

# AIDS IN THE CONTEXT OF SEXUALLY TRANSMITTED DISEASES

M. Matičič, J. Tomažič and L. Vidmar

## SUMMARY

The predominant mode of human immunodeficiency virus (HIV) transmission throughout the world is sexual. The sexual contact with an infected person is estimated to account for nearly 90% of HIV infected cases worldwide. The risk of HIV transmission, practicing unprotected sexual contact with an infected person, depends on several factors: the mode of sexual intercourse, state of the disease in infected partner, virulence of the virus, age and gender of an uninfected partner and coexistence of other sexually transmitted diseases (STDs). There exists also an apparent influence of HIV infection and immunosuppression on the transmission, clinical manifestation, or natural history of other STDs. Awareness of HIV/STD risk is important in all contexts of sexuality, underlying the strategies of prevention and public health intervention. Safer sex messages which include reducing the number of sexual partners, avoiding unprotected sexual practices and using condoms are of extreme importance.

## KEY WORDS

*HIV infection, AIDS, sexual transmission, cofactors, sexually transmitted diseases*

## INTRODUCTION

HIV infection is spreading dramatically around the globe, is increasingly spread by heterosexual behaviours and is ultimately lethal. Current treatment of HIV infection is only of modest benefit, and intense efforts to create an HIV vaccine have been thwarted to date by the antigenic variability of the virus (1).

The modes of transmission of HIV have not expanded significantly beyond those described or predicted early in the epidemic: sexual contact, parenteral transmission, or perinatal transmission from an infected mother (2). In a global sense, the predominant mode of HIV transmission throughout

the world is sexual and accounts for nearly 90% of HIV infected cases (3). Heterosexual and bisexual transmission is more common in developing countries, and homosexual transmission is more common in industrialized countries, where in the foreseeable future heterosexual transmission represents a serious threat to so called second generation of infected (4). Heterosexual contact accounts for about 75% of worldwide infected (5).

## HIV IN GENITAL TRACT SECRETIONS

HIV can be detected by several methods in genital tract secretions both as free and intracellular virus.

The shedding of a virus in an infected person changes depending on the stage of illness, antiviral chemotherapy etc.

Semen is an important vehicle for sexual transmission of HIV (6). The virus was found in seminal plasma and mostly in CD4+ lymphocytes. However, only in 32% of seropositive men HIV was cultured from semen (6). Leucocytospermia significantly influences the increased shedding of HIV. HIV positive lymphocytes were also found in testis, prostatic gland, epididimis and distal urethra, the latter being of great importance for transmission of HIV.

In women's genital tract HIV can be detected in cervicovaginal secretions (predominantly in cervical), in HIV positive CD4 cervical cells and in inflammatory secretions.

Semen of HIV infected men contains more virus than cervicovaginal secretions in HIV infected women.

## FACTORS INFLUENCING THE SEXUAL TRANSMISSION OF HIV

The transmission of HIV virus by sexual contact (genito-genital or ano-genital) is relatively low. For example, the risk of transmission of *Neisseria gonorrhoeae* from an infected female prostitute, in a single sexual exposure was estimated to be 22-25% (7). Overall "risk-per-sex-act" of HIV taking into account heterosexual and homosexual intercourse was estimated to be 0.1 to 0.2% (2, 8). However, some persons become HIV infected after a single risk sexual encounter, whereas others may remain uninfected despite hundreds of unprotected risk sexual contacts. This indicates that the likelihood of HIV infection may be substantially affected by intrinsic properties of either the HIV infected partner, the virus itself, or the uninfected partner (7, 9).

The risk of HIV transmission practicing unprotected sexual contact with an infected person, depends on the mode of sexual intercourse, stage of the disease in infected partner, virulence of the virus, age and gender of an uninfected partner and coexistence of other STDs in both partners.

### Mode of sexual intercourse

The average appearance of sexual transmission of HIV is small, from 1 per 100 in receptive anal intercourse, to even 1 per 1500 in female-to-male transmission.

Unprotected receptive anal intercourse is the most effective mode of sexual transmission of HIV (10).

Most heterosexual transmissions occur through vaginal intercourse although anal intercourse may further increase the risk for women (2). Male-to-female transmission is more efficient than female-to-male transmission, but the efficiency of the latter can be greatly enhanced in the presence of well defined risk factors, including more advanced immunodeficiency in the infected partner, the presence of conventional STDs in either partner, sex during menses etc (Table 1) (9, 11, 12, 13). It is most likely that a sustained heterosexual epidemic in the Third World is only possible because of a common occurrence of such amplifying factors. The cumulative incidence of heterosexual transmission of HIV in a couple, where an infected man practices unprotected sex for a longer period of time, is estimated to be 20% (9).

Table 1. Factors associated with heterosexual transmission of HIV (9).

Factor	male to female	female to male
Lack of condom	Yes	Yes
Anal intercourse	Yes	No
Sex during menses	No	Yes
Number of sexual contacts	Yes	Yes
Advanced disease state	Yes	Yes
Zidovudine decreases risk	Possibly	Unknown
Genital sores, infections	Yes	Yes
Oral contraceptives	Yes	Unknown
Intrauterine contraceptive device	Possibly	Unknown

Receptive oral intercourse also constitutes a risk for persons of either gender, whose insertive partner is HIV positive, although the risk may be less than one sixth of the one of receptive anal intercourse (9).

A very small number of cases of female-to-female transmission have been reported.

### Stage of the disease in HIV infected partner

The risk of transmission appears to be higher if the HIV infected person already has AIDS or a CD4+ T cell count less than 400 per mm<sup>3</sup> (7). Men and women have been found to be more infective also around the period of seroconversion, when body fluids are flooded with HIV. So, the HIV positive person is most infectious in a very early and in late period of infection (14).



### Virulence of the virus

Certain viral strains have also been suggested to be more infectious than other (7). HIV virus manifests a high degree of genetic variability *in vivo*, and genetically different isolates can be recovered from the same HIV infected person at different times and even at the same time.

Table 2. Association of sexually transmitted diseases and HIV infection (15).

Disease	Increased risk for HIV acquisition	Clinical course exacerbated in HIV+ patient
<i>Neisseria gonorrhoeae</i>	+/-	+/-
<i>Trichomonas vaginalis</i>	+	-
<i>Haemophilus ducreyi</i>	+	+
<i>Chlamydia trachomatis</i>	+	+/-
Syphilis	+	+
Herpes simplex virus	+	+
Granuloma inguinale	+	+/-
Human papillomavirus	+/-	+
Lymphogranuloma venereum	+	+/-
Hepatitis B virus	-	+

### Age and gender of an uninfected partner

The risk of HIV infection is higher in females. Young women and women over 45 years of age are the two populations at higher risk. In the puberty, immature cervix and vaginal mucosa do not represent an efficient barrier against infection. In women in and after the period of menopause the physiological changes occur, making the mucosa thinner (9).

### Coexistence of other STDs

There exists now a solid evidence from prospective epidemiologic and clinical virologic studies that both,

genital ulcers (including chancroid, syphilis and genital herpes), as well as nonulcerative STDs (such as gonorrhoea, chlamydial infection or trichomoniasis) enhance the sexual transmission of HIV (Table 2) (13, 15).

Genital ulcerative diseases increase the risk of HIV transmission during a single sexual act by a factor as high as 10 to 100 (16). Nonulcerative STDs are far more common than ulcerative in most populations and so their contribution to the sexual spread of HIV may also be higher, even if their relative risk is probably smaller (17). These findings are supported by perhaps more compelling recent data showing that urethritis and cervicitis can enhance genital shedding of HIV provirus, potentially increasing the inoculum of HIV delivered sexually, and that cervicitis treatment reduces shedding of the virus.

HIV infection and related immunosuppression have had several reported effects on the transmission, clinical manifestations and natural history of other STDs: increased cervical and anal shedding of human papilloma virus (HPV) and increased risk and post-therapy recurrence of cervical dysplasia and cancer; more severe, persistent genital and rectal herpes, with emergence of Acyclovir-resistant herpes simplex virus (HSV); shift in the therapeutic resistance of genital ulcers and neurosyphilis; increased risk of gonorrhoea; and increased risk and severity of pelvic inflammatory diseases (PID) (18, 19).

### CONCLUSION

The mutual reinforcement of HIV and other STDs represents a growing threat to HIV/STD prevention. So, awareness of HIV/STD risk is important in every context of sexuality, especially in the strategies of prevention and public health intervention. Safer sex messages, which include reducing the number of sexual partners, avoiding unprotected penetrative sexual practices and using condoms are of extreme importance.

### REFERENCES

1. Sparling PF, Christopher E, Wyrick PB, Cohen MS. Vaccines for bacterial sexually transmitted infections: A realistic goal? *Proc Natl Acad Sci USA* 1994; 91: 2456-2463.
2. Jones W, Curran JW. Epidemiology of AIDS and HIV infection in industrialized countries. In: Broder S, Merigan TC Jr, Bolognesi D. *Textbook of AIDS medicine*. Baltimore, Maryland: Williams and Williams, 1994: 97-8.
3. World Health Organization. *The HIV/AIDS pandemic. 1993 Overview*. Geneva: World Health Organization, 1993.
4. Quinn TC. Unique aspects of human immunodeficiency virus and related viruses in developing

- countries. In: Holmes KK, Mardh P-A, Sparling PF et al. Sexually transmitted diseases. 2nd ed. New York: McGraw Hill, 1990: 355-369.
5. World Health Organization Global Program on AIDS. Update on AIDS. Weekly Epidemiol Rec 1991; 66: 353-7.
  6. Krieger JN, Coombs RW, Collier AC et al. Recovery of human immunodeficiency virus type 1 from semen: minimal impact of stage of infection and current anti-viral chemotherapy. J Infect Dis 1991; 163: 386-8.
  7. Holmberg SD, Horsburgh CR, Ward JW, Jaffe HW. Biologic factors in the sexual transmission of human immunodeficiency virus. J Infect Dis 1989; 160: 116-125.
  8. Anderson RM, May RM. Epidemiology parameters of HIV transmission. Nature 1988; 333: 514-9.
  9. Wofsy CB. Gender-specific issues in HIV disease. In: Sande MA, Volberding PA. The medical management of AIDS. 4th ed. Philadelphia: W. B. Saunders, 1995: 648-664.
  10. Osborn JE. Public health, HIV and AIDS. In: Broder S, Merigan TC Jr, Bolognesi D. Textbook of AIDS medicine. Baltimore, Maryland: Williams and Williams, 1994: 137-9.
  11. Padian NS, Marquis L, Francis DP et al. Male to female transmission of human immunodeficiency virus. JAMA 1987; 258: 780-790.
  12. Padian NS, Shiboski SC, Jewell NP. Female-to-male transmission of human immunodeficiency virus. JAMA 1991; 25: 1664-7.
  13. Plummer FA, Simones JN, Cameron DW et al. Cofactors in male-female sexual transmission of human immunodeficiency virus type 1. J Infect Dis 1991; 163: 233-9.
  14. Padian NS, Shiboski SC, Jewell NP. The effect of number of exposures on the risk of heterosexual HIV transmission. J Infect Dis 1990; 161: 883-7.
  15. Ballinger RC, Quinn TC. Tropical diseases in the HIV-infected traveler. In: Broder S, Merigan TC Jr, Bolognesi D. Textbook of AIDS medicine. Baltimore, Maryland: Williams and Williams, 1994: 311-322.
  16. Diallo MO, AcKah AN, Lafontaine MF et al. HIV-1 and HIV-2 infections in men attending sexually transmitted disease clinics in Abidjan, Cote d'Ivoire. AIDS 1992; 6: 581-6.
  17. Bucyendore A, Van de Perre P, Karita E, Nzymuira A, Sow I, Fox E. Estimating the sero-incidence of HIV-1 in the general adult population in Kigali, Rwanda. AIDS 1993; 7: 275-8.
  18. Musher DM, Baughn RE. Syphilis. In: Broder S, Merigan TC Jr, Bolognesi D. Textbook of AIDS medicine. Baltimore, Maryland: Williams and Williams, 1994: 295-300.
  19. Aral SO, Holmes KK. Epidemiology of sexual behavior and sexually transmitted diseases. In: Holmes KK, Mardh P-A, Sparling PF et al. Sexually transmitted diseases. 2nd ed. New York: McGraw Hill, 1990: 19-36.

## AUTHORS' ADDRESSES

Mojca Matičič, MD, specialist of internal medicine, Dpt of Infectious Diseases  
 Clinical Centre Ljubljana, Japljeva 2, 61000 Ljubljana, Slovenia  
 Janez Tomažič, MD, MS, specialist of internal medicine, same address  
 Ludvik Vidmar, MD, Head Dpt. of infectious diseases, Clinical Centre  
 Japljeva 2, 61000 Ljubljana, Slovenia