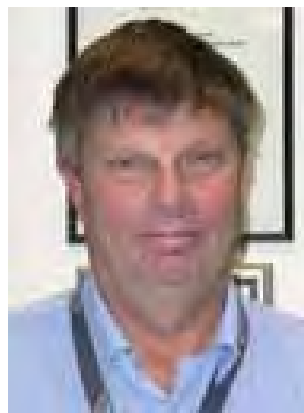


Fungal infection in Australian Aborigines



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Australian Aborigines are disproportionately affected by both superficial cutaneous and systemic fungal infections.

Dermatophytosis, or tinea of the skin and nails, is a common condition affecting Aboriginal people in Top End communities. No recent studies have examined tinea prevalence, but anecdotal observations by health workers indicate that it is endemic¹. One study reported in 1977 found a tinea prevalence of 10.7% among 205 school children aged 6-16 years at Maningrida, one of the largest communities in Arnhem Land². Anthropophilic fungi are the main causes of tinea of the skin and nails in the Top End. In an earlier report, these same authors also showed that an unusual granular variant of *Trichophyton rubrum* is responsible for many tinea infections, causing chronic tinea of the body (tinea corporis), onychomycosis and, rarely, tinea capitis^{2,3} (Figures 1, 2 and 3). These authors also isolated an unusual type of *Microsporum canis* (referred to as 'Maningrida' type) from children with scalp tinea (Figure 4). Tinea is not only a cosmetic problem. Pruritus, that leads to scratching, can result in subsequent superinfection with bacteria, particularly group A *Streptococcus* and *Staphylococcus aureus*^{4,5}.

In the most recent study, Koh *et al*⁶ found similar clinical presentations and confirmed the high incidence of *T. rubrum* granular strains, causing tinea corporis in this region. Nail disease was also more common (36%). Onychomycosis is often thought to be an uncomfortable condition anecdotally, as well as a cosmetic problem. However, subjects with nail involvement may also carry a higher fungal load and be a reservoir of infection for other people or reinfection in themselves⁷. Culture rates from nail clippings are often low. In a retrospective study⁶, 25% of clippings were positive on microscopy and culture and 31% were negative on microscopy, but positive on culture. In a prospective study, 36% of nail clippings were positive on microscopy and culture⁶. These culture rates are comparable with other studies^{8,9}. Tinea capitis was not common in the most recent study, with only two subjects found (both children aged <12 years) and both infected with *Trichophyton tonsurans*⁶. In

other parts of Australia, *T. tonsurans* and, to a lesser extent, *T. violaceum* have become the most common cause of Tinea capitis in Aborigines¹⁰ (Figure 5).

In Aboriginal communities, tinea of the skin is often treated with topical antifungals as they are cheap. However, because



Chronic tinea corporis caused by *Trichophyton rubrum* (granular strain).



Onychomycosis caused by *Trichophyton rubrum* (granular strain).



Tinea capitis caused by *Microsporum canis* ("Maningrida type").



Tinea capitis caused by *Trichophyton rubrum* (granular strain).

of the extensive skin involvement and longer treatment course required (usually 4 weeks) treatment is often abandoned. Griseofulvin was previously recommended for treating tinea^{1,2}, being the only systemic antifungal available at the time; however, it has now been recognised to be less well-tolerated and less effective than newer oral antifungals, particularly in the treatment of onychomycosis, with higher relapse rates upon ceasing^{7, 11}. Anecdotal experience from many years of griseofulvin use in Aboriginal communities is that the prolonged griseofulvin treatment required for extensive tinea corporis was rarely completed. This often resulted in a resigned acceptance by health staff of the high rates of tinea, including severe nail disease. In the study by Koh *et al.* clinical responses to terbinafine treatment for tinea corporis were good⁶. Results are comparable with other open-label, non-controlled studies^{12, 13}. This study and also anecdotal reports from community members and medical practitioners show that terbinafine is an effective and acceptable treatment for tinea (in particular tinea corporis), which has the potential to turn around the perceptions of health staff and community members that tinea is a 'normal' condition for those living in remote Aboriginal communities⁶. However, it is also important to recognise that control of the anthropophilic fungi such as *T. rubrum* must also address the underlying socio-



Tinea capitis caused by *Trichophyton tonsurans*.

economic disadvantages, particularly overcrowding and limited access to functioning health hardware, such as showers.

Cryptococcosis is common in the Northern Territory (NT) of Australia^{14, 15}. Disease is life-threatening and treatment is prolonged and often complicated by the need for surgery and difficulties with medical therapy¹⁴. In Australia, both *Cryptococcus neoformans* and *C. gattii* disproportionately affect Aboriginal people¹⁵. The population-based rates for *C. neoformans* are 8.5 versus 4.4 cases per million persons (Indigenous versus non-

Indigenous) and those for *C. gattii* are 10.4 versus 0.7 cases per million persons¹⁶. In Arnhem Land (rural home to many remote Aboriginal communities), the relative risk for cryptococcal disease for Aboriginal people, compared with non-Indigenous people is 20.6¹⁴.

The high incidence of cryptococcosis in the Aboriginal population of the Northern Territory is not a new finding. Lo¹⁷ reviewed 26 cases of cryptococcosis which occurred in this region from 1957 to 1975: 25 were in full-blooded Aborigines and 24 were in patients with cryptococcal meningitis. All the Aboriginal patients came from settlements, missions, cattle stations, or 'out bush'; none came from the major towns. Fisher *et al* reviewed 35 cases at the Royal Darwin Hospital between 1976 and 1992: 23 had meningitis, ten had pneumonia, one had a dermal infection and one had fungaemia with no obvious focus¹⁴. Twelve (52%) meningitis cases and two (20%) pneumonia cases had no predisposing disease. Thirteen (57%) meningitis cases had concomitant pulmonary cryptococcosis. Arnhem Land was the most common location of infection, with an annual incidence in Aborigines of 0.14/1000. Fourteen (78%) of 18 isolates tested were *C. gattii*. Management was characterised by the frequent need for adjunctive surgery and prolonged or repeat courses of systemic antifungal therapy. Despite this, long-term outcomes were encouraging, with a mortality of 14% overall and 9% in meningitis patients¹⁴. More recently, Jenney *et al.* published 18 cases from 1993 to 2000 and the trends were similar to the previous reports. A significant number of cases of infection are with *C. gattii*, from a mainly rural and Aboriginal population¹⁵. Molecular genotyping has shown that the majority of these *C. gattii* strains belong to the VGII genotype. Multi-locus sequence analysis has shown that these strains are closely related to strains that have recently caused outbreaks in Vancouver and from the Perth/Albany region in Western Australia, where at least 40 sheep died at the same time on a single property.

The NT pattern of disease is considerably different from findings in the region as a whole. Chen *et al.*, for the Australasian Cryptococcal Study Group, found 312 cases of cryptococcal disease in Australia and New Zealand between 1994 and 1997: 85% were due to *C. neoformans* infections (the majority were meningitis) and 79% of these were in immunocompromised patients¹⁸. There were just 47 infections due to *C. gattii*. In summary, *Cryptococcus* is an important cause of pulmonary and CNS disease in the NT, with *C. gattii* being the species most frequently diagnosed. Mass lung lesions are common and surgery may still be required¹⁵.

Other uncommon, invasive fungal infections recently reported in Aborigines include histoplasmosis¹⁹ and mycotic keratitis²⁰. Endemic histoplasmosis occurs uncommonly in Australia. Ralph *et al* reported one suspected and one confirmed case of severe disseminated histoplasmosis in Aboriginal Australians from the NT²⁰. Underlying illness included chronic cardiac disease and Type 1 diabetes mellitus, respectively, and neither patient

was infected with HIV. The clinical presentations resembled malignancy. Diagnosis of histoplasmosis was made on the basis of bowel histology in Case 1, demonstrating characteristic yeasts and lymph node histology and culture in Case 2. Histoplasmosis should be considered in relevant clinical situations, even in HIV-negative patients who have not left Australia¹⁹.

Aborigines and Torres Strait Islanders in far north Queensland are also at increased risk for many eye conditions. Thew and Todd reviewed all cases of culture-positive fungal keratitis presenting at Cairns Base Hospital between 1998 and 2008²⁰. The study included 16 eyes from 16 patients. Five (31.25%) patients were of Aboriginal and Torres Strait Islander descent. Predisposing factors were ocular trauma (n=7) and contact lens wear (n=3). No patients were on topical steroids at presentation. All patients grew filamentous fungi with *Fusarium*, the most common isolate (50%). *Aspergillus*, *Curvularia* and *Lasiodiplodia theobromae* were the next most common, accounting for two cases each²⁰. Thus, a significant proportion of the patients presenting to Cairns Base Hospital with fungal keratitis are Indigenous and the very high percentage of cases due to filamentous fungi is similar to other tropical regions of the world²⁰.

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