INFLUENCE OF SELECTED FORMS OF GRAPHENE NANOPARTICLE ON ISOLATED WORKING HYPERTENSIVE HEART EX-VIVO

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Nanotechnology development is based on new knowledge collected from single answers to questions asked in studies like this our team work on. Graphene has attracted our interest as a carbon nanoparticle having specific and unique features. It has single layer structure presenting very high mechanical endurance, unique electrical properties that are different both from metals and semiconductors, can create multilayer nanoparticles of various sizes. Graphene has great potential to be widely used in future. Having free π electrons and many functional groups can be used in electronics and can attract and even transfer active particles with various therapeutic effects. Graphene's nanoparticle features stemming from its small size markedly increase its tissue and cell penetration capabilities. Some carbon nanoparticles can cause platelet activation in blood, alterations of coronary flow through interactions with nitric oxide and also change mitochondrium functions. These effects may be important with regards to wide future graphene utilization. The presence of various forms of carbon in human environment, the probability of carbon intake or inhalation increases possibilities of their harmful actions and increases the risk of damage of various human and animal organs.

In our project we are going to use an isolated heart perfusion methods which allow us to eliminate the unwanted effects coming from other pathomechanisms than these, planned to be followed and analyzed in the study protocol. It is crucial in graphene's multidirectional multiorgan effects. In our case using isolated working heart perfusion allows us also to reproducibly control initial parameters of heart work which is very difficult and depends on many factors in vivo. This study aims at assessment of the effects of four forms of graphene on heart functions and parameters. The tested nanoparticles vary in particle size, number of graphene layers, presence of chemical functional groups. Their action on heart will be tested in normoxia and normothermia in SHR rats (spontaneously hypertensive) and Wistar rats as control. Our tools allow for an analysis of heart as a pump in single cycles of its work. It is possible to analyze the work of heart under modified preload (volume given in vivo) and afterload (arterial pressure and peripheral vessel resistance). With the special features of our computer software, it will be possible to perform some additional post-hoc analyses if required. Graphene forms will be administered in two concentrations. Their action can alter the cellular structure and we plan to analyze this in histopathologic examinations, necrosis markers levels and assessment of heart oedema after the experiment.

The tests and analyses conducted in our project allow to assess the effects of graphene particle (in various forms) on crucial heart work and heart structure parameters, to analyze the influence of hypertension on heart reaction to graphene. It is going to show whether graphene in various forms and two concentrations can alter the endothelium function; coronary flow, diastolic left ventricle function and cause damage of the heart myocytes and its organelle.