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Tinea Capitis Among Primary School Children: A Clinicomycological Study in a Rural Hospital in Central India

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ABSTRACT

Aims & Objectives

1. To determine the clinical & mycological profile of tinea capitis Among Primary School students of Rural area
2. To correlate of KOH microscopy and culture for diagnosing Tinea capitis.

Methods & Results: A total of 323 Primary School students from six different Government rural schools were enrolled and screened for any infection on hair and scalp. Of these, 81 were clinically found to be of Tinea capitis. Woods lamp examination, 20% KOH microscopy and Fungal cultures were performed for all these cases.

Non-inflammatory type of tinea capitis was predominant (95.06%) type and female students (55.5%) were affected more compared to male(44%). In our study, the positivity by 20% KOH and Fungal culture was 40.74% & 11.11% respectively. The etiological agents were *T. violacium, Microsporum canis & T. rubrum*.

Conclusion: Tinea capitis was detected mostly in pupils with low level of educational and poor socio-economic status of their parents.

Key Words: *Tinea capitis, Dermatophytes*, KOH microscopy

INTRODUCTION

Tinea capitis is a fungal infection of the scalp hair follicles and the surrounding skin caused by *dermatophytes* In fact, Tinea Capitis infection has been described as a "modern-day epidemic." (Ginter-Hanselmayer G et al. 2011). It is the most commonly diagnosed dermatophytosis of childhood and is more frequently seen among prepubescent children. Mohrenschlager M et al.2005)

Dermatophytes genera include *Trichophyton, Epidermophyton* and *Microspora* and are characterized by their ability to invade the superficial layers of the epidermis, particularly the stratum corneum and the high keratin-concentration containing appendages, the hair and nails of the living host. The most common etiological agents include the members of the genera *Microsporum* and *Trichophyton* species. The infection may range from mild, almost subclinical, with slight erythema and a few patchy areas of scaling with dull gray hair stumps to a highly inflammatory reaction with folliculitis, kerion formation, and extensive areas of scarring and alopecia, sometimes accompanied by fever, malaise, and regional lymphadenopathy.

Tinea capitis is a common superficial fungal infection seen predominantly in children of school age in the developing countries. (Ahmed I et al.2006, Ayanbimpe GM et al.2008, Grover C et al 2010). WHO data has revealed that 7-33% of children of various age groups are affected (Mahe A et al. 2005). The epidemiology of Tinea capitis varies within different geographical areas throughout the world and in any given area, the species may change.

Hot humid tropical climates, low socioeconomic status, crowded living condition and poor hygiene contribute to an increased incidence of Tinea capitis. It is highly communicable and may reach epidemic proportions especially in

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overcrowded setups (Mahe et al. 2005, Ginter-Hanselmayer G et al. 2007).

Therefore, an increased level of surveillance in residential schools, hostels, orphanages are recommended. Very few research studies are available on prevalence and etiological agents of Tinea capitis in children from this part of India. Surveillance can be performed using Wood's lamp for the detection of Tinea capitis based on the fact that some dermatophyte species produce characteristic fluorescence under UV light. The chemical responsible for the fluorescence is pteridine (Wolf FT et al 1957). Wood's lamp is helpful in the diagnosis and treatment of an individual patient as well as for mass screening and control of epidemics in schools (Halprin KM et al. 1967). Dermatophytes that cause fluorescence are generally members of the *Microsporum* genus. However, the absence of fluorescence does not necessarily rule out Tinea capitis as most *Trichophyton* species, with the exception of *T. schoenleinii*, are nonfluorescent.

On the basis of the type of hair invasion, dermatophytes are also classified as endothrix, ectothrix or favus. In endothrix infection the fungus grows completely within the hair shaft, the hyphae are converted to arthroconidia (spores) within the hair while the cuticle surface of the hair remains intact (Fuller et al. 2003). In ectothrix infection hair invasion develops in a manner similar to endothrix except that the hyphae destroy the hair cuticle and grow around the exterior of the hair shaft. Arthroconidia may develop both within and outside the hair shaft. Elongated hyphae, parallel to the long axis of the hair, persist within the hair. Favus is a rare type of Tinea Capitis characterized by typical honey-colored, cup-shaped, follicular crusts called scutula (Brajesh et al. 2013).

AIMS AND OBJECTIVES

1. To determine clinical and mycological profile of Tinea capitis in children
2. To correlate KOH microscopy and culture in diagnosing Tinea capitis.
3. To determine the possible associated predisposing factors for fungal infections among them.

MATERIALS AND METHODOLOGY

Study design: A cross-sectional study was carried out in the Department of Microbiology of a Rural Hospital of central India, during the period of **1st June- 31st July 2015** after due approval from the Institutional Ethical Committee.

Setting: Study was carried out in the Microbiology department of a Rural Hospital of central India.

Study participants: All children aged between **6-10 years** of age from the **six** different Government Primary schools, were screened for routine examination and investigations.

Sample size: All total 323 children belonging to classes' I–V standard from six different Government Primary schools were included in this study.

Inclusion Criteria

1. All Students of Classes I–V standard from six different Government Primary school and
2. With the consent of their parents/ respective teachers were included in this study.

Exclusion Criteria:

1. Students, not in the age group of 6–10 years
2. Students receiving anti-fungal treatment.
3. Not giving consent was excluded from the study.

Collection and Processing of Clinical Samples

Questionnaires were designed and adapted for collecting demographic and socio-economic aspects of the child. This included many factors like family size, family income, and history of antifungal treatment, parent's educational level and parents' employment. All areas of the scalp were thoroughly examined to assess the morphological types of Tinea capitis. Wood's light was used for the diagnosis of Tinea capitis; however, the absence of fluorescence did not necessarily rule out Tinea capitis.

Collection of Hair plucking and scalp scrapping:

The specimens were collected and processed according to Weitzman and Summerbell. The lesions were thoroughly cleaned with 70% alcohol. The scalp scrapings were collected from the margins of the lesions with a sterile surgical blade (No.15). The affected dull and lusterless hairs were epilated with the help of a sterile forceps. All the specimens were collected in a clean white sterile paper. All samples were labeled appropriately and transported to the laboratory within 4 h after sample collection for direct microscopic examination and culture.

Direct Microscopy

Potassium hydroxide mounts

Direct microscopic examination of the scrapings and hairs was carried out by mounting with 1-2 drops of 20% KOH for 15-30 min. Slides were then microscopically evaluated for the presence of hyphae, arthrospore or conidia for either ectothrix or endothrix infection. Infection of the hair was described either as ectothrix (sheath of arthroconidia formed on the outside of the hair shaft) or as endothrix (arthroconidia formed within the hair shaft).

Mycology Culture

Each specimen was then inoculated on two separate Sabouraud's Dextrose Agar slopes containing chloramphenicol, one with and the other without cycloheximide (chloram-

phenicol-0.05 mg/mL, cycloheximide-0.5 mg/mL). The cultures were incubated at room temperature for 4-6 weeks and observed regularly for growth. The fungal isolates were then identified.

Identification of isolates

The cultural characteristics of the isolates were noted and identification was done on the basis of Duration of growth, surface morphology, pigment production on the reverse, the texture, whether fluffy, powdery, cottony or floccose, buff, whether the hyphae was radiating at the margins or whether their colony were folded. The microscopic characteristics of their hyphae were also noted. Microscopic examination in lacto phenol cotton blue preparation and slide culture was also done to confirm the isolate. Whenever necessary urease and hair penetration test were done. The clinical, microbiological and etiologic data was collected and correlated. Results so obtained were tabulated and statistical evaluation of the results was done.

Statistical analysis

The results obtained in this study are presented using descriptive statistics (frequency and percentage). We have used the odds ratio with 95% CI to find out the association of predisposing factors like gender, pets, parent's education level with the proportion of mycoses among the pupils.

OBSERVATION & RESULTS

Of the 323 pupils so screened from six different rural schools, 81(25.1%) were found to be screened positive by Clinical examination & Wood's lamp examination **(Table 1)**. Amongst these 81 Tinea capitis cases, 27 were screened positive by Wood's lamp examination and 54 by clinical examinations **(Table 1).**

The proportion of Tinea capitis among primary school children in relation to certain socio- dermographic variables is shown in **Table 2**. Amongst the 81 screened positive Tinea capitis cases, a slight female preponderance was seen, with females comprising 55.5% of the patients. Also it was noted that Tinea capitis cases were more (67.90%) among children from families with low educational level of parents i.e. primary school or less compared to 32.09% amongst those students with high educational level of their parents. Almost 50.61% of students gave a history of pets at home or prolonged contact with animals as most of the study population had farming business **(Table 2)**. Bathing habits among children such as frequency of head bath, use of shampoos and use of hair oils was obtained from all the students. It was observed that the measures of personal hygiene were similar in both students with Tinea capitis and without Tinea capitis.

As per **Table 2** odds for suffering with Tinea capitis (culture positive) are same in both males as well as females (Odds ratio=1) and children from families with low educational level of parents i.e. primary school or less were found to have slightly lesser odds (Odds ratio=0.94) for suffering with Tinea capitis (culture positive) as compared to those children who belong to families with high educational level of their parents i.e. secondary school. Children from families having pet were found to have slightly higher odds(Odds ratio=1.25) for suffering with Tinea capitis (culture positive) as compared to those children who belong to families having no pet.

However all these parameters we studied were not statistically significant as 95% Confidence interval is overlapping as well as including base value of 1.

Among the various clinical variants seen, non-inflammatory Tinea capitis i.e. Grey patch, Black dot and seborrhoeic types was more common (96.29%) than inflammatory TC (3.7%) Among the Non-inflammatory cases, seborrhoeic type was more common than the other types **(Table 3).**

Potassium hydroxide studies were carried out on hair samples from 81 clinically as well as Wood's lamp positive **(Figure 2)** suspected cases of Tinea capitis. The findings are summarized in **Figure 1.**Fungal spores invading hair shafts could be seen in 40.74% (81) of the cases. An endothrix pattern of spore distribution **(Figure 3)** was more common (23.45%) than an ectothrix pattern (13.58%) only 3 cases (3.70%) showed spores in both the patterns simultaneously on initial examination. No fungal elements could be identified in 48 cases (59.25%). Furthermore, we compared the culture results with microscopic examination. In our study, we found 9.87% of Tinea capitis cases positive by both KOH and Culture, 30.86% by KOH only, 1.23% by Culture only while 58.02% cases were negative by both KOH and culture both **(Table 4).**

In our study, the total number of culture positive isolates were 9, out of which *Trichophyton violacium* **(Figure 5)**was the commonest isolate, [4(44.44%)], followed by M*icrosporum canis* **(Figure 4)** [3(33.33%)]and *Trichophyton rubrum* **(Figure 6)** [2(22.22%)]. Most of the culture positivity was in seborrhoeic type of Tinea capitis i.e. 66.66%.

DISCUSSION

Tinea capitis is a common fungal infection in children of school age, particularly among those living in unhygienic conditions. In the present study the rate of tinea capitis was 25.07%as screened by clinical and wood's lamp examination. The lower isolation may be due to geographical and climatic variations, as this year our area received lower rainfall and is less humid and drier; thus are less chances of acquiring fungal infections. Varying prevalence rates of tinea capitis ranging from 4.6% - 39.6% have been reported in studies

from Nepal, Nigeria, Central Africa, India, Iran (Barbhuiya JN et al.2002, Rastegar Lari et al. 2005, Jha et al. 2006, Emele FE et al.2008, Hogewoning AA et al. 2011). These variations may be attributed to social, socio- economic and geographical variations; cosmetic factors play a role in the spread of infection (Higginis EM et al 2000).

Various conflicting views exist regarding the sexual predominance of Tinea capitis. Some authorities believe that Tinea capitis may be common in boys due to shorter hair, allowing easy access for circulating spores (Friedlander SF et al. 2003), while others believe that it may be more common in girls due to tight hair braiding (Chen BK et al.2001). In our study slightly higher proportion of female students (55.5% out of 81 screened positive cases) affected compared to male students (44.4%). This is in contrast with the studies carried out at Kenya (Ayaya SO et al. 2001), Kolkata (D Kundu et al. 2012) and Rajasthan (Kalla G et al. 1995) showing male preponderance.

The present study showed a relationship between level of parental education and the proportion of Tinea capitis in the population studied. The frequency of Tinea capitis was more in children whose parents had primary or no education (67.90%out of 81 screened positive cases) when compared with the frequency in children whose parents attained secondary and post secondary school education (32.09%). All the studied school children were from rural areas in and around Wardha district. Majority of the parents of infected children were involved in farming thus exposing them to environmental agents. The average family size was six members per family and the whole family resided in a single room. The normal level of hygiene was not maintained as the hair wash frequency was not more than twice a week in diagnosed cutaneous mycoses cases because of lack of awareness as well as limitation of water supply. The practice of sharing of combs allowed the spread of infection at a higher rate in Tinea capitis cases specifically. Majority children screened for infection of Tinea capitis belonged to overcrowded government schools. This points to the importance of health education in control of infections. Inadequate and poor infrastructures as was observed in all the six schools could be added as one of the major factors influencing transmission of infection amongst the pupils.

Most of the similar studies reveal that non-inflammatory types of Tinea capitis were more common (51%) than inflammatory variants (32%) (Hussain I et al. 1994, Kalla G et al. 1995, Singal A et al. 2001, Jha BN et al. 2006). In our study, Seborrhoeic type was more common followed by Black dot and grey patch types., study by Bose et al (2011) and Singal A et al (2001) have reported seborrhoeic variant as the predominant type followed by black dot.

In the present study, examination of KOH-stained smears microscopically revealed different patterns of distribution of spores in the hair shaft. KOH positivity was seen in 40.74% of screened positive; out of which endothrix presentation (57.57%) was more common than ectothrix (33.3%) while 9.09% shows mixed pattern of spore arrangement. The fungal culture yielded positive result in 11.11% out of 81 screened positive cases. Isolation rates ranging from 24%-93% have been reported in previous studies from different geographical areas (Singal A et al. 2001, Jha BN et al. 2006, Al Samarai et al. 2007, Garg J et al 2009,Yazdanfar A et al. 2010, Bose et al. 2011, Azab MM et al. 2012). Culture specimens from all the cases were examined. No growth at the end of 6 weeks was recorded in 88.8% of the cases (72 cases). Of those showing growth of fungal elements, *Trichophyton violaceum* was the commonest isolate, [4(44.44%)] which has also been reported by various workers from India and other parts of the world as well (Jha BN et al. 2006, Jehangir M et al.1999) All the culture positive isolates were also shown positive results on KOH microscopy except one isolate of *Trichophyton rubrum* .

In the present study out of 323 students so screened, 25.07% were found to Tinea capitis by clinical and wood's lamp examination. In this study a female preponderance was noted. Low socio-economic background and poor personal hygiene were significant pre- disposing factors of Tinea capitis among the studied students. The most common pattern of Tinea capitis noted was seborrhoeic type. Fungal culture results were positive among 11.11 % of children showing positive results on screening children. Among this *Trichophyton violaceum*(44.44%) was the commonest cause of Tinea capitis in our geographical area followed by *Microsporum canis*(33.33%) and *Trichophyton rubrum* (22.22%).

CONCLUSION

In our study, the sensitivity of direct microscopy considering culture as gold standard was found to be 88.89% and specificity was 65.28%. This emphasizes the need of performing both the tests.

Source of Support: Nil.

Conflict of Interest: None declared.

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Table 1: Proportion of clinically suggestive superficial mycoses according to schools distribution

Name of Villages of Screened Schools	Total No. of Students Screened	Total Positive Clinically (C)	Total Positive by Wood's Lamp (W)	Total Positive by Wood's Lamp+Clinically (W + C)
Nimsoda I	18	4	1	5
Aloda II	18	3	1	4
Borgaon III	27	4	2	6
Waigaon IV	198	35	16	51
Borgaon(datar) V	28	4	2	6
KingaonVI	34	4	5	9
TOTAL	**323**	**54(16.71%)**	**27(8.35%)**	**81(25.07%)**

Table 2: Proportion of Tinea capitis among primary school children in relation to certain socio-demographic variables.

Variable	Category	Culture positive Tinea capitis (n=81)		Total (%)	Odds ratio	95% CI for the Odds
		Yes (n=9)	No (n=72)			
Sex	Male	4	32	36 (44.44)	1	0.25-4.03
	Female	5	40	45 (55.55)		
Parents' education	Primary school or less	6	49	55(67.90)	0.94	0.22-4.09
	Secondary school or more	3	23	26(32.09)		
History of Pets	Present	5	36	41(50.61)	1.25	0.31-5.04
	Absent	4	36	40(49.38)		

Table 3: Clinical types of Tineacapitis

Clinical types &No. of cases		Total
Non-Inflammatory Grey patch : 9 Black dot : 4 Seborrhoeic: 39	**Inflammatory** Kerion : 2	
52(96.29%)	**2(3.70%)**	**54**

Table 4: Comparison of KOH and culture results (Two By Two Table)

Variables	Culture positive Tinea capitis (n=81)		Total
	Yes (n=9)	No (n=72)	
KOH positive	8 (9.87%)	25 (30.86%)	33(40.74%)
KOH negative	1 (1.23%)	47 (58.02%)	48(59.26%)
Total	**9(11.11%)**	**72(88.88%)**	**81**

Parameter	Estimate	Lower - Upper 95% CIs
Sensitivity	88.89%	(56.5- 98.01)
Specificity	65.28%	(53.76- 75.25)
Positive Predictive Value	24.24%	(12.83- 41.02)
Negative Predictive Value	97.92%	(89.1- 99.63)
Diagnostic Accuracy	67.9%	(57.12- 77.06)
Likelihood ratio of a Positive Test	2.56	(2.296 - 2.855)
Likelihood ratio of a Negative Test	0.1702	(0.02345 - 1.236)

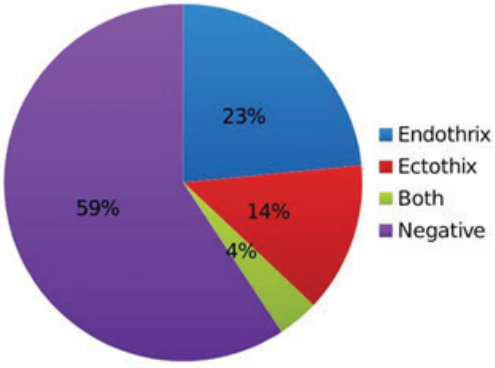

Figure 1: Results of Microscopic diagnosis of cases with Tinea Capitis.

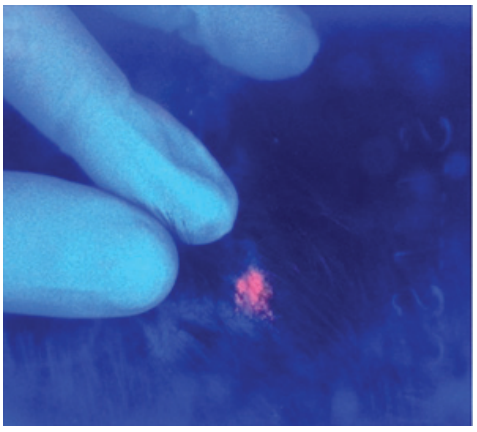

Figure 2: Fluorescence in Wood's Lamp Examination.

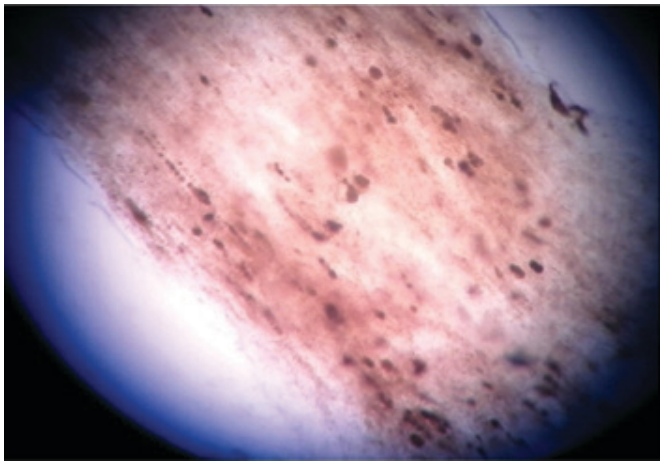

Figure 3: Positive fungal element in Direct KOH mount.

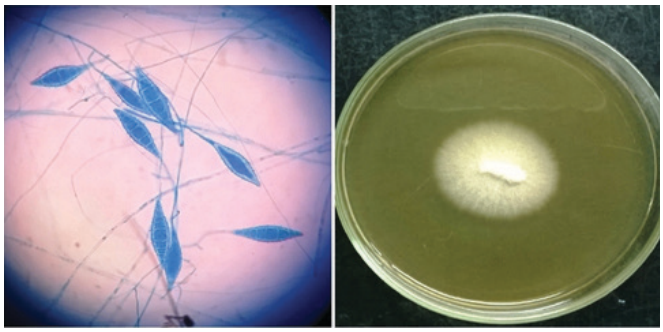

Figure 4: LPCB mount and culture of *Microsporum canis*.

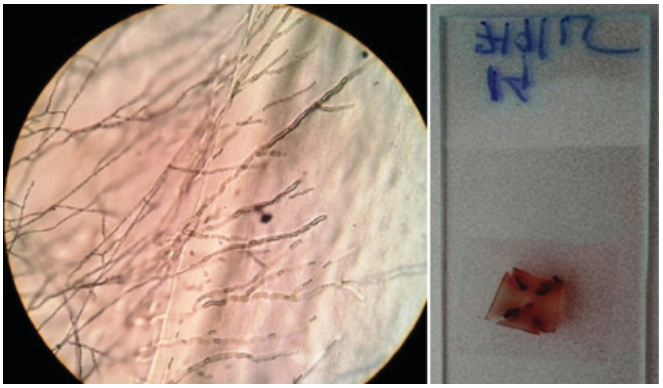

Figure 5: LPCB mount, culture and slide culture of *Trichophyton violacium*.

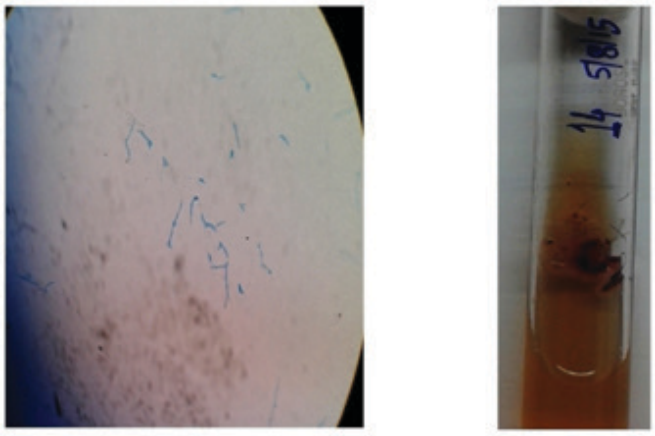

Figure 6: LPCB mount, culture and slide culture of *Trichophyton rubrum*.