

ALLERGEN IDENTIFICATION IN COSMETIC FACIAL ALLERGIC CONTACT DERMATITIS

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ABSTRACT

Allergic contact dermatitis is an acquired sensitivity to various substances that produce inflammatory reactions in those, and only those, who have been previously sensitized to the allergen. Cosmetics are one of the most frequent causes and face is frequently effected site. Avoidance of causative agents is the key in the treatment and identifying them is challenging. So this hospital based cross sectional descriptive study aimed to identify specific allergens causing cosmetic facial allergic contact dermatitis patients in Department of Dermatology, Yangon General Hospital by using patch testing and to identify the most common allergen causing cosmetic facial allergic contact dermatitis. A study population of 32 patients with cosmetic facial allergic contact dermatitis were included in the study. Patch testing was done by using IQ Ultimate chambers (Inert and Quadrate Chambers) and selected Haptens (Chemotechnique Diagnostics, Sweden) and patients' own products when provided by the patient. It was found that female outnumbered male in cosmetic facial allergic contact dermatitis and wanted to know about the possible allergens. Hair dye allergen (p-phenylenediamine, PPD), metal allergens (nickel II sulphate hexahydrate and cobalt II chloride hexahydrate) and fragrance allergens (fragrance mix I, fragrance mix II and balsam of Peru) were found to be the most common positive patch test in this

study. Patch testing is still not widely used as a diagnostic investigation in our country. In a developing country like Myanmar, with the increasing use of internet and social media, marketing and advertising became easier and the use of cosmetic and personal care products has been increasing in general population. As a result the risk of sensitization to various cosmetic allergens and allergic contact dermatitis (ACD) is increased proportionately. Since avoidance of causative allergens is the mainstay of management in ACD, identifying the possible allergen by patch testing is gold standard. It is important to label and put warning for the most common hair dye allergens in local languages so that the public have awareness.

Keywords: Allergic Contact Dermatitis, Patch Test, Common allergens

INTRODUCTION

Allergic contact dermatitis (ACD) is an acquired sensitivity to various substances that produce inflammatory reactions in those, and only those, who have been previously sensitized to the allergen (1). ACD can affect individuals during throughout of life, individuals of all races and both sexes. ACD is one among the most frequently encountered diagnosis in dermatology practice (2).

The diagnosis of allergic contact dermatitis is made by patch testing. It is the gold standard for diagnosing a delayed type hypersensitivity (type IV) and may be very useful in identifying the offending

cosmetic allergen, leading to proper and effective management of the patient (3). In patch testing, patients who are suspected of contact dermatitis are re-exposed to the culprit allergens under controlled conditions to reproduce a mini-eczematous reaction for verifying the diagnosis (4).

Although the prevalence of cosmetic allergy is found to be less than 1% in various studies, it is most likely an inaccurate number due to the tendency of patients not to go seeking medical attention and discontinue use of the product on their own. The analyzed data of 10,061 patients patch tested by North American Contact Dermatitis Group (NACDG) between 2001 and 2004 found that (23.8%) of female patients and (17.8%) of male patients had at least one allergic patch test reaction associated with a cosmetic source (5).

In a study in China, facial ACD was common among patients patch tested and had a better prognosis than other eczema. It was reported that clearance rate of facial ACD was higher (55.4%) than that of other ACD (23.1%). But the relapse rate was also high (42%). Patients with suspected facial ACD should be tested early since the clearance rate was significantly lower (40.9%) in patients with disease duration over 3 months before testing (6).

The numbers of clinically diagnosed allergic contact dermatitis patients in Department of Dermatology, Yangon General Hospital were reported to be (0.7%), (0.9%) and (1.2%) in 2012, 2013 and 2014 respectively among the total patients. But identification of causative allergen was not done.

In a Myanmar study, face is the most common site of involvement among ACD patients. The most common allergen substance is personal care products which represent (40%) of total causative substances and the top five causative substances are hair dyes (20.59%), makeup and snow (20.59%), shampoos (11.76%), perfumes (11.76%) and lip stick (8.82%) (7). However, the identification of causative allergens was done by history taking alone in this study and patch testing was not done.

It is utmost important to identify the specific allergens. This study would provide the allergen identification in cosmetic facial ACD patients, so that they can avoid further exposure to it.

MATERIALS AND METHODS

All patients presenting with cosmetic facial allergic contact dermatitis attending the Department of Dermatology, Yangon General Hospital during January 2016 to December 2016 are included in the study. Patients with other types of face dermatitis (e.g. seborrhoeic dermatitis, acne, and rosacea). Patients on oral steroids (≥ 15 mg prednisolone daily) or other immunosuppressive agents within one month prior to the testing are excluded.

Patch test-Patch testing was done by using IQ Ultimate chambers (Inert and Quadrate Chambers) and selected Haptens (Chemotechnique Diagnostics, Sweden). Hapten used are Fragrance mix I, Fragrance mix II, Formaldehyde, Clophonium, Gallate Mix, Balsam of Peru, Thimerosal, Nikle (II) Sulphate Hexahydrate, Cobalt (II) Chloride Hexahydrate, Potassium dichromate, p-Phenylenediamine (PPD)

Patients who were clinically diagnosed by history taking and physical examination were asked for voluntary consent to perform the patch test after giving information about patch testing. Allergens and patient own products were applied on upper back skin using IQ Ultimate chamber patches and fixed with a tape for 2 days (48hours). When the patients' own products were **leave-on** substances such as sun screen, make up and snow, powders, lotions and lip stick, they were patch tested "as-is". When the patients' own products were **rinse-off** substances such as shampoo, hair dyes, shaving cream/soap and toothpaste, they were diluted in water to achieve correct concentration. First reading was conducted Day-2. Second reading was taken again 48 hours later on Day-4.

The patch test reactions are read according to recommendation of the International Contact Dermatitis Research Group (ICDRG). If the patch test result was positive, it was classified according to ICDRG.

RESULTS

There are 621 of patients with ACD, among them the proportion of patients with cosmetic facial ACD was 79 (12.72 %). Among these patients 32 patients met inclusion criteria and gave consent to perform patch tests.

In 32 patients with cosmetic facial ACD, it was found that 27 patients (84%) were female and five patients (16%) were males.

The most frequent age groups were 20-39 years and 40-59 years (11 patients in each group, 34.38%) followed by age group \geq 60 year (seven patients, 21.87 %) and age group $<$ 20 years (three patients, 9.37%).

Mean age was 41.6 years, oldest age was 70 years old and youngest age was 18 years old.

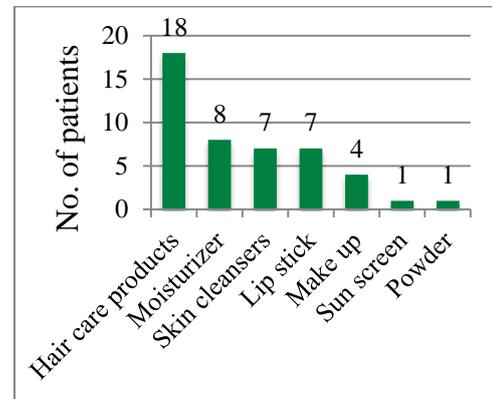


Fig.1. Distribution of contact substances in cosmetic facial ACD (One patient may use more than one contact substances)

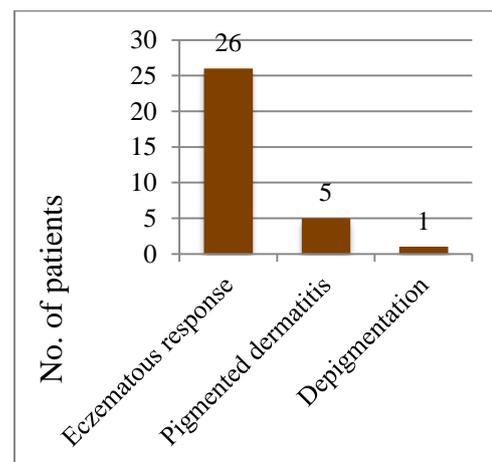


Fig. 2. Distribution of clinical patterns among cosmetic facial ACD patients

The most common site of involvement was forehead (14 patients, 43.8%), followed by perioral/chin, ears, neck (seven patients in each site, 21.9%), whole face (six patients, 18.8%), malar (four patients, 12.5%) and periorbital (one patient, 3.1%). More than one site may be involved on one patient. Other sites include scalp and hands.

Among patch test positive results from both allergens and patient own products, most patients were strong positive reaction with their patch test allergens (46.9%), followed by weak reaction (28.1%), doubtful reaction (15.6%), extreme positive reaction (4.7%) and IR irritant reaction (4.7%).



Fig. 3. Strong positive reaction to fragrance mix 1 and balsam of Peru, and extreme positive reaction to PPD

Among 22 patients with positive patch test, 1 patient showed five positive responses, four patients showed four positive responses, four patients showed three positive responses, five patients showed two responses and eight patient showed single positive response.

Total 33 own products were patch tested in 16 patients. Among these 33 products, 11 were hair coloring products, nine were lipsticks, five were moisturizers, four were cleansers, two were shampoo and one each of make-up and permanent hair curlers. After performing patch test, only 14 positive reactions to patients' own products were noted. Hair dye products caused the majority of positive patch test reactions (8/14) followed by lipsticks (4/14) and moisturizer and shampoo showed one positive reaction each.

Out of 32 patients with cosmetic facial ACD, p-Phenylenediamine (PPD) was the most reported positive test allergen (11 patients) followed by Nikle (II) Sulphate Hexahydrate (six patients), Cobalt (II)

Table 1. Distribution of allergens and positive patch test results (n=32)

Allergens	Total	
	No.	%
Fragrance mix I	4	12.5
Fragrance mix II	1	3.13
Formaldehyde	3	9.38
Clophonium	0	0
Gellate Mix	1	3.13
Balsan of Peru	2	6.25
Thimerosal	2	6.25
Nikle(II)Sulphate	6	18.75
Cobalt(II)Chloride	4	12.5
Potassium dichromate	3	9.38
p-Phenylenediamine	11	34.38

Chloride Hexahydrate (four patients), p-Fragrance mix I (four patients), Potassium dichromate (three patients), Formaldehyde (three patients), Balsan of Peru (two patients), Thimerosal (two patients), Fragrance mix II (one patients), Gellate Mix (one patients), and no positive allergen for clophonium.

DISCUSSION

Among 32 patients, 22 patients (68.8%) were patch test positive with one or more positive reactions to the allergens. In a study in Thailand, 81.6% showed at least one positive reaction to a commercial allergen in facial ACD (8). In Turkey, it was reported that 41.8% of patients with facial ACD had positive patch test reaction (9). The incidence and prevalence of allergic reactions varies from country to country and from region to region,

according to the degree of exposure. The prevalence of sensitivity to an individual substance will depend on many variables, including the selection of individuals to be tested, exposure levels, fashion, environment, introduction of new materials and loss of other, maximum permitted concentrations and usage (10).

The incidence of positive reaction to PPD was high in our study (37.5%) which is quite similar to a study by Thurein-tun (2016) in which frequency of positive to PPD was 43.9%(11). PPD is the main component of permanent hair dye. The result is not surprising since changing hair color had become a trend in younger people and also having black natural hair color in older people, with greying they tend to dye hair in darker shade.

In this study, nickel II sulphate hexahydrate was the second most common patch test positive allergen (18.75%). Nickel could be present as a contaminant in cosmetics, metal brushes used to apply makeup and few eye cosmetics. The third commonest positive allergen was Cobalt II chloride hexahydrate (15.63%). Cobalt chloride is usually present with nickel and is found in soaps, cosmetics pigments and hair dye. Metals were found to be the most common cause of ACD in a study in Thailand (8), however not all the patch test positive allergens are not responsible for the cause of the ACD.

Fragrance allergens (Fragrance mix I, fragrance mix II and balsam of Peru) were also common with total of 21.8%. Fragrances are one of the most common and important allergens in cosmetics ACD in various study (12 and 13). Individual differences between countries and hospitals may be due to several factors such as cultures, preferences and laws and

also selection of patients and usage of allergens. The limitations in this study were small sample size and testing with only a number of selected allergens.

Concerning sex, female outnumbered males with 27 (84%) and male with five (16%) in this study, and female and male ratio was 5.4:1. Female were more prone to ACD due to cosmetic use and tended to seek for medical attention than male and their wish to know about the possible allergens.

In interest to clinical patterns in this study, eczematous response (81.2%) was the most common clinical pattern and it was followed by pigmented dermatitis (15.6%) and depigmentation (3.1%). In studies from Myanmar, it was found that eczematous response (71.1%) was the most common clinical pattern (7 and 11).

Concerning the contact substances in the study population, hair care products were the most common contact substances including hair dyes and shampoo, followed by moisturizer, skin cleansers and lipstick, make up, sunscreen and powder. No one was reported for contact with eye cosmetics and perfumes/fragrances in this study. This may be due to the fact that hair dye reactions may be severe with scalp and facial oedema that hair dye was the most common source of sensitizer for facial cosmetic ACD in this study.

In this study forehead was the most common site (43.8%) followed by perioral/chin, ears and neck (21.9% in each site). Interestingly other sites which include scalp and hands were also common sites for cosmetic facial ACD (28.1%). It was due to extension of the

skin lesions onto scalp, forehead, neck and ears in patients with contact to hair dyes.

Sixteen patients provided 33 own products. Some patients were not willing to use the same product which cause contact dermatitis for patch test and some patient were not able to provide the suspected substances.

A total of 51 positive reactions to used allergens and patients' own products was observed (37 allergens and 14 own products). Among the results there were three extreme positive reaction and interestingly all the extreme reactions were due to hair dye and hair dye allergens (two PPD and one hair dye).

Among positive patch test results age group of 20-39 years was the most common age group with 25% of total patients followed by 40-59 years (21.9%). IT may be due to the younger age group tends to try newer products and is easily persuaded to do so by marketing and advertising. Similarly the age group of 20-35 years has a significant risk factor for facial ACD in a study in Thailand (8).

Concerning patients' own products, hair dye products caused the majority of positive patch test reactions (8/14) followed by lipsticks (4/14) and moisturizer and shampoo showed one positive reaction each. The result is quite similar to a study by Thurein-Tun, in which hair dye was the most common patients' own product patch test positive (11).

Multiple responses with tested allergens were found in 10 out of 22 patients with patch test positive results. Interestingly all the patients with positive reaction to nickel II sulphate, cobalt and fragrance mix I had multiple responses. There seem to be

allergy to metal is higher than expected in our country and source of sensitizations might include contact with cosmetics with impure ingredients since the regulations concerning cosmetics are not yet fully developed. Moreover although metal allergies were found in these patients those metals might not be the cause of ACD and the patient just had allergy to metals.

There were three patients with extreme positive reaction. One patient suffered extreme reaction on 48 hour reading presenting with itchiness, blistering and weeping on tested site which became worsen on 96 hour reading even after applying topical corticosteroid and antihistamines. The author gave necessary treatments for this patient until the symptoms subsided. Apart from that other patients only had local pruritus and inflammation on positive reaction sites in this study. After patch test results were confirmed, the information about avoiding the next time exposure to the resulted allergens was given so that recurrent attack of dermatitis could be avoided.

Since most of the cosmetics were used on face, and when patients suffered cosmetic allergy, face is the commonest site which causes a great deprivation of psycho-social status. Since avoidance of causative allergens is the mainstay of management in ACD, identifying the possible allergen by patch testing is gold standard.

Limitation- The limitations in this study were small sample size at a single medical center and testing with only a number of selected allergens.

It is necessary to perform patch testing with standard series, cosmetic series, and hair dressing series to confirm all of causative allergens. The author hopes that

this study will aid in the information about the patch test and will become a stepping stone for further studies concerning ACD.

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