Choindroitinase ABC I-mediated enhancement of oncolytic virus spread and anti tumor efficacy: Mathematical model and numerical simulation

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ABSTRACT

Oncolytic viruses are genetically engineered viruses that are designed to kill cancer cells while doing minimal damage to normal healthy tissue. After being injected into a tumor, they infect cancer cells, multiply inside them, and when a cancer cell is killed they move on to spread and infect other cancer cells. Chondroitinase ABC (ChaseABC) is a bacterial enzyme that can remove a major glioma ECM component, chondroitin sulfate glycosoamino glycans from proteoglycans without any deleterious effects in vivo. It has been shown that ChaseABC treatment is able to promote the spread of the viruses, increasing the efficacy of the viral treatment. In this talk we develop a mathematical model to investigate the effect of the Chase ABC on the treatment of glioma by oncolytic viruses (OV). We show that the model's predictions agree with experimental results for a spherical glioma. We then use the model to test various treatment options in the heterogeneous microenvironment of the brain. In particular the model predicts that separate injections of OV, one into the center of the tumor and another outside the tumor will result in better outcome than if the total injection is outside the tumor.