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Diagnosis, prevention and treatment of fungal infections


Abstract

Most fungi live harmlessly in the environment, but some species can cause disease in the human host. Nurses working in primary care are likely to see patients with superficial fungal infections and are well placed to offer advice about treatment and measures to prevent the spread of infection in the home.

Aim and intended learning outcomes

THE AIM of this article is to provide an overview of the main fungal infections likely to be encountered in primary care settings, including diagnosis, treatment and strategies for infection prevention and control.

After reading this article and completing the time out activities you should be able to:

■ List the main fungi that give rise to infection in the human host.
■ Differentiate between superficial and systemic mycoses, giving examples of each.
■ Describe the methods used to diagnose fungal infections.
■ Discuss the challenges associated with antifungal therapy.

Introduction

Fungi belong to a diverse group of organisms that includes yeasts, moulds and dermatophytes (fungi that cause parasitic skin disease in humans) (Wilson 2006). They are classified in a separate kingdom from animals, plants and bacteria, and physiologically have most in common with animals. Most fungi live harmlessly in the environment, especially in soil and decaying matter, but approximately 200 species can cause disease in the human host (Wilson 2006).

Fungal infections are not usually serious in otherwise fit, healthy adults, but they can be embarrassing and distressing. Very ill and immunocompromised patients are at risk of serious fungal infections, especially if they have had multiple courses of antibiotics and have undergone invasive procedures (Alberti et al 2001, Kontoyiannis et al 2003). Exogenous infection (cross-infection) caused by fungi can occur from one patient to another at home and in healthcare settings. Fungi can cause healthcare-associated infections (HCAIs) and outbreaks have been reported in the UK and other developed countries (Wilson 2006).

Fungi

More than 300,000 species of fungi have been identified, but most live harmlessly in the environment where they play an important role breaking down and recycling organic material from dead animals and plants. Only a few species are pathogenic (able to cause disease).

Terminology

Go online or use a standard microbiology textbook of your choice to check the meaning of the following terms: saprophyte, parasite, commensal, opportunistic infection, hyphae, mycelium, mycosis, mycology.

Saprophytes are organisms that live freely in the environment, obtaining their nutrients from dead or decaying animals and plants. Most fungi are saprophytic, as are many bacteria. Parasites obtain their nutrients and shelter from another living organism which is called the host. All viruses and some species of bacteria are obligate parasites, meaning that they are unable to live without a host, but no known species of fungi are obligate parasites. Commensals are organisms adapted to live on the skin and mucous membranes of the host and form part of its normal flora. They do not usually cause infection but have the capacity to operate as pathogens if the immune

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Keywords

Antifungal therapy, fungal infections, infection prevention and control, mycosis, vaginal candidiasis

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defences of the host have become weakened through ill health, especially malignant disease. This type of infection is called opportunistic infection.

As the number of seriously ill and immunocompromised patients undergoing invasive procedures increases, it is likely that the number of opportunistic fungal infections reported will also increase and that species considered to be harmless saprophytes will demonstrate opportunistic behaviour, particularly among the critically ill (Salonen et al 2000). Some fungi, for example yeasts, assume a very simple structure and exist as single cells (Figure 1). More complex forms display filamentous branching structures called hyphae. These can become highly interwoven to form a mesh called a mycelium. Larger, more complex fungi are clearly visible without magnification, but as microscopic examination is necessary to aid identification, specimens are sent to the microbiology laboratory. Yeast cells reproduce by forming buds which separate into new cells and they can also form spores. The more complex fungi reproduce by disseminating large numbers of tiny, very lightweight spores (sometimes called conidia). These are easily dispersed by wind and survive in the environment for long periods because they are highly resistant to desiccation. They can present a risk of infection to patients in hospital by contaminating dust which accumulates in places that are difficult reach during usual cleaning procedures (Symoens et al 2002).

A fungal infection is called a mycosis. Fungal infections affecting the skin are sometimes referred to as dermatophytic infections. Mycology is the study of fungi. Examples of human mycoses are shown on Table 1.

Superficial and systemic mycoses

A superficial mycosis is restricted to the skin and its appendages (hair and nails) or to the mucous membranes. A fungal infection affecting the nails is called an onychomycosis. Superficial mycoses such as vaginal thrush, athlete’s foot and ringworm are extremely common, but the precise number affected is unknown, because many people treat themselves with over-the-counter medication and never seek nursing or medical advice. Nurses are particularly likely to see patients for whom self-treatment has been unsuccessful and for whom symptoms have become troublesome.

A systemic mycosis is a serious condition in which hyphae penetrate the deeper tissues. This type of infection can be extensive, frequently life-threatening and is difficult to treat (Salonen et al 2000). In temperate climates systemic mycoses are unusual except in immunocompromised patients and are unusual in patients seen in primary care. This article describes superficial mycoses only.

Table 1 Human mycoses

<table>
<thead>
<tr>
<th>Fungus</th>
<th>Mycosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candida albicans</td>
<td>‘Thrush’ (candidiasis, candidosis)</td>
</tr>
<tr>
<td>Trichophyton interdigitale</td>
<td>‘Athlete’s foot’ (tinea pedis)</td>
</tr>
<tr>
<td>Microsporum audouini</td>
<td>‘Ringworm’</td>
</tr>
<tr>
<td>Aspergillus fumigatus</td>
<td>Respiratory infection immunocompromised patients</td>
</tr>
<tr>
<td>Cryptococcus neoformans</td>
<td>Meningitis in immunocompromised patients</td>
</tr>
</tbody>
</table>

Identification and diagnosis

Diagnosis of the common superficial mycoses is usually made on the symptoms that patients report and clinical examination. Effective diagnosis and management require taking a careful history. Patients should be asked about any over-the-counter and prescribed treatment they are taking, their general state of health and whether any other household member or contact is experiencing the same problem (Parker 2009). Rashes affecting the skin and discharge from the genitalia are likely to cause patients embarrassment and they may have sought the help of a health professional reluctantly, possibly only when self-help approaches have failed.

Mycoses, especially those affecting the feet or between folds of skin, may become apparent only during examination for some other health problem, especially among older people and may reflect difficulties attending to personal hygiene (Parker 2009). Where the nature of the mycosis is less obvious or
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### Table 2 Antifungal drugs

<table>
<thead>
<tr>
<th>Drug group and examples</th>
<th>Indications</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Polyenes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nystatin</td>
<td>Oral and vaginal candidiasis</td>
<td>Topical application&lt;br&gt;Too toxic for parenteral use</td>
</tr>
<tr>
<td>Amphotericin</td>
<td>Systemic and topical fungal infection</td>
<td>Oral, topical and parenteral. Severe toxic effects: fever, hypokalaemia (abnormally low level of potassium in the blood) and nephrotoxicity</td>
</tr>
<tr>
<td><strong>Imidazoles</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clotrimazole</td>
<td>Topical fungal infections</td>
<td></td>
</tr>
<tr>
<td>Ketoconazole</td>
<td>Systemic fungal infections, resistant infections of the skin and mucosae, gastrointestinal tract and vagina</td>
<td>Not as effective as amphotericin&lt;br&gt;Hepatic toxicity (toxic to liver cells)</td>
</tr>
<tr>
<td>Miconazole</td>
<td>Topical fungal infections</td>
<td></td>
</tr>
<tr>
<td><strong>Triazoles</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluconazole</td>
<td>Vaginal and mucosal candidiasis; invasive infections with candida and cryptococcus; prophylaxis in immunocompromised individuals; fungal infections such as tinea pedis</td>
<td>Oral, parenteral</td>
</tr>
<tr>
<td>Itraconazole</td>
<td>As above, plus nail infections, histoplasmosis, aspergillosis</td>
<td>Oral, parenteral</td>
</tr>
<tr>
<td><strong>Other antifungal drugs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Griseofulvin</td>
<td>Dermatophyte fungal infection</td>
<td>Oral&lt;br&gt;Concentrates in keratin so is the drug of choice for intractable fungal infection of the skin</td>
</tr>
<tr>
<td>Flucytosine</td>
<td>Systemic yeast infection</td>
<td>Oral and parenteral&lt;br&gt;Not effective against Aspergillus or dermatophytes</td>
</tr>
</tbody>
</table>

(Adapted from Gould and Brooker 2008)

Symptoms persist, scrapings from the affected skin or fragments of hair or nail should be sent to the laboratory for microbiological examination. In some cases it may be difficult to differentiate between mycoses and other conditions such as eczema or psoriasis, necessitating laboratory investigations (Parker 2009). Skin samples are usually obtained by scraping the lesion gently with a blunt scalpel. Nail parings are obtained with a clipper and the debris that has collected beneath the nail should be included in the sample.

Skin scrapings and hair roots are collected with a commercially available brush (Parker 2009). Transport media are not required because fungi are able to survive in dry conditions. In the case of vaginal infection, a high vaginal swab is required and must be sent to the laboratory in special culture media. In the laboratory, agar plates are inoculated and the organisms are usually identified by the typical size and shape of the cells or the hyphae visible under the microscope. Fungi grow slowly, so patients should be warned that it may take at least two weeks to obtain a diagnosis from microscopy and a further two weeks if the organism has to be cultured. If self-medication with an antifungal agent has already been attempted, samples should not be obtained for two weeks after treatment has ceased because it may interfere with culture in the laboratory (Parker 2009).

### Antifungal agents

**Time out**

Investigate the types of treatment available to treat fungal infections. Effective antifungal agents have been more difficult to develop than antibiotics. From your reading so far, can you think of any reason for this?

**Treatment**

The cellular structure of bacteria is different from that of higher organisms which has permitted the development of chemotherapeutic agents that target bacterial cells but do not damage the host (Gould 2004). As already discussed, fungi are physiologically similar to...
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Higher organisms and consequently many of the drugs available to treat mycoses are highly toxic because they also damage human tissue. Superficial mycoses are treated mainly with topical antifungal agents that can be purchased over the counter, but other antifungal preparations intended for internal use must be taken with caution and few are available without prescription. Topical treatments such as creams, sprays, liquids and powders should be available from pharmaceutical outlets. The main antifungal agents are shown in Table 2. There is growing concern that some fungi are becoming resistant to antifungal drugs, complicating treatment, especially for patients with severe infections (Tortorano et al 2006).

Superficial mycoses

Candida A number of different species of Candida have been identified, but most human mycoses are thought to be caused by Candida albicans which is a commensal in the mouth, vagina and gastrointestinal tract. Superficial candidiasis is extremely common. Up to 75 per cent of women have experienced thrush at some time and about 10 per cent of men attending genitourinary medicine clinics have balanitis (infection of the head of the penis) caused by Candida (Irving et al 1998). Oral candidiasis is common in infants exposed to the organism during passage down the birth canal or during breast-feeding. Candidiasis can affect anyone, but the those at particular risk include: immunocompromised patients, especially those receiving broad-spectrum antibiotics, steroids or cytotoxic drugs, people with diabetes and healthy women who are either pregnant or taking oral contraceptives (Miranda et al 2009). Overt infection can develop in the following sites:

- Oral cavity particularly in people who wear dentures.
- Vagina.
- Glans (head) of the penis.
- Damp, moist areas between skin folds.
- The ‘nappy area’ of babies.
- Folds of skin overlapping the nails (cuticles).
- Feet, in particular the areas between the toes.

Women who develop vaginal candidiasis complain of irritation, vulval soreness and superficial dyspareunia (painful sexual intercourse) (Young 2002). Vaginal discharge associated with Candida is common, but is not always noticeable. It may be thin and watery, or thick, clotted and creamy in appearance. In more severe cases painful vaginal fissures can develop and there may be local oedema. On speculum examination, which is often uncomfortable because of the vulval inflammation, the discharge appears as white plaques adhering to the lateral vaginal walls and covering the cervix (Figure 2) (Young 2002).

Vaginal candidiasis is rarely associated with a serious underlying health problem in otherwise fit women of reproductive age, but it can be a significant source of distress because symptoms are distressing and infection interferes with sexual activity. Some women experience recurrent infections that are difficult to treat, decreasing their quality of life. It has been suggested that they sometimes contribute to clinical depression (Irving et al 1998). People who experience severe and recurrent symptoms can obtain advice and support from the GP, practice nurse, community pharmacist and the National Candida Society (www.candida-society.org).

Most cases of vaginal Candida can be treated with a single dose of fluconazole or with clotrimazole pessaries inserted at night. Local irritation can be treated with clotrimazole cream applied two or three times a day. Some women use probiotic preparations to help treat vaginal thrush, but there is no evidence that they are effective (Young 2002). Sensible self-help remedies include wearing loose fitting cotton underwear, because tight fitting synthetic materials encourage warm, damp conditions that increase local irritation and discomfort, and avoiding heavily scented soaps, shower gels and deodorants. Although vaginal infection caused by Candida is extremely common, many other organisms can also cause vaginosis (Young 2002) and the tendency for women to attempt self-treatment can be a problem if the infection is caused by another organism (Sihvo et al 2000) (Box 1, page 36).

Men who complain of balanitis experience sore, red, itchy skin on the glans penis and sometimes notice a thick, lumpy discharge from the foreskin which they may have difficulty retracting (phimosis). Dysuria and pain on sexual intercourse are common. Local treatment with topical antifungal preparations is usually effective.
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Box 1 Case study
Margaret was aware of changes in vaginal secretion throughout her menstrual cycle. She was not worried about this, as all the information she had gleaned from women’s magazines reassured her that it was normal. However, she became alarmed when she noticed a heavier discharge and local irritation which became worse at night when she was warm in bed. Feeling embarrassed at having to discuss her symptoms with a doctor and not wanting to take time away from work to attend an appointment, she used the internet to obtain information about the possible cause of the discharge. She decided that she had vaginal thrush and purchased over-the-counter-medication in an attempt at self-treatment. The symptoms seemed to become worse: she became sleepless and her ability to concentrate at work declined. Eventually she confided in a friend and on her advice, plucked up the courage to attend a GUM clinic. Margaret was impressed with the speed and efficiency of the examination and diagnosis. She was suffering from bacterial vaginosis which was easily cured.

Candidiasis of the vagina and glans penis can be spread during sexual intercourse, but in many cases infection is not sexually acquired and *Candida* infections are not defined as sexually transmitted, although treatment is more likely to be successful if both partners receive it.

Adults with oral candidiasis usually report having a sore mouth with white plaques that can be wiped away sometimes leaving raw, bleeding areas beneath. Individuals often notice a painful, burning sensation of the tongue and an unpleasant taste in the mouth which they may describe as bitter or salty. Treatment is with nystatin pastilles sucked every six hours after food. Amphotericin B tablets are prescribed for more persistent symptoms. Good oral hygiene is important for everyone, but is especially important for people who have experienced oral candidiasis. Dentures should be removed and scrubbed with a proprietary agent every day, teeth should be brushed with a toothpaste containing fluoride and flossing should take place at least once a day. During an episode of candidiasis dentures should be soaked overnight in sodium hypochlorite solution and rinsed thoroughly before they are next worn. Cases of oropharyngeal and intestinal candidiasis are treated with fluconazole.

When a baby develops oral candidiasis parents will often notice that the child dribbles more than usual and on investigation will find white patches over the gums and the lining of the mouth which come away easily, often leaving raw, bleeding areas. Some babies show no particular signs of distress, but fretfulness and reluctance to feed are common. Oral candidiasis may clear up spontaneously, but many parents are grateful for reassurance and advice provided by their health visitor or GP. Miconazole gel can be obtained without prescription and should be applied for seven days. Parents should be advised to wash their hands and smear a small amount of the gel on the lesions, omitting the back of the throat to avoid choking. Miconazole is not recommended for babies under four months because of the risk of choking. Instead liquid nystatin is applied with a dropper to the affected areas for two days.

Box 2 Fungal infections affecting the feet
Dermatophytic infections of the feet are very common. They affect the spaces between the toes (interdigital infection) or the plantar surfaces (soles). Intertidigital infection usually gives rise to areas of macerated skin, while plantar infections usually look dry, scaly and flaky. In many cases infection arises through the interaction of several species of fungus of low-grade pathogenicity or the interaction of fungi with bacteria. Infections can be hard to treat in people with impaired immunity and the problem is compounded because of the thickness of the stratum corneum, especially over the soles of the feet as it is difficult for topical agents to penetrate (Leyden 1994).

Tinea pedis *Trichophyton rubrum* gives rise to superficial infections of the skin, nails and scalp. Occasionally the palms of the hands can become infected. Infection of the feet is very common, especially mixed infections of *Trichophyton* with other fungal species and sometimes bacteria (Box 2). Such mycoses are called tinea pedis and are often referred to as athlete’s foot. Those affected are likely to complain of:

- A red, itchy rash in the interdigital spaces, often beginning between the fourth and fifth toes. The skin may become white and macerated, break down and become painful (Parker 2009).
- Scaling that is sometimes mistaken for eczema or psoriasis.
- Furrows that resemble chalky lines. The fungi thrive in warm, moist parts of the body, especially the feet, feeding on dead skin cells and exist as harmless saprophytes for most of the time without causing problems. The traditional association between *Trichophyton* infection and people undertaking active sports has been confirmed by epidemiological studies, and the infection is especially common among people who attend public swimming baths, which can become heavily contaminated and operate as the source of outbreaks (Kamihama et al 1997). Regular cleaning is an important infection prevention and control measure. Public shower rooms, locker rooms and saunas are also places where the fungus thrives (Kamihama et al 1997).

People of any age can be affected and young people in their teens are at particular risk of developing athlete’s foot because they are most likely to use communal facilities to participate in active sports, or to live in college halls of residence with shared facilities. Tightly fitting footwear such as trainers cause the feet to become excessively warm and encourage sweating, contributing to risk.

Some people have to wear special rubber footwear at work. For this group, dermatophyte infection of
the feet is an occupational health risk. Other risk factors include obesity, diabetes mellitus, vascular disease and having a weakened immune system (Cheng and Chong 2002). Prevalence is therefore also high among older people, especially men, and is a possible sign of neglect or may reflect underlying illness (Cheng and Chong 2002). Infection is most likely to become persistent and problematic for people who do not dry their feet properly. Lack of flexibility and difficulty bending reduce ability to attend to foot hygiene and place this group of people at special risk.

Many people treat fungal infections of the feet using a combination of self-help measures (Box 3) and an over-the-counter topical antifungal agent. Imidazole preparations such as clotrimazole or micronazole appear most effective. Patients should be advised to continue treatment for two weeks after symptoms have disappeared to ensure that it has been effective.

Some antifungal agents contain hydrocortisone, which is valuable to reduce inflammation and itchiness. Patients should be advised not to use them for more than seven days and to avoid them during pregnancy and breastfeeding unless prescribed because the treatment is toxic to infants or the fetus and could reach them via breast milk or the placenta. Preparations containing hydrocortisone are not suitable for children under the age of ten years.

If symptoms do not resolve, an antifungal agent may have to be prescribed or it may be necessary to take an oral preparation. Dermatophyte infections of the feet are spread through direct skin-to-skin contact and are highly contagious. People who have developed infection once are likely to develop it again as their home or the recreational facilities they use will probably be heavily contaminated with spores. A typical endogenous infection is one that is spread from one anatomical region to another on the same individual. Dermatophytic fungi are highly contagious and both endogenous and exogenous infection are possible.

### Time out

Many people with tinea pedis scratch their feet, transferring spores to their clothes and skin. Later they may notice a rash (caused by the same fungus) elsewhere on their body. What type of infection is this?

**Ringworm** *Microsporum audouini* causes mycosis of the scalp (tinea capitis) and skin (tinea corporis) often called ringworm. Ringworm affecting the scalp is most common in young people, especially boys in the prepubescent years, probably because endocrine changes at puberty increase sebaceous secretions that help to inhibit fungal growth (Fuller et al 2003). People of African-Caribbean descent are especially at risk of ringworm infections, but the reason is unknown (Fuller et al 2003). Adults sometimes carry the fungus, occasionally developing scaly patches of skin. They can spread infection to other people, if symptoms do not resolve, an antifungal agent may have to be prescribed or it may be necessary to take an oral preparation. Dermatophyte infections of the feet are spread through direct skin-to-skin contact and are highly contagious. People who have developed infection once are likely to develop it again as their home or the recreational facilities they use will probably be heavily contaminated with spores. A typical endogenous infection is one that is spread from one anatomical region to another on the same individual. Dermatophytic fungi are highly contagious and both endogenous and exogenous infection are possible.

### Box 3 Dermatophytic infections of the feet: advice for patient

- Wash your feet at least once every day and dry them properly, paying special attention to the spaces between your toes.
- Make sure that your feet are completely dry before putting on your shoes and socks.
- Wear socks made of natural fibers (cotton or wool).
- Change your socks at least daily and if your feet become wet.
- Wash socks, towels and bedclothes at 60°C.
- Avoid footwear made of synthetic materials: they encourage sweating and dampness. Leather shoes are best.
- If possible wear a different pair of shoes every day (alternate two pairs if necessary) to allow them to dry out between use.
- Powder your feet and the inside of your footwear with antifungal powder.
- It is important to avoid the infection spreading to other people. Use a separate towel to dry your feet and do not share it with anyone else.
- Exposing your feet to the air will encourage the infection to clear up.
- Avoid using public swimming baths and other recreational facilities, or if you must use them, avoid walking about in bare feet. Invest in an inexpensive pair of flip-flops for the purpose.
- At home wash shared items such as bathmats with disinfectant and apply disinfect to baths and the floors of showers after use.
- If symptoms do not respond to treatment with an over-the-counter antifungal agent, seek medical advice.
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especially if there is heavy shedding of skin scales laden with spores. Children with ringworm of the scalp are most likely to have small patches of ring-like scaly skin on the scalp which may be inflamed and feel tender, and loss of hair around the affected area.

Occasionally large, inflamed lesions called kerions develop on the scalp. They may release purulent discharge through secondary infection and are painful (Parker 2009). Affected children develop pyrexia and tender, swollen lymph nodes. Bacterial infection is possible in areas of the skin that become broken. Over-the-counter antifungal agents are not effective for treating ringworm of the scalp because the thick skin impedes the penetration of topical agents. Parents should always seek nursing or medical advice because treatment requires oral antifungal preparations which should not be prescribed without laboratory diagnosis (Parker 2009).

The most commonly prescribed drug is terbinafine, which is taken once a day for four weeks. Individuals may need encouragement to adhere to treatment as the side effects, including nausea, diarrhoea and indigestion, can be unpleasant. Some people have also reported that terbinafine affects their sense of taste (Parker 2009), but they can be reassured that this effect is temporary and will disappear once the course of tablets has been completed. Antifungal shampoo will not cure ringworm in the absence of other treatment, but is useful because it helps prevent the spread of infection to other people and may help to resolve the condition faster (Parker 2009).

Most preparations available from high street pharmacy stores recommend application twice a week. There is no evidence that radical approaches such as shaving the affected area will control symptoms or speed recovery and they should not be encouraged. If a kerion has developed, surgical incision and drainage may be required to avoid excessive hair loss and scarring (Parker 2009).

_Microsporum_ is spread by direct contact with the skin or hair of an infected person or through contact with objects that have become contaminated. Infection can be difficult to eradicate because the spores are highly resistant to desiccation, surviving on household objects including combs, towels and bedclothes, which can operate as fomites (objects able to transfer infection). Household pets can become infected.

Transfer of infection is possible when pets are handled or through contact with their beds and blankets. Cattle and horses also carry _Microsporum_ and are a possible source of infection. The spores may be present in soil and it is thought that this is also a possible source. Cases of scalp ringworm appear to be becoming more common in the UK and are a growing public health challenge because many parents fail to receive the appropriate advice regarding treatment (Fuller et al 2003). Outbreaks of ringworm have been reported in schools and can be prolonged (Andrews and Burns 2008).

**Parental advice**

What advice would you give to a parent whose child has developed ringworm of the scalp?

Guidelines for the management of tinea of the scalp have been developed by the British Association of Dermatologists (Higgins et al 2000). Parents should be advised to limit the risk of infection spreading to other members of the household by supervising children’s hygiene. Frequent hand washing with soap and water is important. The mechanical action of washing and drying should physically remove the spores although it will not destroy them.

Personal items such as combs, clothing and towels should not be shared. It is important to look for evidence of infection in household members not previously infected and to ensure that everybody who develops symptoms adheres to their medication and has their hair washed with antifungal shampoo twice a week.

Scratching should be avoided if at all possible to prevent endogenous infection and because it can lead to bacterial infection of the skin that will require treatment with antibiotics. Fingernails should be cut short. Very young children can wear mittens while asleep. If a family pet is suspected as the source of infection (for example a poor coat, patches of fur falling out or excessive scratching) it will need to be taken to the vet for treatment.

Ringworm on areas of the skin other than the scalp seems to affect people of all ages equally, with the exception of infections involving the groin area (tinea cruris) which most often affects young men. Patients who develop ringworm of the body report a red rash which assumes a circular appearance. The ring of fungal growth extends outwards as the mycelium increases in size. The area of skin in the ring looks normal because the mycelium has died and the skin has recovered, but the rim where it is actively growing is itchy and inflamed (Figure 2).

Sometimes the circles merge so the characteristic appearance is lost. When the groin is affected patients complain that the rash becomes worse with friction created by walking and vigorous exercise, especially if tight clothing is worn. Ringworm involving the skin, including the groin area usually

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responds well to topical over-the-counter antifungal treatments, but there are some groups of patients for whom this type of infection can be persistent and difficult to eradicate (Parker 2009).

### Over-the-counter treatment

From your reading so far, which patients do you think are unlikely to respond to over-the-counter topical antifungal treatment?

People whose immune systems are depressed and those with chronic conditions such as diabetes are likely to develop persistent symptoms and will need to seek nursing or medical advice. Infections are particularly difficult to eradicate in people who are obese. These individuals require treatment with oral antifungal agents, either terbinafine or griseofulvin. Griseofulvin produces the same side effects as terbinafine described previously. The drug is not suitable for women who are pregnant or planning pregnancy because it can cause birth defects. Another disadvantage of griseofulvin is that it interferes with both the combined and progestogen-only oral contraceptive pill, so women are advised not to drink or to moderate their usual intake. Griseofulvin acts slowly and treatment may take several weeks. Any patient who develops a Microsporum infection of the skin should be advised to change and wash their underclothing frequently because the spores will persist in skin scales shed from the affected areas.

### Conclusion

Superficial mycoses are not life-threatening, but they can be a source of embarrassment, anxiety and distress to patients presenting in primary care settings, especially if they are recurrent. Nurses play an important role in advising patients about treatment, future prevention and how to limit the spread of infection to others in the same household.

They are well placed to offer advice and recommend sensible approaches to improve self-care. Nurses in extended roles will also undertake clinical examination, take medical histories and obtain specimens to help differentiate mycotic infection from other common skin problems such as eczema and psoriasis. Those who have undertaken the required training will prescribe antifungal treatment.

### References