

## Presence of HIV in blood and semen – double trouble

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HIV is known to weaken the immune system by damaging the immune cells. It is found in blood and body fluids such as semen, vaginal fluid and saliva. HIV is highly variable; it mutates easily. Therefore, there can be many different strains of HIV. HIV viral variants can be present in different cells and secretions of the same infected person, which can then affect the transmission of HIV as well as the defense mechanism of the person with HIV. Such a situation can also influence HIV/AIDS therapy.

HIV can be unpredictable because of its nature to constantly mutate. To determine the type and behaviour of the HIV virus present in both blood and semen in an infected person, researchers from the National Institute for Research in Reproduction (NIRRH), Mumbai, carried out a study in collaboration with J. J. Hospital, Mumbai. They characterized the viral variants in blood cells and spermatozoa of people infected with HIV<sup>1</sup>.

The study was carried out in 12 HIV-infected men recruited from the ART Centre, J. J. Group of Hospitals, Mumbai. Their blood and semen samples were analysed for CD<sub>4</sub> count and viral load. The viral load was also estimated in the seminal plasma. Viral variants were characterized using heteroduplex mobility assay (HMA) and sequencing according to the method of Delwart *et al.*<sup>2</sup>. The CD<sub>4</sub> count was analysed using flow cytometry. Viruses isolated from blood, sperm and seminal cells (leukocytes) were cultured or grown for up to six weeks with peripheral blood mononuclear cells (PBMC) from six healthy donors.

The study showed that the characterization of the C2–V3 region of *HIV1C env* gene by HMA and sequencing demonstrated the presence of distinct variants of HIV in blood (PBMCs) and the sperm of the same individual. Also, the translated amino acid sequences of HIV variants in the PBMCs of all 12 HIV-infected men and sperm of the six healthy sperm donors showed the presence of distinct variants with different numbers of N-linked glycosylation (NLG) sites. Infec-

tivity of PBMCs of these 12 individuals when co-cultured with PBMCs from six healthy individuals did not show a correlation with the blood plasma viral load. Importantly, the infectivity of the sperm samples from four of the five people showed positive correlation with the viral load in seminal plasma.

In simple terms, the type of HIV virus present in the blood of an HIV-infected person can be different from that present in the same person's semen. At times the person may be infected with two different types of HIV virus, both in blood and semen.

Several studies have shown that spermatozoa are risk factors for sexual transmission of HIV<sup>3,4</sup>. Studies have reported that men infected with HIV who are on active antiretroviral therapy have undetectable levels of the virus in blood but they have the virus present in seminal cells. Marcelin *et al.*<sup>5</sup> have detected viral load in semen with undetectable viral load in blood of 5% out of 145 HIV-infected men.

In the NIRRH study, the viral count varied from that in the semen of the same individual. The load of HIV virus in two men was below detectable levels but significant amount of virus was present in their semen. Another individual who was on antiretroviral therapy had undetectable viral load in the blood plasma but his seminal plasma showed 457 copies of viral RNA. Also, five out of seven sperm samples from infected men were found to be infectious.

Because of the variant nature of the HIV virus, there can be two genetically different types of HIV virus affecting one individual or the virus present in both blood and semen may affect the same person in different ways.

According to Bandivdekar, lead researcher of the study conducted at NIRRH, the virus remains undetectable in blood because it disappears due to the antiretroviral therapy given to the HIV-infected men but it can still be present in the semen. In fact, the antiretroviral therapy may not work on both the viral loads; in

semen and in blood. And this can have several repercussions. The HIV virus in the semen can be a huge risk factor for HIV transmission.

In the NIRRH study, in one individual the virus was not detected in the seminal plasma but the proviral DNA was present in the spermatozoa. This may not be good news for couples who opt for assisted reproductive technology (ART). Sperm washing is one of the common methods used in ART for an HIV-negative woman wanting to conceive from the sperm of an HIV-infected person. Studies worldwide have shown that this is the safest way to stay away from HIV transmission to the mother as well as the foetus.

The study reveals that sperm washing may not be completely safe because it may remove the cell-free virus present in seminal plasma but not the proviral DNA or cell-associated virus in the sperm. Alaka Deshpande, in-charge of J. J. Hospital's ART centre, advises that an infected partner should practice safe sex whatever be the levels of virus in his blood or semen.

The mutant nature of the HIV virus can influence the host's defense mechanism and also the treatment. Researchers need to keep in mind about the variant nature of the virus before coming out with newer drugs or a vaccine; they should be able to attack the virus strains at all levels.

1. Jadhav, S. K. *et al.*, *J. Med. Virol.*, 2011, **83**, 760–767.
2. Delwart, E. L. *et al.*, *J. Virol.*, 1994, **68**, 6672–6683.
3. Shevchuck, M. M. *et al.*, *J. Reprod. Immunol.*, 1998, **41**, 69–80.
4. Ceballos, A. *et al.*, *J. Exp. Med.*, 2009, **206**, 2717–2733.
5. Marcelin, A. G. *et al.*, *AIDS*, 2008, **13**, 1677–1679.

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