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Burden of Mycotic Keratitis in West Africa

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Mycotic or fungal keratitis (FK) is a sight-threatening disease, caused by infection of the cornea by filamentous fungi or yeasts. In tropical, low and middle-income countries, it accounts for the majority of cases of microbial keratitis (MK). Filamentous fungi, in particular *Fusarium* spp., the aspergilli and dematiaceous fungi, are responsible for the greatest burden of disease (Hoffman et al 2021). The predominant risk factor for filamentous fungal keratitis is trauma, typically with organic, plant-based material. In developed countries, contact lens wear and related products are frequently implicated as risk factors, and have been linked to global outbreaks of Fusarium keratitis in the recent past. In 2020, the incidence of FK was estimated to be over 1 million cases per year, and there is significant geographical variation: accounting for less than 1% of cases of MK in some European countries to over 80% in parts of south and south-east Asia (Hoffman et al 2021). The proportion of MK cases is inversely correlated to distance from the equator and there is emerging evidence that the incidence of FK may be increasing. Diagnosing FK is challenging; accurate diagnosis relies on reliable microscopy and culture, aided by adjunctive tools such as in vivo confocal microscopy or PCR. Unfortunately, these facilities are infrequently available in areas most in need. Current topical antifungals are not very effective; infections can progress despite prompt treatment. Antifungal drops are often unavailable. When available, natamycin is usually first-line treatment. However, infections may progress to perforation in ~25% of cases (Hoffman et al 2021). Mycotic keratitis refers is most common in tropical and subtropical locations. The annual global incidence of fungal keratitis (based on culture-positive cases) is estimated 1,051,800 (736,250-1,367,300) cases. The highest estimated incidences are in Asia and Africa, and the lowest in Europe. Over million cases of mycotic keratitis occur globally every year (Brwon et al 2020). Over 100 species have been known to be causal agents, and novel pathogens are regularly added: however. the common causative agents are *Fusarium* spp., *Aspergillus flavus*, and *A. fumigatus* and *Candida albicans*. (GAFFI-Fungal keratitis Fact sheet by David W Denning).

Several studies have shown that *Fusarium* spp (13-24%). and *Aspergillus* spp (8-30%). are main agents of IK in Asia, particularly India and China whereas *Candida spp* are more commonly observed agents in temperate regions e. g. U.K., Most parts of North America. Other pathogens such as *Cryptococcus curvatus*, *Arthrographis kalrae*, *Pythium spp*., and many other species of fungi are increasingly being reported as rare causes of fungal keratitis.

Studies on mycotic keratitis in Nigeria

Studies in Nigeria at University of Nigeria Teaching Hospital Enugu (UNTH) over a period of 4 years (1974–1977) dealt with 59 cases suspected of mycotic keratitis with confirmed etiology in 42 cases. *Fusarium solani* was the predominant etiological agent (14 cases) followed by *Penicillium citrinum* (8), *P. expansum* (2), Penicillium and *Aspergillus fumigatus* (5), *A. flavus* (3), *A. niger* (2cases), and one case each of *F. moniliform*, *Candida albicans*, *C. guilliermondii*, *C. parapsilosis* (Gugnani et al 1976; Gugnani et al 1978) The remaining 12 cases were that of *Fusarium moniliforme* (3), *Penicillium citrinum* (2). *P. expansum* (1), *Penicillium sp* (1), *Cladosporium cladosporioides* (1) and *Cladosporium spp* (1). Most cases were aged 20-60 years. Corneal trauma was the important predisposing factor as 27 (67.3%) gave a history of injury to the eye from palm tree leaves, thorns, kernels, or other plant objects, mechanical tools, and frying oil. Cases were recorded throughout the year, the number being higher in March-May, Nov. to Dec. than that during the rest of the year (Gugnani

et al 1976; Gugnani et al 1978). The clinical appearance of the ulcers varied very much. For instance, the ulcers caused by *Fusarium* were sloughing with hypopyon filling more than half of the anterior chamber; corneal abscess and endothelial plaque formation was observed in these cases. The one caused by *A. fumigatus* wee paracentral with hypopyon at the base of anterior chamber. The fungal hyphae of the cases caused by *F. solani* were observed in KOH mounts of corneal scraping, while dichotomously branching hyphae were demonstrated in the histological section of the corneal tissue of the case caused by *A. fumigatus*. The tissue reaction in the cases caused by both fungi reaction in the cases caused by both fungi manifested as necrosis acute cellular infiltration. Corneal ulcers caused by *Penicillium citrinum* appeared as rolled out, while that of *Cladosporim* appeared somewhat dark coloured (Gugnani et al 1978). In a study of conjunctival flora of normal heathy eyes, twenty-two genera of fungi were represented, the clinically important ones being viz., *Cladosporium* (12.9%), *Penicillium* (10.2%), *Aspergillus* (6.7%), *Fusarium* (2.2%), and *Candida* (1.6%) the incidence being higher than that reported in most of the diverse geographic areas of the world Statistical analysis showed that *Cladosporium* was more commonly present in the eyes of adults while Penicillium was more frequently present in the eyes of children. (Gugnani et al 1976; Gugnani et al 1978). *Cladosporium* has been reported to be a predominant air-borne mold in Nigeria. Fusarium solani is common in soil, the air in palm plantations, and contaminated plant objects. *P. citrinum* has been observed to grow frequently on rotten citrus fruits and palm kernels and has also been isolated from air in eastern Nigeria (Gugnani, unpublished data).

Studies on mycotic keratitis in some other countries in West Africa

Ghana

1090 patients were recruited with suspected microbial keratitis between June 1999 and May 2001. Overall, the principal causative micro-organisms in both regions were filamentous fungi (42%): *Fusarium species* and *Aspergillus* species were the commonest fungal isolates. *Pseudomonas* species were most frequently isolated from cases of bacterial keratitis (Leck et al 2002).

A total of 207 consecutive cases of suppurative keratitis in southern part of the country were analyzed, of 109 cases of mycotic keratitis for which records were available, the mean age was 36. 3 yrs, the age range being 1-80 yrs, the majority being males. The largest occupational group among the patients was student/teachers followed by trades and agricultural workers The most common causes of eye trauma were wood, sticks, and twigs (18 patients), other vegetation (10 patients), stone, sand and dirt (17 patients). 122 patients (60.8 %) had no prior injury (Hagan et al. 1995). The most common organisms recovered from corneal smears were *Fusarium* species, *Psudomonas aeruginasa* and *Staphylococus epidermidis*. agents were *Fusarium* spp-46, *A. fla* (*A. fumigatus*-7, *A. niger*-1, *A. nidulans*-1, and *Aspergillus* sp-1 *Lasiodiploidea theobrome*-6, *Scedosporium apiospermum* -2, one each of *Cladosporium cladosporoides*, *Curvulaaria* sp, *Paecilomyces* sp, and Candida sp-1. unidentified species-5 and suspected but culture-negative-27. In one patient four different organisms were isolated, namely, *S. epidermidis*, *Pseudomonas aeruginosa*, *Lasiodipoidea theobromia* and *Dichotompphthorosis* species. No pathogen was recovered from 33 (16.6%) patients. (Hagan et al. 1995).

Siera Leon

In a study of cases of suspected infectious ulcerative keratitis from January 2005 to January 2006) detected of mycotic keratitis was detected in 35.6% of the cases and mixed fungal and bacterial etiology in 13.7% of the cases (Caprotti et al. 2010.

Togo

A study on the burden of serious fungal infections (SFI) based on linear modeling mentioned an annual incidence of 951 cases of mycotic keratitis but no details of fungal etiology were mentioned (Dorkeno et al 2021.)

Coˆte d'Ivoire

A similar study on Coˆte d'Ivoire mentioned an annual incidence of 3350 cases (Koffi et al. 2021).

Conclusion

Reports of cases reported from some countries in West Africa represent only a tip of the true burden of mycotic keratitis in the region. There is a need for comprehensive surveys (involving collaboration between ophthalmologists and microbiologists) of mycotic keratitis in representative communities with the help of primary health centers and hospitals in different countries. There is a report of investigating treatment for mycotic keratitis with herbal preparations comprising Solanum species, bitter orange and tea tree oil, only tea tree oil was found to be promising (Martin and Ernst 2004). It is suggested and physicians and biomedical scientists in west Africa explore the possibility of treating cases of mycotic keratitis with tea tree herbal oil. Further it should be possible to produce a combined antifungal and antibacterial preparation for widespread and immediate prophylactic first-aid use after corneal trauma, especially in rural areas.

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