

Frequency and Main Sites of Allergic Contact Dermatitis Caused by Nail Varnish

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Background: Liquid nail varnish has been used since 1919, and allergic contact dermatitis (ACD) has been recognized for at least 80 years, but it is difficult for nonspecialists to identify this condition.

Objectives: (1) To verify the frequency of ACD from nail varnish in patients with a presumptive diagnosis of contact dermatitis seen at an outpatient clinic, (2) to characterize the groups studied according to site of skin disorder, and (3) to determine the main sensitizer related to varnish.

Methods: Patients with a final diagnosis of ACD caused by nail varnish were assessed by means of retrospective analysis of medical charts and protocols used in the clinic from January 1996 to December 2006. Patch tests with the Brazilian standard series and a complementary series were applied to all patients.

Results: Diagnosis of ACD from nail varnish was made in 8% of cases (157 of 1,971). The most affected sites were the face and neck; however, involvement of some uncommon areas, such as periungual and perianal regions, was also observed.

Conclusions: ACD from nail polishes is a common event and recognition of the condition must be improved. Toluenesulfonamide formaldehyde resin (TSFR) was the most common allergen in the group studied.

NAIL VARNISH is a cosmetic product that has been used in several parts of the world for over 80 years to embellish nails or make them stronger.

In ancient times, powders, adhesives, gels, or pastes were applied on the nail plate, with poor cosmetic effects. In 1919, the first liquid nail polish was launched; the ingredients included collodion mixed with ether and ethanol. The polishes were initially transparent but, 10 years later, gained colors with the addition of pigments. The composition was slowly altered as the chemical and cosmetic industries developed. In 1939, toluenesulfonamide formaldehyde resin (TSFR), a new synthetic resin, was added, which changed the varnish industry by making polishes more brilliant, adherent, and water resistant.

Dermatitis from nail polish has been known since 1925; only in 1941, however, Palmer suggested a synthetic resin as the principal allergen. TSFR was described as the main allergen when Simon studied 13 patients with allergic contact dermatitis (ACD) from nail lacquer in 1943.¹⁻³ Other agents (such as solvents, plasticizers, pigments, and

film-forming components) have seldom been reported as causative agents of contact dermatitis.⁴

The distribution of clinical lesions hinders recognition of the condition, resulting in high morbidity among patients.

Objectives

The objectives of this study were (1) to verify the frequency of ACD from nail varnish in patients with a presumptive diagnosis of ACD seen at an outpatient clinic, (2) to characterize the groups studied according to the site of the skin disorder, and (3) to identify the main sensitizing allergen in nail varnishes.

Patients and Methods

From January 1996 to December 2006, a total of 1,971 patch tests were performed on patients with a presumptive diagnosis of ACD at the Allergy Service–Dermatology Clinic at the Santa Casa de São Paulo Hospital. Those with a final diagnosis of ACD from nail varnish were selected. Through a retrospective analysis of protocols and the medical charts of patients, data were collected on sex, skin color, occupation, duration of skin condition, site of lesion, and patch-test result.

The patch tests were performed with the Brazilian standard series (GBEDC/96), manufactured by FDA–

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Allergenic (Rio de Janeiro, Brazil), and the complementary battery known as the cosmetic series, manufactured by the same company (Table 1 and Table 2). In some cases, the varnish used by patients was applied as a patch test. The same methods were used to apply and read the tests with nail polishes in 49 patients.

The agents were applied on each patient's back in Finn Chambers (Epitest Ltd Oy, Tuusula, Finland). Readings were carried out 48 hours and 96 hours later in accordance with International Contact Dermatitis Research Group criteria established in 1988. Patients were followed up for 6 months after patch testing, to establish the relevance of the patch-test response and the dermatitis presented. The data were entered into an *Excel* (Microsoft Corporation, Redmond, WA) worksheet; they were then quantified, and a descriptive analysis of the cases was prepared.

Results

Among the 1,971 patients studied, 157 (8%) had a positive epicutaneous test reaction to at least one nail varnish component; all (100%) of these patients were female. Fifty-two percent (82 of 157) of the patients were white, 25% (39 of 157) were black, and 23% (36 of 157) were of mixed race. Age ranged from 12 to 76 years (mean age, 31.6 years).

As to the duration of the skin condition, 18 patients (11.5%) had acute disease (lasting less than 3 months), and 139 patients (88.5%) presented with a chronic disorder (lasting more than 3 months).

Fourteen patients (9%) worked in beauty parlors; in all of these patients, the disease was related to their

Table 2. Cosmetic Series

Sorbic acid	Chlorhexidine
Amerchol L 101	Imidazolidinylurea
Butyl hydroxytoluene	Toluenesulfonamide formaldehyde resin
Bronopol	Triethanolamine
Chloracetamide	Ammonium thioglycolate

occupation. The remaining 143 (91%) women had different occupations that were not related to their clinical picture.

The face was the most affected site in 135 of 157 cases (86%). The condition was distributed as follows: periorbital region in 96 of 135 cases (71% of facial lesions), followed by the region around the lips in 40 of 135 cases (30%); mentum in 31 of 135 cases (23%); frontal and auricular regions, each in 25 of 135 cases (19%); nasolabial sulcus in 22 of 135 cases (16%); zygomatic region in 17 of 135 cases (13%); maxillary region in 13 of 135 cases (10%); nasal region in 12 of 135 cases (9%); labial region in 10 of 135 cases (7%); and temporal region in 6 of 135 cases (4%). In some patients, more than one region was affected.

Among the 157 patients with ACD from nail varnish, the second most involved site was the neck (86 cases [55%]); this was followed by the trunk and abdomen in 45 patients (29%), among whom 17 individuals (11%) had involvement of the sternal region. Other areas affected were upper limbs in 31 cases (20%), periungual region of the fingernails in 33 patients (21%), palms in 19 (12%), lower limbs in 10 (6%), periungual region of the toenails in 9 (6%), sole in 4 (3%), scalp in 3 (2%), and gluteal, perianal, and genital regions (2 patients [1%] each) (Table 3).

Of 157 patients assessed, 141 (90%) had positive patch-test results in the complementary series only for TSFR; 9 (6%) had positive results for formaldehyde and TSFR; and 1 patient (1%) had positive results for formaldehyde and the nail varnish. The remaining 6 patients (4%) had positive test reactions only to their nail varnish. All results were considered relevant.

Discussion

Nail varnishes are widely used by all socioeconomic groups throughout Brazil. There are several substances in their composition, including solvents (toluene, butyl acetate, amyl acetate, isopropyl alcohol, ethyl acetate, n-butyl alcohol), plasticizers (dibutyl phthalate, camphor), a film-forming agent (nitrocellulose), inorganic pigments (zinc

Table 1. Brazilian Standard Series

1. Anthraquinone	16. Mercapto mix
2. Balsam of Peru	17. Benzocaine
3. PPD mix	18. Quaternium-15
4. Hydroquinone	19. Quinoline mix
5. Potassium dichromate	20. Nitrofurazone
6. Propylene glycol	21. Parabens
7. p-tert-Butylphenol	22. Epoxy resin
8. Neomycin	23. Thimerosal
9. Irgasan	24. Turpentine
10. Kathon CG	25. Carba mix
11. Cobalt chloride	26. Promethazine
12. Lanolin	27. Nickel sulfate
13. Thiuram mix	28. Colophony
14. Ethylenediamine	29. p-Phenylenediamine
15. Fragrance mix	30. Formaldehyde

PPD = p-phenylenediamine.

Table 3. Body Regions Involved in Patients with Allergic Contact Dermatitis from Nail Varnish

<i>Involved Area</i>	<i>Number of Patients</i>	<i>%</i>
Face	135	35.0
Neck	86	22.0
Trunk and abdomen	45	12.0
Upper limbs	31	8.0
Periungual region of fingernails	33	9.0
Palms	19	4.5
Lower limbs	10	3.0
Periungual region of toenails	9	3.0
Soles	4	1.0
Scalp	3	1.0
Gluteal region	2	0.5
Perianal region	2	0.5
Genital region	2	0.5
Total	381*	100.0*

*Some patients had more than one region involved.

oxide, D & C violet 2, D & C yellow 8, titanium oxide, eosin), and substances to protect against ultraviolet rays (benzophenone-1 and benzophenone-3). A typical nail enamel formulation contains polymer film (nitrocellulose, 15%), polymer resins (TSFR, 7%), lipid plasticizers (7%), solvent mixture (70%), pigment mixture (0–1%) and other suspended agents (1%).¹

Nail lacquer is a known cause of ACD, and TSFR (used in 99% of polishes made in Europe) is considered the main allergen.¹ However, some other substances, such as formaldehyde and other resins, can cause this dermatitis.

In the population studied, 157 patients (8%) were diagnosed as having ACD from nail varnish. This figure was higher than that reported in the literature (ie, that 1 to 3% of the general population suffers from this skin condition).⁴ In Brazil, the use of nail varnish by the female population is very common. Sales of cosmetic products, including nail varnish, have increased in the past years. This suggests that more individuals are exposed, and their sensitization potential is greater.¹

The ACD from nail enamel was diagnosed in patients aged 12 to 76 years. The wide age range is evident as nail varnish is a very common substance in Brazil, and its weekly use leads to higher exposure to the allergen. Some patients have used lacquers from a young age, trying to imitate their mothers. In future studies, this may result in increasingly younger patients with positive and relevant test reactions to nail varnish allergens.

Patients were distributed by skin color as follows: 52% of patients were white, 25% were black, and 23% were of mixed race. The same proportion has been observed in the dermatology outpatient clinic for other conditions. Therefore, ACD from nail polish has no greater prevalence in regard to skin color.

Dermatitis caused by nail lacquer could also be considered an occupational disease.⁵ The results presented show that 14 patients (9%) worked in beauty parlors and that 5 patients were manicurists. The correlation between the dermatitis and professional activity was evident in these patients, and their condition could be deemed an occupational dermatosis. The initial sensitization may have been due to personal use of nail polish, but the occupation led to worsening and to the onset of lesions on the palms, which is a rare site for this sensitizing agent. Moreover, manicures usually clean objects dirty with varnish in their palms, which could lead to sensitization by the resin.

Some studies show that over 80% of ACD lesions caused by nail varnish appear on the neck and face, mainly in the periocular region.^{1,6,7} The distribution of lesions found in the patients studied corresponds to data reported in the literature,^{1,6} in which the face is the most affected site, particularly the periocular region. Eyelids, the lower half of the face, the neck, and the upper trunk are reported as chosen sites for ectopic dermatitis,^{6,8,9} in agreement with the results presented in this article.

There are descriptions of cases at any skin location including the nail plate and the periungual region.^{1,6} The present study found periungual involvement in the hands and feet in 42 cases (27%), demonstrating that these regions are often affected and should always be examined.

Other locations, such as the gluteal, perianal, and genital regions, are rarely involved,⁹ and there were few such cases (3%) in our study. The sites of contact dermatitis from nail varnish, especially uncommon sites, are related to the patient's habits. Another site described in the literature is the gingivae, where contact with nail polish leads to chronic gingivitis.⁹

The clinical aspect of the lesions varied from mild erythema with scaling to erythema and edema, particularly in the periocular region.

The present study showed TSFR as the main allergen in nail varnish contact dermatitis (95%), but reactions to formaldehyde were positive in 7% of cases, isolated or associated with positive test results for the resin. The real impact of this is not clear yet as patients with positive test reactions to formaldehyde usually have no adverse reactions to other products that contain the same agent. Similar observations have been made by other authors.¹⁰

Whenever possible, the products used by patients must be included in the patch tests because, although TSFR is the main allergen for this condition, it is not the only one present in nail enamels. In only six patients (4%) could the test with the product confirm the clinical suspicion of ACD. The allergen causing the dermatitis was not identified, but it was certainly a substance different from TSFR or formaldehyde.

Some industries make TSFR-free polishes—the so-called anti-allergic or hypoallergenic products. These contain other hardening resins, such as glycerophthalic polyester, 4-methylbenzene sulfonamide-epoxy, phthalic polyester, glyceryl tribenzoate, and nitrocellulose. Nevertheless, there are reports of ACD caused by some of these resins.^{7,11}

Nail varnish is a common cause of contact dermatitis, and it is a product widely used by different populations; hence, primary care physicians and dermatologists should be able to identify this clinical picture.

Conclusion

The data gathered in this study suggest that ACD from nail varnish is a common skin disease among female patients suspected of having ACD. Toluenesulfonamide formaldehyde resin was the main sensitizing allergen. The face and neck are the most affected regions, but dermatitis may occur at other sites. The study suggests that it is a common

condition, and further studies with larger population samples are required.

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