Optimal control of a chemovirotherapy model

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Abstract: Chemovirotherapy has been developed as a new way of combination therapy used to treat various types of cancer. A mathematical model of chemovirotherapy is adopted [1], with the objective of applying optimal control theory to find optimal doses of the combined treatment required to neutralize the cancer with minimal toxicity. Two control functions are incorporated into the model, the first one represents optimal dose of chemotherapeutic agent while the second one signifies the optimal dose of oncolytic virus to be injected into the patient's body. Pontryagin's maximum principle is followed to get the characterization of the optimal control pair. A fourth order Runge-Kutta algorithm is used to obtain the numerical solutions of the optimality system which is a two-point boundary value problem. Existence and uniqueness theorem of the optimality system is stated. Numerical simulations show that when the optimal control pair is applied the cancer cells are eventually decreased. Thus, the optimal doses obtained should be espoused in order to successfully eliminate the cancer.

Keywords: Chemovirotherapy, optimal control, Pontryagin's maximum principle, Hamiltonian, optimality system

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