



Inflammatory *Tinea capitis*: a 12-year study and a review of the literature

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Summary

Inflammatory *Tinea capitis* (TC) is a rare form of TC. The aim of this study was to review epidemiological, clinical and mycological profile of inflammatory TC. We present a retrospective study (1999–2010), enrolled all the cases of inflammatory TC observed at a referral hospital in the northern Tunisia. One hundred and twenty-one patients with inflammatory TC, 83 male patients (68.6%) and 38 female patients (31.4%) were enrolled. The mean age was about 8 years. A majority of TC (71.9%) were in patients lesser than 10 years of age. Positive family history and contact with animals were noted in seven and 35 cases respectively. Direct examination was positive in 110 cases (59 ectothrix, 51 endothrix) and positive cultures were obtained in 105 patients (49 *Trichophyton violaceum*, 31 *Microsporum canis*, 13 *Trichophyton interdigitale* complex, 12 *Trichophyton verrucosum*). Systemic treatment was carried out in 115 patients with griseofulvin, in one with terbinafine. A complete recovery was noted in 88 cases; and persistent alopecia in 28 cases. The inflammatory TC is rare, but more common in rural families. The disease mostly affected male genders (68.6%) and *T. violaceum* remains the common pathogen of inflammatory TC in northern Tunisia.

Key words: Kerion, *Tinea capitis*, dermatophytosis, *Trichophyton violaceum*, *Microsporum canis*, griseofulvin, North Tunisia.

Introduction

Tinea capitis (TC) or scalp ringworm is a common dermatophyte infection of the scalp in children between 3 and 7 years of age.^{1–3} The epidemiology of TC varies within different geographical areas throughout the world.⁴ It may occur sporadically or epidemically, and an increase in its incidence has been noted in many countries over the last few decades. The presenting symptoms vary widely and are mostly mild and transient. A more uncommon and often misdiagnosed symptom is inflammatory TC (kerion celsi), a severe

inflammatory reaction with sometimes devastating consequences.^{5–7} The true incidence and prevalence of inflammatory TC remain unknown in Tunisia and no large, long-term study of this form of TC has been conducted in recent years.

The aim of our study was to review the epidemiological and mycological features of inflammatory TC diagnosed in our area and compare the pattern of infectious agents causing inflammatory TC in our study to those of previous Tunisian series and other series of the literature.

Patients and methods

This retrospective study was performed in the Department of Dermatology of La Rabta Hospital of Tunis, Tunisia. We reviewed all cases of patients with an established diagnosis of inflammatory TC observed between January 1999 and December 2010 (12 years). Our department is situated in the northern Tunisia. The

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study included all patients with clinical presentation of inflammatory TC (suppurative and painful plaque associated with purulent drainage), which confirmed by the mycological examination (direct examination and/or culture positive). Mycological investigation, including a direct microscopic mount and fungal culture, was performed for every patient. Clinical materials (scales, hair) were examined microscopically (30% KOH solution). In many cases with a positive direct examination, the type of parasitization of the hair was also recorded. Culture is currently required to identify the precise organism. Microbiological cultures were incubated at 25 °C in Sabouraud 2% glucose chloramphenicol agar and Sabouraud 2% glucose cycloheximide–chloramphenicol agar. The specimens were examined twice weekly. The identification of dermatophytes was based on the macroscopic and microscopic characteristics of the fungi. For each patient, we recorded the age, the gender, the geographical origin, duration of the disease before consultation, the clinical presentation, the contact with other family members or with animals, the responsible dermatophyte and the evolution under treatment and complications. The patients were re-evaluated periodically for at least 6 weeks.

Results

Epidemiological, clinical features

During the analysed period of 12 years, a total of 121 cases (10.08 cases/year) were diagnosed with inflammatory TC among a total number of 881 cases of TC (13.73%). The year-flow for total TC was represented in Fig. 1. The incidence of TC from 1999 was gradually increasing and reaching to its peak in 2006 and 2009. These are 83 male patients (68.6%)

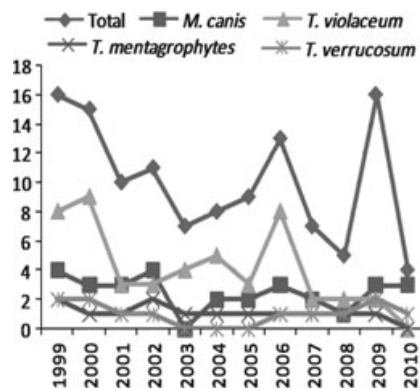


Figure 1 The year-flow for total inflammatory *Tinea capitis* and the dermatophytes isolated from the patients.

and 38 female patients (31.4%) with a sex ratio (M/F) of 2.18.

Our patients come from a rural region in 60 cases (49. 59%), Tunis City in 42 cases (34.71%), and an urban area surrounding Tunis city in 19 cases (15.7%). Patients were 8.09 ± 3.99 years middle-aged (median = 6 years), [range: 18 months to 63 years]. Four cases (3.3%; three girls, one boy) were diagnosed in infants less than 2 years old (ranges: 1–2 years). We identified six cases (4.6%) of TC in adults (more than 18 years) among a total of 42 cases of adult TC (14.28%), concerning five men (83.33%) and one woman (16.67%) with an average age of 31 years (from 20 to 63 years). The distribution of patients according to age and sex was represented in Fig. 2. We note that 71.9% of cases (87 cases) occurred in children younger than 10 years of age. The mean duration of the disease prior to diagnosis was about 1.76 ± 1.25 months (range: 10 days to 3 years; median = 30 days).

Other family members were infected with tinea in seven cases and contact with animals was reported in 35 cases (cats: 17 cases, dogs: 13 cases, rabbits: five cases). Contributing factors were represented in three cases (2.47%): local application of corticosteroids (two cases) and gastric tumour (woman: 63 years old) in one case. None of the patients had positive HIV serology.

In clinical examination, all patients presented with follicular pustular elements on squamous erythematous alopecic patches, realising a kerion (Fig. 3). Cervical (auricular and posterior occipital) lymph nodes and fever were found in 15 patients. Inflammatory TC was associated with erythema nodosum in a 5-year-old boy (published case). Physical examination showed *Tinea corporis* in eight cases (6.61%) (face: four cases, hand: two cases, neck: one case, trunk: one case) and

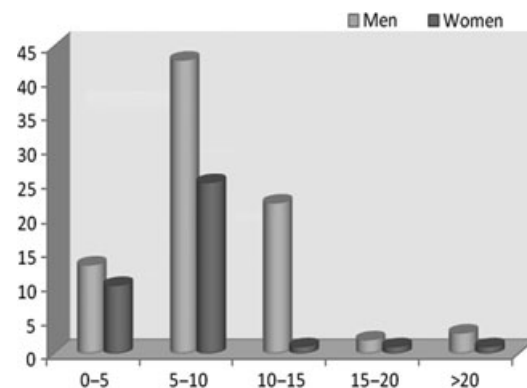


Figure 2 Distribution of patients according to age and gender.

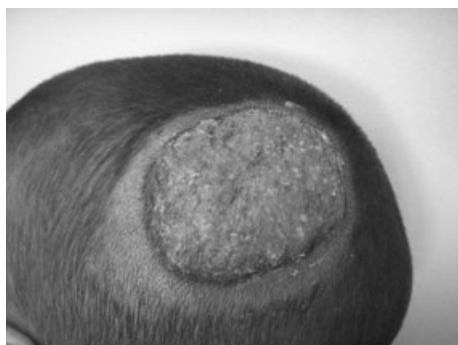


Figure 3 Kerion of the scalp (suppurative plaque of the scalp).

onychomycosis in five cases (4.13%). Twelve patients (9.91%) were treated with an antifungal treatment (with too short followed schedule) before consultation. Three patients presented with a history of hospitalisation in surgical department with the diagnosis of Staphylococcal abscess and treated by intravenous antibiotics and surgical excision.

Mycological features

Direct examination was positive in 110 cases (90.9%). Fifty-nine patients (53.63%) were ectothrix and 51 patients (46.37%) were endothrix. In the 11 cases when direct examination was negative, the culture was positive (*Microsporum canis* (four cases), *Trichophyton violaceum* (three cases), *Trichophyton mentagrophytes* [*T. mentagrophytes* is an older taxonomic name for dermatophytes belonging to the '*Trichophyton interdigitale* complex'] (three cases), *Trichophyton verrucosum* (one case). Positive cultures of dermatophytes were obtained in 105 patients (86.77%): *T. violaceum* (49 cases: 46.66%) was predominant, among them 13 cases of *T. violaceum glabrum*, followed by *M. canis* (31 cases: 29.52%), *interdigitale* complex (13 cases: 12.38%) and *T. verrucosum* (12 cases: 11.44%). Thirteen patients, from whom *T. interdigitale* complex was obtained, had a history of animal contact, including rabbits, dogs, cats

and rats. The annual distribution of the different species is presented in Fig. 1; we note a clear predominance of *T. violaceum* and *M. canis*.

For mycological examination of inflammatory TC in adults, three cases are due to *T. interdigitale* complex, one case to *T. violaceum*, one case to *M. canis* and one case was negative. According to our data, negative culture represent 11.57% of all cultures (14 cases) and contaminated samples were noted in 1.65% of cases (two cases). These negative cultures had a positive direct examination (10 ectothrix, 4 endothrix). The relationship between direct examination and culture is represented in Table 1. These results may be related to an antifungal treatment initiated before sampling (9.91% of our patients), because many antifungal drugs are retained within stratum corneum of epidermis for a long time and may inhibit the growth of dermatophytes on Sabouraud's dextrose agar or the type of dermatophyte is difficult to cultivate. The distribution of aetiological agents by gender was summarised in Table 2. We note a higher prevalence of *M. canis* and *T. interdigitale* complex in male patients.

Treatment and follow-up

Treatment regimen consisted of griseofulvin at the dose of 20–25 mg kg⁻¹ per day and 1 g per day in adult TC for 6–8 weeks for all patients except for one child (5 years old) with inflammatory TC due to *M. canis*, which did not respond to systemic griseofulvin at 20 mg day for 4 months, was treated with oral terbinafine. During the whole treatment period and follow-up, the tolerance was excellent and no side effects or abnormal results in the blood chemistry tests were observed. A systemic antibiotic and prednisone (0.5 mg kg⁻¹ per daily) were associated with 15 cases. Antifungal topics were applied once or twice a day in all patients. The follow-up in 116 patients (95.8%) noted a complete regression in 88 cases, whereas 28 showed a persistent alopecia. A relapse was occurred in one woman who had gastric tumour. She was treated with griseofulvin more than 3 months with a relapse.

Table 1 Correlation between direct examination and culture.

Mycological features	Culture						Total
	<i>Trichophyton violaceum</i>	<i>Trichophyton verrucosum</i>	<i>Trichophyton mentagrophytes</i>	<i>Microsporum canis</i>	Negative	Contaminated samples	
Direct examination							
Ectothrix	–	11	10	27	10	1	59
Endothrix	46	–	–	–	4	1	51
Negative	3	1	3	4	–	–	11
Total	49	12	13	31	14	2	121

Table 2 Aetiology agents of inflammatory TC according to gender.

Sex	Men	Women	Total
Culture			
<i>Trichophyton violaceum</i>	29	20	49
<i>Microsporum canis</i>	23	8	31
<i>Trichophyton mentagrophytes</i>	12	1	13
<i>Trichophyton verrucosum</i>	9	3	12
Negative	9	5	14
Contamination	1	1	2
Total	83	38	121

TC, *Tinea capitis*.

Discussion

We report one of the largest case series of inflammatory TC in the literature. The major findings in our study were the increase over recent years, in the number of cases of inflammatory TC (121 cases: 13.73%), comparatively to our first study in 1998 (22 cases: 1.8%), the high incidence among boys below the age of 10 years, and the rarity in adults, in which the male gender is preferred. *T. violaceum* was the most common pathogen in all cases and *T. interdigitale* complex was predominantly in adult.⁸

TC is a dermatophytosis of the scalp and hair that it has been a major public health problem in Tunisia for decades.⁹ The clinical presentation is a great mimicker and can present itself in various ways, ranging from asymptomatic carriers, scaling lesions and/or alopecia to cervical lymphadenopathy and large painful inflammatory masses. This acute painful inflammatory boggy mass with alopecia on the scalp, often with crusting and purulent discharge, is called kerion celsi and it is the result of an intense hypersensitivity reaction from a dermatophytic infection.¹⁰ This condition is rare, with only few articles in the literature and most of them are case reports.^{7,10–12} In our study, 121 cases of inflammatory TC were reviewed between a total 881 TC (13.73%) and a total 96251 consultants (0.125%) collected through 12 years. The prevalence data we obtained from our study were different with results as reported from many other regions of the world. In Tunisia, the incidence of inflammatory TC is varied from 2.3% to 13%.^{1,11–16} This value was lower than that observed in Spain (18.2%) and Saudi Arabia (19.8%).¹⁷ On the other hand, this rate was higher than that in Nepal (1.5%), Morocco (2.5%), Gabon (4%), Libya (8.2%), China (10.3%), rural Kenya (10.1%), the United Kingdom and the United States.^{18–22}

Inflammatory TC occurs predominantly in rural or suburban areas and some factors (poor personal

hygiene, crowded living conditions and low socioeconomic status) were associated with this increased frequency.^{8,11,12,17} The majority of our patients come from a rural region (60 cases: 49.59%).

As was found in our study, it appears most often in children between 5 and 10 years of age (Fig. 2).^{23–25} Our results were similar to those in other Tunisian studies, noting that living conditions, large family size and close contact with other infected children at school, physical contact with animals and playing outside may facilitate fungal transmission.^{8,11,12,26}

Inflammatory TC is secondary to a vigorous host immune response and its occurrence in neonates and in infants in their first year of life is extremely infrequent and only a few cases occurring at this age have been reported in the literature.^{27–29} The rare presentation of inflammatory TC at this age is probably explained by the immaturity of their immunological system.²⁹ In our series, we found four cases (3.3%; three girls, one boy) of inflammatory TC in infants less than 2 years old and two family members were infected with TC. The most reported factors predisposing infants to TC are humid environment, broad-spectrum antibiotic use, epidermal immaturity and impairment of health (anaemia, immunodepression).³⁰ We do not found predisposing factors in our infants such as immunodepression or impairment of health, but they come from a rural region where hygiene and socioeconomic conditions are unfavourable. It has also been proposed that asymptomatic carriers (mothers), without clinical signs or symptoms of TC, but with positive scalp cultures, could be an important source of disease transmission or a reservoir of dermatophytes.⁴

In our study, the proportion of inflammatory adult TC (14.28%) is approximately in accordance with the previous Tunisian studies (15% and 18%).^{14,15} The adult's hair seems to be relatively resistant to TC, which may be due to protection from fungistatic free fatty acids in the sebum and colonisation by *Pityrosporum orbiculare*.^{31–33} Although the rareness of inflammatory adult TC could be explained by some cases of Inflammatory TC can take form of other forms of TC and treated precociously with favourable evolution. The most reported factors for predisposing adults to TC are contact with infected children, animals or objects, impairment of health (diabetes mellitus, anaemia, immunodepression) and use of topical or systemic corticosteroids.^{34–36} In our study, one adult had used corticosteroid lotions and one woman had gastric tumour.

The incidence of TC may also vary by gender, depending on the causative organism.¹⁹ This study

demonstrated that dermatophytes are more frequent in male genders than female genders. The reason for this is not fully understood, but it indicates that gender may influence susceptibility to particular forms of these infections. Some authors suggest that TC produced by *M. canis* are more usual in male genders, whereas there is no predominant gender for TC caused by *T. violaceum*, or that these latter may even be more common in women.^{17,23} However, these differences in gender have not always been noted.³⁷ In our study, we found a predominance of cases in male genders for inflammatory TC produced by both *M. canis* (74.1%) and by *T. violaceum* (59.1%; Table 2). A possible explanation for this apparent predominance in boys may be that male children help out on farms and have more contact with animals.^{3,23} TC can be transmitted from animals to humans or among humans.^{3,20,38} In our study, only 28.9% patients have contacted with pets like dogs or cats definitely. This lower percentage is likely due to the absence of systematic research of the notion of contact with animals in our medical records.

Inflammatory TC initiates as a dry tinea with scaling and short hairs. Then, there is erythema and inflammation, which generating a painful lesion with clear borders that is covered with numerous pustules producing abundant pus and may be associated with marked cervical lymphadenopathy and fever.² All our patients presented herein had unique lesions with the typical clinical aspect of kerion and presence of lymphadenopathies and fever in 15 cases. After that, the short hairs are gradually expelled or remain below the inflammation. Finally, within around 8 weeks, cell-mediated immunity leads to complete elimination of the parasite. Usually, a definitive alopecia with fibrosis due to the sustained attack on the hair follicle was observed.²

Confirmation of inflammatory TC diagnosis and appropriate treatment are therefore of particular importance in this variety. The gold standard diagnostic method is fungal culture.³⁹ This was performed in all our patients. As reported in our study, some cases of boggy kerions leading to unnecessary hospitalisations, investigations (scanner), surgical interventions and delays in diagnosis.⁴⁰ The short duration of oral antifungal use may imply that patients diagnosed with TC are still being undertreated or comply poorly with the therapy because of the inconvenient dosage and duration. If direct examination and culture are negative, a biopsy should be performed and divided to perform cultures in specific media for fungi.² Careful examination of people in close contact with family members as well as pets may help in the clinical suspicion. In our

study, the direct examination was positive in 90.9% of the cases, while the culture in 86.7%.

TC is a classic example of the changing geographical patterns of dermatophytosis that explain the polymorphisms of clinical and mycological profile of TC.^{41,42} The prevalence of different types of dermatophytes varies between continents and from one country to another, and it is often difficult to know the precise distribution of a particular dermatophyte. Some of the data from Europe showed that *M. canis* and *T. violaceum* were the predominant dermatophyte in central and southern Europe.^{43–46} In the United States, *T. tonsurans* has supplanted *M. audouinii* and *M. canis* as the primary dermatophyte of TC.^{47–49} In south and central Asia, *T. violaceum* is the most common causative agent of TC, whereas *M. canis* is predominated in western Asia.^{50,51} In east Asia (China), the most common species causing TC was *T. violaceum* followed by *T. verrucosum*.⁵² The various organisms causing TC may present with different clinical patterns, which depend on the type of hair invasion and the degree of inflammatory host response.² Inflammatory TC is most often caused by zoophilic dermatophytes (*M. canis*, *T. verrucosum* and *T. interdigitale* complex), but also by anthropophilic (*T. rubrum*) and rarely by geophilic (*M. gypseum*) species.^{11,12}

In Tunisia, a north African country, incidence and pathogens of inflammatory TC were changed through years. In a study undertaken in our department between 1985 and 1998, of 22 cases of inflammatory TC, the predominant causative agents were *T. interdigitale* complex (40%) and *M. canis* (26.6%).⁸ During the period of our study, *M. canis* was present in 29.52% of cases.

On the other hand, our data showed that the incidence of *T. violaceum* (46.6%) exceeded *M. canis* (29.52%). As shown in Fig. 1, the incidence of *T. violaceum* increased gradually from 1999, peaked in 2006, and then dropped quickly in the next 4 years. In general, anthropophilic species tend to induce less inflammatory lesions than geophilic and zoophilic ones.¹⁸ Clinic manifestation is often not very evocative; they are not always diagnosed, allowing their release. This may be explained by the increased number of patients treated incorrectly before consultation. Another explication, it is also possible that adults carry anthropophilic dermatophytes as asymptomatic carries throughout life and develop inflammatory TC only if immunodeficiencies or disruption of the scalp protective mechanisms occurs.¹⁶ As rabbits have become domestic pets, the frequency of *T. interdigitale* complex has increased with higher presentation of inflammatory lesions.²⁷

Accordingly, 13 of our inflammatory TC were produced by *T. interdigitale* complex and rabbits were observed in both patients' environment. In the other north African studies (Morocco), *T. mentagropytes* was the major agent of inflammatory TC (75%).¹⁸ Inflammatory TC is frequently caused by *T. verrucosum*. Cattle are the main source of *T. verrucosum* infections. It was isolated in 12 cases (11.44%) in our series. Our results are different to other study in central Tunisia and southern Tunisia where *T. verrucosum* was the major agents of inflammatory TC.^{1,11,12}

Due to the high risk of scarring alopecia, the aim of treatment is to achieve clinical and mycological cure as soon as possible. Special studies on the management of inflammatory TC are not known. The treatment with griseofulvin (20 mg kg⁻¹ per day for 6–12 weeks) has proven also with this type of childish TC effective.^{53,54} Recently, new antifungal agents (fluconazole, terbinafine, itraconazole)⁵⁴ have become available to treat TC, but did not obtained authorisation in TC in Tunisia. Fluconazole has been shown to be safe and effective of childhood TC caused by *T. tonsurans*, *T. rubrum*, *T. violaceum* and *M. canis*.^{53,54} The use of corticosteroids should be carefully considered in these patients and contraindications for their use should be ruled out.² In the treatment of inflammatory TC, antifungal medicine can be used, but incision and drainage should be avoided.⁴⁰

Conclusion

We report a large study of inflammatory TC. The inflammatory TC is rare, but more common in rural families. The disease continues to contribute to the pathological burden of the school-aged children and *T. violaceum* remains the common pathogen of inflammatory TC in northern Tunisia. Our epidemiological profile is different to that of the other northern African countries, which *T. verrucosum* was the major pathogen of inflammatory TC. The diagnosis should be considered early in any type of scalp lesion and should be confirmed by mycological exams prior to initiation of effective treatment to prevent devastating consequences with scarring and permanent hair loss. We proposed the importance of an early diagnosis followed by timely and effective treatment to prevent scarring and permanent hair loss.

Conflicts of interest

The authors have no conflicts of interest to disclose.

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None.

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