ROUTES OF TOXIC SUBSTANCES INTO THE HUMAN BODY

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Abstract. The entry of poisons into the body, distribution in the body and tissues, metabolism and their excretion from the body are largely determined by the ability to pass through biological membranes, the nature of their interaction with these membranes.

Keywords: toxic, poison, sorption, aerosol, chemicals.

The processes of entry into the body, distribution and transformation that a harmful substance undergoes in the body proceed in time. The way a chemical compound enters the body is determined primarily by the environmental object in which the harmful substance is located, its physicochemical properties, the nature of contact with it, and some other circumstances. In toxicology, there are two main ways that poisons enter the body: exogenous (external) and endogenous (internal).

The distribution of toxicants in the body depends on the chemical structure of the substance and the sorption properties of the tissues of the biological object. The first phase is a dynamic distribution determined by the intensity of blood supply. The toxicant enters the tissues and organs in which the most intense blood flow. The second phase is the redistribution of toxicants with predominant accumulation in tissues, the sorption capacity of which is the highest for these substances. Manganese, chromium, vanadium, cadmium, zinc mainly accumulate in the liver and kidneys. Soluble compounds of lead, beryllium, barium, uranium - in the bone marrow. Ethyl alcohol and urea are relatively evenly distributed. The accumulation of toxicants in certain organs and tissues can have a specific toxicodynamic effect. The general mechanisms of chronic toxicity cannot be understood without considering the relationship between two interrelated processes - cumulation and addiction. Cumulation is the accumulation of a toxicant in the body. Habituation develops when the adaptive and compensatory

capabilities of the organism ensure the preservation of homeostasis at a level compatible with the normal course of basic physiological processes. Otherwise, a pathological condition develops associated with the accumulation of a toxic substance in specific tissues of the body (material cumulation) or the "accumulation" of harmful changes (functional cumulation).

In acute poisoning, chemicals are most often taken orally. The oral route is distinguished by the natural intake of exogenous poisons. A very small part of the chemicals can be absorbed through the mucous membranes of the mouth and esophagus, but this part of the poison does not noticeably affect the nature of the toxic process. Chemicals remain in the stomach for a relatively long time. A significant part of them in the main way of simple diffusion is absorbed into the stomach. Many factors influence the rate of absorption of poisons. The rate of absorption of a poison is often proportional to its concentration in the stomach. The absorption of poisons can be reduced by food in the stomach, its composition, the speed of mixing food and gastric emptying, the functional state of the mucous membrane that secretes gastric juice, the degree of grinding of the solid, the presence of tablet coatings, etc. Through the respiratory tract, toxic substances enter the body in the form of gases, vapors, aerosols, vapor-gas or vapor-gas-aerosol complexes. This path is of paramount importance, because the absorption of substances occurs from a very large surface of the pulmonary alveoli (100-120 m2), much larger than the area of the suction surface of the alimentary canal and skin. The penetration of vapors and gases from the alveolar air into the blood obeys the law of simple diffusion, according to which the process of transition of substances from a gaseous medium to a liquid occurs due to the difference in partial pressure and continues until the equilibrium of concentrations in both phases is reached. The distribution of volatile compounds between the liquid and gaseous phases at the moment of equilibrium is characterized by the Ostwald distribution coefficient, the value of which can be used to judge the rate of blood saturation with volatile substances. The lower the distribution coefficient, the

faster the equilibrium is reached and the blood is saturated. The physicochemical properties of substances, and first of all, the value of the solubility coefficient of vapors in the blood, significantly affect the amount of the substance entering the blood from the air, as well as the rate at which equilibrium is established between the content of the substance in the air and in the blood. So, substances with a high solubility coefficient (alcohol, acetone) pass from the air into the blood for a long time, compounds with a low solubility coefficient (hydrocarbons) quickly reach a concentration between the blood and air. Highly soluble substances (hydrogen chloride, ammonia) can be absorbed into the blood from the upper respiratory tract. Coarse dust or liquid aerosol settles mainly in the nasal cavity, in the nasal part of the pharynx and trachea, a significant part of it is swallowed. Particles up to 1-2 microns in size penetrate into the alveoli. Molecules of vapors and gases adsorbed on dust particles can enhance or weaken the effect of aerosols. In the process of self-cleaning of the respiratory tract, the particles that have settled on the mucous membrane, together with the mucous membrane, move up and are gradually removed from the body. But in the case of water-soluble toxic aerosols, resorption of poison can occur along the entire length of the respiratory tract. The inhalation route of intake is close to internal administration, since in this case the substances bypass the protective barrier of the liver. In the digestive canal, absorption can occur in all departments. The peculiarity lies in the fact that when absorbed through the mucous membrane of the mouth and rectum, chemical agents enter the bloodstream, bypassing the liver. All lipid-soluble compounds, phenols, cyanides are absorbed from the oral cavity. In the acidic environment of gastric contents, chemicals can break down to form more toxic compounds. Since the solubility of substances in gastric juice is much higher than in water, the risk of exposure to this route of entry increases. Thus, lead compounds, which are poorly soluble in water, dissolve well in gastric juice and are therefore easily absorbed. Most of the toxic compounds that are absorbed through the wall of the digestive canal into the blood enter through the portal vein system into the liver

and are neutralized. Changing the pH of the gastric contents affects the degree of ionization of exogenous poisons and their absorption. Oil solutions of toxic substances are not absorbed in the stomach, but in the intestines only after the oil has been emulsified by bile acids. Vomiting as a protective reaction of the body helps to remove poison from the stomach and thereby reduce intoxication. However, in case of poisoning with caustic fluids, vomiting leads to a more severe burn of the esophagus and mouth, and sometimes to damage to the upper respiratory tract. Through the skin, poisons penetrate the body quite often, although not always in such doses that lead to the formation of a pronounced pathological process. Working with toxic substances without skin protection, inept or improper use of dosage forms in self-treatment, and a number of other conditions can lead to the development of acute intoxication when the poison enters the body percutaneously.

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