Onycholysis due to Nail Hardener

HOWARD J. DONSKY, M.D., F.R.C.P.(C), Toronto

For generations the human nail has been a source of pride for women, profit for cosmeticians and consternation to dermatologists. In recent years, however, doctors have become more familiar with this minute portion of the anatomy, and now nails often act as a signpost to guide us in our search for systemic diseases and harmful contactants. Onycholysis is one of these signposts.

A new nail-hardening agent, “Strong and Long”, was placed on the market in 1965 by Helena Rubinstein, Inc. March 1st reported a patient with nail disturbances due to this product. This report describes a similar case.

A 32-year-old housewife presented on June 15, 1966, with distal nail separation and increased subungual keratinization of all her fingernails except the left index and right middle fingers. She stated that she began using the nail hardener in December 1965, and continued its use until May 1966, when she noted separation of the distal aspect of her left ring fingernail. The other fingernails developed similar changes within a few weeks. The patient was otherwise in good health and had no history of previous allergies. She wore protective gloves when her hands were in detergents.

The initial diagnosis was chemically induced traumatic onycholysis due to nail hardener. Potassium hydroxide examination of nail plate and subungual keratin was negative; culture of the subungual keratin grew a fungus, Candida albicans. Patch tests were done with nail hardener, nail polish, 5% formalin and a tape control. The only reaction was a positive test (erythematous pruritic papules) to the nail hardener.

The patient was treated by a nightly application of a topical steroid, 0.025% fluocinolone acetonide cream (Synalar*), occluded by a covering of Blenderm tape. She was instructed to avoid contact with detergents, nail polish and nail hardeners. The nails were normal three months after the beginning of treatment.

Comments

Onycholysis is a loosening of the nail plate beginning at the distal or free edge. Usually this separation is incomplete. Secondary yeast and/or bacterial infection in the space beneath the nail plate is common.

Causative factors of this condition include: (1) congenital or developmental anomalies; (2) trauma—(a) physical, e.g. fur “flushers” or (b) chemical, e.g. strong alkaline soaps and detergents, nail polish removers, varnishes and undercoating materials; (3) eczematous dermatitis—especially when the fingertips are involved; (4) psoriasis—the most common cause, usually produces a yellow margin between the pink normal nail and the white separated area; (5) lichen planus; (6) fungous infections of the nail by Trichophyton rubrum or T. mentagrophytes; (7) syphilis; (8) anemia; (9) vascular disorders with impaired peripheral circulation, e.g. Raynaud’s disease; (10) hyperthyroidism and hypothyroidism; (11) marked hyperhidrosis; (12) drugs, e.g. photo-onycholysis due to demethylchlortetacycline (Declomycin); (13) idiopathic—unexplained.

As the number of recognized causative factors in this process increase, fewer cases will be placed in the idiopathic category. This report adds one more agent to the list of chemically traumatic causes of onycholysis.

Communication with the manufacturers revealed that this nail hardener consists of a 7% aqueous alcoholic solution of an organic chemical not previously used in cosmetics. The chemical formulation is a “trade secret”, since there is a patent pending. They did state, however, that the nail hardener modifies the surface of the nail by reacting with the free amino groups of the keratin of the nail. A polymerization of the active chemical then occurs, producing a film that is practically insoluble in water and organic solvents.

Keratin is a scleroprotein which differs from collagen and elastin by the nature and abundance of the side chains joining the principal chains of amino acids. These side chains may be disulfides, acid-base or hydrogenated. Keratin itself still remains somewhat of a biochemical enigma in that any process that will break it down to its individual chemical groupings will alter the keratin structure. There is no specific histochemical test for keratin, although indirect tests such as the Millon reagent and the xanthoproteic test which demonstrate tyrosine have been used. Keratin is insoluble in dilute alkalies, in water, and in organic solvents, but on acid hydrolysis it yields the amino acids histidine, lysine and arginine in a 1:5:15 molecular ratio. There are two fundamental types of keratin, “soft” and “hard”. Soft keratin is found in the...
epidermis, the internal root sheath of hair follicles and the medulla of hair. Hard keratin is found in nails, the cortex and the cuticle of hair. Tono fibrils are the precursor of both types of keratin. The keratin layer differs from the pre-keratin layers in all sites by the increased concentration of cystine found in keratin. Hard keratin (nails) differs chemically from soft keratin by having a higher ratio of disulfide bonds between the amino acid chains. This greater concentration of disulfide bonds gives hard keratin its characteristic firmness and relative paucity of desquamation.

The nail-hardening chemical reorganizes the keratin amino acids and their various linkages. This usually hardens the keratin further, but, as was apparently the case in our patient, it may occasionally disrupt the keratin, resulting in separation of the nail from its bed.

Cosmetics manufacturers seem to have a problem protecting secret chemical formulae while patents are pending. However, one fails to understand why products cannot be adequately labelled with at least the listing of ingredients by the time they are at the marketing stage. In this way people with known sensitivities could avoid unnecessary reactions.

**SUMMARY**

A case of chemically traumatic onycholysis due to a nail hardening agent is reported. The patient used the nail hardener for six months before noting any nail changes. The diagnosis was confirmed by a positive patch test. Treatment consisted of a topical steroid with occlusion nightly. Her nails were normal three months after the beginning of treatment.

I wish to thank Dr. E. M. Loney, Scarborough, Ontario, who referred this patient for consultation.

**REFERENCE**


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**THE CANADIAN JOURNAL OF SURGERY**

The April 1967 issue of The Canadian Journal of Surgery contains the following articles: history of Canadian surgery, original articles, case reports, experimental surgery and surgical technique.

**History of Canadian Surgery:** As I Remember Him: William Edward Gallie, Surgeon, Seeker, Teacher, Friend—R. I. Harris.


**Surgical Technique:** The Arteriovenous Bypass in Chronic Hemodialysis—B. J. M. Innes and W. L. Ogilvy. Successful Use of the Miller-Abbott Tube—M. Deitel.