ABSTRAK

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Judul : **Model Matematika Pengobatan Leukemia dengan Terapi Sel T *Chimeric Antigen Receptor* (CAR)**

Model sistem persamaan nonlinear dibentuk dan dianalisis untuk mempelajari pertumbuhan leukemia menggunakan terapi sel T *Chimeric Antigen Receptor* (CAR). Model matematika ini melibatkan empat kompartemen yaitu sel darah rentan, sel darah yang terinfeksi, sel leukemia dan sel kekebalan tubuh. Pada penelitian ini, pertumbuhan leukemia dengan terapi sel T *Chimeric Antigen Receptor* (CAR) mengikuti model pertumbuhan logistik dikarenakan terdapat keterbatasan sumber daya (*carrying capacity*) pada saat berada dalam tubuh. Pada model ini dianalisis kestabilan lokal dari masing-masing titik ekuilibrium, penentuan bilangan reproduksi dasar, analisis sensitivitas, serta simulasi numerik sebelum dan setelah pengobatan sesuai dengan syarat eksistensi dan syarat kestabilan. Dari hasil simulasi numerik sebelum pengobatan jumlah sel leukemia lebih cepat menuju kondisi endemik dalam darah, sedangkan setelah pengobatan dengan terapi sel T *Chimeric Antigen Receptor* (CAR), ketika ditambahkan infus eksternal sel T CAR, sel leukemia lebih lama menuju kondisi endemik di dalam darah. Berdasarkan analisis sensitivitas, laju pertumbuhan sel kanker (r) dan laju kematian sel imun (τ) berpengaruh dalam meningkatkan bilangan reproduksi dasar (R_0) dan laju kematian sel kanker akibat interaksi dengan sel imun (κ) dan laju infus eksternal sel T CAR (V) berpengaruh dalam menurunkan bilangan reproduksi dasar (R_0).

Kata Kunci : Leukemia, Model matematika, Sel T CAR

ABSTRACT

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Title ***: Mathematical Model of Leukemia Treatment with Chimeric Antigen Receptor T Cell Therapy* (CAR)**

A system of non-linear equations model was constructed and analyzed to study leukaemic growth using Chimeric Antigen Receptor (CAR) T cell therapy. This mathematical model involves four compartments namely susceptible blood cells, infected blood cells, leukemia cells and immune cells. In this study, the growth of leukemia with Chimeric Antigen Receptor (CAR) T cell therapy followed a logistic growth model because there were limited resources (carrying capacity) while in the body. This model stability points of each equilibrium point, determines the basic reproduction number, analyzes sensitivity, and performs numerical simulations before and after treatment according to the existence and stability conditions. From the results of numerical simulations before treatment the number of leukemia cells was faster towards endemic conditions in the blood, while after treatment with T-cell Chimeric Antigen Receptor (CAR) therapy, when external infusion of CAR T cells was added, the leukemia cells took longer to become endemic in the blood. Based on the sensitivity analysis, the growth rate of cancer cells (r) and the rate of death of immune cells (τ) have an effect on increasing the basic reproduction number and the rate of death of cancer cells due to interactions with immune cells (κ) and the external infusion rate of CAR T cells (V) effect in reducing the basic reproduction number.

Keywords *: Leukemia, Mathematical model, CAR T cells*