Research in Pharmaceutical Sciences, 2012;7(5)
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# Gene Delivery to Cancerous cells in different tissues

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At the most basic level, gene therapy can be described as the intracellular delivery of genetic material to generate a therapeutic effect by correcting an existing abnormality or providing cells with a new function. Initially, inherited genetic disorders were the main focus but now a wide range of diseases, including cancer, cardiovascular disease, neurodegenerative disorders, infectious diseases and other acquired diseases are being considered as targets. Generally, viral vector system show higher gene transfer efficiency than non-viral gene carrier system, but viral systems have potential risk of wild type virus regeneration, immunogenicity and cancer formation.

In this work we present different non-viral gene delivery systems. The first system is a targeted vector, FOL-PEG-g-PEI-GAL, for gene delivery to liver cancer cells. This system was used to deliver Enhanced Green Fluorescence protein Plasmid (EGFP) and luciferase to different cell lines including A549, KB, HEK and HepG2, invitro, which showed high transfection efficiency. According to invivo results, gene delivery to liver cancer, the procedure was well tolerated by the mice; no signs of toxicity were observed but with low transfection efficiency. In another work we prepared and evaluated Chitosan-FAP-B nanoparticles as a novel non viral vector for gene (luciferase) delivery to the lung. Chitosan-DNA-FAP-B nanoparticles were nebulized to mice for targeted gene delivery to the lung. The level of gene expression of Chitosan-DNA-FAP-B nanoparticles in the mice lung was 16-fold higher than chitosan-DNA nanoparticles. This study suggested that Chitosan-FAP-B nanoparticles can be a promising carrier for targeted gene delivery to the lung. However, additional studies will be necessary for improving in vivo gene transfer. We also used an injectable chitosan-based implant for intratumoral gene delivery. In this study a small amount of DNA (10 ug) was delivered by direct i.t. injection by Diethyl methyl chitosan (DEMC) and Triethyl chitosan (TEC). Compared to control, the transfection with i.t. injection increased up to 15 folds with DEMC and 5 fold with TEC. The best TIVR (tumor injection volume ratio) for transfection with DEMC was 0.28. In this study, we introduced an intratumoral injectable system based on a quaternized chitosan derivative for pEGFP delivery to pancreatic cancer tumor which involves simple preparation procedures and can be injected directly into the site, hence should be a useful approach to deliver small amounts of plasmid-based gene for pancreatic cancer local therapy.

Gene therapy has applications across many fields of medicine, particularly the treatment of cancer. The future improvement of present vectors will likely expand the applicability and efficacy of gene therapy. If the current pace of progress is maintained, coming decades should see many products based on this technology being administered on a daily basis for the treatment and prevention of genetic disorders.