



Fungal Organisms Associated with Ocular Infections in a Tertiary Care Hospital

Unegbu VN^{1*}, Anyamene CO², Odibo FJC³, Obum-Nnadi CN⁴ and Ezenwa CM⁵

¹Department of Biological Sciences, Spiritan University Nneochi, Abia State, Nigeria

^{2,3}Department of Microbiology and Brewing, Nnamdi Azikiwe University Awka, Nigeria

⁴Department of Microbiology, Veritas University Abuja, Nigeria

⁵Department of Microbiology, Imo State University, Nigeria

Research Article

Volume 5 Issue 2

Received Date: March 28, 2022

Published Date: August 31, 2022

DOI: 10.23880/oajmms-16000166

*Corresponding author: Unegbu Valentine Nnchetam, Department of Biological Sciences, Spiritan University Nneochi, Abia State, Nigeria, Tel: +2348035402207; Email: donval4u@yahoo.com

Abstract

Background: Ocular infections in man are the contamination and invasion of ocular tissues by micro-organisms leading to the breakdown of the natural defense mechanisms of the eyes. The areas in the eye that are frequently infected are the conjunctiva, lid and cornea.

Aim: This study was undertaken to determine the fungal organisms associated with Ocular Infections in Tertiary Care Hospitals in Abia State.

Methods: Ocular specimens were collected from 500 patients and investigated using culture techniques.

Results: The five hundred (500) patients, thirty-seven 37(7.4%) had fungal contamination. There was a statistical significance ($p=0.006$) in sex as males had 22(8.4%) more fungal contamination while females had 15(6.3%). Age played a significant role ($P=0.001$) as Individuals between 30-45 years were more affected (13.1%) while the least was in the age group 0-15 years (1.4%). The occupation of the patients significantly influenced ($P=0.002$) the prevalence of the fungal contamination of the eyes as individuals who were engaged in farming activities had the highest contamination 11(12.2%) followed by stone quarrying activities 9(13.8%). The least came from the civil servants 2(2.5%). *Aspergillus niger* 40(8.0%) was the most prevalent, followed by *Candida albicans* 32(6.4%) while *Aspergillus fumigatus* had the least 22(4.4%). *Aspergillus flavus* and *Fusarium* spp prevalence were 28(5.6%) and 27(5.4%) respectively.

Conclusions: The culture positivity in this study was very high. Fungal infections of the eye were mostly caused by *Aspergillus Niger*, *Aspergillus flavus*, *Aspergillus fumigatus*, *C. albicans* and *Fusarium* spp.

Keywords: Fungi; Sabouraud Dextrose Agar; Ocular Pathogens; Conjunctivitis; Keratitis

Abbreviations: ASTHA: Abia State Teaching Hospital
Aba; GHU: General Hospital Ugwunagbo; ASDHU: Abia State Diagnostic Hospital Umuahia; FMCU: Federal Medical Centre Umuahia.

Introduction

The eye is a unique organ that is almost impermeable to almost all external agents [1]. The defense mechanisms

of the eye are the tears which contain several substances (e.g. lysozymes and interferon), the eyelids and eye lashes. Pathogenic microorganisms cause diseases to the eyes due to their virulence and host's reduced resistance from many factors such as personal hygiene, living conditions, socio-economic status, nutrition, genetics, physiology, fever and age [1]. The areas in the eye that are frequently infected are the conjunctiva, lid and cornea [2].

Ocular infections in man are the contamination and invasion of ocular tissues by micro-organisms leading to the breakdown of the natural defense mechanisms of the eyes (i.e the bony orbits, eyelids, eyelashes and tears). This situation results in various ocular disorders including conjunctivitis, keratitis, blepharitis, lid abscess, external hordeolum, dacryocystitis and blepharo-conjunctivitis [3]. The effects of these ocular infections are enormous as they cause both physical, emotional stress including psychological trauma if it leads to blindness or severe ocular distortions [3]. The causative agents of ocular infections can be fungi, bacteria viruses and parasites [3].

These infections have been known to affect both male and female of various age groups. In addition, individuals of various occupations like farming, mining, welding etc have had cause to suffer ocular microbial infections [4]. Moreover, some habits especially those that involve cleaning or rubbing the eyes with contaminated hands/fingers transfer these pathogens to the eyes hence the infections. World Health Organization (WHO) reported that industries where dusts and particles are sent into the air has higher ocular microbial infections [4].

Several other factors have also been known to influence the spread of the microbial ocular invasion. Such factors may include the type of residence, social and attitudinal. Some of these infections carry poor prognosis as patients are at risk of losing either their sights or life, or both [5]. This has necessitated the prompt detection of the etiologic agent and the timely institution of appropriate antibiotic treatment for patients with ocular infections.

In Nigeria, conjunctivitis is one of the most common eye problems which causes "red eye" that affect all age groups. Infective keratitis is a major cause of vision loss and blindness second to cataract [6]. Blepharitis is an inflammation of the eyelid margins which can result in patient discomfort and decline in visual function while lid abscess may cause vision-threatening ocular complications [7]. Dacryocystitis is an inflammation of the lacrimal sac and duct [7]. Lastly, eyelid infection causes redness of the eyelids and the skin around the eyes [7].

Mycotic keratitis, the most frequently encountered fungal infections is usually caused by filamentous fungi and occurs in conjunction with trauma to the cornea with vegetation matter. In the tropics it is common in male agricultural workers. In temperate areas, eye trauma is also the cause of fungal keratitis. The common fungal genera involved are *Fusarium*, *Alternaria* and *Aspergillus* spp [8]. The ocular findings may be part of a widespread systematic infection.

The number of people attending various health institutions for eye related problems in Nigeria is currently in the increase. This has resulted in the establishment of optometry clinics in various hospitals across the country. Therefore, this study was carried out to determine the fungal organisms associated with Ocular Infections in Tertiary Care Hospitals in Abia State, Nigeria.

Methods

Study Area

Eye-patients attending the Optometry clinic at Abia State University Teaching Hospital Aba, Federal Medical Centre Umuahia, Abia State Diagnostic Hospital Umuahia and General Hospital Ukwunagbo were the target population.

Study Design

This is a cross-sectional study that included patients with clinically diagnosed bacterial Conjunctivitis, keratoconjunctivitis, Keratitis, Blepharo-conjunctivitis, Blepharitis, Dacryo-cystitis and Lid abscess. All patients were diagnosed by a number of ophthalmologists using standard protocols.

Sample Size/Study Techniques

A total of 500 ocular specimens, consisting of 125 ocular specimens (swabs), each from the four hospitals were used for this study. All individuals examined and diagnosed using the silt-lamp bio-microscope by ophthalmologists as ocular infection patients were included in this study.

Ethical Clearance

Ethical permission (ABSUTH/CS/56/VOL 2/48) was obtained from the hospital authorities and the consent of the patients was also obtained before specimen collection.

Eligibility Criteria

Inclusion Criteria

- Clinically diagnosed patients suspected with ocular infections.

- Patients who gave their informed consent.

Exclusion Criteria

- Patients on topical antifungal treatment
- Patients who refused giving their informed consent.
- Patients with trachoma, peripheral ulcerative keratitis, viral keratitis, allergic and viral conjunctivitis, severe ocular trauma, and patients who had recent ocular surgery.

Data and Specimen Collection

Demography data was collected from patients using structured and predesigned questionnaire.

Specimen Collection

Specimens were collected with the help of ophthalmologists. Specimens from the eyes (eye, conjunctiva, lacrimal sac and cornea) were collected using sterile swab sticks following routine clinical management of the patients [9]. The obtained swabs were examined in the laboratory within 20mins to 1hr of collection.

Laboratory Diagnosis: Direct Smear Examination: KOH Wet Mount Preparation

This was carried out according to the method used by Namitha and Mahalakshmi [9]. Collected swabs were spread over different clean grease free glass slide over which a drop of 10% KOH solution was placed and covered with a cover slip. After 20mins the slides were examined under dry objectives for the presence of fungal elements like yeast cells, spores, hyphae, pseudohyphae, spherules or sclerotic bodies.

Gram Stain

This was done to look for gram positive budding yeast cell, hyphae, and pseudohyphae.

Fungal Culture

The specimens (swab) was used to inoculate on two Sabouraud Dextrose Agar plates with antibiotics but without actidione in a "C" shaped streak and incubated at 25°C and at 37°C, they were examined daily for any growth for the first week and twice a week for a period of four weeks and if any growth on SDA, the identification was done as below.

Isolation of Fungi

The growth was observed for the following-Rate of growth, Morphology of colony, Texture and Surface pigmentation. Microscopic examination like LPCB mount and slide culture were done to identify the fungi. No growth was observed even after 3weeks of incubation, the culture was considered as sterile and the plates were discarded [9].

Germ Tube Test

The Reynold-Braude's test (Germ tube test) to identify *Candida albicans* was done as describes by Cheesbrough [10].

Controls

Prior to actual data collection, comprehensiveness, reliability and validity of questionnaires were pre-tested on ten patients each from the four aforementioned hospitals. All specimens were collected following standard operating procedure for ophthalmic specimen collection.

Statistical Analysis

Statistical analysis was carried out using the SPSS 21.0 window-based program. The proportion of isolated fungi with patient demographic information was compared using the chi-square test. A value of $P < 0.05$ was considered to be statistically significant.

Results

Of the five hundred (500) patients, thirty-seven 37(7.4%) had fungal contamination. Out of 262 males examined, 22(8.4%) had various fungal contamination while 15(6.3%) of the females had similar contaminations. There was a statistical significance between the male and female ($p=0.006$). Age played a significant role ($P = 0.001$) on the prevalence of the contamination. Individuals of 30-45 years were more affected (13.1%), followed by the 45 - 60 year (8.5%) while the least was in the age group 0- 15 years (1.4%). The occupation of the subjects influenced the prevalence of the fungal contamination eyes. Those individuals who are engaged in farming activities had the highest contamination (12.2%) followed by stone quarrying activities (13.8%) and then metal miners (9.7%). The least came from the civil servants (2.5%), Statistical analysis showed a significant influence ($P = 0.002$).

Parameters	No. Screened (%)	Number Infected (%)	χ^2	df	P- Value
Male	262(52.4)	22(8.4)	10.321	4	0.006
Female	238(47.6)	15(6.3)			
Total	500(100)	37(7.4)			

Age in Years					
0-15	71(14.2)	1(1.4)	9.121	5	0.001
15-30	99(19.8)	6(6.1)			
30-45	122(24.4)	16(13.1)			
45-60	118(23.6)	10(8.5)			
> 60	90(18.0)	4(4.4)			
Total	500	37(7.4)			
Occupation					
Schooling	68(13.6)	2(2.9)	11.011	6	0.002
Farming	90(18.0)	11(12.2)			
Civil Servants	80(16.0)	2(2.5)			
Trading	76(15.2)	3(3.9)			
Artisans	59(11.8)	4(6.8)			
Metal mining	62(12.4)	6(9.7)			
Stone Quarrying	65(13.0)	9(13.8)			
Total	500(100)	37(7.4)			

Table 1: Ocular Infections and Sociodemographic Characteristics.

Parameter	Value (%)
No Screened	500(100)
No contaminated	37(7.4)
Observed Organisms	
<i>Aspergillus niger</i>	40 (8.0)
<i>Aspergillus flavus</i>	28 (5.6)
<i>Aspergillus fumigatus</i>	22 (4.4)
<i>Candida albicans</i>	32 (6.4)
<i>Fusarium spp</i>	27 (5.4)

Table 2: Prevalence of fungal contaminants on eye.

Table 2 shows the Prevalence of fungal contaminants on eye. *Aspergillus niger* 40(8.0%) was the most prevalent, followed by *Candida albicans* 32(6.4%) while *Aspergillus fumigatus* had the least 22(4.4%). *Aspergillus flavus* and *Fusarium spp* prevalence were 5.6% and 5.4%, respectively.

Aspergillus niger 40(8.0%), *Aspergillus flavus* 28(5.6%), *Aspergillus fumigatus* 22(4.4%) and *Candida albicans* 10(31.3%) were isolated from Keratitis patients. *Candida albicans* was isolated from patients with Dacryocystitis 7(21.9%), Blepharitis 8(25.0%), Keratitis 10(31.3%), Blepharo-conjunctivitis 2(6.3%) and Lid abscess 5(15.6%). *Fusarium spp* was isolated in patients with only Conjunctivitis 27(5.4%).

	Isolates	Conjunctivitis	Dacryo	Blepharitis	Keratitis	Bleph-Con	Lid Abscess
	37(7.4%)	7(18.9%)	2(5.4%)	3(8.1%)	20(54.1%)	4(10.8%)	1(2.7%)
<i>Aspergillus niger</i>	40(8.0)	0	0	0	40(8.0)	0	0
<i>Aspergillus flavus</i>	28(5.6)	0	0	0	28(5.6)	0	0
<i>Aspergillus fumigatus</i>	22(4.4)	0	0	0	22(4.4)	0	0
<i>Candida albicans</i>	32(6.4)	0	7(21.9)	8(25.0)	10(31.3)	2(6.3)	5(15.6)
<i>Fusarium spp</i>	27(5.4)	27(5.4)	0	0	0	0	0

Table 3: Prevalence of fungal pathogens across the different clinical features of Ocular infection from ASTHA, GHU, FMCU and ASDHU.

Discussion

The culture positivity in this study was 37(7.4%), which was similar to the result from the work of Nwaugo et al. who got 68(15.11%) from patients attending the optometry clinic

at Abia State University, Uturu, Nigeria [11]. The absence of fungal growth in some clinically diagnosed cases of ocular infection may be due to non-fungal causes like bacteria, viruses, eye allergies, post traumatic suppurative scleritis or Hepatic keratitis [12].

The ocular infections were predominantly seen in males (55.3%) who were within the age group 30 - 45 years (77%). This may be attributed to their outdoor activities as people within this age range make up majority of the labor force. Similar result was seen in the study conducted in India [13]. More so, patients of low socio-economic group like farmers, stone quarriers, metal miners had a highest prevalence of ocular infections of (62.2%), (73.8%) and (71%) respectively. These people come in contact with the soil regularly. The soil is the home of all organisms; therefore organisms from the soil contaminate those who come in contact with it. Farming, stone quarrying and metal mining involves tilling the soil which stirs up dust particles. This results in direct contamination of the eyes through dust particles or by touching the eyes with contaminated hands. Alternatively, students and civil servants have little or nothing to do with the soil, thus are not highly contaminated. More so, students and civil servants being probably more educated, have more knowledge about mode of contamination from pathogens and how to prevent it through practice of safe personal hygiene [11]. This was in agreement with the study conducted in India [13] and also, at Southern Ethiopia by Anteneh et al. who observed patients of low socio-economic group were most affected by ocular infections as a result of exposure to eye infection [6].

The fungal organisms observed in this study include *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Candida albicans* and *Fusarium* species. Some authors and researchers from Nigeria and India had earlier mentioned them [11,9,14-15]. *Aspergillus* species are known as contaminants of various materials, hence the high prevalence [11]. The isolation of *Candida albicans* is of enormous health significance. *C. albicans* has been known to cause various dermatological and human systemic infections while *Fusarium* spp are well known dermatophytes [14-15]. The isolation of these fungi pathogens in this study signifies possible eye infection for the patients resulting in various eye complications.

Fusarium spp (5.4%) is the common organism causing conjunctivitis while keratitis was caused *Aspergillus niger* (8.0%), *Aspergillus flavus* (5.6%), *Aspergillus fumigatus* (4.4%) and *C. albicans* (31.3%). *C. albicans* was isolated from cases of Dacryocystitis (21.9%), Blepharitis (25%), Blepharo-conjunctivitis (6.3%) and Lid abscess (15.6%).

Leck, et al. reported that men are more susceptible to conjunctivitis than female [16]. In another studies Sharma et al and Shokohi, et al. reported that Mycotic Keratitis seems to be prevalent in males, in farmers and the most common predisposing factor remains trauma to the cornea [17-18].

Conclusions

The culture positivity in this study was very high. The highest number of fungi species causing eye infection was observed in the case of keratitis. Fungal infections of the eye were mostly caused by *Aspergillus Niger*, *Aspergillus flavus*, *Aspergillus fumigatus*, *C. albicans* and *Fusarium* spp.

Conflicts of Interest

There are no conflicts of interest.

References

1. Alemayehu W, Teklehaimanot R, Forsgren T, Erkestet J (2010) Causes of Visual Impairment in central Ethiopia. *Ethiop. Med J* 33(3): 163-174.
2. Esenwah EC, Ojogbane GE, Azuamah YC, Ezinne N, Ikoro NC, et al. (2015) Common Pathogenic Organisms Found in External Eye Infections among Residents of Abuja, Nigeria. *Int J Res* 2(3): 668-669.
3. Anagaw B, Biadlegne F, Belyhun Y, Anagaw B, Mulu A (2011) Bacteriology of ocular infections and antibiotic susceptibility pattern in Gondar University Hospital, Northwest Ethiopia. *Ethiop Med J* 49(2): 117-123.
4. World Health Organization (2008) Preventing blindness in children, Report of a WHO/IAPB scientific meeting. Geneva, pp: 1-40.
5. Ramesh S, Ramakrishnan R, Bharathi MJ, Amuthan M, Vishwanathan S (2010) Prevalence of bacterial pathogens causing ocular infections in South India. *Indian J Pathol Microbiol* 53(2):281-286.
6. Anteneh A, Tamirat A, Adane M, Demoze D, Endale T (2015) Potential bacterial pathogens of external ocular infections and their antibiotic susceptibility pattern at Hawassa University Teaching and Referral Hospital, Southern Ethiopia. *Afr J Microbiol Res* 9(14): 1012-1119.
7. Grant GG (2007) Dacryocystitis. *E Medicine J Ophthalmol* 2: 1-10.
8. Jain AK, Bansal R, Felcida V, Rajwanshi A (2007) Evaluation of impression smear in the diagnosis of fungal keratitis. *Indian J Ophthalmol* 55(1): 33-36.
9. Namitha BN, Mahalakshmi (2016) Fungal Profile of Ocular Infection in Patients Attending in a Tertiary Care Hospital. *IOSR-JPBS* 11(4): 27-32.
10. Clinical Laboratory Standard Institute (2020) Performance standards for antimicrobial susceptibility

testing, 32nd (Edn.), Wayne, pp: 362.

11. Nwaugo VO, Ukoha OC, Ndom HU (2008) Fungal contamination of eye lenses and frames of patients attending optometry clinic at Abia State University, Uturu, Nigeria. *Afr J Biotechnol* 7(19): 3410-3413.
12. Mazin OM, Lemya AK, Samah OM (2016) External ocular bacterial infections among Sudanese children at Khartoum State, Sudan. *Afr J Microbiol Res* 10(40): 1694-1702.
13. Qudisia N, Arkapal B, Rakesh CC, Satya PS, Monica S (2020) Analysis of antimicrobial susceptibility pattern of ocular infections at Regional Ophthalmic Institute in India. *Int J Basic Clin Pharmacol* 9(4): 642-646.
14. Umamageswari SSM, Jeya M, Suja C (2013) Study of Bacterial and Fungal Profile of External Ocular Infections in a Tertiary Care Hospital. *NJLM* 2(3): 6-10.
15. Suja C, Jasmine V, Mageswari SSU (2019) Bacterial and Fungal Profile of External Ocular Infections in a Tertiary Care Hospital. *Int J Curr Microbiol App Sci* 8(2): 2081-2089.
16. Leck AK, Thomas PA, Hagan M, Kalamurthy J, Ackuaku E, et al. (2002) Etiology of suppurative corneal ulcers in Ghana and South India and epidemiology of fungal keratitis. *Br J Ophthalmol* 86(11): 1211-1215.
17. Shokohi T, Dailami KN, Haghghi TM (2006) Fungal keratitis in patients with corneal ulcer in SARI, Northern Iran. *Arch Iran Med* 9(6): 222-227.
18. Sharma VK, Purohit M, Vaidya S (2009) Epidemiological study of mycotic keratitis. *IJOVS* 6(2).

