Journal of General - Procedural Dermatology & Venereology Indonesia

Volume 6
Issue 1 *(June 2022 Edition)*

Article 3

6-30-2022

Allergen profile of facial ACD to cosmetics among patients at Tertiary Referral Hospital in Yogyakarta

Alessandro Alfieri
Department of Dermatology and Venereology, Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada - Dr. Sardjito General Hospital, Yogyakarta, Indonesia

Niken Indrastuti
Department of Dermatology and Venereology, Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada - Dr. Sardjito General Hospital, Yogyakarta, Indonesia

Sri Awalia Febriana
Department of Dermatology and Venereology, Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada - Dr. Sardjito General Hospital, Yogyakarta, Indonesia

See next page for additional authors

Allergen profile of facial ACD to cosmetics among patients at Tertiary Referral Hospital in Yogyakarta

Authors

- Alessandro Alfieri
  Department of Dermatology and Venereology, Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada - Dr. Sardjito General Hospital, Yogyakarta, Indonesia
- Niken Indrastuti
  Department of Dermatology and Venereology, Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada - Dr. Sardjito General Hospital, Yogyakarta, Indonesia
- Sri Awalia Febriana
  Department of Dermatology and Venereology, Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada - Dr. Sardjito General Hospital, Yogyakarta, Indonesia
- Satiti Retno Pudjiati
  Department of Dermatology and Venereology, Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada - Dr. Sardjito General Hospital, Yogyakarta, Indonesia
- Fajar Waskito
  Department of Dermatology and Venereology, Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada - Dr. Sardjito General Hospital, Yogyakarta, Indonesia

Original Article

Allergen profile of facial ACD to cosmetics among patients at Tertiary Referral Hospital in Yogyakarta

Alessandro Alfieri, Niken Indrastuti, Sri Awalia Febriana, Satiti Retno Pudjiati, Fajar Waskito

Department of Dermatology and Venereology, Faculty of Medicine, Public Health, and Nursing
Universitas Gadjah Mada - Dr. Sardjito General Hospital, Yogyakarta, Indonesia

Email: andro.alfieri@gmail.com

Abstract

Background: Cosmetics are a part of life for most of the population and may cause allergic contact dermatitis (ACD), especially on the face, as the primary exposure of cosmetics is on the face area.
Methods: This research was conducted retrospectively using secondary data. The research subjects and demographic data were taken from the registered list of patients at Dermatology and Venereology Outpatient Clinic Dr. Sardjito General Hospital with a clinical picture of facial ACD due to cosmetics. Patch tests were carried out from January 2017 to December 2020.
Results: From three years period, 26 patients were diagnosed with suspected facial ACD due to cosmetics and underwent patch tests. Of the total 26 patients, 3 patients did not show any reaction to the patch test. On the 23 patients who had reactions on the patch test, there were 66 points on the skin that showed a reaction to allergens. Of the 66 points, 37 points gave a positive reaction picture, with the most common allergen causing the reaction being cobalt(II) chloride hexahydrate (n=4, 10.8%). Then, from 29 points that gave doubtful reactions, the allergen that caused the most reactions was potassium dichromate 0.5% (n=4, 13,8%).
Conclusion: The allergens that most often give a positive or doubtful reaction on the patch test of this study are metal compounds (cobalt and potassium dichromate). This study only looks at the patch test that gives a reaction without looking at the clinical relevance related to cosmetics use.

Keywords: *cosmetics, facial allergic contact dermatitis, patch test*

Background

Cosmetics are products that have become a part of life in the population. These products are commonly used by women, who use an average of 12 products per day that contain up to 168 different components. Meanwhile, men use an average of six products per day which contain approximately 85 kinds of components.[1] According to the National Agency of Drug and Food Control of Republic of Indonesia (BPOM) Number 19 on 2015 concerning cosmetic requirements, cosmetics are defined as ingredients or preparations intended for use on the outside of the human body (epidermis, hair, nails, lips, and external genital organs) or teeth and oral mucous membranes, especially for cleaning, deodorizing, changing appearance, and/or improving body odor or protecting or maintaining the body in good condition. The use of cosmetics can sometimes cause unwanted effects, one of which is the emergence of allergic contact dermatitis (ACD).[2]

The incidence of ACD varies widely depending on the region, frequency of use of cosmetics, the strength of allergens to cosmetic agents, and access to patch tests to confirm the diagnosis. The commonly affected population is women aged 20-55 years.[2,3] The face is the most exposed location to various cosmetics, making facial dermatitis the most frequent clinical presentation in ACD cases due to cosmetics. The distribution of dermatitis condition on the face can be in

several forms, such as lateral facial dermatitis, central facial dermatitis, and generalized facial dermatitis, with a unique cause. Lateral facial and/or neck dermatitis gives a rinse-off picture, commonly owing to shampoo or conditioner during rinsing. Central facial dermatitis can result from the use of ingredients within make-up, creams, topical medications, or moisturizers. In central facial dermatitis, the lateral part is commonly free of lesions because the patient applies the substance and material more to the central part of the face than the lateral. As for generalized facial dermatitis, airborne trigger contactants must be considered, or it can be caused by facial cleansers, foundations, moisturizers, or drugs that are applied simultaneously.[4]

This study aims to identify the allergens that cause facial ACD due to cosmetics among Dr. Sardjito General Hospital patients in the last four years. In that period, 26 patients were diagnosed with suspected facial ACD due to cosmetics and underwent patch tests. The results of this study are expected to assist clinicians in providing an allergen profile to assist in diagnosing and planning proper management of facial ACD cases due to cosmetics.

Methods

This research was conducted retrospectively using secondary data. The research subjects and demographic data were taken from the registered list of patients in Dermatology and Venereology Outpatient Clinic at Dr. Sardjito General Hospital, Yogyakarta, with a clinical picture of facial ACD due to cosmetics and patch tests were carried out in January 2017 - December 2020. The data of research subjects who underwent skin patch test and their reactivity to allergens were taken from the registry of the patch test.

The technical implementation of the patch test is carried out following the standard patch test procedure at the Dermatology and Venereology Outpatient Clinic, Dr. Sardjito General Hospital, Yogyakarta. The allergen is attached for 48 hours to the patient's back using a gamma chamber. Patch test readings were carried out at 48 hours (30 minutes after the allergen chamber was removed to minimize false-positive readings due to adhesive reactions), 72 hours, and 96 hours after the allergen was applied. Patch tests on subjects were performed using allergens from the European Standard Series and Cosmetic Series that were supplied by Chemotechniques Diagnostics® (Vellinge, Sweden) and by the laboratory of the Dermatology Department, Faculty of Medicine, Gadjah Mada University, Indonesia. In addition, the subjects were also tested with cosmetic ingredients that have been used previously, which may be the sources of allergens in facial ACD cases. Positive patch test results are indicated by erythema reactions, edema, vesicles, or bullae on the skin area in contact with the allergen according to the criteria from the International Contact Dermatitis Research Group (ICDRG).

Results

From January 2017 to December 2020, 26 patients, consisting of new and control cases, were diagnosed with suspected facial ACD due to cosmetic and underwent patch tests. There were 23 female patients and 3 male patients. Most patients were in the age group of 11 to 20 years old, with a mean age were 30 years old (Table 1

Table 1. Subject Characteristics

Demographic data	
Sex	
Male	3 (11.5%)
Female	23 (88.5%)
Age Group (years old)	
11 - 20	8 (30.8%)
21 - 30	7 (26.9%)
31 - 40	6 (23%)
41 - 50	2 (7.8%)
51 - 60	3 (11.5%)

All patients were subjected to a patch test and tested using allergens from the European Standard Series and the Cosmetic Series. Of the 26 patients who were subjected to a patch test,

three patients did not react to the contact allergens tested. From the 23 patients who had reactions on the patch test, 66 points on the skin showed a reaction to allergens. Of the 66 points, 37 points gave a positive reaction appearance, with the most common allergen causing the reaction being cobalt(II) chloride hexahydrate (n=4, 10.8%) (Figure 1). From 29 points that gave a doubtful reaction, the allergen that caused the most reactions was potassium dichromate 0.5% (n=4, 13.8%) (Figure 2).

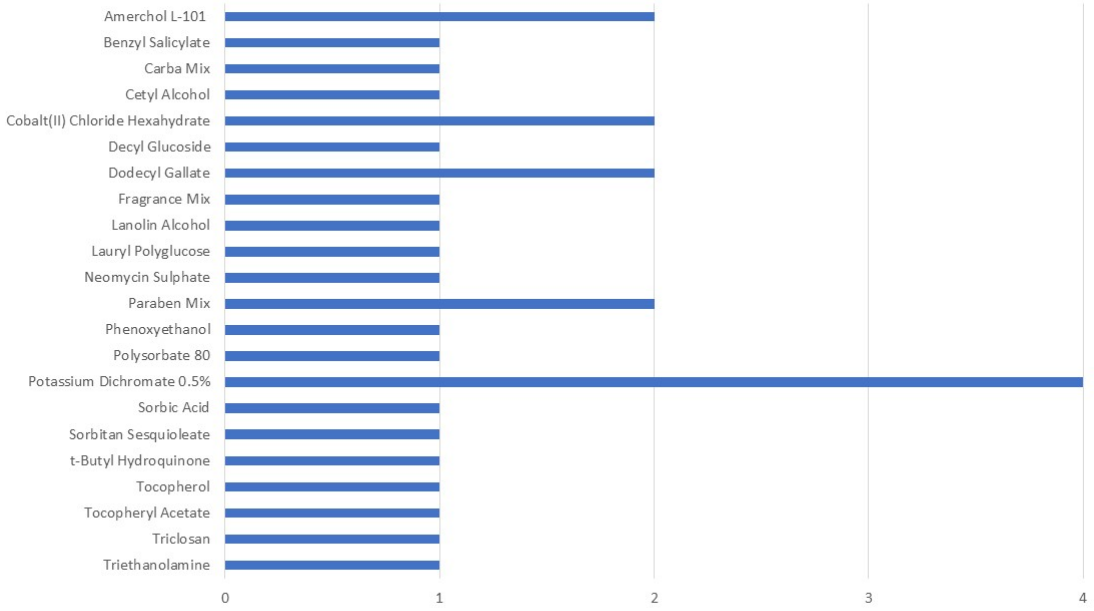

Figure 1. Types of Allergens that Produces Positive Reactions.

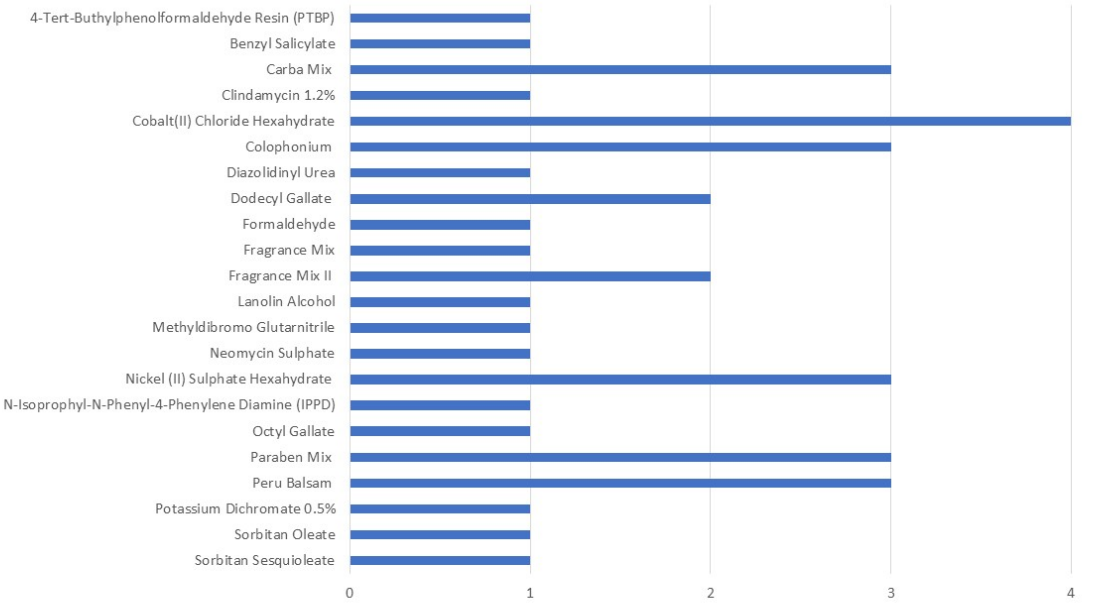

Figure 2. Types of Allergens that Produces Doubtful Reactions.

Discussion

ACD is a common condition occurred on the face. ACD due to cosmetic allergens is increasing in developing countries, such as India, due to increased use of cosmetics.[5] A study conducted in Bangkok showed an ACD prevalence of 51.3% in facial dermatitis.[6] ACD due to cosmetics appears on areas with direct or transferred product application. This transmission can occur through accidental contact with an object, such as a towel and telephone, or interpersonal contact.[2]

The diagnosis of ACD due to cosmetics is based on history, dermatology examination, and patch test. It is paramount to investigate the patient's products, whether at their home or outside. After being diagnosed, patients should understand that they are obliged to avoid contact with these allergens, and this condition can arise when new exposures are present.[1-3] Patch testing is the gold standard for investigating patients suspected of having ACD due to cosmetics.[7] Patch testing with the cosmetic series, in addition to the standard series, can increase the capability to detect relevant allergens in patients.[8] Patch tests in ACD cases due to cosmetics must also use allergens in the form of cosmetic products that patients use on a daily basis.[9] More than 90% of the subjects included in this study were women. ACD due to cosmetics is more common in women than in men because women are more concerned about esthetic than men. Women have also proven to be using more cosmetics and more frequently.[8]

In this study, the allergen that gave the most positive reactions was cobalt(II) chloride hexahydrate (n=4, 10.8%). Cobalt is a heavy metal that has side effects on human health.[10] Several studies have shown the presence of concentrations of cobalt in cosmetics, such as henna dye,[11] foundation cream,[12] skin whitening cream,[11] and eyeliner.[13] This shows that many cosmetic ingredients contain cobalt, and we can suspect the presence of cobalt in the cosmetics used by the subjects in this study. It was also reported that high concentrations of cobalt in a cosmetic ingredient would increase the occurrence of ACD in patients.[14]

In this study, it was also found that potassium dichromate was the most common allergen which gave doubtful results (n=4, 13.8%). Potassium dichromate or chromium is widely used in daily or industrial activities, usually found in bleach, detergents, cement, implants, prostheses, cell phones, make-up, or cosmetics.[15] In Europe itself, chromium use has been banned since 1976, but the use of metal in tiny amounts is still allowed. However, some studies still find chromium content in cosmetics. Studies conducted by Kang, et al[11] and Hwang, et al[16] found chromium content in the tested cosmetic ingredients. Then it can be concluded that despite the presence of chromium in cosmetics, this does not present a significant risk of carcinogenic effects of chromium, but this could potentially contribute to ACD.[15]

From the results of this study, we can also see that paraben mix is one of the allergens that often reacts to patch tests, with both positive and doubtful results. Paraben mix is a preservative or preservative used in soap, shampoo, or face cream.[17] Paraben mix is a mixture of five paraben esters, namely methylparaben, ethylparaben, propylparaben, butylparaben and benziylparaben with each concentration of 3%.[18] The safety of using parabens has remained a challenge for 20 years because of their sensitivity and weak estrogenic activity, which may contribute to breast cancer and male infertility.[19] Although no further studies have been able to demonstrate this hypothesis, the cosmetic industry has started to market "paraben-free" products and replace them with other ingredients.[18] According to European studies, parabens are present in 99% of leave-on products (products intended for prolonged contact with skin, hair, or mucous membranes) and in 77% of rinse-off products (products intended to be removed after application to skin, hair or mucous membranes).[20] The frequency of sensitization of this paraben, according to studies conducted in North America, is in the range of 0.6% to 2.3%.[18] In the use of cosmetics containing parabens, it is often found in ACD that occurs on the eyelids because it is often found in eyeliner, eye shadow, mascaras, and concealer.[21]

Regarding regulatory aspects, parabens have been allowed in cosmetics at concentrations of 0.4% for single parabens and 0.8% for mixed parabens since 2000 in Europe. Then, the European Commission banned the use of isopropylparaben, isobutylparaben, phenylparaben, benzylparaben, and pentylparaben in 2014 and limited the number of concentrations of propylparaben and butylparaben in products to 0.19% in 2015.[19] Whereas in Indonesia itself, according to the National Agency of Drug and Food Control of Republic of Indonesia Number 23 of 2019 concerning Technical Requirements for Cosmetics, imported cosmetics may still contain ingredients in the form of isopropylparaben, isobutylparaben, and/or

benzylparaben, but they must be stated in the packaging. The permissible levels for butylparaben, propylparaben, isopropylparaben, isobutylparaben, and benzyl paraben are of 0.14% in a single ester or mixture or 0.8% when mixed with methylparaben or ethylparaben, provided that the five esters above the concentration do not exceed 0.14%. As for methylparaben and ethylparaben, the maximum content is 0.4% for single esters or 0.8% for mixed esters.

The importance and relevance of doubtful reaction results are still debatable. However, Carlson, et al,[22] said that a doubtful reaction is considered to have the same relevance as allergens that have a positive reaction. In a review by Veverka and Davis,[23] it was also recommended that in a clinical context, doubtful reactions should be viewed and monitored as allergic reactions when the results are relevant to the location and time of occurrence of ACD in patients. With these considerations, this study also discusses the interpretation of the patch test with doubtful results.

Conclusion

In this study, women had the largest population in cases of ACD due to cosmetics on the face, with the most extensive age range between 11 to 20 years. The allergen that has the most positive reaction is cobalt. Whereas in doubtful reactions, potassium dichromate has the highest frequency. The limitation of this study is mere observance of the patch tests with reactions without considering the clinical relevance related to cosmetics ingredients. We suggest further research to determine the relevance between the cosmetics products and the result of the patch tests; and establish a relationship between the ACD locations with certain cosmetics ingredients or allergens.

Author Contributions

All authors act as the guarantor of the manuscript. AA is the main investigator and data collector of this study. AA, FW, NI, SAF, and SRP participated in the conception, data interpretation, and writing of the study. AA and FW participated in data analysis of the study.

Conflict of Interests

The authors have declared that no conflict of interests for this study.

References

1. Alani JI, Davis MD, Yiannias JA. Allergy to cosmetics: A literature review. Dermatitis. 2013;24(6):283-90. Doi: 10.1097/DER.0b013e3182a5d8bc.
2. Park ME, Zippin JH. Allergic contact dermatitis to cosmetics. Dermatol Clin. 2014;32:1-11.
3. Biebl KA, Warshaw EM. Allergic contact dermatitis to cosmetics. Dermatol Clin. 2006;24:215-32.
4. Zirwas MJ. Contact dermatitis to cosmetics. Clin Rev Allergy Immunol. 2019;56(1):119-28. Doi: 10.1007/s12016-018-8717-9.
5. Kumar P, Paulose R. Patch testing in suspected allergic contact dermatitis to cosmetics. Dermatol Res Pract. 2014;2014:695387. Doi: 10.1155/2014/695387. Epub 2014 Sep 9.
6. Puangpet P, Kannawat N, Tresukosol P, et al. Cosmetic allergic contact dermatitis in facial dermatitis patients at the Institute of Dermatology, Thailand. Thai J Dermatol. 2011;27:236–46.
7. Hamilton T, De Gannes GC. Allergic contact dermatitis to preservatives and fragrances in cosmetics. Skin Ther Lett. 2011;16:1-4.
8. Mehta SS, Reddy BS. Cosmetic dermatitis – current perspectives. Int J Dermatol. 2003;42(7):533-42. Doi: 10.1046/j.1365-4362.2003.01786.x.
9. Kasemsarn P, Iamphonrat T, Boonchai W. Risk factors and common contact allergens in facial allergic contact dermatitis patients. Int J Dermatol. 2016;55(4):417-24. Doi: 10.1111/ijd.12880. Epub 2015 Sep 4.
10. Barghasha SS, Ahmed HAM, Al-Otaiqe R, Alkhail BA. Detection of heavy metals in cosmetic creams and antiperspirants marketed in Saudi Arabia, World J Pharm Med Res. 2017;30–9.
11. Kang EK, Lee S, Park JH, Joo KM, Jeong HJ, Chang IS. Determination of hexavalent chromium in cosmetic products by ion chromatography and postcolumn derivatization. Contact Dermatitis 2006;54: 244–8.
12. Ullah H, Noreen S, Fozia, et al. Comparative study of heavy metals content in cosmetic products of different countries marketed in Khyber Pakhtunkhwa, Pakistan. Arabian Journal of Chemistry. 2017; 10-8.
13. Iwegbue CMA, Bassey FI, Obi G, Tesi GO, Martincigh BS. Concentrations and exposure risks of some metals in facial cosmetics in Nigeria. Toxicol Rep. 2016;3:464-72.

Published 2016 Apr 23. Doi:10.1016/j.toxrep.2016.04.004
14. Uter W, Aberer W, Armario-Hita JC, et al. Current patch test results with the European baseline series and extensions to it from the 'European Surveillance System on Contact Allergy' network, 2007-2008. Contact Dermatitis. 2012;67(1):9-19. Doi:10.1111/j.1600-0536.2012.02070.x
15. Bregnbak D, Johansen JD, Jellesen MS, Zachariae C, Menné T, Thyssen JP. Chromium allergy and dermatitis: Prevalence and main findings. Contact Dermatitis. 2015;73(5):261-80. Doi: 10.1111/cod.12436. Epub 2015 Jun 24.
16. Hwang M, Yoon EK, Kim JY, et al. Safety assessment of chromium by exposure from cosmetic products. Arch Pharm Res. 2009; 32: 235–41.
17. Garg T, Agarwal S, Chander R, Singh A, Yadav P. Patch testing in patients with suspected cosmetic dermatitis: A retrospective study. J Cosmet Dermatol. 2018;17(1):95-100. Doi: 10.1111/jocd.12359. Epub 2017 Jun 1.
18. Fransway AF, Fransway PJ, Belsito DV, et al. Parabens. Dermatitis. 2019; 30: 3-31.
19. Sasseville D, Alfalah M, Lacroix JP. "Parabenoia" debunked, or "Who's afraid of parabens?". Dermatitis. 2015;26(6):254-9. Doi: 10.1097/DER.0000000000000147.
20. Orton DI, Wilkinson JD. Cosmetic allergy, incidence, diagnosis, and management. Am J Clin Dermatol. 2004; 5: 327-37.
21. Scheman A, Jacob S, Katta R, et al. Part 2 of a 4 part series. Hair cosmetics: Trends and alternatives. Data from the American Contact Alternative Group. J Clin Aesthet Dermatol. 2011; 4: 42-6.
22. Carlson S, Gipson K, Nedorost S. Relevance of doubtful ("equivocal") late patch-test readings. Dermatitis. 2010;21(2):102-8.
23. Veverka KK, Davis MDP. Dubiously doubtful: An exploration of the literature concerning doubtful, macular erythema, "?+," and "+/-" Patch test reactions. Dermatitis. 2020;31(1):36-41. Doi: 10.1097/DER.0000000000000533.