Novel gene therapy approaches for cancer treatment: potential improvement by the use of magnetic nanoparticles

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Cancer is a highly heterogeneous and complex disease that encompasses a multiple cellular disorders characterized by continuous and indefinite growth. The complexity of this disease at genetic and phenotypic levels implies therapeutic resistance that causes a high number of deaths worldwide. Despite impressive advances in cancer biology, the most common treatments still are chemotherapy, radiation and surgery. Nowadays, innovative technologies such as nanotechnology are promising fields that are being explored as alternatives for cancer treatment. In our laboratory, we explore different novel approaches to contribute to cancer management improvements. We proposed the use of the prooxidative microenvironment of tumors as a feature that distinguishes malignant from normal tissues to direct the expression of therapeutic genes. In this sense, we have developed an oxidative stress response promoter that can sense intracellular ROS levels and can activate the downstream suicide gene expression. In addition, we are also exploring different strategies for chemo and radiosensitization tumor cells through knocking down the expression of chemo-radioresistance gene by small interference RNA. In this context, we are developing different nanocarriers such as immunoliposomes to deliver the nucleic acid. Recently, we explore the use of magnetic nanoparticles to improve the efficiency and selectivity of our nanovehicles. We are optimizing the efficiency of introduction of siRNA in chemo and radioresistance cells by magnetofection and we are also developing immunomagnetoliposomes appointing to improve the accumulation of therapeutic genes in tumors. In this presentation we will report our incipient efforts in this field.