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LECTURE

Nanotechnology in early diagnosis and treatment of dementia

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Abstract

The lack of effective treatment for Alzheimer's disease(AD) stems mainly from the incomplete understanding of AD causes. Currently there are several hypotheses which try to explain the early molecular mechanisms of AD pathogenesis. The current pathophysiologic approach is based on a number of common mechanisms of neurodegeneration, including accumulation of abnormal proteins(tau and ABeta), mitochondrial dysfunction, oxidative stress, impaired insulin signaling, calcium homeostasis dysregulation, imbalance of neurotransmitters, early synaptic disconnection and late apoptotic cell death. Considering that AD is a multi-factorial disease with several pathogenic mechanisms and pathways, a multifunctional nanotechnology approach may be needed to target its main molecular culprits. There are still no effective treatments to prevent, halt, or reverse AD. To very early diagnosis of AD we need to have an affordable, ultra sensitive and selective molecular detection methods. Nanomedicine as a biomedical and pharmaceutical application of nanotechnology for making nanocarriers for instance dendrimers has shown great potential not only for diagnosis but the treatment of many CNS diseases such AD. Ultra-low concentrations of protein biomarkers(eg. ADDL- amyloid-Beta-derived diffusible ligands) which have been implicated in the pathogenesis of AD, is possible to detect ,owing to carrier dendrimers.

Dendrimers are polymeric molecules chemically synthesized with well defined shape size and nanoscopic physicochemical properties reminiscent of proteins.

Recently an increasing number of studies have been focused on the potential of dendrimers to prevent aggregation and fibrillation of proteins involved in neurodegenerative disorders such as AD. Some of dendrimers were demonstrated to cross blood-brain barrier, which legitimized research on these compounds as potential drugs for neurological disorders. Recent our studies have revealed that dendrimers possess the intrinsic ability to localize in cells associated with neuroinflammation(activated microglia and astrocytes) and thus can be used in neuroinflammation therapy.

Above/mentioned findings may be significance in the context of potential application of dendrimers as drug carriers or active compounds *per se*. According to the opinion the author's of this presentation ,they are promising macromolecules for further investigations on their applicable in neurodegenerative disorders, for instance AD.

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