New insights in chemotherapy protocols for brain tumours through mathematical modelling

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ABSTRACT

Gliomas are a type of tumor that arises from glial cells and that present a high mortality rate. Medical doctors believe that the main reason for the inefficiency of treatments lies in the high motility of the tumour cells. In this talk we introduce a model for the evolution of tumour cells and concentration of chemotherapy drug based in mass conservation laws. We will present some mathematical studies that can provide some clues for future medical approaches.

Mathematical models for tumour evolution were first proposed in [5], who introduced partial differential equations in this context. Later work by [3,4], based on the principles followed by [5], modelled tumour cells as having two possible phenotypes (or states), proliferative and migratory, allowing cells to transition between both phenotypes. The study of treatment protocols, based upon the partial differential systems that model chemotherapy effects in tumour growth has also received some attention recently, see [1,2].

The model that we will present is an extension of the model proposed in [2] by adding integral terms to account for the rigidity of the brain tissue. The stability of the solution of the nonlinear system shall be addressed. In order to define treatment protocols, the study of the mass of cells will lead to relations between the treatment parameters that allow to control the total tumoral mass. We will also present some simulations illustrating the obtained results.

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