

Neurotoxicity of Nanomaterials: Where are we and what can we do?

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The development of nanotechnology and chemistry provides many nanomaterials for disease diagnosis and drug delivery. Since central nervous system (CNS) disorders, such as brain tumor, Alzheimer's disease, and Parkinson's disease, are critical threat to human being, nanomaterials are extensively utilized in CNS disorders diagnosis and management [1]. Although impressive achievement has been made, the application of nanomaterials emerged a new concern: neurotoxicity of nanomaterials. Except the intended application of nanomaterials for CNS disorders, nanomaterials for peripheral disorders may also enter brain, while the nanomaterials even can be transferred into brain after inhalation from air. What's worse, toxicity to brain may lead to serious harm to human being. Therefore, neurotoxicity must be paid with great attention.

Recently, we edited a book named "Neurotoxicity of Nanomaterials and Nanomedicine" [2]. In the book, we generally talked about the application of nanomaterials in brain targeting delivery and the intra-brain distribution and excretion of nanomaterials. Then the neurotoxicity of many kinds of nanomaterials are discussed, including titanium dioxide nanoparticles, iron oxide nanoparticles, silver nanoparticles, gold nanoparticles, manganese-containing nanoparticles, silica nanoparticles, carbon nanotubes, and cationic polymers. Finally, the potential strategies to reduce neurotoxicity of nanomaterials are discussed [3].

Although some studies evaluated the neurotoxicity of nanomaterials, there are many aspects are still far from well-known. Therefore, researchers should pay more effort on the following aspects: 1. The excretion route of nanomaterials from brain, especially for the nanomaterials hard to degradate, such as metal nanoparticles. 2. Factors affect nanomaterials entering brain. Although many nanomaterials are developed for brain targeting, there is still lack of general idea about the properties that influence the transportation of nanomaterials into brain. 3. The mechanism of neurotoxicity of nanomaterials. Most of the current studies discussed general toxic mechanism rather than neurotoxic mechanism. Is there any specific mechanism? We should discover it.

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