Sullivan Nicolaides PATHOLOGY
Quality is in our DNA

Sonic Skin Dx

Focus on dermatophytes

Process:

Once specimens are received in the laboratory, microscopy is performed using CalcoFluor White/Evans Blue in KOH, utilising the fluorescent properties of the CalcoFluor White in the stain. An interim report is then released. Specimens are then set up on specialised agar containing antibiotics and cycloheximide to inhibit the growth of bacteria and saprophytic fungi. Cultures are incubated at 28°C for 3 weeks. If microscopy is positive (M+) and no pathogen (C-) has grown in the interim, specimens are held an extra week. Infrequently, where microscopy and culture of nail scrapings is negative and the diagnosis is still suspected, nails can be examined for fungal elements using special stains such as Grocotts, Methenamine Silver or Periodic Acid Schiff (PAS) stains.

Results:

Specimen types have been subdivided into 3 anatomical categories (nails, hair and skin) based broadly on the 3 clinical presentations of onychomycosis, tinea capitis, and tinea corporis/cruris/pedis. Onychomycosis refers to fungal infections of the nails and includes tinea unguium caused by dermatophytes but also non-dermatophyte fungi and yeasts, predominantly Candida spp.

Negative laboratory report:

A common reason for negative microscopy and /or culture is an incorrect clinical diagnosis. More than 50% of dystrophic nails do not have a fungal cause, so it is important to establish a correct laboratory diagnosis before treating a patient with an antifungal agent. Other reasons for false negative results include sampling variation associated with an inadequate specimen and/or splitting the sample to perform microscopy and culture; the presence of nonviable hyphae in the distal portion of the nail; uneven colonisation of the nail by fungus; and overgrowth by contaminant saprophytic fungi. Careful re-collection to obtain sufficient material may be necessary to confirm negative results.

Nails:

The analysis of nail specimens has been broken down into hands, feet and unspecified.

Hands:

Of 1202 specimens processed, (Figure 1) 59% were negative by both microscopy and culture; 11% had hyphae seen on microscopy but were negative by culture; 27% of all finger and thumbnail cultures grew a yeast, predominantly *Candida albicans* (88% of all positive nail/hand cultures). Only 3% of all fingernail specimens grew a dermatophyte. *T. rubrum* was the most common isolate, followed by *T. interdigitale*, the anthropophilic variety of *T. mentagrophytes* (Figure 2).

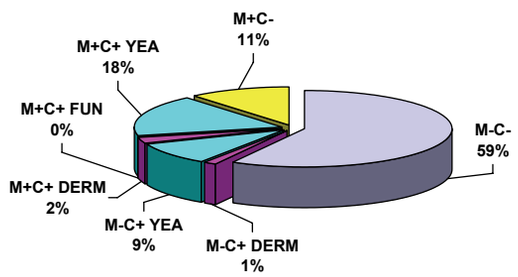

Figure 1: Nails/hands: n=1202 (Refer to Legend)

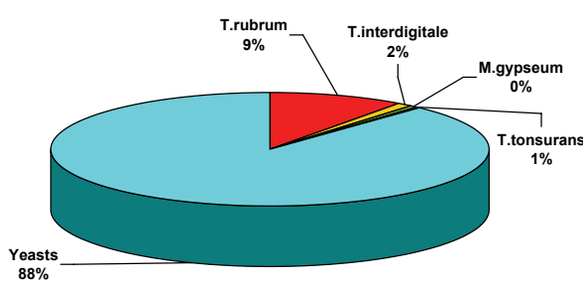

Figure 2: Nails/hands: Culture positive n=369

Feet:

57% of 5097 toenail cultures were negative by both microscopy and culture (Figure 3). 22% were positive by microscopy but culture negative for reasons stated previously. As the literature would suggest, yeast infection of toenails is rare. Dermatophytes (20%) predominate as the main cause of onychomycosis of the lower limbs, with *T. rubrum* and *T. interdigitale* responsible for the majority of infections (Figure 4). Transmission of these dermatophytes is usually via the feet and toe web spaces, which are the major reservoir on the human body. Onychomycosis can be regarded as the end stage of tinea pedis. Desquamated skin scales containing hyphae are shed and survive for months to years on floors and carpets.

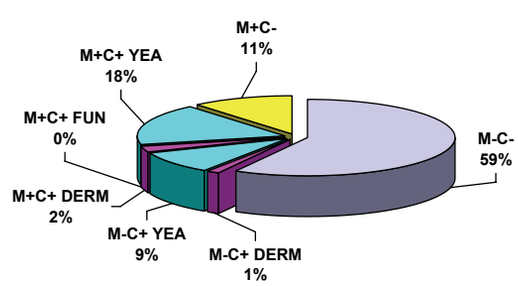

Figure 3: Nails/feet: n=5097 (Refer to Legend)

Dermatophytes are a group of fungi capable of parasitising keratinised tissue such as skin, hair, and nails due to the presence of a unique enzyme keratinase.

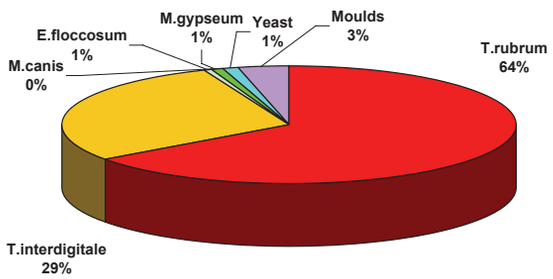

Figure 4: Nails/feet: Culture positive n=1102

Infrequently nondermatophyte moulds are implicated in toenail infections. *Scopulariopsis, Aspergillus, Fusarium* and *Acremonium* species constitute 3% of all positive cultures (Figure 5). There is some uncertainty as to the significance of these cultures, and repeat culture may be indicated.

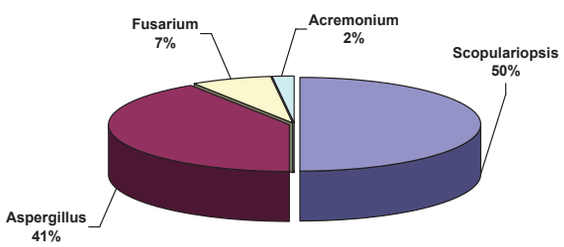

Figure 5: Nails: mould isolates n=54

Unspecified:

The site of collection for 1901 nail specimens (23%) was unspecified (Figure 6). 56% were both microscopy and culture negative; 20% were positive by microscopy alone; 14% grew a dermatophyte and 9% a yeast, reflecting a mixture of both finger and toenail samples.

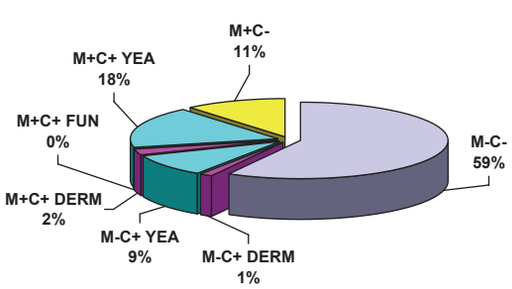

Figure 6: Nails/unspecified: n=1901 (Refer to Legend)

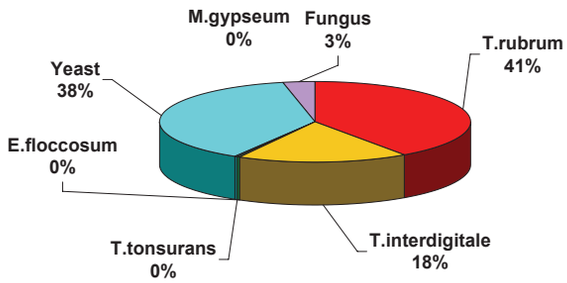

Figure 7: Nails/unspecified: Culture positive n=452

Treatment options:

With tinea unguium, topical treatment is successful only with surgical removal of the nail combined with oral therapy. First-line treatment for all types of nail tinea consists of:

1. terbinafine (child <20 kg: 62.5 mg; 20 to 40 kg: 125 mg) 250 mg orally, daily for 6 weeks for fingernails and 12 weeks for toenails
   or (if terbinafine is not tolerated)
2. itraconazole 200 mg orally, twice daily for 7 days every month for 2 to 4 months
   or
3. fluconazole 150 to 450 mg orally, once weekly for 12 to 52 weeks.

In order to obtain terbinafine under the Pharmaceutical Benefits Scheme, the infection must be proven by microscopy and/or culture. Successful management of candidiasis of the nail requires removal of risk factors e.g. water immersion.

Tinea capitis:

Of 414 hair samples submitted over this period, 329 (80%) were negative by both microscopy and culture. Dermatophytes isolated include *M. canis* (46%); *T. tonsurans* (42%); *M. gypseum* (5%); *T. mentagrophytes* (5%) and *T. rubrum* (2.5%) (Figure 8). This condition afflicts predominantly prepubertal children (Figure 9). Clinically it can present as alopecia or a more inflammatory lesion (kerion). As a generalisation geophilic* and zoophilic* dermatophytes tend to produce more inflammatory lesions than anthropophilic* fungi. It is noteworthy that *T. tonsurans*, an anthropophilic fungus, is emerging as a common cause of tinea capitis in children and spreads easily from child to child.

* See following: Dermatophyte species in Australia

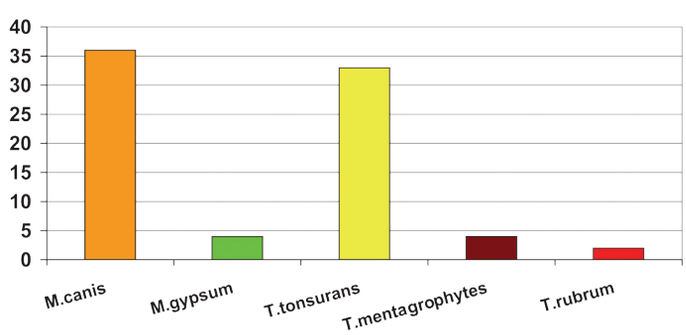

Figure 8: Scalp — Culture positive n=79

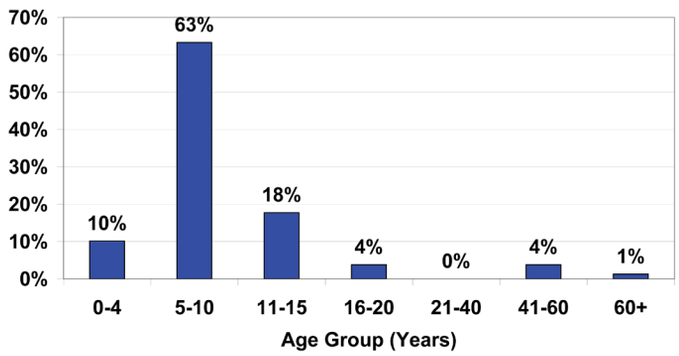

Figure 9: Scalp dermatophytes: n=79 by age

Treatment options:

Tinea capitis often requires oral therapy to eradicate the infection. Treatment options include

1. griseofulvin fine particle (child: 20 mg/kg up to) 500 mg orally, daily for 4 to 8 weeks.
   or
2. terbinafine (child <20 kg: 62.5 mg; 20 to 40 kg: 125 mg) 250 mg orally, daily for 4 weeks

Tinea corporis/cruris/pedis:

Of the 7406 specimens received from skin sites, 73% were both microscopy and culture negative; 5% were positive only by microscopy. Of the 22% culture positive specimens, 19% grew a dermatophyte and 3% a yeast. The human-adapted dermatophyte *T. rubrum* was again the most common culture isolate (Figure 10), followed by *T. interdigitale, T. mentagrophytes, E. floccosum, M. canis, M. gypseum* and *T. tonsurans*.

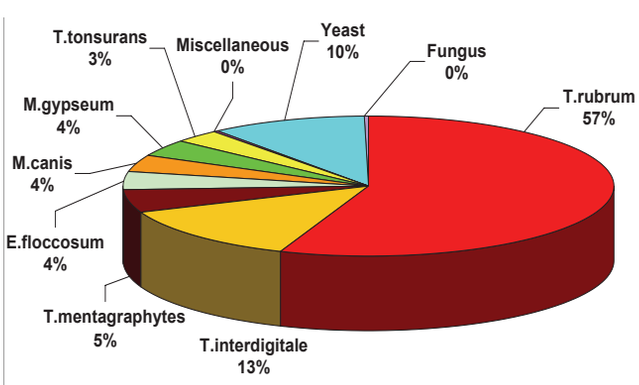

Figure 10 Skin: Culture positive n=1594

Treatment options:

When topical treatments have failed, recommended oral therapy includes:

1. griseofulvin fine particle (child: 10 to 20 mg/kg up to) 500 mg orally, daily for at least 4 weeks
   or
2. terbinafine (child <20 kg: 62.5 mg; 20 to 40 kg: 125mg) 250 mg orally, daily for at least 2 weeks, depending on the response
   or
3. itraconazole capsules 200 mg orally, twice daily for 1 week for tinea of the feet or hands
   or
4. itraconazole capsules 200 mg orally, once daily for 1 week for tinea elsewhere.

* Dermatophyte species in Australia

Anthropophilic		
Epidermophyton floccosum	Humans	Common
Trichophyton rubrum	Humans	Very common
Trichophyton interdigitale	Humans	Common
Trichophyton tonsurans	Humans	Common
Trichophyton violaceum	Humans	Less common
Trichophyton soudanense	Humans	Less common
Microsporum audouinii	Humans	Less common
Geophilic		
Microsporum gypseum	Soil	Common
Microsporum nanum	Soil/Pigs	Rare
Zoophilic		
Trichophyton mentagrophytes	Mice, rodents, guinea pigs	Common
Microsporum canis	Cats	Common
Trichophyton verrucosum	Cattle	Rare
Trichophyton equinum	Horses	Rare
Microsporum nanum	Soil/Pigs	Rare

Legend for figures		
M	Microscopy	*T. rubrum*
C	Culture	*T. interdigitale*
YEA	Yeast	*T. mentagrophytes*
DERM	Dermatophyte	*T. tonsurans*
FUN	Mould/Fungus	*M. canis*
		M. gypseum
		E. floccosum

Reference

Therapeutic Guidelines – Antibiotic version 13 2006+

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