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MORPHOFUNCTIONAL CHARACTERISTICS OF SKINS OF RATS OF VARIOUS AGE GROUPS AT LOCAL COOLING

ABSTRACT

In this article, modern ideas about the structure of skin integuments of animals of different age groups are revealed. The features of the structure of the epidermis in sexually mature and immature animals are described. It is shown that the age-related changes in the dermis are associated with a decrease in the number of fibroblasts, a decrease in the amount of collagen and a change in its structure.

Keywords: the epidermis, keratinocytes, melanocytes, Langerhans cells, dermis fibers, the effect of low temperature on the skin.

The epidermis is a constantly renewing system of cells (with a predominance of keratinocytes), in which proliferation, differentiation and apoptosis processes simultaneously support dynamic equilibrium and play an important role in preserving the integrity of the epithelial layer [6].

Physiological regeneration of the integumentary epithelium during the life of the organism occurs continuously, by proliferation of the cells of the basal layer and their transfer to the upper layers to replace the sloughing layers of horny scales [1, 2]. The epidermis regenerates by cellular type. In different groups of animals in different parts of the body, the rate of renewal of the epidermis is different. Thus, the cover epithelium of the ear of the rat is renewed for 34 days, in the mouse for 24 days, for the abdominal region of the rat for 18 days, for the sole of the mouse for 6 days [10]. The duration of the cell cycle in the cells of the basal layer of the epithelium ranges from 20 to 100 hours [3].

Temperature is the most important factor of the environment affecting the human body and animals. The effect of low temperatures on biological objects depends on the degree of phylogenetic maturity of the organism and is realized through various mechanisms in in vitro and in vivo conditions [14].It is known that with deep cooling, there is a significant decrease in Langerhans cells (CL) and the appearance of pronounced degenerative processes in them [9]. At the same time, the form of CR in the epidermis of cells significantly changed: they lost characteristic process, decreased in size, ATPase activity decreased in them. In the terminal sections of the sebaceous glands, Sudanophilia decreased as it increased in the excretory ducts. After a brief cold exposure to the skin in rats, two- and multi-nucleus cells appeared in the basal layer of the epidermis. Their number reached large values (up to 100), and these cells appeared repeatedly, after and after the cessation of the effect of low temperatures [10].

In young rats, the thickness of the skin is approximately 1.2 mm, i.e. it is 1.5-3 times thinner than the skin in adults, 1.5-2 times less than the total surface of the skin. The thickness of the epidermis in the four-month-old rat is small and is about 0.15-0.25 mm, consists of only two or three layers of cornified epithelium and contains more water than in adult rats, which gives the impression of a large thickness of this layer [4,5]. Keratin is absent in the cells of the granular layer.On top of the horny layer of the epithelium, it is also thin. At the age of 7 months the thickness of the epidermis is from 0.25 to 0.35 mm [7]. In the epidermis of 4-month-old rats, the number of Langerhans cells is increased, the number of melanocytes, on the contrary, is reduced. The basal membrane in the epidermis is poorly developed, the number of fixing fibrils is much less, as a result of which the epidermis-dermis connection is less strong [8,9].

Actually, the skin of rats consists of two layers: papillary and reticular. The papillae of the dermis and the intergrowth of the epidermis are poorly developed. The composition of the skin itself includes collagen, elastic and argyrophilic fibers, creating the density of this layer [11]. In the dermis there are connective tissue cells: histiocytes, fibroblasts, monocytes, mast cells, reticulocytes [13]. Fibers and cells are united by an intermediate amorphous substance, which has a great physiological significance. If the young rats in the dermis are dominated by fibers, then with age, there is an abundance of cellular elements and much more amorphous substance [12]. Actually, the skin of rats consists of two layers: papillary and reticular. The papillae of the dermis and the intergrowth of the epidermis are poorly developed. The composition of the skin itself includes collagen, elastic and argyrophilic fibers, creating the density of this layer [11]. In the dermis there are connective tissue cells: histiocytes, fibroblasts, monocytes, mast cells, reticulocytes [13]. Fibers and cells are united by an intermediate amorphous substance, which has a great physiological significance. If the young rats in the dermis are dominated by fibers, then with age, there is an abundance of cellular elements and much more amorphous substance [12].Collagen, elastic and argyrophilic fibers in 4 months thin, delicate, have fuzzy contours, which indicates their unfinished formation. Cellular elements are located between the fibers and along the course of blood vessels. Among the cells there are many more undifferentiated connective tissue cells [16].

The main component of the dermis is collagen, the structure of which is represented in the form of massive bundles of fibrils in the dense fibrous tissue of the mesh layer [14]. About 15% of the collagen in the skin of a young adult rat is included in the «soluble» fractions. With age, there is an increase in the size of dermal fibroblasts, an increase in the content and compaction of the components of their cytoskeleton: even with light microscopy, actin fibrils remain close to each other; the specific content of microtubules and their organizational centers increases. With age, the amount of hyaluronic acid decreases in the basic substance, and the age-related rearrangements in the skin of rats are associated with changes in the quantitative ratios of various glycosaminoglycans [15]. It is known that the total content of glycosaminoglycans at the age of 1 month was 1700 - 2170 μg / g, with aging this value is reduced to 550-800 μg / g [12].

Local cooling is one of the most common environmental impacts that a person experiences in the Far East. Under the action of low temperatures, free radicals, accumulation, in cells in the form of oxygen, singlets to toxic compounds, lead to secondary damage to cellular structures, in particular, signs of an inflammatory reaction. Destructive processes also develop after the termination of the action of low temperature [3].

Skin is a kind of connective tissue,

which has a high metabolic activity. Collagen dermis throughout the life of the animal undergoes intensive renewal. Even more active in the skin is the metabolism of glycosaminoglycans [13]. The half-life of hyaluronic acid in the skin of rats is only 2.5-4 days. While in the skin of immature rats the process of biosynthesis of hyaluronic acid is slower [14].

Thus, in white rats during the reproductive period changes in the thickness of the epidermis and dermis are noted. These differences are most pronounced between animals of 5 and 18 months of age. In animals of 4 months compared with rats 7 months, the thickness of the epidermis is 10.4% higher, and the thickness of the dermis increases by 11.5%. With age, decreased mitotic activity of the epithelium and an increase in the apoptotic index of the structural elements of the skin. In animals 4 months the level of apoptosis and mitosis is higher than in animals of older age.

Conclusion: age affects the morphological features of all structures of the epidermis and dermis, which is especially pronounced with the onset of the period of puberty of animals. With the action of cold on the skin, there are pronounced degenerative processes in all structures of the epidermis and dermis, especially in young immature animals.

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