Optimal treatment for an heterogeneous in vitro tumor composed of resistant and sensitive cells

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Résumé

We propose to present a mathematical model of heterogeneous tumor growth based on experiments by M. Carré. This model is a competition ODE model and takes into account tumor cells sensitive or resistant to chemotherapy. The originality of the model relies in the control of the resistant cells by the sensitive cells when the chemotherapy only acts on the sensitive cells.
First we prove that this simple model is able to simulate various situations that M. Carré has experimented *in vitro*. Specially metronomic (i.e. low-dose) chemotherapies are more efficient than the classical Maximum Tolerated Dose treatment. This confirms the hypothesis of M. Carré that metronomic therapy take better account of the complex relations of sensitive and resistant cells.
Second, we study optimal treatments to control the global size of the tumor. Such optimal control problems can lead to singular controls of the tumor size. These mathematical results have to be confirmed by *in vitro* experiments, but this work will help in understanding the mode of action of metronomic chemotherapy and thus in calibrating them.

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