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Studies on the Efficacy of Various Antimycotic Drugs on Emerging and Reemerging, Superficial, Cutaneous and Subcutaneous Mycotic Infections

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: The efficacy of five systemic and topical antifungal medications, Voriconazole, clotrimazol, beclometasone, Itraconazole, and Fluconazole, on dermatomycosis, which affects the superficial layers of the skin, nails, foot, and hair, was tested with 180 patients.
Methods: Included were specimen collection, processing, microscopy, and culture, as well as antifungal susceptibility testing using the E-test method. The *Candida* species were confirmed and their susceptibility to Voriconazole and Fluconazole was tested using the automated Vitek 2.
Results: The final strain identification indicated 41 dermatophytes (69.49%), 11 non-dermatophytic molds (NDM) (18.64%), and 7 yeasts (11.87%). (candida). Candida was the most prevalent nondermatophyte species found. *Trichophyton rubrum* was the most prevalent species isolated in *Tinea corporis*, *T. cruris*, *T. capitis,* and *T. faciei*. When tested with the E strips, all dermatophyte strains showed the greatest vulnerability to beclometasone and clotrimazole (MIC range of 0.04–0.64), but homogeneous resistance to Fluconazole (i.e. MIC 32 g/ml).
Conclusion: Variation in species distribution was shown to be statistically significant (p = 0.001) in terms of clinical presentation.

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Keywords: Dermatomycosis; antifungal Etest; VITEK-2 vericonazole itraconazole; clomatrizole; beclometasone; and Fluconazole are some of the terms used in this study.

1. INTRODUCTION

Dermatomycosis (superficial fungal infections) is one of the most frequent dermatological illnesses. High temperatures, poor personal cleanliness, poor diet, suffocation, severe systemic disorders such as diabetes, drug resistance, immune weakened states such as HIV infection, and other factors have all contributed to the spread of these infections [1].

Mycoses (fungal diseases) are divided into three categories: superficial, deep, and systemic. Skinny mycosis is caused by dermatophytes. The lesions occur in circular patterns, with margins that are desquamated and erythematous. Dermatophytosis is an infection caused by dermatophytes attacking keratinized tissue (skin, hair, and nails) in humans and other animals. Even with the most recent breakthroughs in diagnosis and treatment, mycoses remain a major cause of morbidity and mortality. The initiation of proper therapy at the appropriate time has a direct positive impact on the patient's recovery [2]. Fungal infections are routinely treated with azole antifungals. Itraconazole, Fluconazole, Voriconazole, Posaconazole, Isavuconazole, Clotrimazole, and Beclometasone are some of these drugs [3]. New antimycotic medications have recently become available, allowing for more treatment options as well as preventive or preventative objectives.

Resistance has arisen on fungal strains as a result of increased improper use of antimycotic medications. Resistance has emerged in two ways: multiple species gaining secondary resistance or susceptible species being replaced by resistant ones, affecting the epidemiology of mycotic diseases [4]. Antifungal susceptibility testing methods can detect antifungal resistance as well as determine the optimal treatment strategy for a particular fungus [5].

The VITEK-2 yeast susceptibility test is an automated method for identifying yeast species and determining antifungal susceptibility by analyzing yeast growth.
The system is a simplified version of the broth dilution method that includes a software tool that analyzes and interprets susceptibility test findings based on drug MIC values using CLSI clinical breakpoints.

2. METHODS

At the Orlu Local Government Area of Imo State, Nigeria, a two-year prospective study was undertaken in 10 selected hospitals. There were 180 patients in total. The institutional ethics committee gave their approval. The information was gathered in a predetermined format. Specimen collection, processing, microscopy, and culture were performed on patients with sufficient scales, and antifungal susceptibility testing was performed using the E-test method. Isolates of E-Test of Trichophyton rubrum ATCC 28188 and Trichophyton mentagrophytes ATCC 9533 were used as controls in the study. To improve sporulation, Dermatophytes were subcultured on Potato Dextrose Agar (PDA) and incubated at 28°C for 7 days. A haemocytometer was used to adjust the conidial and hyphal suspension to 1x10 6 /ml after the growth was harvested in sterile saline. A swab dipped in the inoculum suspension was used to inoculate Mueller Hinton Agar (MHA) plates. After that, the inoculation plates were dried before the E-strips were applied. The susceptibility of several dermatophytes isolated to Fluconazole, Itraconazole, and Voriconazole was determined using commercially available E-strips (HIMEDIA). To serve as a control, sterile disks were impregnated with 10 l of a 1:100 solution of DMSO. The Estrips for the three medications were put to each infected and dried plate, and then incubated at 28°C for up to 16 hours or longer for filamentous fungi, depending on the fungus' genus. When growth occurred, the size of inhibitory zones for each antifungal drug was measured, as was done in their study. 6 VITEK-2: The automated Vitek 2 was used to confirm Candida species and test susceptibility to Voriconazole and Fluconazole, as well as beclometasone and clotrimazole. Ethical Clearance is a term used to describe the process of obtaining ethical approval

Data Analysis: MIC range was acquired and compared with all the isolates studied.

3. RESULTS AND DISCUSSION

A total of 180 clinically suspected cases of superficial fungal infections were chosen for microbiological investigation at the hospitals. The distribution of samples collected revealed that 104 (57.78%) came from the epidermis, 36

(20.0%) from the foot, and 40 (22.22%) from the nails. The total number of positive cultures was 89, and the final strain identification revealed 51 dermatophytes (57.39%), 21 dermatophytes (57.39%), and 21 dermatophytes (57.39%). (23.6 percent) NDM (non-dermatophytic molds) and 17 yeasts (19.1%) (candida). Candida was the most prevalent species found among nondermatophytes, which was consistent with previous research [6,7].

Direct microscopy and culture were used to identify the distinct species. While 37 (20.55%) of the samples were positive on both microscopic and culture examinations, 52 (28.89%) of the samples were exclusively positive on culture. A total of 49 (27.7%) samples were found to be positive solely on microscopy, whereas 42 (23.33%) were found to be negative on both tests. Antifungal susceptibility testing could not be performed on the 91 culture negative samples. Only 49.44% of people were positive about their culture.

The difference in species distribution based on clinical presentation was statistically significant (p = 0.001). The E-test method was used to determine the antifungal sensitivity of dermatophyte strains to Voriconazole, Fluconazole, Itraconazole, Clotrimazole, and Beclometasone.

The MIC of Voriconazole ranged from 0.007 g/ml to 0.064 g/ml, as indicated in Table 2. After being tested with the E strips, all dermatophyte strains showed the same resistance to Fluconazole, with a MIC of 32 g/ml.

The low susceptibility of dermatophytes to Fluconazole as shown by the E-test method (Uniform MIC 32 g/ml) is consistent with the findings of investigations conducted by [5]. [2] and [1] are two examples. Fluconazole resistance may have developed as a result of widespread use and easy access to the drug in pharmacies, as well as self-medication by patients due to its over-the-counter (OTC) status.

Table 1. Most common species in various clinical presentations

Clinical presentation	Most common species
Tinea corporis & cruris	*T. mentagrophytes (65%)*
Tinea corporis	*T. rubrum (58.8%)*
Tinea cruris	*T. rubrum (60.7%)*
Onychomycosis	*T. mentagrophytes (34.4%), T.rubrum (34.4%)*
Candidal intertrigo	*Candida sp (100%)*
Candidal vulvovaginitis	*Candida sp (100%)*
Tinea pedis	*T. mentagrophytes (52%)*
Tinea capitis	*T. rubrum (63%)*
Tinea faciei	*T. rubrum* (63%)

Table 2. Voriconazole, Itraconazole, Fluconazole, Clotrimazole, and Beclometasone E-test results for three dermatophyte species

Drug Name	Strain	MICRange (µg/ml)
Voriconazole	*T. mentagrophytes*	0.031 – 0.064
	T. rubrum	0.007 – 0.017
	M. gypseum	0.010- 0.017
Itraconazole	*T. mentagrophytes*	0.046 – 0.064
	T. rubrum	0.015 – 0.064
	M. gypseum	0.017- 0.019
Fluconazole	*T. mentagrophytes*	≥32
	T. rubrum	≥32
	M. gypseum	≥32
Clotrimazole,	*T. mentagrophytes* (n = 20)	0.010 – 0.064
	T. rubrum (n = 10)	0.005 – 0.018
	M. gypseum (n = 1)	0.009 – 0.064
Beclometasone	*T. mentagrophytes* (n = 20)	0.008 – 0.064
	T. rubrum (n = 10)	0.004 – 0.018
	M. gypseum (n = 1)	0.010 – 0.064

Table 3. Isolated Candida species and their relative clotrimazole and beclometasone MICs

Candida Specie	Clotrimazole MIC (µg/ml)	Beclometasone MICs
C. tropicali	≤ 1	≤0.13
C. albicans	≤ 1	≤0.13
C. parapsilosis	≤ 1	≤0.13
C. parapsilos	≤ 1	≤0.13
C. albicans	≤ 1	≤0.13

Itraconazole exhibited a MIC range of 0.015 g/ml to 0.064 g/ml in this investigation. [8] found a MIC range of 0.038–1.5 g/ml for Itraconazole in their study. [4] reported similar results in their study on the evaluation of the E-test for dermatophytes. Beclometasone, with a MIC range of 0.004 to 0.064 g/ml, was the most effective against the three dermatophyte species, followed by Clotrimazole, with a MIC range of 0.005 to 0.064 g/ml.

Clotrimazole (MIC 1g/ml) and beclometasone (MIC 0.13g/ml) were shown to be equally effective against Candida species. The high sensitivity of Candida species to beclometasone (MIC0.13 g/ml) found in this investigation appears to be consistent with [2]. Differences in antifungal medication MICs on different species were not statistically significant in this investigation. (p less than 0.05).

4. CONCLUSION

A culture sensitivity report should, ideally, govern the treatment of dermatophytic infections. Beclometasone and clotrimazol are the most appropriate therapy alternatives based on their MIC ranges.

To avoid the rapid development of medication resistance, they must be reserved only for resistant and difficult-to-treat illnesses.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

Ethical clearance was received from the Imo State Ministry of Health via a letter referenced IMMH/20/08/27. Higher susceptibility is associated with a lower MIC range.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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