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ON THE OPTIMAL USE OF BEVACIZUMAB IN UNRESECTED GLIOBLASTOMA: AN EVIDENCE-BASED MATHEMATICAL APPROACH

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ABSTRACT

Glioblastoma (GBM) is the most common and aggressive type of brain tumor in adults, with a median patient survival slightly above one year, despite aggressive combination therapy with the alkylating agent temozolomide (TMZ) and radiation therapy. In the last 20 years, little progress has been made, and antiangiogenic therapy was extensively studied in different clinical trials. A small trial by Balaña et al. [1] on unresected glioblastoma followed a very different approach and showed a positive effect on survival. However, the small sizes of groups and toxicity of the therapy limited its clinical implementation.

We propose a simple mathematical model that consists of three ordinary differential equations that describe the interplay between proliferating cells, hypoxic cells (that proliferate slowly) and vascular network. The model construction is based on the Hanhnfeldt et al. model [3]. First, we analyse mathamatical properties of the model. Then, we estimate the model parameters to reproduce the results obtained by Balaña et al. [1] as well as the results obtained by Chinot et al. [2]. Using such simple mathematical model, we try to understand why the Balaña et al. protocol did reach a positive effect and what are the lessons learnt for the clinics.

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