Nanomedicine for targeted treatment of tumor diseases

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Cancer is the second leading cause of death in developed countries. It is known that standard antitumor therapy has a number of serious adverse biological effects. One of these is the lack of selectivity for tumor tissue, resulting in significant side effects. The relatively low therapeutic concentration of the active compound often results in drug resistance and multi-resistance of tumor cells. Nanotransporters for targeted treatment are a modern and effective way of personalized approach. Carbon, gold, silver and other nanoparticles can be used as the basis of the nanotransporter. Nanoparticles can enter a cell independently of its type and functional group attached to the surface of the nanoparticle. Various in vitro and in vivo studies have shown that many functionalized nanoparticles are biocompatible. The physico-chemical properties of nanoparticles play a decisive role in their potential toxicity. For carbon nanoparticles, shorter and thicker nanotubes have been found to exhibit lower toxicity. Chemically functionalized carbon nanotubes (CNTs) are much better water-soluble and have greater stability in the physiological environment. Attempts to use CNTs to target multivalent ligands in cancer are increasing rapidly. In addition to passive targeting methods based on the enhanced permeability and retention (EPR) effect and the specific acidic environment in the tumor, strategies for actively targeting a selected tumor using ligands or antibodies that increase the specificity of the nanotransporter are also investigated. However, a protein corona plays a major role in the application of nanoparticles in vivo. A protein corona is a cluster of all proteins that can bind to nanoparticles. Protein corona formation is usually associated with a significant reduction in therapeutic potential. Albumin is the most abundant component of the protein corona. It has been shown that the composition of the protein corona depends on the structure and physico-chemical properties of the nanoparticles. However, the effect of surfactants on the structure of CNTs, on the composition and formation of the protein corona, has not yet been studied. In our experiments, the effect of the interaction of bovine serum albumin (BSA) and CNTs was studied. A completely unanswered question is the interaction of nanoparticles with thiol compounds such as low-molecular-weight glutathione or metallothionein. In addition to the above, in some malignant tumors we observe increased expression of albumin receptors (liver, gallbladder, but also breast cancer). This may be advantageous for nanoparticles with a protein corona. Research in this area of nanomedicine is completely open and will certainly bring many unexpected discoveries in the near future.