

ORIGINAL ARTICLES

Epidemiology of Fungal Scalp Infections in the West of Scotland 2000 – 2006

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Abstract**Background**

Fungal infections of the scalp commonly affect the paediatric population and are caused by dermatophytes which have the ability to invade the keratinised structures of skin, hair and nails. This study analyses the changes in the epidemiology of fungal scalp infections in the West of Scotland during the period 2000 – 2006.

Methods

Skin and hair from scalp specimens sent by General Practitioners and Dermatologists throughout the West of Scotland were examined microscopically for the presence of fungal hyphae and/or spores and cultured to determine the identity of the fungi.

Results

The most common dermatophyte to be isolated from scalps during 2000–2006 was *Trichophyton violaceum* with 29 reported cases followed by 23 cases of *Trichophyton tonsurans* infection. During 2000–2002, over 90% of patients were British but during 2003–2006, greater than 50% of patients were of non-UK origin. The majority of *T. violaceum* and *T. tonsurans* infections during this study were from patients originating in either Africa or Pakistan and were from people known to be seeking asylum in the UK.

Conclusions

The overall increase and the change in pattern of reported fungal scalp infections in the West of Scotland may be explained by the migration of people to Scotland from Africa or Pakistan where *T. violaceum* and *T. tonsurans* are endemic. The increase in numbers of infections in the later period of this study reflects an increase in the awareness of General Practitioners and Dermatologists to send samples to Clinical Mycology.

Keywords

Dermatophyte, scalp, *tonsurans*, *Trichophyton*, *violaceum*

Introduction

Tinea capitis, also known as ringworm of the scalp historically was a commonly occurring fungal problem in the paediatric population.^{1,2} The fungi responsible for causing these infections are classified as dermatophytes which infect the keratinised structures of skin and hair as well as nails. Few recent reports exist to show the occurrence of anthropophilic forms of these infections in the United Kingdom, particularly in Scotland. After the introduction of Griseofulvin in the late 1950's,^{3,4} the zoophilic dermatophytes *Microsporum canis* and *Trichophyton verrucosum* were the two most prevalent infections of scalps in the West of Scotland.⁵ Reports from other areas in the United Kingdom also cited high numbers of *M. canis* scalp infections during this period.⁶ However, more recently publications from centres in Birmingham,⁷ London^{8,9} and Bristol¹⁰ have reported that these dermatophytes have been superseded by *T. tonsurans* and *T. violaceum*. *T. tonsurans* is endemic in areas of the USA and Western Europe, and *T. violaceum* is endemic in areas of Africa.^{11,12,13,14,15,16} These changes may reflect an increase in travel between different countries and/or an increase in the immigrant population. We report on data generated from the West of Scotland over the past seven years which highlights the recent increase in the number of scalp infections occurring in Glasgow and surrounding areas. The change in the pattern of tinea capitis in this region is featured, and a possible explanation for these changes based on a rise in the immigrant population of Glasgow is discussed.

Methods and Materials

Skin and hair specimens were received from General Practitioners and Dermatologists throughout the West of Scotland from 2000 to 2006. Samples were sent to the laboratory in specialised folded papers which ensured the optimum preservation of dermatophytic fungi and reduced bacterial contamination. Specimens were dissected into fine fragments, and for hair samples, the Clinical Mycology guidelines stipulated the inclusion of hair roots to be desirable. Direct microscopical examination was performed by digesting a portion of each sample in 20% KOH solution. Slides were examined for the presence of fungal hyphae and/or arthrospores using a light microscope (Prior, B3000) at x10 and x40 magnification. Specimens which were positive on direct microscopical examination were reported to the clinicians within 24 hours.

The remainder of the specimens were cultured to allow full species identification of the dermatophyte to permit the most suitable treatment to be administered and for epidemiological

purposes. Small fragments of the specimens were placed onto Mycosel plates (E&O Laboratories, Bonnybridge, Scotland) which support the growth of dermatophytes whilst restricting the growth of clinically irrelevant fungi and bacteria. The plates were incubated at 28°C and checked by an experienced mycologist twice a week for the growth of dermatophytes. Most isolates were fully identified within seven to ten days. All plates not yielding growth were kept for three weeks as some dermatophytes can take this time to grow in culture. A full identification was made on the basis of colony morphology including the texture, growth rate, colour and microscopical features such as the presence or absence of micro and macroconidia.

Results

During the seven year period, from 2000 – 2006, 108 positive fungal cultures were identified from the scalps of 104 patients of whom 69 were male and 35 female. Ninety three of the patients were aged 10 or less, whereas five were between 11 and 16 years of age and only six patients were greater than 17 years old.

During 2003 to the end of 2006, there was a marked rise in the number of positive cultures from eight in 2002 to 27 in 2006 (Table I). The most commonly occurring isolate over the seven year period was *T.violaceum* followed by *T.tonsurans* (Table I). The third and fourth most common organisms identified were *M.canis* and *Microsporium audouinii* with 15 and 14 patients affected respectively.

Table I: The Number of Cases of Fungal Scalp Infections and the Species of Fungi Identified During 2000-2006.

	2000	2001	2002	2003	2004	2005	2006	Total
<i>M.audouinii</i>			3	1	4	3	3	14
<i>M.canis</i>	2	1	2	1	2	4	3	15
<i>M.gypseum</i>				1			1	2
<i>T.ment var ment</i>			1		1	1	1	4
<i>T.rubrum</i>	3		1	1			3	8
<i>T.soudanense</i>				1	2	1	2	6
<i>T.tonsurans</i>				8	4	6	5	23
<i>T.violaceum</i>			1	7	5	7	9	29
<i>T.verrucosum</i>					2			2
<i>E.floccosum</i>						1		1
Total	5	1	8	20	20	23	27	

T.soudanense has rarely been reported to occur in the West of Scotland. However, in 2003, there was the first recorded case of a scalp infection by *T.soudanense* from the Glasgow laboratory since 1993 (Table I). The patient had recently been living in Africa where this fungus is endemic. A further five cases of *T.soudanense* infections were reported by the end of 2006.

As expected, there remained a low infection rate of the scalp with *Trichophyton rubrum* as it does not invade hair yet it is the most frequently isolated dermatophyte from skin and nail specimens at Clinical Mycology in Glasgow.

The number of cases of *M.canis* infections remained fairly steady throughout the seven years (Table I). No cases of *M.audouinii* were reported during 2000 – 2001 but 14 cases were reported in the five years that followed. During 2000 – 2006 there were few reported cases of *T.verrucosum*, *Epidermophyton floccosum*, *Trichophyton mentagrophytes*

variant mentagrophytes and *Microsporium gypseum*. All are organisms known to cause sporadic infections in the United Kingdom population.

During 2000 – 2002, 93% of fungal scalp infections were from patients who originated from the United Kingdom but during 2003, 70% of patients were of non-UK origin (Table II). All cases of *T.violaceum*, *T.soudanense* and 63% of patients infected with *T.tonsurans* were from Africa. With one exception, all of these patients were immigrants seeking asylum.

Table II: The Origin of Patients with a Fungal Scalp Infection in the West of Scotland.

Year	Patients of UK Origin	Patients of Non-UK Origin	Dermatophyte Species (Non-UK origin where known is stated in brackets)
2000	5	0	2 <i>M.canis</i> 3 <i>T.rubrum</i>
2001	1	0	1 <i>M.canis</i>
2002	7	1	1 <i>T.violaceum</i> (Africa) 2 <i>M.canis</i> 1 <i>T.rubrum</i> 1 <i>T.ment. var. ment</i> 3 <i>M.audouinii</i>
2003	6	14	7 <i>T.violaceum</i> (Africa) 8 <i>T.tonsurans</i> (5 Africa; 1 Turkey) 1 <i>T.soudanense</i> (Africa) 1 <i>M.audouinii</i> 1 <i>M.canis</i> 1 <i>M.gypseum</i> 1 <i>T.rubrum</i>
2004	9	11 (1 unknown origin)	5 <i>T.violaceum</i> (4 Africa; 1 unknown) 4 <i>T.tonsurans</i> (2 Africa; 1 Pakistan, 1 Albania) 2 <i>T.soudanense</i> (Africa) 4 <i>M.audouinii</i> 2 <i>M.canis</i> 1 <i>T.ment. var. ment</i> 2 <i>T.verrucosum</i>
2005	9	14 (7 of unknown origin)	7 <i>T.violaceum</i> (3 Africa; 1 Pakistan, 3 unknown) 6 <i>T.tonsurans</i> (3 Africa, 2 unknown) 1 <i>T.soudanense</i> 4 <i>M.canis</i> 3 <i>M.audouinii</i> (1 unknown) 1 <i>T.ment. var. interdig</i> (1 unknown) 1 <i>E.floccosum</i>
2006	11	16 (2 of unknown origin)	9 <i>T.violaceum</i> (6 Africa; 1 Pakistan) 5 <i>T.tonsurans</i> (3 Africa; 1 unknown) 2 <i>T.soudanense</i> (Pakistan) 3 <i>M.audouinii</i> (1 Pakistan; 1 unknown) 3 <i>M.canis</i> (1 Africa) 1 <i>M.gypseum</i> 1 <i>T.ment. var. ment</i> 3 <i>T.rubrum</i>

Similar to the previous year, the majority of *T.tonsurans* and *T.violaceum* cases occurring during 2004 – 2006 were from patients of Non-UK status (Table II) and greater than 50% were known to be from families seeking asylum. Of the patients from the UK, there was only one report of a *T.soudanense* infection compared to four cases occurring in either African or Pakistan patients and one case of a *T.tonsurans* infection in a UK patient during 2005.

The most recent data from the Clinical Mycology Laboratory in Glasgow show that all patients who had either *M.canis*, *M.gypseum*, *T.rubrum* or *T.mentagrophytes var mentagrophytes* infections were from the UK (Table II) with the exception of one patient presenting with an *M.canis* infection who was African.

Discussion

These data generated from the Clinical Mycology Laboratory demonstrate that fungal infections of the scalp are once again becoming a problem in the paediatric population. The majority of the patients were less than ten years of age and our results confirm findings that they are uncommon infections in patients less than a year old.¹⁷ The reason for the reduction in fungal

scalp infections once puberty is reached is due primarily to the production of sebum which possesses antifungal activities thereby decreasing the risk of fungal infections.¹⁸

Although other factors may play a role in fungal scalp infections such as genetic background, hair braiding and hair type,⁹ it is not clear why more males appear to be infected than females. The pattern produced is in part due to the social behaviour of boys where more physical play and contact sports are adopted by young boys compared to girls. Therefore, this behaviour increases the risk of spreading fungal material to other children. The short cropped hairstyles in boys may also allow easier detection of the clinical symptoms associated with fungal scalp infections.

The various species of fungi isolated in recent years were identical to those found in the 1960's and 1970's from this laboratory.⁵ Previously published work demonstrating the number of affected individuals with fungal scalp infections during 1960 – 1979 in the West of Scotland,⁵ showed the most prevalent organism isolated to be *M.canis* which is one of the commonest causes of scalp infections throughout Europe.^{19,20,21} This organism was responsible for causing almost half the fungal scalp infections in the Glasgow area during this time. This high level was attributed mainly to an outbreak in pedigree show cats. The percentage of patients infected with *M.canis* has decreased in recent years in the West of Scotland and instead, there has been an increase in the number of patients with *T.violaceum*, *T.tonsurans* and *M.audouinii* infections. *M.audouinii* was prevalent before the 1950's but the introduction of Griseofulvin saw a decline in this organism due to its high sensitivity. However, recent years have seen a small increase in scalp infections caused by this organism due to the spread within the same family. The three cases reported in 2002 were all brothers that had been in contact with a cousin who had recently returned from a visit to Africa. There are several further examples of spread within families as is shown by two sisters both with *T.tonsurans* infections and two brothers with *T.violaceum* infections. Another two brothers had *T.soudanense* infections and a mother with a *T.violaceum* infection on her thigh and arm also had a son infected with the same dermatophyte on his scalp. A mother and two of her children were infected with *M.audouinii* and a child with a *T.mentagrophytes var.mentagrophytes* scalp infection had a mother who was affected on her trunk and face by this organism. The asymptomatic carrier rates for other members within these families have not been determined in this study but a report from Hay et al (1996) surveying a population of London school children indicated that the carrier rate within the various classes was approximately 5% ranging from 0% to as high as 47%.⁸

An organism associated with rodent contact, *T.mentagrophytes var.mentagrophytes* is responsible for the majority of scalp infections in areas of Poland.²² Three patients from the West of Scotland were infected with this organism and all had known contact with rodents, in particular pet rats.

The increase in the number of scalp infections in 2003 was accounted for by the movement of people from abroad seeking asylum in this country. At that time, there was a rapid rise in the numbers of immigrants being housed in certain areas of Glasgow, often residing in densely populated living areas with large numbers of people thereby increasing the risk of spreading fungal infections.

Previous reports from Stockholm have demonstrated a link between *T.violaceum* infection and immigration where 68% of affected patients were African.²³ Similarly, a report from Italy demonstrated a link between immigration and *T.violaceum*

infections²⁴ and in Germany, *T.soudanense* infections were reported in African immigrants.²⁵ In the previous study from our Glasgow laboratory, all *T.violaceum* isolates were from immigrants originating from India and *T.soudanense* isolates were from West African immigrants. There appeared to be no clear evidence of spread of either organism to the indigenous population.⁵ In this current report, the main areas of migration were from either Africa or Pakistan resulting in an increase in *T.violaceum* and *T.tonsurans* infections which are endemic in these areas. In June 2003, the Greater Glasgow Health Board was notified of the increase in fungal scalp infections, specifically those caused by *T. violaceum* within Glasgow from our laboratory, and a leaflet sent out to General Practitioners, Health Visitors and Practice Nurses highlighting this issue. This increased the awareness of clinicians towards suspecting a fungal scalp infection and which encouraged samples to be collected for diagnosis.

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