
Contribution of HIV/AIDS to Global Blindness

██████████ Dhananjay Shukla, MS

██████████ Sivakumar R. Rathinam, DNB, PhD

██████████ Emmett T. Cunningham, Jr, MD, PhD, MPH

The human immunodeficiency virus (HIV) appears to have been transmitted from chimpanzees to humans in Central Africa.¹ Human infections were probably sporadic until the 1970s, when rapid urbanization of the African interior led to regional epidemics. Intercontinental travel, along with widespread practices of unprotected sexual intercourse and intravenous drug abuse led, in turn, to rapid globalization of HIV infection in the late 1970s and early 1980s.² The acquired immunodeficiency syndrome (AIDS) represents the advanced form of HIV infection, and was first reported in the United States in 1981.³ Dr Holland and colleagues⁴ reported the ocular manifestations of HIV in 1982. HIV itself was independently isolated by researchers in France and the United States, in 1983 and 1984, respectively.^{5,6} Since these early publications, an estimated 65 million persons have been infected with HIV/AIDS and the infection has claimed over 22 million lives worldwide, including 500,000 in the United States.³

■ Global Prevalence of HIV/AIDS and Geographic Variations

The Joint United Nations Program on HIV/AIDS (UNAIDS) and the World Health Organization (WHO)⁷ have estimated that a total of 39.5 million people were living with HIV in 2006, 2.6 million more than in 2004 (Fig. 1). The most striking increases have occurred in East Asia, Eastern Europe, and Central Asia, where the prevalence in 2006 was 21% higher than in 2004. In many of these regions, new HIV

ADULTS AND CHILDREN ESTIMATED TO BE LIVING WITH HIV IN 2006

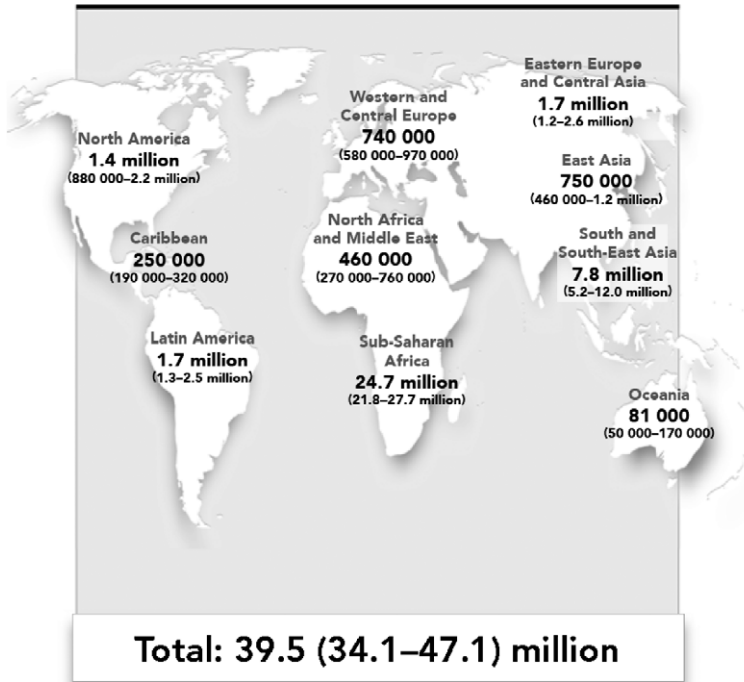


Figure 1. Map showing global prevalence of HIV infection (UNAIDS report 2006). Reproduced with permission from UNAIDS (2006). Source: Joint United Nations program on HIV/AIDS (UNAIDS). 2006 report on the global AIDS epidemic. Geneva, Switzerland: UNAIDS; 2006. Available at http://www.unaids.org/en/hiv_data/2006globalreport/default.asp.

infections are concentrated among people 15 to 24 years of age, who accounted for 40% of the new infections among adults 15 years of age and older in 2006. The contribution to HIV transmission of high-risk behaviors, including injection drug use (IDU), unprotected commercial sex, and unprotected sex between men, is especially evident in the HIV epidemics of Asia, Eastern Europe, and Latin America (Fig. 2). Most HIV infections worldwide still occur during unprotected heterosexual intercourse, however.⁷

Sub-Saharan Africa

The HIV pandemic began in sub-Saharan Africa 3 decades ago and the region is now home to almost 25 million people with HIV/AIDS, 63% of the total infected population worldwide.⁷ Transmission is

Proportions of HIV infections in different population groups by region, 2005

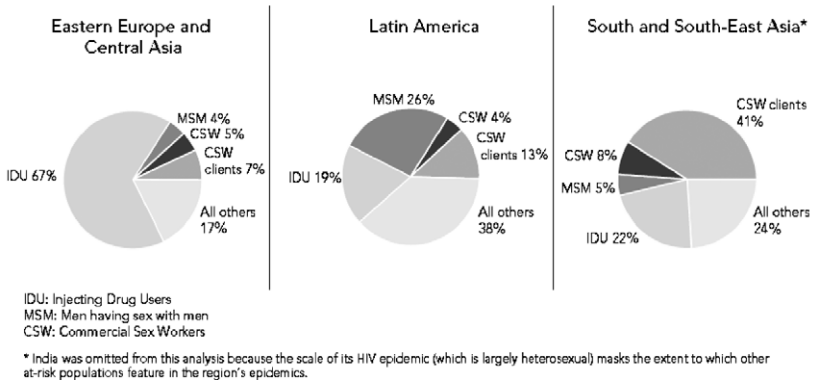


Figure 2. Regional proportions of HIV infections in different population groups, (UNAIDS report 2005). Reproduced with permission from UNAIDS (2006). Source: Joint United Nations program on HIV/AIDS (UNAIDS). 2006 report on the global AIDS epidemic. Geneva, Switzerland: UNAIDS; 2006. Available at: http://www.unaids.org/en/hiv_data/2006globalreport/default.asp.

primarily through heterosexual contact and more women are infected than men. Regionally within Africa, HIV epidemics appear to be following divergent trends.³ There is, for example, evidence of diminishing or stable HIV spread in most Eastern and Western African countries, yet growing epidemics are noted in Southern Africa, particularly Mozambique, South Africa, and Swaziland. One in 3 adults in Swaziland were living with HIV in 2005. South Africa, with an HIV prevalence of 19%, has the world's second largest HIV-positive population with 5.5 million infected. In Mozambique, HIV prevalence in pregnant women rose from 11% in 2000 to 16% in 2004, one of the steepest increases seen in sub-Saharan Africa.^{3,7} Only Zimbabwe, where HIV infection levels in pregnant women were 30% to 32% in the early 2000s before declining to 24% in 2004, showed evidence of a strong decline in national HIV prevalence and incidence. This observed decline seems to be related to a combination of factors, including a reduction in casual sex, increased use of condoms, and later sexual debut for teenagers. Still, approximately 1 in 5 adults in Zimbabwe was living with HIV in 2006.^{7,8}

South and Southeast Asia

After Africa, the Asian continent contains the largest HIV-positive population, with over 8 million infected. In South and South-East Asia, the number of new HIV infections rose by 15% between 2004 and 2006.^{3,7} Economic volatility in Africa and Asia has triggered large-scale

migrations from rural villages to urban slums, leading to social fragmentation and promoting a rise in high-risk behaviors. Although the Asian epidemic began in Thailand, India and China are its newest epicenters. Having begun in rural areas before spreading to cities, China's drug use-related HIV epidemic has now affected 650,000 lives.³ Sexual risk behaviors, observed in 11% of the injection drug users, compound the likelihood of HIV spread. Particularly important is ignorance of the role of unprotected sex in disease transmission, which was responsible for half the new infections in 2005.⁷

A staggering 5.7 million people are now infected with HIV in India, making it the largest HIV-affected population in any single country in the world, and home to 1 out of every 8 people with HIV infection.^{7,9,10} As in China, the majority of HIV infections in India appears to be occurring in a few regions. About two thirds of reported HIV infections have been in 6 of the country's 28 states—mainly in the industrialized South and West and in the North-East tip, where the prevalence of HIV infection is 4 to 5 times higher than in other states. IDU is the main risk factor for HIV infection in the North-East, although most HIV infections in India occur during unprotected heterosexual intercourse.^{7,9,10} Consequently, women accounted for a 38% of people living with HIV in 2005 and a large proportion were from rural areas. Most of these women acquired the virus from their regular partners who were infected during unprotected intercourse with commercial sex workers.^{3,7,10}

Among other Asian nations, the HIV epidemic is on an upswing in Vietnam, Malaysia, and Indonesia, whereas Cambodia, Myanmar, and Thailand registered either a stabilization or slowdown of the epidemic in the recent years.^{7,11} The epidemics in Thailand and Cambodia have been driven largely by the commercial sex industry, the prime target of government-initiated prevention programs. In Vietnam, the use of nonsterile injection equipment is widespread, compounded by sexual risk-taking, especially among the male migrant workers. The number of people living with HIV has doubled in Vietnam since 2000, and affected an estimated 260,000 lives in 2005.¹¹

Eastern Europe and Central Asia

The HIV epidemic has exploded in Eastern Europe and Central Asia, with a 20-fold increase in less than 10 years.⁷ Almost a third of newly diagnosed HIV infections are in people 15 to 24 years of age who inhabit mainly the Russian Federation and Ukraine. Together, these 2 nations account for approximately 90% of all people living with HIV in this region.¹² The HIV epidemics in these countries are mostly affecting young people. In the Russian Federation, for example, some 80% of people with HIV are younger than 30 years of age. In the Russian Federation and Ukraine, women bear a growing proportion of the HIV

burden, accounting for more than 40% of new HIV diagnoses in 2005. Similar to Asia, two thirds of the prevalent HIV infections in 2005 in this region were due to the use of nonsterile IDU equipment, with sex workers and their clients contributing 12% of the infections. The biggest epidemic in Central Asia is in Uzbekistan, which straddles major drug-trafficking routes, and has more than doubled its HIV-positive population since 2001.^{7,12}

Latin America and the Caribbean

The epidemics in Latin America and the Caribbean have remained stable over the past 2 years. Two thirds of the nearly 2 million people living with HIV in Latin America reside in the 4 largest countries: Argentina, Brazil, Colombia, and Mexico. In 2005, one fourth of the HIV infections in Latin America were in men who have sex with men, whereas a fifth were in injection drug users. Although HIV prevalence in sex workers is relatively low in this region, they and their clients account for 17% HIV infections.^{3,7} Brazil has kept its HIV epidemic under control (adult HIV prevalence: 0.5%) with dual emphasis on prevention and treatment¹³; but still has approximately 30% of the HIV population of South and Central America and the Caribbean. Nearly 3 quarters of the 250,000 people living with HIV in the Caribbean are in Dominican Republic and Haiti. After sub-Saharan Africa, the Caribbean is the second most HIV-affected region of the world. Like sub-Saharan Africa, HIV transmission in the Caribbean is largely heterosexual.^{3,7}

North America and Western Europe

In North America and Western Europe, the HIV-infected populations continue to increase, in large part owing to the life-prolonging effects of antiretroviral therapy, new HIV infections each year in North America, and an increase in the number of new HIV diagnoses in Western Europe since 2002.⁷ The most common risk factor remains unsafe sex between men (44% of HIV/AIDS cases reported in 2001 to 2004), followed by unprotected heterosexual intercourse (34% of cases) and the use of nonsterile drug injection equipment (17%).^{7,14} Because of the increase in heterosexual transmission, women account for a growing proportion of the HIV-infected population. The proportion of women among new HIV/AIDS diagnoses has increased substantially, from 15% before 1995 to 27% in 2004, especially the African-American women. Ethnic minorities are also disproportionately affected in general. Although blacks constituted 12% of the US population during 2001 to 2004, they accounted for 50% of HIV/AIDS infections, which were 7 times more common in black men

and 21 times more common in black women as compared with their white counterparts.¹⁵

■ Ocular Manifestations of HIV/AIDS (Fig. 3)

In the era preceding widespread use of highly active antiretroviral therapy (HAART), the CD4⁺ cell count was a reliable predictor of the risk of ocular complications of HIV infection (Table 1).¹⁶ During this era, ocular manifestations of HIV/AIDS affected 50% to 75% of

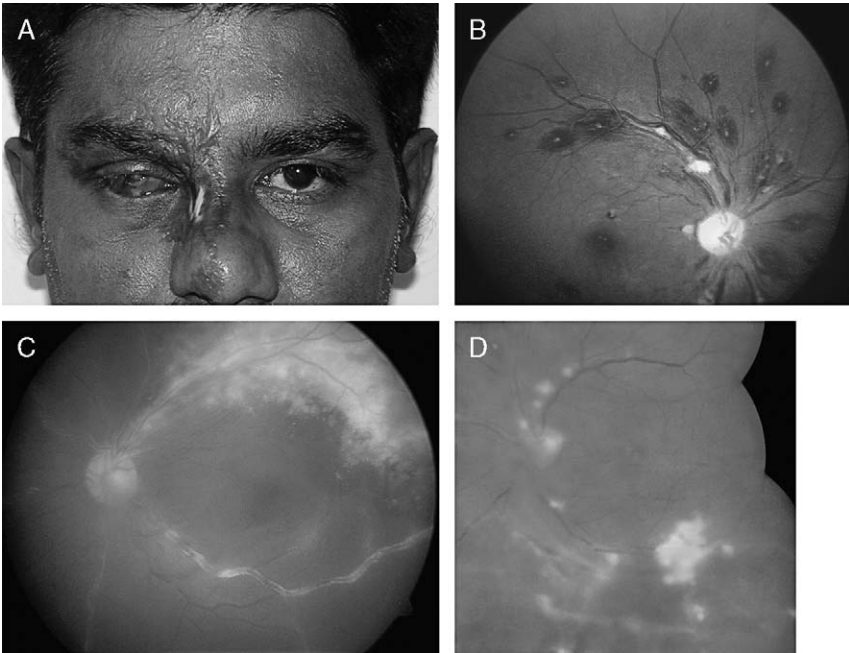


Figure 3. Ocular manifestations of HIV/AIDS. *A*, HZO, which characteristically affects the trigeminal dermatome, is uncommon in HIV except in Sub-Saharan Africa. Visual loss may occur due to corneal involvement, as seen here, or due to retinitis, uveitis, or optic neuritis. *B*, HIV retinopathy is the most common ocular manifestation of HIV infection. Cotton-wool spots are the classic findings, occasionally with superficial hemorrhages and Roth's spots, as seen here. HIV retinopathy is almost invariably asymptomatic, barring rare cases of ischemic maculopathy (see text), not observed in this eye. *C*, CMV retinitis is the most common ocular complication in HIV/AIDS. Note the large patch of retinal whitening at the superotemporal arcade, with bordering satellite lesions and hemorrhages. Such posterior lesions are immediately sight threatening. Retinal vasculitis, seen both within and outside the area of retinitis, is uncommon, but may assume a striking frosted-branch appearance in a minority of patients. *D*, Toxoplasmic retinochoroiditis is uncommon in HIV patients except in countries where toxoplasmosis itself is common, such as Brazil and France. Note the prominent vitreous reaction and paucity of hemorrhages and small satellite lesions at the lesion borders, all of which distinguish toxoplasmic retinochoroiditis from CMV retinitis. Patients with AIDS are more likely to have multiple (as seen here), larger, or bilateral lesions.

Table 1. *Ophthalmic Manifestations of HIV Infection by CD 4⁺ Count*

CD4 ⁺ T-lymphocyte count (cells/ μ L)	Complication
<500	HZO
	Kaposi sarcoma
	Lymphoma
<200	Coccidioidomycosis
	Cryptococcosis
	Histoplasmosis
	Pneumocystosis
	Toxoplasmosis
	Tuberculosis
<100	CMV retinitis
	Microsporidiosis
	Mycobacterium avium cellulare infection
	Progressive multifocal leukoencephalopathy
	Retinal/conjunctival microvasculopathy
	Varicella zoster virus retinitis

Modified after *N Engl J Med.* 1998;339:236–244.

all infected persons at some point during the course of their disease.^{17,18} Although the incidence of ocular complications related to HIV/AIDS has dropped dramatically in regions where HAART is available, both the predictive value of CD4⁺ cell count and the high prevalence of ocular complications continue to be the norm in most parts of the globe.

Orbital and Adnexal Complications of HIV/AIDS

The most common complications affecting the orbit and adnexa are herpes zoster ophthalmicus (HZO), Kaposi sarcoma, molluscum contagiosum, and conjunctival microvasculopathy. The occurrence of HZO (Fig. 3A) in a person less than 50 years old is uncommon, and should suggest the possibility of immunosuppression. HZO affects 5% to 15% of HIV patients.¹⁶ For patients on HAART, protease inhibitors have been reported to double the incidence of HZO, which appears to be milder in patients receiving combination therapy.¹⁹ About 17% of those not on HAART develop acute retinal necrosis (ARN). Kaposi sarcoma affects the skin and mucous membranes in up to 5% of HIV patients. Molluscum contagiosum similarly affects the eyelids of up to 5% of those infected by HIV.^{19,20}

Anterior Segment Complications of HIV/AIDS

More than half of HIV-positive patients have anterior segment complications. The most common visually important complications

include dry eye (keratoconjunctivitis sicca), infectious keratitis, and iridocyclitis. Dry eye developed in 10% to 20% of the HIV patients in the pre-HAART era. Some of these patients suffered from xerostomia and salivary gland enlargement (Sjögren-like syndrome) as well. Since the advent of HAART, however, the incidence of histologically proven Sjögren-like syndrome is reported to have dropped from 8% to below 2%.¹⁹ Corneal infections occur in less than 5% of HIV-infected patients, but may be severe and result in permanent loss of vision. Varicella-zoster virus and herpes simplex virus are the most common causes of keratitis. Anterior uveitis generally occurs in the setting of posterior segment infections, and should be differentiated from drug-induced inflammation.^{16,20}

Posterior Segment and Central Nervous System Complications of HIV/AIDS

The posterior segment manifestations tend to be most visually significant and can be divided into 4 categories: microvasculopathy, unusual malignancies, neuro-ophthalmologic abnormalities, and opportunistic infections.¹⁸

HIV Microvasculopathy

Recognized clinically as scattered cotton wool spots and intraretinal hemorrhages, HIV retinopathy (Fig. 3B) is the commonest ocular manifestation of AIDS, seen in 40% to 60% of patients before the introduction of HAART, typically as CD4⁺ count falls below 50 cells/ μ L. Most patients are asymptomatic. Ischemic maculopathy, characterized by extensive capillary closure involving the fovea, is a severe form of HIV microvasculopathy that can produce abrupt visual loss in a minority of patients.^{17,18}

Unusual Malignancies

Non-Hodgkin lymphoma is second to toxoplasmosis as a cause of cortical visual loss in HIV-positive patients. The overall prognosis for survival for HIV patients with central nervous system lymphoma is poor. The proportion of patients with Non-Hodgkin lymphoma seems to have increased slightly since the advent of HAART.¹⁸

Neuro-ophthalmologic Abnormalities

Neuro-ophthalmic abnormalities occur in 6% to 15% of the patients with HIV/AIDS, cryptococcal meningitis being the most common cause.^{16,18,19} About a quarter of the HIV-positive patients with cerebral cryptococcosis develop neuro-ophthalmic manifestations, most notably, papilledema.^{16,18,20} The prevalence of cerebral toxoplasmosis varies

with the prevalence of latent systemic infection. In France and Brazil where toxoplasmosis is endemic, cerebral toxoplasmosis may affect up to 40% of patients.²⁰

Opportunistic Infections (Fig. 3)

Cytomegalovirus (CMV) retinitis is the most common AIDS-related ocular complication (Fig. 3C), and developed in 30% to 40% of AIDS patients in the United States before HAART.¹⁸ Although its incidence has declined markedly since the advent of combination antiretroviral therapy, CMV retinitis remains the leading cause of ocular morbidity in HIV-positive patients in the industrialized world. Other posterior segment infections still seen in an appreciable number include herpes zoster virus retinitis, herpes simplex virus retinitis, and retinochoroidal toxoplasmosis (Fig. 3D).²

■ Impact of HIV/AIDS on Global Blindness

It is difficult to assess the contribution of HIV/AIDS to global blindness. More than 90% of all HIV sufferers live in the developing world, where ophthalmic prevalence data are often sketchy or unavailable.^{10,17} The spectrum of ocular complications and their prevalence also differ substantially between developing and industrialized nations.¹⁶ Moreover, ocular manifestations of AIDS in children, who are affected mainly in the developing countries, differ from those diagnosed in adults.^{16,19} While estimating the global importance of HIV-related blindness, special attention must be given to those diseases that have the potential to affect both eyes, including CMV retinitis, ARN and the variant of ARN referred to as progressive outer retinal necrosis (PORN), HIV-related ischemic microvasculopathy, ocular syphilis and tuberculosis, cryptococcal meningitis, and ocular toxic or allergic drug reactions.¹⁷

CMV Retinitis

CMV retinitis tends to occur in advanced HIV infections. Because of its strong association with both blindness and mortality in HIV patients, CMV retinitis is universally acknowledged as the clinically most important ocular complication of AIDS. Estimates of the incidence of CMV disease vary considerably between geographical locations.²¹ Unlike the industrialized world, CMV retinitis is uncommon in Africa, affecting less than 10% of the HIV patients, who generally succumb to infections like tuberculosis too early to develop profound immunosuppression.^{20,22} In a South Indian study, CMV retinitis was observed in 17% of HIV-positive patients.²³ In Thailand and also in Brazil, the prevalence in the HIV patients was noted to be 25%.^{17,24}

A clinic-based British study reported “CMV maculopathy” as a cause of visual loss in 38% HIV patients;²⁵ whereas a postmortem study in Italy revealed CMV retinitis in one third of the eyes of people who died of AIDS.²⁶ Overall, these numbers would suggest that between 10% and 40% of the 39.5 million people currently living with HIV/AIDS, or about 4 to 16 million people, have or will develop CMV retinitis. But how many of these patients will be blinded by their disease? In the pre-HAART era in the United States, a majority of the AIDS patients died within a year of the diagnosis of CMV retinitis, such that only about 10% to 15% of patients with CMV retinitis had best-corrected visual acuity $\leq 20/200$ in their better eye at the time of their death.^{27–29} Such figures would suggest that somewhere between 400,000 and 2.4 million people with HIV/AIDS are currently bilaterally blinded ($\leq 20/200$) by CMV retinitis.

ARN/PORN

Necrotizing herpetic retinitis occurs in 2 patterns: PORN and ARN. Most often the cause is varicella zoster virus, although herpes simplex virus and CMV can produce similar syndromes.¹⁷ Herpetic retinitis has been reported to occur in 4% of the Brazilian HIV patients.²⁴ HZO, its common precursor, was reported in 1% of the HIV patients in a large Indian series.²³ A possible exception is Africa, where HZO remains a very common opportunistic infection.^{17,30–32}

HIV-related Ischemic Maculopathy

Although there seems to be no difference in the prevalence of HIV retinopathy between African and North American HIV-infected patients (~50%), reports from Brazil and India suggest somewhat lower prevalence of 1% and 15%, respectively.^{23,24,33} The reasons for such differences are unknown. Although common, HIV retinopathy rarely causes vision loss.

Ocular Syphilis

Syphilis is the commonest bacterial intraocular infection in HIV-infected patients.¹⁶ Vision loss in patients with syphilis occurs most frequently owing to uveitis or optic nerve disease, the former being most common.^{16,34} Two thirds of the global syphilitic infections occur in Sub-Saharan Africa and South/Southeast Asia. In the former, 2% to 17% of the women test positive for syphilis in antenatal clinics, and rates of HIV coinfection are very high.³⁵ It is, therefore, probable that complications leading to blindness attributable to syphilis occur in these developing countries; but are frequently underdiagnosed.

Ocular Tuberculosis

Tuberculosis is the single most important HIV-related opportunistic infection in developing countries.^{36,37} In a Malawian hospital-based study, 94% of the patients diagnosed to have tuberculosis were HIV-positive and 3% of such coinfecting patients had choroidal granulomas.²² In contrast, only about 5% of new tuberculosis cases in India occur in HIV-positive people. However, this number is still significant because India has the highest annual incidence of tuberculosis in the world, approximately 1.8 million, which represents a fifth of new cases globally.³⁷ Although it is unclear whether the increased prevalence of tuberculosis in HIV-infected patients is associated with a significant rise in ocular morbidity, high incidence of coinfections in the developing world suggest that ocular tuberculosis may be more common than recognized.

Ocular Complications of Cryptococcal Meningitis

The most common life-threatening fungal pathogen that affects patients with AIDS is *Cryptococcus neoformans*. The prevalence of cryptococcal disease is about 7% in the general population in United States.³⁸ The infection is probably more common in HIV-affected populations in the developing countries. Studies of HIV-positive patients with neurologic disorders in South India and Zimbabwe showed that the most common cause of neurologic disease was cryptococcal meningitis, affecting nearly half of all patients in both the countries.^{39,40} Patients with cryptococcal meningitis may lose vision owing to either optic neuropathy or cortical blindness.⁴¹

Iatrogenic Ocular Morbidity

Immune Recovery Uveitis A paradoxical worsening of intraocular inflammation is observed in eyes with inactive CMV retinitis in patients who recover functional immunity to CMV in the setting of successful HAART therapy.⁴² Such patients typically lose vision due to cystoid macular edema, epiretinal membrane formation, vitreomacular traction syndrome, and/or cataract. Immune recovery uveitis reported to occur in 18% to 63% of the patients as their CD4⁺ cell counts climb above 50/ μ L.⁴³⁻⁴⁵ Recently, the use of cidofovir was reported as a primary risk factor in the development of immune recovery uveitis.⁴⁵

Drug Reactions Stevens-Johnson syndrome is caused by a hypersensitivity reaction to drugs like sulfa.⁴⁶ Vision loss occurs primarily because of the corneal scarring. A report from Malawi showed that 75% of patients admitted with Stevens-Johnson syndrome were HIV-positive.⁴⁷

Many of these patients had taken sulfadoxine-pyrimethamine. Both cidofovir and rifabutin (used to treat CMV retinitis and *Mycobacterium avium* infections, respectively) can cause a severe vision-threatening anterior uveitis in HIV-infected patients.⁴² The reaction to cidofovir is independent of the immune recovery uveitis, which occurs exclusively after a successful HAART.

Ocular Manifestations in Children

More than 2 million children under 15 years are affected by HIV worldwide.⁷ In contrast to the developed countries, where the ocular involvement in children is 20%, in developing world (especially Africa), pediatric ocular morbidity is estimated to be much higher (38% to 54%).^{19,48–50} Overall, children seem to be less likely to develop ocular complications, and the prevalence of CMV retinitis has been estimated at 5%.⁴⁸ The major reported manifestations in children include keratoconjunctivitis sicca (30%) and ocular toxoplasmosis (5%).⁴⁹

■ **Prevention of HIV/AIDS**

A recent editorial in *Lancet* suggested that the so-called global epidemic of HIV/AIDS is in fact a mosaic of many epidemics, each running its own course shaped by the local geography, society, and culture.⁵¹ The Centers for Disease Control and Prevention recently recommended HIV screening for all individuals aged 13 to 64 years as part of routine medical care irrespective of lifestyle, perceived risk, or local HIV prevalence.⁵² This sweeping revision of previous guidelines assumes importance because a quarter of the more than 1 million Americans living with HIV are unaware of their status.⁵³ Routine prenatal HIV screening has been remarkably successful in preventing mother-to-child HIV transmission.⁵² Legal issues and the potential for civil rights abuses can complicate such population-based approaches, however.⁵⁴

Ocular Screening²

Most authorities recommend annual dilated screening examination for HIV patients with CD4⁺ counts above 100 cells/ μ L, and screening every 3 to 4 months once the counts drop below this level. As CD4⁺ counts recover in response to HAART, follow-up examinations can be extended as appropriate given the level of immune reconstitution.

As transmission occurs from the individuals already infected with HIV, most prevention programs target HIV-positive patients as well, the so-called “positive prevention.” These measures include screening of patients’ partners, disclosure of status to unaffected partners (serodiscordant couples), behavioral counseling (use of condoms), and

perinatal counseling (avoidance of breast feeding).⁵⁵ In Africa, voluntary counseling and testing of sero-discordant couples was reported to reduce transmission by 56%.⁵⁶

Preexposure prophylaxis with antiretroviral drugs is currently under trial. Off-label use of these drugs should be avoided to prevent complications such as renal dysfunction and bone loss.⁵⁷ Scientists have observed that sexually transmitted infections, including HIV, are uncommon among men in societies where circumcision is customary.⁵⁸ Williams and colleagues⁵⁹ recently made the impressive claim, backed by a controlled trial, that routine circumcision of all the men in Africa could prevent 2 million new HIV infections and avert 300,000 deaths over the next 10 years.

Finally, responsive political leadership can help alter the course of local epidemics. Prevention and education efforts targeting the young and the sex workers saved millions of lives in Thailand, Senegal, and Cambodia. Thailand succeeded also by cutting the cost of therapy and monitoring, increasing local drug development and research, instituting perinatal prophylaxis, and promoting patient education. A similar government initiative in Cambodia saw almost a million cumulative infections averted, and a decline in prevalence, previously pegged at an alarming 33%.¹¹ Senegal's success has been credited to both culture, including marriage customs and circumcision, and government initiatives.⁵¹

■ Summary

Although the number of people receiving antiretroviral therapy has increased more than 3-fold since 2003, there remains a great discrepancy in the access to medical care around the world. Although about 16% to 17% of the total number of people in need of antiretroviral treatment in Asia and Sub-Saharan Africa have access to treatment, in South and Central America and the Caribbean, approximately 68% of persons in need of antiretroviral therapy received it in 2005.^{3,7} The available evidence suggests that at present the main cause of blindness associated with HIV infection is CMV retinitis.^{17,18} Although the incidence of such opportunistic infections is deceptively low in the developing world, where nearly all the global HIV population is concentrated, the number of undiagnosed patients may actually be large. Increased survival through improved diagnosis and treatment of such opportunistic infections will further increase the prevalence of AIDS-related blindness for two probable reasons. Most patients are unlikely to sustain the financial burden of prolonged and full-scale HAART (annual cost approximately US \$ 20,300 per adult).⁶⁰ Secondly, blinding complications (eg, retinal detachment) may follow even after complete resolution of opportunistic lesions like CMV retinitis. Further,

depending on the country and how the antiretroviral therapy was targeted, 25% to 100% of HIV cases could become drug-resistant after 30 years of use.⁶¹

All is not necessarily lost, however. The benefits of improved access to treatment and care have been dramatic: an estimated 2 million life years were gained since 2002 in low-income and middle-income countries. In sub-Saharan Africa alone, some 790,000 life-years have been gained.⁷ It is estimated that two thirds of the current and future HIV infections could be avoided by expansion of existing prevention strategies alone. The “3 by 5” initiative by WHO, to distribute antiretroviral therapy to 3 million people in 50 developing countries by the end of 2005, is another positive step.⁶² Governments are finally moving from denial to recognition. Scientists now understand the disease better, to develop new vaccines and therapies. Together, these efforts show the promise to improve the quality and quantity of millions of HIV-affected lives. To revisit the concept of HIV as a composite epidemic,⁵¹ although global initiatives are needed to raise funds and to develop new drugs, it will be local people in the field who will defeat the epidemic by addressing the native patterns fostering this rampaging disease.

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