

EFFECT OF METHYLVINYL PYRIDINE ON THE HISTOLOGICAL STRUCTURE OF RAT SKIN

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Summary: The article describes an experiment in which rats were given an aqueous solution of methylvinylpyridine orally at a dose of 1 mg/kg body weight for periods of 30, 60, 90 days, followed by histological examination of the fine structures of rat skin. Analysis of the results revealed deformation of the stratum corneum and columnar epithelium of the epidermis, as well as disruption of their histological integrity. Thinning of the basal membrane in the dermis was also observed. During active detoxification (intravenous administration of vitamin B1, glucose solutions, glutamine, and ascorbic acid), rapid restoration of the histological structure of the skin was noted.

Keywords: experiment, rats, methylvinylpyridine solution, rat skin, epidermis, collagen fibrils.

ВЛИЯНИЕ МЕТИЛВИНИЛПИРИДИНА НА ГИСТОЛОГИЧЕСКУЮ СТРУКТУРУ КОЖИ КРЫС

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Резюме: Данная статья описывает экспериментальных условиях крысам скармливали водный раствор метилвинилпиридина в дозе 1 мг/кг в течение 30, 60, 90 суток и изучали гистологические изменения в тонких структурах кожи крыс. При анализе полученных результатов выявлены деформация рогового слоя и столбчатого эпителия эпидермиса кожи, нарушение их гистологической целостности. Отмечены случаи утончения базальной мембраны в дерме. При активной детоксикации (внутривенное введение витамина B1, растворов глюкозы, глутамин и аскорбиновой кислоты) наблюдалось быстрое восстановление гистологической структуры кожи.

Ключевые слова: эксперимент, крыс, раствор метилвинилпиридина, кожи крыс, эпидермис, коллагеновые фибриллы.

Introduction. The rapid growth of the chemical industry in our country obliges researchers to comprehensively study working conditions, actively participate in preventing possible harmful effects of chemical compounds on people engaged in various production processes [1,2]. Methylvinylpyridine (MVP), as is known, is a highly valuable substance in the production of synthetic rubber and other materials of great national economic importance. Like all pyridine derivatives, this compound has a damaging effect on the tissue structures of organs in animals and humans [3,4]. Works by a number of authors have established that methylvinylpyridine is very slowly detoxified in the body and can accumulate. The most consistent information on the toxicity of methylvinylpyridine is presented in the works [5,6]. Acute and chronic experiments conducted by researchers by applying drops of methylvinylpyridine to the skin of guinea pigs established the rapid absorption of this compound, which posed a great danger as it led to acute poisoning of the animals. However, despite the available general data regarding skin damage under conditions of direct contact with MVP, the question concerning changes in the fine structures of the skin under conditions of methylvinylpyridine entry into the body and subsequent recovery processes remains completely unstudied. The absence in the literature of necessary histological data, which are of significant scientific and practical interest, prompted the performance of the named topic.

Aim of the study. To investigate in experiment the effect of methylvinylpyridine on the histological structure of rat skin.

Materials and methods. The experimental animals were 30 adult healthy white rats, to which an aqueous solution of methylvinylpyridine was administered orally daily for 30, 60, and 90 days at a dose of 1 mg/kg. After 90 days of the experiment, a group of test rats, along with the administration of methylvinylpyridine, received a complex of vitamins as substances that reduce intoxication. Control animals were similar white rats that received tap water. After the specified periods, the animals'

lives were terminated by instantaneous decapitation. Flaps of skin excised from different sites were used to prepare preparations using various methods of histological and histochemical techniques.

Results. By carefully examining skin preparations taken from animals at 30, 60, and 90 days, during which they daily received the pyridine solution, certain features were noted. They were expressed in loosening of the horny layer, loosening of the spinous and basal layers of the epidermis, and uneven thickness of the basement membrane. The nuclei of the germinal layer cells appeared somewhat enlarged in size. In them, chromatin clumps with significant DNP content were clearly defined. Mitotic phases were often encountered in cylindrical cells. Uneven distribution of RNP in the cytoplasm was observed. Compared to controls, the epidermal ridges everywhere appeared shortened and blunt-ended. The connective tissue papillae of the skin became somewhat smoothed relative to the epidermis. A moderate vascular reaction was noted, manifested by increased blood filling and diffuse leukocytic infiltration of all dermal layers, extending to the subcutaneous zone. At the same time, accumulations of cellular forms of connective tissue were found in all areas of the proper skin. Among them were fibroblasts at various stages of differentiation, histiocytes in a state of phagocytic activity, and mast cells with enhanced metachromasia and degranulation. The fibrous structures of the skin remained without visible microscopic changes. One could only note the disordered arrangement of collagen fibers in the reticular layer. In places between them, wide spaces were observed, against the background of which strongly branching elastic fibers stood out. Argyrophilic fibers were detected in individual areas of the proper skin. They appeared as thin networks along blood vessels or as thickened fragmented formations near collagen bundles at the base of the papillary layer. The finest discontinuous argyrophilic fibers were visible in the vessel walls and near the basement membrane. Skin derivatives and nerve fibers remained without visible changes under the microscope. Occasionally, slit-like spaces were noted between them, through which leukocytes and erythrocytes penetrated into the subendothelial layer. In the middle coat of vessels, in places, dissociation between

muscle cells and accumulations of small groups of lymphocytes were visible here. In the glandular structures of the skin, peculiar changes were also noticeable. The cells of the sebaceous glands were significantly hypertrophied, with increased lipid content in their cytoplasm. The large nucleus of secretory cells weakly took up dyes. In cambial, germinative cells surrounding the secretory portions, hyperchromasia of the nucleus and cytoplasm, as well as clear unevenness in the distribution of nucleoproteins, were noted. Mitotic phases in these cells were encountered only rarely. Pronounced diffuse leukocytic infiltration of hair follicles was observed. Histological and histochemical deviations from the norm were also found in the nerve fibers of the skin. Thus, we became convinced that methylvinylpyridine, when administered orally to the body, is capable of exerting its negative influence even on peripheral parts of the body, i.e., on the skin cover, which, as is known, is a complex organ with multifaceted functions important for the entire organism. Recovery processes proceed slowly and not immediately after cessation of MVP access to the animals' body. Our studies show that under certain conditions, normalization occurs in the fine tissue structures of the body, including the skin. Thus, by examining skin preparations taken from test white rats at 15, 20, and 30 days after the animals were kept in good conditions without administration of the specified methylvinylpyridine solution, we were able to establish the appearance of the first signs of regeneration of skin tissue elements after 15 days of the aftereffect period. Improvement in the state of tissue structures increased with prolongation of the recovery period. Normalization in the structure of the epidermis, connective tissue structures of the skin, its derivatives, and fine nerve fibers was observed at 30 days after cessation of methylvinylpyridine exposure. Only in places during this period was leukocytic infiltration and increased blood filling of vessel lumens still noticeable. Occasionally, deformed fibroblasts were still observed. More active recovery processes in the tissue elements of the skin of test rats occurred under conditions of administration into their body of substances that reduce intoxication (vitamin B1, glucose, glutamic and ascorbic acids).

Conclusion. The changes arising in the fine structures of the skin under the influence of methylvinylpyridine administered through the digestive tract indicate the resorptive properties of this compound. The changes occurring in the skin are reversible under conditions of a prolonged, at least 30-day, interruption in the cessation of methylvinylpyridine access to the body. A noticeable reduction in intoxication in the body of experimental animals and acceleration of regeneration processes in skin tissue structures altered by methylvinylpyridine occur under the influence of vitamins, glucose, and other biologically active substances.

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