A REVIEW ON SUPERFICIAL FUNGAL INFECTIONS: CLINICAL SYMPTOMS AND TREATMENT

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ABSTRACT

The word ‘superficial’ indicates the infection on the skin. The superficial fungal infections are most common in the world and about 70% of the world’s population is affected. The Dermatophytes are responsible for these infections and the infection caused by the Dermatophytes is known as Dermatophytosis. There are three genera of dermatophytes that are Microsporum, Trichophyton and Epidermophyton which are responsible for human infection. The Dermatophytes are the keratin feeding pathogens and mainly affects the hair, nails and skin of the host. The humid and hot climate is required for the growth of Dermatophytes. They cause different types of disease or infections in the human beings such as Tinea faciei, Tinea barbae, Tinea pedis, Tinea cruris etc. and these diseases are named according to their site of infection. Sometimes these fungal infections cause serious disease in human beings. Mainly microscopy, culture and KOH mount tests are used to examine the fungal infections. These are communicable diseases so the precaution will be taken by the patient. The important factor to control the fungal infections is maintenance the hygienic conditions. There are several antifungal drugs such as Itraconazole, ketoconazole, Silver sulfadiazine are available in the market for the fungal infection treatment. Some plant extracts and their essential oils are also used due to their antimicrobial properties.

KEYWORDS: Superficial, Dermatophytes, Antifungal drugs, Essential oils, keratin etc.

INTRODUCTION

Superficial fungal infections are most usual skin infections which influence thousands of the peoples of the globe. These influence the epidermal layer of the skin, hair and nails.¹
Dermatophytes, yeasts and molds are the chief groups of the fungi which cause superficial fungal infections in humans. The Dermatophytes are the keratin feeding fungi. The ‘Dermatophytosis’ term is used when the infection in nails, hair and skin are caused by Dermatophytes\textsuperscript{2}. The Dermatophytes may be classified into the three groups on the basis of their habitat. These are anthropophillic (human), zoophilic (animal) and orgeophillic (soil)\textsuperscript{3}. Dermatophytosis is mainly caused by the genera Microsporum, Trichophyton and Epidermophyton. Among these genera of fungi the host of Microsporum and Trichophyton are human as well as animal where as the host of Epidermophyton is only human. The increase their growth in warm and humid climate hen external temperature is 25-28°C\textsuperscript{4,5}. There are several types of superficial fungal infections like Dandruff, Tinea corporis, Tinea faciei, Tinea barbae, Tinea cruris, Tinea capitis, Tinea pedis etc.

On the basis of site of infection there are various types of fungal infections in human beings. Some of these are Superficial and Systemic.

**SUPERFICIAL DISEASES OR DERMATOPHYTOSIS**

The Dermatophytes are generally causes the skin infections. Keratinophilic and keratinolytic are the two vital properties which are shown by the Dermatophytes\textsuperscript{6}. These are communicable diseases. They digest the keratin of hair, nails, skin etc. There are several types of superficial diseases. Some of them are:-

**Tinea barbae**

It is the rare Dermatophytic disease which affects mainly beard, mustache and neck regions of the men\textsuperscript{7}. The clinical demonstrations are classified into two forms. These are inflammatory and non-inflammatory. These signs are based on the type of fungus and patient's resistant response\textsuperscript{8}. *Trichophyton mentagrophytes var. granulosum* and *Trichophyton verrucosum* are the causative agents of Tinea barbae which are responsible for inflammatory kerion like plagues and infection caused by them is more serious. Sometimes the infection caused by other zoophilic fungi i.e. *Microsporum canis* and *Trichophyton mentagrophytes var. intrdigitale* but these are rare\textsuperscript{7,8}. The clinical symptoms are rashes, itching, kerion like plaques, loose and broken off hairs, pimples near a hair follicle in the neck, and genital area\textsuperscript{9,10}. Sometimes redness and swelling also occurs in the entire area of infection.
Tinea barbae is examined by direct microscopy and culture. The wood’s lamp examination is helpful when *Microsporum canis* Tinea. It shows a dull green fluorescence of the infected hairs. It is treated by the use of Griseofulvin and Terbinafine.

**Tinea faciei**

When the face is affected by Dermatophytes, it is called Tinea faciei. It is mostly seen on the non-bearded region of the face\(^{11,12}\). It affects female more than males\(^{13}\). The causative agents of the Tinea faciei are *T. mentagrophytes*, *T. verrucosum*, *T. tonsurans*, *T. rubrum*, *M. canis*.\(^{12,14}\)

The clinical symptoms of Tinea faciei are red hives on the face with small patches and lifted to the upper lips and chin\(^{14}\). There are itching and burning sensation when exposure to sunlight\(^{15}\). There are about 19% of all superficial fungal infections are caused by Tinea faciei. Tinea faciei is examined by direct microscopy and culture. The drugs for the treatment
of Tinea faciei are Clotrimazole, Oxiconazole, Tolnaftate, Miconazole, Butenafine etc. are easily available in the market.

**Tinea unguium**

The Dermatophytes which cause infection in nails are called Tinea unguium and it is identified as Onychomycosis$^{16}$. The infection of toe nails is very common as compare to finger nails and it is usually found along with the Tinea pedis. It is normally adhere to the tip of toe nail and slowly spreads to the matrix of the nail$^{17}$.

![Fig. 3 Tinea unguium](image)

The causative Dermatophytes are *T. rubrum*, *T. mentagrophytes* and *E. floccosum*. The sign and symptoms are weakness, loss of the shine, lifting up of the nail, change in the nail shape$^{15,10}$. The diagnostic tests for Tinea unguium are microscopy, culture and PCR techniques. It is treated by the drugs Fluconazole, Terbinafine and ciclopirox.

**Tinea cruris**

Tinea cruris is the infection which affects the proximal middle thighs and buttocks$^{18}$. Tinea cruris is also popular by the names crotch itch, crotch rot, gym itch, jock itch, eczema marginatum and ringworm of the groin$^{11}$. It is more common in males. The main causative agents are *T. mentagrophytes*, *M. magnum*, *E. floccosum*, *T. rubrum* and *T. raubitschekii*$^{15,18}$. The Dermatophytes attacks on the stratum corneum and lethal hairs of the infected regions$^{19}$. 
The clinical symptoms of the Tinea cruris are red, brown, tan, peeling and cracking of the skin of infected areas. It can be treated by the antifungal drugs ketoconazole, Clotrimazole, econazole, Oxiconazole etc. It can be diagnosed by KOH mount test, culture and microscopy. Wood lamp examinations.

**Tinea pedis**

It is the common infection and observed in two in ten adults and increase with the aldoscence\(^5\). It is also called ‘one hand two feet syndrome’ which means that the dermatophytic infection of one hand and both feet and found in the patients such as diabetics who have low immunity\(^5\). Naturally it is observe that it infects the feet and then the infection spread to the other regions of the body\(^2\)^20. 

The causative dermatophytes of the Tinea pedis are *T. mentagrophytes var. Interdigitale*, *T. rubrum*, and *E. floccosum*\(^2\)\(^1\). The clinical symptoms of this infection are itching and peeling of skin, swelled and cracked skin exposed to raw tissue, inflammation, pain. It is diagnosed
by KOH staining and culture. Micoconazole, Terbinafine, Naftifine and Butenafine etc are available in the form of cream, lotion and powder for the treatment of Tinea pedis.

**Tinea corporis**

It is also called Ringworm. It affects all the age groups of male as well as females. The causative agents of the Tinea corporis are *T. rubrum* and *T. mentagrophytes*. *T rubrum* was found to be most common agent in the world and 47% cases of the Tinea corporis are due to the *T. rubrum*[22]. The dermatophytes block the layers of skin, hair and nails which is beneficial for its worm and humid conditions helps in the proliferation of fungus. The sign and symptoms of this infection are rashes, lesions are pink to red circular patches and plaques with scaly borders causing irritation and burning sensation[1].

![Fig. 6 Tinea corporis](image)

Fluconazole, Itraconazole, Ketoconazole are the antifungal drugs for the treatment of Tinea corporis. It is diagnosed by the skin biopsy, microscopy, culturing or KOH staining.

**Table 1. Superficial fungal infections with their symptoms, causative agents and Treatment**

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Name of the disease</th>
<th>Causative agent</th>
<th>Clinical symptoms</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tinea barbae</td>
<td><em>Trichophyton mentagrophytes var. granulosum</em> and <em>Trichophyton verrucosum</em></td>
<td>rashes, itching, kerion like plaques, loose and broken off hairs, pimples near a hair follicle in the neck, and genital area</td>
<td>Griseofulvin and Terbinafine</td>
</tr>
<tr>
<td>2.</td>
<td>Tinea faicei</td>
<td><em>T. mentagrophytes, T. verrucosum, T. tonsurans, T.</em></td>
<td>are red hives on the face with small patches and lifted to</td>
<td>Clotrimazole, Oxiconazole, Tolnaftate,</td>
</tr>
</tbody>
</table>
### SYSTEMIC FUNGAL DISEASE

It is the fungal infection which causes infections in the body. There are several types of systemic fungal infection. These are:-

**Blastomycosis**

This disease is most commonly occurs in geographical regions. It affects humans as well as animals. Soil, decaying vegetation are the common habitat of this disease and it is common along waterways\(^\text{[23]}\). The causative agent of blastomycosis is *Blastomyces dermatitidis* which is dimorphic fungus that develop as amould in the environment and as yeast in the tissue\(^\text{[24]}\). It causes chronic and acute pneumonias and disseminated infection with cutaneous patches as the major extrapulmonary manifestation. Clinical symptoms are flu with cough, joint pain, muscle pain, chill and fever.

![Fig. 7 Blastomycosis on skin](image)

**Table:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Organism</th>
<th>Description</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Tinea pedis</td>
<td><em>T. mentagrophytes var. Interdigitale</em>, <em>T. rubrum</em>, and <em>E. floccosum</em></td>
<td>itching and peeling of skin, swelled and cracked skin exposed to raw tissue, inflammation, pain</td>
<td>Micoconazole, Terbinafine, Naftifine and Butenafine</td>
</tr>
<tr>
<td>4. Tinea unguium</td>
<td><em>T. rubrum</em>, <em>T. mentagrophytes</em> and <em>E. floccosum</em></td>
<td>weakness, loss of the shine, lifting up of the nail, change in the nail shape</td>
<td>Micoconazole, Terbinafine, Naftifine and Butenafine</td>
</tr>
<tr>
<td>5. Tinea cruris</td>
<td><em>T. mentagrophytes</em>, <em>M. magnum</em>, <em>E. floccosum</em>, <em>T. rubrum</em> and <em>T. raubitschekii</em></td>
<td>are red, brown, tan, peeling and cracking of the skin of infected areas</td>
<td>ketoconazole, Clotrimazole, econazole, Oxiconazole</td>
</tr>
<tr>
<td>6. Tinea corporis</td>
<td><em>T. rubrum</em> and <em>T. mentagrophytes</em>. <em>T. rubrum</em></td>
<td>rashes, lesions are pink to red circular patches and plagues with scaly borders causing inflammation</td>
<td>Fluconazole, Itraconazole, Ketoconazole</td>
</tr>
</tbody>
</table>
This infection usually starts in the lungs and sometimes causes skin infection and symptoms of skin infection are red pimples and ulcers on the face and other expose parts. It can be diagnose by tissue biopsy, serological test, culture and KOH test. Ketoconazole, Itraconazole, Amphotericin B are the drugs for the treatment of Blastomycosis.

**Histoplasmosis**
This disease is most common in geographical regions. The hosts of the pathogen of Histoplasmosis are humans and animals. *Histoplasmic capsulatum* is the causative agent of the Histoplasmosis which is commonly found in the soil. The pathogen is widely grow in that soil which has high nitrogen content and found under the trees which is used by birds for roosting and nesting. It is primarily a pulmonary infection in a normal host. However, in the transplant Population, depending on the level of immunosuppression, it is more likely to be a disseminated infection\[^{25,26,27}\].

![Histoplasmosis on skin](image)

**Fig. 8 Histoplasmosis on skin**

The clinical symptoms are Chest pain, Chills, Cough, Fever, Joint pain and stiffness, Muscle aches and stiffness, Rash (usually small sores on the lower legs), Shortness of breath. It can be diagnose by tissue biopsy, serological test, culture and KOH test. Itraconazole is the antifungal drug for the treatment of Histoplasmosis.

**Sporotrichosis**
The causative agent of the Sporotrichosis is Sporothrix schenckii. This fungus can survive months or years in the soil, vegetation and wood. It affects the wide number of mammals as well as humans and this disease is more common in cats. It can be transmitted by the contact between soil and fungal species, bites, scratches of animals. Three forms of sporotrichosis – lymphocutaneous, cutaneous, and disseminated. The clinical symptoms of the lymphocutaneous are the lesions, regional lymph nodes may ulcerate, crust and drain a
purulent, thick brownishred or serohemorrhagic exudate. The lymphatics may concurrently become thickened, hard and cordlike. Disseminate to deeper tissues or organs, such as the lungs, bone, liver, spleen, kidneys, testes, gastrointestinal tract and central nervous system (CNS).

**Fig. 9 Sporoptrichosis on skin**

Itraconazole and Amphotericin-B are the antifungal drugs for the treatment of Sporoptrichosis. It can be diagnosed by tissue biopsy, KOH test and by Serological tests.

### Table 3. Systemic fungal disease with their symptoms, causative agents and Treatment

<table>
<thead>
<tr>
<th>S.NO.</th>
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<th>Causative agent</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Blastomycosis</td>
<td><em>Blastomyces dermatitidis</em></td>
<td>flu with cough, joint pain, muscle pain, chill and fever</td>
<td>Ketoconazole, Itraconazole, Amphotericin- B</td>
</tr>
<tr>
<td>2.</td>
<td>Histoplasmosis</td>
<td><em>Histoplasmic capsulatum</em></td>
<td>Chest pain, Chills, Cough, Fever, Joint pain and stiffness, Muscle aches and stiffness, Rash</td>
<td>Itraconazole</td>
</tr>
<tr>
<td>3.</td>
<td>Sporoptrichosis</td>
<td><em>Sporothrix schenckii</em></td>
<td>lesions, regional lymph nodes may ulcerate, crust and drain a purulent, thick brownishred or serohemorrhagic exudates</td>
<td>Itraconazole and Amphotericin-B</td>
</tr>
</tbody>
</table>

**RESISTANCE OF ANTIFUNGAL DRUGS**

The term antifungal resistant defines that they are no longer inhibit the fungus to which they were sensitive previously. It is encoded by the genes of the microbes. The resistance to fungal drugs is a big problem and spread throughout the world. The main reasons of the drug resistance are genetic flexibility of the fungal strains, heavy use of selective drug, failure to
complete the course of treatment and mobility of the world’s population. The resistance of antifungal drugs is a big problem in the developing countries. The infections caused by the antimicrobial drug resistant microbes are failed to respond standard drug therapy. It results to the prolonged illness and longer periods of infectivity. When microbes are resistant to first line antimicrobial drugs, second and third line of drug is administrated which are highly costly and sometimes more toxic. There is no solution of the drug resistant. We can minimize the problem of drug resistance by careful use of drugs and by maintain hygienic conditions.

AROMATHERAPY AS AN ALTERNATIVE TREATMENT AGAINST DERMATOPHYTOSIS (SUPERFICIAL FUNGAL INFECTIONS)

There is a demand of new antifungal drugs due to the drug resistance. The natural antimicrobials are used widely due to easily availability and safely issues. The plants have medicinal properties due to the phytochemicals which are produce by them and perform some physiological actions in the human body\[28\]. The superficial and systematic fungal infections can be cured by the use of essential oils because they have antimicrobial properties, no side effects and eco-friendly The systematic fungal infection cause the internal infection like pulmonary infection, internal ear infection etc. in the human beings and these are treated by the Aromatherapy. There are numerous essential oils which are used in Aromatherapy. Now days, the aromatherapy becomes popular and widely used in the hospitals for the treatment of fungal infections. There are several researchers and scientific trails have declared that the essential oils have become respected in the treatment of Dandruff and fungal infections. Most of the peoples have been cured from the aromatherapies and it has been come in the knowledge after surveys.

The essential oils are wholly natural substances and it is important that it is always buy from a reputable suppliers.

CONCLUSION

From the above reviews, it can be concluded that the Dermatophytes are the keratin feeding pathogens which cause disease in the humans, animals and birds by the digestion of their keratin. These infections are cosmopolitan and very common in all the age groups due to the poor hygienic conditions and closeness of the animals. It is very common in the hot and humid climate because this climate is suitable for the growth of these pathogens. All of these diseases are examine by using microscopy, serological tests, tissue biopsy, culture and PCR techniques. The patient should maintain the hygienic conditions and environment around
them and it should kept in mind that these diseases are communicable diseases so don’t share their clothes, foot wares and any equipment to other persons. There are several antifungal drugs like Clotrimazole; Fluconazole etc are accessible for the treatment. Some medicinal plant extracts and their essential oils are also used for the treatment of fungal infections. Several researchers have been found that the essential oils have antimicrobial properties so these are widely used as an antifungal agent for the treatment of fungal infections.

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