

Tinea Capitis in Black Children

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SUMMARY

Tinea capitis superficialis is a common disease among urban Black children attending schools and crèches in Soweto, and is caused mainly by *T. violaceum* and endothrix anthropophilic fungus. Dissemination of this infection may be the result of human contact in overcrowded schools and crèches rather than of poor hygiene and/or malnutrition.

Combined treatment using systemically-administered griseofulvin and topical application of clotrimazole seems to be highly effective.

S. Afr. Med. J., 48, 2215 (1974).

The remarkable increase of interest in skin diseases caused by fungi has been associated with a better understanding of these cutaneous infections. The abundant literature shows that dermatologists, mycologists and bio-immunologists have worked in close collaboration in an effort to make dermatomycoses more familiar to practitioners. More intelligible classification, new views on their aetiopathogenesis and immune mechanism, more detailed information of their geographical distribution and incidence, a development of more effective drugs, and the assignment of funds to promote prophylaxis and control campaigns, are reported in hundreds of papers.

In spite of the progress, some problems still remain unsolved. One of these, the geographical distribution of dermatomycoses, had led to controversial reports. Van-breuseghem and De Vroey¹ pointed out the difficulty 'of establishing a geographical distribution of dermatophytes', and suggested expressing the dermatophytic geographical spectrum 'according to body locations', and according to certain parameters such as age, sex, occupation and so on.

In South Africa some remarkable papers have been published on this subject. Some of them present figures related to specimens collected at random,² others are more precise, and with detailed parameters report epidemiological data for Whites,³ whose customs and standards of living differ considerably from those of Blacks, whereas a recent article by Brede⁴ is precise in classification but randomised in terms of ethnic distribution.

At Baragwanath Hospital, which caters for an urbanised Black population of approximately three-quarters of a million persons living in Soweto, superficial dermatomycoses account for 4.47% of all cutaneous disorders. This figure—estimated over a period of approximately 5 years—is certainly the lowest reported in recent papers from different countries. In Israel, Tager *et al.*⁵ found an

incidence ranging from 25% to 33%; Sylva⁶ from Brazil reported 22.7%, while Kotrajaras and Udihintamonda⁷ in Thailand reported 40%.

The incidence in our Black children accounts for 28.06% of these diseases. The age range is from 1 to 10 years and the sex distribution shows an equal proportion of males and females. These figures are similar to those reported by Findlay⁸ in his White population of Pretoria.

The most common clinical manifestation observed in Black children is scaling (*tinea capitis superficialis*), and an occasional kerion-like appearance, but no cases of favus were seen. Some clinical findings, such as the duration of this condition, its frequent relapse, its spread among the schools, the contamination of several siblings, the rarity of fluorescence to Wood's lamp, and the frequent finding of an endothrix strain on potassium hydroxyde (KOH) and Parker Superquink blue-black ink microscopy, suggested that a survey in the endemic area could lead to the identification of the types of fungi involved and to a better explanation of the trend of the disease.

PATIENTS AND METHODS

This survey was conducted on 5 058 Black children at crèches and primary schools in Soweto. Of these children, 1 074 were aged from 2 to 6 years, and 3 984 were 7 to 12 years of age.

A group of 15 children, in whom the infection was detected by both microscopy and culture, was then selected for clinical trial in order to compare the efficiency of a new topical agent, clotrimazole, with the more popular griseofulvin.

Facilities for this survey were granted by the Bantu Educational Board and the collaboration of the teachers was exemplary. All children were seen at their schools and crèches, and the screening was performed by the same investigator. Age, sex, and clinical manifestations were recorded. Table I sums up the figures of specimens

TABLE I. AGE DISTRIBUTION AND SPECIMENS COLLECTED

No. of children	Age 2-6 yrs	Age 7-12 yrs
5 058	1 074	3 984
Specimens	MC* +	MC -
263	223	40
Age 2-6 yrs	98	19
Age 7-12 yrs	125	21
Age distribution		
Age 2-6 yrs	9,12%	
Age 7-12 yrs	3,13%	

* MC = microscopy and culture.

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Date received: 4 June 1974.

collected, the age distribution and the results on microscopy and culture.

Specimens were collected only from children showing evidence of scaling, broken-off hairs and uniformly short 'hair-stumps' on the scalp. The method used for sampling, known as superficial biopsy, is that described by Marks and Dawber.⁸ It is performed with a special adhesive glue, Permabond, a cyanocrylate derivative. This is applied to the affected site of the scalp after cleansing with ether. One drop of Permabond is placed at the site and a glass slide is pressed gently over this. The glass slide is removed after 30 seconds. A layer of hairy skin remains attached to the slide, and because of the transparency of the adhesive, the material collected is suitable for microscopy and culture. Two surface specimens were collected and submitted to the Microbiology Department of the SAIMR, one for culture and the other for modified PAS-staining.

The cultures were performed by placing the surface biopsy specimen skin-side down on an Actidione plate (dextrose agar + Chloromycetin + cycloheximide) on day 1, and allowing it to incubate at 25°C. On day 3 the slide and biopsy specimen were transferred to a new Actidione plate. Both plates were reincubated for up to 3 weeks. During this period of time they were regularly examined for dermatophytes.

The second slide was used for modified PAS-staining. Using cotton, the surface biopsy specimen was tied on to the slide as one would tie a parcel. This prevented the material from floating off the slide when it was being dehydrated. The staining was done as follows: 1 min in 100% alcohol, 10 min in 1% periodic acid-Schiff, 20 min in Schiff's reagent, 16 seconds in light green, when it was washed in distilled water, dehydrated by passing through 70, 80, 90, and 100% alcohol, and ending in xylol. It was mounted in De-Pex mounting medium. The slides were examined for the presence of PAS-positive spores and hyphae.

Out of 263 specimens 223 yielded positive cultures. Table II shows that the species of fungi were distributed as follows: *Trichophyton violaceum* 75,33%, *Microsporon audouinii* 21,52%, *M. canis* 0,89% and mixed 2,26%.

TABLE II. DERMOPHYTES SPECTRUM

Infecting fungus		(%)
<i>T. violaceum</i>	168	75,33
<i>M. audouinii</i>	48	21,52
<i>M. canis</i>	2	0,89
Various*	5	2,26
Grand total		
Anthropophilic		96,85
Zoophilic		3,15

* *T. violaceum* + *M. audouinii*; *T. violaceum* + *M. canis*.

T. violaceum was easily recognised by its typical appearance and colour, *M. canis* and *M. audouinii* were differentiated by the use of the rice grain tests. *M. canis* produces large spindle-shaped macroconidia, with thick, rough walls.

M. audouinii has numerous terminal spores, and pectinate hyphae.

Concomitantly we compared the efficacy of a new topical agent with the activity of systemically administered griseofulvin, and the effect of the combination of the two drugs. The new agent, clotrimazole (Bay-b 5097) is a tritylamidazole derivative, and shows a broad spectrum of action against dermatophytes, yeasts and other fungi, and it is also active against Gram-positive organisms.⁹ The series of children submitted to the trial fulfilled the requirements mentioned by Clayton and Connor,¹⁰ in that all patients affected by a naturally occurring infection caused by *T. violaceum*, were of the same racial extraction, of the same age group, living in the same area and under the same social and economic conditions. Consent procedures conditioned the number of children submitted to the trial on a voluntary basis.

Of the series, 15 children were selected and divided into 3 groups of 5 children each. One group was treated topically with 1% clotrimazole cream (2 applications/day), a second group was treated systemically with orally administered griseofulvin in micronised form and adequate dose (12,5 mg/kg/day), and a third group was treated with the combination of griseofulvin and topical clotrimazole. The duration of treatment was 4 weeks for all groups. Clinical and microscopic investigations were carried out at weekly intervals. Table V reports the results.

TABLE III. AGE AND SEX DISTRIBUTION

Age (yrs)	<i>T. viol.</i>		<i>M. audouinii</i>		<i>M. canis</i>		Various	
	M	F	M	F	M	F	M	F
2 - 6	36	22	22	15	—	—	—	3
7 - 12	69	41	7	4	1	1	1	1

TABLE IV. GEOGRAPHICAL VARIATIONS OF DERMATOPHYTES CAUSING TINEA CAPITIS

	Fungus	(%)
Morocco (Levy-Lebhar, 1955)	<i>T. viol.</i>	25 - 40
Israel	<i>T. viol.</i>	40 - 60
Kinshasa	<i>T. viol.</i>	6 - 7
Ruanda-Urundi	<i>T. viol.</i>	32,5
Luluabourg	<i>T. viol.</i>	40 - 70
Chad	<i>T. viol.</i>	60,00
Algeria (Moslems)	<i>T. viol.</i>	23,60
Sahara	<i>T. viol.</i>	52,63
Morocco (Rollier, 1964)	<i>T. viol.</i>	80,00
Algeria (Europ.)	<i>M. canis</i>	89,47
Mozambique	<i>M. aud.</i>	60,60
	<i>T. viol.</i>	23,20
	<i>M. canis</i>	8,90
Zambia	<i>M. aud.</i>	43,00
	<i>T. viol.</i>	11,00
	<i>M. canis</i>	4,00
Johannesburg	<i>T. viol.</i>	75,33
	<i>M. aud.</i>	21,52
	<i>M. canis</i>	0,89

TABLE V. MICROSCOPY BEFORE AND AFTER TREATMENT

Cases	Fungus	Before treatment	After treatment			
			1 wk	2 wks	3 wks	4 wks
Topical clotrimazole						
M-5	<i>T. viol.</i>	+	+	+	+	±
M-3	<i>T. viol.</i>	+	+	+	+	+
F-2	<i>T. viol.</i>	+	+	+	+	+
F-5	<i>T. viol.</i>	+	+	+	+	±
M-5	<i>T. viol.</i>	+	+	+	+	±
Systemic griseofulvin						
FP						
F-8	<i>T. viol.</i>	+	+	+	±	—
M-2	<i>T. viol.</i>	+	+	+	+	—
F-6	<i>T. viol.</i>	+	+	±	—	—
M-10	<i>T. viol.</i>	+	+	±	—	—
M-12	<i>T. viol.</i>	+	±	±	—	—
Systemic griseofulvin						
FP + clotrimazole						
M-7	<i>T. viol.</i>	+	+	—	—	—
M-2	<i>T. viol.</i>	+	+	—	—	—
F-7	<i>T. viol.</i>	+	±	—	—	—
F-9	<i>T. viol.</i>	+	+	±	—	—
F-5	<i>T. viol.</i>	+	+	—	—	—

M-5 = male of 5 years; + = very abundant spores; ± = remarkable decrease in spores.

DISCUSSION

In a survey of tinea capitis superficialis detected among 5 085 schoolchildren in Soweto, 263 of them were affected by a clinical picture consistent with a diagnosis of ringworm of the scalp, but only 223 specimens were found positive on both microscopy and culture. The failure rate of 15.2% is a remarkably low figure when compared with that reported by Knudsen,¹¹ and also reasonably acceptable according to the statement¹² that 'a failure rate of 10% is not unusual in any service'. It is our impression that Marks and Dawber's⁸ method of sampling may reduce the failure rate of cultures. On the other hand, errors of clinical assessment, insufficient material collected, and in some cases inadequate adhesion of Permapond to the hairy skin, may account for failure.

The analysis of our results shows that the anthropophilic fungi are responsible for the vast majority of dermatomycoses affecting the scalps of Black children. Children between the ages of 2 and 6 years appear to be more susceptible.

An outstanding point arising from this survey is that *T. violaceum* plays the major role, and it is followed by *M. audouinii*, whereas *M. canis* involvement is negligible. These figures are in evident contrast with those reported by Brede,⁴ who stated that '*T. violaceum* disappears in the high and dry areas, and it is not often found in the highlands of the Cape, in the Orange Free State or in the veld of the Transvaal, but it appears again in the lowveld of Transvaal . . . '.

Table IV shows that *T. violaceum* is abundantly encountered in various parts of Africa, where its presence reaches the highest proportion in Morocco.¹³ Our findings and those of Scott¹⁴ seem to confirm the view that this

fungus has gained ground in recent years, and therefore a revision of its incidence and geographical distribution is advisable. It is not yet reported whether certain factors such as race, age, sex and nutritional and socio-economic standards play a role with regard to the increased dissemination of *T. violaceum*, but there is evidence that children of negroid extraction are particularly susceptible to it.

To give more validity to our survey it must be underlined that it was based on set parameters indicated by Vanbreuseghem and De Vroey,¹ mainly the body location, the uniform population, the age, sex and standard of life, and the socio-economic status of the children. In addition it must be borne in mind that our findings mirror the epidemiological situation of an urbanised community having only occasional contact with carrier animals. This urbanised community enjoys a better standard of living than its rural counterpart, and the degree of personal hygiene may be regarded as highly satisfactory. Nevertheless, close personal contact in relatively restricted areas such as schools and crèches, bears direct responsibility for more frequent contact between infected individuals or carriers and healthy children. This consideration deserves the attention of the public health service, and throws light on the necessity for periodic inspection of schools and crèches.

Finally, Table V summarises the results of a comparative treatment. Although the clinical trial was carried out in a small batch of children (voluntary procedure limiting the number of patients admitted to the trial), it is of practical value to draw some conclusions on the results.

Although it is well known that griseofulvin represents the drug of choice for tinea capitis, it was also proved that this medicament may produce side-effects on long-term use, and is only slowly diffusable into the keratinous

structures. Particularly in dermatophytic infections caused by *Trichophyton endothrix* (*T. violaceum*) similar to the invisible but continuous shedding of the stratum corneum is a desquamation of the follicular keratin whereby some of the fungus elements could be eliminated undestroyed.¹⁵ It is therefore obvious that in these disorders one must combine the action of griseofulvin with that of topical fungicidal drugs, so that potentially viable fungi located in the tips of the infected hair may be reached by the medicament long before the slow-penetrating griseofulvin. These considerations may justify the increasing volume of recent research on more active topical fungicides. In our experience, in hundreds of cases of dermatophytic infections, we have seen that the combined treatment yielded more satisfactory results.

In this trial it is evident that systemic administration of griseofulvin appears to have more beneficial effect than topical applications of clotrimazole. Direct examination with KOH at weekly intervals showed that griseofulvin was able to control this disease within 3 weeks in 4 out of 5 patients. On the other hand, microscopy of specimens collected from scalps of all subjects treated with the topical agent showed the presence of abundant spores after 4 weeks. Contrariwise, the combined treatment with systemically administered griseofulvin and topically used clotrima-

zole showed that after 2 weeks 4 out of 5 specimens were found negative on KOH examination. The practical value of this observation is obvious, particularly when this method of treatment applies to a community in which prophylactic measures are as important as therapeutic measures.

We wish to thank Professor H. J. Koornhof of the SAIMR, Bayer Pharmaceuticals (SA) (Pty) Ltd, and the Bantu Educational Board for facilities.

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