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Mycosis infections of the eye and some agents of their etiology

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In some parts of the world, particularly in Asia, where they are the leading causes of blindness, ocular fungal infections are thought to be a substantial cause of considerable vision loss. The cornea is usually damaged by the inflammatory process, although it can also impact the orbit, eyelids, lacrimal apparatus, conjunctiva, sclera, and interior components of the eye. The diagnosis and treatment of ocular infections with a fungal aetiology continue to be difficult for ophthalmologists. Establishing a clinical diagnosis, isolating the fungus responsible for the infection, and providing effective local treatment, particularly in cases of corneal infections, are the key challenges. Negative predictive factors include insufficient initial treatment and delayed diagnosis brought on by a lack of suspicion of a fungal cause. The poor commercial availability of drug formulations and the poor penetration of antifungal medications into the eye tissue are also problems.

Keywords: *Ocular mycoses, fungal keratitis, antifungal drugs*

Due to the rise in individuals with acquired immunosuppression brought on by prolonged use of immunosuppressive drugs, long-term broad-spectrum antibiotics, and AIDS, the frequency of ocular fungal infections has significantly grown over the past few decades (Kalkanci and Ozdek, 2011). The epidemiology of the disease is connected to the pathogenesis of eye infections. The most frequent cause of endogenous endophthalmitis is a species of *Candida*, and these infections typically occur in immunosuppressed patients who have a chronic systemic illness, septicemia that is related to it and being treated with broad-spectrum systemic antibiotics, intravenous hyperalimentation requiring a chronic indwelling catheter, or an organ transplant requiring immunosuppression (Lemley and Han, 2007). The second most frequent cause of endogenous fungal endophthalmitis is *Aspergillus species* (FE). Endophthalmitis has been linked to *Aspergillus flavus*, *A. fumigatus*, *A. niger*, *A. terreus*, *A. glaucus*, and *A. nidulans*. Other developing infections like *Fusarium, Penicillium, Pseudallescheria, Cryptococcus species*, dimorphic fungi like *Histoplasma capsulatum, Blastomyces dermatitis, Sporothrix schenckii*, and *Coccidioides immitis* produced endogenous endophthalmitis have been implicated in a number of documented instances (Valluri and Moorthy, 2009). Therefore, any saprophytic fungus present in natural settings has the potential to infect the eye exogenously. *Candida species*, particularly in the postsurgical group, are the primary mycotic causes of exogenous endophthalmitis (Słowik et al., 2015), but *Fusarium* species were only discovered in the posttraumatic and postkeratitis patients. Exogenous endophthalmitis instances have also been linked to *Paecilomyces*, *Aspergillus*, *Acremonium*, *Exophiala*, *Pseudallescheria*, *Scytalidium*, *Sporothrix*, and *Penicillium* species (Rosenberg et al., 2006). Numerous and related to those causing fungal keratitis, fungi are the primary pathogens in posttraumatic endophthalmitis. E*xophiala jeanselmei*, *P. boydii*, *A. niger*, *Scytalidium dimidiatum*, *Helminthosporium* spp., *S. schenckii*, and *Penicillium chrysogenum* are some of the reported organisms. The third clinical

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manifestation of ocular fungal infections is keratomycosis, often known as fungal keratitis.

The use of both hard and soft extended-wear contacts is linked to bacterial infections, which are typically brought on by Pseudomonas aeruginosa. Candida species are virtually always to blame for bacterial infections and fungal keratitis. In agricultural labourers, fungal keratitis typically develops following contact with fungus-contaminated plant material. The majority of instances are brought on by filamentous soil saprophytes like *Zygomycetes*. Instances of ocular infections have been linked to fungi from over 56 genera. There have been reports of septate fungi such as *Epidermophyton floccosum*, *Scedosporium apiospermum* (Saracli et al., 2003), *Absidia* and *Rhizopus* species of *Zygomycetes* group, *Fusarium*, *Aspergillus*, *Curvularia*, *Acremonium*, and *Phialophora* species. Recently, the first account *of Carpoligna pleurothecii*-related fungal keratitis was described (Słowik et al., 2015). Although they are relatively uncommon in the industrialised world, keratitis caused by fungi is more common in many developing nations, particularly those that are tropical. Depending on the study's nation of origin, the percentage of fungal keratitis patients may range from 6 to 53 percent overall (Bharathi, 2007). In Asia, a prominent cause of blinding eye disease is fungus keratitis. The prevalence of fungal keratitis is still quite low in temperate regions like northern America and Britain.

The most frequent cause of fungal keratitis is corneal damage infected with plant matter. Wearing contacts has been linked to an increased risk of *Fusarium keratitis* since around 1980. There have been several epidemics of *Fusarium keratitis* among people who wear contact lenses in Singapore, Hong Kong, the United States, Puerto Rico, and the Caribbean. This specific type of storage solution encouraged the development of contaminating *Fusarium spp*. The orbit and its surrounding tissues, especially the paranasal sinuses, are particularly susceptible to invasive *Aspergillus* and *Zygomycete* infections (Fairley et al., 2000). Although *Aspergillus* can cause eye illness in healthy hosts as well, it is more invasive in immunocompromised hosts. Rhino-orbito-cerebral (ROC) zygomycosis, an invasive zygomycosis, is a severe consequence of diabetic ketoacidosis and the use of immunosuppressive medications after organ donation. For both the initial assessment and for tracking disease development and response to treatment for sinoorbital illness, radiographic imaging of the orbit and paranasal sinuses is quite helpful.

Particularly in the developing countries, ocular fungal infections still play a significant role in causing ocular morbidity and vision loss (Kalkanci and Ozdek, 2011). Broad-spectrum antibiotic use, the rise in patients undergoing operations that cause immunosuppression, postoperative infection, trauma, and chronic corticosteroid use are all contributing factors to the rise in these infections over the past few decades (Tabbara, 2014). The anatomical location of the infection helps to classify ocular fungal infections. These infections can affect the front and posterior portions of the eye as well as the area surrounding the eye (ocular adnexa) (Sodhi et al., 2016; Ramírez-Soto and Bonifaz, 2022).

Aspergillus, *Candida spp.*, *Cryptococcus species*, and *Coccidioides spp*. are the most common pathogenic fungi of the eye, along with *Fusarium*, *Penicillium*, *Pseudallescheria*, and dimorphic fungi like *Histoplasma capsulatum*, *Blastomyces dermatitidis*, *Sporothrix spp*., and *Coccidioides spp. (C. immitAspergillus, Candida spp., Cryptococcus* species, and *Coccidioides spp*. are the most common pathogenic fungi of the eye, along with *Fusarium, Penicillium*, *Pseudallescheria*, and dimorphic fungi like *Histoplasma capsulatum, Blastomyces dermatitidis, Sporothrix spp.*, and *Coccidioides spp*. (*C. immitis* and *C. posadasii*) (Khairallah and Attia, 2014). The non-specific clinical symptoms of ocular fungal infections might make diagnosis challenging. The use of laboratory and diagnostic tools, as well as the identification of the clinical symptoms of ocular fungal infections, have improved it recently (Khairallah and Attia, 2014). This has raised the prevalence of these disorders and the frequency of accurate diagnoses. As a result, it's critical to stay up to date on emerging breakthroughs in the diagnosis and treatment of infectious eye illnesses. In this context, articles describing novel discoveries and reviews on the epidemiology, diagnosis, and treatment of ocular fungal infections have been published in this Special Issue, with a focus on infections in the

ocular adnexa, endophthalmitis, keratitis, and ocular sporotrichosis in particular.

Eye fungus infections present a challenging set of clinical issues for both ophthalmologists and infectious disease specialists. Ocular fungal illness is rare, but it poses a major problem because it can lead to blindness from disorders like fungal keratitis or endophthalmitis (King et al., 2003). Four different types of fungal eye disorders have been identified: mycotic keratitis, an infection of the cornea that typically follows trauma; endogenous oculomycosis; extension oculomycosis; and miscellaneous infections, such as those of the tear ducts, eyelids, and conjunctiva (Shukla et al., 2008).

One of the most difficult types of microbial keratitis for the ophthalmologist to diagnose and treat is fungus keratitis. Human keratitis is caused by fungi that may look like mould or yeast. Because some cases of mould keratitis don't respond to extensive treatment, a therapeutic penetrating keratoplasty may be required (Uno, 2008). Geographical and climatic conditions play a significant role in determining the prevalence of specific infections. Aspergillus and Fusarium spp. are the most prevalent isolates in fungal keratitis, according to reports from throughout the world. Keratomycosis is most common in warm areas and coincides with seasonal increases in temperature and humidity. Due to the limited availability of infected material and the slow growth of a wide variety of fungi on commonly used culture media, the diagnosis of oculomycosis is frequently delayed (El-Sayed et al., 2010). This prompted the creation of culture-independent diagnostic procedures such as PCR, nucleic acid probes, immunological detection, fluorochromatic stains (CFW), and immunological detection (Gaudio et al., 2002).

CONCLUSION

The fungi infections continue to be significant contributors to eye disorders. Fungal corneal infections are the main cause of blindness in Asia. The most typical pathogens inflicting corneal infections and eyeball mycoses are *Candida spp*., *Fusarium spp*., and *Aspergillus spp*. Immunodeficiency (such as AIDS), diabetes, surgery, antibiotic and corticosteroid therapy, as well as drug addiction, are all linked to an increased risk of fungal infections. Early detection of the condition and prompt, intensive antifungal treatment have a substantial impact on how the illness develops and may lessen consequences, such as blindness.

According to the anatomical component of the eye affected by the disease, the epidemiology and etiological agents of ocular fungal infections were discussed. The most often isolated fungi in keratitis and fungal endophthalmitis are *Candida*, *Fusarium*, and *Aspergillus*. The identification of the fungus, which determines the clinical result and optimizes antifungal medication, requires the use of laboratory techniques. Antifungal treatment for this infection has been studied using systemic and intraocular applications. For prospective research intended to assess host characteristics in order to generate results equivalent to those obtained in humans, experimental models are essential. Animal models will enable the study of the aetiology of ocular infections despite the vast research that has been done on the effectiveness of various treatment options.

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