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Opportunistic eye infections in patients with HIV/AIDS: Importance of differential diagnosis and treatment / Infecciones oculares oportunistas en pacientes con VIH/SIDA: Importancia del diagnóstico diferencial y su tratamiento

Figar Tomás, Laube Gerardo

INTRODUCTION

Acquired immunodeficiency syndrome (aids) is the final stage of human immunodeficiency virus (hiv) infection. this condition causes immunosuppression, predisposing individuals to multiple infections that would not normally affect people with a healthy immune system. in ophthalmology, various opportunistic infections can occur that may irreversibly compromise the vision and quality of life of these patients. this study investigated the impact of early differential diagnosis of these infections in patients with hiv/aids.

Theorical Framework

Human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome (AIDS), which occurs after years of depleting the T-cell reserves of the affected body, are now one of the significant public health problems in the world.[1]

AIDS is the critical stage of HIV infection. At this stage of the disease, the HIV carrier has an immune system that is likely unable to replenish the CD4+ T lymphocytes lost under attack by HIV and has also seen its cytotoxic capacity against the virus reduced. This phenomenon coincides with an increase in the virus's replication rates, which reduces the host's ability to respond to other disease-causing agents.[2]

The viruses that cause HIV infection are retroviruses, which are RNA viruses that replicate using an intermediate DNA molecule, which is synthesized by reverse transcriptase, an enzyme derived from RNA and found within the virion. This enzyme complex allows genetic information to be copied or transcribed from RNA to DNA. This process of synthesizing a particle from genetic information encoded in RNA is unique to these viruses.[3]

About epidemiology

In Argentina, epidemiological surveillance of HIV began in 1990 with mandatory reporting of AIDS cases, and in 2001, reporting of HIV infection without AIDS criteria was incorporated.4 From the beginning of the epidemic until 2008, 75 009 cases of HIV/AIDS were reported, of which 51 % presented at least one AIDS-defining event.[4]

Currently (December 2024), it is estimated that there are 140 000 people with HIV in Argentina. And 6400 cases are diagnosed per year (average for 2022 and 2023).[5]

Globally, it is estimated that 39 million people were living with HIV worldwide in 2022, of which 2,2 million resided in Latin America. By the same date, more than 40 million people had lost their lives due to diseases related to Acquired Immunodeficiency Syndrome.[6]

HIV/AIDS and ophthalmology

The frequency of ocular manifestations varies from 30 % to 70 % of all patients in the AIDS stage, with 3 out of 4 cases developing clinical ophthalmological disease at some point.[7]

Ocular complications of HIV can affect any segment of the eye and can be divided into manifestations of the anterior and posterior segments. Ocular pathologies affecting the anterior segment do not usually differ in frequency, etiology, clinical manifestations, or treatment from those observed in the general population. However, these patients may be more susceptible to microorganisms that are exceptionally present in immunocompetent subjects.[8] The various eye diseases associated with AIDS are classified into five main groups:

1. Neuro-ophthalmological disorder.
2. Disorders of the ocular surface, anterior pole, and adnexa.
3. Ocular neoplasms and orbital pathologies.
4. Retinal vascular disorders.
5. Opportunistic ocular infections.[9]

The presentation of opportunistic ocular pathology is associated with severe immunosuppression (low CD4+ T-cell counts and a history or concurrent extraocular opportunistic infections) and with the patient's self-perception of visual acuity deterioration.[3] Appropriate ophthalmological monitoring, including indirect ophthalmoscopy, is justified to detect ocular complications in HIV patients, especially those with the following risk factors: CD4+ T-cell count <100 cells/ml, history or concurrence of opportunistic infections, and ocular symptoms or deterioration in visual acuity.[8]

In the treatment of ocular infections, it is essential to establish a microbiological diagnosis, as clinical manifestations are often nonspecific. In addition, this diagnosis must be obtained as soon as possible because ocular tissues are very vulnerable to an inflammatory response, and their damage leads to irreversible loss of visual acuity and the functional impairment that this entails.[10]

Opportunistic eye infections include cytomegalovirus retinitis, ocular toxoplasmosis, fungal infections (candidiasis, aspergillosis, cryptococcosis), viral infections (herpes simplex and ophthalmic herpes zoster), and bacterial infections such as tuberculosis, syphilis, and Mycobacterium avium complex.

Justification

Opportunistic eye infections in the context of HIV/AIDS patients represent a real diagnostic challenge due to the overlap of symptoms between different infectious etiologies. A misdiagnosis or delayed diagnosis could lead to serious complications such as irreversible vision loss. In this immunosuppressed population, early and accurate identification is critical, as these ocular manifestations tend to occur more aggressively than in the general population. In Argentina, there are approximately 140 000 cases of HIV, which makes this research relevant for improving the quality of life by reducing morbidity and ocular complications in this population. The findings of this study will be helpful for healthcare personnel responsible for treating these pathologies, as they will enable them to reach a differential diagnosis of each opportunistic eye infection more quickly and accurately, and to administer appropriate treatments in each case.

Theoretical Foundations

Opportunistic eye infections in patients with HIV/AIDS are indicative of a deficient immune

system. This vulnerability allows normally harmless pathogens to become threats that can irreversibly compromise the vision and quality of life of this population. This is because eye tissue is susceptible to inflammation, and if treatment is not started early, the possibility of complications increases considerably. Therefore, promoting early identification, accurate diagnosis, and appropriate treatment is essential to address these infections effectively.

The research question

In HIV/AIDS patients with opportunistic eye infections, how does early differential diagnosis influence the prognosis of visual complications?

Literature search strategy

In carrying out this research protocol, a literature search will be conducted, analyzing the PubMed, LILACS, Scielo, and Google Scholar database platforms in search of clinical trials, practical guidelines, articles, and research papers from the last 30 years, taking into account advances in this information and the relevance of the studies. Infectious disease and ophthalmology books will also be consulted.

The MESH terms used in this research were: HIV infection, AIDS, ocular diseases, opportunistic infections, and differential diagnosis. The Boolean operators "AND" and "OR" were used to refine the search.

General objective

The main aim of this study is to highlight the importance of early differential diagnosis of opportunistic eye infections in patients with HIV/AIDS to establish appropriate treatment and avoid possible complications for the patient.

Specific objectives

To develop a clinical guideline based on the review of this study to facilitate the early diagnosis and treatment of opportunistic eye infections in patients with HIV/AIDS.

METHOD

Study design

This research project will conduct a systematic review of the literature to obtain information on how early differential diagnosis of opportunistic eye infections could help prevent visual complications in patients with HIV/AIDS.

Population

The population included in this study consists of men and women over the age of 18 diagnosed with HIV/AIDS who are suffering from an opportunistic eye infection.

Study population

- Men and women.
- Over 18 years of age.
- Confirmed diagnosis of HIV/AIDS.
- Diagnosis of opportunistic eye infection.

Inclusion Criteria

Men and women over 18 years of age diagnosed with HIV/AIDS who are experiencing an

opportunistic eye infection.

Exclusion Criteria

- Patients without a diagnosis of HIV/AIDS.
- Patients under 18 years of age.
- Patients without opportunistic eye infections.
- Patients with severe pre-existing eye diseases, such as macular degeneration, as this could confuse and complicate the results.

Planning for Data Collection

First, the data collection objectives were defined by reviewing various articles related to the study's topic. These articles were then selectively read to include those that may be relevant and exclude those that do not meet the above criteria.

Scope of the study

This work is a literature review that will be carried out in the university setting (Inter-American Open University).

Operational description of the variables

Quantitative variables

- Age of patients.
- Viral load of patients.
- CD4 T-cell count.

Qualitative variables

Types of opportunistic eye infections (classification of opportunistic eye infections reported in the literature).

Patient gender (gender distribution of patients in selected studies).

Data collection tool(s)

The following databases will be used for data collection: PubMed, Lilacs, Scielo, and Google Scholar. These will be searched for patients with HIV/AIDS who have opportunistic eye infections.

Data Analysis Plan

The data analysis plan consists of searching PubMed, PubMed Central, and Google Scholar, taking into account age, viral load, CD4 T-cell count, sex, and type of opportunistic eye infection. The MESH terms used were: HIV infection, AIDS, ocular diseases, opportunistic infections, and differential diagnosis. Boolean operators "AND" and "OR" were also used to refine and improve the search.

Study Biases and Limitations

The main bias in this study could be selection bias, in which case the patients selected for the study do not adequately represent the general population of patients with HIV/AIDS (e.g., if only patients from a specific hospital or a particular demographic group are included), which could limit the generalizability of the results. This study could also have confounding bias (e.g., patients with preexisting eye diseases or coinfections that could affect conclusions about HIV/AIDS and eye diseases).

A potential limitation of this study is that the selected studies' sample sizes are not large enough to draw meaningful conclusions.

Resources needed

Computer and cell phone, internet access, bibliography, and Microsoft Word.

Schedule of activities

First month

- Selection of topic and review of literature.
- Search for and compile relevant articles.
- Define inclusion/exclusion criteria.
- Clearly establish which studies will be included and which will be excluded from the review.

Second month

Drafting of the introduction through data analysis and information extraction. Drafting of the objectives of the work.

Third month

- Definition of the methodology for the work.
- Review with the tutor.

Fourth month

Submission of the work.

RESULTS

The scientific articles selected for this study are detailed below. Twelve scientific articles were selected that addressed opportunistic ocular manifestations in patients with HIV/AIDS, differential diagnosis, treatment, and prognosis. The studies cover different countries such as Brazil, India, China, South Africa, Romania, and others. Most were observational studies, including cross-sectional, retrospective, cohort, and case reports.

The central opportunistic infections reported were: cytomegalovirus retinitis (the most prevalent in most studies), ocular toxoplasmosis, ocular syphilis, cryptococcal choroiditis, HIV-associated retinal microangiopathy, and immune recovery uveitis syndrome.

For diagnosis, indirect ophthalmoscopy was the most commonly used method for detecting CMV retinitis and other posterior segment pathologies. Gharai S, Venkatesh P, Garg S, Sharma SK, Vohra R. Ophthalmic manifestations of HIV infections in India in the era of HAART: analysis of 100 consecutive patients evaluated at a tertiary eye care center in India. Ophthalmic Epidemiol. 2008 Jul-Aug;15(4):264-71. doi: 10.1080/09286580802077716. PMID: 18780260. https://pubmed.ncbi.nlm.nih.gov/18780260/

One hundred HIV patients were evaluated between 2004 and 2005 at an Indian tertiary center, where 45 % of patients presented with ocular manifestations. Cytomegalovirus retinitis was the most frequent (20 % of cases). In half of the cases, the CD4 count was below 100 cells/µL, reinforcing the relationship with immunosuppression.

Seven percent of patients presented with ophthalmic manifestations as the only sign of HIV infection. The onset of immune recovery uveitis was reported in patients treated with highly active antiretroviral therapy, a condition that requires careful differential diagnosis to avoid confusion with active infections.

Rodrigues ML, Rodrigues Mde L, Figueiredo JF, de Freitas JA. Ocular problems in Brazilian patients with AIDS before and in the highly active antiretroviral therapy (HAART) era. Braz J Infect Dis. 2007 Apr;11(2):199-202. doi: 10.1590/s1413-86702007000200005. PMID: 17625760. https://pubmed.ncbi.nlm.nih.gov/17625760/

An apparent reduction in intraocular infections was observed after initiation of highly active antiretroviral therapy, with no change in ocular surface diseases such as blepharitis and keratitis. It is also noteworthy that the differential diagnosis must be adapted to the new profile of pathologies post-treatment with highly active antiretroviral therapy, highlighting the need to evaluate the anterior segment, which remains frequent.

Jabs DA, Van Natta ML, Holbrook JT, Kempen JH, Meinert CL, Davis MD; Studies of the Ocular Complications of AIDS Research Group. Longitudinal study of the ocular complications of AIDS: 1. Ocular diagnoses at enrollment. Ophthalmology. 2007 Apr;114(4):780-6. doi: 10.1016/j.ophtha.2006.11.008. Epub 2007 Jan 25. PMID: 17258320. https://pubmed.ncbi.nlm.nih.gov/17258320/

A retrospective review at San Francisco General Hospital compared the incidence of cytomegalovirus retinitis between the pre-highly active antiretroviral therapy (HAART) and post-HAART eras. They observed an 80 % drop, reaching 5.6 cases per 100 person-years. The average CD4 count in cytomegalovirus cases was <20 cells/µL.

The importance of differentiating active cytomegalovirus retinitis from immune recovery uveitis using ophthalmoscopic examination and immunological evaluation is highlighted.

Tun N, Smithuis FM, London N, Drew WL, Heiden D. Mortality in patients with AIDS-related cytomegalovirus retinitis in Myanmar. Clin Infect Dis. 2014 Dec 1;59(11):1650-1. doi: 10.1093/cid/ciu648. Epub 2014 Aug 13. PMID: 25121775; PMCID: PMC4227575. https://pmc.ncbi.nlm.nih.gov/articles/PMC4227575/

Patients with active cytomegalovirus retinitis were retrospectively analyzed to determine all-cause mortality. All patients were offered comprehensive medical care. The importance of early diagnosis through indirect ophthalmoscopy screening for all patients entering the healthcare system with a CD4 count <100 cells/µL as part of the initial physical examination is emphasized. In addition, treatment should include systemic valganciclovir and intraocular ganciclovir injections during the first few weeks to halt retinitis progression.

Tsuboi M, Nishijima T, Yashiro S, Teruya K, Kikuchi Y, Katai N, Oka S, Gatanaga H. Prognosis of ocular syphilis in patients infected with HIV in the antiretroviral therapy era. Sex Transm Infect. 2016 Dec;92(8):605-610. doi: 10.1136/sextrans-2016-052568. Epub 2016 Apr 4. PMID: 27044266. https://pubmed.ncbi.nlm.nih.gov/27044266/

The eyes of 20 HIV patients with ocular syphilis were studied. Those treated within the first 14 days retained better visual acuity. Diagnostic delay (>28 days) was associated with poor prognosis.

Burke M, Yust I, Katlama C, Vardinon N, Clumeck N, Pinching AJ, Ledergerber B, Gatell JM, Chiesi A, Barton SE, Lundgren JD, Pedersen C. Cytomegalovirus retinitis in patients with AIDS in Europe. AIDS in Europe Study Group. Eur J Clin Microbiol Infect Dis. 1997 Dec;16(12):876-82. doi: 10.1007/BF01700553. PMID: 9495667. https://pubmed.ncbi.nlm.nih.gov/9495667/

A European multicenter study demonstrating that ocular syphilis is an early marker of HIV infection in some cases and that its differential diagnosis should be considered in any unexplained uveitis.

This study found that patients treated with zidovudine had a higher rate of cytomegalovirus retinitis.

Heitor DF, Mora DJ, Damasceno-Escoura AH, Micheletti AMR, Garcia Torres R, Castro Gazotto F, Pardi TC, Rosa A, Silva-Vergara ML. Choroiditis in a HIV-infected patient with disseminated cryptococcal infection: A case report and literature review. Rev Iberoam Micol. 2019 Jul-Sep;36(3):155-159. doi: 10.1016/j.riam.2019.04.004. Epub 2019 Oct 30. PMID: 31676212. https://pubmed.ncbi.nlm.nih.gov/31676212/

Analysis of a case of choroiditis in a patient with HIV infection and disseminated cryptococcosis, highlighting the importance of differential diagnosis with rare fungal etiologies and the need for early confirmation via ocular laboratory tests.

Despite treatment with amphotericin B and fluconazole, the patient died. The autopsy revealed disseminated cryptococcal infection in several organs, including the eyes.

Pathai S, Deshpande A, Gilbert C, Lawn SD. Prevalence of HIV-associated ophthalmic disease among patients enrolling for antiretroviral treatment in India: a cross-sectional study. BMC Infect Dis. 2009 Sep 23;9:158. Doi: 10.1186/1471-2334-9-158. PMID: 19775470; PMCID: PMC2759932. https://pubmed.ncbi.nlm.nih.gov/19775470/

A cross-sectional study in a public center in India, where the prevalence of HIV-associated ophthalmic disease was studied. In the 149 patients evaluated, the prevalence of HIV-associated ophthalmic disease was 17.5 %, with prevalence increasing as CD4 cell counts decreased.

Ocular symptoms are not always evident (only 7.7 % of patients with ophthalmic disease reported ocular symptoms), highlighting the importance of routine screening.

Shi Y, Lu H, He T, Yang Y, Liu L, Zhang R, Zheng Y, Shen Y, Zhang Y, Zhang Z. Prevalence and clinical management of cytomegalovirus retinitis in AIDS patients in Shanghai, China. BMC Infect Dis. 2011 Nov 24;11:326. Doi: 10.1186/1471-2334-11-326. PMID: 22115120; PMCID: PMC3235083. https://pubmed.ncbi.nlm.nih.gov/22115120/

A study was conducted on the prevalence and treatment of cytomegalovirus retinitis in patients with AIDS. Low CD4 T-cell counts were correlated with the onset of retinitis, which in turn responded well to treatment with ganciclovir. Routine eye examinations, such as a dilated fundus examination with an indirect ophthalmoscope, were recommended for AIDS patients with CD4+ T-cell counts < 50 cells/μl.

Atherton RR, Ellis J, Cresswell FV, Rhein J, Boulware DR. Ophthalmic signs in Ugandan adults with HIV-associated cryptococcal meningitis: A nested analysis of the ASTRO-CM cohort. Wellcome Open Res. 2018 Oct 12;3:80. Doi: 10.12688/wellcomeopenres. 14666.2. PMID: 30345376; PMCID: PMC6178913. https://pubmed.ncbi.nlm.nih.gov/30345376/

Cohort study on ophthalmological signs in adults with HIV-associated cryptococcal meningitis. More than a quarter of patients showed various ocular signs, with complex case management, especially in patients with advanced HIV and cryptococcosis, and the importance of basic eye examinations in resource-limited settings.

Hassan-Moosa R, Chinappa T, Jeena L, Visser L, Naidoo K. Cytomegalovirus retinitis and HIV: Case reviews from KwaZulu-Natal Province, South Africa. S Afr Med J. 2017 Sep 22;107(10):843-846. doi: 10.7196/SAMJ.2017.v107i10.12740. PMID: 29022526; PMCID: PMC6766752. https://pubmed.ncbi.nlm.nih.gov/29022526/

Analysis of cases of cytomegalovirus and HIV retinitis in South Africa, the data detail severe clinical findings such as retinal detachment, confirming that late diagnosis with very low CD4 T lymphocytes can cause significant damage if diagnosis and treatment are not provided in time.

Cobaschi M, Loghin II, Dorobăț VD, Silvaș G, Rusu ȘA, Hârtie V, Aramă V. Ophthalmological Manifestations in People with HIV from Northeastern Romania. Medicina (Kaunas). 2023 Sep 6;59(9):1605. doi: 10.3390/medicina59091605. PMID: 37763724; PMCID: PMC10536229. https://pmc.ncbi.nlm.nih.gov/articles/PMC10536229/

A study in northeastern Romania highlights the need for regular examinations for early diagnosis and for specific treatments, such as ganciclovir, to preserve vision. Regarding differential diagnosis, microangiopathies can be clinically confused with other entities, so each case must be studied in depth. The authors associated early diagnosis with visual prognosis.

DISCUSSION

This systematic review identified the main opportunistic ocular manifestations in patients with HIV/AIDS, their diagnostic methods, treatment, and visual prognosis. The results indicate that cytomegalovirus retinitis remains the most common opportunistic eye disease in the population studied, especially in patients with a CD4 T-cell count below 100 cells/µL. Other relevant pathologies were also documented, such as ocular toxoplasmosis, ocular syphilis, cryptococcal choroiditis, HIV-associated retinal microangiopathy, and immune recovery uveitis syndrome.

These results are consistent with previous studies that reported a direct correlation between the degree of immunosuppression and the onset of ocular complications. In particular, multiple studies highlighted that a CD4 T-cell count below 100 cells/µL is significantly associated with an increased risk of cytomegalovirus retinitis, reinforcing the need for ophthalmological screening in advanced stages of immunosuppression.

The introduction of highly active antiretroviral therapy changed the spectrum of ophthalmic diseases in HIV patients. A significant decrease in opportunistic eye infections was observed. However, despite access to treatment, many patients are diagnosed with advanced immune deterioration, highlighting the difficulties in timely access to medical care and treatment adherence.

It is essential to highlight the role of indirect ophthalmoscopy as a key diagnostic tool. Most of the studies reviewed agree on its usefulness, especially in contexts where diagnostic resources are limited. However, one of the main challenges is to ensure that this practice is implemented systematically as part of the initial physical examination of HIV patients, especially when CD4 T-cell counts are low, even in the absence of ocular symptoms, as several studies have shown that such symptoms are not always present. In addition, its use is particularly relevant in the differential diagnosis of opportunistic eye diseases because it allows identification of findings that help distinguish between pathologies that can sometimes present similar signs and symptoms, making a complete ophthalmological examination, accompanied by the patient's medical and immunological history, crucial.

Another relevant topic analyzed in this study is uveitis due to immune recovery syndrome, a pathology that poses significant diagnostic challenges because it can mimic active infections. This leads us to consider integrated immunological and ophthalmological evaluations within a multidisciplinary framework. The correct distinction between uveitis due to immune recovery syndrome and active opportunistic infection has important therapeutic implications and can prevent inappropriate treatments.

A common element in several of the studies analyzed was the need for routine ophthalmological screening. In many cases, ocular manifestations were the first clinical sign of HIV or went unnoticed because they were asymptomatic. This highlights the importance of integrating ocular evaluation into comprehensive care programs for people with HIV, especially in regions where the prevalence of opportunistic diseases is high or in low-resource areas.

From a therapeutic perspective, the studies analyzed highlight the importance of early treatment to prevent potential visual complications and improve patients' quality of life.

In the case of cytomegalovirus retinitis, the combined use of oral valganciclovir and intravitreal ganciclovir is an effective strategy to slow the progression of infection and preserve visual function. In cases such as ocular syphilis, timely antibiotic treatment, preferably with intravenous penicillin, was associated with a better visual prognosis, especially when started within the first 14 days of symptom onset. For less common pathologies, such as cryptococcal choroiditis, antifungal treatment with amphotericin B and fluconazole is considered standard, although clinical outcomes may be limited in the setting of advanced systemic disease.

Proposed clinical applications

A simplified clinical guideline is proposed to facilitate the identification and therapeutic approach to the central opportunistic eye infections associated with HIV/AIDS.

Criteria for clinical suspicion: Patients diagnosed with HIV/AIDS, CD4 T-cell count less than 200 cells/µL.

Patients in advanced stages of the disease or with a history of opportunistic infections.

Presence of visual symptoms: blurred vision, eye pain, photophobia (it should be noted that many cases may be asymptomatic, so these patients should still be studied in the same way).

Recommended ophthalmological examination

Indirect ophthalmoscopy, preferably at the time of admission to the healthcare system if the CD4 T-cell count is less than 200 cells/µL.

Complete evaluation of the anterior and posterior segments of the eye.

Urgent referral to ophthalmology for any suspicious cases.

Differential diagnosis to consider

- Cytomegalovirus retinitis/retinal microangiopathy: pattern of hemorrhages and exudates.
- Uveitis due to immune reconstitution syndrome/active infection (consider recent initiation of antiretroviral therapy).
- Ocular syphilis/ocular toxoplasmosis: consider serological tests + inflammatory pattern.

Treatments based on the studies reviewed

- Cytomegalovirus retinitis: Oral valganciclovir + intravitreal ganciclovir.
- Ocular syphilis: penicillin (ideally within the first 14 days).
- Ocular toxoplasmosis: pyrimethamine, sulfadiazine, folinic acid (based on general guidelines mentioned in the context of studies).
- Cryptococcal choroiditis: intravenous amphotericin B + oral fluconazole.
- Uveitis due to immune recovery syndrome: immunomodulatory treatment with local or systemic corticosteroids, as appropriate.
- HIV-associated microangiopathy does not require specific treatment, so the appropriate antiretroviral treatment should be administered, and immune monitoring should be performed.

CONCLUSIONS

This systematic review identified the main opportunistic ocular manifestations in patients with HIV/AIDS, highlighting cytomegalovirus retinitis as the most frequent. Other relevant pathologies included ocular toxoplasmosis, ocular syphilis, uveitis due to immune recovery syndrome, HIV-associated retinal microangiopathies, and cryptococcal choroiditis.

One of the key findings of this review is the importance of early diagnosis via indirect ophthalmoscopy, even in patients without symptoms, as several studies have shown that the absence of symptoms does not exclude ocular pathology.

Early detection and correct differentiation between active infections and inflammatory conditions, such as immune recovery syndrome uveitis, are of great importance for appropriate treatment.

The results demonstrate the importance of including a systematic ophthalmological examination in cases of patients with HIV/AIDS, especially those with advanced immunosuppression.

The clinical guidelines proposed in this study are presented as a guidance tool for healthcare professionals responsible for caring for this population.

Finally, it is clear that although highly active antiretroviral therapy has significantly reduced

the incidence of these opportunistic infections, progress is still needed in implementing systematic eye examinations, because early differential diagnosis of these conditions not only improves the patient's visual prognosis and quality of life, but also often represents a significant opportunity for early detection and treatment of HIV infection.

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CONFLICT OF INTEREST

None.

AUTHORSHIP CONTRIBUTION

Conceptualization: Figar Tomás, Laube Gerardo.
Data curation: Figar Tomás, Laube Gerardo.
Formal analysis: Figar Tomás, Laube Gerardo.
Drafting - original draft: Figar Tomás, Laube Gerardo.
Writing - proofreading and editing: Figar Tomás, Laube Gerardo.