

Research Article

***Tinea capitis* Infection in Children Along with Tertiary care hospitals With Reference to *In vitro* Antifungal Susceptibility Testing of Dermatophyte Isolate**

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ABSTRACT

Fungal infection of scalp and hair is clinically known as *Tinea capitis*.¹*Tinea capitis* is the most common dermatophytic infection of childhood², especially in school going children.³ It is self limiting disease of children below 20 years of age and seldom beyond puberty.³Fungal infection of scalp and hair is superficial cutaneous mycotic infection. The causative agent of *Tinea capitis* varies with geography, social status and Time,¹⁵ although the clinical appearance is variable.^{15, 18}Late detection and lack of treatment of this disease can result in wide spread infection and in rare cases permanent alopecia. It presents with a variety of clinical picture and more or less depends upon type of dermatophyte involved. Fungal infection of scalp and hair has worldwide distribution. In India the superficial cutaneous mycotic infection is quite common because of the favorable climatic conditions such as high temperature and humidity. Ketoconazole, fluconazole and Griseofulvin seems to be promising therapies against *Tinea capitis*. The discoveries of azole derivative and allied group of antifungal drugs are having significant impact in managing dermatophytosis³. The present study suggests that every patient of *Tinea capitis* infection should be properly studied for mycological examination and should be treated accordingly. This study revealed that Ketoconazole, Fluconazole, and Griseofulvin were the most ideal antifungal drugs for the treatment of *Tinea capitis* fungal infection.

Keywords: *Tinea capitis*, Dermatophyte, agar dilution method and antifungal agents.

INTRODUCTION

Fungal infection of scalp and hair is clinically known as *Tinea capitis*.¹*Tinea capitis* is the most common dermatophytic infection of childhood², especially in school going children.³ it is self limiting disease of children below 20 years of age and seldom beyond puberty.³⁻⁷ Fungal infection of scalp and hair is superficial cutaneous mycotic infection⁸⁻¹⁴. The causative agent of *Tinea capitis* varies with geography, social status and time, although the clinical appearance is variable¹⁵⁻¹⁸. Late detection and lack of treatment of this disease can result in wide spread infection and in rare cases permanent alopecia. It presents

with a variety of clinical picture and more or less depends upon type of dermatophyte involved. Fungal infection of scalp and hair has worldwide distribution. In India the superficial cutaneous mycotic infection is quite common because of the favorable climatic conditions such as high temperature and humidity. Ketoconazole, fluconazole and griseofulvin seems to be promising therapies against *Tinea capitis*. The discoveries of azole derivative and allied group of antifungal drugs are having significant impact in managing dermatophytosis.¹⁹⁻²³ The objective of the present study was to a) To isolates and identify causative agents of *T. capitis* b) To

perform antifungal susceptibility testing against causative agent of *T. capitis* by using commonly used antifungal agents (Ketoconazole, fluconazole and Griseofulvin) c) Clinical Correlation with age and sex. d) Study of fungal causative agents in specimen obtained after oral and topical antifungal therapy. e) To study incidence of *Tinea capitis* infection in children age group and compare with other age groups. Skin scrapping and plucked hair KOH examination, culture on SDA with Chloramphenicol and Cycloheximide (SDA+CC), Incubated at 24°C and 37°C. Dermatophytes were identified by microscopy and culture characteristics. Minimal Inhibitory Concentrations (MIC) was measured with an agar dilution method.

MATERIAL AND METHODS

Total 3000 cases of fungal infection were clinically examined by dermatologists and among them 10 cases were found as *Tinea capitis* infection in children age group i.e. age group 1-10 yrs. After proper & aseptically sample collection, samples were used for culture. Identification was done as per the standard procedure. A total 10 cases of *Tinea*

capitis were included in this study. The antifungal drugs such as Ketoconazole, Fluconazole and Griseofulvin were used by agar dilution method. Out of 10 cases of *Tinea capitis* cases, two isolates were grown on Sabouraud's Dextrose agar. MIC was determine as the lowest concentration of the antifungal drug preventing growth of visible colonies on drug containing slants and compared with visible growth of drug free control tubes of *Aspergillus niger* NCIM 1165 from National Chemical Laboratory (NCL) Pune.

1. Age and Sex distribution

Age group 1-10 was most predominant as compare to other study age groups, it consist of 10 cases, consist of 7 & 3 males and females respectively. Age group 11-20 showed 5 (25%) cases which comprised 4 & 1 Males & Female while age group above 21 were showed 5(25%) cases, comprised 2 males and 3 females. Total 13 (65%) cases were males in all the age groups while 7 (35%) cases were females in all age groups (Table 1)²⁴⁻³².

Table 1: Age and Sex Distribution

Age groups	Patients		Total	Percentage (%)
	Male	Female		
0-10	7	3	10	50
11-20	4	1	5	25
21-above	2	3	5	25
Total	13(65%)	7(35%)	20	100

The age group most affected was 0-10 years (50%)

Table 2a: Distribution of cases according to clinical types of *Tinea capitis* in all cases

S. No.	Clinical types	Males	Females	Percentage
1.	Grey patch	9(45%)	5(25%)	(14)70
2.	Kerion	2(10%)	2(10%)	(4)20
3.	Favus	-	-	-
4.	Black dots	2(10%)	-	(2)10
	Total	13(65%)	7(35%)	(20)100

Table 2b: Distribution of cases according to clinical types of *Tinea capitis* in children

S. No.	Clinical types	Males	Females	Total	Percentage
1.	Grey patch	3(30%)	1(10%)	4	40
2.	Kerion	2(20%)	2(20%)	4	40
3.	Favus	-	-	-	-
4.	Black dots	2(20%)	-	2	20
	Total	7 (70%)	3(30%)	10	100

The most common clinical type grey patch was in male cases 3 (30%) while kerion was in female cases

II) KOH positive and culture positivity or negative

Table 3a: KOH and culture study in all age groups

KOH examination	Culture examination	
	Positive	Negative
Positive	2(10%)	9(45%)
Negative	1(5%)	8(40%)
Total	3(15%)	17(85%)

Table 3b: KOH and culture study in children

KOH examination	Culture examination	
	Positive	Negative
Positive	1(10%)	4(40%)
Negative	1(10%)	4(40%)
Total	2(20%)	8(80%)

The KOH positive & growth on culture media cases were 2 (10%) while 9(45%) cases were showed KOH positivity and no growth on medium (Table 3). 8 (40%) cases were KOH negative and culture negative also. In the present study majority of the cases (45%) in all age groups while (40%) in children age group were KOH positive but culture negative.

III) KOH Negativity and culture positivity or negative

KOH negative & growth on culture media case was found 1 (5%) and 17 (85%) cases were showed KOH negativity and no growth on culture media in all age groups while 1 (10%) & (40%) in children. This isolates belongs to two genera and four species, Out of four isolates two were *Trichophyton violaceum* and other two were *Trichophyton tonsurans* and *Microsporum gypsum* each respectively in all age groups while *Trichophyton violaceum* & *Microsporum gypsum* in children age group³³⁻⁴⁰.

Table 4a: Distribution of cases according to clinical types

Dermatophytes isolated	Clinical types of <i>Tinea capitis</i>		
	Grey patch	Kerion	Black dots
<i>T. violaceum</i>	1	1	-
<i>T. tonsurans</i>	1	-	-
<i>M. gypsum</i>	-	1	-
Total	2	2	-

The most common dermatophyte isolated from the cases was *T. violaceum*.

Table 4b: Distribution of cases according to clinical types in children

Dermatophytes isolated	Clinical types of <i>Tinea capitis</i>		
	Grey patch	Kerion	Black dots
<i>T. violaceum</i>	-	1	-
<i>M. gypsum</i>	-	1	-
Total	-	2	-

Table 5a: Incidence of species

Species Isolated	No. & Percentages
<i>T. violaceum</i>	2(10%)
<i>T. tonsurans</i>	1(5%)
<i>M. gypsum</i>	1(5%)
Total	4(20%)

The maximum number of isolates was *T. violaceum* (10%)

Table 5b: Incidence of species

Species Isolated	No. & percentages
<i>T. violaceum</i>	1(50%)
<i>M. gypseum</i>	1(50%)
Total	2(100%)

Table 6a: Incidence of *Tinea capitis* with other series

Series	Total cases	Cases of <i>T. capitis</i>	Percentage
Mankodi series	600	30	10
Desai et al	467	43	9.2
Gupta series	620	20	3.2
Kalra series	454	14	3.1
S.A.Patil series*	150	1	0.67
Present series	3000	10	0.50

Table 6b: Incidence of *Tinea capitis* in children

Series	Region	Percentage
Grover C. et al	Delhi	40.5
Jayshreenath et al	Kolkata	32.1
D.Kundu et al	West Bengal	10
Varadraj et al	Karnataka	0.50
Present series	Maharashtra	0.50

Table 7: *In Vitro* susceptibility of dermatophyte to Ketoconazole

Isolates	No	0.0001 µg/ml	0.001 µg/ml	0.01 µg/ml	0.1 µg/ml	0.5 µg/ml	1 µg/ml	2.5 µg/ml	5 µg/ml	10 µg/ml	100 µg/ml
<i>T. violaceum</i>	1	+	+	+	+	+					

T. violaceum- MIC: 1µg/ml

Table 8: *In Vitro* susceptibility of dermatophyte to Griseofulvin

Isolates	No	0.0001 µg/ml	0.001 µg/ml	0.01 µg/ml	0.1 µg/ml	0.5 µg/ml	1 µg/ml	2.5 µg/ml	5 µg/ml	10 µg/ml	100 µg/ml
<i>T. violaceum</i>	1	+	+	+	+						

T. violaceum-MIC:0.5µg/ml

Table 9: *In Vitro* susceptibility of dermatophyte to Fluconazole

Isolates	No	0.0001 µg/ml	0.001 µg/ml	0.01 µg/ml	0.1 µg/ml	0.5 µg/ml	1 µg/ml	2.5 µg/ml	5 µg/ml	10 µg/ml	100 µg/ml
<i>T. violaceum</i>	1	+	+	+	+	+					

T. violaceum-MIC: 1µg/ml

Antifungal Susceptibility Testing was done with *Trichophyton violaceum* by using three drugs. It showed MIC 1µg/ml and 0.5 µg/ml and

1µg/ml to Ketoconazole, Griseofulvin and Fluconazole respectively.

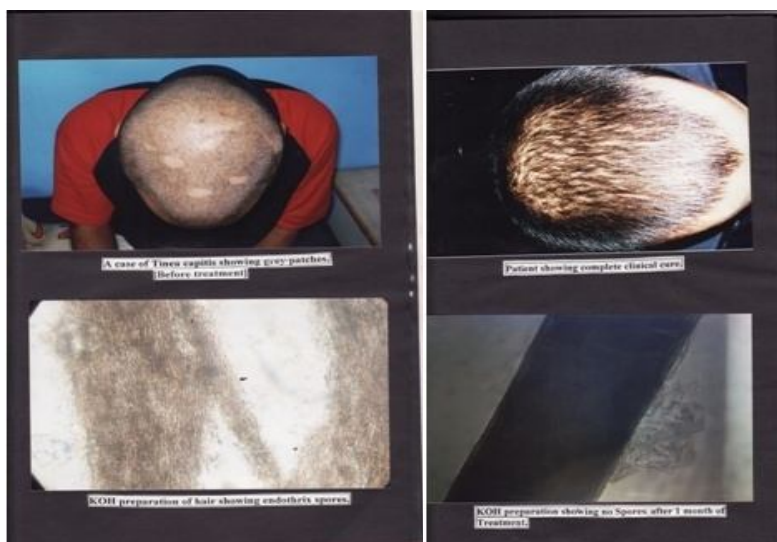


Fig. 1&2: Before and 3 month after treatment of drugs for *Tinea capitis* fungal infection

RESULT AND DISCUSSION

Clinical presentation of *Tinea capitis* were done by dermatologists on the basis of clinical types, Grey patch was 30% in males and 10 % in females. Kerion showed 2(20%) & 2 (20%) in males and females case. Black dot was 20 % in both Male and female cases respectively. Males showed 7 (70%) cases in all types of clinical types than the females, showed 3 (30%) cases. About 40% cases showed KOH positivity and culture negativity and KOH negativity and culture negativity respectively. While 10 % cases showed KOH positivity and culture positivity and KOH negativity and culture negativity respectively. Both species of dermatophytes were in kerion, which was 10% respectively. Incidence of both species of Dermatophyte was 50% each. Incidence of *Tinea capitis* was 0.50 % in children age group. Ketaconazole & Fluconazole were sensitive at concentration of 1.0 µg/ml respectively and Griseofulvin at 0.5.µg/ml.

CONCLUSION

The present study suggests that every patient of scalp hair infection should be properly studied for mycological examination and should be treated accordingly. This study revealed that Ketaconazole, fluconazole, and Griseofulvin were the most ideal antifungal drugs for the treatment of *Tinea capitis* fungal infection. Rate of isolation dermatophytes was decreased due to increasing socio-economic status and awareness about infection. In most cases KOH mount showed positivity but not grew on SDA culture may be patients were being taken antifungal systemically or topically. About 3000 clinically suspected fungal infection patients examined in Skin

OPD, *T. capitis* was suspected in 10 cases (0.50 %).KOH mount was positive for fungal elements in 5 (50%) cases. Culture was positive in 2 (20%) cases. Age group 1-10 is more predominant in this study as compare to other age groups. It comprises 10 (50%) cases. Out of 10 cases 7(70%) were male patients and 3 (30%) cases were female patients. *Trichophyton violaceum* and *Microsporum gypseum* species of dermatophyte were isolated in all age groups while *Trichophyton violaceum* and *Microsporum gypseum* species of dermatophyte were isolated in 1-10 age groups this present study. *Trichophyton violaceum* was sensitive to Ketaconazole & fluconazole at concentration of 1.0 µg/ml respectively and Griseofulvin at 0.5.µg/ml. The retrospective study showed that the cure rate was excellent for *Trichophyton violaceum*

REFERENCES

1. Mohrenschlager M, Seidl H.P, Ring and Abeck D.Paediatric Tinea capitis: Recognition and management. Am J Clin Dermatology. 2005;6(4):203-13.
2. Moraes MS, Godoy-Martinez P and Alchorne MM. Incidence of Tinea capitis in Sao Paulo, Brazil: Mycopathologia. 2006;(2):91-5.
3. Emmons CW. Fungal infection of skin: A review IJCP. 1992;3:20-23.
4. Lambert DN Griseofulvin and Ketoconazole in treatment of dermatophytic infections. Int. J dermatology 1989;28:5.
5. Else Svejgaard: Epidemiology and clinical feature of dermatophytoses and dermatomycoses. Acta dermatol,

- Venerol (Stock). Suppl. 1986;21:19-26.
6. Rattan A. Antifungal Susceptibility testing. Indian J Medical Microbial. 1999;17: 125-128.
 7. Nagabhushanam P and Tirumalarao D. Dermatophytosis in Hyderabad area: Indian J dermatol, Venerol . 1972;38;2.
 8. Pushpa Talwar, Hanjan BS and Subramaniam S. Incidence of T. pedis among local population in Chennai. Indian J dermatol, Venerol, Leprol. 1980;44(4):209-215.
 9. Tanaka S and Summer Bell RC. Advances in dermatophytes and dermatophytosis, J Medical and Veterinary Mycology. Suppl. 1992;30(1):29-39.
 10. Nath P and Agarwal AK. Some observation on mycotic infections in Lucknow. Indian J Dermatology and Venerol 1971;36:182.
 11. Ziemer A and Kohi K: Trichophyton induced inflammatory Tinea capitis in 63 years old man. Mycoses. 2005;48(1):76-9.
 12. Lehmanns, Ott H, Backer M and Heimann G. Identification of geophilic and zoophilic dermatophytes in siblings with Tinea capitis : A pathogenic factor. Hautartz 2004;55(10):101-3.
 13. Ishizaki S and Ito H. Two cases of Tinea capitis by M. ferrugineum believed in Myanmar. 2003;44(3):203-7.
 14. Silverberg NB. Tinea capitis focus on Frisan- American women; J. Am. Acad Dermatol. 2002; 46(2 suppl understanding): s 120-4.
 15. Arenas R, Toussant S and Isa-Isar: Kerion and dermatophytic granuloma, Mycological and pathological findings in 19 children with inflammatory T. capitis of the scalp. Int. J Dermatol. 2006;45(3):215-9.
 16. Kondo M, Nakano N, Shiraki Y and Hiruma M. A Chinese Japanese boy with black dot ring worm due to T. violaceum. J Dermatology. 2006;33(3):165-8.
 17. Asayaya so and Kamar KK: An etiological of Tinea capitis in school children. East Afr Med J . 2001;78(10):531-5.
 18. Christiansen AH and Svejgard E: Studies on antigenic structure of T rubrum, T. mentagrophytes, M. canis and. E floccosum by crossed Immunoelectrophoresis. Acta. Pathol-Micro scand c. 1976;84:337-341.
 19. Jones HF, Reinnarrdt JH and Rinaldi MG: Acquired immunity to dermatophytosis Arch dermatology. 1974;109:84-8.
 20. Gamberg Nielsen P. Dermatophytes and keratin in patients with hereditary palm plantar, keratoderma. Acta dermatology, venerol (stock). 1993;73(6):416-18.
 21. Reyes AC and Frieelman L. Comparison of the specificity of dermatophytis reacting antibody in human and experimental animal sera. J Invest. Dermatology. 1996; 47:27.
 22. Hanffin JM. Immunological reactivity in dermatophytosis. Br. J dermatology. 1974. 90.
 23. Kaaman. T cell mediated reactivity in dermatophytosis in skin responses to purified Trichophytin in Tinea pedis and Tinea Cruis. Acta Dermatol, Venerol. 1981;119.
 24. Higgins EM, Fullar LC and Smith CH. Guidelines for management of Tinea capitis. Br J dermatology. 2000;143;53-58.
 25. Pol Merkur Lekarski. Allergic phenomenon course of dermatomycosis, Article in Polish. 2003;14(84):532-4.
 26. Evans EGV and Richardson MD. Medical mycology a practice approach, Oxford University New York, Tolstoy's: 47-87.
 27. James L and Harris. Modified method for fungal slide culture. J of Clinical Microbiology. 1986;1:460-461.
 28. Henry Earl Jones. Problem of dermatophytes. J of Am Acad of Dermatology. 1993; 23:779-81.
 29. Venugopal PV and Venugopal TV. In vitro susceptibility of dermatophytes to Itraconazole IJDVL. 1992;58:360-371.
 30. Else Svejgard. Oral ketaconazole as an alternative to Griseofulvin in recalcitrant dermatophyte infections and onychomycosis. Acta Derm Venerol (Stock). 1985;65: 143-149.
 31. Hussain H. Randomized double blind controlled comparative study of terbinafin versus Griseofulvin in Tinea capitis. J of Dermatology Treat. 1995; 6:167-9.
 32. Jones TC. Overview of the use of terbinafine (Lamisil) in children. Br J Dermatol. 1995;132:683-9.

33. Baudrez Rasselet F. Efficacy of terbinafine treatment of Tinea capitis in children varies according to the dermatophytic species. *Br. J. Dermatology*. 1996;135:1011-12.
34. Ghannoum M, Isham N, Hajjen R, Cano M, A. Hasawi, Yearlick d, Warner J, Long L, Jessu PC and Elewski B. Tinea capitis in Cleveland: Survey of Elementary School student: *J Am Acad dermatology*. 2003;48(201):89-93.
35. Ranganathan S. Effect of social-economic status on the prevalence of dermatophytosis in Madras. *Indian J Dermatology, Venerol and Leprol*. 1995;61: 16-8.
36. Kamalam A and Thambiah AA. Occurrence of clinical different types of T. capitis caused by T. violaceum in different school in Chennai: *IJMR*. 1979;70:403-406.
37. Pankajalaxmi VV and Subramaniam. Mycoses in Madras (superficial): *Indian J Dermatology and Venerol*, 1974;40:5.
38. Vijay Kumar and Sharma RC. Clinical mycological study of Tinea capitis: *Indian J Dermatology, Venerol, Leprol*. 1996;62:207-9.
39. Gupta AK, dlova N, Borda PTA, Morar N, Taborda V, Lynde CW, Konnikor N and Borge M. Once weekly a fluconazole is effective in children in treatment of Tinea capitis: A prospective, multicentre; *Br J dermatology*. 142: 965-968.
40. Koneman EW. Laboratory approaches to the diagnosis of fungal infection. 5th edition.