New heights of antiretroviral drug delivery

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Statement of the Problem: HIV has been accepted as an incurable infection that can be kept under control, however difficult to eliminate. The hope for possible cure has stemmed from the reports of the populations at high risk of infection remaining free of HIV infection in spite of repeated exposures to the virus. Hence Anti- HIV drug development has often followed a curious meandrous route, and being a molar drug, particularly in HIV resistance has been accepted difficult and agonizing since there are no molar absolute determinations in regards to adverse effect. Nanotechnology in improving the current treatment, advancing new therapeutic strategies as well as providing alternatives in the quest for HIV/AIDS. Methodology & Theoretical Orientation: Nanoparticles localized in the endothelium provide prolonged drug effects because of their sustained release characteristics, and also protect the encapsulated agent from enzymatic degradation. It can be well targeted to organs like brain and placenta. Targeting drug to placenta also helps in stopping transmission of disease to fetus. It as drug carriers systems can improve the delivery of antiviral agents to the mononuclear phagocyte system, enhancing the activity of drug for the treatment of HIV infection. By using Polyhexylcyanoacrylate Nanoparticles loaded with either the human immunodeficiency virus (HIV) protease inhibitor saquinavir or the nucleoside analog zalcitabine were prepared by emulsion polymerization and tested for antiviral activity in primary human monocytes/macrophages in vitro. Both nanoparticulate formulations led to a dose dependent reduction of HIV-1 antigen production. Another investigation shows the possibilities of targeting antiviral drugs such as AZT to macrophages using Nanoparticles as colloidal drug carriers. In the first the body distribution of 14C-labelled AZT bound to Nanoparticles and a similarly prepared control solution with unbound AZT were studied in rats after I.V. injection. In a second of experiments polysorbate 80 coated Nanoparticles and a solution of AZT was bound to Nanoparticles using the surfactant bis (2-ethylhexyl) sulphosuccinate sodium (DOSS). AZT concentrations were up to 18 times higher in organs belonging to the RES if the drug was bound to Nanoparticles compared with unbound AZT. Thus this allows dose reduction. The new WHO guidelines would probably pave way for AIDS free next generation. Hence these findings are extremely significant and need to be followed by larger and controlled studies. The paper will indeed generate discussion on this important advancement. Conclusion & Significance: Nanotechnology can impact the treatment and prevention of HIV/AIDS with various innovative approaches. Treatment options may be improved using nanotechnology platforms for delivery of antiretroviral drugs. Controlled and sustained release of the drugs could improve patient adherence to drug regimens, increasing treatment effectiveness. In the future, targeted co-delivery of two or more antiviral drugs in a nanoparticle system could radically improve treatment of viral reservoirs. Our group and collaborator investigators have developed nanoparticles with the potential to co deliver both hydrophobic and hydrophilic drugs and these may provide versatility for co-delivery of antiviral drugs. In addition to delivering antiviral drugs, nanomaterials have shown their ability to inhibit viral replication by themselves.

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