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Editorial

HIV Microbicides and Multiple Prevention Technology as Methods to Stop the Spread of HIV

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Human Immunodeficiency Virus (HIV) is a retrovirus that can result in rare opportunistic infections occurring in humans. The onset of these infections is known as Acquired Immune Deficiency Syndrome (AIDS). The major modes of HIV transmission are sexual contact, exposure to infected blood, infected needles and mother-to-child. Sexual transmission is responsible for the majority of infections [1], resulting in transmission of HIV due to infected semen or vaginal and cervical secretions containing infected lymphocytes [2]. HIV destroys the human immune system by attacking the CD4+ T helper cells, a sub group of lymphocytes, which are a type of white blood cell that is part of the adaptive immune system [3,4]. This leaves the body susceptible to opportunistic infections, which leads to the onset of AIDS.

HIV microbicides are formulations of chemical or biological agents that can be applied to the vagina or rectum with the intention of reducing the acquisition of HIV. An effective microbicide product has the potential to reduce the global HIV infection rate [5-7]. The ideal vaginal HIV microbicide must have activity against cell free and cell associated HIV, it must not cause damage to the tissue or flora of the vagina, it must be retained in the vagina, act locally and retain its activity in the presence of semen and across a broad pH range [8]. There are a range of mechanisms by which vaginal microbicides may prevent HIV infection from providing a physical barrier that prevents HIV entering the vaginal mucosa [9] to destroying the virus as soon as it enters the vagina [10,11] and the maintenance of the vaginal flora, which provides a protective vaginal pH [12,13], or the prevention of either HIV binding to CD4 receptors [14,15] or its replication process [16,17].

For the last twenty years researchers have been developing and evaluating a range of vaginally administered HIV microbicide formulations for their potential at preventing the sexual transmission of HIV. In the early years the focus was more on non-specific microbicide candidates, which either destroyed the virus upon entry to the vagina or maintained the protective pH of the vagina. However, due to a lack of efficacy with these strategies the focus has shifted to more specific candidates such as antiretrovirals, protease inhibitors and entry inhibitors. The positive result of the Centre for the AIDS Program of Research in South Africa (CAPRISA) 004 trial, which assessed the effectiveness and safety of a 1% vaginal gel formulation of tenofovir and demonstrated a 39% reduction in HIV transmission [18] has encouraged the microbicide field and there are a number of lead candidate vaginal microbicide products currently under clinical evaluation, including a tenofovir vaginal ring, tenofovir vaginal gel, tenofovir vaginal tablet and a dapivirine vaginal ring. However, researchers are now starting to focus their attention on the development of the next generation of microbicides, which are products containing multiple antiretroviral drugs or a combination of an antiretroviral and another type of microbicide such as a protease or entry inhibitor. These combination products offer significant advantages over their single antiretroviral counterparts, which include greater protection by targeting different stages in the viral replication cycle, reduced drug levels needed for efficacy due to synergistic effects and a broader range of activity against resistant strains of HIV [19].

Multiple Prevention Technologies (MPTs) are products, preferably single device products and administered via a single route, that are expressly designed to simultaneously address multiple sexual and reproductive health needs, such as unintended pregnancy, HIV infection and other sexually transmitted infections (STI) [20]. MPTs can fall into a number of categories: 1) a drug delivery device or formulation that releases multiple active agents of which is effective against different diseases, 2) a drug delivery device or formulation that release a single active agent that is effective against a range of different diseases or 3) a barrier device such as a condom or diaphragm that releases one or more active agents which are effective against multiple disease states. According to the Coalition Advancing Multipurpose Innovations (CAMI), every minute a woman is infected with HIV, there are 86 million unplanned pregnancies around the world annually and 1 million people contract an STI every day [20]. MPTs offer a solution to these reproductive health issues using a single device, which will result in a number of benefits for the users, including convenience, adherence, improved effectiveness, reduction in cost and environmental impact [21]. New MPT products should be more effective than existing MPT products such as the male condom, which even though is effective against unintended pregnancies and STIs [22,23] suffers from adherence and compliance issues [24].

In conclusion, even though a microbicide is a preventative strategy and not a cure for HIV infection it is imperative that a safe and effective HIV microbicide product is developed, with second generation microbicide and MPT products following shortly behind. The reason for this is that next to an effective vaccine, microbicide and MPT products can provide women with a discreet method of protection that they can control, which will ultimately reduce the spread of this terrible disease.

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