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Toxicocinetics of gold nanoparticles and carbon nanotubes on the visceral system of experimental animals with cancer

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Introduction: The main researches of toxicokinetic and nanoparticles focus on studies related to the assessment of biological and toxic effects of nanoparticles, as well as possible future use as a means of drug delivery and diagnostic purposes. Study the most general laws of the biological and toxic effects of nanoparticles, depending on their shape, size, form factor, the source material, surface area, surface charge, impurities and other physical and chemical characteristics of the structure and the mechanisms of their effects on cells and tissues, consider topical issues nanotoxicology. Equally important are the studies that determine the dose, route of delivering and the concentration of nanoparticles in the target organ, duration of exposure [5, 8]. The purpose of this study was to investigate the reactions of the structure of the mucosa of the gastrointestinal tract in CBA mice at inserting of oral multi-walled carbon nanotubes, and also consider the features of overcoming the epithelial barrier, intestinal absorption and renal responses.

Methods: During the study the different parts of the gastrointestinal tract and kidneys 60 CBA mice (vivarium TIBOH FEB RAS) after oral inserting of nanotubes for 1, 2, 3, 4, 5, 6 days. To eliminate the effect on the proliferative activity of epithelial cells of the mucous membrane of the gastrointestinal tract of estrogen in the experiments involved only male mice. Biopsy specimens were carried out in accordance with the "Rules of the work with experimental animals" from 12/08/77. Gastric biopsies were taken in accordance with the gold standard of WHO cardia, fundus and antrum. The collected material was sliced to semithin tissue sections of gastrointestinal tract and kidneys, which were stained with hematoxylin-eosin. Analysis of the material held on the microscope Olympus Bx51 (Japan) with a digital camera, CD 25, and proprietary software for morphometric studies.

Results: During the experiment, there was a migration of nanotubes through mucosal barrier, the epithelium and its basement membrane. Nanotubes on the first day of the experiment are identified at the level of mucosal mucosal barrier wall of the esophagus, cardiac, fundal and antral. On the second and third days in the wall of the mucosa of the duodenum, small intestine and colon nanoparticles overcome mucosal, epithelial barrier, where they are identifiable by light microscope. The second face of nanotubes passing through the stage of the epithelial barrier is directly cytoplasm of the epithelium.

Discussion: First nanotubes occupy border position in the apical part of the epithelium, then they reach the basement membrane of the epithelium, where they are arranged in a line parallel to the basal membrane. In case of oral insertion of nanotubes reaction and permeability of the epithelium of the mucous membrane of the intestine is most pronounced compared to epithelial cells of the mucous membrane of the stomach, duodenum, small intestine and colon. According to our data, the morphological picture of the distribution of nanotubes in the epithelium is similar to that in the microbial contamination of Helicobacter pylory of mucosa shells of the gastrointestinal tract. In the absence of receptor recognition of nanotubes due to the presence of certain chemical properties, as part of a short-term experiment, there is only contamination of nanoparticles in epithelial cells. In this case, we have noted as a defensive reaction of the mucous membrane increased secretory activity of the glandular epithelium. In general, we observed that the multi-walled carbon nanotubes do not have a pronounced toxic effect on the body CBA mice with short-term experiment. Despite this, it is necessary to point out some of the nanomaterial immunogenicity and increased migratory activity of the cells, which is manifested in the lymphoid infiltration.

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