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Research Article

A Preliminary Study to Determine the Diagnostic Capability of a Wood's Lamp for Cutaneous Fungal Infections in Underserved Areas of the Dominican Republic

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Abstract

Skin infections caused by bacteria, fungi, and viruses are frequently encountered by physicians and healthcare providers worldwide. Fungal infections, particularly of the skin, are a chronic issue in areas with a tropical, humid climate. A common group of cutaneous fungal infections are the dermatophytes (Tinea). These infections are from molds including *Trichophyton, Microsporum* and *Epidermophyton*. Wood's lamp examination, which utilizes ultraviolet light, is another method to screen for fungal skin infections. Several fungal species (i.e. *Microsporum, Malassezia*) characteristically fluoresce bright green or gold under UV light and can provide a clue as to whether fungi are present. A Wood's Lamp was positioned next to the suspected lesion to determine if the lesion fluoresced. The scraping was then obtained through the use of a scalpel using gentle pressure to prevent any pain or discomfort. Immersion oil was placed on the scraping on a microscope slide. The scrapings were then stained with iodine and observed under a microscope to look for the presence of hyphae, which would indicate a positive fungal infection. The preliminary study consisted of 23 patients with suspected asymptomatic dermatological fungal infections. Of the 23 lesions, 11 fluoresced with UV light, but of those 11, only 8 showed hyphae and 2 showed yeast. Upon reviewing our results, it appears that a Wood's lamp exam is not an efficient diagnostic indicator for cutaneous fungal infections. The Wood's lamp has a fairly high specificity for fungal infections, but the sensitivity was lacking due to a number of the cutaneous fungi not fluorescing when exposed to UV light. Despite the lack of significant data, we believe that the Wood's lamp would be a beneficial tool to have in poorer rural clinics in the developing world. We also believe that it would be a significant help for medical students in making a more confident diagnosis of cutaneous fungal infections, and therefore providing better patient diagnosis and treatment while on medical volunteer mission trips.

Keywords: Dermatophytes; Dominican Republic; Fungal infection; Wood's lamp

Introduction

Skin infections caused by bacteria, fungi, and viruses are frequently encountered by physicians and healthcare providers worldwide. When the integrity of the skin becomes compromised from something as simple as dry skin or by the penetration of a sharp object, it becomes more susceptible to colonization by microorganisms. Fungal infections, particularly of the skin, are a chronic issue in areas with a tropical, humid climate. Over the past 12 years, the Edward Via College of Osteopathic Medicine has conducted medical mission's clinics throughout Honduras, El Salvador and the Dominican Republic (DR). Many of the medical students and clinical personnel have reported extensive fungal infections in the people particularly in the poorer rural village areas. This motivated us to develop a preliminary research project involving the effectiveness of inexpensive and practical diagnostic techniques in the DR. Fungal skin infections are more common in the pediatric population of the DR due to poor hygiene practices, in the geriatric populations due to degeneration of the skin barrier and years of sun damage, and in individuals with compromised immune systems due to HIV, cancer, organ transplantation and diabetes [1-7]. Cutaneous fungal infections can present in a variety of ways depending on the pathogen. Typically, the patient will present with new onset localized pruritus and on closer examination hyper or hypo-pigmented lesions with erythema [1,3,8,9].

A common group of cutaneous fungal infections are the dermatophytoses (tinea). These infections are from molds including *Trichophyton, Microsporum* and *Epidermophyton* [10]. Each pathogen targets specific skin anatomy that is unique to itself. *Trichophyton rubrum*, which is the most common pathogen in the dermatophyte group, targets skin, nails, and hair, while *Microsporum* sp. primarily targets hair. *Epidermophyton* sp. favors areas of skin folds making it more common in obese individuals [8,10,11]. These

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dermatophytes can be acquired through direct contact and can be transmitted between humans (anthropophilic) and nonhumans (zoophilic). Naming dermatophytoses is based on the area of the body which is infected: tinea capitis (scalp); tinea corporis (trunk, legs, and arms); tinea cruris (groin); tinea pedis (feet); and tinea unguium (nail bed). Superficial scraping of the lesion followed by microscopic examination with KOH or iodine solution will show septate hyphae leading to an identification and diagnosis. Treatment of the tinea dermatophytes depends on the anatomical location. A topical antifungal (i.e., terbinafine, fluconazole, clotrimazole) twice daily for 2-4 weeks is the preferred treatment for tinea pedis, tinea corporis, and tinea cruris. Tinea unguium is quite difficult to treat but oral terbinafine, fluconazole, griseofulvin for 6 weeks (fingernails) or 12 weeks (toenails) has shown to be efficacious. Griseofulvin is the treatment of choice for tinea capitis and the only medication approved by the FDA for this region of the body [1,2].

Tinea versicolor is another cutaneous fungal infection common in humid environments and is due to *Pityrosporum*, known as *Malassezia*, a normal part of skin flora. *Pityrosporum* can also cause dermatologic conditions such as seborrheic dermatitis and pityrosporum folliculitis. Tinea versicolor presents as a reddish brown lesion in lighter skinned individuals and as hyperpigmented or Hypopigmented lesions in darker-skinned individuals. It is commonly found on the neck, chest, arms, and back. Definitive diagnosis is made by scraping the infected skin and observing the fungi microscopically using KOH. Spores with angular hyphae will often resemble a "spaghetti and meatballs" appearance [12,13]. Due to the large surface area often seen with this infection, selenium shampoo, ketoconazole shampoo or terbinafine sprays are used instead of topical treatments. Oral ketoconazole or fluconazole is reserved for cases resistant to topical therapy [1,2].

The diagnosis of cutaneous fungal infection can be determined a few different ways. As mentioned earlier, microscopic examination of a skin scraping prepared with KOH or iodine solution is common especially in dermatology practices where microscopic examination is readily available. A culture of the scale, hair or nail is another option used to identify the specific organism but may take weeks before the results come back from the laboratory [2]. Wood's lamp examination, which utilizes ultraviolet light, is another method to screen for fungal skin infections. Several fungal genera (i.e. *Microsporum, Malassezia*) characteristically fluoresce bright green or gold under UV light and can provide a clue as to whether fungi are present [14]. Before administering antifungal medications which may have many side effects (i.e. hepatotoxicity, gastrointestinal upset) it is important to perform at least one diagnostic test to ensure the patient will benefit from the treatment [1].

With the humid, tropical climate of the DR, villagers are at greater risk of acquiring cutaneous fungal infections. Rural residents in the poorer areas of the DR may not be able to afford a laboratory diagnostic identification. It is our belief that these patients would benefit from a less invasive and inexpensive screening tool like a Wood's lamp to assist in the diagnosis of cutaneous fungal infections. The purpose of our research was to perform a preliminary study to test the efficacy of the Wood's lamp as an inexpensive diagnostic tool for cutaneous fungal infections inpatients in rural areas of the DR.

Methods

This research study was approved by the Institutional Review Board at the Edward Via Virginia College of Osteopathic Medicine (IRB#2014/026). It was designed as a preliminary study to look at the effectiveness of a Wood's lamp in diagnosing a fungal skin infection. It was conducted in various mission sites of Veron, Dominican Republic over the course of one week. Informed consent was obtained from each patient with suspected cutaneous fungal infections. Under the supervision of clinical preceptors, a Wood's Lamp was positioned next to the suspected lesion to determine if the lesion fluoresced. The scraping was then obtained through the use of a scalpel using gentle pressure to prevent any pain or discomfort. Immersion oil was placed on the scraping on a microscope slide. The scrapings were then stained with iodine and observed under a microscope to look for the presence of hyphae, which would indicate a positive fungal infection.

Results

The preliminary study consisted of 23 patients with suspected asymptomatic dermatological fungal infections. Of the 23 lesions, 11 fluoresced utilizing UV light, but of those 11, only 8 showed hyphae and 2 showed yeast. Therefore, one of our samples may have been improperly retrieved or possibly be a species of bacteria that fluoresces. We also had 12 lesions that did not fluoresce, of which five turned out to have hyphae on microscopic examination. Our findings are demonstrated in Table 1 below.

Discussion

Upon reviewing our results, it appears that a Wood's lamp exam is not an efficient diagnostic indicator for cutaneous fungal infections. The Wood's lamp has a fairly high specificity for fungal infections, but the sensitivity was lacking because some of the cutaneous fungi did not fluoresce when exposed to UV light. For the purposes of identification, diagnosis and treatment of dermatological fungal infections in rural areas of the DR, the Wood's lamp provides a quick and easy screening tool, but microscopic examination of the skin sample is needed for a more definitive diagnosis in order to provide appropriate standard of care for the patient. However, the ease of performing such an examination would make the Wood's lamp a useful screening tool for rural use, and we believe it would be an asset to have in rural clinics for identifying dermatophyte infections and for basic technician training and use.

One limitation to our study was the inadequate time spent in the various clinics. We believe if the research continued for longer than one week, the results would demonstrate a larger scope of diagnoses made with a Wood's lamp as well as to provide more evidence for its usefulness in rural, clinical practices. Another limitation was the unavailability of a dark place to examine patients. Fluorescence could have been more prominent if a patient was examined in a darker

Table 1: Results of the Wood's lamp fluorescence capability in determining cutaneous fungal infections.

Fluorescence	Evidence of Fungus	No Evidence of Fungus	
Positive Fluoresce Under Lamp	10	1	11
Negative Fluoresce Under Lamp	5	7	12
Totals	15	8	

place; however, due to the small areas where we set up our clinics, this was difficult to achieve.

Conclusion

Despite the lack of significant data, we believe that the Wood's lamp would be a beneficial tool to have in poorer rural clinics in the developing world. We also believe that it would be a significant help for medical students in making a more confident diagnosis of cutaneous fungal infections, and therefore providing better patient diagnosis and treatment while on medical volunteer mission trips.

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