

A Clinico-mycological spectrum of Superficial Mycoses of the scalp in the paediatric population

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Abstract

Introduction: A clinico-mycological study was conducted to assess the profile of dermatophytes and non-dermatophytes in patients with superficial mycoses of the scalp.

Material and Methods: This descriptive cross-sectional study was conducted at the Department of Microbiology, Basic Medical Sciences Institute, in collaboration with the Department of Dermatology, Jinnah Postgraduate Medical Centre, Karachi. The study was carried out from May 2019 to September 2019. A total of 114 children were enrolled in the study having a clinical diagnosis of superficial mycoses of the scalp. The hair specimens and scales from the scalp were collected by using sterilized forceps and a scalpel on a piece of filter paper. The specimens were processed for wet mounts (KOH and CFW staining) and mycological culture on Sabouraud's dextrose agar (SDA, with and without antibiotics) and Dermatophyte test medium (DTM).

Results: The most common clinical presentation was found to be dermatophytoses (28.4%). Non-dermatophytoses was seen in 16.41% of cases, while 55.2% of cases were culture negative. The most common isolated dermatophyte was *Trichophyton violaceum* (33.35 5.4%), while among non-dermatophyte molds, *Aspergillus* spp. accounted for 45% of cases.

Conclusion: Tinea capitis in children is mostly caused by dermatophytic species but the role of non-dermatophytes cannot be neglected the unambiguous diagnosis of scalp mycoses can be made by mycological culture and conventional techniques like KOH mounts and CFW staining. The knowledge of the mycological spectrum of a disease is not only required for clinical management but it also signifies the local disease burden.

Keywords: Calcofluor white stain, Dermatophytes, KOH mount, Tinea capitis.

Introduction

Superficial mycoses are the fungal infections of the skin, hair, and nail which are confined to the topmost layers of skin and its appendages. It is estimated that superficial mycoses constitute about 7-15% of childhood cutaneous infections.¹ The mycoses of the scalp are mainly amalgamated with tinea infections, commonly termed as tinea capitis. The tinea capitis is primarily associated with dermatophytes, while yeast and non-dermatophyte molds of anthropophilic and zoophilic origin are also found to be causative agents, but to a lesser extent.² Tinea capitis and other superficial mycotic infections of the scalp are mostly seen in children, followed by adolescents and being relatively uncommon in adults.³ The superficial mycotic infections of the scalp were once considered as diseases of overcrowded and fiscally constrained populations of tropical and sub-tropical regions, but due to the changing dynamics of world population, the dermatomycoses of the scalp have spread to the entire globe. Hence, the global prevalence of tinea capitis is in constant momentum.

The etiologic agents of tinea capitis are *Trichophyton* and *Microsporum* species of dermatophytes. The species of dermatophytes which are involved in tinea capitis varies geographically. In the United Kingdom, the United States of America, and Canada *T. tonsurans* is the main causative agent. The situation in Asian countries is somewhat discrete, as *T. violaceum* and *T. mentagrophytes* are found to be the culprit organisms. The lesions in tinea capitis are proportionally related to the causative species. The inflammatory types of lesions are predominantly seen with *T. violaceum*, *T. tonsurans*, *T. mentagrophytes*, *T. rubrum*, and some zoophilic species.^{4,5} The non-inflammatory lesions are observed in anthropophilic species but super-imposed bacterial infections can trigger inflammation.⁴ The clinical presentation of dermatomycoses ranges from dandruff, pruritus, and patchy alopecia to grey patches, black dots, pustules, and kerion. The tinea capitis often mimics alopecia areata, seborrheic dermatitis, psoriasis, and bacterial folliculitis, making its diagnosis complicated and confounding, therefore laboratory confirmation is a mandatory requirement.

The laboratory diagnosis of fungi involves conventional as well as classical methods. Wet mounts with 10% potassium hydroxide (KOH), Calcofluor white (CFW), and lactophenol cotton blue (LPCB) mount are among conventional methodologies, on the other hand, mycological culture is a classical gold standard diagnostic method, which yields fungus at

the species level.⁵ The newer molecular techniques like Polymerase chain reaction (PCR), Matrix-assisted laser desorption/ionization Mass Spectrometry (MALDI-TOF-MS) have become a benchmark in fungal diagnosis but their associated cost has made them an unaffordable technique in developing countries like Pakistan. This study emphasizes the clinical presentation of scalp mycoses and the epidemiology of various species of dermatophytes and non-dermatophytes among study subjects.

Materials and Methods

This cross-sectional study was conducted at the Department of Microbiology, Department of Microbiology, Basic Medical Sciences Institute, in collaboration with the Department of Dermatology, Jinnah Postgraduate Medical Centre, Karachi. A total of 114 children under the age of 10 years, belonging to both genders were enrolled, who were clinically diagnosed as cases of superficial dermatomycoses (tinea capitis). The hair was collected by using sterilized forceps and scales were scraped from the skin with the help of a blunt scalpel on a glass slide.⁶ The specimens were packed in sterilized filter paper and were properly labeled with the subject's details. Half part of each sample of the specimens was immersed in 10% Potassium hydroxide (KOH) and was examined under the light microscope on low power objectives. Simultaneously, Calcofluor white (CFW) staining was performed to visualize fungal elements under a fluorescent microscope. The samples were said to be positive if they show any sign of fungal hyphae or spores with fluorescent apple green colour. The remaining part of each specimen was inoculated on vials of Sabouraud's dextrose agar (SDA) with and without antibiotics (cycloheximide, chloramphenicol, and gentamicin) and Dermatophyte test medium (DTM). The vials were observed daily for one week and then a periodical check was made for the presence of growth, colony morphology, pigmentation, and pigmentation on the reverse. The species were identified on Lactophenol cotton blue (LPCB) mount, slide culture, and urease test. The vials which failed to show any significant growth within thirty days were considered as growth negative. Data were analyzed on the Statistical Package for Social Sciences (SPSS), version 21. The frequencies were calculated by descriptive statistics, the association was found out by using the Chi-square test, kappa statistics were used to determine the level of agreement between the tests.

Results

The mean age of children was found to be 7.01 ± 2.3 years with a male to female ratio of 1.28:1 (64/50). Almost all patients belong to the low-income group 113 (99.1%). Around 15.7% of subjects had a positive family history along with the habit of sharing common household items among family members. Cervical and occipital lymph nodes were found to be enlarged in 43 (37.7%) children. A significant association was observed between culture positivity and lymph node enlargement when calculated by the Chi-square test (P -value=0.001). The mean duration of illness among study subjects was found to be 3.39 ± 0.23 months. A majority of patients 96 (84.2%), presented with multiple complaints, the most common set of the clinical presentation was alopecia 72 (63.1%), dandruff 64 (56.1%), and pustules 56 (49.1%). About 21 (18.4%) subjects had a history of relapse of the same types of lesions. A substantial number of 69 (60.5%) patients have previously used either standard medical treatment, complementary treatment, or both to cure the ailment.

The 74.6% were found to be fungal positive on KOH mounts, while fluorescent microscopy gave 81.6% fungal positivity. The culture was found to be least sensitive, being positive in just 44.7% of cases. The most common isolated dermatophyte species was *T. violaceum* (34.35%), on the other hand, among non-dermatophytes, *Aspergillus spp.* (45%) topped the list. About 55.2% of cases showed no considerable fungal growth and were considered negative.

Table 1: Demographic characteristics of the study population

Demographic feature		Mean \pm SD/ n (%)
Gender	male	64 (55.6)
	female	50 (43.85)
Age		7.01 ± 2.3
Socioeconomic group	low	113 (99.1)
	medium	1 (0.9)
	high	-
Mean duration of illness		3.39 ± 0.23 months
Complaints	single	18 (15.8)
	multiple	96 (84.2)
Relapse cases		21 (18.4)
Previous treatment taken	Yes	69 (60.5)
	No	45 (39.47)

Table 2: Association of Lymph node Enlargement and Culture Positivity

Enlarged lymph nodes	Culture result		P-value
	Positive	Negative	
Cervical	26	6	0.001*
Occipital	7	4	
Total	33	10	

*P-value less than 0.05 is considered significant

Table 3: Comparison between Direct Microscopic Techniques and Culture

Test result	Direct microscopic techniques	Culture %	p-value	Kappa index
	CFW staining %	KOH mount %		
positive	74.6	81.6	44.7	0.001
negative	25.4	18.4	55.3	*

*P-value <0.05 is considered significant

** Kappa index range for substantial agreement is 0.61-0.80

Table 4: Distribution of various Species of Dermatophytes and Non-Dermatophytes

Isolated fungi	Frequency n (%)
Dermatophytes	
<i>T. violaceum</i>	11 (34.35)
<i>T. mentagrophytes</i>	9 (28.12)
<i>T. tonsurans</i>	4 (12.54)
<i>T. soudanense</i>	3 (9.37)
<i>M. canis</i>	3 (9.37)
<i>M. gypseum</i>	2 (6.25)
Non-dermatophytes	
<i>Aspergillus</i>	9 (45.0)
<i>Penicillium</i>	3 (15.0)
<i>Alternaria</i>	3 (15.0)
<i>Curvularia</i>	3 (15.0)
<i>Candida</i>	1 (5.0)
<i>Mucor</i>	1 (5.0)

Discussion

The study was conducted to determine the clinical and mycological profile of dermatomycoses of the scalp among children, which is a frequent complaint recorded in the paediatric outpatient department. Table 1 illustrated the demographic details of the study population. Our study demonstrated that the mean age of children was about 7.01 ± 2.3 years. This

is in accordance with the study by Farooqi et al.⁷ The children of this age are normally attending school or madrasa, therefore, they are more prone to contract fungal infections as the fungus has a propensity to disseminate via spores and can be transferred from one person to another. The study showed a slight male preponderance with a male to female ratio of 1.28:1. Males have short hair and they tend to catch fungal infections more conveniently than females, as most of the female children in our society braid and tie up their hair, hence the female participants showed a comparatively lower level of fungal infestation.⁸ The dermatomycoses are generally considered as the disease of poverty, and our study reinforces the theory as the majority of children fall in low socio-economic strata. Sharing of common household items like combs, hair-brushes, head-scarves, caps, hats, and pillows were seen in 15.7% of cases, a similar number of cases showed a positive family history of scalp lesions, indicating that fungus shows ping pong mechanism of transmission. Our observation was in agreement with Basyouni et al who reported the same results.¹⁰ Multiple complaints were observed in children; the most frequently observed feature was patchy alopecia, seen in 63.1% cases, followed by dandruff and pustules, which were recorded in 56.1% and 50% patients respectively, although Puri and Puri documented black dot as the most common recorded complaint.⁹ Another worth noticing characteristic was an association of enlarged lymph nodes with culture positivity, (P -value=0.001). It stipulated that enlarged cervical and occipital lymph nodes in superficial scalp mycoses are considerably related to the presence of fungal elements. Our finding shows a complete agreement with Fernandez et al, who have also elucidated the same association.¹¹

The specimens were examined under light and fluorescent microscopes to dig out the presence or absence of fungal spores and hyphae. The sensitivity of KOH wet mount and CFW mount was found to be 74.6% and 81.6% respectively. A substantial degree of agreement was observed between two tests, calculated by kappa index ($k=0.795$). Our findings were in agreement with Bonifaz et al who reported the kappa index of 0.808; however, Gupta et al reported contradictory results, documenting 31.1% positive cases with microscopic methods.^{12,13} The effectiveness of microscopic techniques in detecting fungal pathogens carries a crucial role as these techniques are low budgeted and comparatively less time-consuming than culture. According to our study, culture was found to be the least sensitive in detecting fungal

pathogens. About 44.1% of cases were culture positive, among them, dermatophytes were the predominating isolates (28%). *T.violaceum* was the most common isolated dermatophyte; similar results have been documented by Zehn et al and Puri and Puri, but Farooqi et al have reported *T. soudanense* as the main causative dermatophyte.^{13,10,8} Non-dermatophytes were also identified in scalp lesions and *Aspergillus spp* were the most common species identified, as shown in Table 4. Our results were in accordance with the work done by Khaled et al and Kaur et al, who have presented the same findings.^{16,15} Although dermatophytes are found to be primary offenders in tinea capitis, the role of non-dermatophytes cannot be overlooked.

Conclusion

Tinea capitis is one of the most common dermatological complaints in the paediatric outpatient department. The clinico-mycological spectrum of disease highlights the disease burden in the local community. The knowledge of fungal species is related to their clinical manifestation, hence helping clinicians in making the diagnosis and related treatment.

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