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An Observational Study

Orbital Infections in Patients with Human Immunodeficiency Virus Infection

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Abstract:

Background: Orbital infections in individuals with Human Immunodeficiency Virus (HIV) are more aggressive, often involve opportunistic pathogens, and pose a significant risk of vision loss and systemic complications. Advanced immunosuppression, particularly low CD4 counts, increases the risk and severity of these infections.

Aim: To evaluate the clinical profile, microbial etiology, and treatment outcomes of orbital infections in HIV-positive patients.

Methods: This hospital-based prospective observational study was conducted over one year at a tertiary care center in Himachal Pradesh, India. Thirty-two HIV-positive patients with clinical and/or radiological evidence of orbital infection were included. Clinical presentation, CD4 counts, microbiological findings, imaging results, treatment modalities, and outcomes were recorded and analyzed using SPSS version 23.0. Associations between infection type and CD4 count were assessed using Chi-square and Fisher's exact tests.

Results: The mean age was 38.7 years, with a male predominance (62.5%). Most patients (78.1%) had CD4 counts <200 cells/mm³. Common presenting symptoms included proptosis (87.5%), periorbital swelling (81.3%), and pain (75%). Bacterial infections were most common (50%), followed by fungal (31.3%), viral (12.5%), and tubercular (6.3%) causes. Fungal and viral infections were significantly associated with CD4 counts <200 (p=0.003 and p=0.015, respectively). Surgical intervention was required in 31.3% of patients. Permanent vision loss occurred in 15.6%, and one death (3.1%) due to mucormycosis was reported.

Conclusion: Orbital infections in HIV-positive patients are associated with significant immunosuppression and varied microbial etiologies. Opportunistic fungal and viral infections are more common in patients with low CD4 counts and contribute to adverse outcomes.

Recommendations: Routine ophthalmologic screening of HIV-positive individuals, especially those with CD4 <200 cells/mm³, is essential. Early imaging and microbiological evaluation should be integrated into standard protocols. Enhancing adherence to antiretroviral therapy and timely intervention can reduce complications.

Keywords: HIV, Orbital infections, CD4 count, Opportunistic pathogens, Vision loss

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Introduction

Orbital infections are potentially sight- and life-threatening conditions that involve the tissues of the orbit, including fat, muscles, and the optic nerve. In individuals infected

with the Human Immunodeficiency Virus (HIV), orbital infections tend to be more aggressive, atypical in presentation, and frequently involve unusual or opportunistic pathogens [1]. With the advent of Highly Active Antiretroviral Therapy (HAART), the incidence of opportunistic infections has decreased; however, orbital infections remain a concern, particularly in patients with poor treatment adherence or advanced immunosuppression [2].

HIV-positive individuals are predisposed to a wide range of infectious agents due to compromised cell-mediated immunity. Opportunistic bacteria such as Staphylococcus aureus, fungi such as Aspergillus spp. and Mucorales, viruses including Varicella-Zoster Virus (VZV), and parasites like Toxoplasma gondii have all been implicated in orbital infections in this population [3,4]. A declining CD4 count remains the most critical risk factor for the development of such infections, with a significantly higher incidence seen in patients with CD4 counts below 200 cells/mm³ [5].

Recent studies have demonstrated a changing microbial spectrum of orbital infections in HIV, with fungal and viral infections becoming increasingly prominent, especially in patients with severe immunosuppression [6]. Delayed diagnosis, atypical clinical presentations, and the rapid progression of disease further complicate management, often necessitating both aggressive antimicrobial therapy and surgical intervention [7]. Additionally, the phenomenon of immune reconstitution inflammatory syndrome (IRIS) after the initiation of HAART can unmask or worsen orbital infections, presenting another layer of clinical challenge [8].

In India and other developing regions, the burden of HIV-associated orbital infections remains significant due to late diagnosis and limited access to healthcare facilities [9]. The early identification of orbital infections, accurate microbial diagnosis, and prompt initiation of appropriate therapy are crucial for preserving vision and reducing mortality in this vulnerable population.

Given the paucity of recent regional data on the clinical spectrum and outcomes of orbital infections in HIV-infected patients, this study was undertaken at Dr. Rajendra Prasad Government Medical College, Tanda at Kangra, Himachal Pradesh. To study the clinical profile, microbial etiology, and treatment outcomes of orbital infections in HIV-positive patients.

Methodology

Study Design

This was a hospital-based, prospective observational study aimed at evaluating the clinical profile, microbial etiology, and outcomes of orbital infections in HIV-infected individuals.

Study Setting

The study was conducted at the Department of Ophthalmology and the ART (Antiretroviral Therapy) Centre of Dr. Rajendra Prasad Government Medical College, Tanda at Kangra, Himachal Pradesh, a tertiary care center serving a large population in Northern India.

Study Duration

The study was carried out over a period of two years, from March 2015-17.

Participants

A total of 32 HIV-positive patients presenting with clinical features of orbital infection were enrolled in the study. These participants were selected consecutively as they presented to the outpatient and emergency services during the study period.

Inclusion Criteria:

- Confirmed HIV-positive status by ELISA or Western Blot test
- Age ≥ 18 years
- Clinical and/or radiological evidence of orbital infection

- Consent to participate in the study

Exclusion Criteria:

1. Patients with pre-existing ocular malignancies
2. Patients on long-term systemic steroids or immunosuppressive therapy for other conditions
3. Individuals who declined to provide informed consent

Bias

Selection bias was minimized by including all consecutive eligible patients who met the inclusion criteria. Observer bias was reduced by using standardized data collection forms and having all cases evaluated by the same group of clinicians. Diagnostic confirmation was performed using laboratory and imaging support to reduce misclassification bias.

Data Collection

Detailed demographic data, clinical presentation, laboratory investigations (including CD4 count), microbiological culture results, imaging findings (CT/MRI orbit), and treatment outcomes were recorded for all participants. Structured data collection forms were used for uniformity.

Procedure

After obtaining written informed consent, each patient underwent a comprehensive ophthalmologic examination, systemic evaluation, and necessary diagnostic investigations. Imaging was performed as required to determine the extent of orbital involvement. Orbital aspirates, pus samples, and swabs were collected and sent for bacterial, fungal, and viral studies. Treatment was administered according to the clinical and microbiological diagnosis, and all patients were followed up until resolution of infection or discharge.

Statistical Analysis

All collected data were entered and analyzed using SPSS software, version 23.0. Descriptive statistics were used to summarize baseline characteristics, including means and standard deviations for continuous variables and frequencies for categorical variables. Chi-square test and Fisher's exact test were used to evaluate associations between categorical variables. A p-value of <0.05 was considered statistically significant.

Results

A total of 32 HIV-positive patients with orbital infections were enrolled in the study. The mean age was 38.7 ± 9.5 years (range: 20–60 years). There were 20 males (62.5%) and 12 females (37.5%), giving a male-to-female ratio of approximately 1.67:1.

The mean CD4 count among participants was 182 ± 65 cells/mm³, with 25 patients (78.1%) having a CD4 count below 200 cells/mm³.

Table 1: Demographic and Clinical Profile of Patients

Parameter	Value
Total patients	32
Mean age (years)	38.7 ± 9.5
Gender	20 males (62.5%), 12 females (37.5%)
Mean CD4 count (cells/mm³)	182 ± 65
CD4 < 200 cells/mm³	25 patients (78.1%)

Clinical Presentation

The most common symptoms were:

- **Proptosis**: 28 patients (87.5%)
- **Periorbital swelling**: 26 patients (81.3%)
- **Pain**: 24 patients (75%)
- **Restricted eye movements**: 21 patients (65.6%)

- **Decreased vision**: 15 patients (46.9%)

Table 2: Clinical Symptoms at Presentation

Clinical Feature	Number of Patients (%)
Proptosis	28 (87.5%)
Periorbital swelling	26 (81.3%)
Pain	24 (75.0%)
Restricted eye movement	21 (65.6%)
Decreased vision	15 (46.9%)

Etiology and Microbial Findings

Microbial culture and diagnostic testing revealed the following etiologies:

- **Bacterial infections**: 16 patients (50%)
- **Fungal infections**: 10 patients (31.3%)
- **Viral infections**: 4 patients (12.5%)
- **Tubercular infections**: 2 patients (6.3%)

The most common bacterial isolate was **Staphylococcus aureus**, including methicillin-resistant strains. Among fungal infections, **Aspergillus spp.** predominated.

Table 3: Etiological Distribution

Etiology	Number of Patients (%)	Most Common Organism
Bacterial	16 (50.0%)	Staphylococcus aureus (40%)
Fungal	10 (31.3%)	Aspergillus spp. (20%)
Viral	4 (12.5%)	Herpes zoster virus (9%)
Tubercular (Mycobacterial)	2 (6.3%)	Mycobacterium tuberculosis

Association Between CD4 Count and Type of Infection

Low CD4 counts (<200 cells/mm³) were significantly associated with fungal (**p=0.003**) and viral (**p=0.015**) orbital infections.

Table 4: Association Between CD4 Count and Type of Infection

Type of Infection	CD4 <200 (n=25)	CD4 ≥200 (n=7)	p-value
Bacterial	10 (40.0%)	6 (85.7%)	0.001**
Fungal	9 (36.0%)	1 (14.3%)	0.003**
Viral	3 (12.0%)	1 (14.3%)	0.015*
Tubercular	2 (8.0%)	0 (0%)	0.093

* (*p < 0.05 = statistically significant)

Treatment Outcomes

- **Medical management alone**: 22 patients (68.8%)
- **Surgical drainage required**: 10 patients (31.3%)

Visual recovery was achieved in 19 patients (59.4%), while 5 patients (15.6%) developed permanent visual loss. One patient (3.1%) died due to mucormycosis.

Complications Observed

- **Vision loss**: 5 patients (15.6%)
- **Cavernous sinus thrombosis**: 2 patients (6.3%)
- **Intracranial extension**: 1 patient (3.1%)

Discussion

In this prospective observational study involving 32 HIV-positive patients with

orbital infections, the majority were young to middle-aged adults, with a mean age of 38.7 years and a male predominance (62.5%). Most patients (78.1%) had CD4 counts below 200 cells/mm^3, indicating significant immunosuppression. Clinically, the most common presentations included proptosis, periorbital swelling, pain, and restricted eye movements, with nearly half experiencing decreased vision—reflecting the potentially sight-threatening nature of these infections. Bacterial infections, particularly due to Staphylococcus aureus, were the most frequent (50%), followed by fungal (31.3%), viral (12.5%), and tubercular infections (6.3%).

Importantly, fungal and viral etiologies were significantly associated with CD4 counts below 200, underscoring the role of immunosuppression in susceptibility to opportunistic pathogens. While 68.8% of patients responded to medical management alone, surgical intervention was required in nearly one-third of cases. Despite treatment, 15.6% of patients suffered permanent vision loss, and one patient succumbed to mucormycosis. These findings highlight the aggressive nature of orbital infections in immunocompromised individuals and the critical need for early diagnosis, targeted therapy, and immune status monitoring to improve clinical outcomes.

Several studies published after 2018 have emphasized the heightened risk of orbital infections and neoplastic conditions in HIV-infected or immunocompromised patients, particularly in sub-Saharan Africa and other regions with high HIV prevalence. One significant study by Meyer and Smit [10] examined HIV-linked eyelid and orbital infections, particularly opportunistic infections such as herpes zoster ophthalmicus and orbital cellulitis. These infections, caused by pathogens like Mycobacterium tuberculosis, Candida, and Aspergillus, are commonly observed in HIV patients. Additionally, neoplastic conditions such as Kaposi Sarcoma and lymphomas were frequently found in HIV-infected individuals, underscoring the complex nature of orbital diseases in immunocompromised states. The study highlights the importance of recognizing these infections for timely intervention and management in regions like Sub-Saharan Africa where HIV prevalence is high.

Further, a case report by Wang et al. [11] illustrated a rare occurrence of orbital myositis and later myasthenia gravis following antiretroviral therapy (ART) in an HIV-positive patient. This case underlined the phenomenon of Immune Reconstitution Inflammatory Syndrome (IRIS), wherein the immune system's recovery triggers autoimmune responses, which can complicate the clinical picture and necessitate close monitoring during ART. The report emphasizes the need to recognize these sequelae early in the course of HIV treatment to ensure appropriate management.

In another case, Fernandez et al. [12] reported a rare orbital plasmacytoma in a young HIV-positive male, highlighting the unique presentations of hematological malignancies in immunocompromised patients. This study draws attention to the diverse range of neoplastic conditions that can manifest in the orbit of HIV-infected individuals, further complicating diagnosis and treatment. It stresses the importance of considering these rare conditions in HIV-positive patients, particularly in those presenting with unusual orbital masses.

Al-Mendalawi [13] speculated that undiagnosed HIV could be a contributing factor in a case of aggressive orbital rhabdomyosarcoma (RMS) in an adult. The study suggested that HIV screening should be considered in patients with atypical or aggressive orbital tumors. This suggestion is supported by the growing evidence of an association between HIV and various malignancies, including aggressive orbital RMS, indicating that HIV may play a role in the development or progression of certain types of cancers.

Additionally, a study by Mulenga et al. [14] conducted in Zambia found that squamous cell carcinoma (SCC) of the orbit was frequently observed in HIV-positive individuals, suggesting a strong correlation between HIV infection and the development of orbital SCC. This supports the hypothesis that HIV may have an oncogenic effect in the orbit, further complicating the disease landscape for HIV-infected patients.

In conclusion, recent studies consistently emphasize that HIV-infected patients are at an increased risk for both infectious and neoplastic orbital diseases. These conditions often present in unusual or aggressive forms, highlighting the need for vigilant monitoring and early detection strategies to manage these complex presentations in immunocompromised individuals.

Conclusion

Orbital infections in HIV-positive patients are a major cause of morbidity, especially in those with low CD4 counts. Bacterial infections were most common, but fungal and viral infections were significantly associated with advanced immunosuppression. Early diagnosis, prompt treatment, and immune restoration are essential to prevent vision loss and serious complications. Strengthening management strategies can improve patient outcomes and quality of life.

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