Journal of Applied Pharmaceutical Science Vol. 6 (11), pp. 021-027, November, 2016
Available online at http://www.japsonline.com
DOI: 10.7324/JAPS.2016.601104
ISSN 2231-3354 

Evaluating the diagnosis and management of oculomycosis in Ghana

Linda Gyanfosu[1, 3], George A. Koffuor[1*], Samuel Abokyi[2], Ben Ababio Danso[3]

[1]Department of Pharmacology, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
[2]Department of Optometry, School of Allied Health Sciences, University of Cape-Coast, Cape-Coast, Ghana.
[3]St. Michael's Catholic Hospital, Pramso (Bosomtwi District), Ashanti Region.

ARTICLE INFO

Article history:
Received on: 23/08/2016
Revised on: 04/09/2016
Accepted on: 30/10/2016
Available online: 29/11/2016

Key words:
Culture and sensitivity test,
Visual impairment,
Antifungal eye drops,
Keratomycosis,
Endophthalmitis.

ABSTRACT

Appropriate diagnosis and treatment of oculomycosis is crucial in curbing its associated visual impairment. This study therefore evaluated the diagnosis and management of oculomycosis in Ghana. A cross-sectional survey involving 120 eye care practitioners from six regions of Ghana was conducted. Using a structured questionnaire, information on procedures of diagnosis and management of oculomycosis were collected. Clinical features were considered by 66.7% eye care practitioners in diagnosing oculomycosis, with only 37.5% requesting for laboratory investigations. Fluconazole (79%) and natamycin (44%) were the most commonly prescribed antifungal eye drops by practitioners based on efficacy. Majority of practitioners (59.2%) reported non availability of antifungal eye drops from pharmacies. Age, profession, location of facility and type of facility were strongly associated ($P \leq 0.01$-0.001) with the practitioners' diagnostic practice of requesting for laboratory investigations. Diagnosis of oculomycosis in Ghana is based more on clinical features, especially in the district areas, than on microbiological investigations, which does not augur well for better prognosis and management. Treatment is mainly by systemic antifungals, as antifungal eye drops are hard to come by. While a successful therapy was not without some visual consequences, it reduced significantly corneal scarring, blurred vision, and blindness associated with oculomycosis.

INTRODUCTION

Oculomycosis is gradually becoming a public health issue as it remains one of the most difficult and challenging ocular diseases to diagnose and treat by eye care practitioners (El-Seidi *et al.,* 2006). Prompt diagnosis and treatment of oculomycosis is imperative to prevent vision-threatening complications of the infection. Clinical signs and features, such as the formation of hyphae in the cornea (Rajmane *et al.,* 2011), an indolent course, irregular feathery margins, dry texture, corneal satellite lesions, hypopyon, corneal ulcer, and keratitis are suggestive of oculomycosis (Graff *et al.,* 2006). Clinical symptoms include photophobia, chemosis, redness, tearing and severe ocular pains (Nayanar and Vanathi, 2012). Using clinical features alone to diagnose oculomycosis is sometimes not reliable as it cannot distinguish it from other microbial infections because of overlapping clinical features (Ansari *et al.,* 2013). The diagnosis of oculomycosis using characteristic clinical features together with microbiological investigation is therefore very important in establishing a tentative diagnosis of oculomycosis. Selecting appropriate and effective topical ocular antifungal agents for treatment is also a challenge, as these drugs may not be readily available or accessible to the patient. This study therefore attempted to evaluate the diagnosis and management of oculomycosis in Ghana. Findings from this study could inform the Ministry of Health, and agencies under its umbrella, as well as Non-Governmental Health Organizations and Private Health Institutions on policies to make to help the management of oculomycosis in Ghana.

METHODOLOGY

Study area

This study was conducted in the Greater Accra, Eastern, Ashanti, Central, Brong Ahafo, and Northern Regions of Ghana, between March and December, 2014.

* *Corresponding Author*
George Asumeng Koffuor, Department of Pharmacology, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. E-mail:gkoffuor @ yahoo.com

These regions were chosen based on the number of practitioners and distribution of eye care facilities to ensure appropriate representation of participants across the country (National Eye Care Report, 2005).

Study population

The study population comprised three categories of eye care practitioners: Ophthalmologist, Optometrist and Ophthalmic nurses. These practitioners were selected because they were deemed to have knowledge in ocular disorders including oculomycosis. An ophthalmologist is a specialist in medical and surgical eye problems. An optometrist is the first point of call in case of eye conditions, therefore has gained the expertise to diagnose and treat simple ocular disorders of common occurrence, while an ophthalmic nurse is also trained to work with other eye care professionals in managing ocular disorders.

Eye care facilities involved in this study

Teaching hospitals, Government hospital (GHS), Christian Health Association of Ghana (CHAG) hospitals, as well as private and Non-Governmental Organizations (NGOs) comprised the selected hospitals and eye clinics from the regions used. The different health facilities influence the number of patients visiting, as well as the kind of cases reported to the facility, and hence the diagnosis and management of a disease/disorder.

Sampling size

A total of 120 eye care practitioners were recruited from the various eye care facilities. The sample size was deemed appropriate based on information obtained from the Eye Care Unit Annual Report 2011, and from calculation based on Glenn's equation, i.e. $N_o=z^2pq/e^2$ [Where N_0 is Sample size, z^2 is the abscissa of the normal curve that cuts off an area α at the tails ($1-\alpha$ equals the desired confidence level, e.g. 95%), e is the desired level of precision, p is the estimated proportion of an attribute that is present in the population and q equals to 1-p].

Sampling technique

Cluster sampling was used in recruiting participants. First and foremost, each eye care facility in a specific region was classified based on its location as rural (those located in districts areas) or urban (those located in metropolitan areas). For each region, two rural and three urban eye care facilities were then randomly selected to participate in the study. Ophthalmologists were recruited firstly, followed by Optometrists and then Ophthalmic nurses during a visit to selected facilities. This order format followed the ranks and the expertise in terms of handling cases related to the eye.

Study design and instrument for data collection

A cross-sectional survey of optometrist, ophthalmologist and ophthalmic nurses was conducted using structured questionnaire designed to cover the following: Bio-data of eye care practitioner's practices regarding diagnosis, request for microbiological investigations, and antifungal therapy selection among others. Questionnaires were self-administered by the practitioners within a time frame of 5 minutes. An initial testing of the questionnaires was carried out using 10 practitioners to assess the ability of this study instrument in obtaining data suitable for this study.

Inclusion criteria

For a professional to be included in this survey, that individual should be a registered eye care practitioner in active practice, being involved in diagnosing and managing of ocular diseases and disorders including oculomycosis, and having had at least one year working experience after their internship were eligible for the study. Practitioners who were registered but not in active service or had less than a year of working experience, as well as those that had retired from active service were excluded from the study.

Limitations to the Study

The data collection method used may not have allowed practitioners enough time to come out with more information like an in-depth interview could have provided. The study assumed that the responses given by participants were representative of what happens in the eye care facilities in Ghana. Hawthorne's effect could also have affected the responses of some practitioners since they knew it was a study and could present information that was actually not the case.

Ethical consideration

The study was approved by the Department of Pharmacology, KNUST, ethics committee. Informed consent was obtained from all practitioners before participation in accordance with the tenets of Declaration of Helsinki regarding the use of human subjects for research. In addition, permission was obtained from the Head of each health facility used for the study. Responses by participants were kept confidential by not taking their names. Participants were not given any incentives or influenced in any way to part-taking in the study, and had the freedom to opt out of the study at will.

Data analysis

Data obtained was collated and analyzed using SPSS V 20 (SPSS, Chicago, Illinois, USA). Pearson's chi-square (χ^2) was used to show relationship between two categorical variables. $P \leq 0.05$ was considered significant. Sigma Plot V 11 (Systat Software, Inc., San Jose, CA) was used to plot the graphs.

RESULTS

Demographics of practitioners

Out of 120 practitioners who participated in this survey, 63 (52.5%) were males and 57 (47.5%) were females. Fifty-two

(43.3%) were Optometrists, 51 (42.5%) Ophthalmic nurses, and 17 (14.2%) Ophthalmologists. The majority of these practitioners 40.0% (48) were aged 21-30 years with only 16 (13.3%) aged 50 years or older. Majority, 68 (56.7%) had worked for at most 3 years with 12 (10.0%) having worked for over 13 years (Table 1). Sixty-two (51.7%) of the practitioners worked in health facilities located in the District, while 58 (48.3%) worked in eye clinics located in the Metropolis. The practitioners were almost equally distributed across the different types of eye care facilities in the country (Table 2).

Table 1: Age and duration of practice of 120 eye care practitioners

Parameter	Distribution	Frequency
Age (years)	21-30	48 (40%)
	31-40	35 (29.2%)
	41-50	21 (17.5%)
	51-60	16 (13.3%)
Duration of Practice (Years)	1-3	68 (56.7%)
	4-8	18 (15.0%)
	9-13	22 (18.3%)
	>13	12 (10.0%)

Table 2: Location of practice for practitioners interviewed

	Distribution	Frequency
Type of institution	Teaching Hospital	30 (25%)
	Government Hospital	32 (27.6%)
	CHAG Institution	33 (27.5%)
	NGO/ Private	25 (20.8%)

CHAG = Christian Health Association of Ghana; NGO = Non-Governmental organization

Factors considered in diagnosis of oculomycosis

Practitioners who considered: history of presenting complain were 80 (66.7%); findings of slit-lamp biomicroscopy were 96 (80%), and unresolved corneal ulcer to conventional antibiotic treatment were 47 (39.2%) (Figure 1). Clinical signs, symptoms and features seen on examination with slit lamp biomicroscopy that aided diagnosis of oculomycosis were reduce visual acuity, cornea ulcer, keratitis, and hypopyon among others (Figure 2).

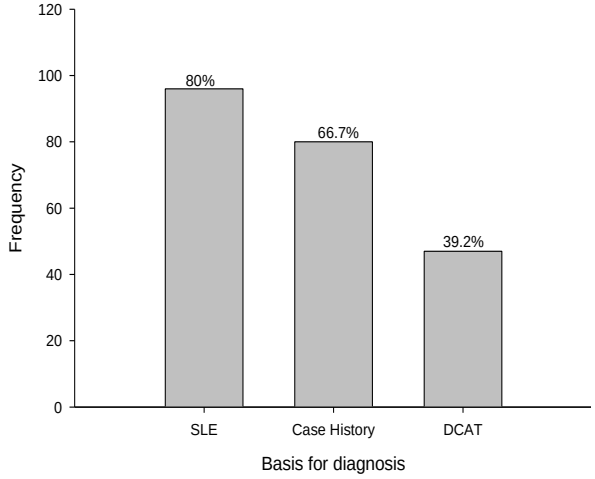

Fig. 1: The mode of diagnosis of oculomycosis employed by the eye care practitioners. SLE= Slit lamp Examination; DCAT= Difficulty with conventional antibiotic treatment.

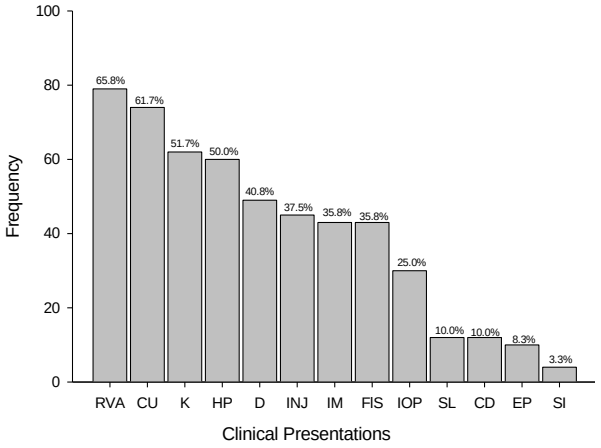

Fig. 2: Clinical presentation of oculomycosis as reported by practitioners. RVA: Reduced visual acuity, CU: Corneal ulcer, K: Keratitis, HP: Hypopyon, D: Discharge, INJ: Injections, IM: Indistinct margin, FlS: Fluorescein stain pattern, IOP: Intraocular pressure, SL: Statellite lesions, CD: Cornea degeneration, EP: Endothelial Plaques, SI: Stromal infiltration

Diagnosis by laboratory investigation

Only few practitioners, 45 (37.5%) requested for microbial laboratory investigation to establish a fungal involvement in a suspected case of oculomycosis. Of these, 31 (68.9%) requested for corneal scraping and culturing. Twenty-four 24 (20%) requested for microbiological investigations either when there was unsuccessful treatment with conventional antibiotics, while 32 (26.6%) requested when there was characteristic fungal corneal ulcer appearance.

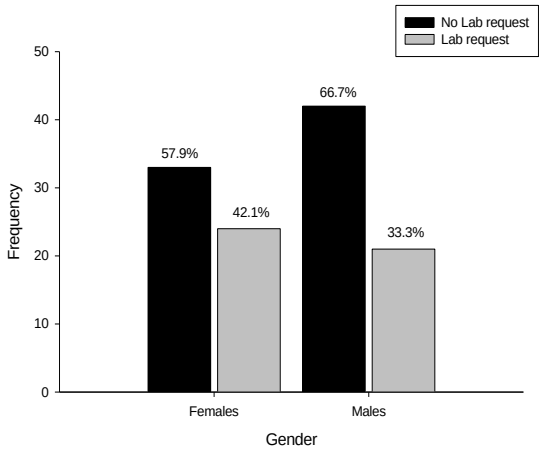

Fig. 3: The association between gender of eye care practitioners and laboratory investigations request. There was no significant difference (P =0.350) between gender of the eye care practitioner and their request for laboratory investigations on oculomycosis. (Pearson's Chi Square (χ^2) test)

Factors associated with practitioner's request on laboratory investigation

Age of practitioners ($P \leq 0.001$), type of profession ($P = 0.003$), location of facility ($P = 0.008$), and type of facility ($P \leq 0.001$) were factors significantly associated with the request or otherwise for laboratory investigation for fungal isolation leading to the diagnosis of oculomycosis. A greater proportion of females, 24 (53.3%), requested for laboratory investigations (Figure 3);

although the association between gender and request for laboratory investigations was not significant (P = 0.350). The majority of practitioners age between 41-60 years were those requesting for laboratory investigations in situations of suspected oculomycosis (Figure 4).

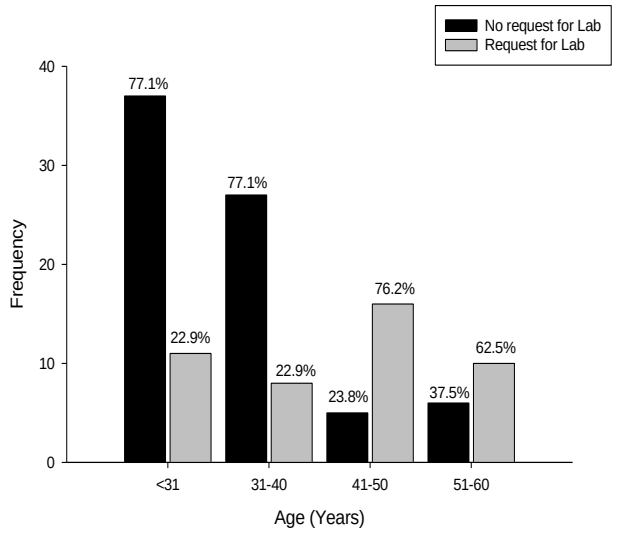

Fig. 4: The association between age of the eye care practitioner and request for laboratory investigation for oculomycosis. There was significant difference ($P \leq 0.001$) between age of eye care practitioners and their request for laboratory investigations on oculomycosis. (Pearson's Chi Square (χ^2) test)

The majority of Ophthalmologists, 10 (58.8%), did request for laboratory investigation for the diagnosis of oculomycosis, unlike the other two eye care professionals (Figure 5).

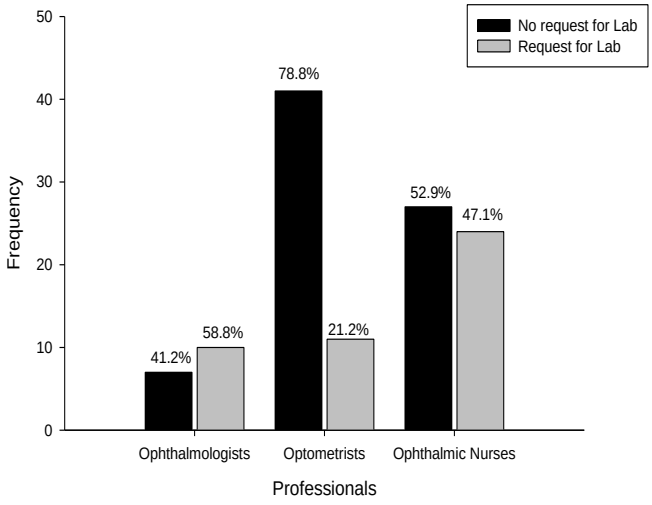

Fig. 5: The association between the professional and laboratory investigations request. There was significant difference (P = 0.003) between kind of eye care practitioner and their request for laboratory investigations on oculomycosis. (Pearson's Chi Square (χ^2) test)

Also, an equal number of the practitioners who had practiced between 9-13 years did request for laboratory investigation to aid in diagnosis of oculomycosis, as compared to the others. There was no significant difference (P = 0.564) between the duration of practice of the eye care practitioners and their request for laboratory investigation on oculomycosis (Figure 6).

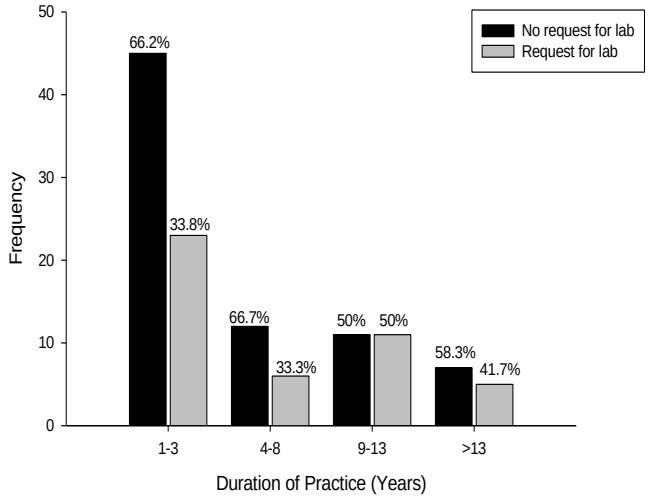

Fig. 6: The duration of practice of practitioners and request for laboratory investigations for oculomycosis. There was no significant difference (P =0.564) between the duration of practice of the eye care practitioners and their request for laboratory investigation on oculomycosis. (Pearson's Chi Square (χ^2) test)

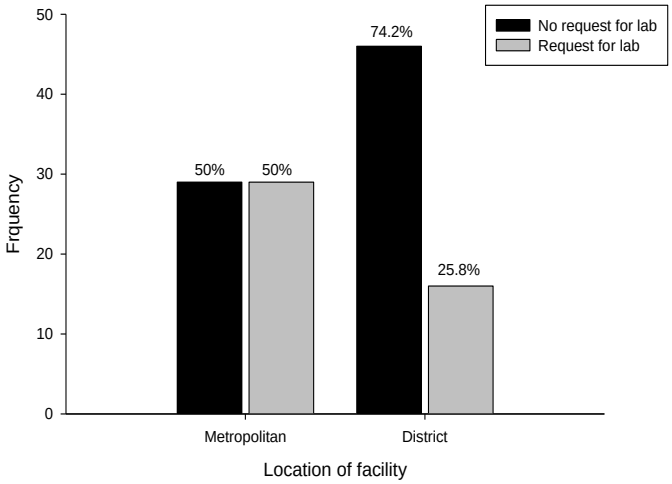

Fig. 7: The association between location of facility and request for laboratory investigation. There was a significant difference (P = 0.008) between the location of eye facilities of eye care practitioners and their request for laboratory investigations (Pearson's Chi Square (χ^2) test).

While an equal number of practitioners 33 (27.6 %) located in the metropolis request for laboratory investigation towards the diagnosis of oculomycosis, majority of those located in the districts do not (Figure 7); thus location of practice (i.e. metropolitan or district) was associated (P = 0.008) with the request for laboratory investigation on oculomycosis. Most of the practitioners working with teaching hospitals, 21 (70%), requested for laboratory investigations, as compared to those in other facilities (Figure 8).

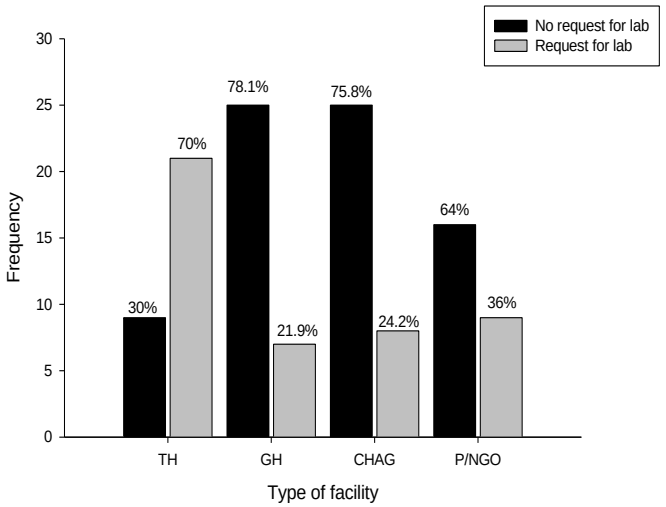

Fig. 8: The association between type of facility and the request for laboratory investigation TH=Teaching hospital; GH= Government Hospital; CHAG= Christian Health Association of Ghana; P/NGO= Private/Non-Governmental Organization. There was a significant difference ($P \leq 0.001$) between the type of facility in which the practitioners works and request for laboratory investigation for oculomycosis (Pearson's Chi Square (χ^2) test)

Topical ocular antifungal agents and its accessibility

Out of the total number of practitioners who undertook this study, 71 (59.2%) reported difficulties in accessing topical ocular antifungals and 80 (66.7%) reported that their patients, even if they did, obtained their prescription from retail pharmacies instead of hospital pharmacies. The common topical ocular antifungals that practitioners prescribed were fluconazole (79%), natamycin (44%), extemporaneously prepared miconazole (31%) or econazole eye drops (7%). According to the practitioners, these drugs were selected due to their efficacy.

Visual outcome and co-morbidity of oculomycosis

The reported visual consequence reported by eye care practitioners included Corneal scarring 67(55.8%), reduced visual acuity 54 (45%) and blindness 23 (19.2%). While a successful therapy of oculomycosis was not without some visual consequence, they reduce significantly these adverse effects. Co-morbidities reported by eye care practitioners were diabetes 61 (50.8%), HIV/AIDS 71 (59.2%), hypertension 11 (9.2%), and sickle cell disease 8 (6.7%).

DISCUSSION

Proper diagnosis of any disease or disorder helps in rapid, accurate and proper selection of drugs, as well as in proper treatment; to improve the chances of a complete recovery (good prognosis). This study therefore evaluated diagnosis and management practices of oculomycosis in Ghana. In this study, characteristic clinical symptoms of oculomycosis were used by the majority of eye care practitioners, and these were based on the history of presenting complain (HPC), clinical examination (using slit lamp biomicroscopy), and unresolved corneal ulcer to conventional antibiotic treatment; these modes of diagnosis for oculomycosis have also been reported widely (Jastaneiah *et al.*, 2001, Ansari *et al.*, 2013, Thomas, 2003 and Mravičić *et al.*, 2012). The details elicited in HPC included trauma with vegetative matter, sand, soil, stone, spontaneous occurrence, use of herbal and other unknown eye drops. Trauma occurs from ocular injuries (sometimes trivial) involving some type of vegetable matter, soil and sand related to the physical activities of people. Trauma has been reported by Srinivasan *et al.*, 1997 to be the most common predisposing factor of oculomycosis. Oculomycosis could occur without any known cause as some patients' report, but it could be that particular attention was not paid to the predisposing factor.

Some characteristic clinical features informing a diagnosis of oculomycosis (using a slit lamp biomicroscopy) as reported by some eye care practitioners were corneal ulcer, keratitis (i.e. a corneal inflammation characterized by cornea haziness, superficial punctate stains, and oedema, and even in some cases corneal bullae), indistinct cornea margins, stromal infiltrates, satellite lesions, cornea degenerations (rough texture, raised borders, brown pigmentations), endothelial plaques, and other corneal features. These are specific clinical features of oculomycosis (Thomas, 2003; Mravičić *et al.*, 2012). Non-specific features such as hypopyon, discharge, injections or redness, and fluorescein stain pattern (hyphae like pattern) were also reported.

Within the setting of rural eye hospitals in the tropics, laboratory facilities are rare and diagnosis is based on clinical characteristics. As a direct result of this presumptive diagnosis, treatment is often empirical (Leck *et al.*, 2002).

Microbiological investigations are essential for identification of fungus to confirm diagnosis of suspected oculomycosis. From our study, forty-five practitioners requested for microbiological investigations, only after there was unsuccessful treatment with conventional antibiotics or when there was characteristic fungal corneal ulcer appearance. This practice of diagnosis is essential but cannot be relied on alone in recent years. It has been suggested that where facilities are available, microbial investigation is the most important practice to help in diagnosis and prevent delays which can cause visual impairments. Ansari *et al.*, 2013, reported that because of overlapping clinical features of the etiologic agents of keratitis which makes it difficult to distinguish one from another, tissue sampling and culture continues to be an imperative utility in the diagnosis of oculomycosis.

Practitioners indicated that samples were collected by corneal scraping for culture and sensitivity test. Corneal scraping and culturing procedures are very important for the isolation of fungi (Ansari *et al.*, 2013). Fungi can penetrate deeper layers of the cornea, so tissue swabbing is inadequate in isolating or confirming fungal agent involved in oculomycosis. Corneal scraping using a surgical blade is recommended to obtain a tissue specimen (Ansari *et al.*, 2013).

Although in clinical practice, females request for microbiological investigations more than males, and that females are more meticulous with a step to step approach in clinical examination before making diagnosis, there was no significant

association to that effect as far as this study was concerned. This augurs well for the practitioners practice in Ghana as one should not be of a particular gender in other to request for microbial investigation. It was observed from the results of this study that, the more one gets older in practice, the more likely they would request for microbiological investigation for suspected oculomycosis. Majority of ophthalmologists were older professionals, and requested for microbiological investigation, unlike the other eye care professionals. In an earlier study (Gyanfosu *et al.,* 2016), findings indicated that Ophthalmologists encountered more ocular disorders than the other eye care professionals, hence making them more proficient in the diagnosis and management of oculomycosis (Dahl *et al.,* 2014). Ophthalmologists receive special training in all aspects of eye care, including prevention, diagnosis, and medical and surgical treatment of eye conditions and diseases, thus providing the full spectrum of eye care. Optometrists provide primary eye care services, including eye examinations and diagnosis of eye diseases taking intermediate (6-7yrs) length of training. It is worth noting that although each professional's responsibilities differ, and depending on the setting of the health facilities, there are overlapping job description.

It was also found that health facilities located in the Metropolitan areas showed borderline association to the request for microbiological investigation for oculomycosis; implying that a significant number of practitioner in the metropolitan areas make the request. This could be influenced by the availability of many medical laboratories in the cities compared to the districts.

The practitioners indicated the common fungi isolated were *Aspergillus spp, Fusarium spp* and *Candida albicans*. Our study revealed *Candida albicans* to be the most common fungi isolated during microbiological investigation. In 1995, Hagan *et al.,* found *Fusarium spp* to be the common fungi followed by *Aspergillus spp* to be the cause of suppurative keratitis in Ghana. Other studies have also mentioned many different fungal species isolates (Thomas *et al.,* 2013, Jastaneiah *et al.,* 2001, Ibrahim *et al.,* 2012, Leck *et al.,* 2002, Hagan *et al.,* 1995). *Candida albicans* are part of the normal eye flora which reside as a lifelong, harmless commensal. It is not surprising that *Candida albicans* is the most common fungi isolate, because it has been shown to have a high virulence in ocular infections (Schreiber *et al.,* 2003).

Oculomycosis, if not diagnosed and treated with celerity, can be rapidly destructive to the integrity of the eye, resulting in devastating ocular damage. The main aim of treating oculomycosis is to preserve vision which depends on rapid diagnosis and efficient administration of appropriate antifungal therapy. Access to topical antifungals is generally difficult in Ghana as reported by the eye care practitioners. Worldwide, access to commercially available topical antifungals is also low (Ibrahim *et al.,* 2012). Majority of the practitioners indicated that patients obtained topical antifungal medications from retail pharmacies instead of hospital pharmacy. Ocular topical antifungals are not on the NHIS medicines list (http://www.nhis.gov.gh/MedList.aspx). Most hospitals stock their pharmacies based on their prescriptions which is also based on the essential medicine list (EML, 2010) and the NHIS drug list. Even though ocular antifungal eye drops are on the essential medicine list, but because they are not on the NHIS listed medicines, hospitals do not stock them. Retail pharmacies usually buy and stock varieties of medicines from pharmacy wholesalers, and hence patients acquire these medications from them.

The practitioners admitted that fluconazole is the common topical antifungal readily available in Ghana. The eye care practitioners reported that extemporaneous preparation made from gyno-daktarin (which contains miconazole) cream was used as antifungal eye drops for patients when access to standard topical antifungals was difficult. The various topical antifungal preparations selected were effective and accessible as reported by the eye care practitioners. Oculomycosis presents a visual impairment to the patient if the condition is not diagnosed early for a rapid and appropriate intervention. Some prominent adverse effects after treatment of oculomycosis as reported by eye care practitioners were corneal scarring, blurred vision, redness of the eye, reduced vision, and blindness.

CONCLUSION

Diagnosis of oculomycosis is based more on clinical features, especially in the district areas, than on microbiological investigations, which does not augur well for better prognosis and management. Treatment is mainly by systemic antifungals, as antifungal eye drops are hard to come by. While a successful therapy was not without some visual consequence, it significantly reduced corneal scarring, blurred vision, and blindness associated with oculomycosis. Avenues to obtaining topical ocular antifungals should be created, while efforts to include some of these topical antifungals in the NHIS medicine list should be initiated. This then will enhance diagnosis and ensure effective management of oculomycosis, and increase the chances of complete recovery.

ACKNOWLEDGEMENTS

Authors are grateful to Misters Michael Atta Mensah, Michael Martey Ofori and Ernest Adiwokor for their earnest contributions made in analyzing this data.

Financial support and sponsorship: This research is supported in part by International Medical University internal grant (BPI-01/11(46)2014) and Malaysia Toray Science Foundation (MTSF) Science and Technology Grant 2014 (IMUR160/2014).

Conflict of Interests: There are no conflicts of interest.

REFERENCES

Dahl AA, Stöppler MC. 2014. Ophthalmologists and Optometrists: Similarities and Differences. [ONLINE] Available at http://www.medicinenet.com/script/main/art.asp?articlekey=22559. [Accessed on 4 June 2016].

El-Seidi EA, Ibrahim ZA, El-Hodaky SK, Hasan HA. Characterization of ocular fungal infections in Egypt. Egypt Journal of Medical Microbiology, 2006; 15(1):237-48.

Glenn DL. 1992. Determinig Sample size. Sampling the evidence of extension program impact, PEOD-5. [ONLINE] Available at: http://www.edis.ifas.ufl.edu/pd006. [Accessed on 28 November, 2015].

Graff JM, Goins KM, Sutphin JE. 2006. Fungal Keratitis - Fusarium: 41-year-old female contact lens wearer with persisting keratitis. [EyeRounds.org.] Available at: http://www.EyeRounds.org/cases/59-fusarium-fungal-keratitis-ReNu-MoistureLoc.htm. [Accessed on 03 November, 2016]

Gyanfosu L, Koffuor GA, Abokyi S, Ababio-Danso B. Eye Care Practitioners' Perception of Oculomycosis in Ghana. Br J Med Med Res, 2016; 15(1):1-10

Hagan M, Wright E, Newman M, Dolin P, Johnson G. Causes of suppurative keratitis in Ghana. Br J Ophthalmol, 1995; 79(11):1024-8.

Ibrahim MM, de Angelis R, Lima AS, Viana de Carvalho GD, Ibrahim FM et al. A new method to predict the epidemiology of fungal keratitis by monitoring the sales distribution of antifungal eye drops in Brazil. PLoS ONE, 2012; 7(3):1-4.

Jastaneiah SS, Al-Rajhi AA, Abbott D. Ocular mycosis at a referral center in Saudi Arabia: A 20-year study. Saudi J Ophthalmol, 2011; 25(3):231-8.

Leck AK, Thomas PA, Hagan M, Kaliamurthy J, Ackuaku E, John M, Newman MJ, Codjoe FS, Opintan JA, Kalavathy CM, Essuman V, Jesudasan CA, Johnson GJ. Aetiology of suppurative corneal ulcers in Ghana and South India, and epidemiology of fungal keratitis. Br J Ophthalmol, 2002; 86(11):1211-5.

Mravičić I, Dekaris I, Gabrić N, Romac I, Glavota V, Mlinarić-Missoni E. 2012. An overview of fungal keratitis and case report on Trichophyton keratitis. [ONLINE] Available at: http://www.intechopen.com/books /keratitis/fungal keratitis. [Accessed on 25 January 2006].

Nayanar VS and Vanathi. Fungal keratitis. Kerala Journal of Ophthalmology, 2012;24(3):199-211.

Schreiber W, Olbrisch A, Vorwerk CK, König W, Behrens-Baumann W. Combined topical fluconazole and corticosteroid treatment for experimental candida albicans keratomycosis. Invest Ophthalmol Vis Sci, 2003; 44(6):2634-43.

Srinivasan M, Gonzales CA, George C, Cevallos V, Mascarenhas JM, Asokan B, Wilkins J, Smolin G, Whitcher JP. Epidemiology and aetiological diagnosis of corneal ulceration in Madurai, south India. Br J Ophthalmol, 1997; 81(11):965-71.

Thomas PA, Kaliamurthy J. Mycotic keratitis: epidemiology, diagnosis and management. Clin Microbiol Infect, 2013; 19:210-220.

Thomas PA. Current perspectives on ophthalmic mycoses. Clin Microbiol Rev, 2003; 16(4):730-97.

Vijaya SR, Mangala PG, Sarita Nk. Prevalence of Oculomycosis in a Tertiary Care Centre. Al Ameen Journal Medical Science, 2011; 4(4):334-338.

Zubair A, Darlene M., Anat G. Curr Fungal Infect Rep, 2013; 7(3):209-218.

Zubair Ansari, Darlene Miller, Anat G. Current thoughts in fungal keratitis: diagnosis and treatment. Curr Fungal Infect Rep, 2013; 7(3):209-218.

2005. National Eye Report. [ONLINE] Available at: http://www.ghanaeyefoundation.org/privatecontent/File/Annual %20report%2005.pdf. [Accessed on 25 January 2006].

2010. Ghana essential medicine list 6th edition. [ONLINE] Available at http:// www.moh-ghana.org. [Accessed 9 December, 2015].

2014. National Health Insurance Scheme. [ONLINE] Available at http://www.nhis. gov.gh/MedList.aspx. [Accessed 08 July 2016].

How to cite this article:

Gyanfosu L, Koffuor GA, Abokyi S, Danso BA. Evaluating the diagnosis and management of oculomycosis in Ghana. J App Pharm Sci, 2016; 6 (11): 021-027.