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Fabrication of Ligand Coated Lipid-Based Nanoparticles for Synergistic Treatment of Autoimmune Disease

Authors : Asiya Mahtab, Sushama Talegaonkar

Abstract : The research is aimed at developing targeted lipid-based nanocarrier systems of chondroitin sulfate (CS) to deliver an antirheumatic drug to the inflammatory site in arthritic paw. Lipid-based nanoparticle (TEF-lipo) was prepared by using a thin-film hydration method. The coating of prepared drug-loaded nanoparticles was done by the ionic interaction mechanism. TEF-lipo and CS-coated lipid nanoparticle (CS-lipo) were characterized for mean droplet size, zeta potential, and surface morphology. TEF-lipo and CS-lipo were further subjected to in vitro cell line studies on RAW 264.7 murine macrophage, U937, and MG 63 cell lines. The pharmacodynamic study was performed to establish the effectiveness of the prepared lipid-based conventional and targeted nanoparticles in comparison to pure drugs. Droplet size and zeta potential of TEF-lipo were found to be 128. 92 ± 5.42 nm and +12.6 ± 1.2 mV. It was observed that after the coating of TEF-lipo with CS, particle size increased to 155.6± 2.12 nm and zeta potential changed to -10.2± 1.4mV. Transmission electron microscopic analysis revealed that the nanovesicles were uniformly dispersed and detached from each other. Formulations followed sustained release pattern up to 24 h. Results of cell line studies ind icated that CS-lipo formulation showed the highest cytotoxic potential, thereby proving its enhanced ability to kill the RAW 264.7 murine macrophage and U937 cells when compared with other formulations. It is clear from our in vivo pharmacodynamic results that targeted nanocarriers had a higher inhibitory effect on arthritis progression than nontargeted nanocarriers or free drugs. Results demonstrate that this approach will provide effective treatment for rheumatoid arthritis, and CS served as a potential prophylactic against the advancement of cartilage degeneration.

Keywords : adjuvant induced arthritis, chondroitin sulfate, rheumatoid arthritis, teriflunomide
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