Original Article

Trichoscopic and Clinico-Morphological Evaluation of Tinea Capitis

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Abstract

Introduction: Tinea capitis (TC) is a common fungal infection of the scalp, especially in children. Trichoscopy is a noninvasive technique that allows rapid and magnified *in vivo* observation of the hair with the visualization of morphologic features that are often imperceptible to the naked eye. **Aim:** This study aimed to evaluate the usefulness of trichoscopy in clinical diagnosis and to study various clinico-morphological patterns of TC. **Materials and Methods:** This cross-sectional, observational study included 140 clinically diagnosed cases of TC seen during a period of 1 year (April 2021 to March 2022). All patients were evaluated using a dermoscope (DermLite DL4 Multispectral 3 Gen, San Juan Capistrano, CA, USA,10×). **Results:** The prevalence rate of TC in this study was 2.69 per thousand population. The most common clinical variant was gray patch followed by kerion and black dot, and the most common etiological agent was *Trichophyton tonsurans*. The characteristic trichoscopic features were as follows: comma hairs (80%), followed by corkscrew hairs (68.6%), bent hairs (54.2%), zigzag hairs (35.7%), and morse code-like hairs (15%). Other findings included scaling (89.2%), followed by black dot (67.1%), broken hairs (42.8%), and crusting and pustules (32.1% each). Comma and corkscrew-shaped hairs were most common in the black dot type, whereas zigzag, bent hairs, and morse code hairs were common in the gray patch type of TC. There was a significant association between trichoscopic findings and type of TC. **Conclusion:** Trichoscopy can be considered a novel tool for rapid diagnosis and selection of the appropriate therapy and in the monitoring of treatment efficacy in TC.

Keywords: *Comma hair, cork-screw hair, "L"-shaped hairs, tinea capitis, trichoscopy*

Introduction

Tinea capitis (TC) is a superficial fungal infection of the hair follicle of the scalp and almost invariably involves the pediatric age group, although adult cases can also be seen in immunocompromised states. Among children, the worldwide prevalence of TC varies from 7.1% to 47.5%, while in India it is reported between 0.5% and 10%.[1,2] Geographical distribution within India varies, with *Trichophyton (T.) violaceum* (88.6%) being the most common etiological agent in North India; *T. violaceum* (60%) followed by *T. mentagrophytes* complex (43%) in hilly areas and *T. violaceum* (37.5%) followed by *T. rubrum* (21.8%) in South India; and *T. tonsurans* (61.1%) in Kashmir.[2-5]

The diagnosis is mainly clinical, aided by potassium hydroxide (KOH) mount, Wood's lamp examination, culture, and biopsy. However, these conventional mycological examinations are rather complex, time-consuming, and require trained personnel and mycological tools.[6] Trichoscopy is a noninvasive technique allowing rapid and magnified *in vivo* observation of the hair with the visualization of morphologic features often imperceptible to the naked eye.[7] It can be a useful tool for reaffirming the clinical diagnosis of TC and subsequent monitoring of therapy responses. This study aimed to evaluate the usefulness of trichoscopy in clinical diagnosis and to study various clinico-morphological patterns of TC.

Materials and Methods

This was an observational, cross-sectional study conducted from April 2021 to March 2022 at a tertiary care center. After obtaining approval from the Institutional Ethics Committee, we enrolled 140 consecutive, newly diagnosed cases of TC of both genders and all age groups. Those refusing consent and those who had undergone topical and systemic antifungal

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treatment for the last 1 and 6 months, respectively, were excluded from the study.

After obtaining written informed consent and a detailed history, a thorough general and dermatological examination was performed with respect to the morphology, distribution, and special features of the lesions. The clinical diagnosis was confirmed by mycological confirmation (KOH). Wood's lamp, biopsy, culture, and other necessary investigations were performed as and when required.

All the patients were subjected to trichoscopic examination using a DermLite DL4 Multispectral (3 Gen, San Juan Capistrano, CA, USA) trichoscope with a 30 mm lens system with 10 × magnification and cross-polarized and non-polarizing illumination. Despite this being an observational study, we have also followed 56 patients who were regular in follow-up to observe the changes in dermoscopic findings in response to antifungal therapy. Statistical analysis of the data collected was performed using the Statistical Package for Social Sciences (SPSS) version 25.0 and Microsoft Excel. Descriptive statistics were used, and the data were measured in terms of proportion. The significance of the difference in proportion was inferred by the Chi-square test. The level of significance was kept at 95% for statistical analysis.

Results

Of the 98,873 patients who attended our skin outpatient department during the study period, 266 presented with TC, accounting for a prevalence rate of 2.69 per thousand population. Of the 266 patients, 140 who met the inclusion and exclusion criteria were enrolled in the study.

The socio-demographic profile of 140 enrolled patients is depicted in Table 1. The most common age group affected was 5–12 years of age (63.4%), followed by <5 years (30%). The gender distribution was comparable, with a male-to-female ratio of 1.1:1 (73:67). The majority of the patients (59.3%) were from rural areas and belonged to the lower two strata of socioeconomic status (66.4%) according to the modified Kuppuswamy scale 2022. In the majority of patients (45.7%), the duration of the disease was 1–3 months, followed by <1 month (31.4%). The most common presenting feature was patchy hair loss with scaling (88.6%), and itching was the most common complaint (85%), followed by discharge (30.7%), scalp swelling (25.7%), and neck swelling (7.9%). The association of TC with other sites other than the scalp was observed in 13 patients: tinea faciei in seven, tinea corporis in five, and onychomycosis in one case.

All patients (140) were subjected to a wet-mount KOH examination, of which 117 were positive for fungal hyphae and spores. The culture was performed in those who were tested as negative on KOH examination (23 patients) and also in those who were willing to come back after 4–6 weeks for reports (22 patients). Among the total of 45 specimens subjected to culture, 33 cases showed the growth of the organism, which accounts for 73.3% of culture positivity. Most of the KOH-negative patients showed positivity in culture (20 of 23 patients). The most common species grown on culture were *T. tonsurans*, followed by *T. violaceum*, *T. mentagrophytes*, *T. rubrum*, *Microsporum (M.) canis*, and *M. gypseum*. On Wood's lamp examination, fluorescence was found among 36 patients, commonly bright green fluorescence is seen, which is a feature of microsporum species.

The most common clinical type of TC observed was gray patch (57.8%), followed by kerion (26.4%) and black dot (15.7%). The characteristic trichoscopic findings were comma hairs (80%), followed by corkscrew

Table 1: Socio-demographic profile of tinea capitis patients (Total *N*=140)

Demographic profile	*n* (%)
Sex	
Male	73 (52.1)
Female	67 (47.9)
Age (years)	
<5	42 (30)
5–12	89 (63.4)
12–18	8 (5.7)
>18	1 (0.7)
Mean age (years with SD)	6.5 ± 2
Residential area	
Rural	83 (59.3)
Urban	57 (40.7)
Socioeconomic status	
Upper middle	4 (2.9)
Lower middle	43 (30.70)
Upper lower	42 (30.0)
Lower lower	51 (36.40)
Duration (months)	
<1	44 (31.4)
1–3	64 (45.7)
3–6	13 (9.3)
>6	19 (13.6)
Personal history	
H/o similar illness in the past	10 (7.1)
H/o similar complaints in sibling	65 (46.2)
H/o contact with animal	53 (37.9)
Sharing of comb/bedding/clothes/towels/caps, etc.	100 (71.4)
Bathing/washing frequency	
- Daily	11 (7.9)
- Once per week	9 (6.4)
- Twice per week	76 (54.3)
- Thrice per week	44 (31.4)

hairs (68.6%), bent hairs (54.2%), zigzag hairs (35.7%), and morse code-like hairs (15%). Other findings included scaling in the majority (89.2%), followed by black dots (67.1%), broken hairs (42.8%), crusting and pustules (32.1% each), "i"-shaped hairs (12.1%), pigtail hairs (6.4%), and "L"-shaped hairs (5%) [Table 2 and Figures 1 and 2].

All three subtypes of TC showed significant differences in the proportion of trichoscopic findings. Comma hairs (86.4%) and corkscrew hairs (95.5%) were most commonly found in a black dot type of TC [Figure 3a and 3b], whereas zigzag hairs (40.7%), morse code-like hairs (23.5%), and bent hairs (56.8%) were commonly found in the gray patch type of TC [Figures 4a and 4b]. The correlation of culture findings in KOH-negative cases with trichoscopic findings is shown in Table 3.

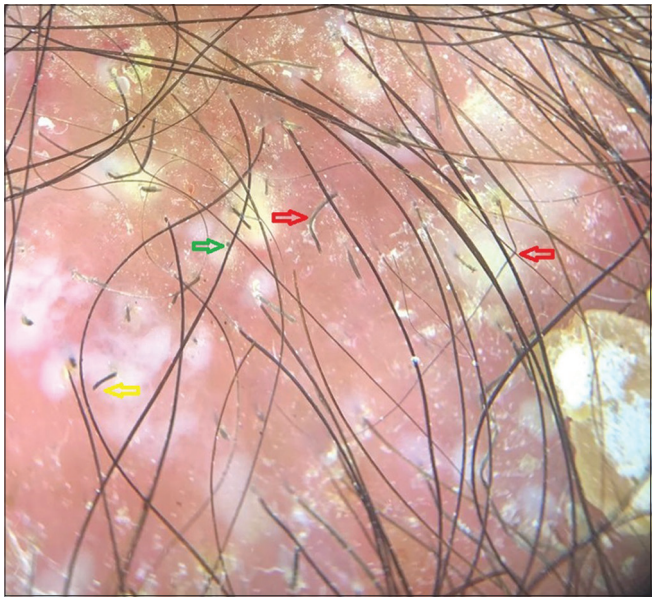

Figure 1: Trichoscopy shows "L"-shaped hair (red arrow), broken hairs (yellow arrow), and black dots (green arrow) in kerion (Dermlite DL4, 10x, polarized mode)

In our study, 56 patients were followed up, and it was found that specific trichoscopic findings such as comma hairs, corkscrew hairs, zigzag hairs, morse code-like hairs, and bent hairs disappeared in 4–6 weeks after therapy initiation. Perifollicular and diffuse scaling tend to resolve more slowly compared with hair shaft abnormalities.

Discussion

TC is the most frequent manifestation of dermatophyte infection in children, especially in lower socioeconomic groups. It is screened by microscopy (10% KOH hair mount) and confirmed by growth in Sabouraud dextrose agar (SDA) culture media that takes 3–4 weeks, causing delayed treatment that increases the risk of horizontal transmission in other family members.[8] Trichoscopy aids in rapid and early diagnosis to initiate prompt treatment and is also helpful in monitoring the treatment's efficacy.

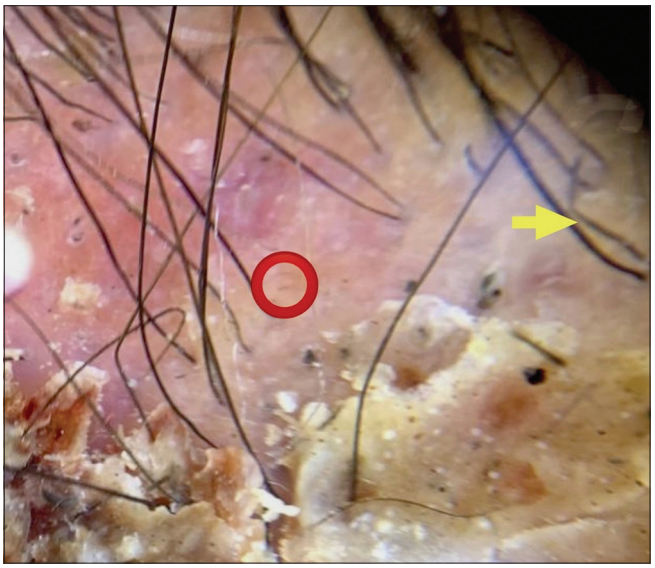

Figure 2: Trichoscopy shows pigtail hair (red circle) and L shaped hair (yellow arrow) in kerion (Dermlite DL4, 10x, polarized mode)

Table 2: Distribution of patients according to trichoscopic findings

Trichoscopic findings	Type of tinea capitis			*P* (Chi-square value)
	Gray patch (*n*=81)	Kerion (*n*=37)	Black dot (*n*=22)	
Comma hairs	68 (83.9%)	25 (67.6%)	19 (86.4%)	0.085 (4.921)
Corkscrew hairs	56 (69.1%)	19 (51.4%)	21 (95.5%)	0.002 (12.481)
Zigzag hairs	31 (40.7%)	11 (29.7%)	8 (36.3%)	0.666 (0.812)
Bent hairs	46 (56.8%)	19 (51.4%)	11 (50.0%)	0.780 (0.496)
Morse code-like hairs	19 (23.5%)	2 (5.4%)	0 (0.0%)	0.004 (11.097)
Scaling	74 (91.4%)	37 (100%)	14 (63.6%)	<0.001 (19.933)
Crusting	7 (6.8%)	37 (100%)	1 (4.5%)	<0.001 (106.304)
Pustules	10 (12.3%)	34 (91.9%)	1 (4.5%)	<0.001 (82.797)
Broken hairs	31 (38.3%)	27 (72.9%)	2 (9.1%)	<0.001 (26.641)
Black dot	47 (58.0%)	26 (96.2%)	21 (95.5%)	0.004 (11.210)
"i"-shaped hair	11 (13.6%)	5 (13.5%)	1 (4.5%)	0.494 (1.412)
Pigtail hairs	5 (6.2%)	4 (10.8%)	0 (0.0%)	0.259 (2.701))
L-shaped hair	1 (1.2%)	6 (16.2%)	0 (0.0%)	0.001 (13.375)

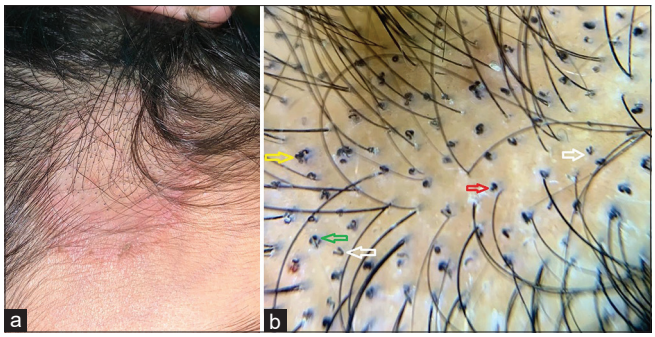

Figure 3: (a) Macroscopic view of black dot type of tinea capitis (b) Trichoscopic view, shows numerous comma hairs (red arrow), corkscrew hairs (yellow arrow), bent hairs (white arrow), and zigzag hairs (green arrow) in the black dot type (Dermlite DL4, 10x, polarized mode)

Table 3: Correlation of culture findings in KOH-negative cases with trichoscopic findings

Trichoscopic findings	KOH-negative cases (*N*=23)	
	Culture positive (*n*=20/23)	Culture negative (*n*=3/23)
Comma hairs	16	3
Corkscrew hairs	13	3
Zigzag hairs	4	0
Morse code-like hairs	3	1
Bent hairs	12	3

The prevalence rate of TC in our study was relatively low 2.69 per thousand population when compared to other studies 0.5-10 per thousand population, which can be attributed to the different geographical locations, cultural factors, and health-seeking behavior of patients.[1,2] In our study, the most common age group affected was 5 to 12 years (63.4%) and only one patient above 18 years of age had TC. The rarity of TC in adults is explained by the quantity of fungistatic saturated fatty acids in sebum, which increases at puberty, and the thicker caliber of adult hair, which protects against dermatophytic invasion. In adults, it generally occurs in immunosuppressed patients.[9] The majority of patients in our study belonged to the lower two strata of socioeconomic class (66.4%) according to the modified Kuppuswamy scale, and this could be attributed to lack of personal hygiene, overcrowding, poverty, and illiteracy, leading to the occurrence and spread of TC, and a similar trend was reported by Reddy *et al.*[10]

Of the various clinical variants of TC, the non-inflammatory type was most frequently encountered in 73.5%, followed by the inflammatory type (26.4%). A similar higher proportion of non-inflammatory types of TC has been reported in the past by Geetha *et al.*,[11] Kamalam *et al.*,[12] and Bose *et al.*[13] Among the non-inflammatory clinical variants, the gray patch is the most commonly observed type in our study (57.8%), which concurs with the studies by Aldayel *et al.*[14] and Sehgal *et al.*[15] In a study by Kalla *et al.*,[16] the black dot type was the most common type. The seborrheic type of clinical presentation was the most common type of TC in studies by Bose *et al.*[13] and Samarai *et al.*[17] which is not consistent with our study. This may be due to differences in the geographical distribution of dermatophytic species. Kerion (26.4%) was the most common clinically observed inflammatory type in our study, which is similar to the studies performed by Nath *et al.*[18] and Kamalam *et al.*[19]

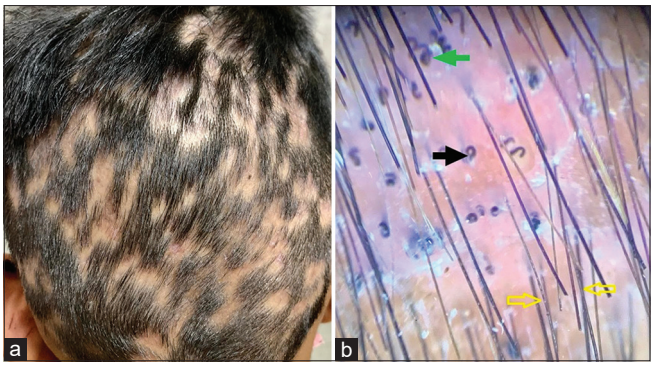

Figure 4: (a) Macroscopic view of gray patch type of tinea capitis (b) Trichoscopic view shows corkscrew hairs (green arrow), comma hairs (black arrow) and morse code-like hairs (yellow arrow) in gray patch type (Dermlite DL4, 10x, polarized mode)

The most common characteristic dermoscopic finding in our study was comma-shaped hairs (80%), followed by corkscrew hairs (68.6%), which is consistent with studies conducted by Arrazola-Guerrero *et al.*[20] (41%), Bhat *et al.*[21] (83%), and Isa *et al.*[22] (72%). Comma hairs are short hairs that appear as a comma punctuation mark and are homogeneous in color and thickness. They are slightly curved with fractured hair shafts, associated with ectothrix- and endothrix-type fungal invasions, and are probably shaped as a result of subsequent cracking and bending of a hair shaft filled with hyphae.[23] In 2008, Slowinska *et al.*[23] described for the first time the sign of comma hair in two children with TC. In 2011, Hughes *et al.*[24] reported the signs of corkscrew hair in six black children, especially in cases of *T. soudanense* infection. These two signs are often found simultaneously, within the same patient, which could be explained by the fact that our population is of an intermediate skin prototype.

In the current study, corkscrew hairs and zigzag-shaped hairs were seen in 68.6% and 35.7% of patients, respectively; these findings were also detected in another study.[24] The zigzag-shaped hairs or corkscrew hairs seem to be a variation of the comma hair, manifesting in black patients. Corkscrew hairs are multiple twisted and coiled hairs with corkscrew-like structures. These are predominantly noted in *Trichophyton* and *Microsporum* species. Zigzag hairs explain the structure of hair that is bent acutely at different angles, thus resembling the letter "Z."[25]

Bent hairs are characterized by bending of the hair shaft with homogeneous thickness and pigmentation and were found in 54.2% of cases. Morse code-like hairs, also known as barcode-like hairs, are due to perforation of the shaft by the

fungal spores and are seen in ectothrix infection, particularly in *Microsporum* species. This produces multiple white bands across the shaft resembling barcode, which, on higher magnification, appears as translucent areas representing fungal colonies.[26,27] They were found in 15% of cases in our study, in concordance with the study by Waśkiel-Burnat *et al.*[28]

Black dots, formerly called "cadaverized hairs," first observed by Sandoval *et al.,*[29] were also noted in 67.1% of our patients. They are remnants of broken or dystrophic hairs, fractured before emerging from the scalp, and provide a sensitive marker for disease activity as well as severity, but they are not specific to TC as they are also observed in alopecia areata. Short broken hairs result either from the transverse fracture of weakened terminal hair shafts by the inflammatory process or by the rapid regrowth of incompletely destroyed hair shafts that previously formed the black dot. This feature was observed in 42.8% of cases in the current study. A similar finding has been reported in a few other studies.[29,30] They are nonspecific trichoscopic findings as they are also found in alopecia areata and trichotillomania, but they may be a sign of the severity of the disease. Ekiz *et al.*[31] observed broken and dystrophic hairs, comma-shaped hairs, corkscrew hairs, and black dots as trichoscopic features of TC, which were also observed in our study.

Perifollicular and interfollicular scaling was seen in 89.2% of our patients, which differentiates it from alopecia areata and trichotillomania. "i"-shaped hairs are block hairs with an accented distal end,[27] resembling the English alphabet "i," and were found in 12.1% of patients. They are not specific to TC, as they are also present in patients with alopecia areata and trichotillomania.[32] We also found two unique findings that have not been reported previously. Pigtail hairs in 6.42% and "L"-shaped hairs in 5% of patients are predominantly seen in kerion and need to be validated in future trichoscopy studies of TC. Pigtail hairs are short vellus hair that is coiled inward and attached to the scalp surface and can also be observed in alopecia areata, whereas "L"-shaped hairs resemble the English alphabet "L."

Hughes *et al.*[24] stated that comma-shaped hairs and corkscrew hairs were detected in zoophilic infection. In our study, a history of contact with animals was found in 53 (37.9%) patients, and on culture, zoophilic species such as *Microsporum canis*, *T. mentagrophytes*, and *T. verrucosum* were isolated. This high incidence of animal contact may be attributable to farming and the low socioeconomic status of our patients.

We have also classified our trichoscopic findings based on various clinical variants of TC. Comma and corkscrew-shaped hairs were most commonly found in the black dot type, whereas zigzag, bent hairs, and morse code hairs were most commonly found in the gray patch type of TC, which is consistent with the studies by Kumar *et al.*[30] and Waśkiel-Burnat *et al.*[28] and in contrast to the study of Isa *et al.*[22] where comma and corkscrew hairs were significantly present in the gray patch variant. The study by Bourezane and Bourezane on 24 patients indicated that infection caused by endothrix agents was responsible for abnormalities in hair shape, while infection caused by ectothrix agents was responsible for abnormalities in hair color, and finally, infection caused by both ectothrix and endothrix agents presented as a mixed dermoscopic pattern.[33] This is consistent with the results of our study, where comma and corkscrew hairs were significantly present in the black dot type of TC.

These dermoscopic findings seem interesting when considering the choice of probabilistic treatment, especially with the emergence of species more sensitive to terbinafine than to griseofulvin. As reported in the guidelines for the management of TC in England, the first-line treatment is terbinafine for trichophytic tinea (commonly manifested as the black dot) and griseofulvin for microsporic tinea (commonly manifested as the gray patch).[34]

Conclusion

Trichoscopy is akin to the dermatologist's stethoscope. It is a rapid, inexpensive, noninvasive, and modern diagnostic tool that helps in diagnosis and differentiating TC from other clinically similar dermatoses (trichotillomania or alopecia areata or seborrheic dermatitis) by magnifying both surface and subsurface features up to 10 times. It is not only of value in the diagnosis of TC but also in the selection of the appropriate therapy and in the monitoring of treatment efficacy, as it may be used to verify the disappearance of trichoscopic signs after therapy. Moreover, it may be helpful as a rapid screening tool in high-risk population.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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