Modification of Plasmid DNA-Based Gene Transfer

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Gene therapy based on ultrasound with microbubbles offers a novel approach for the prevention and treatment of variety of diseases. The major development of gene transfer has importantly contributed to intense investigation of the potential of gene therapy in cancer or cardiovascular medicine. The amazing advances in molecular biology have provided a dramatic improvement of the technology that is necessary to transfer target genes into somatic cells. Gene transfer methods have been surprisingly improved. In fact, some of them (retroviral vectors, adenoviral vectors or liposome based vectors, etc) have been used in the clinical trials already. But some severe side effects were reported in clinical gene therapy using such viral, so people desire safe and efficient clinical gene therapy. Recently, ultrasound-mediated gene transfer has been reported to augment the transfection efficiency and facilitate local gene expression. Interestingly, gene transfer into the fetal central nervous system was successfully achieved by intrauterine injection with microbubble-enhanced ultrasound. Compared to other viral vectors, there are some theoretical advantages including safety, simplicity of preparation, and local gene transfer. Thus, we focused on the development of gene transfer using naked plasmid DNA with an ultrasound or microbubble-enhanced ultrasound method.