

Study of changes in biochemical parameters of rats after acute exposure to gold core-shell hybrid nanostructures



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BACKGROUND

Gold nanoparticles (GNPs) are one of nanomaterials widely used for biomedical purposes. Due to large surface area and high sorption capacity, they can be coated by various biomolecules to produce gold core-shell hybrid nanostructures (GHNs). GHNs possess a great potential as agents for diagnostics, controlled drug delivery, bioimaging, cancer treatment, photodynamic therapy, etc. Use in biomedicine arises a problem of GHNs' toxicity towards humans. Therefore, studies of biological effects caused by GHNs after *in vivo* administration are of great relevance.

OBJECTIVES

The aim of this study was the measurement of biochemical parameters of rats after acute exposure to GHNs in order to reveal GHNs-mediated biological action.

MATERIALS AND METHODS

GHNs were obtained on the base of GNPs of a 30 nm diameter synthesized by a reduction of sodium citrate. Then, GNPs were coated by immunoglobulins G by physical adsorption method. After single intravenous administration of GHNs to adult rats in a dose of 1000 mg/kg of body weight, alanine aminotransferase (ALT) and alkaline phosphatase (ALP) were measured in rats' organs and tissues. These parameters were used to evaluate the function of liver which is known to be the target organ for nanotoxicants.

RESULTS

Effect of GHNs on the enzymatic activity of ALT

Organ/tissue	Experimental value, %	Control value, %
Brain	114±8,0	100
Lungs	113±15	100
Kidneys	102±2,9	100
Spleen	109±17	100
Serum	125±15	100
Intestine	108±7,9	100

Effect of GHNs on the enzymatic activity of ALP

Organ/tissue	Experimental value, %	Control value, %
Brain	112±2,9	100
Lungs	107±5,6	100
Liver	115±5,8	100
Kidneys	108±1,9	100
Intestine	101±9,6	100
Serum	115±8,7	100
Spleen	103±7,3	100

The obtained data indicated that the maximum change in the activity of ALT was observed in blood (it increased by 25% as compared to control animals). For ALP, the maximum increase in the activity was recorded in the liver and serum (15% higher than control values).

SUMMARY

Overall, an increase in the enzymatic activity of ALT and ALP after intravenous administration of GHNs indicates the development of hepatic pathologies in rats as a result of acute toxicity of GHNs.

REFERENCES

1. D Cabuzu, A Cirja, R Puiu and AM Grumezescu. Biomedical applications of gold nanoparticles. Current topics in medicinal chemistry. 2015. 15(16): 1605-1613.
2. J Peng and X Liang. Progress in research on gold nanoparticles in cancer management. Medicine. 2019. 98(18):e15311.
3. H Bahadar, F Maqbool, K Niaz and M Abdollahi. Toxicity of nanoparticles and an overview of current experimental models. Iranian biomedical journal. 2016. 20(1):1-11.
4. M Ajdary, MA Moosavi, M Rahmati, M Falahati, M Mahboubi, A Mandegary, S Jangjoo, R Mohammadinejad and RS Varma. Health concerns of various nanoparticles: a review of their in vitro and in vivo toxicity. Nanomaterials 2018 8(9).

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