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Review

Current Topics of Tinea Capitis in China

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Abstract

Tinea capitis is one type of superficial fungal infection which is found all over the world. The major etiologic agent of tinea capitis varies in different areas. Tinea capitis in China has unique characteristics. The epidemiology, transmission and therapy of child and adult tinea capitis in China are reviewed in this paper.

Key words: tinea capitis, epidemiology, transmission, therapy, China

Introduction

Tinea capitis is characterized by hair shaft and intrapillary epidermis invasion by several so-called dermatophytic fungi: it is diagnosed mostly in children. The clinical symptoms and signs include scaling, hair loss and/or inflammatory lesions. Tinea capitis is a exogenous infection that originates from different sources (human, animals and/or soil). Based on host preference and natural habitat, the etiologic agents are classified into three categories: anthropophilic, zoophilic, and geophilic species. Anthropophilic species usually infect humans. Zoophilic species are pathogens of animals other than man. Transmission from animals to humans does occur. Geophilic species inhabit soil and infect both humans and animals.

Some species are transmitted by fomites, i.e., objects other than the above which harbour and can transmit diseases, e.g., pieces of wood, packing materials, towels, hats, etc.

Epidemiology of tinea capitis in China

The major etiologic agents of tinea capitis in China have been changing over time. In the 1950s and 1960s, *Trichophyton schoenleinii* and *Microsporum ferrugineum* were the predominant etiologic agents of tinea capitis in the country[1, 2]. Tinea capitis caused by *T. schoenleinii* often presented as favus in appearance. In the late 1960s, a concerted therapy program was initiated in Henan, Anhui, and Hubei provinces where a high incidence of favus occurred[3-5]. This concentrated effort was successful. After treatment the incidence of favus decreased greatly, down to below 1 per 100,000[3-5]. However, *T. schoenleinii* was not the most common organism isolated from patients with tinea capitis. In this time period, the number of cases of tinea capitis caused by *M. ferrugineum* relatively increased. Thus in the late 1970s *M. ferrugineum* took the place of *T. schoenleinii* as the major etiologic agent of tinea capitis in China[2]. In the 1980s, infections due to *T. mentagrophytes* and *T. violaceum* occurred more frequently. Wu *et al.* collected nationwide data on the etiology of tinea capitis during the years 1986 to 1996[6]. In 1986, *T. mentagrophytes* and *T. violaceum* were the predominant etiologic agents of tinea capitis in China, accounting for 52.3% and 17.4% of the reported cases, respectively. However, in 1996 infections caused by *M. canis* increased dramatically and *M. canis* replaced *T. mentagrophytes* as the primary etiologic agent of ringworm of the scalp. The shift of pathogens was probably related to the fact that raising pets became popular in urban areas of China and zoophilic species, e.g., *M. canis*, can be easily transmitted from pets to humans. Up to now, *M. canis* is still the most common organism isolated from hairs of patients with tinea capitis in most areas of China including Haerbing[7], Beijing[8], Shanghai[9], Shandong[10], Guangdong[11], Chongqing[12], Sichuan[13], Hubei[14], Guizhou[15], Jilin[16] and Jiangsu provinces[17].

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Except for Chongqing and Sichuan all of these lie in the east and south of China.

The predominance of specific pathogens causing tinea capitis vary with geography, environments, climates, occupations, ethnic groups and life styles. Xinjiang Uyghur Autonomous region, for example, is located in northwest China. All the southern area is the Taklimakan desert. The climate there is dry, hot and seldom has rainfall. The Xinjiang region is far away and relatively isolated from the rest of China. Most of the residents (>60%) are Uyghur people, who traditionally work with livestock or farm. Probably for these reasons, the etiologic agents found there are quite different from those of other regions in China. For example, *T. violaceum* is probably the most frequently isolated etiologic agent, accounting for 47.95% of the cases[18]. *M. ferrugineum* ranks second to *T. verrucosum* in Xinjiang whereas it is rare in other areas of the country. In our Xinjiang study[19], done in the south of Xinjiang in 2001, three species were isolated from patients with tinea capitis (Fig. 1, 2). Compared to dermatophytes which caused tinea capitis in Xinjiang before 1990, *T. violaceum* was still the major etiological agent, followed by *T. verrucosum* and *T. tonsurans*. Infections due to *T. schoenleinii* and *M. ferrugineum* were not detected in our study.

Tinea capitis infections can be classified by their clinical appearance such as tinea alba, favus, black dot ringworm and kerion formation. In China, tinea alba is the most common type of tinea capitis and the most common pathogen is *M. canis*. In the 1950s and 1960s, favus was common in rural areas of China. Favus has almost disappeared due to the success of concentrated therapy of tinea capitis. Black dot ringworm is the common type amongst Uyghurs in the Xinjiang region[18].

Transmission of tinea capitis

Tinea capitis can be transmitted/contacted from infected human beings, animal vectors, from soil and fomites. It is also very common for an outbreak of tinea capitis to take place amongst a certain population. Generally speaking, tinea capitis due to *T. tonsurans* is transmitted from human to human; for example, a higher incidence was found in wrestlers than in ordinary people in Japan, Korea, and China as well. Tong *et al.* reported an outbreak of trichophytosis in a wrestling school in Wuhan in 2002[20]. In six months, 25 cases of trichophyiosis were detected in 43 wrestling students. Seven of these cases were diagnosed as tinea capitis and 18 were tinea corporis (Fig. 3). The organism cultured from infected hair and skin samples was identified as *T. tonsurans*. The clinical appearances of the patients showed that the sites of the lesions were exactly where the wrestlers had contact with each other during their practices. In these cases, we assume that human-to-human contact was the key to transmission.

Humans may become infected with zoophilic dermatophytes by direct contact with family

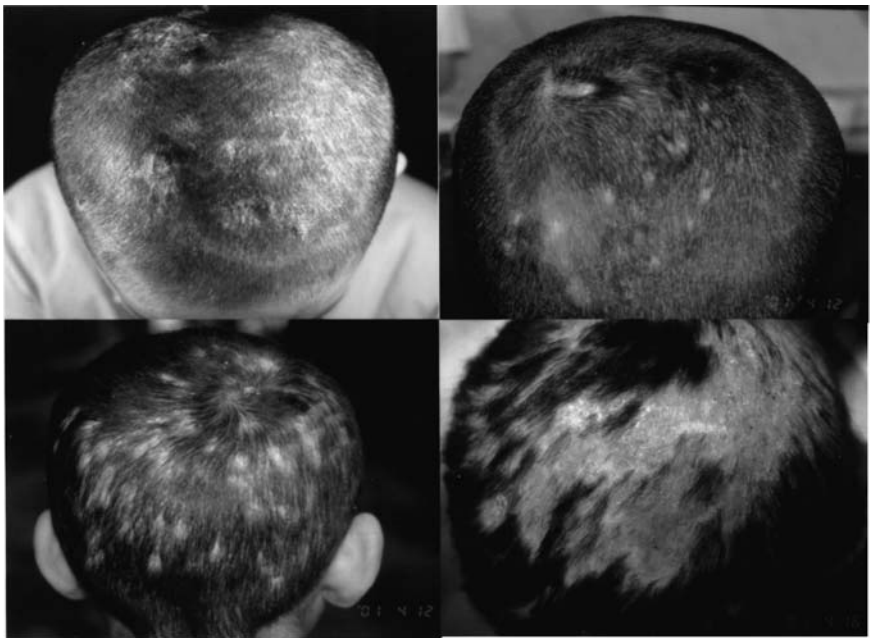

Fig. 1. Appearances of tinea capitis in the Xinjiang area in our study carried out in 2001.

Fig. 2. Microscopic appearance of the affected hair from a patient in Xinjiang.

Fig. 3. Appearances of trichophytosis (tinea capitis and tinea corporis) found in a wrestling school in Wuhan in 2002. (provided by Dr. Tong[20])

pets or wild animals. *M canis*, which is common in China, is usually transmitted from cats or dogs to the patients. Ma *et al.* studied the epidemiology of tinea capitis in Beijing[8]. 63 percent of the patients had raised cats or dogs or once kept them close to the In 2000, an outbreak of tinea capitis caused by *M. canis* was found in a sports school in Beijing[21]. The total number of exposed children was 71, of which 42 had clinical evidence of tinea capitis. The fungus isolated from broken hairs and gymnasium carpets was identified as *M. canis*. All the strains had the same origin according to molecular biological methods including RAPD, NTS analysis and DNA sequencing.

Adult tinea capitis

Tinea capitis is uncommon in adults. In 1952, Pipkin reported 1034 cases of tinea capitis in the Southwest United States with only 4.9% of them being post pubertal subjects[22]. In the central region of China, the incidence of tinea capitis in adults was from 6.0% to 13.6%[23, 24]. From 1982 to the present a total of 436 patients in our hospital were diagnosed with tinea capitis (proven by mycological methods); only 11 (2.5%) of these were older than age 15. However, in southern Taiwan, the incidence of tinea capitis in adults was reported to be much higher than in mainland China. Lee and Hsu[25] reported 27 culture-proven cases of tinea capitis over a two year period and 17 (63%) of these were in adults. Adults with dermatophytic infections of hair are thought to acquire the infection from contact with fungi on hairdressing equipment[26] or in child-care settings[27]. Other possible explanations include extensions of an infection from glabrous skin or nails (tinea unguium). In adults, women are more frequently infected with tinea capitis than men[25, 28]. All 11 patients in our hospital were

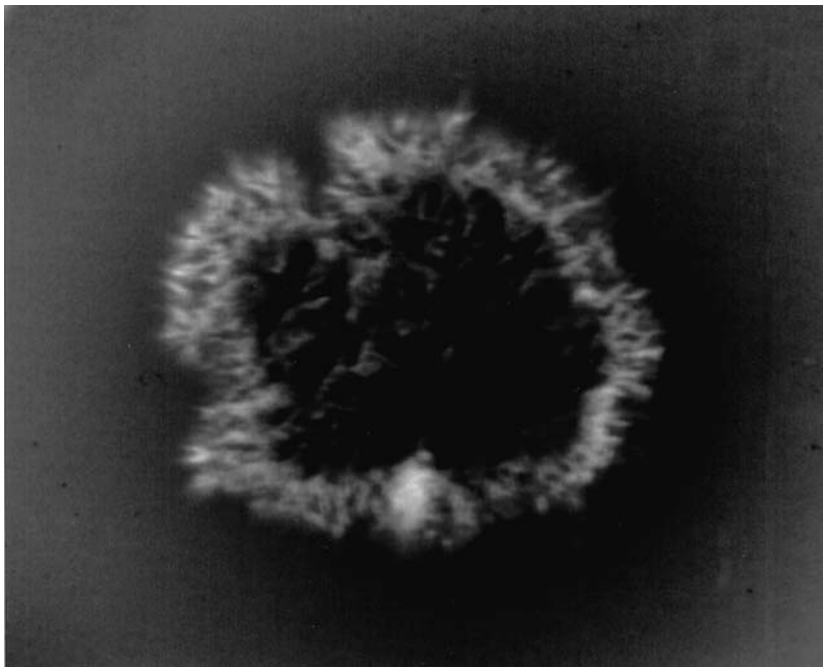

Fig. 4. Colony of *T. violaceum* cultured from the hair of an adult patient on SDA.

female. Most of our tinea capitis cases occur in postmenopausal women[25, 28].

We have reviewed the published papers (from Chinese journals) on tinea capitis in adults from mainland China since 1980. There were 45 culture-proven cases. Among them, *T. mentagrophtes* was the most frequent pathogen, accounting for 55.6% (25/45), followed by *M. canis* (6/45), *T. violaceum* (6/45), *T. schoenleinii* (4/45), *T. rubrum* (2/45) and *T. tonsurans* (2/45).

Tinea capitis can infect both healthy individuals and immunosuppressed patients. In Taiwan, only one of 17 adult patients with tinea capitis was immunosuppressed[25]. Several cases of tinea capitis in immunosuppressed patients have been reported in the literature, e.g., patients with systemic lupus erythematosis treated with corticosteroids, a renal transplant recipient, and HIV infected patients. The risk factors of tinea capitis in adults included underlying conditions such as diabetes, anemia, immunosuppression, corticosteroids, hormonal changes (e.g., menopause) and degrees of exposure to the pathogen (e.g., tineas located elsewhere on the body, contact from infected children or fomites). We found a case of adult tinea capitis presented as black dot ringworm in our hospital; the pathogen of the patient was *T. violaceum* (Fig. 4). The patient was diagnosed as pemphigus vulgaris and treated with prednisone before suffering from tinea captis[29].

Therapy of tinea capitis

In China, griseofulvin is the "gold standard" for treatment of tinea capitis. The clinical outcome of griseofulvin is satisfactory, the drug is inexpensive, safe and well-tolerated. The efficacy of griseofulvin proved to be very good in therapy trials in the late 1960s and early 1970s. Its extensive use in tinea capitis by *T. schoenleinii* is probably a big reason why it is almost extinct in China today.

Recently, newer antifungal agents have become available to treat tinea capitis. Itraconazole has been showed to be effective in tinea capitis when used continuously or as pulse therapy. The continuous therapy regimen is 3-7 mg/kg/d for 3-6 weeks. Several studies have been reported in China on the efficacy of itraconazole to treat tinea capitis. In one report, 43 patients were treated with itraconazole at a dose of 6.25 mg/kg/d for 6 weeks[30]. At week 6 the clinical cure rate was 88.4% and the mycological clearance rate was 100%. In summary, the clinical cure rates of continuous itraconazole in treatment with tinea capitis were 80 to 90% in China. No serious adverse effects were reported. The pulse regimen is effective in tinea capitis with the dosage schedule being 5 mg/kg/d for 1 week (one pulse) with 3 weeks off between successive pulses. Usually three pulses are administered to the patients. Li and Dong evaluated the pulse therapy of itraconazole in treatment of 46 cases of tinea capitis[31]; the

cure rate and the mycological clearance rates were both above 90%.

Terbinafine is also useful in the therapy of tinea capitis in China. The commonly used dosage for a <20 kg patient is 62.5 mg/d; 20-40 kg, 125 mg/d; >40 kg, 250 mg/d, and the duration of therapy is 2-6 weeks. Tinea capitis caused by *Trichophyton* species was reported to respond effectively to 2-4 weeks of treatment with terbinafine. We did a clinical trial to evaluate the efficacy of terbinafine in treatment of tinea capitis in Xinjiang[19]. The pathogens isolated in the clinical trial all were *Trichophyton* species. The patients were treated with terbinafine for 2 weeks and 4 weeks according to their body weight. At week 8 the clinical cure rates were both about 80% and the mycological clearance rate in all was above 94%. There were no significant differences of clinical cure rate or mycological clearance rate in the two groups ($p>0.05$), and no serious adverse effect was found in our research. When the organism is *Microsporum* species, a treatment duration of 6 weeks is appropriate.

Prophylaxis of tinea capitis

Tinea capitis is an infectious disease which occurs most often in prepubescent children. It may be transmitted by the shared use of contaminated hairbrushes, by contact with fomites or by direct physical contact with an infected person. Occasionally, an outbreak of tinea capitis occurs under some special conditions. In order to control the disease, the first step is to treat the patient who is thought to be the primary source of the infection. It is also crucial in prophylaxis of tinea capitis that pets should be examined regularly and infected pets should be treated and kept away from children. Suspected contaminated items should be decontaminated to control and restrict an outbreak of tinea capitis.

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