however, been conducted over short time periods or have been retrospective. They have used insensitive means of renal assessment, such as measurements of serum creatinine concentration, and formal assessments of skeletal mass or density have not been included. It has been suggested that if parathyroidectomy were the routine treatment of the disease the cost would be large.³ Yet the cost is the equivalent of only five and a half years of medical follow up.⁴

There are many reasons why parathyroidectomy should be recommended for all patients with asymptomatic mild primary hyperparathyroidism. Firstly the patient may have symptoms; subtle physical and psychological changes may be present but are appreciated by patients only when they are cured. Secondly, untreated patients have a small risk of developing renal failure in the long term.⁵ Thirdly, there is an appreciably increased risk of bone loss,⁶ which may have devastating effects, particularly in older women.⁷ In the elderly symptoms such as confusion may be caused or exaggerated by primary hyperparathyroidism and relieved if the disease is eradicated.⁸ The confused elderly may also develop acute hypercalcaemia, particularly if dehydration is brought on by an intercurrent illness.

A further compelling reason for parathyroidectomy comes from a recent study that found mortality during a 14 year follow up period to be significantly higher in patients with untreated hypercalcaemia than in age and sex matched controls.⁹ Cardiovascular disease was the predominant cause of death, and patients with primary hyperparathyroidism are known to have an increased incidence of such disease.¹⁰⁻¹² Now it has been shown that this increased mortality can be reduced eventually by parathyroidectomy¹³: 441 patients who had undergone parathyroidectomy for mild primary hyperparathyroidism were followed for up to 22 years, and the increased risk of death started to decline after about five years and was less than expected by the end of the study.

The accurate diagnosis of primary hyperparathyroidism is now usually straightforward, and with increasing improvements in measurements of parathyroid hormone it is likely to become easier.¹⁴ The most important requirement for parathyroidectomy surgery is an experienced surgeon.

Preoperative localisation of tumours is unnecessary, particularly in patients undergoing neck exploration for the first time.¹⁵ In the past decade one of us has surgically explored 387 patients with hyperparathyroidism and had four failures—a failure rate of slightly over 1%. There have been no deaths and minimal morbidity, and hospital stay has usually been less than five days. Similar results are reported by specialist endocrine surgeons throughout the world. When the results are so good in specialist centres it seems churlish not to refer patients with mild but persistent hyperparathyroidism for an operation.

JOHN C STEVENSON

Consultant Endocrinologist,
Cavendish Clinic,
London NW8 9SQ

JOHN A LYNN

Consultant Endocrine Surgeon,
Royal Postgraduate Medical School,
London W12 0HS

- 1 Rohl PG, Wilkinson M, Clifton-Bligh P, Posen S. Hyperparathyroidism. *Med J Aust* 1981;ii: 519-21.
- 2 Van't Hoff W, Ballardie FW, Bicknell EJ. Primary hyperparathyroidism: the case for medical management. *Br Med J* 1983;287:1605-8.
- 3 Paterson CR, Burns J, Mowat E. Long term follow up of untreated primary hyperparathyroidism. *Br Med J* 1984;289:1261-3.
- 4 Heath H, Hodgson SF, Kennedy MA. Primary hyperparathyroidism. *N Engl J Med* 1980;302: 189-93.
- 5 Purnell DC, Scholz DA, Smith LH, *et al.* Treatment of primary hyperparathyroidism. *Am J Med* 1974;56:800-9.
- 6 Pak CYC, Stewart A, Kaplan R, Bone H, Notz C, Browne R. Photon absorptiometric analysis of bone density in primary hyperparathyroidism. *Lancet* 1976;ii:7-8.
- 7 Stevenson JC, Whitehead MI. Postmenopausal osteoporosis. *Br Med J* 1982;285:585-8.
- 8 Heath DA, Wright AD, Barnes AD, Oates GD, Dorricott NJ. Surgical treatment of primary hyperparathyroidism in the elderly. *Br Med J* 1980;280:1406-8.
- 9 Palmer M, Adami H-O, Bergstrom R, Jakobsson S, Akerstrom G, Ljunghall S. Survival and renal function in persons with untreated hypercalcaemia: a population-based cohort study with 14 years of follow-up. *Lancet* 1987;ii:59-62.
- 10 Rosenthal FD, Roy S. Hypertension and hyperparathyroidism. *Br Med J* 1972;iv:396-7.
- 11 Ljunghall S, Palmer M, Akerstrom G, Wide L. Diabetes mellitus, glucose tolerance and insulin response to glucose in patients with primary hyperparathyroidism before and after parathyroidectomy. *Eur J Clin Invest* 1983;13:373-7.
- 12 Ljunghall S, Lithell H, Vessby B, Wide L. Glucose and lipoprotein metabolism in primary hyperparathyroidism. Effects of parathyroidectomy. *Acta Endocrinol (Copenh)* 1978;89:580-9.
- 13 Palmer M, Adami H-O, Bergstrom R, Akerstrom G, Ljunghall S. Mortality after surgery for primary hyperparathyroidism: a follow-up of 441 patients operated on from 1956 to 1979. *Surgery* 1987;102:1-7.
- 14 Brown RC, Aston JP, Weeks I, Woodhead JS. Circulating intact parathyroid hormone measured by a two-site immunochemiluminometric assay. *J Clin Endocrinol Metab* 1987;65:407-14.
- 15 Anonymous. Parathyroid gland localization [Editorial]. *Lancet* 1986;ii:726-7.

Regular Review

Heterosexual transmission of human immunodeficiency virus

ANNE M JOHNSON

Heterosexual transmission is probably the commonest way that human immunodeficiency virus (HIV) is spread, yet, although parts of Africa already have a heterosexual epidemic, the potential for a major heterosexual epidemic in the United States or Europe remains a subject for speculation. Future heterosexual spread is likely to depend on two key factors: patterns of sexual and needle sharing behaviour; and the probability of transmission of HIV from men to women and from women to men.¹

Epidemiology of heterosexually acquired HIV

By the end of 1987, 1964 cases of AIDS in which the only risk factor for HIV transmission was heterosexual contact had been reported to the Centers for Disease Control in the United States. These accounted for 3.9% of all cases of AIDS reported. Just over two fifths of the patients (857) were born in countries where heterosexual transmission is believed to be important; the remaining three fifths (1107) were hetero-

sexual partners of people with AIDS or at risk for AIDS—that is, partners of bisexual men, drug users, haemophiliacs, and so on. Whereas the proportion of heterosexual cases is small, the absolute number is now equivalent to the total number of cases reported in the United States by mid-1983. While all newly reported cases of AIDS increased by 46% in the year August 1986 to August 1987 compared with the equivalent period in the previous year, heterosexual cases (excluding those in patients not born in the United States) increased by 85%. The doubling time of this heterosexual epidemic is now shorter than that of the epidemics among drug users or homosexual men.² At present the heterosexual epidemic in the United States is largely being driven by heterosexual transmission from injecting drug users.³ In an analysis of American born patients who had acquired AIDS through heterosexual contact Chamberland *et al* reported that 66% had been infected by drug using partners and only 14% by bisexuals (Chamberland M *et al*, third international conference on AIDS, Washington 1987).

In Britain 44 heterosexually acquired cases of AIDS had been reported by the end of 1987, accounting for 3.6% of all cases. In total 308 reports of heterosexually acquired HIV infection have been recorded through laboratory reporting (Public Health Laboratory Service Communicable Diseases Surveillance Centre, unpublished data). There are few studies of the prevalence of HIV infection among heterosexuals in Europe and the United States. In Britain two of every 100 000 blood donations were found to contain antibodies for HIV up to February 1987. About 0.4 of every 100 000 donations were from people infected heterosexually and a further 0.2 from those with no identified risk factor.⁴ These figures considerably underestimate the true prevalence of infection since those at high risk of heterosexual infection are asked not to give blood, and laboratory reports reflect only those presenting for testing.

In the United States blood donors have higher rates of infection—38 per 100 000.⁵ In a study of military recruits 1.5 in every 1000 had antibodies to HIV. Positivity was associated with male sex, black race, increasing age, and residence in an area with high incidence of AIDS.⁶ A study in United States army personnel in Germany found seropositivity to be associated with homosexuality, bisexuality, or drug use in 79% of cases.⁷

Studies of those attending genitourinary clinics show evidence of limited heterosexual spread. A study in a London clinic in 1986 found that three of 231 heterosexual men and two of 395 women were infected, and four were thought to be infected heterosexually.⁸ In a study of 4028 clinic attenders in Baltimore 2.7% of men and 1.8% of women not reporting high risk behaviour were infected.⁹ A series of studies among European prostitutes found little evidence of infection except among those who injected drugs (table I).¹⁰⁻¹⁷ In a multicentre study in the United States of 568 prostitutes 62 were infected, but 47 (76%) gave a history of drug use.¹⁷ Prostitutes in Europe and the United States report high rates of condom use, which may have protected them from sexual infection.¹³ Nevertheless, there is now evidence of limited heterosexual spread among prostitutes in the United States, which underlines the need to inform prostitutes and their clients about how to reduce the risk.

Studies in Africa have shown very different patterns: the evidence points towards a predominantly heterosexual epidemic. African patients rarely report either homosexuality or drug abuse, although reuse of needles for medical injections may have a limited role in transmission.¹⁸ The risk of seropositivity in central and east African populations is

TABLE I—Prevalence of antibodies to HIV in female prostitutes in Europe and the United States

City/area	No tested	No (%) with antibodies	% Of those with antibodies who were drug users	Reference
Europe				
London	50	0	NA	10
Paris	56	0	NA	11
Nuremberg	399	0	NA	12
Copenhagen	101	0	NA	13
West Germany	~2000	20 (1)	50	14
Athens	200	12 (6)	0	15
Pordenone, Italy	14	10 (71)	100	16
United States				
Multicentre	568	62 (11)	76	17

NA=Not applicable.

associated with the number of heterosexual partners each year, contact with prostitutes, and a history of sexually transmitted diseases (Katzenstein DA *et al*, third international conference on AIDS, Washington 1987).¹⁸⁻²²

Further support for the epidemic in Africa being primarily heterosexual comes from the nearly equal sex ratio among cases and the observation that the highest rates of HIV infection are seen in the sexually active age groups; rates of infection in children aged 4-15 and in those over 60 are very low.^{18, 21} In some African cities the prevalence of patients with antibodies to HIV is up to 29% among adults attending genitourinary clinics, 18% among blood donors, and 9% among women attending antenatal clinics²¹⁻²³ (Mhalu F *et al*, third international conference on AIDS, Washington 1987); studies in central Africa show that the highest rates are among female prostitutes.²²⁻²⁴ Serial studies in Nairobi indicate that female prostitutes were the first group to suffer from high rates of infection, with the prevalence increasing from 4% in 1981 to 61% in 1985.²³ In contrast with the United States and Europe, few of the clients of these prostitutes use condoms, which has probably contributed to the rapid dissemination of infection.^{23, 25, 26}

Mechanisms of heterosexual transmission

The isolation of HIV from semen and from cervical secretions of infected women makes it biologically plausible that HIV can be heterosexually spread from men to women and from women to men.²⁷⁻³⁰ Experimental vaginal infection of a chimpanzee and case reports of infection through artificial insemination show that infection can occur without trauma to the vagina.^{31, 32} Case reports and epidemiological studies provide evidence that sexual transmission can occur both ways, and infection has been reported after one or two episodes of vaginal intercourse.³³⁻⁴¹ Case cluster reports show that some people are infectious to consecutive heterosexual partners over several years (Franzen C *et al*, second international conference on AIDS, Paris 1986; Clumek N *et al*, third international conference on AIDS, Washington 1987).

Transmission from men to women

Several studies have investigated women partners of men with AIDS and HIV infection in an attempt to measure transmission probabilities, and they have produced widely differing results (tables II and III).^{37, 42-46} Among the partners of haemophiliacs the highest proportion infected is only 17%, but in other risk groups anything from 18% to 73% of women

partners are infected. Some of the difference among these studies may relate to methodological problems in assessing risk. The studies vary in the risk group studied, the clinical state of the index case (several examining only partners of patients with AIDS), and in their definition of the contact case, some examining only long term partners. Most studies have examined partners at only one point in time, and few follow up studies have been published giving details of sexual behaviour.

Infectivity has been suggested to increase as people progress towards AIDS. Goedert *et al* studied the women partners of 24 infected haemophiliacs and showed that three of the women developed antibodies more than four years after their partners did. Transmission was associated with a low T4 lymphocyte count in the index case (Goedert JJ *et al*, third international conference on AIDS, Washington 1987). Studies of patients with haemophilia have been able to study those who are infected but asymptomatic, which may

TABLE II—*Studies of sexual transmission of HIV from men to women*

Clinical state of male index case	Risk group of index case	No of women partners with antibodies to HIV/No studied	% Of partners with antibodies to HIV	Reference
AIDS/asymptomatic	Transfusion associated	10/55	18	42
AIDS/AIDS related complex/asymptomatic	Mixed	22/97	23	37
Not stated	Army personnel	6/18	33	†
AIDS/AIDS related complex	Intravenous drug user	41/88	47	‡
AIDS	Mixed	14/28*	50	43
Not stated	Patients from Africa	28/38	74	§

*Includes 10 women who developed antibodies to HIV over a median follow up of 24 months.

†Redfield RR, *et al*, second international conference on AIDS, Paris 1986.

‡Steigbigel NH, *et al*, third international conference on AIDS, Washington 1987.

§Taelman H, *et al*, third international conference on AIDS, Washington 1987.

TABLE III—*Studies of HIV transmission to women sexual partners of men with haemophilia and HIV infection*

No of women patients with antibodies to HIV/No of women studied	% Partners with antibodies to HIV	Reference
1/30	3	*
3/77	4	44†
10/148	7	45
2/21	10	46
4/24	17	‡

*Miller EJ, *et al*, third international conference on AIDS, Washington 1987.

†Jones P, *et al*, third international conference on AIDS, Washington 1987.

‡Goedert JJ, *et al*, third international conference on AIDS, Washington 1987.

account for transmission rates being lower than in studies of other risk groups, which have often included patients with AIDS and the AIDS related complex.

Something that requires further study is the relative risk for transmission of different sexual practices. Fischl *et al* showed that seroconversion was associated with not using barrier contraception.⁴³ Padian *et al* reported a relative risk of 2.3 for those engaging in anal intercourse compared with those having only vaginal intercourse but emphasised that anal intercourse was not necessary for transmission.³⁷ Another factor that may influence transmission is genital ulceration:

TABLE IV—*Studies of transmission of HIV from women to men*

Clinical state of women index case	Risk group of index case	No of men partners with antibodies to HIV/No of men studied	% Of partners with antibodies of HIV	Reference
AIDS/asymptomatic	Transfusion associated	2/25	8	42
Not stated	Army personnel	2/6	33	*
Not stated	Patients from Africa	4/10	40	†
AIDS/AIDS related complex	Intravenous drug user	7/12	58	‡
AIDS	Mixed	14/17§	82	§

*Redfield RR, *et al*, second international conference on AIDS, Paris 1986.

†Taelman EJ, *et al*, third international conference on AIDS, Washington 1987.

‡Steigbigel NH, *et al*, third international conference on AIDS, Washington 1987.

§Three men developed antibodies to HIV over median follow up of 24 months.

There is some evidence that the risk of transmission increases both with the duration of the sexual relationship and the frequency of sexual contact. Fischl *et al* studied the long term women partners of 28 men with AIDS: only four of the 28 women had antibodies to HIV at entry to the study, but a further 10 developed antibodies over a median follow up period of 24 months.⁴³ Padian *et al* found an increasing risk of infection in those with more than 100 sexual exposures to the index case, but a univariate analysis found no association between the risk of transmission and the stage of the disease in the index case.³⁷ They estimated a risk of infection of one in every 1000 episodes of sexual contact (Padian N *et al*, the third international conference on AIDS, Washington 1987). However, Peterman *et al* found no relationship between frequency of contact and risk of transmission.⁴²

one African study found an increased risk of being infected in those with a history of genital ulceration (Greenblatt RM *et al*, third international conference on AIDS, Washington 1987).

Transmission from women to men

Studies of transmission from women to men have been small so that it is difficult to assess the relative risks of transmission from women to men and from men to women (table IV). The studies there are give a wide range of results, similar to those for transmission from men to women. Some of these studies are unpublished and details of sexual behaviour are not available. In the study by Fischl *et al* nine of the 17 male partners of women with AIDS were infected at

entry to the study and three subsequently developed antibodies to HIV.⁴³ In many couples both partners had no risk factors for infection other than being Haitian immigrants, and it is not clear whether infection occurred first in the man or the woman.

Infectivity

One key biological variable in heterosexual transmission that we cannot yet measure is the infectivity of the index case. In other infectious diseases infectivity correlates with the quantity of infectious virus excreted. As yet there is no simple quantitative assay for HIV virus. One measure for infectivity might be concentrations of HIV antigen if they correlate with the quantity of infectious virus in the blood. This would be analogous to the high infectivity of those who carry the hepatitis B e antigen as compared with those with antibody only. Antigen concentrations tend to increase with progression towards AIDS and show some correlation with the ability to isolate infectious virus.^{47, 48} Such hypotheses can be substantiated only by careful longitudinal research. Studies of relationships followed over time might help to unravel some of these problems, but many couples will, of course, change their sexual behaviour once HIV infection is diagnosed. It appears that infectivity varies both between individuals and within individuals over time. Case studies show that some people remain highly infectious over time,

but epidemiological studies show that this is not true of all those infected. Treatment to reduce infectivity may be important in controlling the epidemic.

Predicting the future epidemic

The future of the heterosexual epidemic in Europe and the United States will depend on rates of partner change in the heterosexual population. Thus we must collect information on sexual behaviour in representative samples of the population; monitor behaviour change in response to education programmes; and continue research on transmission. Since heterosexuals far outnumber male homosexuals heterosexually acquired HIV may eventually account for a higher proportion of the cases than at present. Nevertheless, because heterosexuals change partners less often than homosexuals in Britain, the epidemic among heterosexuals is likely to develop more slowly than among homosexuals.¹ Un-tempered optimism, such as delayed our public health response to the homosexual epidemic, should not colour our response to a potentially devastating epidemic.

ANNE M JOHNSON

Lecturer,
Academic Department of Genitourinary Medicine,
University College and Middlesex School of Medicine,
London W1N 8AA

- May RM, Anderson RM. Transmission dynamics of HIV infection. *Nature* 1987;326:137-42.
- Centers for Disease Control. Update: acquired immunodeficiency syndrome—United States. *MMWR* 1987;36:522-7.
- Moss AR. AIDS and intravenous drug use: the real heterosexual epidemic. *Br Med J* 1987;294:389-90.
- Gunson HH, Rawlinson VI. HIV antibody screening of blood donations in the United Kingdom. *Vox Sang* 1988;54:34-8.
- Schorr JB, Berkowitz A, Cumming PD, Katz AJ, Sandler SG. Prevalence of HTLV III antibody in American blood disorders. *N Engl J Med* 1985;313:384-5.
- Burke DS, Brundage JF, Herbold JR, et al. Human immunodeficiency virus infections among civilian applicants for United States military service, October 1985 to March 1986. *N Engl J Med* 1987;317:131-6.
- Smith GL. Bisexuality, a risk factor for HIV infection in military men. *Lancet* 1987;ii:1402-3.
- Carne CA, Weller IVD, Johnson AM, et al. Prevalence of antibodies to human immunodeficiency virus, gonorrhoea rates and changed sexual behaviour in homosexual men in London. *Lancet* 1987;ii:656-8.
- Quinn TC, Glasser D, Cannon RO, et al. Human immunodeficiency virus infection among patients attending clinics for sexually transmitted diseases. *N Engl J Med* 1988;318:197-203.
- Barton SE, Underhill GS, Gilchrist C, Jeffries DJ, Harris JRW. HTLV III antibody in prostitutes. *Lancet* 1985;ii:1424.
- Brenky-Faudeux D, Fribourg-Blanc A. HTLV III antibody in prostitutes. *Lancet* 1985;ii:1424.
- Smith GL, Smith LKF. Lack of HIV infection and condom use in licensed prostitutes. *Lancet* 1986;ii:1392.
- Krogsgaard K, Gluud C, Pedersen C, et al. Widespread use of condoms and low prevalence of sexually transmitted diseases in Danish non-drug addict prostitutes. *Br Med J* 1986;293:1473-4.
- Schultz S, Milberg JA, Kristal AR, Stoneburner RL. Female to male transmission of HTLV III. *JAMA* 1986;255:1703-4.
- Papaevangelou G, Roumeliotou-Karayannis A, Kallinkos G, Paoutsakis G. LAV/HTLV III infection in female prostitutes. *Lancet* 1985;ii:1018.
- Tirelli U, Vaccher E, Sorio R, Carbone A, Monfardini S, et al. HTLV III antibodies in drug-addicted prostitutes used by US soldiers in Italy. *JAMA* 1986;256:711-2.
- Centers for Disease Control. Antibody to human immunodeficiency virus in female prostitutes. *MMWR* 1987;36:157-61.
- Quinn TC, Mann JM, Curran JW, Piot P. AIDS in Africa: an epidemiologic paradigm. *Science* 1986;234:955-63.
- Clumek N, Van de Perre P, Carael M, Rouvroy D, Niaramba D. Heterosexual promiscuity among African patients with AIDS. *N Engl J Med* 1985;313:182.
- Van de Perre P, Clumek N, Carael M, et al. Female prostitutes: A risk group for infection with human T-cell lymphotropic virus type III. *Lancet* 1985;ii:524-6.
- Melbye M, Njelesani EK, Bayley A, et al. Evidence for heterosexual transmission and clinical manifestations of human immunodeficiency virus infection and related conditions in Lusaka, Zambia. *Lancet* 1986;ii:1113-5.
- Clumek N, Robert-Guroff M, Van de Perre P, et al. Seroepidemiological studies of HTLV III antibody prevalence among selected groups of heterosexual Africans. *JAMA* 1985;254:2599-602.
- Piot P, Plummer FA, Rey MA, et al. Retrospective seroepidemiology of AIDS virus infection in Nairobi prostitutes. *J Infect Dis* 1987;155:1108-12.
- Kreiss JK, Koech D, Plummer FA, et al. AIDS virus infection in Nairobi prostitutes. *N Engl J Med* 1986;314:414-8.
- Mann J, Quinn TC, Piot P, et al. Condom use and HIV infection among prostitutes in Zaire. *N Engl J Med* 1987;36:345.
- Vittecoq D, May T, Roue RT, Stern M, et al. Acquired immunodeficiency syndrome after travelling in Africa: an epidemiological study in seventeen caucasian patients. *Lancet* 1987;ii:612-4.
- Zagury D, Bernard J, Leibowitch J, et al. HTLV III in cells cultured from semen of two patients with AIDS. *Science* 1984;226:449-51.
- Vogt MW, Witt DJ, Craven DE, et al. Isolation of HTLV III/LAV from cervical secretions of women at risk for AIDS. *Lancet* 1986;ii:525-7.
- Wofsy CB, Cohen JB, Hauer LB, et al. Isolation of AIDS-associated retrovirus from genital secretions of women with antibodies to the virus. *Lancet* 1986;ii:527-9.
- Vogt MW, Witt DJ, Craven DE, et al. Isolation patterns of the human immunodeficiency virus from cervical secretions during the menstrual cycle of women at risk from the acquired immunodeficiency syndrome. *Ann Intern Med* 1987;106:380-2.
- Fultz PN, McClure HM, Daugharty H, et al. Vaginal transmission of human immunodeficiency virus (HIV) to a chimpanzee. *J Infect Dis* 1986;154:896-900.
- Stewart GJ, Tyler JPP, Cunningham AL, et al. Transmission of human T-cell lymphotropic virus type III (HTLV III) by artificial insemination by donor. *Lancet* 1985;ii:581-4.
- The Collaborative Study Group of AIDS in Haitian Americans. Risk factors for AIDS among Haitians residing in the United States. Evidence of heterosexual transmission. *JAMA* 1987;257:635-9.
- Harris C, Butkus Small CB, Klein RS, et al. Immunodeficiency in female sexual partners of men with the acquired immunodeficiency syndrome. *N Engl J Med* 1983;308:1181-4.
- Cabane J, Thibierge E, Godeau P, Moreau A, Wattiaux MJ. AIDS in an apparently risk-free woman. *Lancet* 1984;ii:105.
- Tauris P, Black FT. Heterosexuals importing HIV from Africa. *Lancet* 1987;ii:325.
- Padian N, Marquis L, Francis DP, et al. Male to female transmission of human immunodeficiency virus. *JAMA* 1987;258:788-91.
- Calabrese LH, Gopalakrishna KV. Transmission of HTLV III infection from man to woman and woman to man. *N Engl J Med* 1986;314:987.
- L'Age-Stehr J, Schwarz A, Offermann G, et al. HTLV III infection in kidney transplant recipients. *Lancet* 1985;ii:1361-2.
- Staszewski S, Schieck E, Rehmet S, Helm EB, Stille W, et al. HIV transmission from male after only two sexual contacts. *Lancet* 1987;ii:628.
- Redfield RR, Markham PD, Salahuddin SZ, Wright DC, Sarngadharan MG, Gallo RC. Heterosexually acquired HTLV III/LAV Disease (AIDS-related complex and AIDS). Epidemiologic evidence for female-to-male transmission. *JAMA* 1985;254:2094-6.
- Peterman TA, Stoneburner RL, Allen JR, Jaffe HW, Curran JW. Risk of Human Immunodeficiency Virus transmission from heterosexual adults with transfusion-associated infections. *JAMA* 1988;259:55-8.
- Fischl MA, Dickinson GM, Scott GB, Klimas N, Fletcher MA, Parks W. Evaluation of heterosexual partners, children and household contacts of adults with AIDS. *JAMA* 1987;257:640-4.
- Jones P, Hamilton PJ, Bird G, et al. AIDS and haemophilia: Morbidity and Mortality in a well defined population. *Br Med J* 1985;291:695-9.
- Allain JP. Prevalence of HTLV/LAV antibodies in patients with haemophilia and in their sexual partners in France. *N Engl J Med* 1986;315:517.
- Kreiss JK, Kitchen LW, Prince HE, Kasper CK, Essex M. Antibody to human T-lymphotropic virus type III in wives of hemophiliacs. *Ann Intern Med* 1985;102:623-6.
- Pedersen C, Nielsen CM, Vestergaard BF, Gerstoft J, Krogsgaard K, Nielsen JO. Temporal relation of antigenaemia and loss of antibodies to core antigens to development of clinical disease in HIV infection. *Br Med J* 1987;295:567-9.
- Falk LA, Paul D, Landay A, Kessler H. HIV isolation from plasma of HIV-infected persons. *N Engl J Med* 1987;316:1547-8.