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Abstract

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THE OPTOMETRIC IMPLICATIONS OF THE AIDS VIRUS

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ABSTRACT

This article is designed as an informative and comprehensive literature review about the Human Immunodeficiency Virus(HIV) that causes the Acquired Immunodeficiency Syndrome(AIDS) and the implications of AIDS on the practice of optometry. This article is divided into three sections: the first section describes the effect of the virus upon the body's immune system and reports current statistics regarding the spread and mortality rate of AIDS. The second section is a practitioner's guide on how to detect the particular signs and symptoms of the more common ocular diseases affecting AIDS patients. The third section describes the transmissibility of the HIV from patient to practitioner, or from patient to patient via the optometric office.

As primary health care practitioners, we need to be informed, as completely and accurately as possible about the virus that causes Acquired Immune Deficiency Syndrome(AIDS) and the impact of the disease AIDS in our patients and on our practice.

The virus causing AIDS is currently denoted as the Human Immunodeficiency Virus(HIV). Previously, other commonly utilized names for the same virus have been the Human T-cell Lymphotropic(Leukemia) Virus Type-III(HTLV-III) or the Lymphadenopathy Associated Virus(LAV). This virus can severely devastate the body's immune system, making the fight against infectious diseases for the AIDS patient exceedingly difficult. There is a 90 percent mortality rate for AIDS patients who were diagnosed in 1981 as having AIDS, and the cumulative mortality rate of all diagnosed AIDS patients(from January 1981 - Jan. 1987) is 57 percent.[1]

The range of manifestations of HIV infection may include no signs or symptoms, nonspecific signs and symptoms of illness, autoimmune and neurologic disorders, a variety of opportunistic infections, and several types of malignancy. In June, 1985, Center for Disease Control (CDC)

defined AIDS as the presence of a reliably diagnosed opportunistic disease which is indicative of underlying cellular immune deficiency in a person with no known underlying cause for reduced resistance, with a concurrent positive serologic or virologic test for HIV.[2] This means that the clinical diagnosis of AIDS is at a point in the disease process when the HIV has caused severe symptomology. The most common presenting opportunistic infection in AIDS is Pneumocystis carinii pneumonia(58 percent).[2] Kaposi's sarcoma, a malignancy of the skin or conjunctiva, is present in 18 percent of the AIDS patients. Some of the other more common opportunistic infections seen in AIDS patients are: Toxoplasma gondii encephalitis or disseminated infection, Cryptosporidium enteritis, Candida esophagitis or disseminated infection, Histoplasma capsulatum, Mycobacterium avium-intracellulare disseminated infection, Mycobacterium tuberculosis disseminated infection, cytomegalovirus retinitis and disseminated infection, herpes simplex esophagitis and mucocutaneous lesions, varicella zoster virus disseminated infection, primary brain lymphoma(undifferentiated non-Hodgkin's and Burkitt's-like), and lymphocytic interstitial pneumonitis. Before the HIV infection has reached the stage of allowing opportunistic disease to occur, two preliminary stages are manifested. The earliest is the change in the person's immune status from seronegative to seropositive for the

AIDS virus. These people have antibodies to the HIV, which are detectable with the Enzyme-Linked Immunosorbant Assay (ELISA). Once someone has converted to seropositivity, the person may feel healthy, but s/he is infectious and most likely unaware of his/her infectious state.[3]

The second stage of infection with the HIV is called AIDS Related Complex (ARC). A person who is seropositive for antibodies to HIV, is diagnosed as having ARC when s/he is from a high risk category (homo/bisexual male, intravenous(IV) drug abuser, hemophiliac[1]) and has had one or more of the following symptoms for more than three months: fever and night sweats, persistent lymphadenopathy, chronic diarrhea, and /or an unexplained autoimmune condition.[4]

TABLE ONE: Current and Future Predictions of the Spread of the AIDS Virus

	cumulative reported active AIDS cases (since Jan. 1981)	cumulative deaths due to HIV	number of AIDS patients who are alive	number of persons who have ARC[5]	number of persons who are seropositive
as of Jan. 1987[1]	29,435*	16,418	12,601	126,010	1,260,100
projected figures for Jan. 1991[5]	294,350	164,180	126,010	1,260,100	12,601,000

*males-27,050;females-1,969;children-416

Table One lists the current number of reported active AIDS cases since 1981, the number of people who currently have ARC and are HIV positive, and the future predictions of the spread of the HIV. It is currently estimated that approximately 45 percent of HIV positive individuals will go on to either develope ARC and/or AIDS.[6]

To test for the presence of the antibody to HIV in donated blood and plasma an ELISA test is utilized. The American Red Cross, the Council of Community Blood Centers , and the American Association of Blood Banks found that in a given month, approximately 0.89 percent of the units of blood were initially reactive using the ELISA. [2] Because the ELISA reacts when antibodies to HIV are detected, and not to the virus itself, the reliability of the ELISA test does not rule out the possibility of some AIDS infected blood being utilized. This can occur when the infected donor is unable to produce any antibodies to HIV, produces too few antibodies to be detected on the ELISA, or donates infectious blood prior to his body developing antibodies to HIV(it may take two weeks to six months to

develop antibodies to HIV.[7]) Currently this problem is being handled by discouraging high risk groups from donating blood.[8]

The projected number of infected/infective individuals demonstrates the fact that the practitioner will be seeing patients that have AIDS,ARC or who are knowingly or unknowningly carrying antibodies to HIV. In a recent issue of the Journal of the American Optometric Association, it was stated that practitioners in areas where a high percentage of AIDS cases have been reported, could conceivably examine an HIV infected person once in every 200 patient encounters.[9] A report by the CDC found serum antibody prevalence to HIV in San Francisco area homosexuals to have increased from 1 percent in 1978, to 25 percent in 1980, to 65 percent in 1984.[10] Of the group tested in 1984, 55 percent of men had no symptoms. Also in New York City, 87 percent of heavy IV drug users tested HIV positive and may therefore be considered as potentially infectious.

TABLE TWO

January, 1987

AIDS Cases (adults only) By Risk Factor Combinations[1]

RISK FACTORS	NUMBER OF PERSONS	PERCENT
Homo/Bisexual Male	18,537	63.9
Intravenous(IV) Drug Abuse	4,448	15.3
Homo/Bisexual Male w/hemophilia	2,116	7.3
Heterosexual Contact w/AIDS pt.	1,052	3.6
Undetermined*	915	3.2
Transfusion of Contam. Blood/Plasma	537	1.9
Homo/Bisexual Male w/Transfusions	350	1.2
IV Drug Abuse & Heterosex. Contact	306	1.1
IV Drug Abuse & Blood Transfusion	153	0.5
Bisexual Male w/Heterosexual Contact	148	0.5
Hemophilia/Coagulation Disorder	143	0.5
Hemophilia & Blood Transfusion	104	0.4
Homo/Bisexual Male & IV Drug & Bld Trans	81	0.3
Heterosexual Contact & Bld. Trans.	49	0.2
Homo/Bisexual Male & IV Drug & Hetero.	47	0.2
TOTAL:	28,986	100.0

*Includes patients on whom risk information is incomplete(due to death or loss to follow up.)

Table Two lists the cumulative AIDS cases to date by risk factor combinations, showing the two highest risk factors(bi/homosexual male, IV Drug Abuse) comprise 79.2% of the total AIDS cases.

In terms of the reported AIDS infection via heterosexual contact, male-to-female sexual transmission is the most prevalent mode of HIV transmission. However, indications that female-to-male sexual transmission of HIV infection occurs via female prostitutes are currently being studied. Attempts to isolate the virus from cervical and vaginal secretions are in progress. In several preliminary studies, in various cities, between 5% to 40% of prostitutes had detectable HIV antibodies.[11]

Researchers at the Pasteur Institute in Paris identified the causative agent of AIDS in 1983 and called it LAV(lymphadenopathy-associated virus). The American researchers, led by Robert Gallo at the National Cancer Institute found his version of the AIDS virus in 1984 and named it HTLV-III(human T-lymphotropic/leukemia virus Type-III). Both Gallo and the French researchers think that their viruses are almost identical, but both insist on using their own designated names for the virus.[12]
Although direct comparative results have not been published; because HTLV-III and LAV have the same apppearance by electron microscopy, attack the same cells, and-when isolated from American AIDS patients-

were immunologically indistinguishable, HTLV-III and LAV are likely to be the same virus.[10] In the summer of 1986 in Paris, France, in order to reduce variances in the virus' nomenclature, a committee of AIDS researchers recommended the use of Human Immunodeficiency Virus(HIV) as the term for the virus causing AIDS.[12]

Evidence is accumulating that the virus was present in Africa at least a decade before the first U.S. cases were detected and seems to be endemic in central African nations. A species of monkeys, the African Green, carries a virus that is very similar to the HIV and is called the Simian T-Lymphotropic Virus(STLV-III). One-half to two-thirds of the African Green monkeys are infected with STLV-III, and this virus may have been passed into humans via animal bites and the practice of Africans eating the green monkeys. It is further hypothesized that the virus got from Africa to the U.S. via American homosexual men vacationing in Haiti, a country with many African immigrants and an extremely high number of AIDS cases per capita.[13]

Infection with the HIV causes a collapse of the immune defenses in the AIDS patient by reducing the number and changing the function of the T4 lymphocytes, an important type of cell in the immune system.

One type of white blood cell called lymphocytes, fall into two categories: the B-cells and the T-cells. B-cells are the source of antibodies(proteins which bind to other molecules foreign to the body and known as

antigens.) When a B-cell recognizes an antigen, the B-cell becomes activated and produces antibody molecules that are specific for the antigens. When a T-lymphocyte recognizes an antigen, it performs a function which is dependent upon the T-lymphocyte's type. The cytotoxic T-cells destroy infected, foreign or malignant cells by disrupting(lysing) their cell membranes. The inducer T-cell, triggers the maturation of T-lymphocytes into functionally distinct cells. Helper T-cells trigger the initiation and expansion of the immune reaction of the other T-cells and most B-cells. Helper T-cells enable cytotoxic T-lymphocytes to destroy cells containing the antigen and they allow B-lymphocytes to secrete the appropriate antibodies. The fourth kind of T-cells, suppressor T-cells, dampen the immune response of B and T-cells by shutting down the immune system several weeks after they've been activated. These four types of T-cells are placed into two categories on the basis of their biochemical surface markers: the T4 cell category, which the HIV infects, consists of the T-Helper cells and T-Inducer cells. The second category, the T8 category, includes the T-Suppressor and T-Cytotoxic cells.[14]

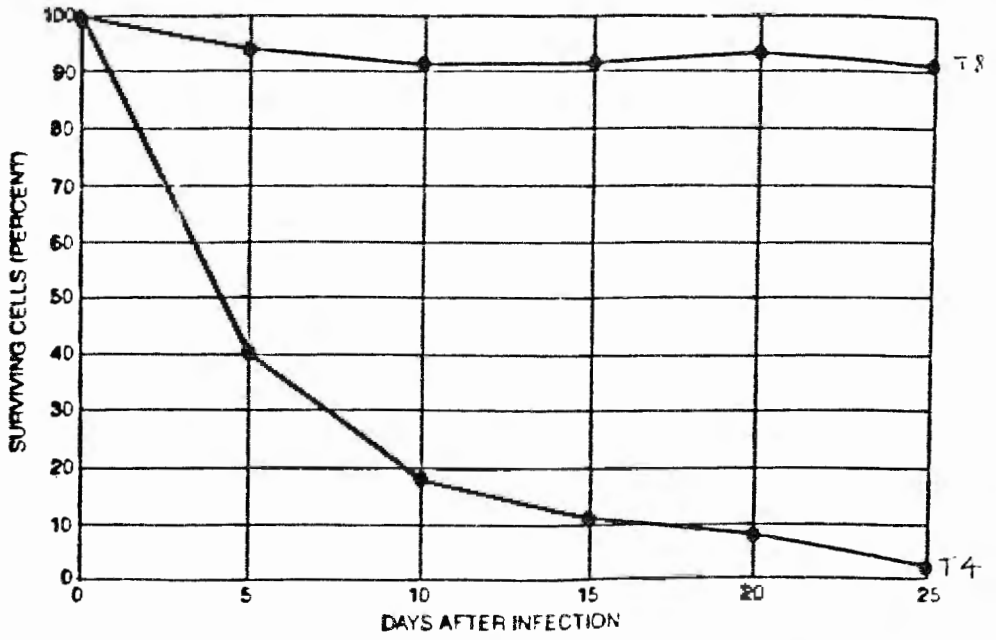
The HIV is an envelope virus, where the core is surrounded by a lipid/glycoprotein capsule.[15] Upon entering the bloodstream, the HIV seeks out T4 lymphocytes, matches various surface chemical markers, and enters the T4 cell, shedding its protective capsule and exposing its core which contains RNA.[13] The AIDS virus is also a retrovirus. This means

that the virus' genetic information is carried on RNA and utilizing a special enzyme, reverse transcriptase, makes a DNA copy of its RNA inside the host cell. The viral DNA is then able to integrate itself into the host cell's chromosomes in the form of a virus known as a provirus. The T4 cells transcribe the viral genes and make the proteins which they encode, thereby becoming 'factories' producing more HIV, which then bud from the T4 cell's surface. It has recently been discovered that HIV has a peculiar biological property that causes the infected T4 cell to speed up the reproduction of the HIV. This property is called transacting transcriptional regulation(TAT), and allows for an extremely efficient method of virus replication, which eventually induces death of the T4 cell.[14]

The virus can wait in T4 cells for weeks, months or even years before it starts to destroy the immune system. The latent period, or carrier state, is generally two to five years, with the active state of the virus often triggered by the immune system being activated in response to some other infection.[13]

Besides infecting T4 cells of the immune system, the virus also infects monocytes and macrophage cells, causing further weakening of the immune system. The AIDS virus disrupts the host cell membranes, eventually inducing several cells to fuse and form 'giant cells', which soon die.

Ordinarily, T4 cells make up 60 to 70 percent of the circulating T-cell population. As shown in the graph below,[14] in AIDS, the T4 cells(consisting of T-Helper and T-Inducer cells) are selectively depleted, while the levl of T8 cells(consisting of T-Suppressor cells and T-Cytotoxic cells) remains normal.



SURVIVAL OF *T* CELLS in culture after exposure to the AIDS virus differs by cell type. The virus has little effect on the number of *T8* cells. It causes the number of *T4* cells, its preferred host, to decline dramatically. The virus affects the replication of infected cells.

B-cells are unable to produce sufficient quantities of specific antibodies to the AIDS virus, however they are able to secrete large amounts of nonspecific immunoglobulins. The cytotoxic T-cell response is also hampered. In summary, infection of the T4 cells with the HIV leads to a reduction in the number of T4 cells, an inability of the T4 cells to

recognize antigens, and therefore results in a severe depression in the functional ability of the AIDS patient's immune system. This leaves the AIDS patient with virtually no immunological means of defense against an infectious agent which, in HIV uninfected people, would be easily dealt with by their intact immune systems.[15]

In a television interview(1986), Dr. David Baltimore, a Nobel Prize winning professor of biology at the Massachusetts Institute of Technology, stated that a vaccine for the AIDS virus is not forseen for at least five years or more.[16] With the Surgeon General's report on the predicted 270,000 AIDS patients by 1991, and no real cure in the near future, Dr. Baltimore emphasized the strong need for public education.

There are some early clinical trials which have been met with some success, not in killing the AIDS virus, but in prolonging the life of a patient with AIDS or ARC. The drug azidothymidine(AZT) has been found to prolong the life of an ARC patient and decrease the incidence of opportunistic infection. However this drug is severely debilitating to patients, causing anemia and toxicity to bone marrow cells. AZT does not kill the AIDS virus; patients taking this drug still are infected with HIV. The patient just has a decreased likelihood of getting a deadly opportunistic infection. Two other drugs, d-penicillamine and CS-85, both considerably less toxic than AZT, are also currently being tested.[17]

OCULAR MANIFESTATIONS of AIDS

The incidence of ocular manifestations of the AIDS virus is between 40 and 94 percent.[18] The most common manifestations are retinal microvasculopathy leading to cotton-wool spots and hemorrhages, cytomegalovirus(CMV) retinopathy, Kaposi's sarcoma, cranial nerve palsies, herpes zoster ophthalmicus, papilledema, toxoplasmic retinochoroiditis, Mycobacterium avium-intracellulare infection, and corneal ulcers caused by Candida albicans.

Cotton-Wool Spots

Cotton-wool spots are the most common ocular lesions in patients with AIDS.[18] One study of AIDS patients at UCLA found that cotton-wool spots were present in 53 percent of the patients, and usually were manifested six months after generalized lymphadenopathy was noted.[19] One theory on the mechanism of the AIDS-related microvasculopathy which causes the cotton-wool spots is that the viral antigen/antibody complex becomes embedded in the arterial wall, occluding the vessel and causing focal retinal ischemia.[18] The retinal ischemia causes a stasis in

axoplasmic flow, resulting in a microscopic swelling of the nerve fiber layer and ophthalmoscopically visible retinal edema which is the cotton-wool spot.

In AIDS patients cotton-wool spots occur in the superficial retina near the optic nerve head, and may obscure the view of retinal vessels on ophthalmoscopy.[4] The cotton-wool spots are asymptomatic and transient in nature, developing and regressing within four to six weeks. Cotton-wool spots are occassionally seen in patients with AIDS-Related Complex(ARC), but it is currently unknown if the presence of cotton-wool spots is predictive of the patient going on to develop the full AIDS illness.[18]

Retinal Hemorrhages

The retinal microvasculopathy that caused the cotton-wool spots can be found in 89-100 percent of AIDS patients.[18] This microvasculopathy of occluded vessel lumens, swollen endothelial cells, thickened basal laminae and degenerating pericytes can lead to retinal hemorrhages.[4]

In the UCLA study[19] retinal hemorrhages were found to occur in 27 percent of the AIDS patients, presenting as punctate or flame-shaped hemorrhages in the posterior fundus. In 10 percent of the patients the hemorrhages had white central areas(Roth spots). Alterations in the retinal microvascularization may affect optic nerve vessels as well as

the retinal, causing ischemic optic neuropathy, where the nerve head appears swollen and pale. Visual field changes relative to the location of the ischemic optic neuropathy can occur.

Cytomegalovirus(CMV) Retinopathy

Cytomegalovirus retinitis is the only common infection of the eye in patients with AIDS. In one study by Holland et al, 32 percent of patients had CMV retinopathy.[19] Although CMV retinopathy usually manifests itself in extremely debilitated AIDS patients, CMV retinopathy is estimated to be the presenting ocular sign in five percent of AIDS cases.[20]

CMV retinitis is a necrotizing infection, leading to full thickness atrophic destruction of the retina. The patient may be ill with disseminated CMV infection or the patient may be asymptomatic.[21] The CMV retinopathy is often preceded by cotton-wool spots, which do not always occur where the CMV retinopathy will develop.[4] The earliest sign of CMV retinitis is white granular patches which may be unilateral or bilateral. The lesions will have irregular, feathered borders which become necrotic. The necrosis may involve all layers of the retina including the RPE. Sheathing of the retinal vessels and intraretinal hemorrhages are signs characteristic of this infection.[21] The retinal infection usually starts in the posterior pole next to the major vascular arcades, but may develop first in the peripheral retina. Choroidal inflammation, serous

retinal detachment, exudative and rhegmatogenous retinal detachment can result from the retinitis. The retinal tears may be hidden by extensive retinal necrosis and mild vitreal haze. The optic nerve head may appear normal or edematous in the early stages of the retinitis and necrotic in the final stages of the retinopathy. Toxoplasmic retinitis may seem similar to CMV retinitis, however toxoplasmic infection tends to occur in patients who are not immuno-compromised, be posterior in location, centered around old scars and accompanied by vitritis. The anterior segment changes may include flare, cells and/or multiple small keratic precipitates on the cornea.[22]

CMV retinopathy is progressive and may lead to total loss of vision. Steroid usage is contraindicated in the treatment of the AIDS patient due to the possibility of the immunosuppressive drug increasing the retinal necrosis. CMV retinopathy is a poor prognostic sign. In one study, no patient survived longer than six weeks after the development of the CMV retinitis.[19] Although several drugs have been found to halt the spread of the CMV retinopathy, none can eradicate the infection. If an optometrist suspects that a patient is manifesting a sign of CMV retinopathy, the patient should be referred to a retinal specialist with a note that AIDS must be ruled out.

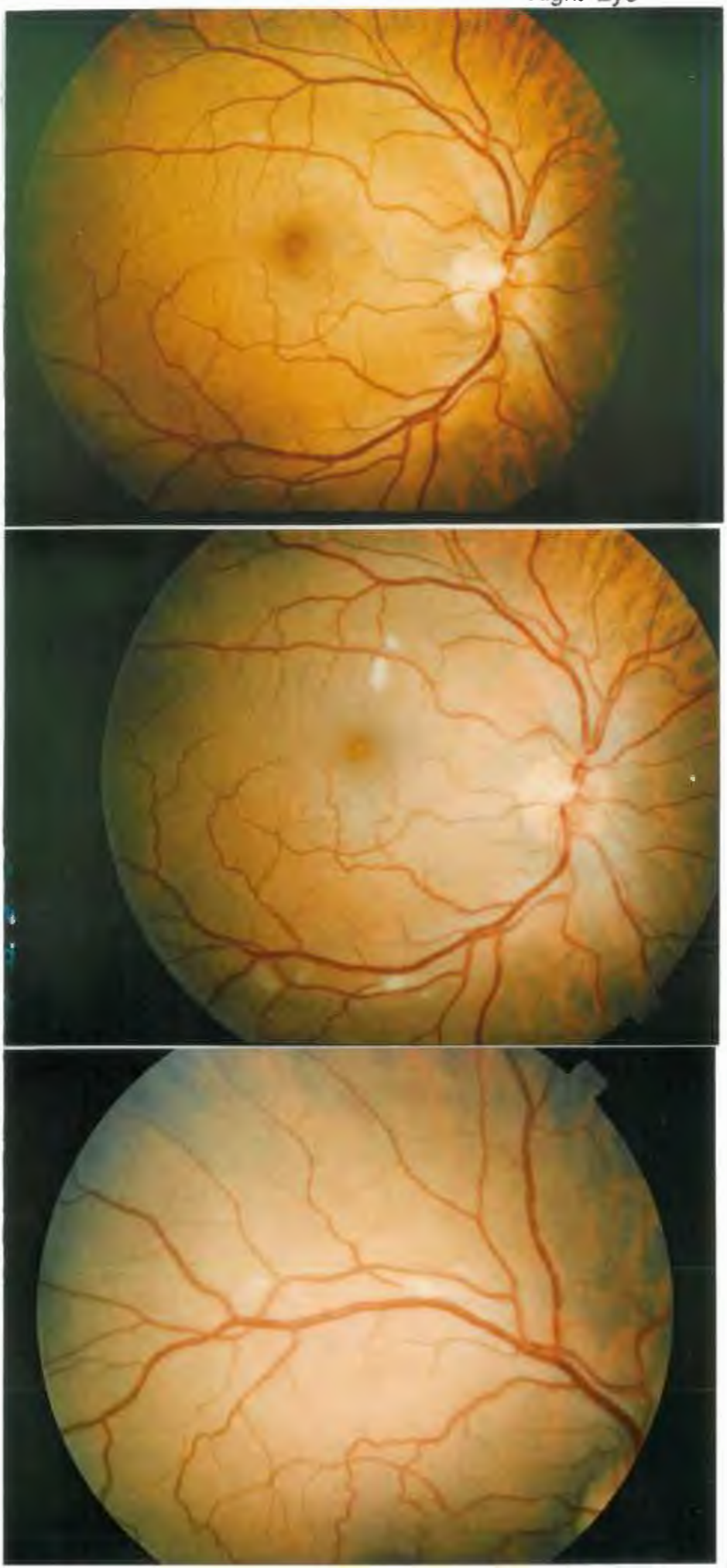
In a case study a white, homosexual male(L.S.) presented at the UCSF Francis I. Proctor Foundation complaining of decreased vision in his left eye. His right eye had a cotton wool spot which later disappeared, with several other cotton wool spots appearing at later times(see Figure 1-pictures A,B,C.) His left eye initially presented with signs of CMV retinitis(see Figure 2-pictures A,B,C) which progressed into more extensive retinal necrosis, eventually leading to retinal gliosis shortly before the patient died(see Figure 3-pictures A,B,C.)

Kaposi's Sarcoma

Kaposi's sarcoma is a neoplastic vascular disorder characterized by multiple violaceous nodules on the skin. Kaposi's sarcoma may develop anywhere on the skin of the body, on the eyelids, eyelid margins, conjunctiva, and rarely within the orbit.

The conjunctiva is the most common site for initial presentation of Kaposi's sarcoma, with approximately 17 percent of patients with Kaposi's sarcoma showing just conjunctival involvement[23] and 24 percent showing conjunctival or lid lesions.[19] Conjunctival Kaposi's sarcoma may appear as a bright red subconjunctival lesion or as a fairly discrete violaceous,

FIGURE ONE
Right Eye



A) L.S. November, 1985
Cotton Wool

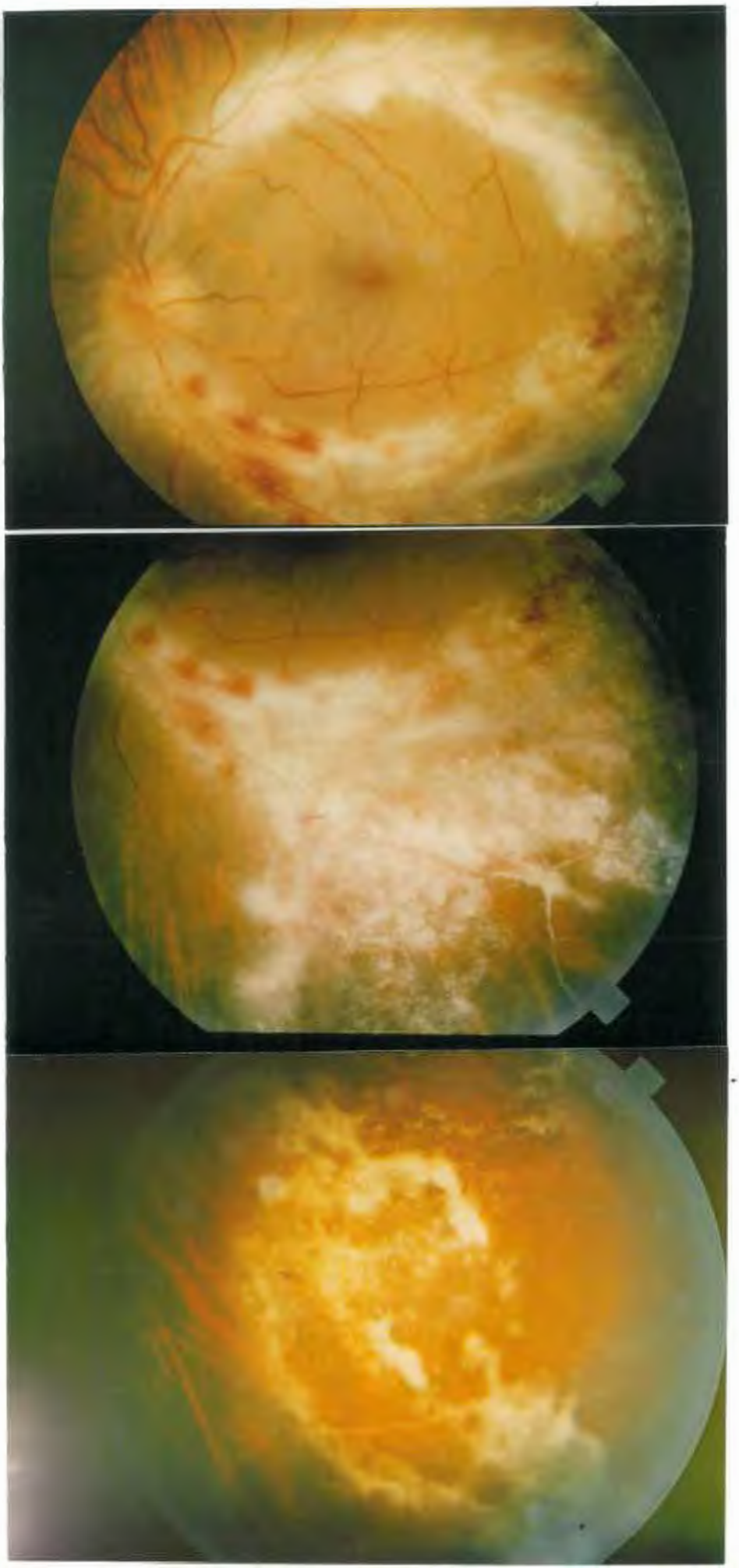
B)L.S. December, 1985
Cotton Wool

C) L.S. January 31, 1986
Cotton wool-sup. temp.

All photos courtesy of J. Sheppard, M.D

UCSF Francis I. Proctor Foundation

FIGURE TWO
Left Eye

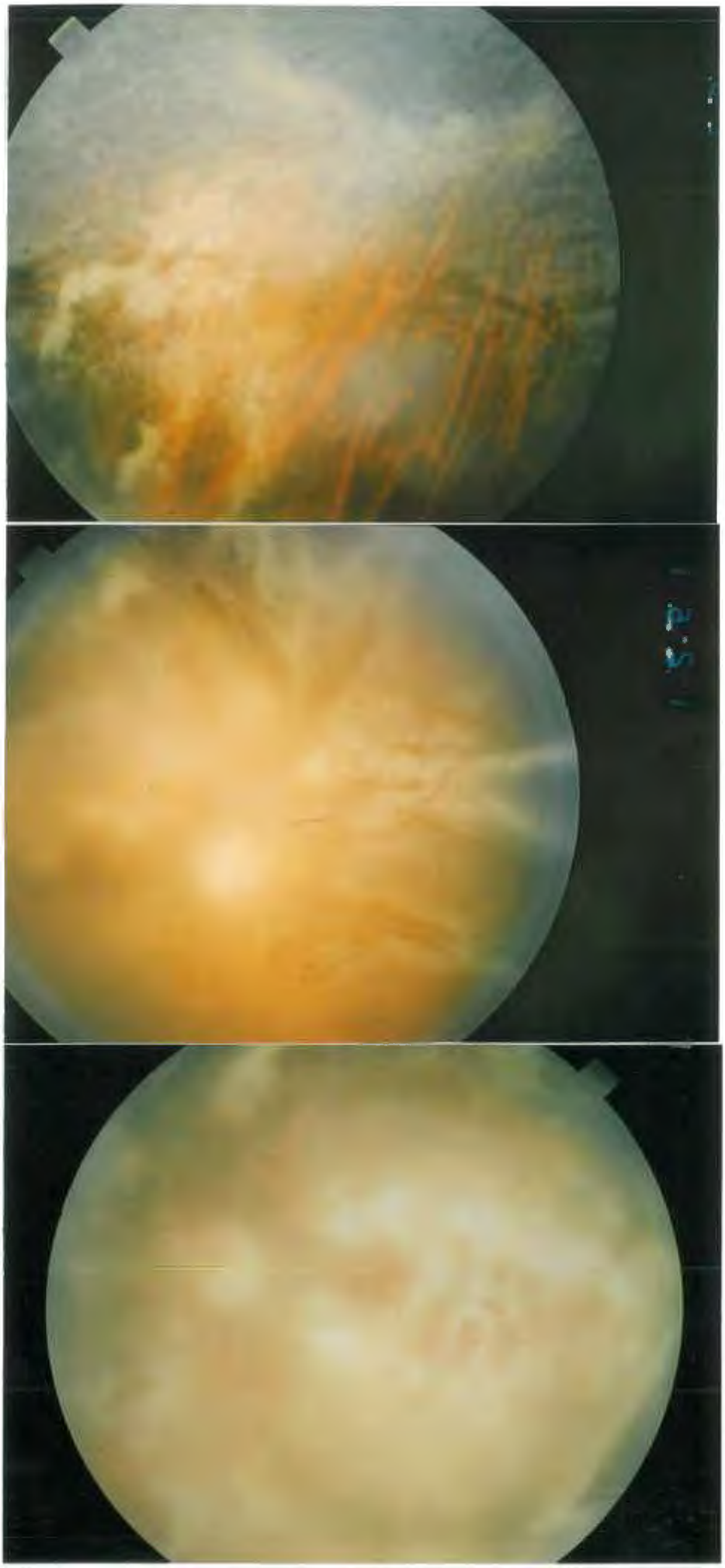


A) L.S. November, 1985
CMV-induced retinopathy

B)L.S. November, 1985
close-up of above picture

C) L.S. December,1985
Adv. CMV retinopathy

FIGURE THREE
Left Eye



A) L.S. January 31,1986
CMV-induced retinopathy
Signs of visible sclera &
Moderate gliosis

B)L.S. April, 1986
advanced gliosis

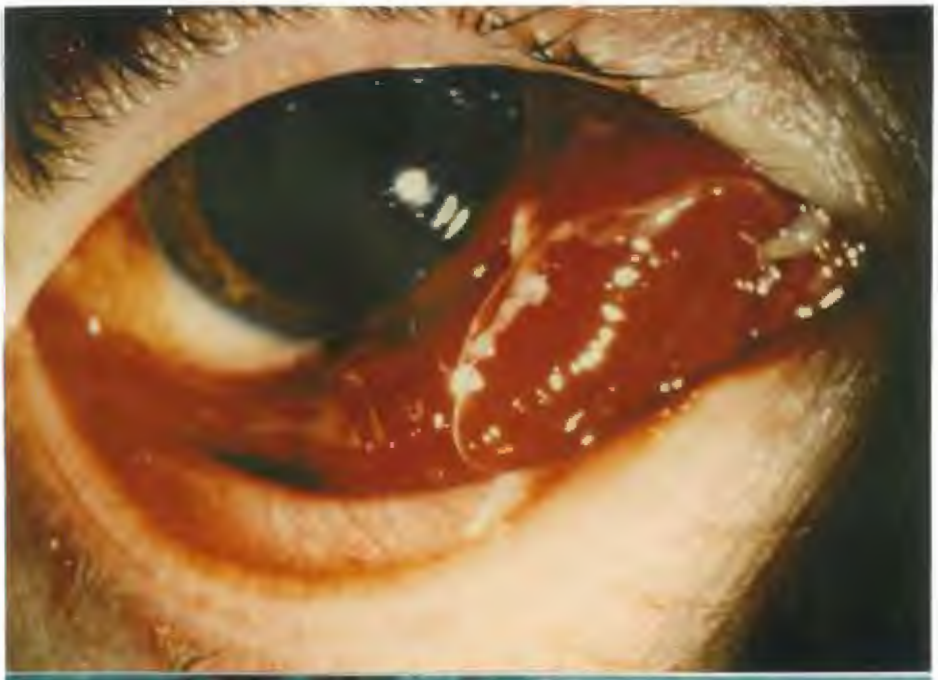
C) L.S. May 13, 1986
Adv. CMV retinopathy
with adv. gliosis

subconjunctival mass.[18,19](see Figure 4-pictures A and B.) These tumors never regress spontaneously, but slowly spread subconjunctivally. The conjunctival tumors rarely interfere with vision or eyelid function.[23] Kaposi's sarcoma of the eyelid presents differently. Purple-red nodules appear on the eyelids resulting in eyelid edema, entropian formation and trichiasis.[18]

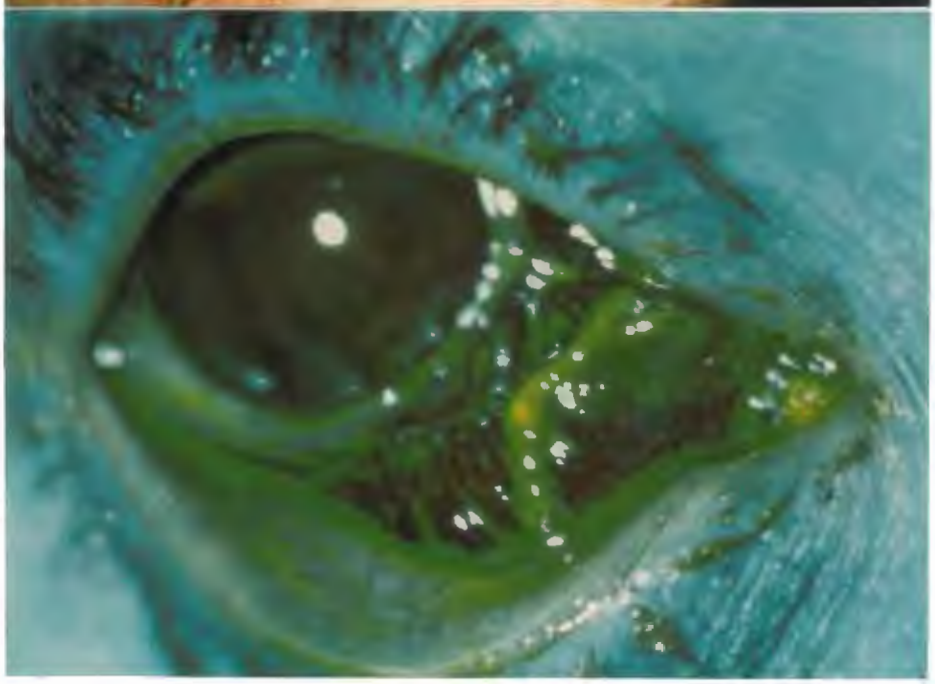
The differential diagnosis of Kaposi's sarcoma includes inflammation of the conjunctiva, diffuse hemorrhage of the conjunctiva, pyogenic granuloma, squamos cell carcinoma, and malignant melanoma.[25]

The incidence of Kaposi's sarcoma differed among five different groups of AIDS patients.[24] Forty six percent of patients with AIDS-related Kaposi's sarcoma were homo/bisexual males without intravenous(IV) drug use. 27.8 percent of patients with Kaposi's sarcoma were homo/bisexual males with IV drug use. Females with IV drug use comprised 12.5 percent, and heterosexual males with IV drug use comprised 3.8 percent of AIDS patients with Kaposi's sarcoma. It is interesting to note that the fifth group, comprised of 16.3 percent of AIDS patients with this condition, were heterosexual IV drug users. Optometrists must be alert for this

FIGURE FOUR



A) Adv. Kaposi's Sarcoma



B) Same patient with flourescein

All photos courtesy of J. Sheppard, M.D.-UCSF Francis I. Proctor Foundation

condition occurring in heterosexual AIDS patients who are IV drug users. This study also found that in 83 percent of the patients, Kaposi's sarcoma appeared in the patients before an opportunistic infection was observed.[24]

Simple excision or cryotherapy can be used on isolated Kaposi's sarcoma lesions, but when the lesions are multifocal, chemotherapy is used.[4]

If Kaposi's sarcoma is suspected, referral to an oncologist or anterior segment specialist is recommended.[19]

Herpes zoster ophthalmicus

Herpes zoster ophthalmicus is usually a disease of older individuals. It is characterized by a vesicular rash(which usually crusts), occurring along the distribution of the ophthalmic division of the trigeminal nerve. Foreign body sensation in one eye, conjunctival injection, ciliary flush, cell and flare reaction, corneal punctate epithelial staining and subepithelial infiltrates are also associated with this condition.[26]

Several studies have suggested that when a diagnosis of herpes zoster ophthalmicus is made in patients who are less than 45 years old, there is a significant probability that the patient has AIDS or ARC.[26,27,28] In one study,[27] 64 percent of the patients with herpes zoster ophthalmicus who were under 45 years of age had characteristics that put them in the high risk group for developing AIDS. These patients also had the extremely low T-helper/suppressor cell ratio characteristic of the immune system deficiency of AIDS or ARC. In another study,[28] 61 percent of the under 45 year old patients with herpes zoster ophthalmicus belonged to a group at high risk for developing AIDS or ARC. Of these AIDS-risk patients, 91 percent had an extremely low T-helper/suppressor cell ratio and 36 percent had generalized lymphadenopathy. Within the 2.5 year follow-up, 21 percent of the patients in this study developed AIDS and subsequently died. These studies indicate that herpes zoster ophthalmicus in a young patient may be one of the earliest clinical markers for the immune deficiency caused by HIV infection.

Treatment of herpes zoster ophthalmicus in AIDS-risk patients should not include systemic steroids, because of their potential for further immunosuppression. Topical steroids, mydriatics, topical antibiotics, human leukocyte interferon and certain antiviral agents(vidarabine and acyclovir) may be used in treatment of these patients.[26]

Intracranial Disease

Intracranial disease may cause neuro-ophthalmic signs, such as cranial nerve palsies and papilledema.

Intracranial disease occurs occassionally in the immuno-compromised AIDS patient, with one study reporting a 3 percent incidence.[19] Cranial nerve palsies may be the first manifestations of intracranial disease and are most probably a result of inflammation or pressure from meningitis, encephalitis, and/or intracranial masses.[18] Palsies of the third, fourth and sixth cranial nerves may result in severe diplopia. Careful motility examination should be performed in all cases of diplopia to determine which of the nerves are involved. Palsy of the fifth cranial nerve may result in decreased reflex blinking, leading to exposure keratitis and conjunctivitis. Palsy of the seventh nerve can result in paresis of the obicularis oculi, lagophthalmos and exposure problems.

Papilledema is a manifestation of the intracranial diseases that occur in AIDS patients, with 14 percent of the AIDS patients in one study having papilledema.[29] Papilledema presents in patients as a swollen nerve head, with patients reporting transient obscurations in vision lasting several seconds and with the visual acuity normal between these episodes.[18]

AIDS patients have an increased occurrence rate of Burkitt's lymphoma, a rare form of cancer causing intraorbital masses. Burkitt's lymphoma

may also damage extraocular muscles, cranial nerves and the optic nerve, resulting in diplopia and papilledema. Eyelid swelling, proptosis and tenderness may be signs of this problem.

Any signs or symptoms of these neurological problems, especially with fairly sudden onset, requires a referral to a neuro-ophthalmologist or neurologist for a computerized tomography(CT) scan to rule out intracranial mass lesions.

Mycobacterium avium-intracellulare infection

Mycobacterium avium-intracellulare infections, which are rare in the average population, are seen in increased numbers in AIDS patients. Holland and associated reported that six percent of the AIDS patients they studied showed signs of Mycobacterium avium-intracellulare infection,[19] and another study reported that three percent of AIDS patients studied manifested signs of this infection.[29] Retinal and choroidal granulomas located near the area of hemorrhagic retinal detachments in patients with CMV retinopathy were the major clinical manifestations of M. avium-intracellulare infection.[19]

Toxoplasmic Retinochoroiditis

Toxoplasma infection of the eye in the AIDS patient is an occassional occurrence. Ocular involvement from *Toxoplasma gondii* infection in both the AIDS patient and non-AIDS patient presents as a focal or multifocal, yellow-white hazy retinochoroiditis, with the active lesion seen at the border of an old inactive scar and with vitreous inflammation overlying the active lesion.[30] Ocular toxoplasmosis accounts for less than three percent of ocular infections in AIDS patients. However, intracranial toxoplasmosis is the most common opportunistic infection of the central nervous system in AIDS patients.[18]

One AIDS patient who presented with ocular toxoplasmosis had uniocular confluent patches of yellow-white necrotic retinal tissue that covered most of the post-equatorial retina and also a marked vitritis. Because of this patient's known poor health status, acute retinal necrosis was ruled out, since, by definition, this occurs in systemically healthy patients. Cytomegalovirus infection of the retina was ruled out because the marked vitritis is not usually present in CMV infection.[30] Also, ocular toxoplasmosis does not have the grainy, hemorrhagic appearance seen in the viral infection, nor does toxoplasmosis spread like CMV retinopathy.[18] Toxoplasmosis should be suspected when any retinal lesion not characteristic of CMV retinopathy is seen in an AIDS patient.

Candida albicans

Candida albicans is an opportunistic yeast, infecting individuals with depressed immune function. Mucocutaneous candidiasis in has a high incidence of occurrence in AIDS patients, however, intraocular Candida infections occur infrequently in these patients.[18] Candida chorioretinitis resembles cotton-wool spots, except that Candida lesions have an associated vitreous haze of inflammatory cells and enlarge over time.[18]

It was suggested by Santos et al[31] that mycotic corneal ulcers may result from immunological abnormalities secondary to HIV infection. This suggestion is based on a patient who was referred to the UC San Francisco Ophthalmology Research Center, with a Candida albicans corneal ulcer in one eye, and after treatment for the initially presenting eye, the patient went on to later develop a C. albicans ulcer in the other eye. Because this patient was an intravenous drug user and homosexual, the status of his immune system was monitored. Intravenous drug abuse is a known risk factor for candidemia. Also, this patient did test positive for antibodies to HIV and had a low helper/suppressor T-cell ratio. Therefore, asymptomatic HIV infected individuals seem to have a greater predisposition to Candida albicans corneal ulcers.

PREVENTION of TRANSMISSION

The CDC reported that three-quarters of all AIDS cases have been reported by only 280 of the more than 6,000 acute-care hospitals in the United States.[32] A recent issue of the Morbidity and Mortality Weekly Report stated that from January 1, 1986 to mid-April of 1986, 3,854 new cases of AIDS were reported nationwide; during that same time period in 1987, the number of AIDS cases reported was 6,022.[33] From these statistics, it can be inferred that optometrists in high-risk areas of the country will have patients who are infected with the AIDS virus. Many of the infected persons will be asymptomatic.

The presence of the HIV in the tears of AIDS patients but not in tears of a patient with ARC has been confirmed.[34] This study, utilizing Schirmer's filter paper strips, obtained tear samples from six AIDS patients and found that the tears of three of the six patients had low-levels of both reverse transcriptase and AIDS viral proteins, and one of the six patients had a high level of positive detection of reverse transcriptase and the AIDS virus. The other two AIDS patients and the patient with ARC had no clinical signs of the AIDS virus in their tears.

HIV was also isolated from a conjunctival epithelial cell scraping of a 33-year-old woman with AIDS.[35] Her only known exposure was a sexual contact with a bisexual. She had a history of opportunistic infections, but no ocular complaints.

The cornea also can contain HIV. Corneoscleral tissue from a donor had reverse transcriptase activity indicative of the presence of HIV.[36] The presence of HIV in the central cornea of the left eye, and central and limbal areas of the right cornea were confirmed by the detection of HIV specific viral proteins. The donor did test positive for the serum antibody to HIV, but had no overt clinical signs of AIDS. Another study suggests that the HIV may be common in the corneas of infected individuals, many of whom may be asymptomatic.[37] This study found that the HIV was detected in two of three corneas of HIV-infected patients tested.

Corneal transplantation has not been implicated in the transmission of AIDS. However, if a patient needs to be referred for corneal graft surgery, the patient should know if the eye bank providing the donor corneas screens donors for the presence of HIV. Corneal surgeons strongly prefer to use tissue from an HIV-negative donor than an unscreened donor, and eye banks are in the process of setting up appropriate screening programs.[38]

Contact lenses of HIV infected individuals can contain the HIV. [39] Three patients who had ARC and three patients who had AIDS(five men and

one woman) wore high-water(70% water, 30% Lidofilcon A) contact lenses for 14 to 16 hours. After the lenses were removed, one lens was immediately cultured from each patient and the other was placed in saline solution, and the saline was processed for the presence of the HIV. One patient with AIDS was unable to complete the study because of a dry eye syndrome. All three of the patients with ARC had detectable HIV in the contact lens . One patient with AIDS and one with ARC had detectable HIV in the saline solution into which the other contact lens had been placed.

Even though the AIDS virus has been isolated from the tears, cornea, conjunctiva and contact lenses of AIDS patients, there have been no studies which document the transmission of HIV from these patients to seronegative individuals through contact with their eyes, tears or contact lenses.

The conjunctiva and corneal epithelia are both squamous and readily desquamate upon mild irritation.[35] Some of the procedures carrying increased risks of coming into contact with the AIDS virus in HIV infected patients include contact lens fitting, contact tonometry, foreign body removal, instillation of staining fluids, irrigation, Schirmer testing, cornea sensitivity measurement(aesthesiometry), Jones test for lacrimal drainage, instillation of eyedrops, lid eversion, palpation and general contact with tears.[40]

Even though contact lenses have not served as an avenue of transmission for HIV, they must be disinfected between patients, as a study found that HIV is not killed after 10 days of air drying at room temperature.[41] Early studies recommended that trial hard, soft and RGP lenses should be disinfected with a hydrogen peroxide contact lens disinfecting system currently approved for soft lenses, or with the standard heat disinfection regimen(78-80 degrees Celcius for 10 minutes) on soft lenses and hard lenses which can be safely heat-treated.[32,41-43]

A more recent study on the safe disinfection of HIV-contaminated contact lenses found that several contact lens cleaning solutions were effective against HIV.[44] A total of 26 lenses in a mixed variety of PMMA, RGP, and low, medium and high water content soft contact lenses(made by a wide variety of manufacturers) were infected with HIV. On the PMMA and rigid gas permeable contact lenses two drops of the Boston cleaner were rubbed(gloves were worn) for 30 to 60 seconds on both sides of the lenses, which were then rinsed for five seconds with a sterile, isotonic saline(Lens Plus). On the low(37.5-43%) soft lenses, Pliagel(made by CooperVision Pharmaceuticals) was used in the same manner. Miraflow(made by CooperVision Pharmaceuticals) was used on the medium(55%) water content and high(70-79%) water content soft lenses. Subsequent to the use of these cleaning soutions, several of the lenses were placed in disinfecting and/or conditioning solutions for varying

amounts of time. The contact lenses were all kept in culture flasks and checked at one month for the presence of HIV. All of the lenses upon which cleaning solutions had been utilized tested negative for the presence of HIV, regardless of whether or not disinfecting or conditiong solutions had also been utilized. It is important to note that the contact lenses utilized as a positive control(either not cleaned or rinsed with sterile, isotonic saline and then incubated) still tested positive for the reverse transcriptase activity characteristic of the AIDS virus at the end of the experiment. The contact lenses which were used in this study had never been in a human eye, since the researchers were trying to mimic the normally deposit-free state of a contact lens set used for trial fitting. This study indicates that commercially available contact lens cleaning solutions can disinfect contact lenses contaminated with HIV.

Because contact tonometers come in direct contact with the eye, the probe must be disinfected after each use. Several groups of researchers recommend a 5-to-10-minute exposure to a fresh solution of 3% hydrogen peroxide, or a fresh solution of 1:10 dilution of common household bleach(sodium hypochlorate,) or 70% ethanol, or 70% isopropanol. These disinfectants are also recommended for the Schiotz tonometer. The probe should be thoroughly rinsed in tap water and dried before reuse.[42,43,45] According to the Haag-Streit Company many of these chemical treatments will destroy the probe after consistent use.[46] The Haag-Streit Company

markets PANTASEPT for disinfection of applanation tonometer probes. The solution, when diluted to the proper concentration, contains a variety of disinfectants which most likely will kill the HIV.[40] This, however, remains to be proven. A study testing the effect of various probe cleaning solutions has found that bleach causes the least damage to the probe.[46] Tonometry may also be performed safely with a MacKay-Marg instrument in which the sleeve is discarded after each use.[35]

Foreign body removal may present a danger to the optometrist in case of accidental self-injury. Sharp items should be considered as potentially infective and disposed of in puncture resistant containers or safely disinfected. The risk of HIV infection following a needlestick-type injury involving an HIV-infected source patient is less than 1%.[32]

For a general office safety procedure, handwashing after a procedure involving contact with tears and between patients is recommended. Gloves should be worn when there are cuts, scratches or dermatologic lesions on the hands.[42,45] General working surfaces which are potentially contaminated can be disinfected by wiping with a dilute(0.2% or greater) household bleach solution or with an alcohol solution(30% or greater). 70-80% alcohol is the optimum concentration for virtually instantaneously killing the AIDS virus.[40] A study found that the HIV was not inactivated by ultraviolet radiation in doses which were much higher than those used in hospitals and labs.[47]

In summary, if a patient is suspected of being infected with the AIDS virus, careful questions regarding any symptoms such as fever, malaise or lymphadenopathy should be asked, and possibly a referral for a blood test to rule out AIDS.

The risk of transmission of the virus from AIDS patients to health care workers is considered minimal. In one study, a total of 531 health care workers were evaluated.[48] One hundred-fifty of these workers reported exposure to HIV that was a result of injury by needle, scalpel or other sharp object that had been contaminated with blood or body fluid from an AIDS patient, or mucous membrane exposure(contamination of mouth, nasal or conjunctival membrane by blood or urine of an AIDS patient.) Of these 150 health care workers, none had serological evidence of HIV infection 6 to 46 months following exposure. However, as has recently been publicized, non-needle-stick exposures to blood from infected patients is a viable mode of viral transmission. CDC states that three health care workers have become seropositive for HIV following exposure to infected blood.[49] Health Care Worker 1 had chapped hands, and the duration of contact with the blood of the patient experiencing a cardiac arrest may have been as long as 20 minutes. Health Care Worker 2 sustained contamination of oral mucous membranes and a needle-scratch

from an IV drug abuser of unknown HIV-infection status. Health Care Worker 3 had a history of dermatitis involving an ear. Health Care Worker 1 and 3 were not wearing gloves, and Health Care Worker 2 had contaminated blood on her face and mouth. This brings the total number of health care workers who have become infected(with or without needlestick injury) to 9.

Because AIDS is a deadly virus, optometrists must take the necessary precautions as outlined above to prevent patient to patient and/or patient to optometrist transmission.

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