus humoral factors are most of all with protein origin (5), makes us suggest that epithelial cells of the three regions (zones) of the thymus are engaged (involved) in the synthesis of thymus factors. However, the finely dispersed chromatin in the eccentrically located in the cell nuclei of second group, together with the excess of vesicullar structures and intracellular cysts

in cytoplasma (objects of our previous investigations — 4, 12) support the idea of their participation in the synthesis of products with non-protein origin (mucopolysaccharides). The prevailing condensed chromatin and the presence of ring-like or compact nucleolus are signs of low or even absent functional activity (2, 3). The same features established in our present study indicate that small number of epithelial cells do not take part or are not still involved in the synthesis of thymus factors.

The mitotic activity of certain epithelial cells is also interesting concerning the opinion of S. Marie (1964): by mitosis there is a possibility to restore the number of degenerated epithelial cells incorporated in Hassalii corpuscles (in medulla) or of transformed epithelial (in lymphoid) cells (in core). J. Scheiff (1976) reports multinuclear epithelial cells in preparations of mice. According to him the increase in number of the nuclei relates to the age involution of thymus which requires further our investigations of mice Swiss concerning age.

The established and reported peculiarities of the fine structure of nuclei support and prove our previous conclusions for a definite morphological heterogenicity of thymus epithelial cells being the base of their various functional activity.

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НЕКОТОРЫЕ ОСОБЕННОСТИ УЛЬТРАСТРУКТУРНОЙ ХАРАКТЕРИСТИКИ ЯДЕР ЭПИТЕЛЬНЫХ КЛЕТОК ВИЛОЧКОВОЙ ЖЕЛЕЗЫ

Ц. Маринова, Е. Бошнакова

РЕЗЮМЕ

Исследована тонкая структура ядер эпительных клеток вилочковой железы 13 четырехмесячных мышей породы Swiss, забитых посредством декапитации. Описаны ультраструктурные характеристики, общие для всех ядер. Наряду с ними обнаружены и определенные различия в тонкой структуре ядер эпительных клеток, принадлежащих к различным областям вилочковой дольки, с одной стороны, и к одной и той же области, с другой. Эти различия связаны главным образом с формой ядра, характеристикой некоторых из нехроматиновых ядерных структур, ядерным контуром, а так же и с широтой перинуклеарного пространства. Установлена закономерность в сочетании особенностей тонкой структуры ядра и цитоплазмы, которая связана с функциональной активностью эпительных клеток.