Effect on tumor growth in systems of two different types of tumor-associated neutrophils : A mathematical model

Han Eol CHO [1], Jun Ho LEE [1], and Yang Jin KIM [1,2*]

1) *Department of Mathematics, Konkuk University, Seoul 143-701, KOREA*
2) *Mathematical Biosciences Institute, The Ohio State University, Columbus OH 43210, USA*

Corresponding Author: Yang Jin KIM, ahyouhappy@gmail.com

ABSTRACT

Until recently, the role of tumor-associated neutrophils (TANs) as members of the complex tumor microenvironment has long been ignored due to technical difficulties in tumor biology, furthermore, the role of TANs is controversial because both tumor-promoting and tumor-suppressing effects have been reported. But these neutrophils are emerging as important agents in tumor invasion and metastatic regulation. In this study, we divided into two components depending on the role of TANs: (i) the antitumorigenic neutrophils, called N1 TANs (ii) the tumorigenic neutrophils, called N2 TANs. TGF-beta has been identified as a major cytokine in the tumor microenvironment that induce N2-dominant state and IFN-beta in the tumor microenvironment was shown that enhance N1 TANs and can suppress tumor growth by interacting p53. We developed a mathematical model to investigate the dynamics of tumor growth between tumor suppressive N1 TANs and tumor promoting N2 TANs. The model predicts the dynamics between N1 TANs and N2 TANs in response to various TGF-beta and IFN-beta stimuli. In addition, we investigated how N1 and N2 influence tumor growth depending on who dominates. Also, we simulate this model if it happens on human brain tissue where two different parts, gray matter and white matter, with different diffusion term exists.

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