

Allergic contact dermatitis from hair dye and development of lichen simplex chronicus

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Those who dye their hair frequently manifest allergic contact dermatitis (ACD) from *p*-phenylenediamine (PPD)-containing hair dye. PPD is known to be the most frequent sensitizer in hair dye, but there has been no documentation of this sensitizer having a role in chronic dermatologic conditions. Our department experienced a case of a 62-year-old woman with lichen simplex chronicus (LSC), who complained of aggravation after hair dyeing and made such an association. We conducted a prospective and retrospective study to further evaluate the clinical associations between the two. In our prospective study, patch testing was performed in selected patients who regularly carried out hair dyeing and also had clinical manifestations of LSC. Also a retrospective examination was conducted in cases where patch testing had been performed with PPD in the past for suspected ACD and further selected cases with concurrent LSC and/or other neurodermatitis. 11 and 14 patients in our prospective and retrospective study, respectively, presented with both LSC and positive findings to PPD. 5 (45.5%) and 4 (28.6%) patients in our prospective and retrospective study showed clinical relevance from clinical improvement after stopping use and rechallenge. We report several cases of patients diagnosed as having LSC and/or prurigo nodularis who showed clinical improvement after discontinuing the use of hair dye. The suggestion can therefore be made that hair dye could be a possible aetiological agent causing LSC in those using hair dyes.

Keywords: allergic contact dermatitis; hair dye; lichen simplex chronicus, PPD. © Blackwell Munksgaard, 2004.

Accepted for publication 12 December 2003

Lichen simplex chronicus (LSC) is essentially a disease of unknown aetiology caused by long-standing problems of pruritus, chronic rubbing and itching (1). Previous reports trying to unveil the probable causative factor for this chronic and sometimes debilitating problem have not achieved clear success, although some have proposed that, prior diseased state, infection or psychologic aetiology may have associations (2–4).

Allergic contact dermatitis (ACD) from hair dye is a worldwide problem of those who dye their hair. Among the many constituents in hair dye formulas, *p*-phenylenediamine (PPD) is known to be the most frequent contact sensitizer (5). In the acute stages, mild symptoms such as burning and itching up to severe cases of intense erythema, exudation, crusting and oedema can result. There has been no documentation of this sensitizer having a role in chronic dermatologic conditions.

Our department experienced a case where a 62-year-old woman who complained of clinical

manifestations of grouped pruritic erythematous lichenoid papules on both lower extremities. She also had persistent pruritus starting a few years ago with no remembrance of the exact onset. Such skin lesions had been noted to have been aggravated a month ago after her last session of hair dyeing. She was treated with topical corticosteroid and oral antipruritics at several local clinics, but the symptoms continued to show fluctuation with no progressive improvement. Histopathologic findings of the lichenoid papules on the leg comprised hyperkeratosis, acanthosis, irregular elongation of the rete ridges in the epidermis, vertical arrangement of fibres in the papillary dermis and patchy perivascular infiltration. The infiltration was mostly of lymphocytes with some eosinophils. Diagnosis of LSC was made from clinical and histological findings. As she recollected aggravation after the use of hair dye, we performed patch testing with the hair dye that she had used and PPD. Readings were made

on day (D) 2 and D4 according to the recommendations of the ICDRG.

She showed weakly positive reactions to both allergens, and as we suspected possible clinical relevance, a recommendation was made to stop hair dyeing. Her skin lesions gradually showed improvement without recurrence up to 12 months of follow-up.

This case prompted us to conduct a 2-phase study with the aim to examine further other patients with LSC, or other neurodermatitis such as prurigo nodularis, and to see whether their hair dyeing habit had any influence on their skin problem.

Patients and Methods

Patients

Phase 1: prospective study. (Table 1) In our prospective study period of 14 months (2001.5–2002.7), patch testing was performed in 27 cases where the patients regularly performed hair dyeing and also had clinical manifestations of LSC. 18 cases (66.7%) were female, and the mean age of total subjects was 48.4 years.

Phase 2: retrospective study. (Table 2) Retrospective examination was made on 560 cases from March 1997 to April 2001, where patch testing with the Korean standard patch test kit was performed. Among the subjects, 318 cases (56.8%) were patch tested using the complete standard series for suspected ACD, whereas the remaining cases were tested with a limited number of allergens which included PPD to reveal the causative agent(s). We found 63 cases (11.3%) that showed positive reactions to PPD.

Of these 63 patients, we further selected cases that met the criteria below:

- (1) Prior hair dye use at any given intervals.
- (2) Clinical manifestations of LSC and/or other neurodermatitis.

Methods

Patch test. Patch testing was performed on the back of patients showing no eczematous lesions at the time of the test. PPD from the Korean standard kit was applied on the back using Finn Chambers[®] on Scanpor[®] Tape (Epitest Ltd, Helsinki, Finland). Fixomull[®] elastic tapes (Beiersdorf, Germany) were also used for fixation. Readings were made after D2 and D4 (or D3), according to the recommendations of the International Contact Dermatitis Research Group.

Interview (in person or by telephone). Patients showing positive patch test results along with associated clinical findings were reviewed. Patients with insufficient clinical information were interviewed. Patients were asked for information concerning their use of hair dyes, the nature and course of their chronic skin manifestations and whether any clinical improvement was seen after discontinuing the use of hair dye. The method used for acquiring information was mostly by telephone and whenever possible in person.

Results

Patch test results

Phase 1: prospective study. (Table 1) Of the 27 cases, 11 patients (40.7%) showed positive findings on patch testing. The age of patients ranged from 48 to 62 years (mean 54), with 7 females and 4 males. They had all been using hair dye for more than 5 years at a frequency of 1–3 months. 9 patients presented with widespread skin lesions, with only 2 showing localized lesions in areas like the back and abdomen. 2 had concurrent lesions of prurigo nodularis. 9 of 11 patients showed only weak positive reactions, whereas 2 showed strong positive reactions. 3 out of the 11 patients with either weak positive or strong positive reactions

Table 1. Patients' profile, patch test results and clinical relevance (phase 1)

Case number	Age/sex	Clinical features	Distribution	Hair dye				Patch test (PPD)
				Onset of use (years)	Frequency of use (months)	Aggravated after use	LSC improved after stopped	
1	62/F	LSC	Widespread	16	1–2	Yes	Yes*	+
2	54/F	LSC	Widespread	10	2	?	No	++
3	55/F	LSC	Widespread	13	1	Yes	Yes*	+
4	50/F	LSC	Abdomen	10	2–3	?	No	+
5	60/M	LSC	Widespread	5	3	?	No	++
6	57/M	PN	Widespread	7	1	?	Yes	+
7	55/M	LSC	Widespread	25	2	Yes	Yes	+
8	56/F	LSC	Widespread	10	2	?	Yes*	+
9	48/F	LSC	Widespread	10	3	?	Yes*	+
10	3/F	PN	Widespread	25	1–2	Yes	Yes	+
11	55/M	LSC	Back	8	2	Yes	Yes*	+

LSC = lichen simplex chronicus; PN = prurigo nodularis; PPD = *p*-phenylenediamine; ? = not noticed by patients.

*Patients who showed almost total clearance.

Table 2. Patients' profile, patch test results and clinical relevance (phase 2)

Case number	Age/sex	Clinical features	Distribution	Hair dye				Patch test (PPD)
				Onset of use (years)	Frequency of use (months)	Aggravated after use	LSC improved after stopped	
1	60/M	LSC	Face, buttock	10	1	Yes	Yes*	+
2	77/M	LSC	Widespread	25	2	?	No	+
3	40/F	LSC	Back, chest	18	2–3	?	No	+
4	60/F	LSC	Back	20	3	?	No	+
5	54/M	LSC	Widespread	10	1–2	?	No	+
6	59/F	LSC	Widespread	5	2	?	Yes*	+
7	68/F	LSC	Widespread	20	3	Yes	Yes	+
8	49/F	LSC	Widespread	3	1–2	Yes	Yes*	+
9	59/M	LSC	Widespread	15	2	?	No	+
10	54/F	LSC	Neck, waist	18	2	?	Yes	+
11	51/F	LSC	Perineum, back	7	1–2	?	No	+
12	41/M	LSC	Widespread	2	2	?	No	+
13	46/F	LSC	Widespread	6	1	Yes	Yes	+
14	42/F	LSC	Face, genitalia	5	2	?	No	+

LSC = lichen simplex chronicus; PPD = *p*-phenylenediamine; ? = not noticed by patients.

*Patients who showed almost total clearance.

recalled scattered lesions of pruritic papules, scales and excoriations on the scalp, face, ear or neck region after the use of hair dye. The 2 patients with strong positive reactions were both included in these 3 subjects.

Phase 2: retrospective study. (Table 2) 14 (22.2%) out of 63 patients who had positive PPD results had clinical findings of LSC and were using hair dyes at the time. Their age ranged from 40 to 77 years (mean 55.8) with 9 females and 5 males. Hair dye use varied from 6 months to 25 years. They were dyeing their hair at a frequency of 1–3 months. 8 patients presented with widespread lesions, whereas 6 presented with only localized lesions. All patients showed only weak positive reactions to PPD. 4 out of 14 patients in the retrospective study also recalled scattered lesions of pruritic papules, scales and excoriations on the scalp, face, ear or neck region after the use of hair dyes.

Clinical relevance

Phase 1. Of the 11 patients, 8 patients showed various degree of clinical improvement and 5 of them achieved almost total clearance after discontinuing the use of hair dye. 5 of these 8 patients successfully avoided further aggravation of their symptoms after switching to hair dyeing agents without PPD. The patients with near-total clearance showed only residual hyperpigmentation on the lesional sites.

In 5 of 8 patients who showed improvement, rechallenge aggravated the lesion.

Phase 2. In our retrospective review, 6 out of 14 patients who stopped the use of hair dye achieved gradual improvement of their chronic dermatitis over a period of a few months. 3 of these 6 patients actually achieved total clearance.

Rechallenge with hair dyeing was made in 5 out of 6 who improved, and aggravation was seen in 4 of these.

Discussion

ACD due to hair dye is a frequently encountered problem and a common result of contact hypersensitivity. Among the various ingredients of conventional hair dye, PPD is widely accepted to be the major indicator of such allergy (5). Currently, due to its strong sensitizing potential, some European countries banned the use of PPD in commercial hair dye, whereas in the US, the WHO recommends a simple self-testing technique for any allergic reactions or irritation. PPD in hair dyes can be a particular problem in many Asian countries, because black-coloured synthetic hair dye is widely used in these regions. In practice, we found only 2 such products that were commercially available, which did not contain PPD in Korea. Particularly in age groups over 40, people show age-specific behavioural patterns and actions that differ from the younger generations, and hair dyeing seems to be one of the habits that older generations subscribe to in order to look better in social life. As in occupational exposure mentioned above, this age-specific habit could be the cause of the frequent exposure of PPD and result in eventual problems due to hair dyes. The patients included in this study who showed positive findings to PPD were all over the age of 40, and their mean age was 55 years, being higher than the mean age of the study population in either groups.

Although no reports were found concerning the development of LSC associated with hair dye or

PPD, several reports (6–9) have documented workers in the photographic industry having a high incidence of ACD from PPDA derivatives, which appeared to be related to lichen planus or lichenoid eruptions in remote parts of the body as well as sites of direct contact. Our prospective study allowed us to investigate whether hair-dyeing individuals with chronic lesions such as LSC have associations between them. 5 (45.5%) of the 11 patients improved by discontinuing its use, and the findings were supported by patch test results and rechallenge tests. Another 3 patients seemingly improved by discontinuing its use but could not be confirmed by rechallenge tests, in which case a clear clinical association could not be made. In our retrospective review, 4 (28.6%) of 14 cases showed positive relevance supported by rechallenge tests. The difference in percentages of clinical relevance between the 2 phases is considered to be due to the initial method of patient selection. The patients in phase 2 were initially tested for a suspicious aetiology causing ACD, and most had acute problems to solve rather than chronic lesions like LSC; thus, the possibility of recall bias could have interfered in evaluation. Although PPD in hair dye may not be the sole aetiology for their LSC, the few patients showing total clearance after discontinued usage and subsequent aggravation after rechallenge proved to have clinical relevance. In prior reports, the most likely mechanism of systemic spread of PPD was suggested to be through inhalation or transepidermal absorption of the offending agent rather than direct contact (10).

It was also interesting to find that all patients showing clinical relevance showed only weak positive patch test findings, whereas 2 patients who showed strong positive reactions did not show clinical relevance with LSC. In patients with strong positive reactions, acute findings of ACD were also found after the event of hair dyeing, and this may have allowed the patient to avoid further distressing relapses without any doubts. In our clinical experience, patients with acute lesions on the scalp and face after hair dyeing were mostly the primary subjects receiving patch tests with PPD, and in most cases confirmed, strong positive reactions to PPD were more frequently seen than weak positive reactions on patch testing. After such confirmation, recommendations to avoid PPD-containing hair dyes were given, and most patients discontinued usage to strictly avoid further relapses. However, the weak positive findings in the above relevant cases may have allowed most patients to have overlooked the possibility of hair dyeing as the aetiology of their chronic skin manifestations in

the past. In our study, we found only a limited number of patients who recollected ACD lesions on the scalp and adjacent areas of possible direct contact. This finding may be due to the fact that the patients, in relations to weak positive findings, did not experience severe enough symptoms to remember or the possibility of the presenting symptom of LSC being so severe that it was easily overlooked. The presenting symptoms of patients who improved did not show improvement with a rapid course of treatment of lesions and avoidance of PPD. The possible reason for such delay in improvement may be due to either the chronicity of the LSC lesion or residual dye remaining on the hair shaft for several months.

We report several cases of patients diagnosed as LSC and/or prurigo nodularis who showed clinical improvement after discontinuing the use of hair dye. The suggestion can therefore be made that hair dye could be a possible aetiological agent causing LSC in those using hair dyes. Although no definite mechanism can be proposed at this time as to how PPD has such an association in such cases, patch testing in these individuals allows us to evaluate further the probable cause and to make confirmation after discontinued usage.

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