Understanding HIV Viral Load

Implications for Counselling

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ABSTRACT

This paper provides an overview of HIV viral loads in blood and genital fluids and how these relate to HIV transmission during sexual activity. Current knowledge around HIV viral loads and transmission are then discussed in relation to HIV disclosure laws in Canada. HIV counsellors and health care workers should ensure that their clients/patients are aware that blood viral load is not necessarily equivalent to genital tract viral load and that the development of drug resistance within the two compartments may be unrelated. This is an important factor in preventing the spread of HIV as well as for HIV-positive individuals in not unintentionally exposing themselves to potential legal repercussions.

Key words: HIV; prevention; counseling; blood; semen; viral load

RÉSUMÉ

Cet article fait le point sur les charges virales associées au VIH dans le sang et les liquides organiques génitaux et sur les liens entre ces charges et la transmission du VIH lors de rapports sexuels. Les connaissances actuelles en regard des charges virales et du risque de transmission du VIH sont ensuite examinées à la lumière des lois canadiennes sur la notification des partenaires. Les professionnels de la santé, de même que les intervenants exerçant dans le domaine du VIH, doivent s'assurer que leurs clients comprennent bien que la charge virale dans le sang diffère de celle associée aux liquides des organes génitaux, et qu'une résistance aux médicaments antirétroviraux qui peut se manifester dans le sang n'implique pas nécessairement une même résistance dans les liquides génitaux. L'information présentée dans cet article pourrait contribuer à prévenir la transmission du VIH en plus d'éviter que les personnes infectées ne s'exposent à des poursuites faute d'avoir été informées.

Mots clés : VIH; prévention; counseling; sang; sperme; charge virale

Due primarily to widespread education campaigns, the rate of HIV transmission declined in Canada throughout the 1990s. Since 2001, however, there has been a steady increase in the number of new diagnoses each year in all populations, with the exception of intravenous drug users.¹ This increase in sexual transmission of HIV is reflected in the rise in gonorrhea and syphilis across the country.² Similar trends have been reported in the United States³ and Australia.⁴ The reasons for this apparent lapse in safer-sex practices are likely complex but have been attributed in part to "Safer Sex Fatigue" and "HAART optimism".⁵ An additional factor influencing choices around safer sex may be a misinterpretation of HIV viral loads (VL). Since the goal of highly active antiretroviral therapy (HAART) is an undetectable VL in the blood, this has been perceived by individuals to indicate an absence of virus in the genital fluids. This in turn has led to the prevalent belief among community members and health care professionals that condoms are no longer needed for those on HAART since HIV transmission would be unlikely when the HIV VL is undetectable.^{5,6} Convincing data to support this belief are lacking.

The sexual transmission of HIV is associated with an array of both behavioural and biological factors such as frequency and type of sexual contact, condom usage, HIV VL, male circumcision, and the presence of other sexually transmitted infections (STIs). Since sexual transmission of HIV is likely influenced by the quantity of virus present in genital tract secretions, VL has become an integral component of many models designed to predict transmission risk.^{7,8} In a study done in Uganda, Quinn et al.⁷ found no cases of HIV transmission within serodiscordant couples provided the blood VL of the seropositive individual was less than 1500 copies/mL. However, this study was undertaken prior to the introduction of HAART in Africa, and thus the correlation between transmission and blood VL is based on data from individuals whose low VLs are the result of either more effective immunologic control of HIV or reduced viral fitness. For obvious ethical reasons, similar studies have not been carried out for individuals whose viral loads are controlled medically.

In an effort to predict sexual transmissibility of HIV for individuals whose blood

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VL is suppressed on HAART, several studies have attempted to correlate HIV VL in the blood with that in the genital tract for individuals receiving HIV medications. While in some cases reduced blood VL was correlated with a lower VL in the semen,^{9,10} other studies have found correlation coefficients between blood and semen VLs ranging from as low as 0.26 to 0.75, or were insignificant.¹¹⁻¹³ In women, vaginal and cervical VLs correlate with each other, but correlations with blood VL are poor.^{14,15} Indeed, several studies have demonstrated that for patients on HAART with undetectable blood VLs, between 10-40% have detectable HIV virus in the semen at any given time.^{11-13,16}

This lack of correlation between the blood and genital compartments may be explained by the fact that HIV is located within multiple cell types (macrophages/monocytes and CD4+ T-lymphocytes) with differing anatomic localizations and immunologic activation. As a result, factors that influence HIV replication within these cells may vary between body compartments. In addition, many HAART medications do not easily enter the genital tract from the blood and remain at concentrations in genital fluids below those required to effectively suppress HIV replication.¹⁷⁻¹⁹ Consequently, despite HAART-induced VL reductions in the blood, after six months of therapy up to 40% of individuals still have detectable virus in the semen and vaginal secretions.^{12,20,21} Other factors that increase HIV VL in the genital tract include the presence of other STIs which attract activated lymphocytes latently infected with HIV. As a result, individuals may experience an increase in the genital tract VL due to localized inflammation, without a concurrent rise in the blood VL.^{22,23}

According to Blankson,²⁴ sites such as the genital tract also act as reservoirs: "an anatomical site in association with which a replication-competent form of the virus accumulates and persists with more stable kinetic properties than in the main pool of actively replicating virus" (p. 557). Different genotypic HIV strains have been isolated from the blood and genital secretions of the same individual with differing drug resistance mutations, demonstrating independent genetic evolution between the two compartments and identifying the genital tract as a sanctuary site for HIV.²⁵⁻²⁸

An undefined factor that can influence the probability of HIV transmission is the so-called "blip" periods wherein individuals on HAART with undetectable blood VLs experience a detectable increase in the amount of HIV in the blood. The cause of these "blips" is not well understood but is assumed to be due to systemic immune responses (i.e., to the common cold, flu, vaccine, etc.).²⁹ Since in most clinical situations blood VLs are measured once every three months, the frequency and duration of these blips are currently unknown. The unpredictable occurrence of these VL blips is among the reasons why pregnant HIV+ women on HAART with undetectable VLs are given supplemental AZT during delivery to reduce the risk of mother-to-child transmission. Thus, since viral blips appear to occur at random, with one blip not predicting the likelihood or timing of a future blip, it cannot be assumed that the HIV VL remains below detection at all times even if the blood VL is consistently below detection when measured quarterly. As a result, the potential for HIV transmission cannot be considered negligible, even when the levels of HIV are consistently below the level of detection.

Because the blood and genital tract represent different immunologic environments, because there is the potential for localized immune activation due to infections with STIs, because there are random periods of HIV replication for those on HAART, and because all HAART medications do not achieve concentrations in the genital tract sufficient to suppress HIV replication in the semen and vaginal fluids, an undetectable VL in the blood cannot be taken to indicate an undetectable VL in the genital tract. Since genital tract and blood viral loads may be discordant, it should not be assumed for patients on HAART that the blood VL accurately predicts transmission probabilities.

HIV prevention strategies should involve both seronegative and seropositive individuals and accurate timely information needs to be provided to the community. It is of concern that HAART came into widespread use in Canada in the late 1990s and that the increased trend in HIV transmission followed shortly thereafter, beginning in 2001. While this may be due in part to "HAART optimism", it is possible

that the rise in HIV infections has also resulted from individuals making decisions to engage in unprotected sexual intercourse based on an undetectable blood VL of the seropositive individual. We therefore encourage HIV prevention counsellors and health care providers to remind both seronegative and seropositive individuals that the blood viral load for those on HAART is not an accurate measure of HIV transmission risk.

The potential legal ramifications of making decisions based on VL to engage in particular sexual practices that may transmit HIV should also not be ignored. In Canada, the Supreme Court established that, "every HIV-positive person has a legal obligation to disclose his or her HIV status where he or she engages in a sexual activity that poses a significant risk of serious bodily harm (i.e., transmission of HIV) to another person" (p. 1).³⁰ While serious bodily harm was clarified as the acquisition of HIV, the Supreme Court failed to define what constitutes a *significant* risk. For example, were someone to have an undetectable blood VL, would disclosure be required if it is assumed this meant a low probability of transmission? To address this question, it is important to return to the cases that shaped disclosure laws in Canada: *R. v. Currier*, and *R. v. Williams*. While in the *Currier* case the Supreme Court ruled the defendant was guilty of aggravated assault for not disclosing his HIV status before engaging in sexual activity with an HIV-negative individual who subsequently seroconverted to HIV positive, in the *Williams* case the Court established that criminal prosecution is not dependent on the seroconversion of a partner exclusively but can include recklessness regarding sexual activity and known HIV status. The question arises then as to whether an HIV-positive individual with an undetectable blood VL could be considered reckless were they to engage in unprotected sexual intercourse with a seronegative partner without disclosing their HIV status. Although both of the above criminal cases established that neither intent nor seroconversion is a requirement for prosecution, the exact boundaries surrounding criminal liabilities have yet to be established for the disclosure of HIV-positive serostatus where the blood viral load is undetectable.

While HAART has proven to be highly efficacious in decreasing HIV-related morbidity and mortality, it is important not to assume that the HIV VL in the blood of patients on therapy accurately reflects the VL in the genital tract. Indeed, while naturally occurring low HIV VLs in the blood have been correlated with decreased likelihood of transmission, this has not been demonstrated for medically controlled blood VLs. Counsellors and health care professionals should be aware of this in discussing the risks of HIV transmission for patients on HAART and choices to engage in unprotected sexual contact. This has direct implications in reducing the spread of HIV as well as for HIV-positive individuals in not unintentionally exposing themselves to potential legal repercussions.

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