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Human stem cells carrying polymer nanoparticles with visible and near-infrared dyes for dynamic imaging of inflammatory focuses in the brain

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The chronic inflammation in the brain is one of the main causes of neuronal cell death and the progression of neurodegenerative disease. Currently, nanoparticles (NPs) are widely used because they have unique properties that make them suitable for diagnostics and treatment. However, NPs face different biological barriers that limit their successful biodistribution. The blood-brain barrier (BBB) is a main and highly selective semipermeable border of endothelial cells that regulates the transfer of solutes and chemicals between the circulatory system and the central nervous system. To solve the problem of overcoming BBB, mesenchymal stem cells (MSCs) have recently become widespread. MSCs have a certain innate homing ability toward the site of inflammation and have thus gained more attention as vehicles for targeted neuroinflammation therapy. The objective of the study was to create a novel, active, and multifunctional platform using human MSCs as a carrier of core-shell polymeric nanoparticles (NPs) loaded with fluorescent dye in near-infrared (NIR) or visible range for dynamic monitoring of lipopolysaccharides (LPS)-induced inflammatory focus in the mouse brain. As a result, the main amount of MSC carried with NPs, is accumulated in the inflammatory focus of the brain. Hence, a potentially useful MSC platform that combines their inflammatory tropism and multimodality NP optical imaging of migration and distribution is proposed for pursuing MSC-mediated theranostics against brain inflammation.

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