Subcutaneous and Deep Fungus Infections

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Moulds and yeasts, so-called dimorphic fungi, cause a number of cutaneous infections. Transmission takes place via inoculation of the agents as a result of injury, e.g. following barefoot walking in semiarid to arid areas, or through haematogenous spread, mostly from the lung. Examples for inoculation mycoses are mycetomas caused by various fungi and bacteria, chromoblastomycoses due to melanized or brown-pigmented fungi and sporotrichosis due to *Sporothrix schenckii*, a ubiquitous occurring dimorphic fungus. Secondary cutaneous involvement after haematogenous transmission occurs in blastomycosis, coccidioidomycosis, cryptococcosis and histoplasmosis, frequently in immunosuppressed patients.

Subcutaneous or deep fungal infections of the skin are considered diseases of the poor, as a part of the increasing number of neglected conditions in hot climate zones, which affect people living under low-level socioeconomic conditions and hygienic standards.

6.1 Mycetoma

Mycetoma (also called Madura foot) is a chronic putrid, nodular, sinus-forming infection of the subcutaneous tissue predominantly on the feet; it represents a chronic inflammation with the development of painless granulomas growing to form tumour-like masses. Destruction of deep tissues, such as muscles, bones, joints and rarely tendons, may result. The causative agents of *actinomycetomas* are bacteria, whereas *eumycetomas* are caused by various moulds. In rare cases mixed bacterial and fungal infections may occur. Eumycetomas and actinomycetomas are an infection of the poor carrying not only medical significance; they are frequently a medical and social challenge [1]. In distinct rural areas of Africa, but also in Asia (India) and Middle America (Mexico), mycetomas lead to socioeconomic consequences involving the affected patients, their families and the societies in general [2]. Mycetoma has been added by the WHO to its list of neglected tropical disease priorities [3].

6.1.1 Epidemiology

Barefoot-walking populations in India and in tropical countries of Africa may be affected by moulds and develop mycetomas. In the western part of the African continent, in Senegal and Sierra Leone, the infection is endemic; also Sudan is considered a mycetoma homeland. The African countries with endemic incidence are summarized as "trans-African mycetoma belt," the geographic region between Senegal and Sudan extending between the 15° and 30° North latitude, dry areas with sparse rainfall (50–1000 mm/year). There is an associate to distinct species of fungi and actinomycetes in the environment, depending on the amount of rainfall, temperature and humidity. In addition, mycetomas occur in the central and northern parts of South America, in French Guiana, in Guatemala and in Mexico [4]. Rarely, cases of mycetoma were reported in Bulgaria and Romania due to *Scedosporium apiospermum* and *Madurella mycetomatis*. In the USA *Scedosporium boydii* represents the most frequent pathogen. Overall, eumycetomas occur in tropical and subtropical climate zones, whereas actinomycetomas are more frequently seen in North Africa, e.g. in Morocco and Tunisia.

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6.1.2 Pathogenesis

The most common causative agent of eumycetoma is *Madurella mycetomatis*; actinomycetomas are caused by actinomycetes belonging to the genera *Actinomyces*, *Nocardia* and *Streptomyces* species. The agents are introduced by small traumas, usually through thorns into the subcutaneous tissue of barefoot-walking people. Distinctive for both eumycetoma and actinomycetoma is the formation of microcolonies of the organisms in the vital tissue, seen on their surface as 0.3–1 mm grains. Black, red, white (pale) or yellow grains are easily visible under the light microscope, also with naked eye in some cases, depending on the type of the causative agent [3] (see Table 6.1).

6.1.3 Clinical Picture

After inoculation of the mould, a painless tumour-like subcutaneous swelling occurs, spreading into the skin and the underlying deep tissues, finally leading to destruction of muscles, tendons and bones. The time course of the overall development takes a period of months or years. First symptoms are localized at the affected lower extremities, mostly the feet, where nodule and hard subcutaneous plaques are palpable. The superficial nodules often have multiple sinuses producing serosanguineous discharge, either spontaneously or following pressure.

Mycetomas affect mostly healthy, young adult males, although no age is exempted. The general condition of the patient remains unaffected; fever is rare. Although the lesions are generally found on the lower extremities (80%), mostly on the soles and the foot arches (Fig. 6.1), other localizations such as the scalp, shoulders, neck, arms, and hands may be also affected, especially in endemic areas (Fig. 6.2). In Togo, West Africa, 19 out of 30 patients suffered from a mycetoma of the feet; further affected body sites were the trunk, the head (scalp) and the arms. In India, actinomycetomas due to *Nocardia asteroides* have been described also affecting the neck, breast, back, buttocks, elbows, palms, groins, vulva, thighs and knee. The clinical picture of the two types of mycetoma is similar. Initial subcutaneous nodules occur in both (Fig. 6.3). In malnutrition and other illnesses in the tropics associated with immunodeficiency (HIV infection, leishmaniasis, repeated courses of malaria), fast proliferation of the microorganisms may occur; in late stages the limbs show bizarre deformations, leading to disablement, joint ankylosis, fibrosis, pain and limb atrophy.

For differential, other infections such as pseudomycetoma caused by dermatophytes, chromomycosis, hyalohyphomycosis etc. have to be considered. Botryomycosis represents a mycetoma-like infection of the skin due to staphylococci and/or streptococci and might also develop in individuals living in Europe and North America. Also, noninfectious conditions such as podoconiosis, malignant tumours of the soft tissue or bones and Kaposi's sarcoma may mimic mycetoma.

Madurella mycetomatis may be cultured in vitro for diagnostic purposes (Fig. 6.4); the formation of grains is a distinctive clinical feature [5], and their examination from the discharge may be helpful for diagnosis of tumour-like giant mycetomas occasionally seen (Fig. 6.5). Deep punch biopsies show epithelioid cell granulomas together with microcolonies or grains and druses, e.g. conglomerates of septated and branched, radially arranged broad hyphae, sometimes with vacuole formation. The grains show round, sometimes oval, or kidney-like configurations. In case of suspected actinomycetoma, Gram staining should be done.

Table 6.1 Colour of eumycetoma grains dependent from the species of the causative mould

Grains	Infective agents
Dark and black	*Madurella mycetomatis*, *Madurella grisea*, *Exophiala jeanselmei*, *Medicopsis romeroi*, *Leptosphaeria senegalensis*, *Leptosphaeria tompkinsii*, *Curvularia lunata*
Pale or unstained	*Pseudallescheria boydii*, *Acremonium* spp., *Fusarium* spp., *Neotestudina rosatii*, *Aspergillus nidulans*, *Aspergillus flavus*, *Microsporum ferrugineum*, *Microsporum audouinii*, *Microsporum langeronii*
White	*Scedosporium apiospermum*
Yellow-brown	*Nocardia brasiliensis*, *Nocardia caviae*, *Actinomadura madurae*, *Streptomyces somaliensis*
Yellow	*Pleurostomophora ochracea*

6.1.4 Management

Management comprises the application of systemic antibacterial agents for *actinomycetoma* and of antifungals in combination with surgical procedures for *eumycetoma*. If systemic antifungal treatment is not available or affordable, painless mycetomas progress to limb destruction and force amputation. Late stages can be complicated by secondary infections resulting in bacteraemia and septicaemia with lethal consequences.

For *eumycetomas* itraconazole 2 × 200 mg/day is recommended over 1–1½ year; terbinafine 250–500 mg/day may be an alternative. Experiences with posaconazole and vori-

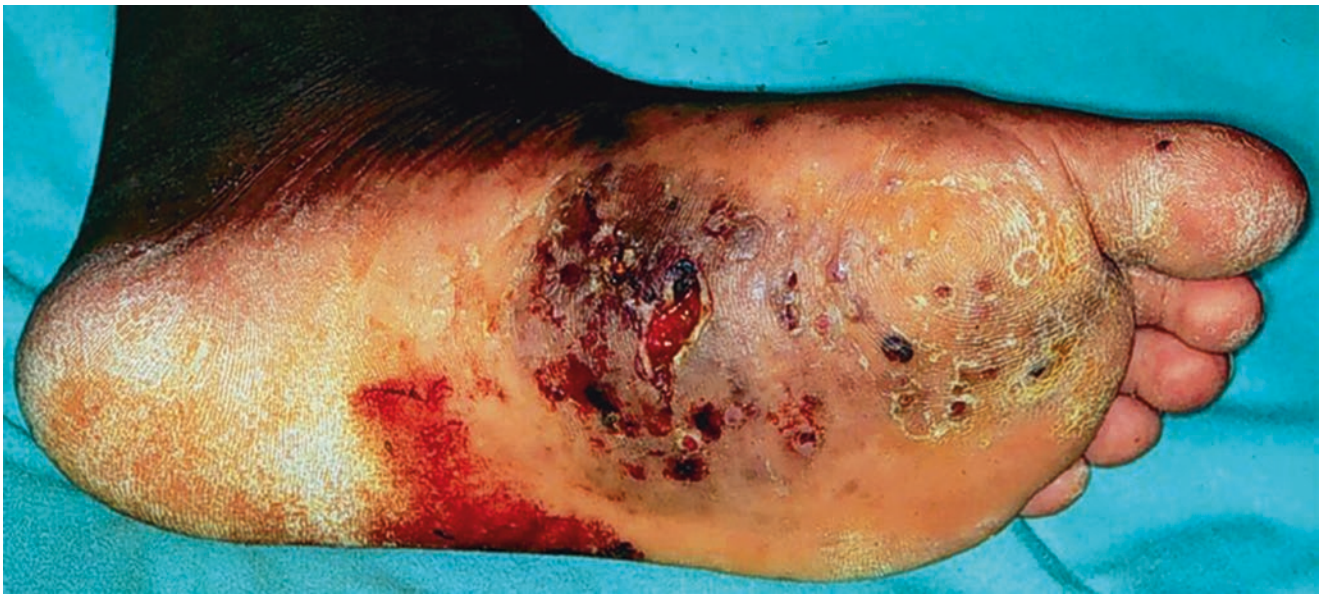

Fig. 6.1 A 17-year-old refugee from Senegal: *Eumycetoma* of the foot, showing hard nodules with multiple sinuses producing serosanguineous discharge. Nodules and grains at the instep

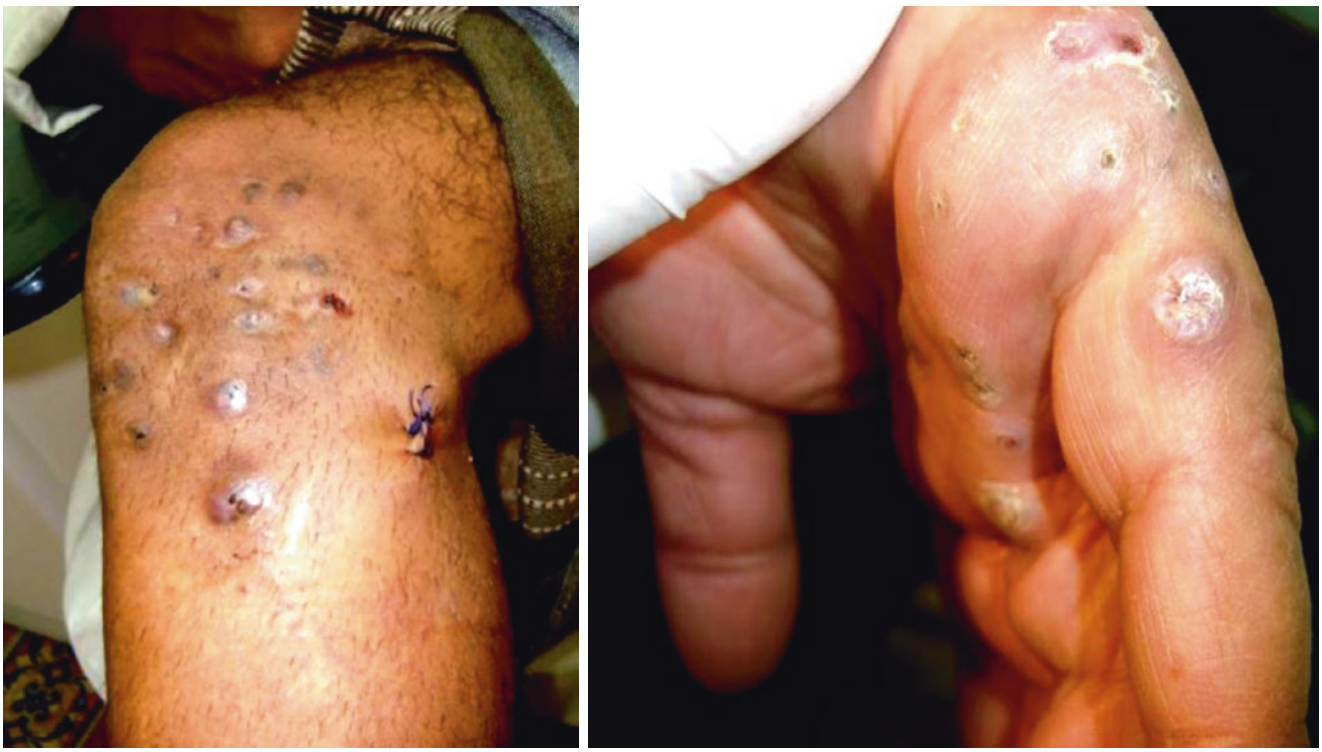

Fig. 6.2 Left: *Eumycetoma* of knee with multiple nodules in a patient from Yemen; right: multiple and firm nodules on the hand

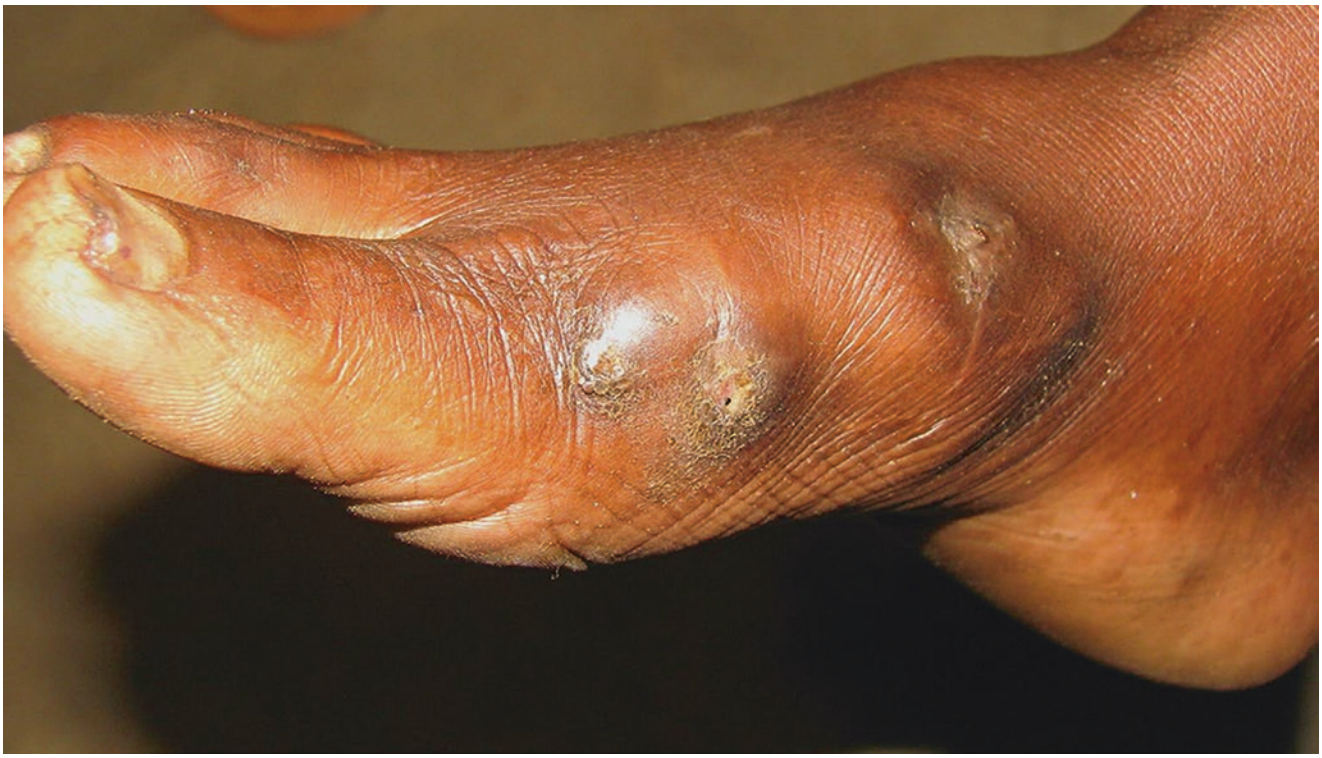

Fig. 6.3 Subcutaneous nodules of *mycetoma* on the dorsum pedis. A 20-year-old male in Tanzania

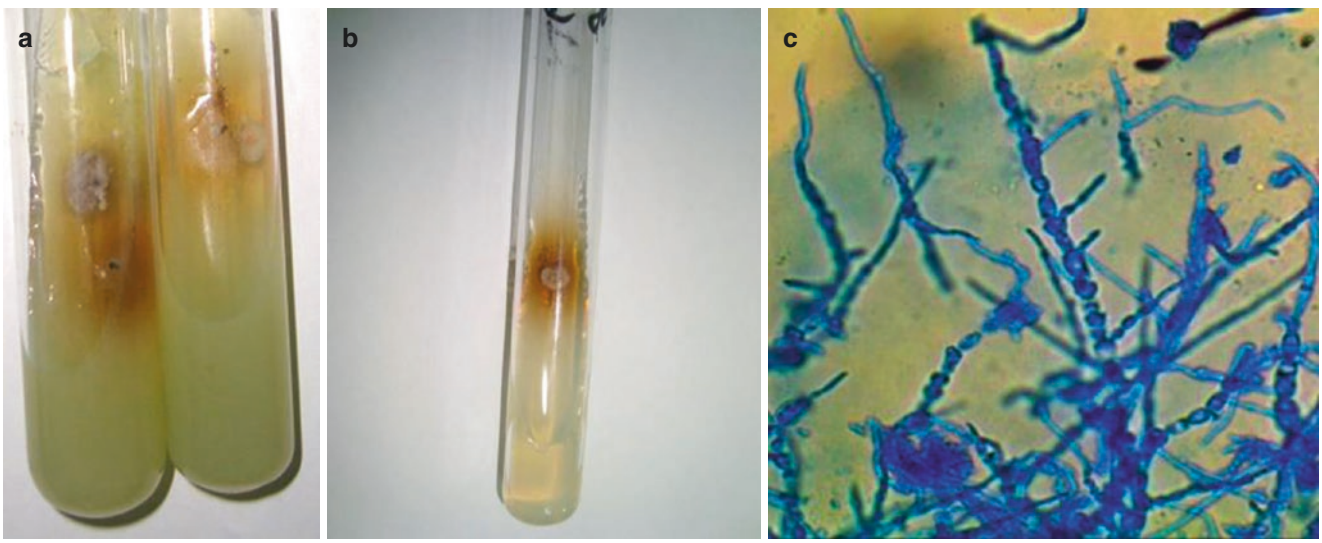

Fig. 6.4 (**a**–**c**) *Madurella mycetomatis*. (**a**) Primary culture from granules on Sabouraud's dextrose agar (Dermasel) showing diffuse brown pigment and grey to light brown thallus; (**b**) colonies on potato dextrose medium developing brown pigment; (**c**) microscopic picture showing hyphae and chlamydoconidia

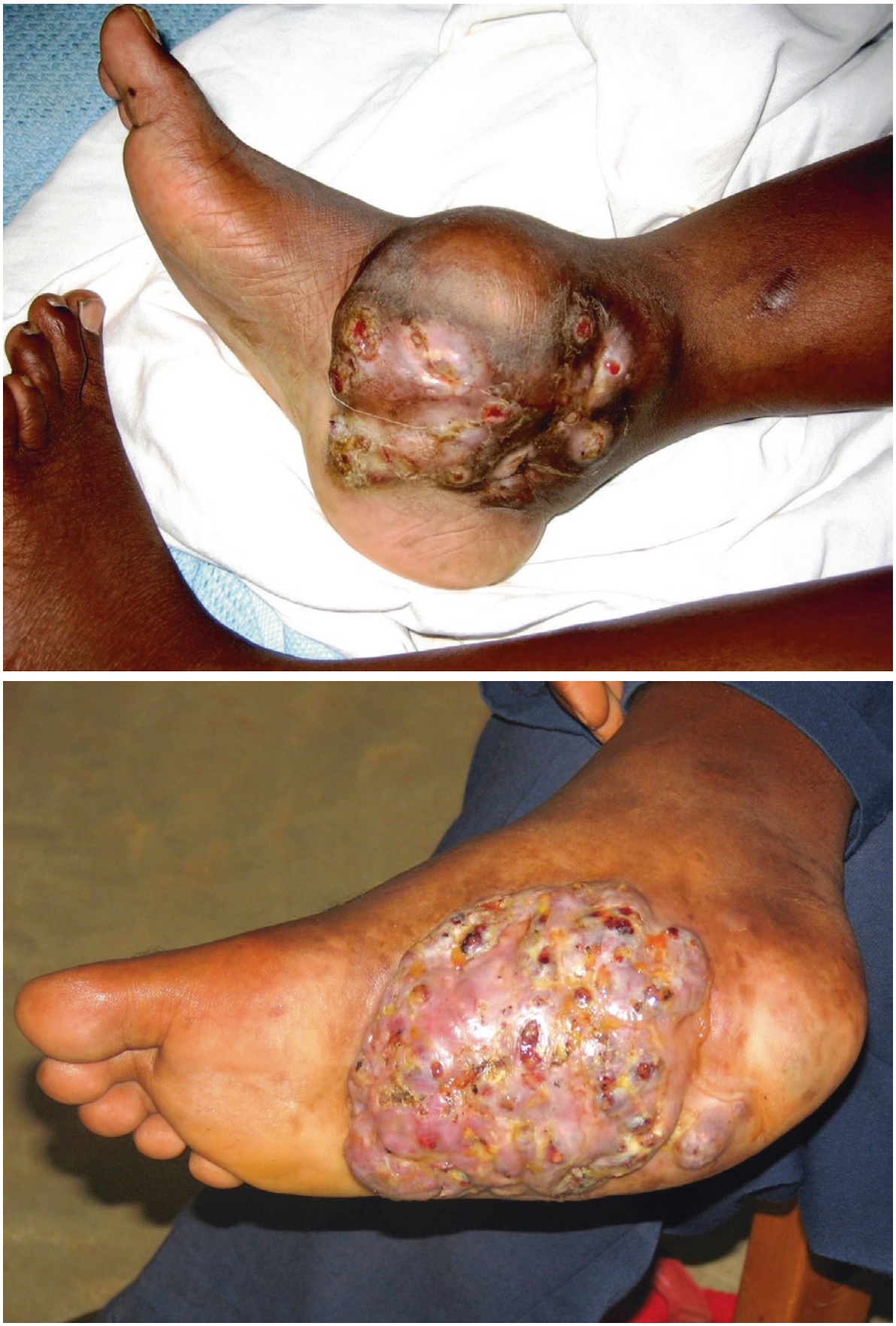

Fig. 6.5 *Giant mycetomas* with exophytic growth and serosanguineous discharge on the feet of young males (Kilimanjaro District, Tanzania). Black grains are seen on the surface

Table 6.2 Treatment of actinomycetomas

	Antimicrobial management
Actinomadura madurae	Streptomycin sulphate 1 g/day + dapsone 100–200 mg/day
Nocardia spp.	Trimethroprim-sulfamethoxazole 80/400 to 160/800 mg/day + dapsone 100–200 mg/day
Streptomyces somaliensis	
Actimomyces pelletieri	
Pronounced, widely spread actinomycetoma	Trimethroprim-sulfamethoxazole 80/400 to 160/800 mg/day + dapsone 100–200 mg/day over several months until clearing + amikacin i.v. 15 mg/kg bw/day, 3–5 pulses every 2–3 w

conazole are limited. Large tumourous eumycetomas often show delayed response to antifungals and should be removed surgically. Also *actinomycetomas* respond with delay to treatment (see Table 6.2). Overall recurrences are common and amputations unavoidable.

As a prophylaxis, walking barefoot in highly endemic countries should be avoided whenever simple shoes are available and affordable. Early wound disinfection is mandatory.

6.2 Chromoblastomycosis

Chromoblastomycosis or chromomycosis is a chronic subcutaneous fungal infection of the skin generally presented in form of verrucous or vegetating lesions on uncovered areas caused by melanized or brown-pigmented fungi of the order *Chaetothyriales* [6]. The disease occurs worldwide, although endemic areas are concentrated in the tropics and subtropics with higher prevalences in Latin America (Brazil and Venezuela), in Central America and in Africa. Cases were also seen in other countries, e.g. India, China, Japan, Sri Lanka, Malaysia and Australia. Affected patients are usually outdoor labourers, farmers or individuals routinely not wearing shoes, with history of inoculation of plant thorns or wood splinters. Most cases of chromoblastomycosis occur among males aged 30–60 years. There is no ethnic predisposition.

6.2.1 Pathogenesis

A large number of melanized (dematiaceous) fungi have been associated with chromoblastomycosis. The most common pathogen is *Fonsecaea pedrosoi* which is considered as the primary etiological agent worldwide, found in 80% of the total set of strains [7]. Pathogenesis depends on the conversion of hyphae into the muriform phase (sclerotia) with more melanin content. *F. pedrosoi* is saprophytic in nature, living in soil and plant debris. It was isolated from thorns of the tropical plant *Mimosa pudica*. The second most frequently isolated agent is *Cladophialophora carrionii*, geographically found in dry, desert regions in Latin America and Africa, isolated from cactus plants. Other less common pathogens include *Phialophora verrucosa* [8], *Rhinocladiella aquaspersa* and *Exophiala jeanselmei*, *spinifera* and *dermatitidis*.

6.2.2 Clinical Picture

Chromoblastomycosis is a benign, chronic skin infection believed to originate in traumatic inoculation of the causative agents, primarily involving the arms and legs. Papules of different sizes expand over several months to evolve into several types of skin lesions leading to polymorphic appearances. Hyperkeratotic nodules with verrucous surface and tumour-like masses are seen together with plaque-like lesions of various shapes and sizes, reddish to violaceous in colour (Fig. 6.6); regressional hypopigmented scarring areas may develop spontaneously or after therapies (Fig. 6.7). On their surface there are usually black dots of fungal cells and necrotic tissue, leading to ulcerations and scarring. Haematogenous or lymphogenous spread may lead to metastatic lesions and secondary bacterial infection to lymphatic obstruction and elephantiasis.

Diagnosis is made clinically, based on the characteristic features of the infection. Direct microscopy with KOH scrapings collected from crusts or black dots to detect the muriform phase of the fungus and cultures may be helpful to identify the *F. pedrosoi* as the causative agent (Fig. 6.8). Dematiaceous isolates are obtained after 10–15 days of incubation. Molecular identification based on PCR methods is suitable for identification of *F. pedrosoi* strains.

6.2.3 Management

Treatment of chromoblastomycosis consists of long-term courses of antifungal chemotherapy often combined with physical interventions as conventional surgery, cryosurgery with liquid nitrogen or thermotherapies. Itraconazole 200–400 mg/day or terbinafine 250–500 mg/day, respectively, for about 1 year will be required for clearing. Also, other triazoles such as voriconazole and posaconazole are seemingly more potent in their in vitro activity against the agents of chromoblastomycosis; however, only a few therapeutic experiences exist, and the higher cost makes their use unfavourable in many endemic areas. A case of extensive and severe chromoblastomycosis with therapeutic failure under first choice antifungals and good response to voriconazole has been recently reported [9].

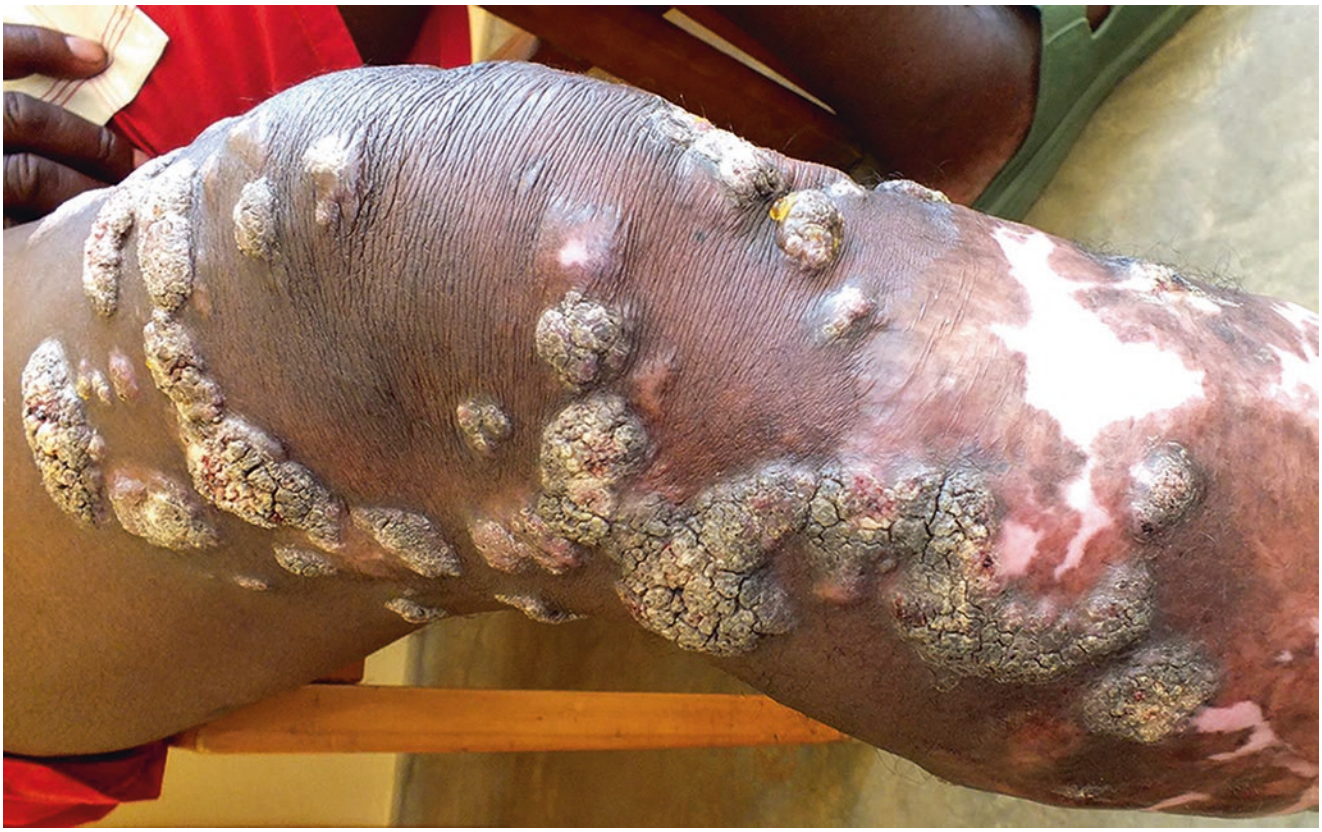

Fig. 6.6 *Chromoblastomycosis* of the right leg in a 64-year-old Tanzanian farmworker, showing subcutaneous nodules with verrucous surface. Hypopigmented scars are results of an intermittent antifungal treatment phase. RDTC Moshi, Tanzania; courtesy Prof. H. Grossmann

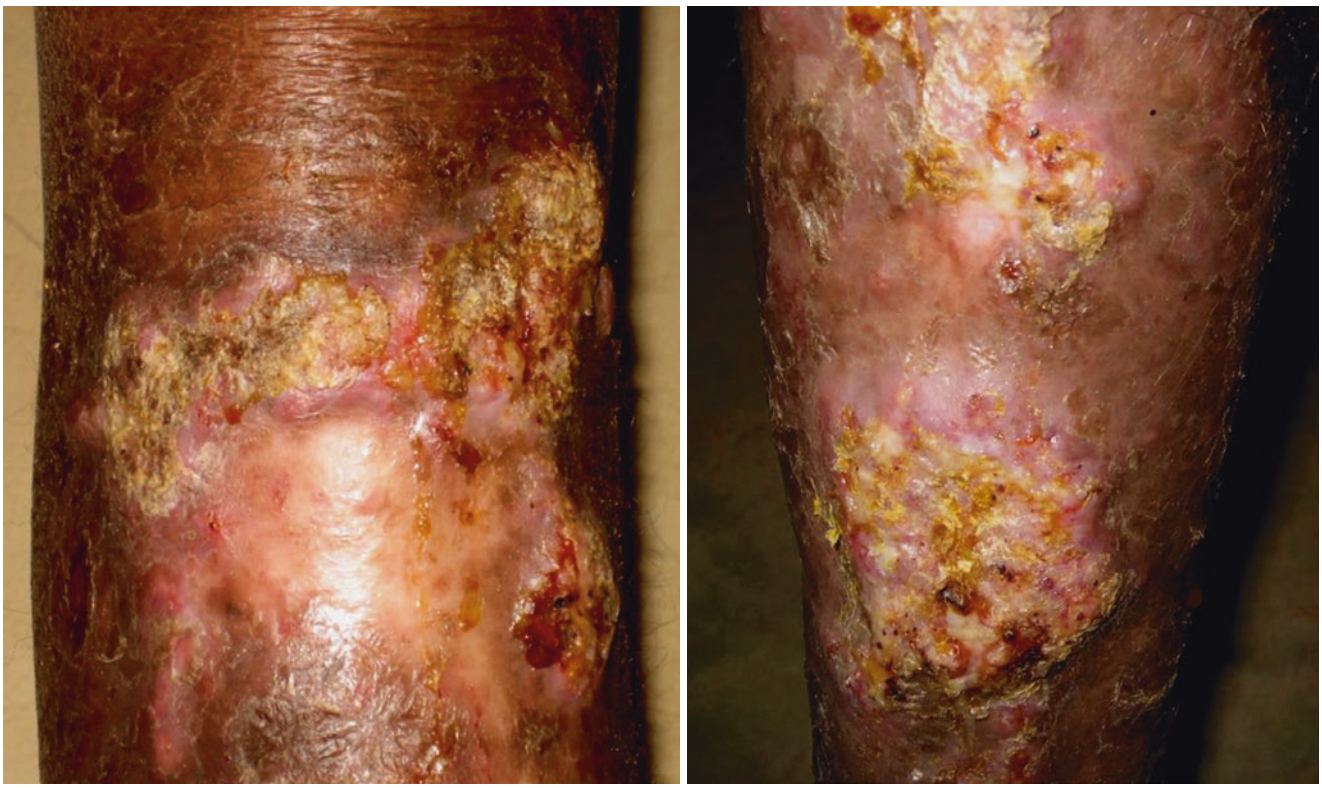

Fig. 6.7 Lesions of *chromoblastomycosis* with scarring under treatment with itraconazole over several months

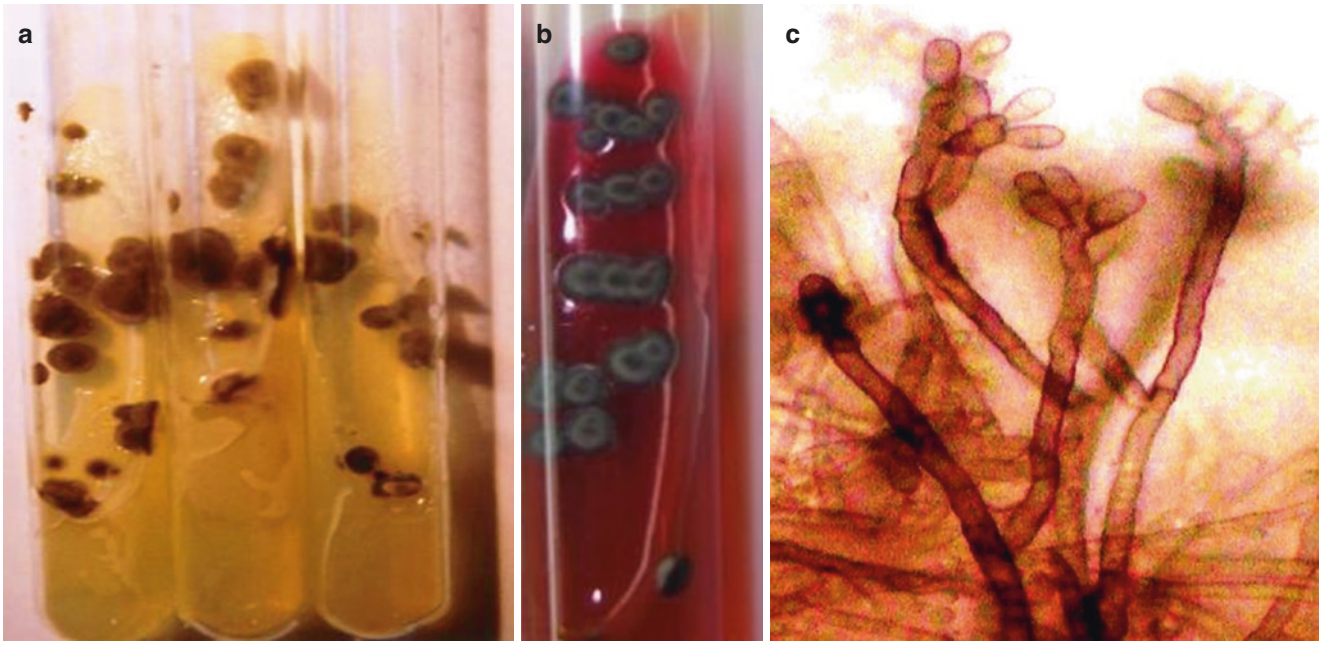

Fig. 6.8 *Fonsecaea pedrosoi.* (**a**) Colonies with greenish black thallus on Sabouraud's dextrose agar; (**b**) On dermatophyte test medium (DTM), the fungus grows with black thallus; the colour of the agar changes to red; (**c**) *Rhinocladiella*-like conidiation with 1–2 cell conidia is microscopically seen

6.3 Sporotrichosis

Sporotrichosis is a traumatic fungal infection with *Sporothrix schenckii* following thorn injuries of the skin, hands and/or arms or injuries of the lower extremities if walking barefoot, showing lymphogenic spread and distribution. Characteristically, the condition has been also called "rose gardener's disease" in the Anglo-American literature. Other body sites are rarely affected [10]. Infected animals (dogs, cats, horses, rats, pigs, armadillos, birds and reptiles) may also serve as a pathogen reservoir for human infection following scratching or biting [11].

Despite the fact that the fungus *Sporothrix schenckii* is ubiquitously found in nature in nearly all parts of the world, most sporotrichosis appears in tropical and subtropical countries. There are no studies concerning the exact incidence; each case represents a single infection reported as a rare event, most of them in the USA, India and Japan [12].

6.3.1 Pathogenesis

Causative agent of sporotrichosis is the dimorphic *Sporothrix schenckii*, an ubiquitous saprophytic fungus found on plants and in soil [12]. Currently, nine confirmed cases of cutaneous sporotrichosis were identified in the Northern territory of Australia. Patients were occupational or recreational gardeners, with each reporting exposure to mulching hay, originating from a single farm. Interestingly, the implicated hay had been stored over the monsoon season and had been affected by rain [13]. Six different species within the genus *Sporothrix* are known: *S. schenckii sensu stricto*, *S. brasiliensis*, *S. globosa*, *S. mexicana* and *S. albicans*. The dimorphic fungus *S. schenckii* develops tough, white yellowish, later on dark brown colonies with few aerial mycelium and submersed growing mycelium; thin septated hyphae are observed. Conidiogenous cells arise from hyphae and form conidia in groups on small clustered denticles.

6.3.2 Clinical Picture

At the port of entrance, slowly growing painless red, later on ulcerated putrid papules and crusted nodules develop along the lymphatics, indicating lymphangitis as a subcutaneously palpable hard and gnarled strand (Fig. 6.9). Rarely, haematogenous spread occurs in disseminated cutaneous sporotrichosis as a result of autoinoculation. Extracutaneous lesions and systemic infections are rare complications. For differential diagnosis other granulomatous inflammatory reactions, such as atypical mycobacteriosis, skin tuberculosis and cutaneous leishmaniasis, should be considered. For cultivation common growth media can be used with native tissue taken as a punch from the wound (Fig. 6.10). Biopsies show a granulomatous inflammatory reaction; in PAS and Grocott-Gomori stains, both cigar-shaped yeast cells and asteroid bodies may be detected.

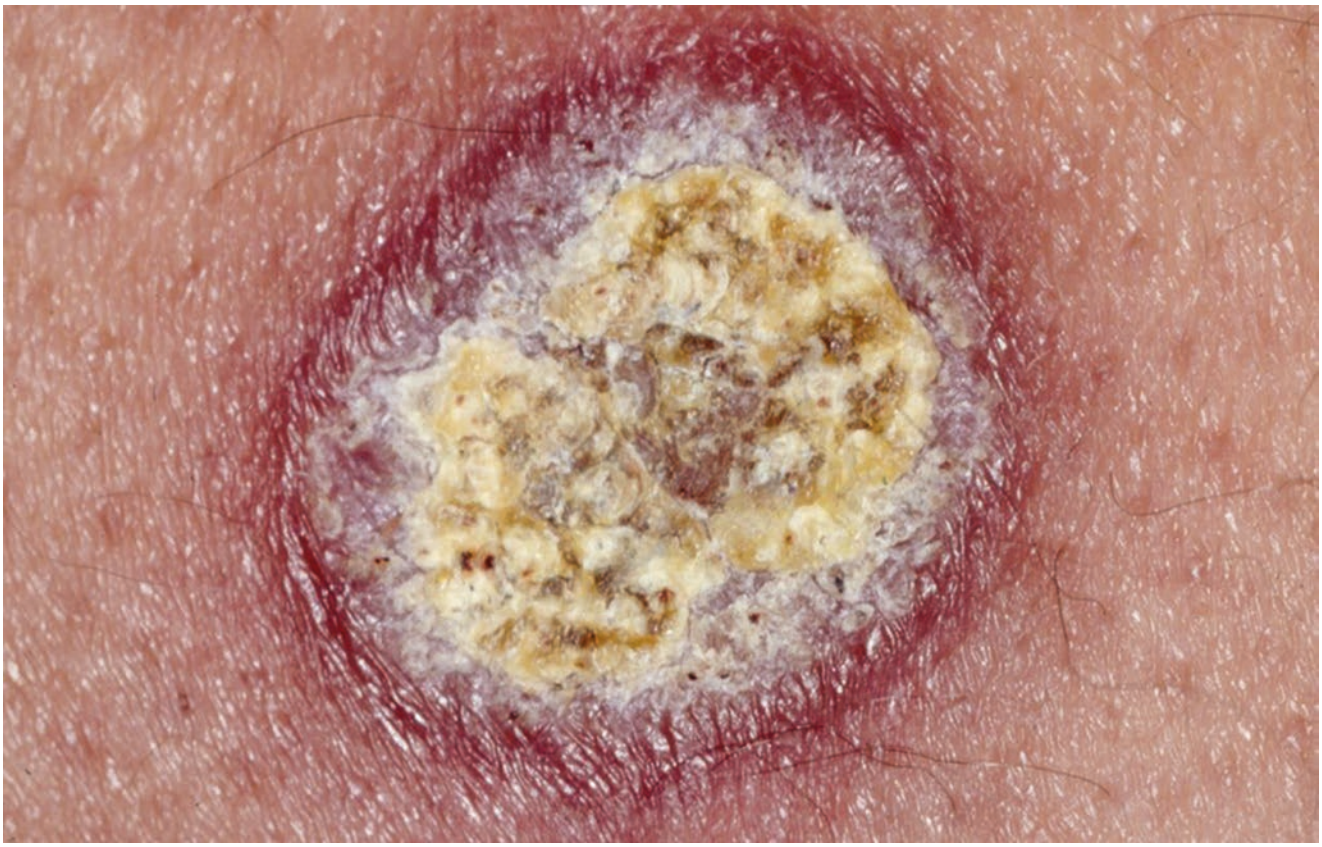

Fig. 6.9 Crusted lesion of *cutaneous sporotrichosis* after treatment with itraconazole. The patient had developed ulcerated nodules and palpable lymphangitis after a holiday trip to the Amazonas Delta in Brazil

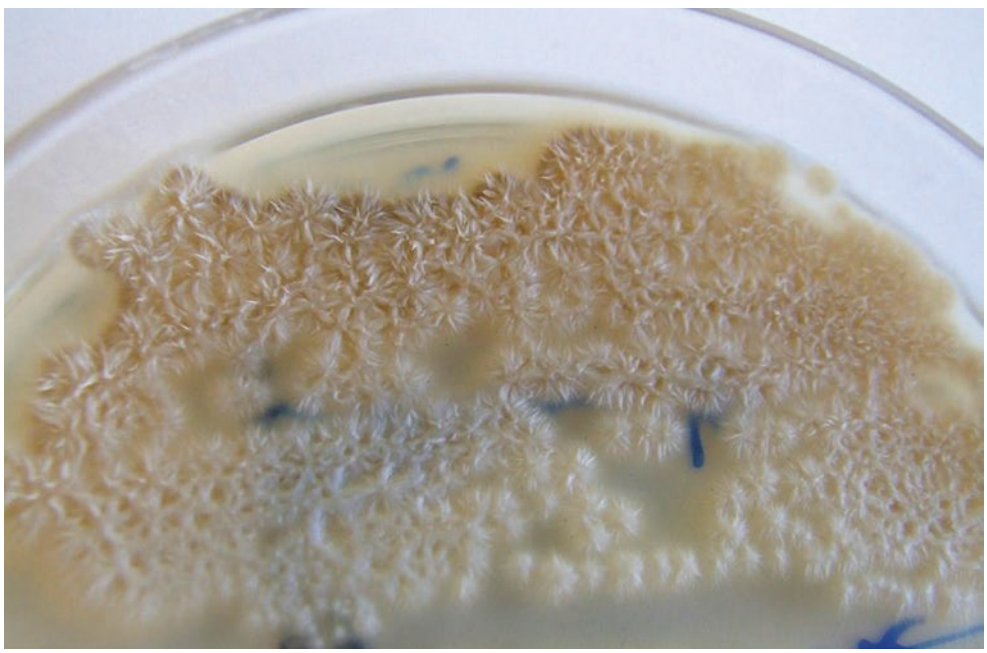

Fig. 6.10 Tough, white yellowish, later on dark brown colonies of *Sporothrix schenckii*

6.3.3 Management

Potassium iodide given orally in saturated solutions remains a first-line choice for treatment of uncomplicated cutaneous sporotrichosis in countries with poor resources [14]; initial dose is 0.5–1.0 mL 3×/day.

Itraconazole 100–200 mg/day is the current drug of choice in all forms of cutaneous and lymphangitic sporotrichosis, given for months to avoid relapses [15, 16]. Fluconazole can be also used in circumscribed cutaneous sporotrichosis at a dosage of 150 mg 1×/week. Fluconazole seems not be sufficient in lymphocutaneous sporotrichoid spread infections due to *S. schenckii*. Terbinafine at dosages of 500–1000 mg/day for 12–24 weeks was successfully administered in uncomplicated cutaneous sporotrichosis. Further options for managing are thermotherapy, cryotherapy with liquid nitrogen and photodynamic management with methylene blue. In disseminated infections and CNS involvement, amphotericin B should be considered.

6.4 Cutaneous Cryptococcosis

The capsulated yeasts *Cryptococcus neoformans* and *Cryptococcus gattii* are the two pathogenic species within the genus. *C. neoformans* occurs in animals, e. g. in the nasal cavity of koalas; its natural habitat has the yeast in hollow tree trunks. *C. gattii* causes infections in the tropics, e. g. in Central Africa, Australia, California, Central America and also South Europe. The occurrence of *C. gattii* in association with Eucalyptus trees is well known. Cryptococcoses are transmitted externally; the yeast pathogen arrives to the host from the environment, e.g. with bird's droppings, in particular from pigeon and parrots residues. Soil and dust also can contain *C. neoformans* yeast cells.

6.4.1 Pathogenesis

Cutaneous cryptococcosis usually affects immunocompromised HIV-infected patients; HIV-associated cryptococcosis is an AIDS-defining infection (see Chap. 37). Recipients of solid organ transplants are also at risk to develop cutaneous cryptococcosis [17]. Human cryptococcosis is caused by *C. neoformans* (capsule serotypes A, D and AD) and *C. gattii* (serotypes B and C). Characteristic are the mucous, bright colonies [18].

6.4.2 Clinical Picture

Haematogenous spread of the cryptococcus infection affects the central nervous system, in most cases as a result of a subclinical pulmonary cryptococcosis; in immunosuppressed patients meningoencephalitis is a serious, often lethal complication. Cryptococcosis of the skin develops predominantly as a secondary infection following haematogenous spread [19], often involving the face (Fig. 6.11). Cutaneous disseminated cryptococcosis presents skin-coloured nodules on the face, the arms and upper trunk, often umbilicated and mimicking mollusca (Fig. 6.12). In some cases also plaque-like lesions with ulceration and crusts as an aggressive cellulitis are found [20], with accompanying lymphadenitis. Rarely, primary cutaneous cryptococcosis may develop as a result of inoculation of the yeast from the environment.

From swabs taken from ulcerated skin lesions, cream-coloured to yellow brown, glossy, very slimy colonies grow on Sabouraud's dextrose agar. On *Guizotia abyssinica* creatinine agar (so-called Staib agar), brown-stained colonies are indicating *C. neoformans* (Fig. 6.13). Histology shows in PAS stain small yeast cells with unipolar budding.

6.4.3 Management

Initial management of cutaneous cryptococcosis comprises amphotericin B plus 5-fluorcytosin [21], combined with oral fluconazole. Monotherapy with fluconazole should be continued over several months [20]. Itraconazole represents the second-line antifungal drug in cryptococcosis. Echinocandins are not effective. After successful management, lifelong intake of fluconazole is recommended to avoid relapses [22].

6.5 African Histoplasmosis

African histoplasmosis is a rare infection caused by the dimorphic fungus *Histoplasma capsulatum var. duboisii* which is endemic in Central and West Africa, most likely also in South Africa and the island of Madagascar. A natural reservoir of the organism has been discovered in a bat cave in Nigeria with asymptomatic infections in its surroundings [23, 24]. An indigenous case has been recently reported from Kerala, India [25]. African histoplasmosis is established as an AIDS-defining infection in HIV-infected immunocompromised patients; it may occasionally occur combined with cryptococcosis. Infections of immunocompetent individuals were also registered in Senegal and Burkina Faso [26, 27]. An imported case was reported from France [28]. Severe lung histoplasmosis was detected in a Swiss tourist after having visited a cave in a trunk of a tree with colonies of bats in Uganda [29]. The port of entry of the infectious organism is unknown. There is a lack of awareness about

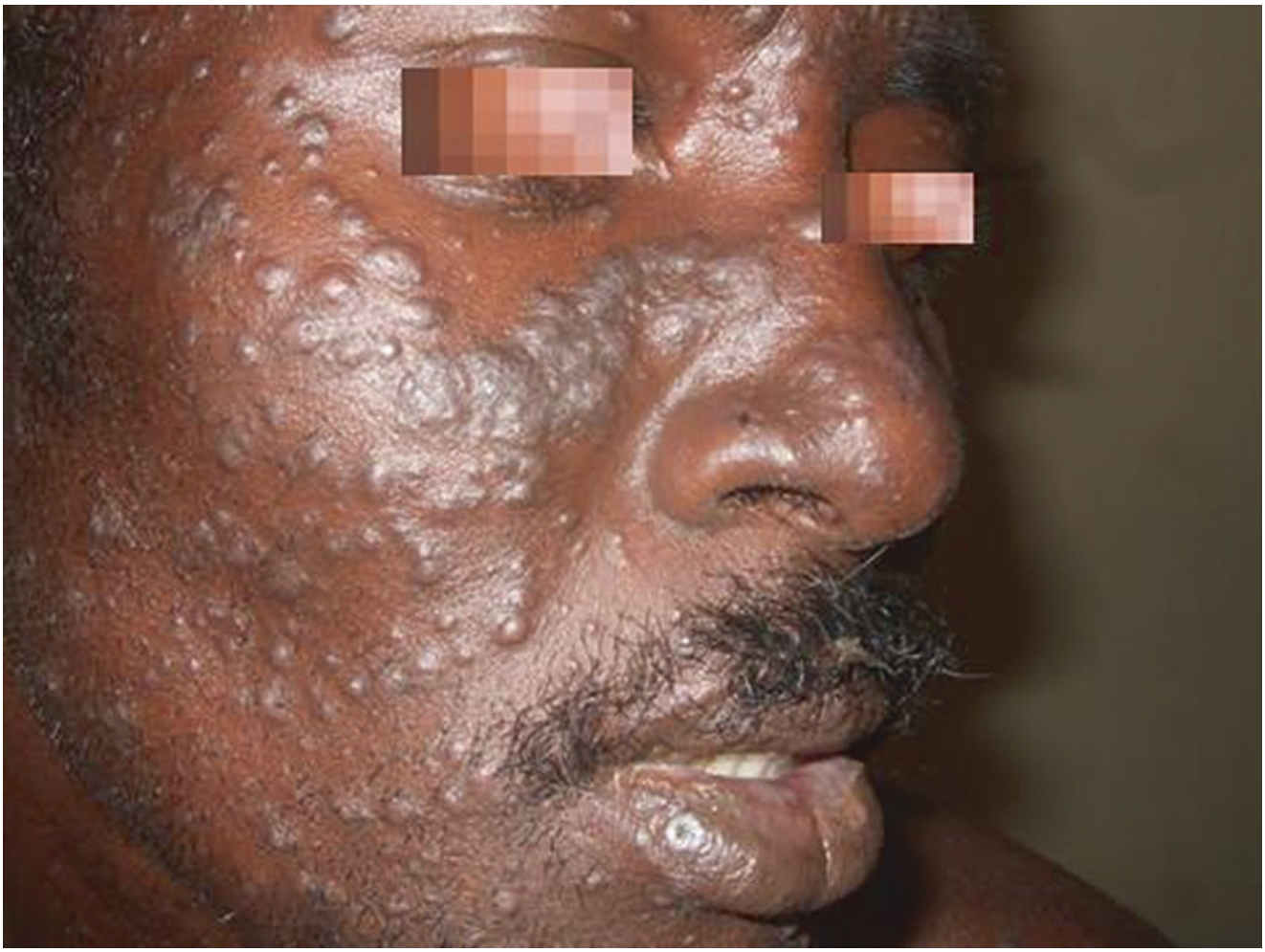

Fig. 6.11 *Cutaneous cryptococcosis* of the face in a HIV-positive male with 51/mm^3 CD4+ T-cell count, before ART treatment. Cryptococcus meningitis was not diagnosed (Uganda)

histoplasmosis, its course and management, possibly due to under diagnosis.

Clinically, disseminated granulomatous nodules and plaques are presented with seropurulent fistules and crusting discharge from the openings (Fig. 6.14); differential diagnosis to other deep fungal infections is clinically difficult, and co-infections may occur (Fig. 6.15). The subcutaneous tissue and the bones may be affected; systemic dissemination involving the lungs, lymph nodes and other visceral organs is rarely described [26, 29]. Polymorphous ulcerative and budding skin lesions may occur. For treatment, it seems that itraconazole 400 mg/day offers favourable results. In patients with severe dissemination, 2–4 weeks of amphotericin B intravenously followed by maintenance management with oral itraconazole have been recommended. Posaconazole may serve as a rescue management [30].

6.6 Cutaneous Blastomycosis

Cutaneous blastomycosis occurs in the USA and the North American territory including Canada. Particularly in southern USA, states near to Ohio and Mississippi rivers endemic areas are known. In South America, only single infections have been reported. Further major foci are in Africa; in Congo, Uganda and Tanzania blastomycoses occur.

6.6.1 Pathogenesis

Causative agent is the dimorphic fungus *Blastomyces dermatitidis* which exists as a non-pathogenic form as a mould in nature and converts to pathogenic yeast at body temperature [31]. The infection is acquired via the air route after inhalation of spores causing primary pulmonary infection [32];

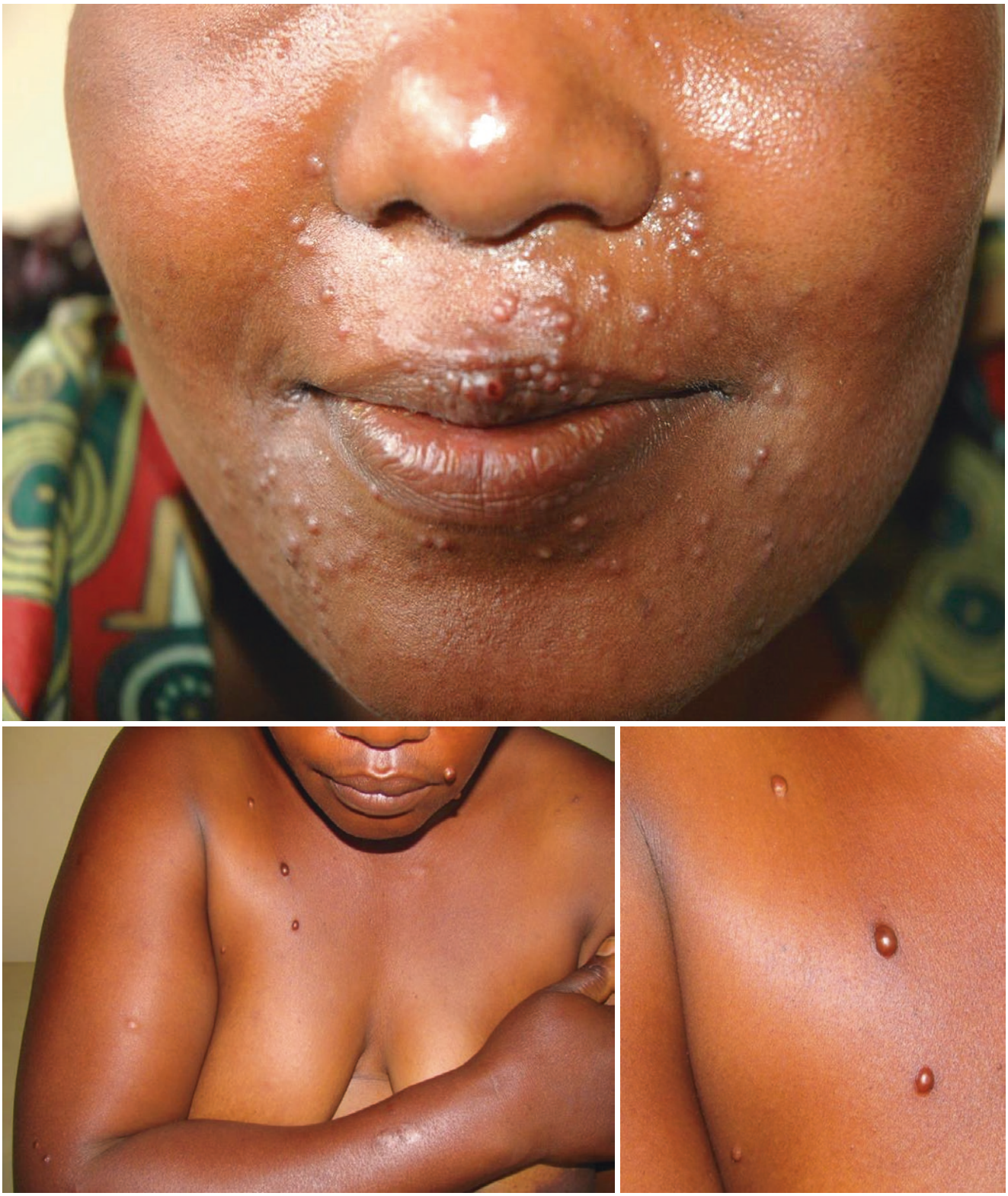

Fig. 6.12 *Disseminated cutaneous cryptococcosis* in HIV-positive females (Tanzania)

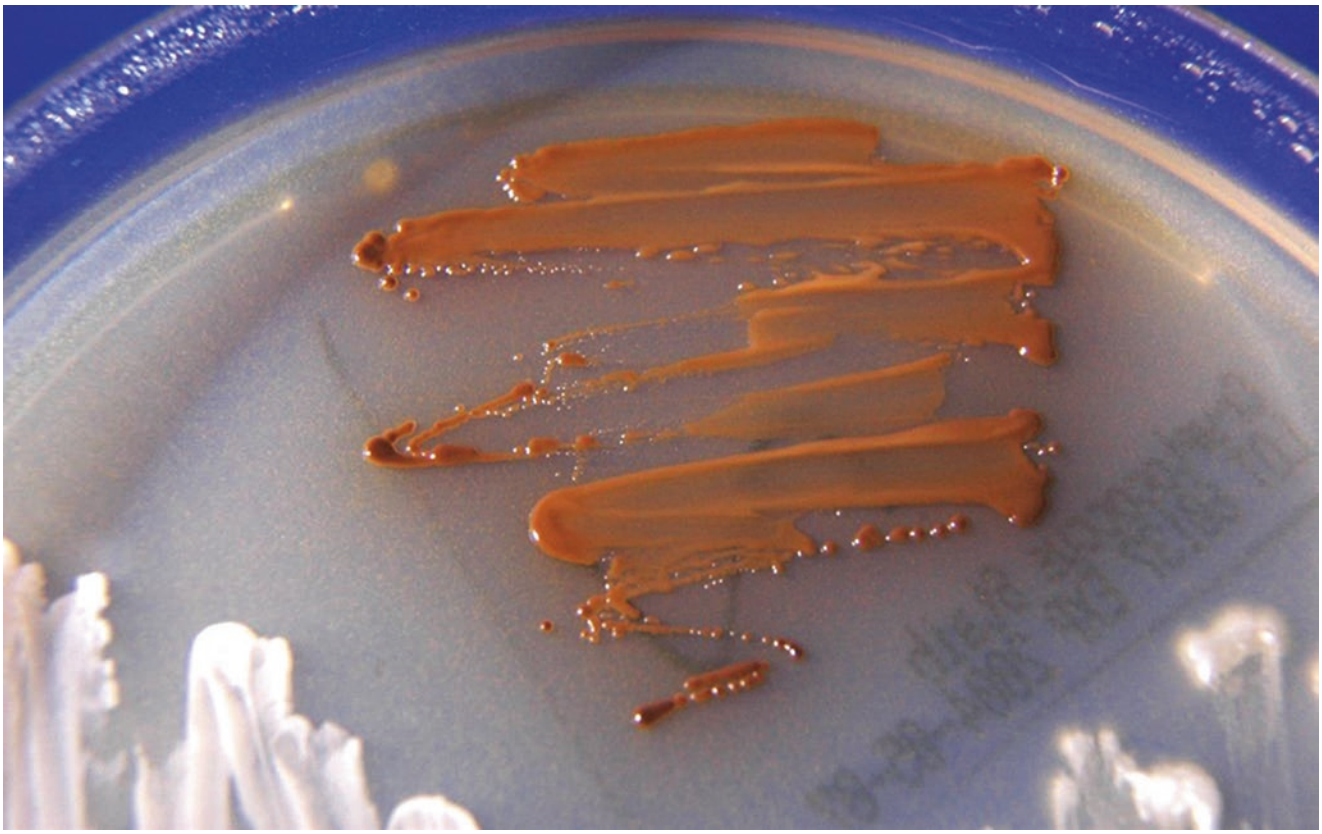

Fig. 6.13 *Cryptococcus neoformans* cultured on *Guizotia abyssinica* creatinine agar

systemic dissemination may follow. Primary cutaneous blastomycosis may rarely occur [31]. There is no indication for transmission person to person. Immunosuppressed patients are at risk to develop disseminated disease after haematogenous spread involving the skin and/or the bones. The infection also affects animals, e.g. dogs. *Blastomyces dermatitidis* has its natural habitat in the environment, particularly in soil and dust. In humid regions *Blastomyces* can be found in the soil with high organic content. In tissue, e.g. the lungs, the fungus grows in its yeast cell form with ellipsoid budding cells 8–15 μm in size. In cultural media the mycelial form develops under lower temperatures (20–28 °C); the fungus grows as mould.

6.6.2 Clinical Picture

Blastomycosis involves the skin following haematogenous spread from the lungs; the time of incubation is long, 45 days in average. Primary cutaneous blastomycosis following traumatic inoculation is rare. Skin infection initially presents papules which evolve to nodules. A verrucous variant has been described, and also ulcerations with livid red and elevated margin and erythematous indurations are seen. Panniculitis or erythema nodosum-like lesions may occur; lymphangitis and lymph node swelling like chancre are palpable.

In native KOH preparations from swabs unipolar sprouting budding cells are observed, whereas skin biopsies reveal epidermal microabscesses and necrosis together with inflammatory cell infiltrates in cutis and subcutis. In Grocott-Gomori and PAS stainings, 8–15 μm-sized unipolar budding cells can be seen in granulation tissue.

Differential diagnosis includes pyoderma, cutaneous leishmaniasis, skin tuberculosis and nontuberculous mycobacteria infection. Malignancies such as ulcerated basal cell or squamous cell carcinoma should be excluded.

6.6.3 Management

Management of choice for primary cutaneous blastomycosis is long-term administration of antifungals, itraconazole or fluconazole [33, 34]. Today, posaconazole is used in systemic blastomycosis for single patients. In complicated and severe courses, amphotericin B is given intravenously.

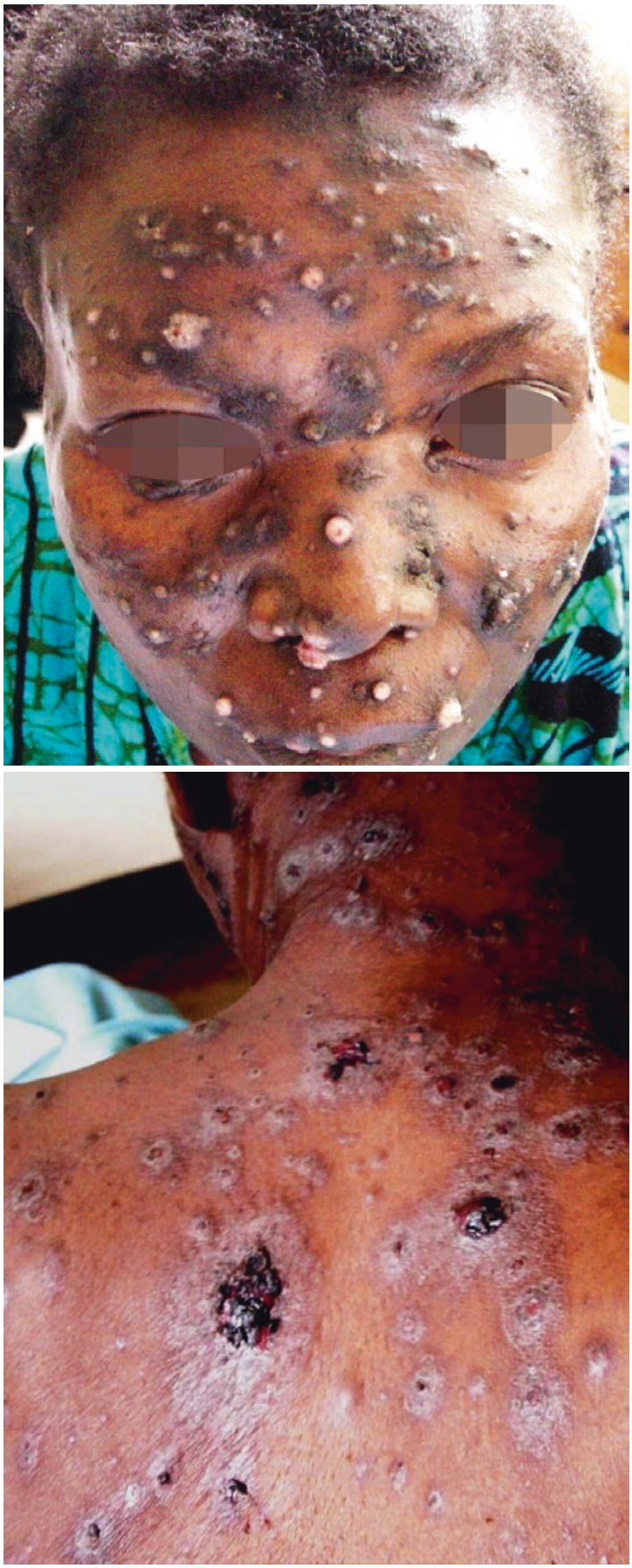

Fig. 6.14 *African histoplasmosis*: Cutaneous dissemination in a HIV-positive female, 2 weeks after initiation of treatment with itraconazole (400 mg/day). Courtesy Dr. M. Ketema, RDTC Moshi, Tanzania

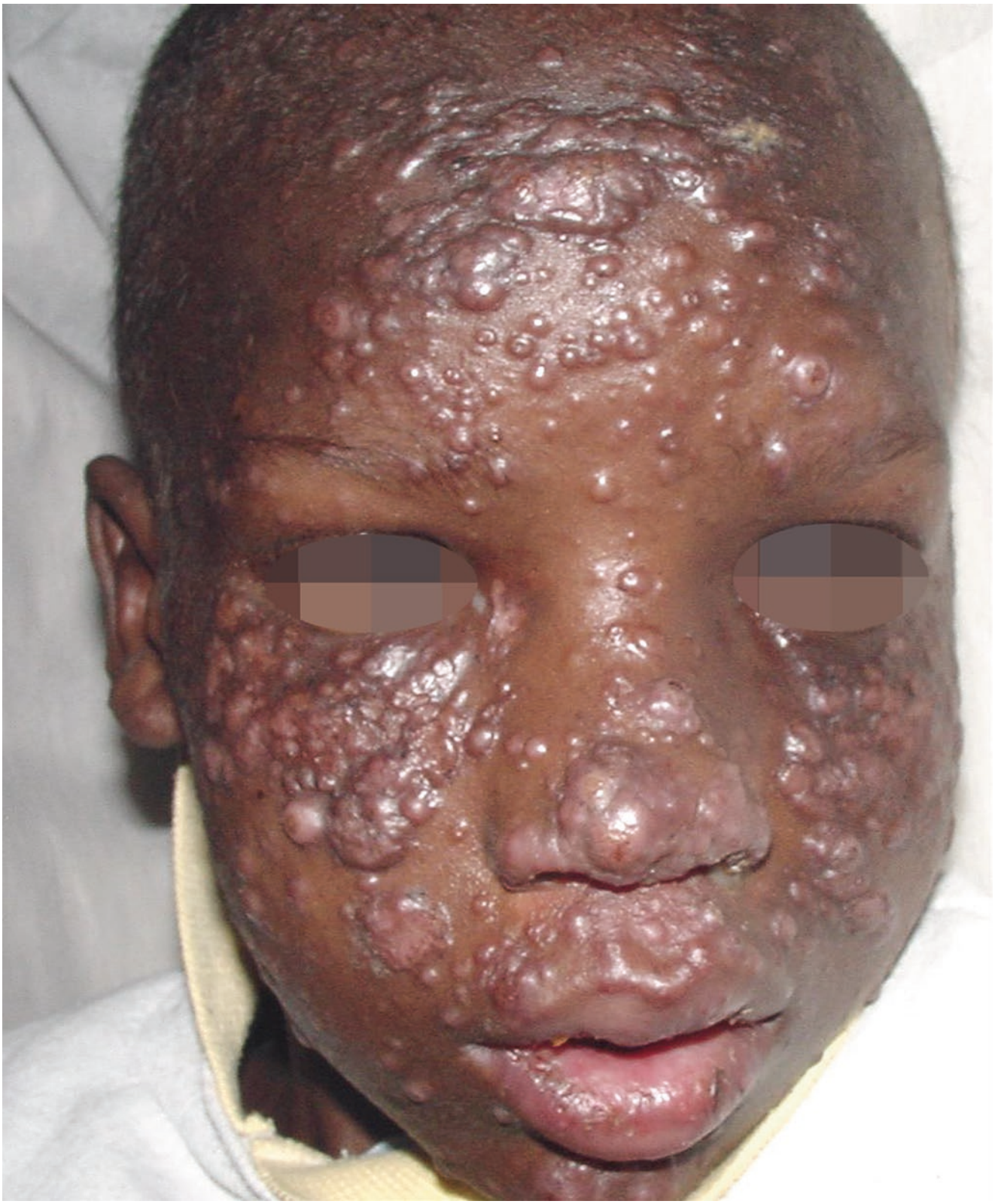

Fig. 6.15 *African histoplasmosis* DD: cryptococcosis. Co-infection? (RDTC Moshi, Tanzania; courtesy Dr. M. Ketema)

Conclusions

Subcutaneous and deep fungal infections of the skin are often seen in hot climate zones due to the climatic conditions, the low level of hygienic standards and the large numbers of HIV-infected immunocompromised individuals. They are considered as the diseases of the underprivileged and poor, may be seen in migrants and refugees and are difficult to treat. Saturated solution of potassium iodide remains as an antigranulomatous agent a first-line treatment choice, e.g. for uncomplicated cutaneous sporotrichosis. For any other subcutaneous/deep fungal infection of the skin, long-term administration of itraconazole, fluconazole or terbinafine is mainstay of treatment available in most countries; amphotericin B may be indicated in cases with systemic dissemination which often represent a therapeutic challenge. New potent antifungal azoles such as voriconazole and posaconazole were shown to be highly effective; however, they are expensive, still unattainable for most patients and countries with limited resources.

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