

Nail changes due to diabetes and other endocrinopathies

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ABSTRACT: Most endocrine-associated nail disorders are non-specified but can provide valuable clues for diagnosis of some endocrine disorders. The nail effects of diabetes, thyroid disorders, parathyroid dysfunction, adrenal and ovarian dysfunction are discussed in relation to nail health and pathology. Diabetes mellitus affects many organ systems including skin and nails. The lower extremity consequences of diabetes is related to the poor peripheral circulation, neuropathy, and immunopathy. Sharp brittle nails can puncture the adjacent skin and escape notice due to the lack of sensation in the feet resulting in potential limb-threatening bacterial infections. Thyroid, adrenal, and ovarian hormones affect the nails in many ways, and various endocrine abnormalities with nail manifestations are reviewed.

KEYWORDS: nails, endocrine, diabetes mellitus, thyroid, parathyroid, pituitary.

Hormones affect many organ systems and body functions, including the integrity and quality of skin, hair, and nails. The various effects of endocrinopathies on skin and hair are well documented, but less is known about the hormonal impact on nails. This review highlights some of the known and postulated interactions between hormones and human nails. Diabetes, thyroid disorders, parathyroid dysfunction, adrenal hormone abnormalities, and ovarian dysfunction are discussed in relation to their influence on nail health and pathology. Most endocrine-associated nail changes are nonspecific, but can provide clues to the diagnosis of some endocrine disorders.

Diabetes mellitus effects on nails

Diabetes mellitus (DM) affects 16 million Americans and the incidence is increasing in the United States and worldwide. Diabetes is a metabolic disorder caused by the abnormal release of or sensitivity to the hormone insulin, with loss of blood glucose control. Uncontrolled

diabetes can have devastating effects on many organ systems including cardiovascular, neurologic, ocular, renal, and cutaneous, with its impact on skin, hair, and nails.

Over time many diabetics develop nails that are yellow, thickened, and sometimes fragile, ridged, and brittle (Fig. 1). There is definite overlap with some of the physical attributes seen in diabetic nails and those seen due to aging. It is unclear whether diabetes exacerbates nail changes associated with aging or vice versa. Periungual erythema and telangiectasia can be seen in the nail folds as an early finding of diabetes. Thickening of the skin of the dorsal hands and feet and proximal nail folds can be seen in up to one-quarter of diabetics (Figs. 2 and 3). The skin becomes thickened, rough, and indurated, particularly



Fig. 1. Yellow, thickened nails are characteristic of long-standing diabetes. **Fig. 2. Thickened skin on the lower extremities of a diabetic.**

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Fig. 3. Onychogryphosis in diabetics is not uncommon.



Fig. 4. Vesicles and healing erosions occur in the diabetic with vascularly and neurologically compromised extremities.

over the joints on the dorsum of the digits (1). Thickening of the toenails and even onychogryphosis (Fig. 3) can be related to the microangiopathic changes of the lower extremities in diabetic patients. Vesicles and bulla on the toes are sometimes seen in diabetic patients (2). These blisters can become infected and pose a threat to the integrity of the diabetic foot (Figs. 4 and 5).

Onychomycosis and its associated complications have been reported in diabetic patients (3). Gupta showed that diabetics have a threefold higher risk of developing onychomycosis than age-matched controls. The risk was not related to the degree of diabetic control or whether the diabetic was type 1 or 2 (4). Many of the abnormalities and adverse reactions that occur in the lower extremities in diabetics are related to four main factors: impaired peripheral circulation due to diabetic angiopathy, loss of sensation of the lower extremity because of diabetic peripheral neuropathy, impaired wound healing related in part to diabetic immunopathies, and unrecognized trauma resulting in a breach in cutaneous integrity. These factors are referred to collectively as the diabetic foot.

The risks of untreated onychomycosis in the high-risk diabetic, that is, diabetics with advanced neuropathy and angiopathy, is related to the mechanical effects of the thickened, brittle or

sharp mycotic nail causing traumatic skin lesions that escape notice due to loss of sensation in the lower extremities. These minor breaks in the skin around the nails can become infected, leading to serious limb-threatening bacterial infections in the diabetic (5). Ulceration and cuts of the nail bed and perionychium can result in necrosis and severe paronychia infections (Figs. 6 and 7). In addition, diabetics often have difficulty performing normal nail grooming due to their inability to bend over and reach their feet. Many diabetics are visually impaired and cannot inspect their feet daily for problems. Fungal and bacterial infections of the nail unit in diabetics should be cultured and treated with the appropriate antimicrobial agents.

Glucagonoma syndrome occurs in patients with malignant islet cell tumor and hyperglucagonemia. Glucagon along with insulin helps regulate blood glucose levels. There are many clinical features of glucagonemia including soft and flexible fingernails (6).

Thyroid abnormalities

Thyroid hormone deficiency or surplus can have effects on the hair, skin, and nails. The nail changes seen with hyperthyroidism are subtle and usually consist of onycholysis beginning in the fourth or fifth nail, the so-called Plummer's nails (7). This onycholysis is reversed when the hyperthyroidism is normalized. Nakatsui reported three patients who presented with onycholysis and were found to be hyperthyroid; he suggests that patients with unexplained onycholysis should be screened for asymptomatic thyroid disease (8). Hyperthyroidism has been associated with yellow nail syndrome, which is characterized by yellow, slow-growing nails and absent lunulae and cuticles.



Fig. 5. Nail bed erosion in a diabetic.



Fig. 6. Acute bacterial infections in the periungual tissue of a diabetic patient.



Fig. 7. Large ulceration of the lateral nail fold in a diabetic patient.



Fig. 8. Thin, ridged, brittle nails sometimes occur in patients with hypothyroidism.

There are no pathognomonic changes of hypothyroid nails. Changes reported are slow growth, hapalonychia (thin nails), longitudinal sulcus, and brittle nails (9). Nails in hypothyroid patients are sometimes described as dry, brittle, lusterless, and longitudinally ridged (10) (Fig. 8). There are reports of associated endocrinopathies, especially hypothyroidism, and chronic mucocutaneous candidiasis (CMCC), a rare inherited condition characterized by *Candida* infection of the mucous membranes and nails. Because a high percentage of patients with CMCC develop thyroid abnormalities, regular monitoring with thyroid function tests is needed (11).

Parathyroid disease

Several nail changes have been associated with hypoparathyroidism and hypocalcemia, including brittle, thin, and fragile nails affecting the distal half of the nail. In hyperparathyroidism a pseudo-racquet nail can be seen. These nails appear broader and shorter than normal because of acroosteolysis of the distal phalanx due to calcium mobilization (12) (Fig. 9).

Estrogen states

During pregnancy the growth rate of nails is increased and during lactation the nail growth rate is decreased. It is not known if these growth rate changes are related to hormones or to other metabolic factors. Hyperpigmentation in the form of longitudinal pigmented bands occurs during pregnancy in some woman (13).

Haenggi and Linder (14) studied nail fold capillaries in postmenopausal women on hormone replacement therapy (HRT) compared to those not on HRT and to premenopausal women. Nail fold capillary diameter, loop width, and capillary density were measured by video capillaroscopy at the proximal nail fold. The results



Fig. 9. Racquet nails are short and broad. Pseudo-racquet nails occur in patients with acro-osteolysis due to calcium loss in the distal phalanx in patients with hyperparathyroidism.

showed a significant decrease in capillary blood flow in postmenopausal women as compared to premenopausal women. HRT resulted in an increased capillary blood flow of 20–30% of initial values at 6 and 12 months (14). The significance of the increased blood flow to the nail unit in premenopausal women and women on HRT therapy is unknown.

Unfortunately there are no large controlled trials that evaluate the effect of estrogen on nail growth and nail quality. As the ovaries cease estrogen production during menopause, many women complain of changes in the strength, appearance, and flexibility of their nails. Some women note that their nails are thinner, softer, and more brittle. Many women note increased brittleness, peeling, and softness of their nails. While these changes can be due to a variety of causes, the authors opinion is based on clinical observation that many women experience a decline in the strength and flexibility of their nails in the postmenopausal period. These nail changes appear to be postponed in women on HRT. Large-scale controlled studies are necessary to scientifically study the effect of menopause and HRT on nail health.

Brosche et al. evaluated the integral lipid levels in the nail plates of 70 patients age 20 to 92 years old. There appeared to be an age associated increase in cholesterol lipids in nails in men but not in women. They propose that this age-dependent decrease in integral lipids in the nail plate in women might explain the increased incidence of brittle nails in women as they age (15).

A case of contraceptive pill-induced porphyria cutanea tarda presenting with onycholysis of the fingernails was reported by Byrne et al. (16).

Gas chromatography-mass spectrometry was used by Choi et al. for the measurement of testosterone and pregnenolone in nail plates. The levels of both steroids were higher in male than in female subjects. The levels of testosterone was higher than pregnenolone was higher in all subjects except in the toenails of female subjects (17).

Adrenal dysfunction

Chronic adrenal insufficiency is associated with pigmentation of the skin and mucous membranes. Nail changes are characterized by hyperpigmented longitudinal bands in the nail plate (18). These bands occur on multiple nails and gradually disappear after the therapy is successful. Patients with Cushing's syndrome may have an increased incidence of *Candida* paronychia (19).

Pituitary disorders

Acromegaly occurs when the pituitary gland produces too much growth hormone, usually in association with benign pituitary adenoma. The nail changes reported in patients with acromegaly are nonspecific. Absent lunulae, koilonychia, brittle nails, and macronychia have been described (20). Micronychia has been reported, but it is unclear whether it is true micronychia or simply the illusion of smaller nails due to growth and hypertrophy of soft tissue of the fingers.

In summary, an intact and functioning endocrine system plays a role in healthy nails. Hormone levels that are too high or too low are associated with a variety of nail pathologies. Although one should be cautious about diagnosing endocrinopathies from nonspecific nail changes, some nail signs can provide valuable clues to aid the work up of internal hormonal aberration.

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