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Dermatophyte and Cyclohexamide-Resistant Fungi Isolated from Patients with Tinea Capitis and from Air in Hospitals in Minia, Egypt

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ABSTRACT: Out of 210 tinea capitis cases studies, 16 were negative when examined with KOH, among the remaining 194 cases, 123 were males (63.4%) and 71 were females (36.6%) and the age of incidence ranged between 7 and 15 years. *Microsporum* was the main causal agent being identified in 82 cases (42.3%) and was represented by 5 species among which *M. canis* was common in Egypt (55 cases, 28.4%). *Trichophyton* constituted 32% and was represented by 8 species among which *T. violaceum* was the most common (24.2% of total cases). *Candida* were isolated from 3.6% of total cases. The 47 species and twenty-five genera from nondermatophyte-cyclohexamide resistant fungi were recovered from the diseased skin tissue. *Penicillium* and *Aspergillus* were the most abundant followed by *Scopulariopsis, Alternaria, Thermoascus, Chrysosporium* and *Cladosporium*. Studies of the air-borne fungi in-door the hospital wards revealed the occurrence of 57 species belonging to 28 genera, among which *Aspergillus flavus, Penicillium chrysogenum, P. corylophilum, A. niger, Tritirachium rosum* and *Alternaria alternata* were the most common. Results of the out-door experiments were basically similar to those of the in-door experiments.

KEYWORDS: Dermatophytes, cyclohexamide, tinea captitis, fungi.

Tinea capitis is a common and widely distributed disease throughout the world. It was reported from; Iran(Chadgani *et al.*, 1987); Argentina (Tello & Chappuis, 1984); West of Scotland (Gentles & Scott, 1981); India (Khosa *et al.*, 1981); Australia (McAlleer, 1981); and from Kuwait (Karaoui *et al.*, 1979). In Egypt, tinea capitis in Cairo (Verhagen, 1979); In Ismaila (Abdallah *et al.*, 1986) and in Assiut (Abdel-Hafez *et al.*, (1980).

Studies on fungal air spore in hospitals could provide information on dissimination and spread of fungal spores causing mycosis. Such studies are lacking in Egypt, particularly at hospitals in upper Egypt. Generally, studies on keratinolytic fungi of the air are rare (Alteras and Lehrer, 1977 and Della Franca and Caretta, 1984). In Egypt, Maghazy (1989) studied the keratinophilic fungi of the air and the floor dust in primary schools in Assiut.

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The aim of this study was to study the dermatophytic causal agents and the non-dermatophytic combined infections of tinea capitis Minia Governorate. The fungal flora of the air in the hospitals where patients with mycosis are located is also reported.

Materials and Methods

Two hundred and ten patients diagnosed clinically as tinea captits in three hospitals at Minia city (Skin and Venereal clinic at Minia University hospital, Dermatology and Venereology disease clinic and Dermatology clinic at Minia chest hospital) were studied. Specimens for mycological study were obtained from the lesions after wiping the surfaces with 70% ethyl alcohol to remove surface adhering organisms and dust from the skin. These were then packed in steril filter paper envelops, sealed and labelled. Care was taken to avoid contamination with tick scales which were

mostly composed of debris and dirt but no fungal elements. Direct microscopic examination of KOH preparations was carried out. Fungal isolations were performed on Sabouroud's dextrose agar medium (Moss and McQuown, 1969) supplemented with 20 I.U./ml sodium salt of penicillin, 40 μg/ml dihydrostreptomycin and 0.05% cyclohexamide (actidione). Before adding to the agar, the first two antibiotics were separately dissolved in sterile distilled water while the third was dissolved in methanol. Plates were incubated at 28℃ for 3-4 weeks and the developing colonies were examined and identified.

Determination of air-borne fungi was performed by exposing Petri plates containing Sabouraud's dextrose agar supplemented with the antibiotics mentioned previously to the air once every month for 2 hours between 9:00 AM - 1:00 PM during a year period. Exposure took place in the in-door and out-door in the hospital wards in Dermatology and Venereology disease clinic, Minia. Plates were incubated at 30℃ for 2 weeks, colonies were counted and fungi were isolated and identified.

Results and Discussion

Dermatophytes from diseased skin tissues: Out of 210 cases, 16 were negative for what ? when examined with KOH. Among the remaining 194 positive cases, 123 were males (63.4%) and 71 were females (36.6%), indicating more tinea capitis infected males then females. In this respect it could be mentioned that, Guinani & NjoKu-OBL (1986) also noticed more males infected with tinea capitis than females and similar results were also recorded in Eastren Nigera by Wolf *et al.*, (1986) and by Abdel-Hafez *et al.*, (1980) in Assiut. On the contarary, Abdallah *et al.*, (1986) in Ismailia city observed more females infected with tinea capitis than males.

The age incidence of tinea capitis ranged between one and 15 years (Table 1). Two age groups (1-5 years and 6-10 years) contributed 78 cases each (40.2%) and 38 cases belonged to the age group 11-15 years (19.6%). Comparing our data with those reported by other investigators, it could be mentioned that; in Jordan, Shtayeh & Arda (1985) recorded higher frequency of tinea capitis in children up to 14 years, and in Nigera, Ajao & Akintude (1985) recorded more tinea capitis in 1-13 years-old children. This means that infection by tinea capitis is generally more frequent among children up to 13-14 years old.

Table 1. Age distribution of tinea capitis (194 cases).

Age group by years	No. of cases	%
1-5	78	40.21
6-10	78	40.21
11-15	38	19.59
Total	194	100.00

Microsporum, Trichophyton and *Candida* were the main dermatophytes associated with tinea capitis as indicated in Table (2) and Fig. (1). *Microsporum* was isolated more frequently and was represented by 5 species among which *M. canis* was the most dominant and was isolated from 55 cases. This fungus was reported to be the most common causal organism of tinea capitis in Jordan, (Shtayeh & Arda, 1985); in London, (Ridley, 1979); in Cairo, Egypt, (Verhagen, 1974) and in Assiut (Abdel-Hafez *et al.*, 1980). On the other hand, *M. audouinii* (which isolated less frequently) was reported to be the main causal organism of tinea capitis in Nigeria, (Ajao & Akintude, 1985) and in USA (Sinski & Kelley, 1987). Other *Microsporum* species were very rare and were isolated from 1-4 patients only.

Trichophyton was the second most prevalent causal agent of tinea capitis (recorded in 32% of total cases) with eight species identified among which, *T. violaceum* was the most common. This fungus was also the main etiological agent of tinea capitis in Sengal and Mouritani Valley (Marill *et al.*, 1976) and in Assiut, Egypt (Abdel-Hafez *et al.*, 1980). Other *Trichophyton* sp were infrequent and occurred only in 1-4 cases.

Candida ranked third among the dermatophytes isolated. It was isolated from 7 males only accounting for 3.6% of the total cases and was represented by 3 species: *C. albicans, C. tropicalis* and *Candida* sp. *Candida* species were recovered from

Table 2. The isolation and occurrence of fungal dermatophytes isolated from human patients infected with tinea capitis.

Genera & Species	No. of cases of isolation			% of occurrence			O. R.
	O+♀	O	♀	O+♀	O	♀	O+♀
Microsporum	82	52	30	42.3	26.8	15.5	H
M. canis	55	32	23	28.4	16.5	11.9	L
M. audouinii	23	16	7	11.9	8.3	3.6	R
M. persicolor	2	2	0	1.0	1.0	0.0	R
M. vanbreuseghemii	1	1	0	0.5	0.5	0.0	R
Microsporum sp.	1	1	0	0.5	0.5	0.0	R
Trichophyton	62	40	22	32.0	20.6	11.3	L
T. violaceum	47	31	16	24.2	16.0	8.2	L
T. mentagrophytes	4	3	1	2.1	1.6	0.5	R
T. longifusus	3	0	3	1.5	0.0	1.5	R
T. schoenleinii	2	2	0	1.0	1.0	0.0	R
T. tonusurans	1	0	1	0.5	0.0	0.5	R
T. mentagrophytes var. *quinckeanum*	1	1	0	0.5	0.5	0.0	R
T. rubrum	1	1	0	0.5	0.5	0.0	R
Trichophyton sp.	3	2	1	1.6	1.0	0.5	R
Candida	7	7	0	3.6	3.6	0.0	R
C. albicans	2	2	0	1.0	1.0	0.0	R
C. tropicalis	2	2	0	1.0	1.0	0.0	R
Candida sp.	3	3	0	1.5	1.5	0.0	R

O. R. = Occurrence remarks.
H = High occurrence: more than 65 cases (out of 194 cases).
L = Low occurrence: between 30-65 cases.
R = Rare occurrence: less than 30 cases.

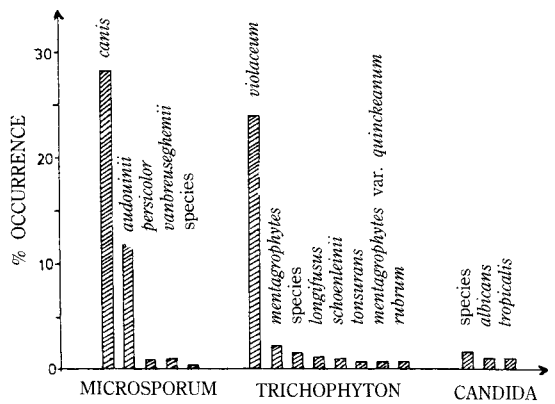

Fig. 1. The occurrence of dermatophytes isolated from Tiea capitis.

tinea capitis lesions from USA (Cox, 1986), Argentina (Silvia *et al.*, 1986) and from Nigeria (Ogbonna *et al.*, 1986).

Non-dermatophytes from diseased skin tissues: Twenty-five genera and forty-seven species from other keratinophilic and cyclohexamide resistant frungi were recovered as associated fungi with tinea capitis infection as shown in Table (3). *Penicillium* and *Aspergillus* were the most predominant saprophytic genera isolated. These were recovered from 48 and 24 cases comprising 24.7% and 12.4% of the total cases studied and were represented by 8 and 6 species respectively. *Sco-*

Table 3. The isolation and occurrence of cyclohexamide-resistant fungi isolated from human patients infected with tinea capitis.

Genera & Species	No. of cases of isolation	% of occurrence	O.R.	Genera & Species	No. of cases of isolation	% of occurrence	O.R.
Penicillium	48	24.7	L	*Cladosporium*	5	2.6	R
P. chrysogenum	20	10.3	P	*C. herbarum*	2	1	R
P. corylophilum	11	5.7	R	*C. cladosporioides*	2	1	R
P. lilacenum	5	2.6	R	*C. sphaerospermum*	1	0.6	R
P. citrinum	4	2.0	R	*Acremonium*	4	2	R
*P. funiculosum*sp.	3	1.5	R	*A. strictum*	1	0.5	R
P. brevi-compactum	2	1	R	*A. kiliense*	1	0.5	R
P. purpurogenum	2	1	R	*A. roseum*	1	0.5	R
P. surantio-vireus	1	0.5	R	*Acremonium* sp.	1	0.5	R
Aspergillus	24	12.4	R	*Mucor*	2	1	R
A. ochraceus	8	4	R	*M. racemosus*	1	0.5	R
A. flavus	6	3	R	*M. pusillus*	1	0.5	R
A. niger	6	3	R	*Myrothecium verrucaria*	1	0.5	R
A. oryzae	2	1	R	*Chaetomium indicum*	1	0.5	R
A. candidus	1	0.5	R	*Sporendronema* sp.	1	0.5	R
A. sydowii	1	0.5	R	*Trichoderma harizianum*	1	0.5	R
Scopulariopsis	8	4	R	*Myceliophthora anamorph of Arthroderma tuberculatum*	1	0.5	R
S. brevicaulis	6	3	R	*Gymnoascus reesii*	1	0.5	R
S. prumbitii	2	1	R	*Ulocladium atrum*	1	0.5	R
Alternaria alternata	6	3	R	*Trichothecium roseum*	1	0.5	R
Thermoascus aurantiacus	5	2.6	R	*Geotrichum candidum*	1	0.5	R
Chrysosporium	5	2.6	R	*Stachybotrys atra*	1	0.5	R
C. keratinophilum	3	1.5	R	*Phialophora spinifera*	1	0.5	R
C. tropicum	2	1	R	*Phialophora* sp.	1	0.5	R
Malbranchea	3	1.5	R	*Scolecobasidium humicola*	1	0.5	R
M. chrysosporioidea	2	1	R	*Hormiactis candida*	1	0.5	R
Malbranchea sp.	1	0.5	R	*Paecilomyces lilacinus*	1	0.5	R
Microascus trigonosporus	2	1	R				

O. R. = Occurrence remarks.
H = High occurrence: more than 65 cases (out of 194 cases).
L = Low occurrence: between 30-65 cases.
R = Rare occurrence: less than 30 cases.

pulariopsis was isolated from 8 cases; *Alternaria*, 6 cases; *Thermoascus*, *Chrysosporium* and *Cladosporium* (5 cases for each). The remaining species were recovered from less than 5 cases. These non-dermatophytic cyclohexamide resistant fungi are not responsible for causing the disease and did not originate as contaminantes during preparation and isolation of specimens, but represent saprophytes or secondary invadors of the damaged skin substrate.

Table 4. In-door air-borne fungi in the hospital wards during one year period.

Genera & Species	Total count	Percentage of total count	Number of months of isolation	O.R.
Total count	654			
Aspergillus	152	23.24	11	R
A. flavus	86	13.15	6	M
A. niger	54	8.26	5	M
A. ochraceus	4	0.61	3	M
A. sydowii	6	0.92	2	L
A. nidulans	1	0.15	1	L
A. melleus	1	0.15	1	L
Penicillium	223	34.10	10	H
P. chrysogenum	67	10.24	8	H
P. corylophilum	56	8.56	7	H
P. citrinum	44	6.73	4	M
P. luteum	7	1.07	2	L
P. funiculosum	4	0.61	2	L
P. thomii	8	1.22	1	L
P. miczynskii	16	2.45	1	L
P. cyclopium	1	0.15	1	L
P. rubrum	1	0.15	1	L
P. capsulatum	1	0.15	1	L
Acremonium	33	5.05	10	H
A. strictum	15	2.29	6	M
Acremonium spp.	7	1.07	4	M
A. kiliense	4	0.61	3	M
A. rutilum	7	1.07	3	M
Alternaria	33	5.05	8	H
A. alternata	32	4.89	8	H
A. tenuissima	1	0.15	1	L
Chrysosporium	20	3.05	8	H
C. keratinophilum	9	1.38	4	M
C. queenslandicum	3	0.45	3	M
Chrysosporium	5	0.76	3	M
C. xerophilum	2	0.31	1	L
C. tropicum	2	0.31	1	L
Cladosporium	33	5.05	6	M
C. cladosporioides	27	4.13	5	M
C. macrocarpum	5	0.76	2	L
C. herbarum	1	0.15	1	L
C. sphaerospermum	2	0.31	1	L

Tabel 4. Continued

Genera & Species	Total count	Percentage of total count	Number of months of isolation	O.R.
Candida	8	1.22	4	M
C. albicans	6	0.92	3	M
C. tropicalis	1	0.15	1	L
Candida sp.	1	0.15	1	L
Malbranchea	8	1.22	4	M
Malbranchea	7	1.07	3	M
M. chrysosporioidea	1	0.15	1	L
Tritirachium roseum	40	6.12	2	L
Scopulariopsis	3	0.45	2	L
S. brevicaulis	2	0.31	1	L
S. brumptii	2	0.31	1	L
Mucor racemosus	3	0.46	2	L
Geotrichum candidum	2	0.31	2	L
Botryotrichum piluliferum	2	0.31	2	L
Gliocladium roseum	1	0.15	2	L
Thermoascus aurantiacus	2	0.31	2	L
Monodictys levis	3	0.45	1	L
Trichurus spiralis	1	0.15	1	L
Emericellopsis spp.	1	0.15	1	L
Phialophora fastigiata	1	0.15	1	L
Auxarthron zuffianum	1	0.15	1	L
Chaetomiun jodphurense	1	0.15	1	L
Paecilomyces inflatus	1	0.15	1	L
Cunninghamella echinulata	1	0.15	1	L
Stachybotrys atra	1	0.15	1	L
Mortierella sp.	1	0.15	1	L
Arachniotus citrinus	1	0.15	1	L
Oidiodendron griseum	1	0.15	1	L
Beauveria sp.	1	0.15	1	L
Sterile hyphae	1	0.15	1	L
Yeast cells	75	11.47	10	H

O. R. = Occurrence remarks.
H = High occurrence: more than 6 months (out of 12).
M = Moderate occurrence: between 3-6 months.
L = Low occurrence: less than 3 months.

Air-borne fungi from hospital wards: Fifty-seven species which belong to 28 genera were collected from in-door experiments (Table. 4). Five genera were of high seasonal occurrence and these were, *Aspergillus, Penicillium, Acremonium, Alternaria* and *Chrysosporium.*

Aspergillus was the most frequent genus and was one of the basic components of air-borne fungi. It regularly appeared in eleven months and was represented by 6 species. *Penicillium* and *Acremonium* occurred in ten months each. *Penicillium* count irregularly fluctuated and was represented by eleven species, of which *P. chrysogenum* and *P. corylophilum* were the most common. *Alternaria* and *Chrysosporium* were encountered in 8 months. Among the group of chrysosporia isolated from the air in this investigation were; *C. keratinophilum, C. queenslandicum, C. xerophilum, C. tropicum* were *Chrysosporium* sp. *Cladosporium* emerged in 6 months and was represented by 4 species. *Candida* was isolated in 4 months and 3 species were identified namely; *C. tropicalis, C. albicans* and *Candida* sp. *Malbranchea* was reported in 4 months and two species were recovered which were *Malbranchea chrysosporioidea* and *Malbranchea* sp. Twenty species were of low occurrence (1-2 months) as shown in Table, (4). Results of the out-door experiments were basically similar to those of the in-door experiments. Most of these species are common in the open-air in Egypt as reported by Moubasher & Moustafa (1974) in Assiut; by Mazen & Shaban (1983a) in Minia; by Moubasher *et al.*, (1981a) in Quena, and by Moubasher *et al.*, (1985b) in Sohag.

Della Franca and Caretta, (1984) studied keratinophilic fungi in the air at Pavia, Italy and recovered *A. flavus, Alternaria alternata, Cladosporium* (6 species), *Penicillium* (3 species) and many others which are resistant to antibiotics. Maghazy (1989) in Egypt studied the air keratinophilic fungi in primary schools in Assiut and isolated *Aspergillus* (6 spp.), *Penicillium* (6 spp), *Cladosporium* (2 spp), *Chrysosporium* (2 spp) and *Alternaria* (1 sp.). It is worthmentioning that through most of the non-dermatophytes isolated from the diseased skin tissues were isolated from the air no real dermatophytic fungus was caught from the air of the Dermatology hospital wards during this study indicating that the pathogenic dermatophytes on the contrary to the saprophytes are not transimitted by air but mainly by some other means.

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