OCULAR MANIFESTATIONS AMONG HIV INFECTED MILITARY PERSONNEL IN KENYA.

A dissertation submitted in part fulfillment for the degree of Masters of medicine (Ophthalmology), at the University of Nairobi.

By

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Year 2008

DECLARATION

This dissertation is my original work and has not been presented for a degree at any other university.

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APPROVAL

This dissertation has been submitted in part fulfillment of the degree of masters of medicine in ophthalmology with our approval as university supervisors.

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DEDICATION

This dissertation is dedicated to my loving and caring wife, Maryanne for her patience and encouragement; our beloved sons, Victor the ever inquisitive one and Wesley a source of great joy.

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List of Abbreviations

AC	Anterior Chamber
AFMH	Armed Forces Memorial Hospital
AIDS	Acquired Immune Deficiency Syndrome
ARV	Anti-Retroviral Drugs
CCC	Comprehensive Care Clinic
CI	Confidence Interval
CMV	Cytomegalovirus
CMVR	Cytomegalovirus Retinitis
CSCC	Conjunctival squamous cell carcinoma
CSWS	Commercial Sex Workers
CWS	Cotton Wool Spots
DH	District Hospital
HAART	Highly Active Anti-Retroviral Therapy
HIV	Human Immunodeficiency Virus
HPV	Human Papilloma Virus
IPNO	In-Patient Number
IRIS	Immune Reconstitution Inflammatory syndrome
IQR	Interquantile Range
KNH	Kenyatta National Hospital
KS	Kaposi's sarcoma
LE	Left Eye
NO	Number
NVD	Neovascularisation at the Disc
NVE	Neovascularisation Elsewhere
OPNO	Out-patient Number
OR	Odds Ratio
PCP	Pneumocystis Carinii Pneumonia

RE	Right Eye
SCC	Squamous Cell Carcinoma
SNCO	Senior Non-Commissioned Officer
STI	Sexually Transmitted Infections
SVC	Service
TB	Tuberculosis
UN	United Nations
UNAIDS	United Nations Joint Programme on HIV/AIDS
UNICEF	United Nations Children's Education Fund
WHO	World Health Organization
KMOD	Kenya Ministry of Defense
WRD	Walter Reed Project
KEMRI	Kenya Medical Research Institute
DHQ	Defense Headquarters

ABSTRACT

Background: The eye is one of the commonly affected organs by HIV/AIDS. However, data on HIV/AIDS related ocular lesions among HIV infected military personnel is not available in Kenya.

Objectives: To determine the magnitude, describe the pattern of HIV/AIDS related ocular lesions and assess the visual impairment both in patients on HAART and those without HAART.

Method: This was a cross-sectional descriptive study conducted on HIV positive military personnel in Kenya. Consecutive HIV positive military personnel presenting to the Comprehensive Care Clinic, whether or not on HAART, were evaluated for ocular lesions over a two month period in the year 2008. Visual acuity was obtained with the use of a Snellen's chart. Both anterior and posterior segments were examined using a Haag Streit 900 slit lamp. Data was entered into a well structured questionnaire and analyzed using SPSS version 12.0. A p-value of < 0.05 was considered statistically significant.

Results: A total number of 228 (48 females and 180 males) with a mean age of 41.32 (±0.46) years were examined. The lowest CD4+ count was ranging from one to six hundred and eighty three cells per microlitre with a mean of 169.2 (±9.5). One hundred and sixty five (72.4%) participants had HIV related ocular lesions. Among the lesions conjunctival microvasculopathy (57%) was the most common adnexial finding while the most significant posterior segment finding was retinal Microangiopathy at 47.4 %.

The leading cause of blindness was cytomegalovirus retinitis followed by chorioretinitis. Herpes Zoster Ophthalmicus was not associated with a significant visual impairment.

The likelihood of having HIV/AIDS related lesions was higher among cases with both the lowest and current CD4+ cell count of less than 200 cells/microlitre.

Conclusion:

The presence of vision threatening ocular lesions even in the setting of HAART shows the importance of early detection and treatment. Routine ocular examination of HIV infected military personnel and prompt treatment of ocular lesions could have an impact on their visual outcome.

1.0 INTRODUCTION AND LITERATURE REVIEW

Acquired immunodeficiency syndrome (AIDS) is a chronic transmissible disease resulting from HIV infection. The resultant immunosuppression makes AIDS patients susceptible to opportunistic infections, tumors and vascular complications including those that affect the eye [1].

It was first recognized in 1981 when 5 cases of *pneumocystic carinii* pneumonia (PCP) in previously healthy homosexual men were reported in the United States of America [2].

AIDS is caused by HIV. Infection of T- lymphocytes with HIV leads to profound defects in cellular immunity including cutaneous anergy, decreased in-vitro lymphocyte proliferative responses to various mitogens and antigens and a decrease in circulating T-helper cells, resulting in a lowered T- helper to T - suppressor cell ratio[3].

Modes of infection with the virus are all well documented. Heterosexual transmission is responsible for the highest number of new cases in Africa [4].

1.1 Epidemiology

Three distinct viruses, HIV types 0, 1 and 2 (HIV–0/HIV-1/HIV-2), cause AIDS. HIV-1 is responsible for the great majority of infections globally, HIV-2 being very rare outside of West Africa. Individual cases of HIV-2 infection have been described in other parts of Africa, Europe, the Americas, and Asia (India), but most people with HIV-2 infection have epidemiological links to West Africa[5].

The numbers of HIV infections continue to rise as do the deaths due to AIDS. According to a UNAIDS report a total of 33.2 million people in the world were

living with HIV at the end of 2007. This figure includes an estimated 2.5 Million adults and children who were newly infected with HIV in 2007[6].

In many regions of the world, new HIV infections are heavily concentrated among the young (15 – 24 years of age). In adults 15 years and older, young people accounted for 40 % of new HIV infections in 2007[6].

Sub-saharan Africa continues to bear the brunt of the global HIV/AIDS epidemic. Two thirds (63 %) of all the children and adults with HIV globally live in Sub-Saharan Africa with its epicenter in southern Africa. One third (32 %) of all people with HIV globally live in the southern Africa and 34 % of all deaths due to AIDS occur there. Almost three quarters (72 %) of all adults and children's deaths due to AIDS occurred in sub-Saharan Africa in 2007[6].

The first case of HIV/AIDS was reported in Kenya in 1984 [7]. Kenya has over one million persons estimated to be living with HIV/AIDS[8]. The HIV/AIDS prevalence in Kenya is estimated at 5.1 % compared to 7.5 % in Sub-Saharan Africa and 1.1 % globally. In 2003 150,000 people died of HIV/AIDS in Kenya [9]. HIV is spread primarily through heterosexual sex in Kenya[9].

1.2 HIV and the Military

Worldwide, thousands of soldiers are infected with HIV[10]. The prevalence of infection may compromise the safety of blood supply in military hospitals[10]. Leaders and politicians worry about HIV in the military for political and cultural reasons, including the potential fallout of being accused of sending troops to spread AIDS on foreign peace-keeping missions. Military leaders are also worried about exposing their troops to HIV infection from allies [10, 11]. The UN has over 70,000 troops deployed in 18 different assignments; since 1980, more of these soldiers died of AIDS than have been killed in combat [11].

HIV infection is prevalent to varying degrees in virtually every army in the world. Uganda's army is estimated to have a 20% prevalence of HIV[10]. War is the harbinger of AIDS; as populations are displaced during war, servicemen turn to prostitutes for sex, and women sell sex to provide for their families. Wartime rapes spread HIV and other sexually transmitted diseases. In addition, soldiers are typically young, sexually active men who are likely to seek commercial sex. Even during peacetime, they have sexually transmitted infection (STI) rates two to five times greater than those of civilian populations[10, 11]. During armed conflict their rate of infection can be up to 50 times higher[10]. While the military may contribute to the spread of HIV, it also has the capacity to help prevent transmission. Mandatory HIV-antibody testing in many armies may help research and practical efforts to monitor and control HIV prevalence and incidence in populations. Additional steps may be and have been taken by military forces to educate the public and promote and develop AIDS control programs. Recently demobilized personnel could contribute to AIDS awareness programs as instructors and role models [11].

The HIV-positive soldier should not be deprived of active duty, training, deployment, and promotion unless debilitating symptoms emerge. The prevention and care programs must resolve: greater training and sharing of data between civil and military sectors, greater international cooperation, long-term view of the disease, and intersectoral cooperation[10].

1.3 Ocular Lesions

The eye is one of the commonly affected organs by HIV/AIDS. However, data on HIV/AIDS related ophthalmic lesions in the military is not available in Kenya and is scarce in other sub-Saharan Africa countries, where two-thirds of the world-infected people are living.

A number of studies have shown the presence of ocular lesions in 40% to 80% of HIV/AIDS patients[12 - 15]. Despite the fact that majority of the HIV infected people are living in Africa, most of the literature on ocular disease related to HIV infection is from developed countries. Moreover, the pattern of ocular manifestations of AIDS in developing countries has been said to be different from that of developed countries for various reasons. Many HIV-infected African patients may die before they develop the AIDS defining illness from opportunistic infections while they have high level of CD4+ T-lymphocyte count[15 -18].

AIDS related lesions potentially affect almost all ocular structures. Some of the lesions seen in AIDS patients are herpes zoster ophthalmicus, molluscum contagiosum, conjunctival squamous cell dysplasia and neoplasia, Kaposi's sarcoma, Keratitis, uveitis, microvasculopathy, Cytomegalovirus (CMV) retinopathy, Toxoplasma retinochoroiditis and optic neuropathy [13,17,19,20].

In developed countries the most commonly encountered ocular lesions in HIV/AIDS patients are HIV microvasculopathy that occurs in 70% to 80% and CMV retinitis, a visually devastating condition, occurs in 30% to 40% [15, 21, and 22]. Unlike in the developed countries the lesions have been observed only in 5% of HIV infected patients in Sub-Saharan African countries[23, 24]. On the other hand, herpes zoster[25] infection has been found to be among the first important ocular manifestation of AIDS in Africa affecting 5% -15% of the patients usually occurring at CD4+ count above 200 cells/mm^3, followed by conjunctival squamous cell dysplasia and neoplasm.[15, 17].

Herpes zoster infection is recognized as a marker of HIV infection in young Africans[16, 17, 25]. A population based study in Uganda reported an incidence rate of general herpes zoster in HIV infected people of 35.6/1000 person-years, but only 4.25% of this was HZO[26]. A study done in Ethiopia showed 95% seropositivity in patients with herpes zoster ophthalmicus[27]. Studies conducted in Rwanda, Uganda and Malawi have shown a strong association between the conjunctival squamous cell dysplasia/neoplasm and HIV- positive patients in a range of 75% to 80%[28 - 31].

Seventy to 80 percent of HIV-positive patients eventually have asymptomatic conjunctival microvascular changes, including segmental vascular dilatation and narrowing, microaneurysm formation, the appearance of comma-shaped vascular fragments, and "sludging" of the blood column.[21] These changes are correlated with the occurrence of retinal microvasculopathy. Increased plasma viscosity, HIV-related immune-complex deposition, and direct infection of the conjunctival vascular endothelium by HIV have been proposed as possible causes.[21]

The prevalence of conjunctival squamous cell carcinoma (CSSC) in HIV positive was found to be 7.8 in a hospital based study in Kenya[32]. Suggested contributing factors for the high incidence of conjunctival squamous cell dysplasia in Africa are

ultra violet exposure and high rate of infection with human papilloma virus - 16 [17].

Studies from Kenya among both the adult and paediatric populations however showed ocular lesions to occur in 18% - 67% of HIV/AIDS patients, with retinal microvasculopathy being the most common finding in these patients [33 - 37].
Awan et al in 1990 at KNH found ocular manifestations in 66 % of adult HIV/AIDS patients, cotton wool spots being the most common lesion (25%) [32].
Nyaga et al found 31 % to have ocular lesions among paediatric age group in 1995 at KNH. Retinal ischaemia was most common (13.6%) [34].

Epee studied TB/AIDS patients in 1998 at Mbagathi DH and found 65 % had ophthalmic lesions; CWS was most common at 27% [35].
Onyango et al in 2004 found 18.1% had ophthalmic lesions among high risk group of CSWs in Nairobi's Majengo slums. CWS was most common at 50% [36].
M'mbongo et al found 67.3% of paediatric AIDS patients at Mbagathi DH, to have ophthalmic manifestations in 2005. Retinal microvasculopathy was the most common at 31% [37].

1.4 Ocular Lesions of HIV/ AIDS in the Era of HAART

For years, the CD4+ T-lymphocyte count proved a reliable predictor of the risk of ocular complications of HIV infection [38]. Recently, however, the use of highly active antiretroviral therapy[39] has allowed substantial and sustained, albeit incomplete, repopulation of T lymphocytes to occur in many patients[40]. Such observations have raised the question of whether reconstituted T-lymphocyte populations are in fact functional and, more specifically, whether the current or the lowest CD4+ T-lymphocyte count is a better predictor of the risk of HIV-associated disorders[33]. One would hope that increases in circulating CD4+ T lymphocytes induced by highly active anti-retroviral therapy would be protective, and reports of spontaneous resolution of cytomegalovirus retinitis in patients with increased

CD4+ counts as a result of such therapy are now beginning to appear [42, 43]. However, the recovery of CD4+ T lymphocytes takes months to years, and patients have permanent or long-lasting depletion of T-lymphocyte repertoires[44]. A report by French et al in Australia on cytomegalovirus retinitis in patients who were receiving highly active antiretroviral therapy[41] and whose CD4+ counts were higher than 200 cells per cubic millimeter suggests that reconstituted CD4+ cells may fail to provide protective immunity, although the possibility that the onset of cytomegalovirus retinitis preceded the recovery of CD4+ T lymphocytes was not ruled out [45].

1.5 Immune Reconstitution Inflammatory Syndrome

Some patients initiating HAART experience unique symptoms during immune system recovery. In these patients, immune recovery uveitis occurs with increased $CD4^+$ T-lymphocyte counts and decreased plasma HIV-1 viral loads [46]. This deterioration is a result of an inflammatory response or "dysregulation" of the immune system to both intact sub- clinical pathogens and residual antigens[44].

Resulting clinical manifestations of this syndrome are diverse and depend on the infectious or noninfectious agents involved. Deterioration occurs during the immune recovery. Given the role of the host inflammatory response in this syndrome, the term immune reconstitution inflammatory syndrome (IRIS) has been proposed [47]and has become the most widely used and accepted term to describe the clinical entity.

2.0 RATIONALE

Several studies on the ocular manifestations among HIV infected patients have been done in the civilian population in the Kenya. However, there is no information available on the ophthalmic lesions of HIV/AIDS patients among the military in the country. There is also no information on the ocular manifestations in HIV/AIDS patients taking anti-retroviral drugs in the country despite more increased number of patients being on HAART both in the military and civilian populations.

HIV related eye disease is an important cause of blindness. Some professions including the military demand very good vision especially in terms of visual acuity, colour vision and stereopsis. The study on ophthalmic manifestations of HIV/AIDS among military personnel in Kenya is of national importance for socio-economic reasons since the security of any country depends on a healthy military and the importance of good vision among military men and women cannot be over emphasized.

The study findings help in creating awareness among military health care providers and improve the care of HIV/AIDS patients since most ocular lesions in AIDS may go unnoticed if thorough ocular evaluation is not undertaken.

The results provide basis for informed health policy formulations and their implementation in the care of eye patients who have HIV/AIDS.

3.0 OBJECTIVES OF THE STUDY

3.1 MAIN OBJECTIVE

To determine the magnitude and pattern of ocular manifestations of HIV/AIDS among the military personnel in Kenya.

3.2 SPECIFIC OBJECTIVES

1) To determine the prevalence of ocular manifestations of HIV/AIDS in the military personnel attending an HIV/AIDS clinic at AFMH in Nairobi, Kenya.

2) To determine the pattern of ocular manifestations of HIV/AIDS among the military and to determine the important causes of visual loss among these patients.

3) To determine the effect of HAART on the magnitude and pattern of ocular manifestations among the military personnel in Kenya.

4.0 METHODOLOGY

4.1 Study Design

This was a cross - sectional descriptive study conducted in HIV/AIDS patients in the Armed Forces Referral Hospital.

4.2 Study Population

Patients referred from all disciplines of out-patient and in-patient departments from the various units of the armed forces to the CCC were study subjects.

Those included in the study were military personnel in active service; patients who are sero-positive for HIV with or without symptoms of AIDS; patients both on HAART and not on HAART, those who gave informed and written consent. Those who declined to give informed consent were excluded from the study.
Patients who fulfilled the above mentioned criteria were enrolled consecutively and underwent a full ocular evaluation by the investigators.

4.3 Study Setting

KMOD HIV AIDS PROGRAM

The study was conducted at the Armed Forces Memorial Hospital's Comprehensive Care Clinic, Nairobi to determine the ocular manifestations in HIV/AIDS patients. The Comprehensive Care Clinic is run by the KMOD program for HIV/AIDS
The HIV/AIDS program of the Kenya Ministry of defense (KMOD) is a collaboration between the KMOD, the US Department of Defense, through Walter Reed Project (WRP) and Kenya Medical Research Institute (KEMRI).

The KMOD provides personnel and office space, the US DOD provides technical assistance and funding through WRP/KEMRI.

Begun in 2001, this comprehensive AIDS program for soldiers and their families supports comprehensive services, including voluntary counseling and testing (VCT), the prevention of mother to child transmission (PMCT), the prevention and treatment of Tuberculosis (TB), sexually transmitted diseases, other opportunistic infections and treatment/care of HIV positive soldiers and dependants since January 2004.

Enhanced HIV surveillance and data management is also supported.
Both Short term and long term training for KMOD medical officers and program coordinators are funded.

The goals of the program include assisting KMOD to develop comprehensive HIV policies/activities, to promote risk reduction behaviors and to build capacity within KMOD and as the program matures to extent services to the very needy civil population in the neighborhood of military camps country wide.

Each participant was required to give informed consent through signing a consent form. Participants were briefly interviewed to obtain socio-demographic data. Information regarding HIV/AIDS history, history of systemic opportunistic infections, tumours or vascular conditions and any ocular symptoms was sought from the participants' clinical notes. The information was then entered into a well structured questionnaire (appendix I).

The visual acuity was taken for far with a Snellen's chart at six metres under bright light conditions; near vision charts were used for near visual acuity. Subjective

refraction using a trial frame and lenses from the refraction box was done for those patients with poor vision which improved on Pin Hole.

Objective refraction was done using a retinoscope and refraction bars before the subjective refraction where indicated. Colour vision, contrast sensitivity and brightness sensitivity were tested as required by the appropriate charts and tools.
Pupillary reactions were checked with a bright torch under dark room conditions.
Anterior segment and adnexa were examined for any lesions using a Haag Streit slit lamp biomicroscope. Tetracaine was used for ocular surface topical anaesthesia and fluorescein strips used for corneal staining in patients with ocular surface lesions and for intra-ocular pressure measurement.
Intra-ocular pressure was measured by applanation tonometry using the Goldmann applanation tonometer.
Tropicamide was used to dilate the pupil for examination in patients suspected to have posterior segment lesions.
The examination findings were documented in the questionnaire. Photo documentation of adnexial, ocular surface and fundus lesions was done whenever necessary using a digital camera (Digimax S1000) and fundus camera respectively.
Patients requiring Fluorescein angiography (FLA) and visual field were referred to KNH for Humphrey visual field analysis or Goldmann perimetry and FLA examination.
The ocular findings together with the treatment options were discussed with the patient at the end of the examination.
Those patients requiring further treatment were treated and or referred appropriately.

4.3 Study Period

Data collection was done in the months of February and March 2008. All the participants who met the inclusion criteria were examined during the study period.

4.4 SAMPLING PROCEDURE

All patients attending the clinic and consented to participate in the study were examined during the study period.

4.5 SAMPLE SIZE

The sample size was determined by the using the following formulae:

$n = Z^2 crit * p (1 - P) / D^2$

Where

n = required sample size

p = Prevalence of ocular manifestations in the military (18%) - Ethiopian study[12]

D = Precision of the study set at 0.05 (5%).

Z is the cut off points along the X - axis of the normal probability distribution that represents probability matching the 95% confidence interval.

Substituting the above formulae, we get:

n = 226.8

Therefore the required minimum sample size = 227 patients.

4.6. DATA COLLECTION AND ANALYSIS

The data was collected using a well structured questionnaire. The filled questionnaire was kept in a safe place ready for the data entry and for confidentiality of the patients' details.

After cross checking the questionnaire for any missing entries a data base was designed in the Micro Soft Access which allowed the researcher to set controls and validation of the variables. On completion of the data entry exercise the data was exported in a statistical package (SPSS - Version 12) for analysis.
The analyzed results are presented in tables and figures.

Odds ratio (OR) and its associated 95 % confidence interval (C.I) was employed to assist in the factors that were more likely to explain the presence or absence of ocular manifestations.

P value of less than 5 % was considered statistically significant.

4.8 ETHICAL CONSIDERATIONS

Approval was obtained from KNH Ethical and research committee. Consent to conduct the study was also sought from the Army Commander through the Army Senior medical officer. It was also agreed that these senior officers will review and agree to the results before publication is done.

Participation in this study was completely voluntary with neither intimidation nor financial or material inducements. Every participant gave informed consent through signing a consent form.

Tropicamide was used to dilate the pupils for posterior segment examination. Participants were warned against irritation and transient blurring of vision after Tropicamide instillation. Discomfort during slit lamp examination due to the bright light entering into the eye was to be expected but this again was transient.

The ocular findings together with the treatment options were discussed with the patient at the end of the examination.

Those patients requiring further treatment were treated and or referred appropriately.

Confidentiality of patients' details was be maintained.

5. RESULTS

A total of 228 consecutive clients who presented to the Comprehensive Care Clinic during the study period were examined. Clients were from the three services, Kenya Army (KA), Kenya Airforce (KAF) and the Kenya Navy (KN)

5.1 Demographic Data

Table 1: Distribution of Service Units (n = 228)

Unit	Frequency	Percentage
Nairobi	135	59.2
KAF	33	14.5
Nanyuki	25	11.0
KN	20	8.7
Nakuru	15	6.6
TOTAL	**228**	**100**

Majority of the clients, 135 (59.2%) were from Army units in Nairobi and its environs

Figure 1: Distribution of the Army Units (n=228)

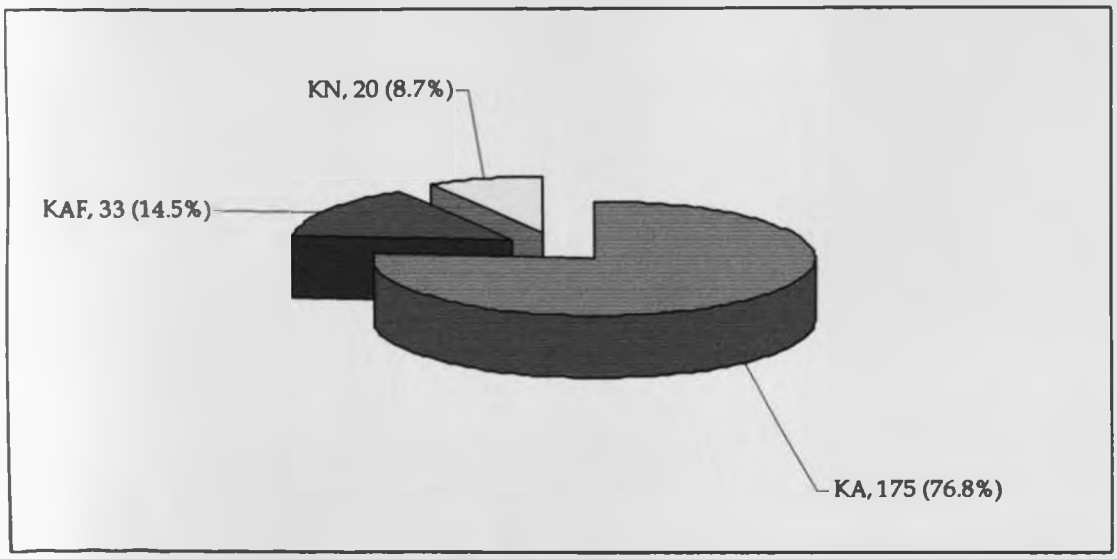
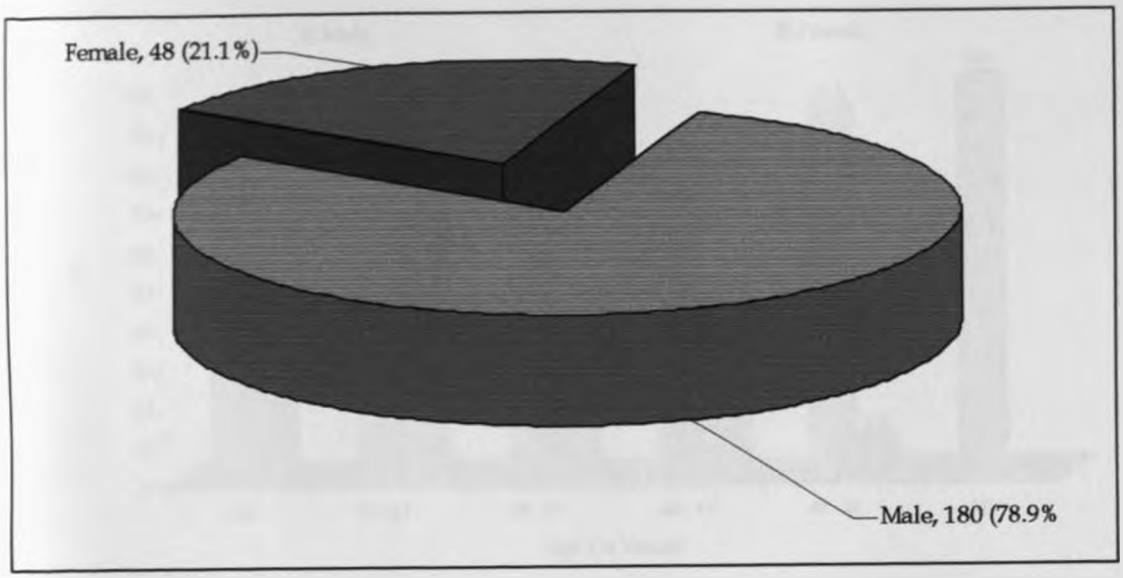
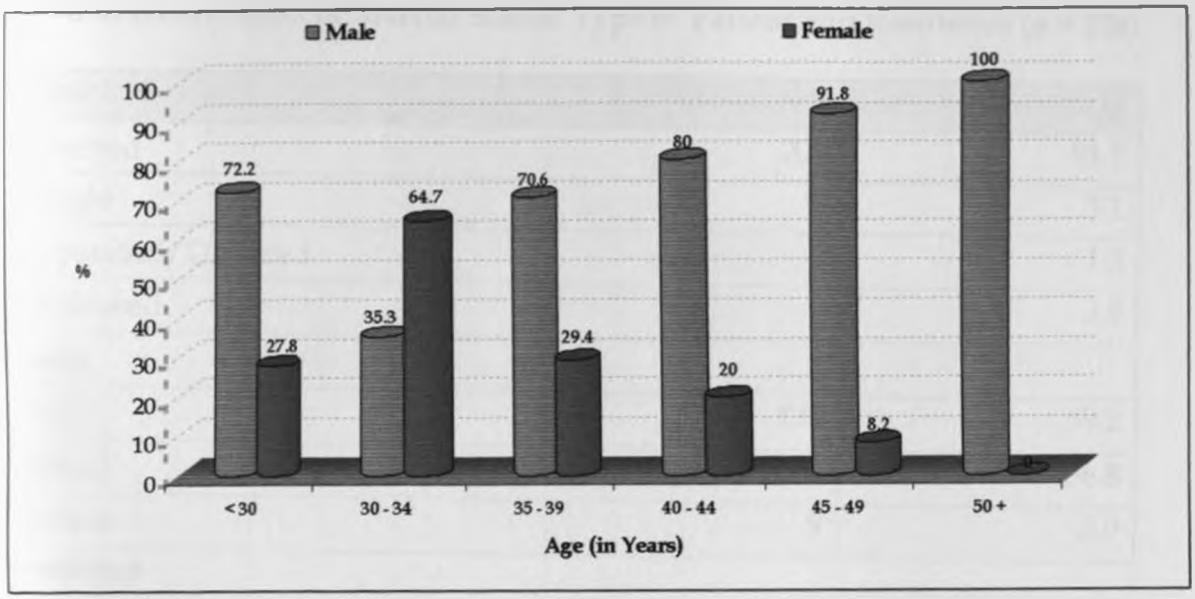


Figure 2: Distribution by Sex (n = 228)



Majority of the participants 180 (78.9%) were males. Generally there are more males than females in the military with a ratio of 6:1.

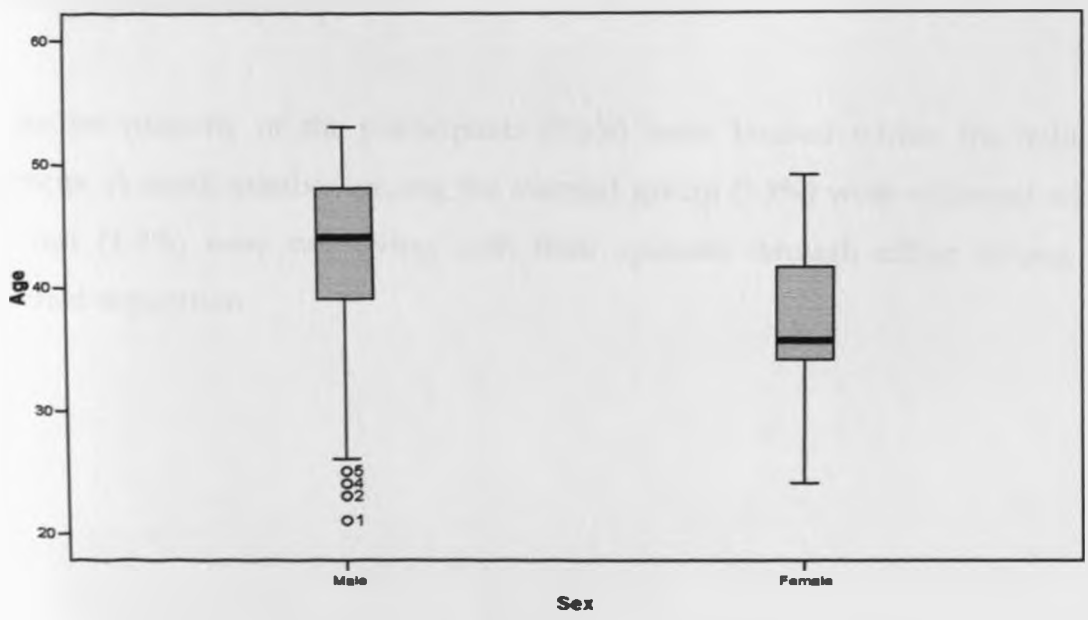
Figure 3: Distribution by Age and Sex (n = 228)



The mean age of the study client was 41.32 (±0.46) years, median age 42 years, mode 39 years and ranged 21 to 53 years with the interquantile range of between 37 and 47 years.

There were more females in age group 30 -34, but more males were noted above age 40yrs. Females retire early in the military.

Figure 4: Distribution of the Mean Age by Sex (n = 228)



MARITAL STATUS, RANK AND RESIDENCE

Table 2: Distribution of Marital Status, Type of Patient and Residence (n = 228)

Marital Status	Frequency	Percentage
Married	209	91.7
Single	7	3.1
Separated/Divorced	3	1.3
Widowed	9	3.9
Ranks		
NCO	135	59.2
SNCO	84	36.8
Officer	9	3.9
Residence		
Barrack	131	57.5
Outside Barracks	97	42.5

Most of the participants were from the lower cadres (59.2%) which included the Non- commissioned officers (NCO) and other ranks (ORS) while the commissioned officers accounted for (9%). In all the ranks the married participants (91.7 %) were the majority.

A greater majority of the participants (7.5%) were housed within the military barracks. A small number among the married group (3.9%) were widowed while the rest (1.3%) were not living with their spouses through either divorce or informal separation.

Figure 5: Distribution by Ranks

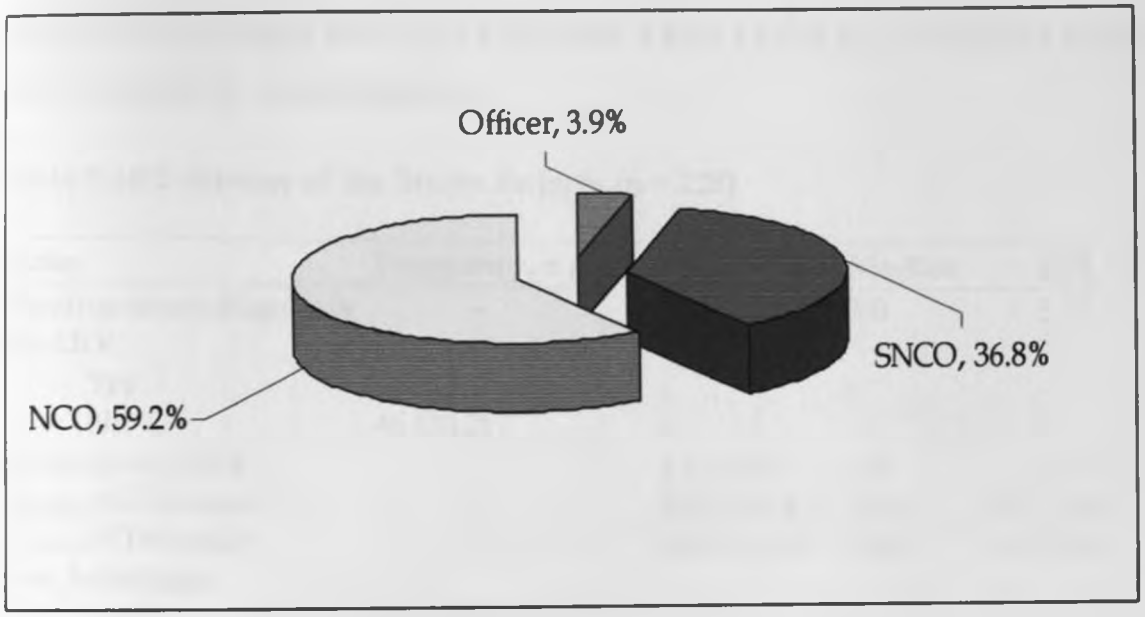
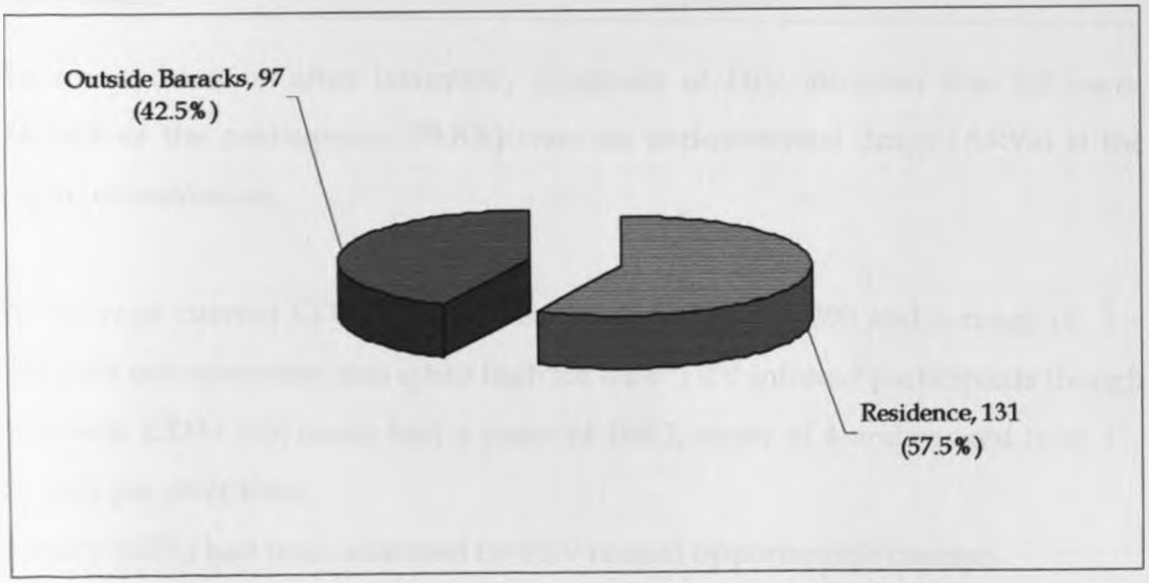


Figure 6: Distribution by Residence



5.2 HIV/AIDS History

DURATION (YEARS) SINCE DIAGNOSIS, CD4+ LEVELS, ARV TREATMENT AND HOSPITAL ADMISSIONS

Table 3: HIV History of the Study Patients (n = 228)

Factor	Frequency, n (%)	Mean (SE)	Median	IQR
Duration since diagnosis	-	3.5 (±0.2)	3.0	3 - 5
On ARV				
Yes	182 (79.8)	-	-	-
No	46 (20.2)	-	-	-
Duration on ARV		2.2 (±0.2)	2.0	2 - 3
Current CD4 count	-	260.9 (±13.1)	203.0	203 - 368
Lowest CD4 count		169.2 (±9.5)	145.5	57 – 229
Ever Admitted:				
-Yes	154 (67.5)	-	-	-
-No	74 (32.5)	-	-	-
No. of Children	-	3.7 (±0.18)	3.0	3 - 4
No. Partners	-	1.1 (±0.03)	1	1 - 1

The mean duration after laboratory diagnosis of HIV infection was 3.5 years. Majority of the participants (79.8%) were on anti-retroviral drugs (ARVs) at the time of examination.

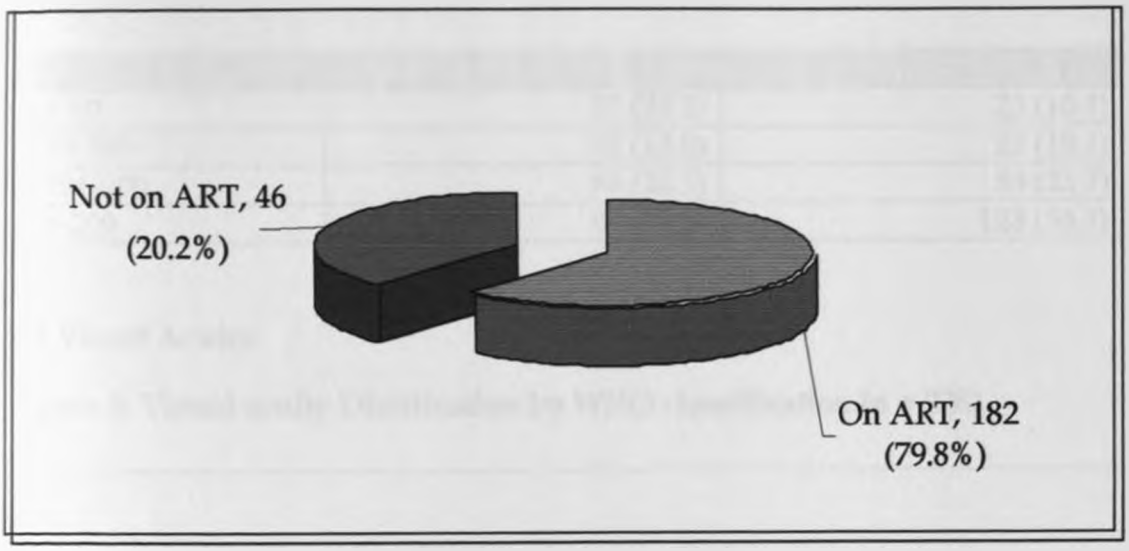
The average current CD4+ count (Mean 260.9), mode of 200 and a range of 1 – 1259 cells per microlitre was quite high for these HIV infected participants though the lowest CD4+ cell count had a mean of 169.2, mode of 4 and ranged from 1 – 683 cells per microlitre.

Majority (68%) had been admitted for HIV related opportunistic disease.

Many denied having more than one sexual partner currently but admitted to having more than one in the past.

Family size was nuclear in many participants (Median No. of children = 3-4).

Figure 7: Distribution by HAART (n= 228)



Majority of the participants were on HAART. These drugs are available to all those who qualify and are willing to commence treatment.

Table 4: Association between Opportunistic Diseases and lowest CD4 count

Lesions (n)	Lowest CD4 Count, n (%)		OR (95%CI)	P-Value
	≤ 200	> 200		
TB (91)	70 (46.6)	21 (25.9)	2.5 (1.4-4.7)	0.001
HZ (24)	19 (12.9)	5 (6.2)	2.3 (0.8-6.3)	0.112
KS (6)	6 (4.1)	-		0.065
SCC (1)	1 (0.7)	-		0.457
Oral Thrush (73)	55 (37.4)	18 (22.2)	2.1 (1.1-3.9)	0.019

Participants with low CD4 count (<200 cells per microlitre) were more likely to have suffered from opportunistic diseases than those with higher CD4 count (>200 cells/microlitre)

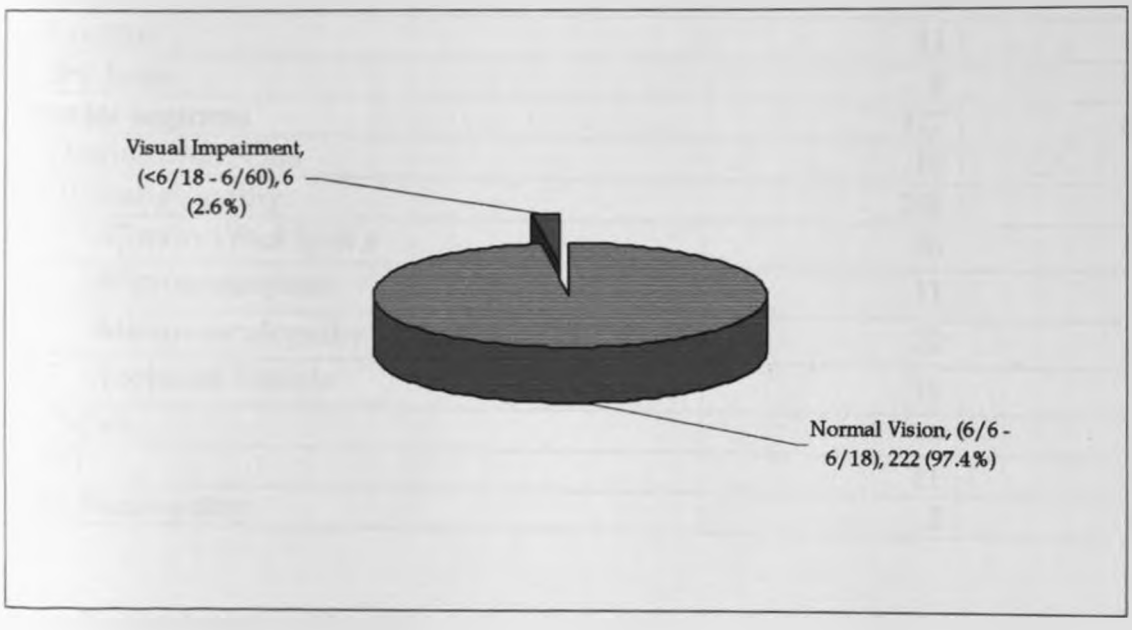
There was significant association between TB, KS and the lowest CD4 count withp-value of 0.004 and 0.018 respectively.

Table 5: Pattern of lowest and Current CD4+ count

CD4 Count	Lowest, n (%)	Current, n (%)
< 50	55 (24.1)	23 (10.1)
50-100	32 (14.0)	23 (10.1)
101-200	60 (26.3)	54 (23.7)
> 200	81 (35.5)	128 (56.1)

5.3 Visual Acuity

Figure 8: Visual acuity Distribution by WHO classification (n = 228)



Majority (97.4) had normal visual acuity. Only 2.6 % had visual impairment. None were blind by WHO classification.

5.4 Ocular manifestations of HIV/AIDS

Table 6: Pattern of Ocular Disorders. (n = 228)

Disorder	Frequency	Percentage
Adnexae	**133**	**58.3**
Blepharitis	33	14.4
Molluscum C	3	1.3
KS	2	0.9
SCC	2	0.9
HZO	10	4.4
Conjunctival microvasculopathy	130	57
Anterior segment	**27**	**11.8**
Uveitis	5	2.2
Keratitis	14	6.1
Dry Eyes	8	3.5
Posterior segment	**117**	**51.3**
Chorioritinal Scars	10	4.4
Microangiopathy:	108	47.4
-Cotton Wool Spot s	36	15.8
-Microaneurysms	11	4.8
-Microvasculopathy	22	9.6
-Tortuous Vessels	16	7.0
CMVR	8	3.5
RD	11	4.8
Optic Neuropathy	**2**	**0.9**

Overall prevalence was 72.4%.

The most common adnexial finding was conjunctival microvasculopathy. This was noted in 57% of the participants. Kaposi sarcoma, molluscum contagiosum and squamous cell carcinoma were noted in only about 1% of the patients.

Uveitis was noted in 2.2% of the participants. This was non granulomatous

Retinal microangiopathy was found in 35% of the participants. The most common sign being cotton wool spots (15.8%).

Cytomegalovirus retinitis was found in eight patients (3.5%). Presumed ocular toxoplasmosis in the form of Chorioretinitis was found in 4.4% of the participants.

Two participants (0.9%) had optic neuropathy. Some participants had more than one finding hence the total number is more than the sample size.

Table 7: Association between Ocular Manifestations and lowest CD4 count (n=228)

Manifestations by anatomical location	Lowest CD4 Count, n (%)		P-Value
	< 200	OR (95%CI)	
Adnexae (133)	89 (66.9)	1.5 (0.9 - 2.5)	0.164
Blepharitis (33)	27 (81.8)	3.0 (1.2 - 7.6)	0.016
Molluscum C (3)	2 (66.7)	1.2 (0.1 - 13.1)	0.899
KS (2)	2 (100.0)	-	0.643
SCC (2)	2 (100.0)	-	0.609
HZO (10)	9 (90.0)	5.5 (0.7 - 44.5)	0.139
Microvasculopathy (130)	87 (66.9)	0.7 (0.4 - 1.3)	0.175
Anterior segment (27)	16 (59.3)	0.8 (0.4 - 1.8)	0.655
Uveitis (5)	2 (40.0)	0.4 (0.1 - 3.2)	0.278
Keratitis (14)	8 (57.1)	0.8 (0.3 - 2.3)	0.630
Dry Eyes (8)	6 (75.0)	1.8 (0.4 - 9.0)	0.480
Posterior segment (117)	77 (65.8)	0.8 (0.5 - 1.4)	0.394
Chorioritinal Scars (12)	7 (58.3)	0.8 (0.2 - 2.6)	0.722
Microangiopathy (108)	70 (64.8)	1.1 (0.7 - 2.0)	0.623
CMVR (8)	8 (100.0)	-	0.006
Optic Neuropathy (2)	2 (100.0)	-	0.113
RD (11)	9 (81.8)	2.7 (0.6 - 13.0)	0.188

Participants with the lowest CD4+ cell counts less than 200 cells/microlitre were more likely to have lid and conjunctival manifestations of HIV/AIDS although this is not statistically significant. Conjunctival microvascular changes can occur at higher CD4 count levels.

All patients with KS, SCC, CMVR and optic neuropathy had the lowest CD4 count of <200 cells/microlitre.

Table 8: Association between Ocular Manifestations and current CD4 count (n=228).

Manifestations by anatomical location	Current CD4 Count, n (%)		P-Value
	< 200	OR (95%CI)	
Adnexae (133)	62(46.6)	1.3 (0.8 – 1.4)	0.321
Blepharitis (33)	25 (75.8)	5.0 (2.1 – 11.7)	<0.001
Molluscum C (3)	2 (66.7)	2.6 (0.2 – 29.0)	0.423
KS (2)	2 (100.0)	-	0.108
SCC (2)	2 (100.0)	-	0.108
HZO (10)	9 (90.0)	5.5 (0.7 – 44.5)	0.272
Microvasculopathy (130)	60 (46.2)	0.8 (0.5 – 1.4)	0.421
Anterior segment (27)	9 (33.3)	0.6 (0.3 – 1.4)	0.240
Uveitis (5)	2 (40.0)	0.4 (0.1 – 3.2)	0.278
Keratitis (14)	5 (35.7)	0.7 (0.2 – 2.1)	0.526
Dry Eyes (8)	4 (50.0)	1.3 (0.3 – 5.0)	0.722
Posterior segment (117)	58 (49.6)	1.6 (0.9 – 2.7)	0.074
Chorioritinal Scars (12)	6 (50.0)	1.3 (0.4 – 4.2)	0.660
Microangiopathy (108)	53 (49.1)	1.5 (0.9 – 2.5)	0.132
CMVR (8)	6 (75.0)	4.0 (0.8 – 20.4)	0.071
Optic Neuropathy (2)	2 (100.0)	-	0.108
RD (11)	6 (54.5)	1.6 (0.5 – 5.3)	0.464

There was a significant association between blepharitis and the current CD4 count of < 200 cells/microlitre.

Patients with KS, SCC and optic neuropathy all had a current CD4 count of <200 cells/microlitre

There was no significant association between CMVR and current CD4 count

There was no significant association between conjunctival microvascular changes and the current CD4 levels.

Table 9: Association between VA and ocular Manifestations (n=228)

Manifestations by anatomical location	VA, n (%)		
	Visual Impaired	OR (95%CI)	P-Value
Adnexae (133)	6 (4.5)	1.0 (0.9 – 1.0)	0.036
Blepharitis (33)	5 (15.2)	34.6 (3.9 – 307.7)	<0.001
Molluscum C (3)	0	-	0.774
KS (2)	0	-	0.815
SCC (2)	0	-	0.815
HZO (10)	0	-	0.619
Microvasculopathy (130)	6 (4.6)	1.0 (1.0 – 1.1)	0.031
Anterior segment(27)	1 (3.7)	1.5 (0.2 – 13.4)	0.711
Uveitis (5)	1 (20.0	10.9 (1.0 – 115.9	0.014
Keratitis (14)	0	-	0.525
Dry Eyes (8)	0	-	0.636
Posterior segment (117)	6 (5.1)	1.1 (1.0 – 1.1)	0.016
Chorioritinal Scars (12)	1 (8.3)	3.8 (0.4 – 35.7)	0.205
Microangiopathy (108)	6 (5.6)	0.9 (0.9 – 1.0)	0.009
CMVR (8)	0	-	0.636
Optic Neuropathy (2)	0	-	0.815
RD (11)	1 (9.1)	4.2 (0.5 – 32.8)	0.170

Participants with lid, conjunctival, retinal and anterior chamber manifestations were more likely to have visual impairment. There were multiple lesions in the same patient, some vision threatening.

Table 10: Association between Ocular Manifestations and HAART (n=228)

Manifestations by anatomical location	On HAART, n (%) Yes	OR (95%CI)	P-Value
Adnexae (133)	111 (83.5)	1.7 (0.9 - 3.3)	0.106
Blepharitis (33)	30 (90.9	2.8 (0.8 -9.7)	0.086
Molluscum C (3)	2 (66.7)	0.5 (0.04 - 5.6)	0.568
KS (2)	2 (100.0)	-	0.475
SCC (2)	2 (100.0)	-	0.475
HZO (10)	7 (70.0)	0.57 (0.14 - 2.3)	0.651
Microvasculopathy (130)	109 (83.8)	0.6 (0.3 - 1.1)	0.081
Anterior segment (27)	22 (81.5)	1.1 (0.4 - 3.2)	0.819
Uveitis (5)	2 (40.0)	0.2 (0.03 - 0.9)	0.025
Keratitis (14)	12 (85.7)	1.6 (0.3 - 7.2)	0.571
Dry Eyes (8)	8 (100.0)	-	0.148
Posterior segment(117	104 (88.9)	0.3 (0.15 - 0.60)	<0.001
Chorioritinal Scars (12)	10 (83.3)	1.3 (0.3 - 6.1)	0.756
Microangiopathy (108)	96 (88.9)	3.2 (1.5 -6.5)	<0.001
CMVR (8)	8 (100.0)	-	0.148
Optic Neuropathy (2)	2 (100.0)	-	0.475
RD (11)	11 (100.0)	-	0.087

Participants with KS, SCC, CMVR and optic neuropathy were all on HAART. Most of these conditions are associated with low levels of CD4 count. HAART is based on WHO clinical staging of AIDS and CD4 count. Resolution of CMVR after rise in CD4 count is associated with atrophic retina, retinal holes and traction membranes and eventual retinal detachment There were eleven patients with RD.

Table 11: Association between Ocular Manifestations and HAART

Ocular Manifestations	On HAART		OR (95%CI)	P-value
	Yes, n (%)	No, n (%)		
Yes	139 (61.0)	26 (11.4)	2.5 (1.3 – 4.9)	*0.007*
No	43 (18.9)	20 (8.8)		

Patients on HAART were more likely to have ocular manifestations than those who were not on HAART **(P=0.007).**

6.0 DISCUSSION

The prevalence of ocular manifestations was found to be 72.4 % (Table 5). This compared well to studies carried out on HIV positive patients on routine follow-up at their respective clinics in the western world and Asia which demonstrated prevalence rates ranging between 40 – 80% [12 - 15] in the general population. On the other hand Abeba T/Giorgis et al while studying ophthalmic manifestations of HIV/AIDS in the Ethiopian Military in the year 2005/2006 found a prevalence of 32.8% [20].

Availability of treatment for opportunistic infections and HAART plus a good health facility network among the Military in Kenya could have avoided early death and explain the wide discrepancy between the findings in this study and those of other studies in Africa.

Patients with pre existing ocular manifestations may develop other new ocular lesions while on HAART. This, coupled with other new patients acquiring the HIV infection also developing ocular lesions, does increase the prevalence of ocular manifestations.

Patients on HAART had low CD4+ cell count previously. They also had severe HIV/AIDS related disease hence had increased number of ocular manifestations.

The study looked at the association of ocular manifestations with the patients' lowest and current CD4+ cell levels. Patients in the lowest CD4+ count category were noted to have more conjunctival microvasculopathy (66.9%) than patients in the current CD4+ (46.2%) count category. Most studies[53] have reported microvasculopathy at both extremes of CD4 count. The higher viral load, however, in patients with a low CD4 count may lead to more capillary endothelial damage and hence more conjunctival microvasculopathy.

HIV related ocular lesions were found to involve all ocular structures.

ADNEXAL MANIFESTATIONS

The most common adnexial finding was conjunctival microvasculopathy at 57% (**Table 6)** and included tortuous and dilated blood vessels, sludging of blood column, coma shaped blood vessels. This prevalence is lower compared with other studies which have found conjunctival involvement to be in the range of 70 - 80 % [48]. The high prevalence of conjunctival microvasculopathy has been attributed to the cumulative number of patients with high CD4 count surviving due to HAART[40]. These changes correlate with the occurrence of retinal microvasculopathy. Both have been found to be associated with severe immunosuppression. Studies done in Dakar, Burundi and Malawi have shown that microvasculopathy to be frequent in sub-Saharan Africa [49-52] as opposed to other studies which showed microvasculopathy to be less frequent compared to other lesions [14, 16]. The prevalence of conjunctival microvasculopathy in patients with Kaposi's sarcoma has been found to be significantly higher than in patients without Kaposi's sarcoma [53]

Blepharitis was found in 57% of the participants **(Table 6).** This was mainly posterior blepharitis. Although there was a significant association between blepharitis and CD4 levels <200 cells/microlitre it has not been found to be HIV/AIDS related in earlier studies. There was a significant association between blepharitis and visual impairment. These patients had other coincidental ocular lesions which do explain the visual impairment. For instance, two patients with CMV in the right eye had old macular chorioretinal scars in their left eyes. Another two patients with CMV in the left eye also had optic atrophy in the other eye. These patients had concurrent blepharitis infection.

This study found the prevalence of herpes zoster ophthalmicus to be 10.5 %. None had active HZO infection. The prevalence noted in this study is lower than that

noted by Melinda et al in HIV patients in 2001 (15%) and Moraes et al in 2002 found that HZO affects about 5-15% of patients who are infected with HIV[15, 17] Different studies have reported wide ranging prevalence of HZO. Msosa et al at Kenyatta National Hospital found a 0.8% prevalence of HZO in patients attending an eye clinic regardless of their HIV status. In Uganda, Morgan et al reported a prevalence of 4.25% in HIV patients at a rural hospital.

HZO was not associated with significant ocular complications and visual disability. This is probably because most (83.8%) of these patients were on HAART and only 33% had CD4+ cell count of below 200 cells per microlitre.

Kaposi's sarcoma and squamous cell carcinoma were found in two (0.9%) patients each **(Table 6).** A hospital based study in KNH by Chisi et al showed the prevalence of squamous cell carcinoma in HIV positive patients to be 7.8% [32] while studies in Uganda and Malawi showed a higher prevalence in the range of 75 - 80% [27 - 29]. In Uganda and Malawi they first identified squamous cell carcinoma patients then later determined their HIV sero status. Kaposi sarcoma is a frequently encountered AIDS-related malignancy and was found to have a higher prevalence in other studies [54].

Molluscum contagiosum of the lids was found in three (1.3%) participants. This is in contrast to an earlier study by Husak et al which showed a higher prevalence. They examined 39 HIV positive patients and reported that Molluscum contagiosum was a rather frequent infection in HIV viraemia and could serve as a marker of immunosuppression in HIV infection [55].

The reason for the low prevalence of this infection could be due to the fact that majority of the patients were on HAART and that their current CD4+ cell count was above 200 cells/ Microlitre.

A case report by Albini and N Rao found that patient's reconstituted immune system from HAART can limit molluscum contagiosum infection. Such limited expression of molluscum contagiosum could be from a competent T cell response as noted in individuals with normal immune function or those with reconstituted immune response from HAART [56].

ANTERIOR SEGMENT

Twenty seven participants (11.8%) had anterior segment manifestations **(Table 6).** Keratitis (6.1%) was the most common anterior segment lesion found. Five patients (2.2%) had clinical herpes simplex keratitis, four had herpes zoster keratitis and the rest were non-specific superficial punctate keratopathy. Akduman et al looked at the anterior segment manifestations of HIV/AIDS and found corneal infections in 4% of their HIV- infected patients [57] as opposed to 6% in this study. Patients with old HSV/VZV keratitis had recurrent episodes and some patients had new HSV/VZV infections as the disease progressed. Patients on HAART live longer and hence higher chance of having new episodes. The keratitis noted in this study was not associated with visual impairment **(Table 9).**

Eight patients (3.5%) had dry eye syndrome although this was not associated with visual impairment. The highest prevalence of dry eye syndrome was reported by Lucca et al in the USA. They noted a prevalence of 15% in HIV infected male patients [58]. The cause is related to HIV-mediated inflammation and destruction of primary and secondary lacrimal glands. The higher current CD4+ count and the lower viral load in patients on long term HAART could possibly explain the lower prevalence in this study.

Uveitis was seen in 2.2% of the patients. This was mainly anterior uveitis and was associated with CMVR and VZV keratitis. Uveitis was noted more in patients on HAART as compared to patients not on HAART ($p = 0.025$) **(Table 10).** This

possibly is due the immune reconstitution inflammatory syndrome. Cataract which is commonly associated with uveitis was not seen in this study. This was not significantly associated with visual impairment.

POSTERIOR SEGMENT

The most significant posterior segment findings were retinal microangiopathy at 47.4 %. Cotton wool spots were the most prevalent (36%) of the retinal microangiopathic lesions. Our results compare well with previous studies which showed a prevalence of CWS in the range of 25-50 % [33-37]. The prevalence increases to 75% when examination is performed during autopsy[59]. Retinal microangiopathy was found more in patients with the current CD4+ count <200 cells /microlitre **(Table 7)** though this was not statistically significant. There is a higher prevalence of retinal microangiopathy in patients on HAART as compared to their counterparts not on HAART ($p<0.001$). These were not inflammatory changes however.

The prevalence of presumed CMV retinitis was 3.5 %, two patients had active CMV retinitis, and the rest had resolved retinitis. This finding could be explained by the larger number of participants who were on HAART, therefore living longer as opposed to studies in the pre-HAART era. New infections of CMV do keep occurring despite the large numbers of patients on HAART though this is on a decline as reported by Jabs et al at John Hopkins in the USA[40]. The accumulation of the old and new cases of CMV hence increases the prevalence as reported by many studies in the HAART era. All the CMV cases were noted to occur at a CD4 of less than 200 in the lowest CD4 count as opposed to the current CD4 count category where some cases were noted to occur at a CD4 above 200. This could be due to the fact that there was an improvement in the CD4 count in the patients while on

HAART even though they had a low CD4 count of less than 200 at some point in time.

CMV retinitis was a familiar cause of blindness in patients with advanced AIDS in Western countries prior to the introduction of highly active antiretroviral therapy (HAART). CMV retinitis then occurred in roughly one-third of patients with AIDS, and accounted for over 90% of cases of HIV-related blindness [60]. CMV retinitis is now clinically infrequent in patients with AIDS in developed countries, thanks to the widespread availability of HAART, although the problem has not disappeared[44]. Successful fundamentals of management are screening in patients with low initial CD4+ counts, and effective anti-CMV treatment with Ganciclovir and related compounds, combined with HAART [21].

Eleven patients had retinal detachment. Nine were attributable to CMV retinitis sequel such as retinal holes from retinal atrophy and tractional membranes in healed CMV retinitis. Two could not be attributed to a specific infectious or inflammatory condition.

There were 10 (4.4%) patients with chorioretinal scars from presumed toxoplasmosis. These could have been acquired in childhood or resolved with rise in CD4 cell count when patients were started on HAART. Although some patients had centrally located scars there was no significant association with visual impairment by WHO classification. In Ethiopia, Giorgis et al noted in chorioretinal scars in 3.1% of HIV/AIDS patients[20].

Two patients (0.9%) had optic neuropathy **(Table 6)**. This was associated with CMVR and retinal microvasculopathy. Mueller AJ, Plummer DJ Dua R. et al in an analysis of visual dysfunctions in HIV-positive patients without retinitis[61] found retinal microvasculopathy to be associated with progressive optic neuropathy.

The study showed a high proportion of unilateral blindness due to HIV/AIDS related lesions. Among the ocular blinding conditions CMVR was the most common at 44% followed by Chorioretinal scars at 33%. Retinal detachment and optic neuropathy accounted for 22% each. This could be attributed to the long term sequel of these conditions having an impact on the visual acuity of these patients after resolution of the active process. The Ethiopian study found CMV also found CMVR to be a leading cause of blindness in their study of ocular manifestations among HIV positive personnel [20].

Nine participants were unilaterally blind (Visual Acuity less than 3/60).

This was mainly due to CMVR, RD, Chorioretinal scars and uveitis although they also had non-blinding lesions in the anterior and posterior segments

7.0 CONCLUSIONS

1. The prevalence of ocular manifestations of HIV is 72.4%. Adnexial findings were commonest at 66 % and were not associated with blinding conditions. One patient had enucleation for squamous cell carcinoma which was confirmed on biopsy

Posterior segment lesions were noted in 51% on HIV/AIDS patients. These were associated with blinding conditions like CMVR, chorioretinal scars and optic neuropathy. The least prevalent manifestations were note in the anterior segment (11.8%)

2. Visual impairment was commonly associated with bilateral lesions in patients with blepharitis probably due to associated dry eye syndrome and keratitis.

Posterior segment manifestations such as CMV retinitis, optic neuropathy and Chorioretinal scars were the common cause of unilateral blindness.

3. Most of the manifestations were non-blinding. Fortunately the blinding conditions were unilateral and there was preservation of vision in the better eye with restoration of high CD4 count after HAART.

4. Most of the participants were on HAART. Patients on HAART were noted to have more ocular manifestations of HIV/AIDS.

8.0 RECOMMENDATIONS

1. There is a high magnitude of ocular manifestations among HIV infected military personnel in the country which affects all the segments of the eye. Routine ocular examination should therefore be incorporated in the comprehensive care of HIV/AIDS patients in the military particularly for patients with low CD4 counts (<200 cells/microlitre) and or in the late stages of HIV/AIDS.
2. There is need for a cohort study to look at the impact of HAART on the blinding ocular manifestations of HIV/AIDS.
3. There is need for education and creation of awareness among healthcare givers about early detection and prompt referral to the ophthalmologist since most of the blinding posterior segment manifestations such as CMV are treatable.
4. Blepharitis may be associated with severe dry eye syndrome which cannot be explained from the data in this study. There is therefore need to follow it up with another study.

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APPENDIX I: QUESTIONNAIRE

SECTION A: SOCIO-DEMOGRAPHIC DATA

1. Study Number ☐☐☐
2. File (IPNO/OPNO) _____
3. Service / Unit _____
4. Sex Male ☐ Female ☐
5. Age (in years) ☐☐
6. Marital status
   - Married ☐
   - Single ☐
   - Separated/Divorced ☐
   - Widowed ☐
7. Residence Barracks ☐ Outside barracks ☐
8. Type of patient
   - Officer ☐
   - NCO ☐
   - SNCO ☐
9. Tribe _____

SECTION B: HIV/AIDS HISTORY

9. Duration since diagnosis _____
10. Is the patient on ARVs ☐ Yes ☐ No
11. Duration on ARVs _____
    a) Any interruptions? _____
    b) Any changes _____
12. Type of ARVs _____

13. CD4+ Count ☐☐☐ Lowest

☐☐☐ Current

Clinical Stage _____

14. Opportunistic infections (Tick all that apply)

- Kaposi sarcoma ☐
- HZO ☐
- Tuberculosis ☐
- Oral thrush ☐
- Squamous cell carcinoma ☐
- Meningitis ☐
- Toxoplasmosis ☐
- Skin rashes ☐
- Fever ☐
- Diarrhea ☐
- Other Specify _____

16. Ever been admitted (HIV/ AIDS related) ☐ yes ☐ No

17. Other treatments _____

18. Number of children ☐☐ and HIV status _____

19. Number of partners ☐☐ and HIV status _____

SECTION C: OPHTHALMIC EXAMINATION

20. Symptoms	RE	LE
Poor vision	☐	☐
Pain	☐	☐
Red Eye	☐	☐
Tearing	☐	☐
Photophobia	☐	☐
Others (Specify) ----------	☐ ----------	☐

20. VA RE SC N _____ F LE SC N _____ F

CC N _____ F CC N _____ F

21. IOP RE _____ LE _____

22. Lids	RE	LE
Normal	☐	☐
Ulceration / lesion	☐	☐
Granuloma	☐	☐
Scar	☐	☐
Swollen	☐	☐
Other (Specify)	_____	_____

22. Orbit		
Cellulitis	☐	☐
Abscess	☐	☐
Periostitis	☐	☐

Other (Specify)	_____	_____
Conjunctiva		
Chemosis	☐	☐
Discharge	☐	☐
	☐	☐
Microangiopathy	☐	☐
Injected	☐	☐
Nodules	☐	☐
Other (Specify)	_____	_____

24. Cornea

Haze	☐	☐
KPs	☐	☐
Vascularisation	☐	☐
Stromal infiltration	☐	☐
Opacification	☐	☐
Other (Specify)	_____	_____

25. Sclera

Inflamed	☐	☐
Episcleritis	☐	☐
Nodules	☐	☐
Thinning	☐	☐
Other (Specify)	_____	_____

26. A/C

Depth (Specify)	☐ _____	☐ _____
Flare	☐	☐
Cells	☐	☐
Hypopyon	☐	☐
Hypheama	☐	☐
Other (Specify)	_____	_____

	RE	LE
27. Iris		
Colour (Specify)	☐ _____	☐ _____
Atrophy	☐	☐
Rubeosis	☐	☐
Synechiae	☐	☐
Nodules	☐	☐
Other (Specify)	_____	_____
28. Pupil		
Shape	_____	_____
RTL	_____	_____

29. Lens		
Clear	☐	☐
Cataract	☐	☐
Other (Specify)	_____	_____

30. Choroid

	RE	LE
Granuloma	☐	☐
Choroiditis	☐	☐
Scar	☐	☐
Pigment	☐	☐
Other (Specify)	_____	_____

31. Vitreous

Normal	☐	☐
Cells	☐	☐
Opacities		
Haemorrhage	☐	☐
Haze	☐	☐
Others	☐	☐

32. Retina

Cotton wool spots	☐	☐
Microaneurysm	☐	☐
Haemorrage	☐	☐
RD	☐	☐
Scar		
Maculopathy	☐	☐
Vasculitis	☐	☐
Retinitis	☐	☐
NVE	☐	☐
Necrosis	☐	☐
Microangiopathy	☐	☐
Other (Specify)	_____	_____

33. Optic Nerve

Neuritis	☐	☐
Papilloedema	☐	☐
Papillitis	☐	☐
Atrophy	☐	☐
NVD	☐	☐
Other (Specify)	_____	_____

2. CONSENT FORM

I _____SVC NO_____ Rank_____ Unit _____ having read the contents of the consent do hereby willingly agree to take part in this study on ophthalmic manifestations of AIDS. The information has been explained to me by Dr. Mutua T. N.

Date _____ /_____ /_____ Signature _____

APPENDIX *III*: PLATES

PLATE 1: CMV RETINITIS

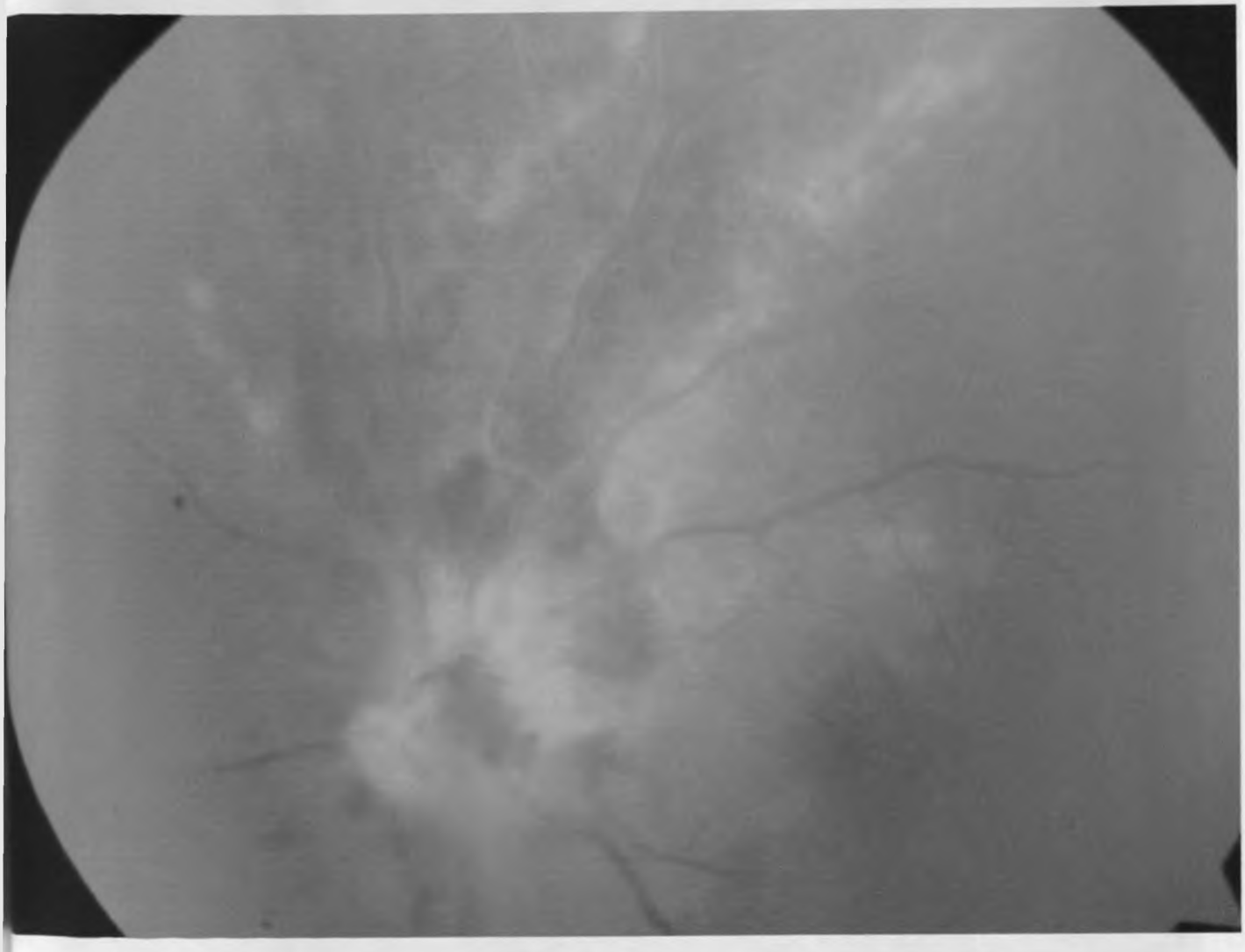

PLATE 2: HERPES ZOSTER OPHTHALMICUS AFFECTING V2 AND V3

PLATE 3: CONJUNCTIVAL KAPOSI SARCOMA