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HIV/AIDS Current Treatment in Nanotechnology

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AIDS (Acquired Immunodeficiency Syndrome) is a chronic and life-threatening condition which is caused by the virus HIV (Human Immunodeficiency Virus). This virus damages the individual immune system; HIV interferes with individual's body ability to fight with the infection and disease. HIV is STI (Sexually Transmitted Infection) and it also spreads by contact with the infected blood, from mother to child during pregnancy, childbirth or breast-feeding. Without medication, it will take few years before HIV weakens the individual immune system to the point that individual may have AIDS [1]. At present there is no cure no medicine and no preventive vaccine for HIV/AIDS. Combination antiretroviral therapy has improved treatment, but it should be taken for lifetime, and has several side effects and ineffective in individuals in whom the virus develops its resistance. The finest way to fight against global infections is through preventive strategies, vaccines being as the most effective agents. Vaccines are very effective in controlling the major infectious diseases like polio, mumps, measles; rubella and smallpox are completely eradicated.

Nanotechnology is a new discipline of science and an emerging field which is advancing in several areas of medicine field. It is a revolutionizing in the medicine field in 21st century. Nanotechnology involves in the understanding, design, engineering and fabrication of materials at the atomic and molecular level. It has a vast potential and advance treatments and prevention of HIV/AIDS. Earlier the treatments are focused on the antiretroviral drugs that are effective only to a certain degree [2].

Nanoscale delivery system enhances and modulates the distribution of hydrophobic and hydrophilic drugs into and within the different tissues. The particular feature of nanoscale delivery systems appears to use in clinical treatment and in prevention of HIV. The targeted delivery of antiretroviral drugs to CD4+ T cells and macrophages as well as delivery to the brain and other organ systems should ensure that the drugs must reach latent reservoirs. Moreover, by controlling the release profiles of the delivery systems, drugs should release over a longer period and at higher effective doses to the specific targets. Various nanoscale drug delivery systems may explore for these purposes. The use of nanotechnology for delivery of antiretroviral drugs has been extensively reviewed. More significantly, the intravenous single dose administration of the nanoparticle-loaded macrophages in a rodent mouse model of HIV brain infection resulted in significant antiviral activity in the brain and produced measureable drug levels in the blood up to 14 days post-treatment [3].

In a recent study based on polymeric systems, nanosuspensions (200 nm) of drug rilpivirine (TMC278) stabilized by PEGylated tocopheryl succinate ester (TPGS 1000) and polyethylene-polypropylene glycol (poloxamer 338) were studied in mice and dogs [4]. In addition to being used as delivery agents, nanomaterials have also shown to have therapeutic effects of their own. Studies have shown that capsid of HIV could be a target for structure-based drug design for inhibiting the viral replication. As a result, both experimental and computational studies identified compounds that may inhibit assemble of HIV capsid. Various nanomaterials are found to inhibit the viral replication in vitro and suggested that these effects are based on structural interference with viral assembly [5].

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