Identification of Quercetin-loaded iron oxide nanoparticles in the hippocampus under unilateral magnetic field exposure condition

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The treatment of neurodegenerative diseases is associated with certain difficulties due to the existence of the blood-brain barrier (BBB). Nanotechnology-based delivery systems provide an attractive strategy to cross the BBB and reach the central nervous system. The incorporation of bioactive agents in various nanovehicles facilitate their delivery across the membrane barriers and impact on the target locus [1]. In case of using magnetic iron oxide nanoparticles (MNP) as a drug delivery system, the orientation and location of particles could be controlled by external magnetic field [2], which is characterized by good bioavailability. Thus, it was suggested that exposure of the magnetic field to the brain could have impact on the transport of drug-loaded MNP.

The purpose of this study was to detect the iron containing tabs in the cortical structures of the experimental rats (150-180gr) after intravenous (tail vena) injection of Quercetin loaded MNP (Q-MNP) under unilateral exposure of the magnetic field (1 tesla, 1 hour) on the brain (temporal lobe projection). The administration of the Q-MNP were made after 30 minutes of the magnetic field exposure, and the extirpation of the brain were performed after 80-120 min of the magnetic field removal. The brain was fixed in a Buen's solution, which keeps the iron in tissue well. Perl's Prussian blue stain was used to determine the iron content in brain structures. For the positive control for iron staining was used spleen – the naturally high iron containing structure.

The brain slices from two groups of animals with the right and the left side exposure of the magnetic field were prepared for visualization of the iron tabs and evaluation of their amount. Iron inserts were counted in the CA1/CA3 fields of the hippocampus, in the dentate gyrus and neocortex. In order to determine the influence of magnetic field on the target delivery of Q-MNP, comparison analyses between the numbers of iron inserts in the treated and untreated site were performed. For statistical analyses of the obtained data software PRIZM was used.

Our experiments showed that the number of iron inserts are significantly higher in the magnetic field-exposure site compare with the untreated contralateral site, suggesting that the exposure of magnetic field improves target-delivery of the Quercetin-loaded MNP to the brain.

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Reference

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