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ADVANCES OF HAART TO THE IMMUNOTHERAPEUTIC TREATMENT OF HIV INFECTION: AN OPTIMAL CONTROL APPROACH

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Infectious diseases pose great threat in global public health. One of such devastating and killer diseases is Acquired Immunodeficiency Syndrome (AIDS) and its etiologic agent Human Immunodeficiency Virus (HIV) which is the world's most leading cause of mortality until today. In absence of vaccine, immunotherapy is the most effective treatment strategy for HIV positive patients. Highly Active Anti-Retroviral Therapy (HAART) has become important for such treatment of HIV infection aiming to develop the internal immunity of the HIV positive patients so that body itself can fight against the pathogen. In this talk, we discuss a HIV immunology model in terms of nonlinear ordinary differential equations (ODEs) with the help of optimal control techniques. Optimal control theory has long history in modelling the nonlinear behaviour of human physiological control system and thus plays significant role in obtaining optimal control strategy of infectious diseases. It has been challenging to understand the mysterious mechanism of host-pathogen interactions of the underlying disease inside human body. Optimal control of nonlinear ODEs in terms of mathematical modeling in biomedical engineering has been successfully modelled and designed to understand the evolution of disease dynamics. Since 1980 several models have been proposed and studied most of which were studied using optimal control techniques in absence of constraints. So application of optimal control with constraints in infectious diseases is sparse in existing literature. Here, we propose a modified HIV model introducing state constraint to the dynamics aiming to find optimal immunotherapeutic treatment strategy using optimal control technique where state constraint may play crucial role. This new model has been analysed numerically and the simulation results have been presented in support of analytical findings. We show that introduction of state constraint to the model have significant effect to the immunotherapeutic treatment for obtaining more realistic control strategies of such diseases.

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