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A Comprehensive Review of Pathogenesis,Diagnosis,And Treatment of Dermatophytosis

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ABSTRACT:

Dermatophytosis is a serious skin infection that occurs in the hands, feet,nails, and face and also occurs on the whole body.There are two different types of genraTrichophyton and Microsporum.The cause of dermatophytosis is due to different socio-economicstatus.The accurate diagnosis of dermatophytosis using several diagnostic techniques.Conventional methods were used for the diagnosis of dermatophytosis.Direct microscopy examinations were performed by KOH solution wet-mount preparations of skin scrapings from the active border of the lesion can be used to confirm the diagnosis.To prevent the spread of dermatophytosis, patients should maintain good hygiene, and wear washed clothes. Takea bath twice a day and maintain a distance fromtheother spouse. Patients were urged to wear loose clothes which prevent sweating and itching.To treat dermatophytosis clinically several medications like topical antifungals,systemic agents like griseofulvin,ketoconazole and azole,itraconazole,fluconazole, and terbinafine.

I. INTRODUCTION:

Ringworm, also known as fungus corporis, is a shallow dermatophyte disease that affects the skin, with the exception of the hands, feet, scalp, unshaven areas, face, crotch, and nails (onychomycosis or fungus unguium), which are all susceptible to fungus manuum, athlete's foot, and mouth fungus.[1,2]Depending on whether their major source is a person, an animal, or dirt, dermatophytes are classified as either anthropophilic, zoophilic, or geophilic.[1,3,4] Both the mildness and severity of an infection depend on a number of variables, including the host's response to the fungus' metabolic products, the virulence of the infecting species or specific strain, the infection's anatomical site, and local environmental conditions.[5]A fungal infection of the scalp, eyelashes, and eyebrows known as tinea capitis, sometimes known as ringworm of the scalp, is most frequently brought on by either of the dermatophytes from the two genera Trichophyton and Microsporum. Trichophyton tonsurans (T. tonsurans) and Microsporumcanis (M. canis) are the principal culprits.[6-15]Depending on the degree and kind of the infection, these disorders can be successfully treated with oral or topically applied antifungal medications.[16]Since its introduction in the late 1950s, the oral antifungal medication griseofulvin has been the standard treatment for fungi infections.[17]The antifungal drugs fluconazole and itraconazole, as well as the allylamine terbinafine, have a wide range of antifungal action against yeast, non dermatophytes, and dermatophytes.This article will discuss the pathogenesis,diagnosis, and treatment strategies of dermatophytosis.[16]

PATHOGENESIS OF DERMATOPHYTES:

The capacity of dermatophytes to synthesize different proteins or enzymes is crucial for their invasion of keratinized skin layers.[18,19]Keratinases, adhesins, lipases, phosphatases, DNases, and non-specific proteases are significant enzymes that help dermatophytes carry out a variety of pathogenic activities, such as attaching to and penetrating the stratum corneum of the skin, subverting the host immune system, and scavenging nutrients.[19]When a human's skin surface comes into touch with live fungal arthrospores or hyphae, dermatophytosis frequently results. Under the right circumstances, these fungi are then encouraged to adhere to the human's skin

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and germinate to create infection.[20]Dermatophytosis often develops on human skin after an incubation period of one to two weeks.[21]The best conditions for the growth of infections are humidity and a warm environment.[22]However, a number of factors, including close quarters, wearing occlusive clothing, growing urbanization, low socioeconomic level, contact with animals, and poor hygiene, can raise the risk of dermatophytosis infection.[23]Asexually reproducing conidia or arthrospores are the culprits behind dermatophyte infections.These infections can be made worse by the host's immune suppression, maceration of the skin, and damaged skin.[24]Typically, cutaneous infections are limited to the top, dead, cornified layers of skin. In healthy immunocompetent hosts, the host defense systems, such as the activation of serum inhibitory factor, polymorphonuclear leukocytes, and complements, prevent the fungus from penetrating deeper tissues.[25]Increased epidermal cell proliferation in response to the fungus infection causes the active border to scale.[26]Scaling is caused by an increase in epidermal turnover after inflammation. The fungus spreads centrifugally from the scalp's inoculation point along the stratum corneum plane.Additionally, the fungus can descend from the stratum corneum and reach the hair follicle and the hair.[27]It might enter the hair shaft through the outer sheath of the hair follicle.[6]It is typical to see air holes within the hair shafts.Hairs with an infection become brittle and are simple to break off. Anthropophilic dermatophytes typically cause less severe inflammation than zoophilic dermatophytes. [28,29]

DIAGNOSIS:

One of the most prevalent infectious disorders that affect people, dermatophytosis can be chronic in nature and, if untreated, can result in significant irreparable damage to the skin, hair, and nails.[30]Most often, Sabouraud's dextrose agar or potato dextrose agar combined with antibiotics and cycloheximide is used for the isolation of fungi from clinical specimens.[31]The traditional methods utilized for the laboratory diagnosis of dermatophytosis included the direct microscopic inspection of clinical samples and the recovery of the causal agent in culture.[32]The molecular diagnostic approaches give a substantially quicker diagnosis of dermatophytosis and, in most cases, direct species identification for a focused treatment to minimize needless antifungal medication and toxicity, as well as for epidemiological objectives.[33-36]Microscopic analysis of potassium hydroxide (KOH) wet-mount preparations of skin scrapings from the active border of the lesion can be used to confirm the diagnosis if necessary.[37]The test is conducted by adding a drop of 10–20% KOH to the scrapings on a microscopic slide.1 To hasten the death of the squamous cells, the material is gently heated.[38]

DNA EXTRACTION METHODS:

Numerous other techniques have been used in the recent literature, including manual homogenization of the clinical material, bead beating, freeze/thaw processing,and the age-old yet hazardous phenol-chloroform extraction.[39-43]Most frequently, fungal DNA extraction from skin, hair, and nails was done after the keratin structure had been disturbed. In other protocols, skin scales, hair, and nails were mechanically disrupted or pre-cut into little pieces.[44-53]It is also possible to effectively disrupt skin, hair, and nail samples non-enzymatically at room temperature for 1 hour or overnight using a Na2S dissolving solution.[54-56]There is a paucity of comparisons of the effectiveness of the many procedures mentioned in the literature for DNA extraction from dermatological samples.The amount of time needed for each regimen, however, varies significantly. For regular usage, this is a constraint that must be taken into account.[57]

CLASSICALPCR STRATEGIES:

The main benefits of traditional PCR are its ease of use and low cost, even in comparison to other procedures. [58]With particular primers, several techniques sought to find a single species. Trichophyton rubrum in nails and Microsporumcanis in human and animal skin could both be identified without additional testing thanks to the detection of an amplicon of a specific size in an agarose gel.[59-61]By finding 19.6 and 13.8% more dermatophyte-positive samples, respectively, PCR outperformed culture alone or the combination of conventional approaches.We have shown that the use of multiplex PCR in clinical settings produces quick results with high sensitivity and specificity, enhancing laboratory assistance intheclinical evaluation of tinea unguium and sparing the patient from having to wait to start an effective course of treatment.[62]

MANAGEMENT OF DERMATOPHYTOSIS:

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The biggest difficulty dermatologists confront today is the management of dermatophytosis.Thereare various types of therapy like topical, and oral were used in the management process and It will be listed below.

NON-PHARMACOLOGICAL THERAPY:

- Patients shouldn't share their clothes, sheets, towels or bathroom tissue.Every day, hot water must be used to completely wash and dry all clothing, including socks and underwear.[63]
- Until appropriate treatment is received, avoid or limit close interaction with a child or spouse.During an active infection, sexual intimacy with a partner should be avoided.[64]
- Taking a bath twice a day is beneficial for patients who exercise, are in environments where people tend to sweat a lot or have primary hyperhidrosis.[65]
- Patients should be urged to wear light, loose-fitting clothing since fungus thrives best in warm, humid settings.[38]

PHARMACOTHERAPY:

Topical antifungals are the preferred method of treatment for dermatophytosis, and research has shown that they are more effective than placebo.[66,67]The azoles (such as econazole, ketoconazole, miconazole, clotrimazole, miconazole, oxiconazole, sulconazole, sertaconazole, and luliconazole), allylamines (such as naftifine, terbinafine), benzylamine (butenafine), ciclopirox, and tolnaftate are among the most frequently used anti-fungal.[68-81]

TOPICAL ANTI-FUNGALS:

The most effective localized infections of the glabrous skin are treated with topical antifungal medicines. They are less effective in treating infections of the scalp, nails, long-lasting, widespread trunk infections, and thick stratum corneum infections of the palms and soles.Additionally, topical antifungal medicines used to treat dermatophyte infections can be less effective in treating immunosuppressed patients. There is no doubting that topical antifungal drugs are considerably less likely than systemic antifungals to have adverse side effects. The most prevalent adverse effect associated with modern topical antifungals is irritant contact dermatitis, albeit it is far less common than it was with the topical organic acids and phenolic agents used in the 1940s. It has been discovered that all topical antifungals now available on the market cause it; the incidence in preliminary clinical trials varied from 1% to 6%. True allergic contact dermatitis, which is distinguished by a delayed onset of redness, itching, and scaling, is rare, but isolated reports of it have been made for all formulations.[82-89]

SYSTEMIC AGENTS:

The development of systemic medications for the treatment of dermatophyte infections began in the 1950s with the discovery of griseofulvin.

GRISEOFULVIN:

Griseofulvin has been around for a while, and during the Vietnam War, it was even given to a large number of American soldiers as a preventative precaution against the frequent, frequently debilitating fungal infections that occurred in the tropics. Griseofulvin is the first medicine that is regularly used in dermatology to highlight the potential problems that can result from drug interactions.[82] Warfarin is metabolized by cytochrome P-450 enzymes, and the interaction between griseofulvin and this drug might cause serum levels of warfarin to drop, decreasing the effectiveness of anticoagulant therapy.[90] Patients using Griseofulvinmicro size experienced a low rate of aberrant baseline and follow-up laboratory test results, and there were no clinically significant laboratory test outcomes. No patients had their usage of Griseofulvinmicro size terminated or had additional laboratory tests run as a result of monitoring suspicious laboratory test results.[91] Western textbooks recommend a dosage of 1 g of griseofulvin per day for a period of four weeks.750 mg or 1 g of griseofulvin should be administered daily in two separate doses for six weeks at a dose of 10-15 mg/kg body weight.[63]

KETOCONAZOLE AND AZOLES:

As the first systemic substitute for griseofulvin for the treatment of dermatophyte infections, ketoconazole was first made ingestible in the 1970s. Ketoconazole causes several undesirable skin symptoms, such as urticaria and morbilliform eruptions, that are similar to those caused by griseofulvin.[92]When ketoconazole was first launched, it quickly became clear that it was linked to hepatic issues and had a wide range of potential medication interactions. Hepatitis brought on by ketoconazole appears to be an unusual side effect.[93-95] It is even more crucial to alert patients to the early signs of hepatitis (vomiting, nausea, lethargy, and malaise) and encourage them

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to stop taking the medication right away if they experience any of these side effects.[82] Itraconazole and ketoconazole must be absorbed in an acidic environment for absorption.[92]

The beginning of shortness of breath and anxiety, which are suggestive of anaphylaxis, is an intriguing but uncommon reaction seen with the initial dose of ketoconazole. These reactions were once assumed to be perhaps related to prior contact sensitization to topical azoles, however, the many immunological processes implicated rule out this possibility. The documented occurrences have been minor and have resolved either naturally or after taking antihistamines.[96,97]

FLUCONAZOLE:

Although the Food and Drug Administration has approved fluconazole, an oral triazole, for the treatment of dermatophytosis, reports indicate that it is effective and can even be taken in once-weekly dosages for nail infections. Different kinds of allergic skin responses can be brought on by fluconazole.[92] Although hepatitis has been linked to the use of fluconazole, it is far less likely than with the use of ketoconazole.[98,99] Headaches, upset stomach, skin rash, an increase in liver enzymes, and, less frequently, hepatotoxicity, a reaction similar to serum sickness, Steven-Johnson syndrome, an extension of the QT interval, and Torsades de pointes are side effects of fluconazole.[100]Fluconazole should be used 50-100 mg/day for two to four weeks. The administration of fluconazole 100 mg daily for at least 2-4 weeks after clinical clearance is advised rather than weekly regimens, which are strongly discouraged. Fluconazole is recommended to be used only in circumstances where other compounds cannot be provided, due to underlying comorbidities, obvious contraindications, and in lactating mothers.[63]

ITRACONAZOLE:

Itraconazole, another triazole antifungal drug, is authorised for use in the US to treat onychomycosis but not dermatophytosis. Itraconazole has also been linked to allergic reactions such as erythema multiforme, anaphylaxis, urticaria, pruritus, and acute generalised exanthemic pustulosis.[101] Itraconazole has been known to cause peripheral edoema when taken alone, and it frequently does so when combined with calcium channel blockers.[102,103] In the majority of European nations, itraconazole is preferable to griseofulvin.[104] A consensus statement suggested using itraconazole at a dose of 100 mg twice daily for a minimum of 2-4 weeks in naive individuals and four weeks in resistant cases.[105] Itraconazole's dose is restricted to 100 mg twice daily by scientific reasoning. But in reality, 200 mg twice daily or higher prescription doses are common. Not only are such high doses of the medicine unnecessary, but they also pose a risk. It would be safe to assume that less than four weeks of itraconazole 100 mg twice a day results in a higher incidence of recurrences and relapses.[63]

TERBINAFINE:

Terbinafine, an oral allylamine, has been reported to be useful in treating a number of dermatophyte infections, however, it is only licensed for the treatment of dermatophytosisin the United States. Terbinafine allergies are possible; cases of erythema multiforme, toxic epidermal necrolysis, urticaria, morbilliform rash, fixed drug eruption, acute generalized exanthemic pustulosis, and cutaneous lupus erythematosus have been documented.[106-108] Clinical cure is achieved with terbinafine at a dose of 250 mg once daily for 4-6 weeks. Mycological cure was observed in 91.8% of patients in the itraconazole group after four weeks, as opposed to 74.3% of patients in the terbinafine group, in a randomized research comparing oral itraconazole to oral terbinafine. Itraconazole and terbinafine were found to be both efficient and secure by the authors.[109] Terbinafine has a very limited role in the current epidemic-like scenario of superficial dermatophytosis, according to the study's findings it is effective in treating tinea corporis, tinea cruris, and tinea faciei by 2% at two weeks and 30.6% at four weeks.[110] Since a single dose of 500 mg contradicts the fundamentals of the drug's pharmacokinetics and pharmacodynamics, a divided dose of 250 mg twice daily is preferred to that of 500 mg once daily.[111]

II. CONCLUSION:

Dermatophytosis and superficial infection might not be serious infections but they should be taken with the utmost care to prevent any serious complications.In this article pathogenesis,diagnosis, and treatment options are emphasized which can be applied clinically by

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physicians and other healthcareprofessionals,to manage the infection. The pharmacological treatment for dermatophytosismostly covers antifungal agents such as Griseofulvin,ketoconazole,itraconazole,fluconazole , and terbinafine.A proper diagnosis and treatment could greatly improve the patient's condition.

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