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### Key Features

- Pitting and onycholysis are the most common clinical manifestations of nail psoriasis.
- The frequency of clinical features differs in the fingernails versus toenails.
- Nail matrix changes include nail pitting, leukonychia, red spots in the lunula, and crumbling.
- Nail bed abnormalities include onycholysis, splinter hemorrhages, hyperkeratosis, and “oil-drop” salmon patch discoloration.
- The quality of life in patients with nail psoriasis is lower than in psoriasis patients without nail involvement.

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## 6.1 Introduction

Nail involvement is present in over half of patients with psoriasis and consequently has a prominently negative impact on society [1, 2]. The clinical gamut of nail involvement is diverse and includes changes to the nail matrix, the nail bed, or both [3]. The main nail matrix dystrophy is nail pitting while onycholysis, subungual hyperkeratosis, splinter hemorrhages, and oil-drop discoloration are the major nail bed findings [4]. Lesions of the nail plate are due to the location of disease in the nail matrix as well as the duration of the disease [5]. This chapter will describe the broad array of clinical features of nail psoriasis in order to help clinicians identify the condition, which will enable dermatologists to treat the symptoms and hopefully improve patients' lives.

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## 6.2 Epidemiology

For patients with nail psoriasis, certain clinical features are more prevalent than others and the majority of these features are found mainly in the fingernails [6]. In a 2012 study, nail pitting was present in the majority of 71 patients who had psoriatic nails; this abnormal variation occurred in the fingernails and/or toenails of 43 (60.6 %) of the patients [7]. Onycholysis was the most common nail bed change which was displayed in the fingernails and/or toenails of 52.1 % of the patients [7]. According to a study by Brazzelli et al., when looking at each individual fingernail, pitting was most commonly seen in the fourth nail of the right hand and the third nail of the left hand [8]. Onycholysis was seen more frequently in the first fingernail (thumb) of the right hand and the fourth on the left hand [8]. Overall, the fourth fingernail and the first toenail were the most affected by psoriatic changes [8]. Pitting in the toenails is relatively rare [8]. Only 2.9 % of patients had pitting in the toenails while 46.0 % had fingernail pitting [8]. On the contrary, in this study, onycholysis was more prevalent in the toenails (68.6 %) than the fingernails (46.0 %) [8].

Additionally, according to a 2011 study conducted in Greece, out of the 225 psoriatic patients, 152 (66.7 %) had psoriasis of the nails [9]. The most prevalent features out of this population were an oil-drop salmon patch discoloration and onycholysis with 79.6 and 76.3 % of the patients displaying these features, respectively [9]. Pitting was found in 57.9 % of the patients, while subungual hyperkeratosis was found in 50.7 % [9]. Crumbling of the nail was found in 41.4 % of the patients [9]. Leukonychia and hemorrhages were apparent in 28.9 % of the patients, and red spots were the least common and only found in two of the patients [9].

Furthermore, a 2007 study from Kuwait demonstrated that the prevalence of nail changes was 37.81 % in children with psoriasis [10]. For these patients with nail implications, nail pitting, the most common feature, was found in 61.84 % of the children, followed by onycholysis in 30.26 % of patients, subungual hyperkeratosis in 13.16 % of patients, and finally discoloration of the nail plate in 7.90 % of the children [10]. When compared to adults, this study shows that a smaller percentage of children with psoriasis have nail changes [10]. However, the order of the frequency

of the nail changes including nail pitting, onycholysis, subungual hyperkeratosis, and discoloration of the nail is similar [10].

The distribution of the psoriatic characteristics differs between fingernails and toenails. Toenails typically display discoloration, subungual hyperkeratosis, onycholysis, and crumbling while the fingernails more commonly display pitting, subungual hyperkeratosis, splinter hemorrhages, and oil spots [8, 11]. As can be seen in Table 6.1, there are great variations between different studies in the prevalence of the specific nail features, demonstrating the need for studies that use a greater population of patients with psoriatic nail changes. The table compares fingernail versus toenail involvement of the clinical features. The statistically significant results in Table 6.1 demonstrate that pitting and onycholysis are very common in psoriatic fingernails; studies by Palmou et al., Puri et al., and van der Velden et al. further support this notion (Table 6.2) [3, 12, 13]. In addition, subungual hyperkeratosis and onycholysis are common in the toenails, while pitting and leukonychia are relatively rare in the toenails.

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## 6.3 History

Nail manifestations of psoriasis were first described by Robert Willan in his textbook *On Cutaneous Diseases* published in London in 1808 [14]. Psoriasis was designated as lepra vulgaris. In 1872, Hebra first described nail pitting, and in 1948, John Alkiewicz first identified parakeratosis as the cause of nail pitting [15]. Then, in 2003, the ability to evaluate the clinical features of nail psoriasis improved immensely with the establishment of the Nail Psoriasis Severity Index (NAPSI). NAPSI is a significant tool that enables physicians to determine the severity of nail psoriasis and its response to treatment [16].

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## 6.4 Clinical Features

### 6.4.1 Overview

The clinical features of nail psoriasis, as well as skin psoriasis, are due to inflammatory hyperkeratotic papules. These papules present differently based on where in the nail they occur (Table 6.3) [5]. The clinical features originate in either the nail matrix or nail bed. The nail matrix is the portion of the nail unit that produces the nail plate. The lunula is the most distal portion of the matrix, which can be seen through the nail plate and appears as a white arch. Conversely, the nail bed is a portion of the nail unit that is situated between the lunula and the hyponychium – the skin underneath the nail plate edge [5, 17].

Nail pitting, leukonychia (white spots), red spots in the lunula, and at times crumbling originate in the nail matrix and become incorporated into the developing nail plate. All of these characteristics are seen in the nail plate. In contrast, onycholysis, splinter hemorrhages, hyperkeratosis, and an “oil-drop” salmon patch

**Table 6.1** The prevalence of particular nail changes in fingernails and toenails in patients with psoriatic nails

	Percentage of patients with <i>fingernail</i> involvement in study by Brazzelli et al. [8]	Percentage of patients with <i>fingernail</i> involvement in study by Salomon et al. [11]	Percentage of patients with <i>fingernail</i> involvement in study by Idrees et al. [7]	Percentage of patients with <i>toenail</i> involvement in study by Brazzelli et al. [8]	Percentage of patients with <i>toenail</i> involvement in study by Salomon et al. [11]	Percentage of patients with <i>toenail</i> involvement in study by Idrees et al. [7]
Nail clinical feature						
Pitting	46.0 %	56.6 %	57.7 %	2.9 %	1.2 %	59.2 %
Leukonychia	5.1 %	N/A	1.4 %	8.0 %	N/A	0.0 %
Crumbling	14.6 %	N/A	N/A	53.3 %	N/A	N/A
Onycholysis	46.0 %	2.4 % <sup>a</sup>	49.3 %	68.6 %	2.4 % <sup>a</sup>	46.5 %
Splinter hemorrhages	24.1 %	N/A	N/A	10.2 %	N/A	N/A
Subungual hyperkeratosis	5.1 %	79.5 %	28.2 %	51.8 %	74.7 %	29.6 %
Discoloration including oil drop	13.9 %	12.0 %	7.0 %	29.2 %	7.2 %	5.6 %

<sup>a</sup>Not statistically significant

**Table 6.2** Frequency of specific nail abnormalities in patients with psoriasis

Nail clinical feature	Percentage of patients with nail involvement in study by Palmou et al. [12]	Percentage of patients with nail involvement in study by Puri et al. [13]	Percentage of patients with nail involvement in study by van der Velden et al. [3]
Pitting	65.4 %	70 %	73.5 %
Leukonychia	7.7 %	N/A	40.8 %
Crumbling	9.6 %	N/A	42.9 %
Onycholysis	27.1 %	52 %	93.9 %
Splinter hemorrhages	21.2 %	12 %	93.9 %
Subungual hyperkeratosis	7.7 %	40 %	46.9 %
Discoloration including oil drop	N/A	10 %	67.3 %

**Table 6.3** Function of different constituents of the nail apparatus

Constituent	Function
Proximal nail fold (PNF)	Protects the nail matrix from environmental agents. The cuticle, the cornified cell layer of the PNF, helps seal the nail plate and prevents nail matrix damage
Nail matrix	Produces the nail plate. The proximal matrix produces the dorsal nail plate; the distal matrix produces the ventral nail plate
Nail bed	Provides adhesion to the nail plate as its horny layer is part of the ventral nail plate
Hyponychium	Transition zone between the nail bed and the epidermis

**Table 6.4** Main clinical features of nail psoriasis in nail matrix and nail bed

Clinical features originating in the nail matrix	Clinical features originating in the nail bed
Nail pitting	Onycholysis
Leukonychia (white spots)	Splinter hemorrhages
Red spots in the lunula	Subungual hyperkeratosis
Crumbling	Oil-drop salmon patch discoloration

discoloration occur in the nail bed (Table 6.4) [16]. Other nail changes in patients with psoriasis include longitudinal ridges, extending from the cuticle to the distal part of the nail, and transverse ridges (Beau lines) [11]. Beau lines are a consequence of sporadic irritation of the nail matrix and may spread to the nail plate, resulting in an impermanent loss of the nail [6].

Aside from the primary clinical features of nail psoriasis, there are often secondary features present as well. For instance, fungal infections (onychomycosis), which can mimic the clinical features of nail psoriasis, were present in 18 % of the patients with psoriatic nails. Unfortunately, the presence of both conditions increases the severity of nail psoriasis [11, 18]. Moreover, there is a significant correlation between psoriatic nails, joint pain, and joint deformities [19]. All of these clinical features are clues to the physician that the patient has nail psoriasis (Fig. 6.1).

**Fig. 6.1** These nails show signs of both nail bed and nail matrix psoriasis: note thickening due to subungual hyperkeratosis, abnormalities of the nail plate surface, leukonychia, and erythema of the lunula



**Table 6.5** Descriptions of nail matrix features

Clinical features	Main characteristics
Pitting	Irregular, superficial depressions in the nail plate
Leukonychia	White spots in the nail plate
Red spots in the lunula	The white arch of the nail contains erythematous spots
Crumbling	Destruction of the nail plate

**Fig. 6.2** Psoriatic pitting. Pits are large, deep, and irregularly distributed. Onycholysis is also present



## 6.4.2 Nail Matrix Features

Nail matrix features include pitting, leukonychia, red spots in the lunula, and crumbling (Table 6.5). Nail pits can be recognized as superficial depressions in the nail plate that move distally with nail growth [20, 21]. Pits are typically irregularly spaced and almost exclusively seen in the fingernails with rare occurrence in the toenails [8, 22]. Psoriatic pits are typically deep, large, and irregularly distributed (Fig. 6.2). Nail pits are due to psoriasis of the proximal nail matrix that causes

abnormal keratinization with the presence of parakeratotic cells in the uppermost surface of the nail plate [23, 24]. The proximal nail fold can also contribute to the formation of nail pitting [21]. When these loosely packed cells slough off from the nail plate, a pit or depression forms [24]. The remaining parakeratotic cells are visible as scales within the pit [25]. The number of pits is important: less than 20 pits are nonspecific for diagnosis, but the presence of more than 20 pits is suggestive of psoriasis and more than 60 pits is diagnostic [26]. In a 2013 study, none of the patients in the control group (without psoriasis) had more than 20 pits while 8 % of the psoriasis patients had between 20 and 60 pits and 12 % had more than 60 pits. Moreover, the incidence of nail pitting rises with increases in the severity of psoriasis [22]. Nail pitting is characteristic of psoriasis; however, it may also be seen in alopecia areata and eczema [6, 20, 26]. Evaluating the nails for pitting is essential as it can provide support for diagnosing psoriasis [22, 27].

Unlike nail pitting, leukonychia occurs when psoriasis affects the middle and/or distal part of the nail matrix, and the parakeratotic cells are within the ventral nail plate [24]. In leukonychia the nail surface is smooth; persistence of the parakeratotic cells as white scales within the pits may resemble leukonychia, but in this case the nail has a rough surface [5]. The perception of white spots is due to the desquamation of parakeratotic cells and the light reflected on the nail plate [24, 28].

Red spots in the lunula are a result of a modification of the amount of blood beneath the nail due to a variation in the pattern of the vessels, vessel dilatation, or a change in the composition of the blood. There are no signs of an increase in the amount of capillaries or dilation; thus, it is proposed that the erythematous lunulae are due to either augmented arteriolar blood flow or venous vasodilation of unclear origin [29]. Furthermore, alterations in the nail plate may result in a greater appearance of the underlying nail bed or a lack of compression of the blood vessels in the nail bed [29, 30]. In particular, a decrease in the thickness of the nail plate may present with nail bed erythema [31]. Moreover, the lunula may look spotted or red with intermediate and ventral matrix involvement [32].

Nail crumbling, another nail matrix feature, is related to a thick and dystrophic nail plate as well as a hyperkeratotic nail bed [33]. The consequences of crumbling sometimes include a visible comprehensive devastation of the nail plate [33]. Crumbling may be present when extensive psoriatic changes affect the entire nail matrix [28]. Additionally, crumbling is suggestive of a long duration of disease [5].

### 6.4.3 Nail Bed Features

Nail bed features include onycholysis, splinter hemorrhages, subungual hyperkeratosis, and oil-drop salmon patch discoloration (Table 6.6). Onycholysis appears white due to the loss of attachment of the nail plate to the nail bed [20]. The detachment is due to a significant lesion at the hyponychium where parakeratosis interferes with the adhesion of the nail plate to the nail bed [20, 24]. As a result, onycholysis is frequently associated with keratin fragments that accumulate below the nail plate [24]. Onycholysis usually originates distally and/or laterally and

**Table 6.6** Descriptions of nail bed features

Clinical features	Main characteristics
Onycholysis	Detachment of the nail plate from the nail bed
Splinter hemorrhages	Ruptured nail capillary producing a dark red longitudinal line
Subungual hyperkeratosis	An accumulation of keratinocytes below the nail plate
Oil-drop salmon patch discoloration	A yellow/reddish-brown plaque with excessive glycoproteins

**Fig. 6.3** Onycholysis without erythematous border. Diagnosis is suggested by presence of irregular pits in some nails



**Fig. 6.4** Onycholysis with erythematous border



advances proximally toward the nail matrix [5, 34]. This separation occurs along a convex line [6]. Air accumulates underneath the nail plate and is responsible for the whitish appearance (Fig. 6.3) [35]. An erythematous border around the onycholytic area is diagnostic for psoriasis and most frequently seen in fingernails (Fig. 6.4) [36]. Onycholysis in combination with subungual hyperkeratosis is typical for psoriatic toenails [36]. Trauma and irritation also have the potential to cause



**Fig. 6.5** Distal splinter hemorrhages. The clinical features are suggestive but not diagnostic. In this patient diagnosis was confirmed by presence of typical scalp psoriasis



onycholysis. Bacteria and yeast may invade more easily in the presence of onycholysis, and discoloration may ensue [21]. For instance, a greenish or brown color may occur due to the infiltration of *Pseudomonas aeruginosa*, mold, or yeast [34]. Interestingly, nails affected by onycholysis have a faster growth rate than unaffected nails; however, the etiology of this phenomenon remains unclear [37]. Unfortunately during prolonged onycholysis, abnormal keratinization of the nail bed as a result of environmental exposure reduces the likelihood that the nail plate will be able to reattach to the nail bed [21].

Splinter hemorrhages also involve the nail bed and are longitudinal dark red lines (1–3 mm in length) that occur when the capillaries in the dermal papillae rupture (Fig. 6.5) [20, 38]. Capillary rupture is due to excessive inflammation and swelling or clots [39]. The anatomy of the nail bed capillaries is the foundation for the characteristic appearance of splinter hemorrhages, and the hemorrhages' longitudinal path also follows the direction of nail growth. The papillary network contains arterioles, which originate from deeper vessels that anastomose and form an arcade. Arterioles extend from the arcade into the dermis's papillae to form capillary loops which drain into the venules parallel to the arterioles [40]. Most of the capillary loops occur in the distal third of the nail [39]. According to an Austrian study with 120 participants, there is an average of 8.71 capillaries/mm in the nail bed. A hairpin structure with a linear afferent and efferent portion connected by a rounded end point is the normal morphology of these capillaries, residing in the dermal ridges of the nail bed [41, 42].

Another nail bed feature is subungual hyperkeratosis, which is an accumulation of scales beneath the nail plate [20]. Subungual hyperkeratosis involves the distal nail bed and hyponychium [24]. In the fingernails, scaly debris gather under the nail plate [24]. In the toenails, however, subungual hyperkeratosis is normally securely attached to the thickened nail plate [43]. Subungual hyperkeratosis can differ in its clinical appearance due to differences in color and the amount of keratosis [5]. In psoriasis, subungual hyperkeratosis is usually silvery white (Fig. 6.6), but may be

**Fig. 6.6** Severe subungual hyperkeratosis. The silvery white color is typical for nail psoriasis



**Fig. 6.7** Salmon patches and onycholysis with erythematous border. Note pits with scaly surface on the third fingernail



yellow and greasy, or green or brown if there is secondary colonization [5]. Pathology shows thickening of the stratum corneum, parakeratosis, and loss of the granular layer in the hyponychium [5]. The yellow-greasy appearance is due to the accumulation of serum glycoprotein, and the green or brown color is due to the colonization of various microorganisms [5]. Clinicians can identify the severity of psoriatic activity in the hyponychium based on the degree of elevation of the nail plate above the nail bed [5].

The oil-drop salmon patch discoloration is a yellow/reddish-brown drop that occurs in the nail bed and/or the hyponychium and is seen by observation through the translucent nail plate [35]. These salmon patches are irregular in size and shape [6]. The oil drop may be seen in the central part of the nail, or it may surround an onycholytic area in the distal nail bed (Fig. 6.7) [43]. Psoriatic inflammation involving dilated capillaries, the infiltration of lymphocytes, parakeratotic cells, and neutrophils contribute to the salmon spots [24, 35]. The characteristic salmon color can be further explained by the overlying nail plate, which obstructs air from going in between the keratin layers and results in a coherent appearance [44]. Moreover, the oil-drop sign is due to a subungual accrual of glycoprotein [24].

## 6.5 Diagnostic Clues

Clinical diagnosis of nail psoriasis can be difficult as the symptoms are common features of many nail disorders. The presence of multiple signs in different nails is highly suggestive. Diagnosis is particularly difficult in the case of simple onycholysis (onycholysis without peripheral oil-drop discoloration) in the fingernails and in the case of subungual hyperkeratosis occurring in fingernails and/or toenails. For simple onycholysis, not associated with other nail signs of psoriasis, dermoscopy of the hyponychium is probably the only way to make the correct diagnosis. In the instance of subungual hyperkeratosis, the presence of white silvery scales is highly suggestive of psoriasis. Furthermore, acquired subungual hyperkeratosis involving all nails, all fingernails, or all toenails is very suggestive. Other suggestive features of nail psoriasis include more than 20 irregular pits in the fingernails, onycholysis with an erythematous border, and salmon patches in the nail bed.

### Summary for the Clinician

In summary, it is essential for clinicians to be able to recognize the wide array of nail matrix and nail bed features in order to diagnose nail psoriasis and to be aware of other potential complications that may arise [3]. For example, the clinical changes in psoriatic nails can increase the risk of infection. A fungal infection with nail psoriasis will worsen the disorder; therefore, it is vital for the clinician to exclude their coexistence [18]. Additionally, many patients with nail psoriasis also present with psoriatic arthritis. By recognizing this significant correlation, physicians have the ability to reduce the severity of any current or future joint involvement related to psoriasis [19]. Moreover, the overall quality of life is significantly diminished in patients with nail involvement compared to those without. Patients with psoriatic nails tend to have a larger area of their skin affected by psoriasis and take more days off of work, and their overall health is worse than patients without nail features [45]. Therefore, identifying the clinical features of nail psoriasis and treating the symptoms is essential for the well-being of the patient.

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