

Original paper

Unexpected subungual *Sarcoptes* infestation of toenail – a case report and literature review

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ABSTRACT. Scabies is the skin infestation caused by *Sarcoptes scabiei* var *hominis*. It is one of the commonest dermatological infection which can affect people around the world. However, nails are relatively rarely involved, and the fingernails are mostly infected. The report a case of a 77-year-old woman, long-term pensioner of a nursing home, who had isolated toe subungual *Sarcoptes* infestation. In addition, the results of systematic review of toenails scabies was presented. Analysis of 21 subungual *Sarcoptes* infestation cases, revealed that patients in any age (median age 45+/-31.7-year-old) and sex can be affected. Most of the patients had concomitant diseases. Seventy-five percent of cases of nail involvement were treated with combined or sequential therapy. The most used drugs were ivermectin (IVR) and permethrin (PER) (each used in 47.6% cases), following γ -BHC (38.1%) and crotamiton (CRO) (23.8%). It seems that the crucial for adequate diagnosis in scabies affected nails is a precise anamnesis, early and accurate diagnosis that consists of examining not only skin lesions, but including assessing toenails, and differentiation of *Sarcoptes* infestation from other nail diseases as onychomycosis or psoriasis. Important to achieving a cure is at least frequent nail trimming, softening the nail plate with urea or in the difficult cases the mechanical removal of subungual plaque with using of a scabicide in the location allowing to penetrate it under the nail plate.

Keywords: toenail scabies, *Sarcoptes* infestation, crusted scabies, scabicide, onychomycosis

Introduction

Common scabies (classical scabies, ordinary scabies; OS) and crusted scabies (formerly Norwegian scabies, CS) are the skin disease caused by infestation of ectoparasitic mites – *Sarcoptes scabiei* var. *hominis* but differ with clinical symptoms and the number of infested mites [1]. It is one of the commonest dermatological infection disease with high morbidity, especially in developing countries. The Global Burden of Disease estimated that in 2015–2017, over 145–200 thousands people in the world were infected with *Sarcoptes scabiei* [2–4]. Due to this fact, in 2017, World Health Organization (WHO) included scabies in a group of so-called Neglected Tropical Diseases [5]. In contrast, in the developed world,

OS and CS cause outbreaks in health institutions and vulnerable communities most of all [6].

It seems that the biology and pathology of scabies is well known and hence the diagnosis and treatment of this disease is well established. Nevertheless, in this paper, we report a case of a patient who had isolated subungual *Sarcoptes* infestation. We also made the systematic review of toenails scabies due to present the knowledge of diagnostic features, methods of *Sarcoptes* infestation in nails and treatment options.

Materials and Methods

The PubMed and Scopus databases were searched up till April 2020. The following keywords was used (without quotation marks): “nail scabies”,

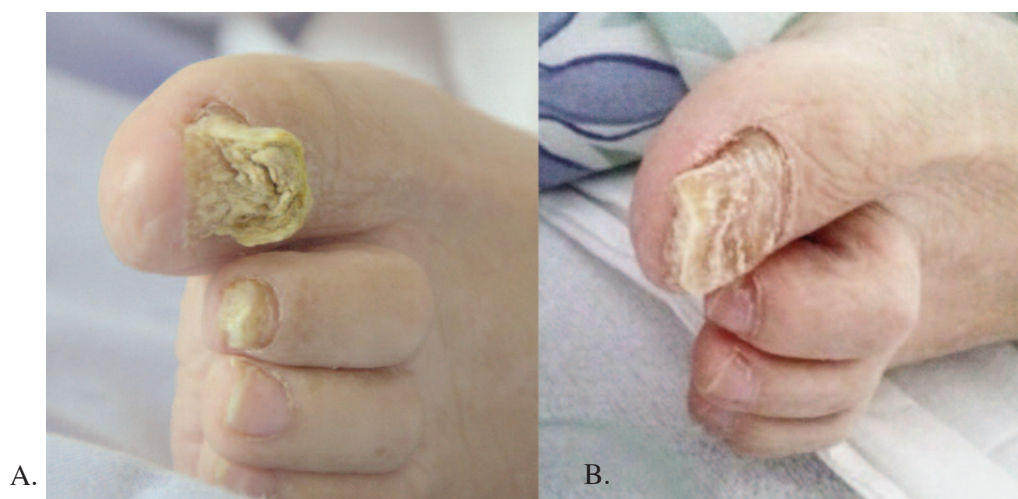


Figure 1. Clinical features of toenails on initial consultation, before the treatment (A); 1 year after first dermatological examination (B) (photo P. Krzyściak)

“subungual scabies”, “nail AND *Sarcoptes*”, “nail scabies OR subungual scabies OR nail AND *Sarcoptes*”. To find more published articles, hand searching was used after searching the databases. Following excluding some studies that were weakly related to the goals of this review and selecting the main articles, then the reference lists of the articles were checked independently by two authors (K.T-Ć and P.K.) to ensure identification reliability. Disagreements were discussed and resolved by consensus. We did not take into account the outbreaks caused by scabies, but only sporadic cases. Articles written in languages other than English were also excluded. Finally, we excluded cases of fingernails involvement by scabies and only toenails and mixed infections included to review.

Case presentation

In May/June 2014, a 77-year-old woman pensioner of the long-term care center in Cracow (Poland) was included to study group for toenails mycoses research study. At the time of the examination, the patient had no contact, requiring the help of third parties, with upper and lower limb contact tures, without skin lesions and pressure sores on the skin of the body. Only dry, flaky skin on the feet and affected toenails were found (Fig. 1). The collected material was subjected to a direct microscopic examination of a specimen and the culture on Sabouraud Glucose Agar (BioCorp S.A., Warszawa, Poland) and Fungisel Agar with Phenol Red (Graso Biotech, Starogard Gdanski, Poland) was established.

Clinical history showed diagnose with

Alzheimer’s and Parkinson’s diseases, hypertension, ischemic heart disease, hypothyroidism, and rheumatoid arthritis, requiring constant care, was admitted to a long-term care centre in 2012. From the anamnesis, it is known that a woman in the past travelled a lot to various countries of the world in connection with her work. Alzheimer’s was diagnosed seven years before and progressing. At that time, she was hospitalized many times in neurological departments, and from 2012 to 2014 also in the Department of Internal Medicine. Additionally, during these years she was repeatedly consulted dermatologically, successively due to changes in the skin of the face (rosacea was diagnosed in 2012), then due to the skin lesions on the groin, itchy pustular changes back (in 2013 contact allergic rash was diagnosed), exfoliative, keratinizing skin on the feet and finally changes and excessive keratinization of the toenails (in May 2014, 4 nails were removed). The patient was treated during this time with oiling creams, steroid preparations, and vitamins. It is also known that in 2013, being a pensioner of the above-mentioned centre, she stayed in a double room and an episode of itching and minor skin lesions was found in the woman who lived with her. Topical treatment applied at that time (no further data) resulted in improvement.

The microscopic examination of nails sample revealed hyphae and abundant number (~100 per POV) eggs and mites were detected and numerous, in places, crowded oval-shaped structures ranging in size from 0.1 mm to 0.5 mm, covered with a transparent, finely striated sheath, with symmetrically closely arranged pairs of legs and

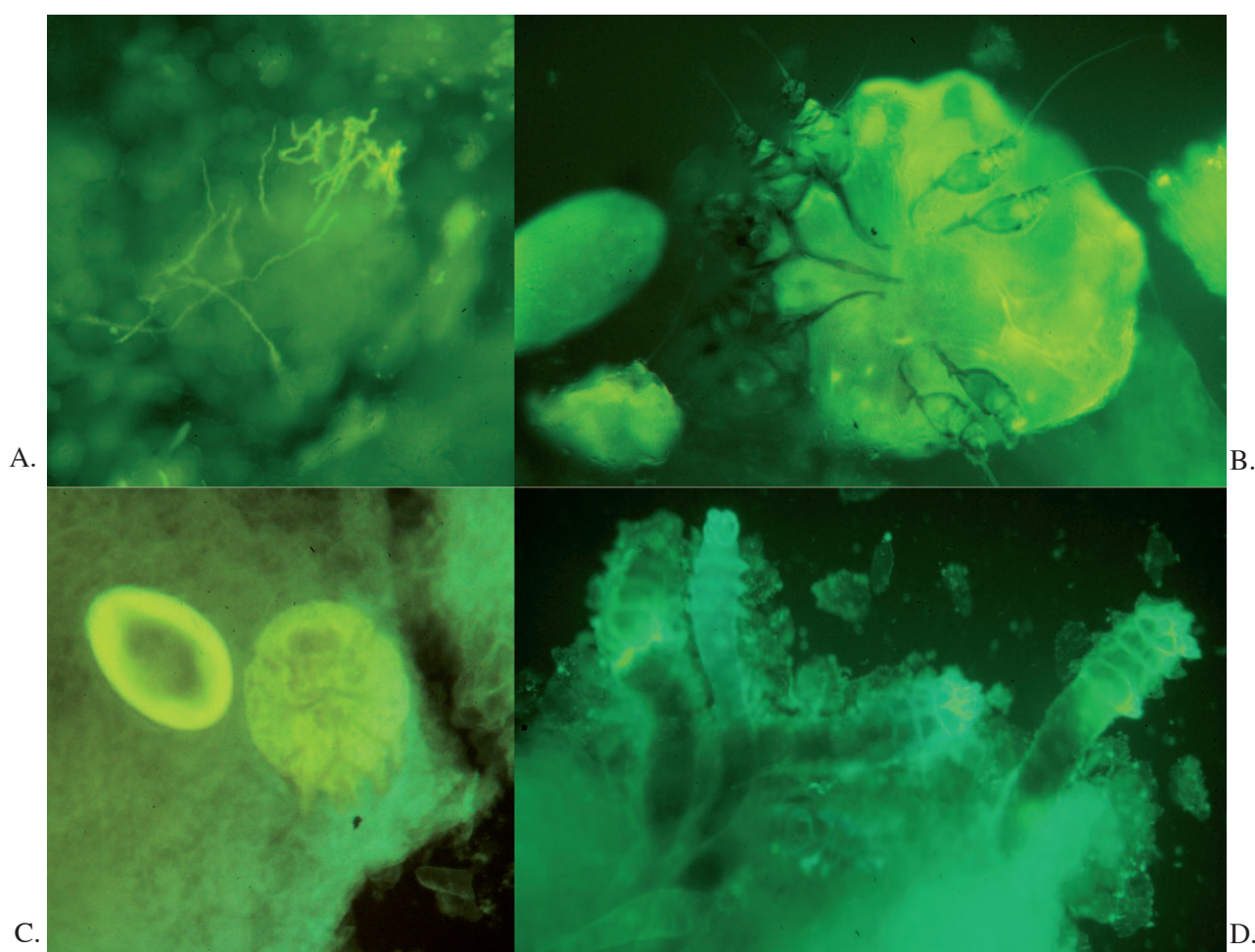


Figure 2. Microscopic Calcofluor White mounts of toenails showed fungal hyphae (A); mites of *Sarcoptes scabiei* var. *hominis* with eggs (B, C); skin scraping from chick with *Demodex folliculorum* mites (D) (photo P. Krzyściak)

spikes recognized as a *Sarcoptes* (Fig. 2B, 2C). In mycological culture growth of *Absidia* sp. was regarded as a contamination, there were no growth of suspected dermatophytes. The patient was treated with topical ointment, probably permethrin (PER), but we have not been able to obtain detailed data. For sure, the part of therapy was the removal of the infected nails.

One year later the control microbiological examination was performed. The nail had no hyperkeratosis, however, still was changed. In the collected material there were no *Sarcoptes*, fungal hyphae were still present however in the culture there were again no dermatophytes. Only the *Aspergillus versicolor* colony was observed. No further examination to prove the aetiological character of this mould was performed.

Because of severe skin flaking on the patients' face, the appropriate material was collected. Under microscopic examination, *Demodex folliculorum* was found (Fig. 2D).

Results

Literature review

In total, 139 articles that meet the searching terms were found: for nail scabies – 50 (43 in English only) and 139 (125 in English only); for subungual scabies – 10 (7) and 17 (12); nail AND *Sarcoptes* – 15 (13) and 42 (33); nail scabies OR subungual scabies OR nail AND *Sarcoptes* – 16 (13) and 39 (31) in the PubMed and Scopus database, respectively. Finally, in this systematic review we found 11 cases of toenails involvement and 8 toenails and fingernails scabies infections coexistence.

Discussion

Clinical features

The most common areas affected by scabies are hands (86% of patients), wrists (82%), the genital area in men (64.5%), abdominal area (56%), nipples

in women (28%) [26]. Nails are relatively rarely involved, and the fingernails are mostly infected [1,26]. Although scabies is common around the world [27,28], our review shows that it still can be a diagnostic problem especially in atypical body site as toenail [6,13,15,21,23].

Nails involvement more often occurs in the CS than in the ordinary form of scabies and is consisted of clinically as hyperkeratosis, onycholysis, and subungual debris characterized by large, psoriasis-like accumulations of scales under it [14,19,22,23, 29]. The subungual manifestation of toes is often misdiagnosed with other skin conditions, which can imply inappropriate steroid treatment [13,15,17,18, 21,23]. In our review, it was observed in 28,6% of analyzed cases (n=6/21). It, in turn, can exacerbate the symptoms of *Sarcoptes* infestation and causes the progress to CS a more severe form. Whereas, it is also commonly believed that fingernails often become reservoirs for *Sarcoptes* mites and are frequent sources of relapse in untreated cases or even after treatment of cutaneous manifestation of CS or unguis scabies [19,29,30]. In contrast, the toenail infestation is reported relatively rare (Tab. 1). Characteristic clinical findings as thickness, subungual hyperkeratotic debris, nail plate deformity, periungual scale or crust, longitudinal nail split, distal onycholysis, dystrophy, yellow opacity, as in toenail scabies infestation may also be seen in onychomycosis or traumatic nail, nail dystrophy, nail psoriasis, an ingrown nail [24]. One report described the unusual colour change from yellowish to greenish caused by *Sarcoptes* infestation mimicking pseudomonas-like infection [24].

We describe the case of an elder woman, who was for many years a nursing home pensioner with an overgrowth nail plate. Our case is unique because it is an isolated scabies toenails infection, probably also as overlooked persistence after treatment of prior infestation. After careful examination of our patient, no other locations of scabies were found. In elderly people, a change in the appearance of the toenails may be more frequent than in the general population, and onychomycosis is suspected in such patients much more often than other infections. Nevertheless, thick hyperkeratotic debris causing raising of toenail plate should be of interest to caregivers even when pensioner does not have the opportunity to be infected cause her immobility. In our case, firstly we also suspect dermatophyte invasion of the toenail plate however coinfection

of *Sarcoptes* with dermatophytes in the nails has not been finally proved in the laboratory examinations. Scabies limited to the toenails was presented previously by Oh and Vandergriff [19], nevertheless, it was the result after incomplete cured of the CS. Our case highlights the importance of nail examination as well as collecting complete anamnesis to make a proper diagnosis of scabies in the absence of any obvious risk factors. 14.3% of reviewed scabies cases were accompanied by a fungal infection, but dermatophytes were confirmed in only one case (33.3%), which may indicate that the simultaneous occurrence of these infections is not common. In our opinion, solely detection of septate hyphae in KOH mount accompanying *Sarcoptes* is insufficient to diagnose onychomycosis because maybe the mold infestation associated with the presence of mites.

Scabies nail involvement are predominant in middle age patients (median 55 Y+/-31; mean 45+/-31.7 year; range: 2M-90s year). Nevertheless, any age group can be affected. In our review, there were six (28.6%) patients under 18 years old, three infants and 3 young children (median 1.75; mean 3.5 year; range: 2 M-9 year). There was no difference between sexes with a predisposition to be affected (11 M vs 10 F) what no differs from typical skin localization of scabies where both sexes are equally affected in [6].

In our review most of the patients had concomitant diseases, 4 had diabetes and 4 Down's syndrome; four were immunosuppressed (2 were HIV infected, one had acute myeloid leukemia, one patient had kidney transplantation), and one skin infection – lepromatous leprosy (Tab. 1). These findings do not differ with comorbidities which coexist with scabies without toenail infection [31]. Another risk factor of CS or OS development is glucocorticosteroides (GCS) treatment. In this literature review, 9 cases, including one described in this paper, mention topical use of GCS [10,12, 15-18,20,21,23] or another one oral GCS treatment [13]. Generally healthy individuals might be also infected [6], which was reported also in our review (Tab. 1). In the eight from 12 reviewed cases of scabies, contact persons were affected [10,12, 15-18,20,23-24]. One of three patients who stayed in nursing homes or long-term acute care hospitals was a proven source of an outbreak of scabies [15], two others were the source of infection for the medical personnel or caregivers and for fives coinfection was detected in their households. No

scabies transmission was found in four cases [17, 21,22,24].

Many researchers emphasize that delayed or misdiagnosis of *Sarcoptes* infestation may lead to serious consequences such as extensive outbreaks of the infestation which is observed for example in the health institutions and among nursing home residents and personnel [10,16,32]. In our case, infestation in toenails with *Sarcoptes* was found probably as persistence of earlier infestation from other residents, however, any patient staying at the same time in the room had symptoms of scabies. Among other cases from our report, patients, especially those with a wrong diagnosis and long-treated, were the source of infestation for their caregivers (36.4 % in our review) (Tab. 1).

Treatment

According to The European guideline for the scabies therapy, topical preparations of permethrin (PER), benzyl benzoate (BB) and oral ivermectin (IVR) are recommended for the treatment of scabies. Alternative drugs include: 0.5% malathion, 1% IVR (1% topical IVR preparation demonstrates effectiveness comparable to 5% PER cream), sulfur preparations (6–33 %) and synthetic pyrethrins in foam. For the CS combination of topical scabicides with oral IVR is recommended [33]. European guidelines state that topical treatment should be applied to the skin beneath the ends of the nails at night and left in place for 8–12 h [33]. In our research, 75% of cases of nail involvement were treated with combined or sequential therapy. The most used drugs were IVR and PER (each used in 47,6% cases) following γ -benzene hexachloride (γ -BHC lindane) (38.1%) and crotamiton (CRO) (23.8%) (Tab. 1).

A known problem in treating subungual infections is the restricted permeability of the nail plate to topical drugs. This problem is also related with PER and other antiscabetic drugs which may not adequately penetrate thick crusts and nail plates [13,15]. PER is an amphiphilic drug, while the nail plate is non-hydrated and fat-free. Due to this fact, a lot of cases need softening or mechanical brushing or even removing the nails plate. Urea cream or 5% salicylic acid was used to soften the nails and aid adequate penetration of topical scabicide agents [13,14,16,23]. In another case, treatment was helped with the frequent trimming of the infected nails [19]. Nakamura et al. combined scabicide ointment under occlusive dressing with nails brushing [15].

In our review, patients were treated with various topical antiscabetic, in the way that drug was spread on the skin and then an occlusive dressing was applied [12,14,15]. This procedure enables the absorption of topical drugs through the skin in the area of the nail. Due to this fact European principles of scabies treatment from 2017 indicate that topical treatment should be applied to all skin regions including finger and toe web spaces and the skin beneath the ends of the nails [33]. Strongly hyperkeratotic nails may need more aggressive methods for example surgical removing nails [8,14,20].

Treating children was also challenging because for many years treatment of scabies in children was not so well-defined and side effects was not well-known. In the cases from our review, different treatment regimens were used, which depended on children's age, the extent of the scabies infestation, and the availability of drugs. Infants were treated with topical agents, while older children were treated with oral IVR and topical acaricides (Tab. 1). Unfortunately, we cannot conclude which treatment was the most effective due to the difference in age and small tested group enrolled in our review.

Treatment failures in *Sarcoptes* infestation have been documented. It may be due to inadequate drug application, length of treatment, the inappropriate drug dose, inadequate exposure time to scabicide, drug resistance, and failure to clipping nails [1,27,34]. Isogai et al., reported failure of treatment with BB and CRO ointment with presence of the mites and eggs survived in toenails. Re-treatment with γ -BHC in occlusive dressing revealed a complete cure [12]. DePaoli and Marks [8] noticed that the thick subungual debris i.e. occurring in tinea unguium, may protect the area from the mitocidal activity of topical drug. While Ohtaki et al. [13] concluded that treatment with corticosteroids may also be responsible for treatment failure in nail scabies by topical acaricides. This is probably due to the side effects of steroids as the skin is thin and devoid of lipids. The local action of steroids also reduces the body's non-specific cellular response, contributing to the failure of anti-scabies treatment.

In summary, the crucial for adequate treatment in nails infected by *Sarcoptes* is a precise anamnesis, early and accurate diagnosis that consists of examining skin lesions including assessment of toenails, and differentiation of *Sarcoptes* infestation from other nail infections such as onychomycosis.

Table 1. Summary of all cases included in the review of toenails involvement of *Sarcoptes*

No.	Sex/age	Affected nails	Duration	Scabies type	Treatment	Outcome	Previous scabies	Accompanying/preceding disease	Coinfection with fungi	Nursing home pensioner	Country [Ref.]
1	F/51 Y	TN	ND	OS	CRO 3M	Cure	No	D, hypertension, anemia, rheumatoid arthritis, pyelonephritis	No	ND	JP [7]
2	M/24 Y	FN & TN	> 2 Y	CS	40% urea with γ -BHC occl. 5D, Nails removed and curettage of subungual debris;‡	Cure	ND	DS	Yes, <i>T. rubrum</i> 4M after initial visit	ND	S [8]
3†	M/35 Y	FN & TN	3 M	CS	γ -BHC	ND	AIDS, Kaposi's sarcoma,	ND	No	US [9]	
4	F/6 M	FN & TN	~2M	CS	γ -BHC whole body 4–6h	Cure	ND	Premature birth; AIDS; sepsis; pulmonary infiltrates, tGCS	ND	NA	US [10]
5	F/31 Y	TN	~2 M	OS	CRO 20D	Cure	No	HIV positive, oandidosis	ND	ND	IT [11]
6	M/86 Y	TN	~5 M	OS	(BB, CRO 2W body lesion) γ -BHC occl. 9W	Cure	No	Aspiration pneumonia, tGCS	ND	ND	JP [12]
7	M/72 Y	TN	>2 M	CS	CRO, keratolytic ointment, 5% SA in petrolatum, 1W failed oIVR, CRO, SA 3W γ -BHC occlusive 1M	Cure	ND	Dementia, oGCS	Yes, treated with terbinafine	ND	JP [13]
8	F/55 Y	FN & TN	>8 M	CS	SA daily, PER, body lesion 2M 40% urea occl., then PER with nails removing 2M	Cure	No	D, poor hygiene	No	ND	GB [14]
9	M/71 Y	TN	3 Y	CS	oIVR, 5% SA occl., o IVR + γ -BHC body 3W nail occl. γ -BHC 2W failed t chlorhexidine; occlusive dressing; nail brushing; 7W	Cure	No	Bullous symptoms, tGCS	No	Yes	JP [15]
10	M/2 M	TN	6 W	CS	PER, 10% urea 3W	Cure	No	Low birthweight, tGCS	ND	NA	IN [16]
11†	M/61 Y	TN	2 W	CS	oIVR, PER 2W	Cure	Yes	Kidney transplantation, tGCS	No	ND	IT [17]

No.	Sex/age	Affected nails	Duration	Scabies type	Treatment	Outcome	Previous scabies	Accompanying/preceding disease	Coinfection with fungi	Nursing home pensioner	Country [Ref.]
12	F/67 Y	FN & TN	few W	CS	oIVR, PER	ND (significant improvement of the nail dystrophy)	No, (PER scabies prophylaxy)	DS, tGCS	No, previous topical antifungal treatment	NM	US [18]
13	M/66 Y	TN	> 1Y	CS	PER 1m, repeated trimmed/clipping nails	Cure	Yes, CS treated with PER, IVERCS persistent infestation in toenail plate	D	No	ND	US [19]
14	M/90s Y	TN	>5 M	CS	IVR; CRO, BB, γ -BHC; nails removed	Cure		D, underweight (~30 kg), weight fluctuations up to 60 kg, tGCS	ND	No	JP [20]
15	F/3 Y	FN & TN	>3 M	CS	PER, IVR nails debridement was completed	Cure	No	DS, underweight, persistent onychodystrophy, tGCS	No	NA	US [21]
16†	M/56 Y	FN & TN	>7 M	CS	PER, IVR	ND	ND	LL, mentally retarded, alcohol abuser	ND	ND	BR [22]
17†	F/8 Y	FN & TN	6 M	CS	oIVR, PER, urea 1W	Cure	ND	DS	No	NA	US [23]
18	M/4 M	TN	>1 W	CS	Sulfur 1W	Cure	No	No	No	NA	TH [24]
19	F/9 Y	TN	1 Y	CS	oIVR, γ -BHC 2W	Cure (nails remain yellowed)	No chromosomal abnormalities, poly-dactyly, right renal agenesis, congenital malalignment of toe nail; intellectual disability	No	NA	TH [24]	
20†	F/80 Y	FN & TN	> 1 M	CS	oIVR (2w), PER 7D	Cure	No	AML, secondary myelodysplastic syndrome, immunosuppression	No	long-term acute care facility	US [25]
21	F/79Y	TN	ND	CS	PER#, nail removing	Cure	Yes	Alzheimer's disease, Parkinson's disease, tGCS	<i>Absidia</i> sp.; <i>Aspergillus versicolor</i> after one Y from the first visit	Yes	PL

Explanations: F- female, M - male, FN - fingernails, TN - toenails, Y - year, M - month, W-week, OR - ordinary scabies, CS - crusted scabies, CRO- crotamiton, γ -BHC- γ -benzene hexachloride (lindane), IVR - ivermectin, PER - permethrin, SA - salicylic acid, o - oral, t - topical, occl. - occlusion, D - diabetes, DS - Down's syndrome, LL- lepromatous leprosy, AML- acute myeloid leukemia, ND - no data, IVR - ivermectin, NA - not applicable; GCS – glucocorticosteroids, †included in the review based on photos, ‡ the thick subungual debris of tinea unguium may have protected the area from the miticidal activity of lindane, § nail involvement have been described, but not laboratory confirmed, ¶ nails still remained yellow, scabies mites and eggs not found, # due to difficulties in cooperation with a nursing home, the treatment was not confirmed

Important to achieving a cure is at least frequent nail trimming, softening the nail plate with urea or in the difficult cases the mechanical removal of subungual plaque with using of a scabicide in the location allowing to penetrate it under the nail plate.

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