

INTISARI

MODEL MATEMATIKA SPASIAL-TEMPORAL RESPON LIMFOSIT T-SITOTOKSIK TERHADAP KARSINOMA SERVIKS

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Dalam penelitian ini disajikan suatu model matematika yang menggambarkan dinamika pertumbuhan tumor pada kasus karsinoma serviks dengan adanya respon imun seluler dari Limfosit T Sitotoksik (CTLs). Respon imun seluler ini terjadi pada lesi dini karsinoma serviks yaitu *Cervical Intraepithelial Neoplasia* (CIN) II dan III. Model tersebut merupakan pengembangan dari model matematika spasial-temporal respon Limfosit T Sitotoksik terhadap tumor solid yang dibangun oleh Matzavinos dan Chaplain (2004). Model matematika dalam penelitian ini merupakan suatu sistem reaksi difusi yang terdiri dari enam persamaan diferensial (CTLs, *antigen presenting cells* (APC), matriks ekstraseluler (ECM), *chemokine*, sel tumor, dan kompleks tumor-CTLs). Migrasi CTLs tidak hanya ditentukan oleh motilitas random dan respon terhadap *chemokine* (kemotaksis) sebagaimana digunakan oleh Matzavinos dan Chaplain (2004) dalam modelnya akan tetapi juga melibatkan respon CTLs terhadap komponen penyusun matriks ekstraseluler (haptotaksis). Analisis linear hanya dilakukan terhadap model tanpa melibatkan difusi sedangkan simulasi numerik terhadap titik ekuilibrium bebas tumor dilakukan untuk model tanpa melibatkan difusi dan model dengan melibatkan difusi. Simulasi terhadap model tanpa melibatkan difusi menunjukkan potret fase dan diagram trayektori titik ekuilibrium bebas tumor yang tidak stabil sedangkan simulasi terhadap model dengan melibatkan difusi menunjukkan eksistensi distribusi CTLs, APC, ECM, *chemokine*, sel tumor, dan kompleks tumor-CTLs yaitu semi stasioner terhadap waktu dan homogen terhadap ruang.

Kata kunci: karsinoma serviks, respon imun, limfosit t-sitotoksik, kemotaksis, haptotaksis, model spasial-temporal.

ABSTRACT

MATHEMATICAL MODEL OF SPATIO-TEMPORAL RESPONSE OF CYTOTOXIC-T LYMPHOCYTES TO CERVICAL CARCINOMA

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In this research a mathematical model describing the growth of tumour dynamic in case of cervical carcinomas with the presence of a cellular immune response by cytotoxic-t lymphocyte (CTLs) is presented. This cellular immune response occurred in early stage of cervical carcinomas, *Cervical Intraepithelial Neoplasia* (CIN) II and III. This is a development of a mathematical model of spatial-temporal response of cytotoxic-t lymphocytes to solid tumour formulated by Matzavinos and Chaplain (2004) consisting of sixth differential equations (CTLs, antigen presenting cells (APC), extracellular matrix (ECM), chemokine, tumour cells, and tumour-CTLs complex). The migration of CTLs is not only determined by a combination of random motility and response to the presence of chemokines (chemotaxis) which are used by Matzavinos and Chaplain (2004) in their model but also determined by response to the presence of extracellular matrix components (haptotaxis). A linear stability of model without diffusion, which is ordinary differential equation (ODE) system, is analyzed but the numerical simulation are not only presented for ODE system but also for partial differential equation (PDE) system of model with diffusion. The numerical simulation for ODE system shows phase portraits and trajectories of free state tumour equilibrium which is unstable and for the PDE system demonstrate the existence of CTLs, APC, ECM, chemokine, tumour cells, and tumour-CTLs complex distributions that are quasi-stationary in time and homogeneous in space.

Keywords: cervical carcinoma, immune response, cytotoxic-t lymphocytes, chemotaxis, haptotaxis, spatial-temporal model.