



Onychomycosis: Recommendations for Diagnosis, Assessment of Treatment Efficacy, and Specialist Referral. The CONSONANCE Consensus Project

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Received: January 18, 2022 / Accepted: February 14, 2022 / Published online: March 9, 2022
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ABSTRACT

Introduction: Onychomycosis is the most common nail disorder in adults, with high recurrence and relapse rates. Its diagnosis may be difficult by non-experts because the clinical signs may overlap with other dermatoses. The treatment may be challenging, as it should be patient-tailored.

Methods: An online survey was conducted among European Nail Society (ENS) members to provide recommendations on the diagnosis and assessment of distal lateral subungual onychomycosis (DLSO) in non-specialized clinical environments, as well as recommendations for patient referral.

Results: DLSO diagnosis is predominantly based on clinical aspects, and microscopy and fungal culture are commonly employed to establish the diagnosis. Assessment of clinical features is the main method for DLSO follow-up, and the main criterion to define cure is a combination of mycologic cure and clinical

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s13555-022-00698-x>.

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cure. The most commonly selected treatments for onychomycosis include oral antifungals, topical antifungals, and nail debridement. According to the nail experts, predisposing factors of DLSO to be evaluated include concurrent tinea pedis diagnosis, immunocompromised status, and diabetes. The minimum clinical aspects to be evaluated for DLSO diagnosis should include subungual hyperkeratosis, white-yellow-orange subungual scales, and absence of salmon-pink coloration. Recommendations for clinical signs that should be evaluated to confirm treatment effectiveness include normal appearance and color of the nail, reduction or absence of scales under the nail, and absence of onycholysis. Recommendations for specialist referral include lack of treatment effectiveness, need of additional therapies, concurrent presence of other diseases or comorbidities, severe DLSO, and presence of a dermatophytoma or involvement of the nail matrix.

Conclusions: According to the surveyed nail experts, after evaluating clinical signs and predisposing factors for DLSO, the diagnosis should include subungual hyperkeratosis, nail color (yellow-orange), and onycholysis and thickening. In cases of severe DLSO, when there is treatment failure, concomitant diseases/comorbidities, presence of a dermatophytoma or involvement of the nail matrix, or involvement of several/all nails, referral should be considered.

Keywords: Antifungals; Consensus; Dermatophytes; Diagnosis; European Nail Society; Onychomycosis; Primary care; Referral; Treatment

Key Summary Points

Why carry out this study?

Onychomycosis is the most common nail infective disease, responsible for 50% of all consultations related with nail disorders.

Patients with onychomycosis usually consult healthcare professionals who are not specialized in nail disorders and who usually do not have the specific knowledge and access to techniques to properly diagnose and define cure of onychomycosis.

This situation reinforces the need to define the criteria to be used in non-specialized clinical practice environments for proper diagnosis and treatment efficacy assessment of mild to moderate onychomycosis.

What was learned from the study?

The study provides recommendations on the minimum clinical changes for proper diagnosis and treatment efficacy assessment of mild to moderate onychomycosis in non-specialized environments.

The recommendations of this study are in line with current existing recommendations for the management of onychomycosis and include the incorporation of recommendations for patients' referral to specialized healthcare professionals.

INTRODUCTION

Onychomycosis is a common fungal infection of the nails caused by dermatophytes, non-dermatophyte molds, and/or yeasts. It is the most common nail disorder in adults and accounts for approximately 50% of all nail-related diseases. Onychomycosis is divided into five subtypes based on the pattern of fungal invasion, of which distal lateral subungual onychomycosis (DLSO) is the most common presentation (58–85% of all presentations) [1, 2].

Onychomycosis risk factors include advanced age, diabetes, and immunosuppression, among others [3], and the infection has a wide variability in prevalence (from < 1% to 28%), depending on the country, patient age, and responsible fungus.

Clinical evaluation of onychomycosis may be challenging because other conditions, such as psoriasis, lichen planus, or traumatic onycholysis, can be misdiagnosed as onychomycosis. Onychomycosis may be caused by a variety of fungal agents which respond differently to antifungal treatments; consequently, an accurate diagnosis is essential before commencing therapy [4]. Routine diagnostic techniques include direct microscopy with potassium hydroxide (KOH), fungal culture, histopathology, and PCR testing [5]. Dermoscopy (onychoscropy) can also be used to identify DLSO [6]. However, these techniques may not be available to general practitioners, who are usually the healthcare providers who provide the clinical diagnosis. According to the National Ambulatory Medical Care Survey (2007–2016), dermatophytosis is predominantly diagnosed by general practitioners (40.3%), followed by dermatologists (26.4%), and pediatricians (26.2%) [7].

The most common therapies for onychomycosis include oral and topical antifungals, often employed concomitantly with physical treatments (clipping, debridement, etc.) [8]. Onychomycosis therapy must be individualized, taking into account the extent and severity of nail abnormalities, the causal agent, and the characteristics and preferences of the individual patient, to avoid side effects and potential polypharmacy issues.

The aim of the CONSONANCE (CONsensus on ONychomycosis Assessment in Non-specialized Clinical Environments) project is to provide recommendations on the minimum clinical criteria needed for DLSO diagnosis and the assessment of treatment efficacy by healthcare professionals not specialized in nail diseases and other non-expert healthcare professionals in their daily clinical practice, as well as to issue recommendations for patient referral.

METHODS

A questionnaire was distributed among members of the European Nail Society (ENS) to define recommendations for onychomycosis diagnosis, treatment efficacy assessment, and criteria for patient referral in non-specialized environments. No criteria for participation other than ENS membership were established.

The CONSONANCE project occurred in five successive phases: scientific committee creation, survey questionnaire development, survey administration, data collection, and data analysis.

The ENS established a scientific committee consisting of six experts in nail diseases from five different countries. This scientific committee developed a 26-item questionnaire (Electronic Supplementary Material 1) containing three main sections: participant profile, current clinical practice for DLSO diagnosis and treatment, and essential recommendations for non-experts to establish the diagnosis of DLSO, as well as definitions of treatment efficacy and reasons for referral. The full ENS membership was invited to participate, and the questionnaire was issued online from 20 October 2020 through to 9 December 2020, via an online platform that ensured data anonymity and confidentiality.

Nominal variables, such as the number of responders, were expressed as *n* and percentages, and continuous variables were expressed as means and standard deviation (SD). For the interpretation of items scored on the ordinal 9-point (1–9) Likert-type scale, the presentation of the answers was grouped in three levels: 1–3 (totally unnecessary/totally disagree/not relevant), 4–6 (neutral), and 7–9 (totally necessary/totally agree/extremely relevant); however, means and SD were also obtained. When the mean score for a statement was ≥ 7 , the item was considered to be “necessary, agree or relevant”. In turn, when the mean score was ≤ 3 , the item was considered to be “unnecessary/disagree/not relevant”. Data were analyzed using SPSS version 22.0 software (IBM SPSS, Armonk, NY, USA).

Ethics Committee approval was not applicable in this study because it is an opinion-based survey among healthcare professionals. There was no need to collect any type of patient data. Hence, the approval of an Ethics Committee was not required.

RESULTS

Participant Profile

Overall, 185 ENS members were invited to participate: 41 completed the first two sections of the questionnaire, and 38 participants also completed the third section. Participants were mostly dermatologists (98%) and from Europe (71%), working in a practice specialized in nail diseases (78%), with an average of 20.1 (SD 13.4) years treating nail diseases. On average, the respondents evaluated 296 patients per month, with 26% of the patients suffering from nail diseases; of these nearly 11% presented with onychomycosis, of whom 77% had DLSO.

CURRENT CLINICAL PRACTICE OF SURVEY PARTICIPANTS

For diagnosis of DLSO, all participants *always* evaluated the clinical aspects of the nail. 95% *always* or *often* asked for relevant medical history, and 91% *always* or *often* employed onychoscopy. In agreement with current recommendations [1], microscopic examination of a nail sample prepared with KOH and fungal culture were *always* or *often* performed by 81% of the respondents in both cases. At follow-up, clinical aspects of the nail were *always* or *often* evaluated by 100% of the participants, and dermoscopy was *always* or *often* performed by 86% of the participants (data not shown).

The treatments most often used for onychomycosis include oral antifungal treatment (47%), topical antifungal treatments (40%), and nail debridement (29%). For first-line therapy, topical antifungals were used in 88% of the cases when < 50% of the nail was affected. However, when > 50% of the nail, or the matrix was affected, combined oral and topical, or oral

antifungals alone were prescribed by > 70% of the respondents. Nail avulsion and nail debridement were also employed in cases of more severe DLSO.

Regardless of disease severity, the follow-up interval of patients with DLSO was reported as every 3 months. The main criterion to establish cure for nail experts was “complete cure” (i.e., both mycologic cure and clinical cure) (used by 54% of the respondents); however, 34% of the survey participants indicated that they only take into consideration the “clinical cure” (completely normal nail clinically). The survey participants reported taking the decision to stop treatment based on the following factors: mycologic cure (negative result upon KOH-stained microscopic examination and culture) (22% of the participants), clinical cure (29%), or both (29%) (data not shown).

Definition of Key Recommendations for Non-Specialized Clinical Environments

Diagnosis of DLSO

According to the respondents, when considering the diagnosis of DLSO in non-specialized environments with no access to specialized equipment and diagnostic tests, the minimum clinical aspects that are mandatory to be evaluated include subungual hyperkeratosis (mean Likert-type scale score 7.32) and a yellow-orange-colored nail plate (7.05) (Fig. 1a, b). Two thirds (66%) of survey participants considered that onycholysis (Fig. 1c) should also be evaluated when DLSO is suspected. According to the nail experts, predisposing factors which should be evaluated for the diagnosis of DLSO include concurrent tinea pedis (7.92) and immune function compromise, such as HIV infection, oncological therapy (7.21), or diabetes mellitus (7.00). Other predisposing factors that should be considered are frequent attendance at swimming pools, gyms, or any other warm and moist area, as well as psoriasis (6.53) (Table 1).

Differential Diagnosis of DLSO

DLSO has overlapping clinical features with other nail diseases. Care should be taken to



Fig. 1 Clinical signs of onychomycosis. **a** Subungual hyperkeratosis, **b** subungual scales white-yellow-orange, **c** onycholysis, **d** dermatophytoma, **e** nail matrix with onychomycosis. (Images in Fig. 1a, b, d, e are courtesy of BM Piraccini; Image in Fig. 1c is courtesy of NG Di Chiacchio)

correctly identify signs and symptoms to establish the correct diagnosis. According to the survey participants, in cases of mild to moderate DLSO the main clinical signs for DLSO include subungual hyperkeratosis (mean Likert-type scale score 7.08), white-yellow-orange subungual scales (7.03), and yellow-orange nail discoloration (6.97). The presence of salmon-pink nails (2.84) was considered a sign for excluding onychomycosis but should be considered as possibly indicating the presence of nail psoriasis (Table 2).

Assessment of the Efficacy of Onychomycosis Treatments

To confirm the effectiveness of a treatment for mild to moderate DLSO in the context of non-expert real-life practice, clinical signs considered to be *extremely relevant* include a normal nail plate (mean Likert-type scale score 8.13), reduced/absent hyperkeratosis (7.74), normal nail color (7.37), and absence of onycholysis (7.21) (Table 3).

Key outcomes considered most relevant to confirm the effectiveness of a treatment for mild to moderate DLSO include normal newly grown nail plate (mean Likert-type scale score 8.42) and normal nail plate appearance (7.89) (Fig. 2). Patient satisfaction with the appearance of the nail plate was very close to being considered as a key outcome (6.97) (Table 3).

Criteria for Specialist Referral

Recommendations from the survey participants for specialist referral included lack of treatment effectiveness, need of additional therapies, concurrent presence of other diseases or comorbidities (psoriasis, diabetes, etc.), severe DLSO, presence of a dermatophytoma (Fig. 1d), or involvement of the nail matrix (Fig. 1e) (Table 4).

Recommendations to non-experts for the diagnosis, treatment assessment, and indications for specialist referral for DLSO are summarized in Table 5. The CONSONANCE Scientific Committee agreed with the recommendations established by the survey respondents.

DISCUSSION

The CONSONANCE project provides data from nail experts based their current clinical practice for the diagnosis, treatment, and follow-up of DLSO. Moreover, the project aims to guide DLSO management in non-expert environments (dermatologists not specialized in nail diseases, general practitioners, and pharmacists). The participants and the Scientific Committee agreed with the minimum clinical criteria for DLSO diagnosis, treatment efficacy assessment, and patient referral. The recommendations appear to corroborate existing knowledge [1], although they focus on health-care professionals that do not usually have the specific knowledge and access to diagnostic tests and equipment to properly diagnose and manage onychomycosis.

A thorough physical examination is essential for DLSO diagnosis, especially in non-expert environments where access to specialized equipment and diagnostic tests is limited or

Table 1 Clinical aspects and predisposing factors to be evaluated by non-experts for the diagnosis of distal lateral subungual onychomycosis

Clinical aspects and predisposing factors for DLSO diagnosis	Score, mean (SD) ^a	Percentage agreement among survey respondents ^b		
		Totally necessary (%)	Neutral (%)	Totally unnecessary (%)
Clinical aspects				
Subungual hyperkeratosis	7.32 (2.756)	74	21	5
Nail color: yellow-orange	7.05 (2.874)	68	21	11
Nail plate thickening	6.61 (2.671)	55	37	8
Onycholysis	6.58 (2.745)	66	16	18
Several toenails affected	6.29 (2.854)	47	40	13
Nail crumbling	6.05 (2.731)	53	26	21
Toenails and finger nails affected	5.55 (2.393)	42	32	26
Nail surface abnormalities	5.24 (2.718)	34	34	32
Paronychia (periungual inflammation)	5.05 (2.112)	34	34	32
Several finger nails affected	4.89 (2.336)	26	40	34
Longitudinal nail fissures	4.39 (2.756)	24	37	39
Predisposing factors				
Current tinea pedis diagnosis	7.92 (1.323)	95	3	2
Compromised immune function like HIV or oncological therapy	7.21 (1.947)	79	16	5
Diabetes	7.00 (2.027)	76	13	11
Frequent attendance to pools, gyms, spas, or any other warm and moist areas	6.68 (2.417)	66	17	17
Psoriasis (nail psoriasis/body psoriasis/psoriatic arthritis)	6.53 (2.586)	68	13	19
Frequent occlusive footwear	6.47 (2.447)	60	24	16
Older adult (> 65 years)	6.37 (2.223)	50	40	10
Peripheral vascular disease	6.24 (2.006)	55	34	11
History of repetitive nail trauma	6.05 (2.493)	42	40	18
Genetic predisposition (similar nail changes in the family members)	5.08 (2.907)	37	29	34

DLSO Distal lateral subungual onychomycosis, SD standard deviation

^aItems are scored on a 9-point (1–9) Likert-type scale; see section [Methods](#) for complete explanation

^bA total of $n = 38$ respondents completed the third section of the survey

Table 2 Clinical aspects that need to be evaluated by non-experts for mild to moderate DLSO differential diagnosis

In case of DLSO...	Score, mean (SD)	Percentage agreement among respondents		
		Totally agree (%)	Neutral (%)	Totally disagree (%)
There is subungual hyperkeratosis	7.08 (1.992)	71	24	5
Subungual scales are white-yellow-orange in colour	7.03 (2.047)	69	26	5
The nail color is yellow/orange	6.97 (1.979)	74	18	8
The nail plate is thicker and opaque	6.45 (2.076)	55	34	11
The nail plate is detached	6.37 (1.909)	50	42	8
Abnormalities are observed on the nail plate surface	5.29 (2.347)	34	42	24
Finger nails can also be affected	5.11 (2.436)	31	45	24
There is periungual inflammation	4.63 (2.476)	29	26	45
Only 1 nail is commonly affected	4.58 (2.882)	32	26	42
The nail color is solid white	4.45 (2.854)	24	37	39
The distal margin presents fissuring	4.32 (2.527)	21	37	42
All toe nails are commonly affected	4.29 (2.629)	18	40	42
The nail shows one or several brown-black lines	4.13 (2.612)	21	24	55
Longitudinal fissures are observed on the nail plate	3.89 (2.679)	21	24	55
The nail color is green	3.61 (2.824)	18	21	61
The patient reports pain	3.42 (2.344)	13	21	66
The nail color is salmon pink	2.84 (2.319)	11	15	74

The total number of participants, as 41 participants answered sections 1 and 2, and 38 completed the third section

non-existent. According to the British Association of Dermatologists (BAD) guidelines, the clinical presentation of DLSO includes nail discoloration, thickening, onycholysis, and subungual hyperkeratosis [1]. All participants in the present survey agreed with the BAD recommendation that is important to evaluate the clinical aspects of the nail for diagnosis.

A proper anamnesis, including comorbidities, habits, and patient occupation, is also important when there is a suspicion of DLSO. An increased prevalence of onychomycosis in patient populations with impaired immunity has been reported. Overall, 79% of survey

participants considered it *totally necessary* to inquire about concurrent immunosuppressive diseases, such as HIV infection and diabetes mellitus. The prevalence of dermatophyte toenail onychomycosis has been reported to be around 3-fold more common among HIV-positive individuals and diabetic patients than in the unaffected population [9]. Furthermore, 68% of the survey participants considered assessing psoriasis as a predisposing factor for DLSO diagnosis. In addition, in a survey conducted among members of the Canadian Society of Dermatology, respondents considered that comorbidities, such as diabetes and

Table 3 Relevance of clinical signs and outcomes to confirm the treatment effectiveness for mild to moderate DLSO by non-experts

	Score, mean (SD)	Percentage agreement among survey respondents		
		Extremely relevant (%)	Neutral (%)	Not relevant (%)
Clinical signs				
The nail plate is normal	8.13 (1.695)	89	8	3
Hyperkeratosis is reduced/absent	7.74 (1.519)	84	16	0
The nail colour is normal	7.37 (1.634)	68	29	3
Absence of onycholysis	7.21 (1.947)	68	32	0
Periungual inflammation is absent	6.68 (2.157)	55	29	16
All the treated nails are changing in the same way	6.45 (2.627)	55	37	8
Key outcomes				
The newly grown nail plate is normal	8.42 (0.976)	95	5	0
Normal nail plate appearance	7.89 (1.351)	84	16	0
Patient satisfaction with the appearance of the nail plate	6.97 (2.137)	61	34	5

The total number of participants, as 41 participants answered sections 1 and 2, and 38 completed the third section



Fig. 2 Nail plate appearance before (a) and after (b) onychomycosis treatment. (Images are courtesy of BM Piraccini)

peripheral vascular disease, should be assessed [10]. Diabetes and peripheral vascular disease were predisposing factors thought to be considered by 76% and 55% of the participants in the present survey, respectively. Other fungal infections, such as tinea pedis plantaris and tinea pedis interdigitalis, are described as risk

factors for onychomycosis [5], and 95% of participants in the present survey considered it to be *totally necessary* to evaluate concurrent tinea pedis when suspecting DLSO. In addition to biological predisposing factors, also environmental risk factors for onychomycosis have been previously described. Although the underlying mechanisms for onychomycosis transmission have not been elucidated, household contact has been identified as a major risk of onychomycosis transmission. Evidence of transmission in almost half of households with at least one affected subject has been reported, highlighting the role of households in the spread of onychomycosis [11].

Together with clinical evaluation and assessment of predisposing factors, it is important to consider other conditions or nail infections that are included in the clinical differential diagnosis of onychomycosis. The foremost challenge to healthcare providers is to differentiate DLSO from nail unit psoriasis, traumatic onycholysis, and nail unit lichen planus. The consideration of nail unit psoriasis

Table 4 Criteria for patient referral in case of suspicion of DLSO

Statements	Score, mean (SD)	Percentage agreement among survey respondents		
		Totally agree (%)	Neutral (%)	Totally disagree (%)
When other treatments in addition to topical and oral are needed, such as nail avulsion	8.47 (1.428)	95	3	2
When the fungal infection seems to progress despite oral treatment	8.45 (1.501)	92	3	5
When the oral treatment is not showing efficacy	8.42 (1.518)	92	5	3
When the patient suffers from other nail diseases	8.24 (1.731)	92	5	3
When the patient suffers from concurrent nail or skin psoriasis	8.16 (1.717)	87	10	3
In presence of a dermatophytoma (yellow or white streaks or patches in the subungual space. It is a dense fungal mass encased in a layer of biofilm)	7.92 (1.549)	82	18	0
When the patient presents severe comorbidities (uncontrolled diabetes, immunodepression, peripheral vascular disease...) or polypharmacy	7.76 (1.979)	79	16	5
When the nail matrix is involved	7.68 (2.042)	84	11	5
When the topical treatment is not showing efficacy	7.53 (2.076)	79	16	5
When patient presents severe DLSO	7.39 (2.224)	71	18	11
When several/all nails are involved	7.03 (2.455)	66	24	10
When subungual hyperkeratosis is thicker than 2 mm	6.87 (2.232)	63	32	5
When the need for oral treatment is considered	6.34 (2.374)	53	37	10
When the patient presents mild to moderate DLSO	4.61 (2.320)	24	42	34

The total number of participants, as 41 participants answered sections 1 and 2, and 38 completed the third section

is based on a potential clinical history of psoriasis, skin signs, arthritis, finger nail involvement, presence of nail signs (such as pits), and

salmon patches. For the consideration of nail unit lichen planus, the clinical history needs to be taken into consideration, as well as skin

Table 5 Recommendations to non-experts for patient's diagnosis, treatment assessment and referral when DLSO is suspected**Recommendations to non-experts**

- Clinical aspects to be evaluated for the diagnosis suspicion of DLSO are subungual hyperkeratosis and yellow–orange nail color
- Predisposing factors to be evaluated for the diagnosis suspicion of DLSO are current tinea pedis diagnosis, compromised immune function (e.g. HIV) or oncological therapy, and diabetes
- For mild to moderate DLSO differential diagnosis suspicion, in case of DLSO, there is subungual hyperkeratosis, and scales are white-yellow-orange. In addition, the nail color is NOT salmon-pink
- Clinical signs to confirm the effectiveness of a treatment for mild to moderate DLSO are normal nail plate, reduction/absence of scales under the nails, normal nail color, and absence of onycholysis
- Key outcomes to confirm the effectiveness of a treatment for mild to moderate DLSO are a normal newly grown nail plate with normal appearance
- Patient's referral should be considered:
 - when other treatments in addition to topical and oral are needed
 - when the fungal infection seems to progress despite oral treatment
 - when the oral treatment is not showing efficacy
 - when the patient suffers from other nail diseases
 - when the patient suffers from concurrent nail or skin psoriasis
 - in the presence of a dermatophytoma
 - when the patient presents severe comorbidities (uncontrolled diabetes, immunodepression, peripheral vascular disease, among others) or polypharmacy
 - when the nail matrix is involved
 - when the topical treatment is not showing efficacy
 - when patient presents severe DLSO
 - when several/all nails are involved

The total number of participants, as 41 participants answered sections 1 and 2, and 38 completed the third section

signs, involvement of mucous membranes and of the hair, and presence of nail signs (such as thinning, longitudinal fissuring, and dorsal pterygium). Traumatic onycholysis can be confirmed by a complete podiatric examination. In addition, there are also some worrisome signs which indicate that patients need a prompt referral to a nail specialist, including when the disease spreads to other toe-/fingernails and the presence of paronychia with serum or pus discharge (Fig. 3).

DLSO often has a similar clinical presentation if caused by dermatophytes, non-dermatophytes, or yeasts [1], but these organisms may respond differently to antifungal agents [4]. Therefore, it is important to identify the causative organism before starting treatment. In our study, mycologic confirmation was a common practice among survey participants, with the percentage reporting mycologic confirmation (81%) higher than previously reported by Koshnick et al. among dermatologists (63.6%) [12]. According to Koshnick et al., in non-



Fig. 3 Differential diagnosis for onychomycosis. **a** Nail psoriasis, **b** traumatic onycholysis, **c** nail with lichen planus, **d** paronychia with serum or pus discharge. (Images are courtesy of BM Piraccini)

specialist environments, up to 46.6% of family practitioners and 21.6% of podiatrists do not obtain a confirmatory diagnostic test before starting treatment of toenail onychomycosis [12]. This lower percentage could possibly be explained by limited access to laboratories able to process fungal cultures. Subsequently, therapy can sometimes be initiated based on clinical presentation alone. A recent study showed that performing confirmatory testing before starting treatment with both topical and oral antifungals is cost-effective [13], and this recommendation is even stronger when any oral antifungal treatment is considered [14]. Identification and treatment of onychomycosis are essential because the disease has a great impact on patients' lives, involving psychological and physical effects, and also a great socioeconomic impact (occupational life) [15–17]. The importance of confirming the diagnosis of onychomycosis before prescribing an oral antifungal is supported by the first recommendation of the American Academy of Dermatology's (AAD) contribution to the Choosing-Wisely campaign [18].

Even if clinical trials for onychomycosis use mycologic cure (negative mycologic culture and KOH) and clinical cure as primary endpoints [19], in this survey, nearly one third of the participants considered *cure* or *treatment completion* only taking into account the nail clinical features (clinical cure). We believe that this is a very high percentage, considering that in cases of severe onychomycosis, up to 10% of the nail is likely to remain clinically abnormal, even when mycology indicates a cure of fungal

infection [20]. Inspection of the nail may also have limitations in patients with comorbid diseases affecting nails, such as nail unit psoriasis and traumatic nail dystrophy. Nevertheless, a recent survey among dermatologists also agreed on assessing treatment efficacy by clinical judgement of the normal regrowth of the proximal nail [21].

Survey participants were also asked about criteria to define treatment completion; answers were nearly equally distributed between mycologic cure (22%), clinical cure (29%), and complete cure (29%). One possible explanation of this distribution may be that the kind of treatment (topical or oral) was not specified. Overall, topical therapies show lower mycologic cure and complete cure rates than oral therapies; however, oral treatments have more adverse effects [8]. These findings could support the use of a topical antifungal medication until nail plate appearance is normal, and may explain why clinicians are more cautious in prescribing long-term systemic antifungal treatments.

It is important to highlight that cure is not achieved in 20–25% of treated patients [22]. Patient comorbidities, such as immunosuppression or diabetes mellitus, have an impact on treatment efficacy, since potential interactions between both therapies have to be considered. Finally, patient age, treatment compliance, and fungal resistance also have an impact on treatment efficacy [23].

It is important to recognize that this project was based on a survey, the answers rely on respondent expertise, and the recommendations should not be considered as guidelines. All

participants were ENS members, mostly dermatologists with extensive experience in onychomycosis. The respondents reported evaluating an average of 296 patients per month, and 26.4% of these patients presented with nail diseases, a higher percentage than the nail disease average seen by dermatologists (10%) [24] in general, reinforcing these study results. However, the composition of the panel (98% dermatologists and no primary care physicians) could be also a potential limitation, and selection bias cannot be excluded. Another possible limitation was the questionnaire length, which might have caused some bias secondary to fatigue and potentially could also explain why only 22.16% of the ENS members invited to complete the survey answered all of the questions.

CONCLUSIONS

Nail specialists commonly use microscopic examination and fungal culture to diagnose DLSO, but these methods are often not available in non-specialized environments. Therefore, our survey participants have reported the minimum clinical changes needed to evaluate DLSO in such situations, including the presence of subungual hyperkeratosis, white-yellow-orange subungual scales, and the presence of yellow nail discoloration. Good indicators to define treatment effectiveness include normal appearance and color of the nail, reduction or absence of scales under the nail, and a reduction of onycholysis. In cases of severe DLSO, when there is treatment failure, concomitant diseases or comorbidities, presence of a dermatophytoma, involvement of the nail matrix, or involvement of several/all nails, referral to specialized healthcare professional should be considered.

ACKNOWLEDGEMENTS

We thank the participants who completed this survey, and Maite Artés, Nathalie Bofarull, and Malena Águila (Adelphi Targis S.L.) for the

project management and their contributions throughout the study.

Funding. Sponsorship for this study and Rapid Service Fee were funded by Almirall S.A. The authors have received no payment to write this article.

Medical Writing, Editorial, and Other Assistance. Editorial assistance in the preparation of this article was provided by Maite Artés, Nathalie Bofarull, and Malena Águila (Adelphi Targis S.L.). Alba Gomez and Alba Llopis provided medical writing assistance. Support for this assistance was funded by Almirall S.A.

Authorship. Bianca Maria Piraccini, Michela Starace, Adam I Rubin, Gioia Di Chiacchio, Matilde Iorizzo, and Dimitris Rigopoulos meet the International Committee of Medical Journal Editors (ICMJE) criteria for authorship for this article, take responsibility for the integrity of the work as a whole, and have given their approval for this version to be published.

Author Contributions. All authors contributed to the study conception and design and were involved in the writing and review of this article. All authors read and approved the final manuscript.

Disclosures. Bianca Maria Piraccini reports personal fees from Pierre Fabre—Ducray, Difa Cooper, Dercos—L’Oreal, ISDIN, Legacy Healthcare, Pfizer, Almirall, and Lilly, outside the submitted work. Michela Starace reports personal fees from APS SRL, Difa Cooper, and ISDIN. Adam I. Rubin, Gioia Di Chiacchio, Matilde Iorizzo, and Dimitris Rigopoulos have nothing to disclose.

Compliance with Ethics Guidelines. Ethics Committee approval was not applicable in this study because it is an opinion-based survey among healthcare professionals. There was no need to collect any type of patient data. Hence, the approval of an Ethics Committee was not required.

Data Availability. The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

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