

Occupational dermatitis in hairdressers – influence of individual and environmental factors

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Summary

Background. Hairdressers are at risk of developing occupational contact dermatitis because of their intense contact with wet work in combination with chemicals.

Objectives. To perform an analysis of a cohort study of hairdressers with occupational contact dermatitis recognized in the period 2006–2011, focusing on individual and environmental factors associated with the disease.

Methods. The study was a descriptive, register-based survey including all hairdressers with recognized occupational contact dermatitis in Denmark in the period January 2006 to September 2011. Data were obtained from the Danish National Board of Industrial Injuries.

Results. The study comprised 381 patients (373 women and 8 men). The median age was 25 years, 64.8% were apprentices, and 35.2% were fully trained hairdressers. The prevalence of atopic dermatitis was 36.0%, and was significantly higher among apprentices than among fully trained hairdressers (44.9% and 19.4%, respectively) ($p < 0.001$). Of the patients, 48.3% had their dermatitis recognized as occupational irritant contact dermatitis, 46.7% had their dermatitis recognized as occupational allergic contact dermatitis or combined allergic and irritant contact dermatitis, and 5.0% were recognized as having occupational contact urticaria.

Conclusion. The low median age, the high percentages of atopic dermatitis in apprentices and the fact that more apprentices than fully trained hairdressers had recognized occupational contact dermatitis underlines the importance of early prevention.

Key words: allergic contact dermatitis; contact urticaria; epidemiology; hairdresser; irritant contact dermatitis; occupational.

Because of their intense contact with wet work in combination with chemicals, hairdressers are at risk of developing occupational contact dermatitis (1, 2). A recent study reported that hairdressers work for an average of only 8.4 years in the profession before leaving it, and that hand eczema significantly influences a decision to change career (3). Contact allergy may also have a

significant impact, and another study found that 66% of hairdressers with positive patch test reactions to the hair-dressing series stopped working as hairdressers because of hand eczema (4).

The most frequent irritant exposure is wet work, including frequent hand and hair washing, the use of gloves, and contact with irritating hair chemicals. Furthermore, friction dermatitis may occur from handling damp hair while cutting it. Frequently reported contact allergies in hairdressers are related to hair dyes and bleach, permanent wave chemicals, rubber chemicals, and metals (nickel).

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p-Phenylenediamine (PPD) is a common culprit (5), and Schwensen et al. reported, from a study of patch test results in hairdressers and matched controls, that PPD, toluene 2,5-diamine, *p*-aminophenol and *m*-aminophenol were important sensitizers. Furthermore, they found that contact allergy to thiurams was associated with being a hairdresser (6).

We present data from a cohort of hairdressers with contact dermatitis recognized as an occupational disease in the period 2006–2011, and focus on individual and environmental factors associated with the disease.

Methods

The study was a descriptive, registry-based survey including all hairdressers with occupational contact dermatitis in Denmark recognized in the period January 2006 to September 2011. Data were obtained from the Danish National Board of Industrial Injuries. Data included demographic information (sex, and age at onset), information on diagnosis (irritant or allergic contact dermatitis, or contact urticaria), localization, medical history, including information on atopic dermatitis, and on apprenticeship at the time of onset. Health-related information obtained from the Danish National Board of Industrial Injuries was based on either medical specialist certificates or patient files from dermatological departments or departments of occupational and environmental medicine.

All patients (except for one, owing to pregnancy) had been patch tested with the European baseline series or the TRUE Test[®], supplemented with a hairdresser's series. When contact urticaria was suspected, a prick test, histamine release (HR) test (7) or radioallergosorbent test (RAST) had been performed.

With respect to the diagnosis, the following criteria were applied: Occupational irritant contact dermatitis was diagnosed whenever a relevant occupational irritant exposure was identified, but there was no relevant contact allergy. Occupational allergic contact dermatitis was diagnosed when a relevant occupational allergy was diagnosed (i.e. positive patch test reaction to an allergen present at the workplace), irrespective of a possible concurrent irritant exposure. Occupational contact urticaria was diagnosed when a specific substance at the workplace had resulted in an immediate allergic reaction, and the patient subsequently had a positive result with the suspected substance in a prick test, an HR test, or a RAST. To avoid subgroups with very low numbers of patients, all patients who had occupational contact urticaria were registered as such, although some also had irritant or allergic contact dermatitis. Atopic dermatitis was defined

as being present in patients who had been diagnosed according to either medical specialist certificates or documentation in patient files.

For statistical analysis, SAS ENTERPRISE GUIDE 7.1 (SAS, Cary, NC, USA) was used. The chi-square test was used to test for possible differences between apprentices and fully trained hairdressers. The trial was approved by the Danish Data Protection Agency (journal number BBH-2011-41).

Results

A total of 381 hairdressers (apprentices or fully educated) were recognized as having occupational contact dermatitis in Denmark in the period January 2006 to September 2011, and were included in the study. The number of included patients per year was stable over the study period. The median age was 25 years (quartiles 21–29 years); 373 women and 8 men were included. Two hundred and forty-seven (64.8%) had their dermatitis notified during apprenticeship and later recognized as occupational contact dermatitis. Subdiagnoses of occupational hand eczema and diagnosis of previous or current atopic dermatitis, stratified with respect to current position, that is, apprenticeships or fully trained hairdressers, are shown in Table 1. No significant differences between apprentices and fully trained hairdressers were found with respect to prevalence rates of irritant and allergic contact dermatitis (Table 1). Occupational contact urticaria was found in 19 (5.0%) of the patients, 9 of whom also had atopic dermatitis. Seven patients had occupational contact urticaria as the only diagnosis. The overall prevalence of atopic dermatitis was 36.0%, and was found to be significantly higher in apprentices than in fully trained hairdressers, at 44.9% and 19.4%, respectively ($p < 0.001$) (Table 1). With respect to localization of eczema, hand eczema was found in 99.2% of all cases. Thirty-three (8.7%) patients had eczema elsewhere than the hands; of these, 10 had atopic dermatitis.

Prevalence rates of recognized occupational contact allergies in the patients diagnosed with occupational allergic contact dermatitis are shown in Table 2. Contact allergies to components of hair dyes and bleaches were by far the most frequent; however, contact allergies to biocides, surfactants, metals, fragrances and rubber chemicals were also found. Eighteen patients had contact allergy to cocamidopropyl betaine; 6 of these had atopic dermatitis. There were no significant differences between the two groups ($p = 0.81$). Occupational contact urticaria was suspected and diagnosed in 19 (4.7%) patients: 7 (1.8%) with contact urticaria caused by ammonium persulfate alone, 1 (0.2%) with contact urticaria caused by potassium persulfate alone and 4 (1.0%) persons had contact urticaria caused by both ammonium and

Table 1. Subdiagnoses of occupational hand dermatitis, and of previous or current atopic eczema, stratified with respect to job position, that is, apprentice or fully trained hairdresser

Diagnosis	Hairdressing apprentices (n = 247), n (%)	Fully trained hairdressers (n = 134), n (%)	Total (N = 381)	OR (95%CI)*	p-Value*
OICD	119 (48.2)	65 (48.5)	184 (48.3)	0.987 (0.648–1.503)	0.96
OACD	112 (45.3)	66 (49.3)	178 (46.7)	0.855 (0.561–1.303)	0.47
OCU	16 (6.5)	3 (2.2)	19 (5.0)	3.025 (0.865–10.574)	0.085**
AD	111 (44.9)	26 (19.4)	137 (36.0)	3.390 (2.064–5.568)	0.001

AD, atopic dermatitis; CI, confidence interval; OACD, occupational allergic contact dermatitis (including patients with mixed occupational irritant contact dermatitis and OACD); OCU, occupational contact urticaria; OD, crude odds ratio; OICD, occupational irritant contact dermatitis.

*Chi-square test.

**Fisher's exact test.

potassium persulfate. One case had a positive reaction towards a bleach product. The specific allergen was not clarified further.

Prevalences of non-occupational contact allergies in apprentices and fully trained hairdressers are shown in Table 3. One hundred and seven (28.1%) had non-occupational contact allergy to nickel, and this was significantly more frequent in fully trained hairdressers than in apprentices, at 35.8% and 23.9%, respectively ($p = 0.013$).

Discussion

We included a total of 381 cases of occupational contact dermatitis in hairdressers over a period of 5 years; this is ~5% of all recognized cases of occupational contact dermatitis in Denmark during this period (1). The median age in this cohort of hairdressers with occupational contact dermatitis was 25 years, as opposed to a mean age of 36 years for occupational contact dermatitis in general in Denmark (1), and 64.8% were apprentices. This finding, showing that the onset of occupational contact dermatitis in hairdressers occurs at an early age, and occurs more often in apprentices than in fully trained hairdressers, is in agreement with previous findings (8), and strongly emphasizes the importance of prevention at a very early stage during apprenticeship (9). Subdiagnoses of eczema were evenly allocated between apprentices and fully trained hairdressers; however, the very similar distribution of irritant contact dermatitis and allergic contact dermatitis in hairdressers, at 48.3% and 46.7%, respectively, was found to differ significantly from the distribution of irritant contact dermatitis and allergic contact dermatitis in patients with occupational contact dermatitis in general in Denmark, which was previously reported to be 70.1% and 29.9%, respectively (1). The high prevalence of allergic contact dermatitis in hairdressers may reflect the

intense exposure to sensitizing chemicals during work as a hairdresser. Also, many Danish hairdressers have acquired hair dye allergy from personal hair dyeing (10).

The prevalences of atopic dermatitis were 44.9% in apprentices and 19.4% in fully trained hairdressers. In a previous study of patients with occupational skin disease, the prevalence of atopic dermatitis was reported to be 22.3% (1), whereas the prevalence in the general adult population in Denmark has been reported to be 5–10% (11), but our results are in agreement with a previous study in hairdressers reporting a prevalence of atopic dermatitis of 38.1% (apprentices and fully trained hairdressers) (8). The significant difference in the prevalence of atopic dermatitis between apprentices and fully trained hairdressers has not previously been reported. The finding supports the idea that atopic dermatitis significantly influences the development of hand eczema (11, 12), and indicates that a 'healthy worker effect' is found among fully trained hairdressers. However, the high prevalence of atopic dermatitis in the younger population can also be interpreted as an effect of the 'atopic dermatitis epidemic', hence affecting the youngest generation more than the oldest.

In a Danish study, Bregnhøj et al. found atopic dermatitis in 21.4% of the hairdressing apprentices and in 29.8% of a matched control group in the general population (13). The lower prevalence reported by Bregnhøj et al. may be attributable to the fact that they investigated hairdressing apprentices in general and not a selected group with occupational contact dermatitis, as is the case in our study. With respect to localization of the eczema, hand eczema was found in almost all patients, as would be expected.

As discussed above, we found components of hair dyes to be the most frequently involved haptens, which is in agreement with previous reports (6, 14). Of the hairdressers in our cohort, 21.5% were sensitized to components of hair dyes. Vogel et al. recently reported that PPD sensitization occurred in 3.3% of the patch tested

Table 2. Occupational contact allergies in hairdressers recognized as having occupational contact allergy

Contact allergen	N = 187 (49.1)*
Hair dye, N = 82 (21.5)	
Toluene-2,5-diamine	45 (11.8)
<i>p</i> -Phenylenediamine	51 (13.4)
<i>m</i> -Aminophenol and <i>p</i> -aminophenol	4 (1.1)
Bleach, N = 76 (19.9)	
Ammonium persulfate*	73 (19.2)
Hydroquinone	6 (1.6)
Surfactants, N = 18 (4.7)	
Cocamidopropyl betaine	18 (4.7)
Permanent wave liquids, N = 9 (2.4)	
Ammonium thioglycolate	3 (0.8)
Glyceryl thioglycolate	6 (1.6)
Couplers, N = 2 (0.5)	
Resorcinol	2 (0.5)
Rubber additives, N = 10 (2.6)	
Thiuram mix	9 (2.4)
Mercapto mix	1 (0.3)
Carbamate mix	1 (0.3)
Biocides, N = 20 (5.2)	
Formaldehyde	9 (2.4)
Methylisothiazolinone/methylchloroisothiazolinone, methylisothiazolinone	7 (1.8)
Methyldibromo glutaronitrile	2 (0.5)
Paraben mix	1 (0.3)
Imidazolidinyl urea	2 (0.5)
Diazolidinyl urea	1 (0.3)
Quaternium-15	3 (0.7)
Fragrance, N = 10 (2.6)	
Fragrance mix I or II	7 (1.8)
<i>Myroxylon pereirae</i> (balsam of Peru oil)	4 (1.0)
Metals, N = 17 (4.5)	
Potassium dichromate	1 (0.3)
Cobalt chloride	2 (0.5)
Nickel sulfate	17 (4.5)

Each patient may have more than one occupational contact allergy. Numbers in parentheses are percentages of all 381 included patients.

*All occupational allergic contact allergies; those combined with occupational contact urticaria are also included.

population, and that the frequency was 4.4-fold increased in hairdressers (15). In agreement with this, we found that 13.4% of hairdressers in our cohort were sensitized to PPD. Contact allergy to ammonium persulfate was found in 19.2%, which is a higher frequency of occurrence than previously reported (6). Testing with an updated and relevant hairdresser series is important for diagnosis (16). Biocides were also frequent sensitizers resulting in contact allergy, and 5.2% of patients were diagnosed with occupational contact allergy to one or more biocides, formaldehyde or formaldehyde releasers being the most frequent ones, followed by methylisothiazolinone/methylchloroisothiazolinone. Occupational contact allergy to nickel was found in 4.5% of patients, and occupational contact allergy to fragrances and rubber chemicals was found in 2.6% and 2.6% of patients,

respectively. The occurrence of contact allergy to thiurams, in most cases acquired from gloves at the workplace, is within the same range as the prevalence of sensitization to thiurams among hairdressers found by Schwensen et al. (6, 17).

The prevalence of non-occupational nickel allergy in our study population (28.1%) was similar to that found by Thyssen et al. (21.9%) (18). We found that trained hairdressers more often have contact allergy to nickel than apprentices (having a lower median age). This may be attributable to the regulatory interventions on nickel release (19). Surprisingly, contact allergy to cocamidopropyl betaine was found in 18 (4.7%) hairdressers. As cocoamidopropyl betaine has been considered to be an irritant as well as a contact allergen (20), an association with atopic dermatitis could be expected, owing to the more sensitive skin in this group. We found, however, that the prevalence of contact allergy to cocoamidopropyl betaine was not increased in atopic dermatitis patients as compared with non-atopic dermatitis patients.

With respect to contact urticaria, we had only a few cases, the major culprits being latex and persulfates. Exposure to these allergens is common in the hairdressing trade, and results from contact with gloves and bleach. We may have underestimated the prevalence of persulfate allergy, as this was not systematically tested for.

The advantage of the present study is that the data comprise a complete cohort of hairdressers with recognized occupational hand eczema in Denmark over a period of 5 years.

A limitation of our study is that it only comprises the recognized cases, which may represent only the tip of the iceberg. Although medical doctors, by law, are obligated to report occupational diseases, it is likely that underreporting occurs (21). A previous study found that only 20.7% of hairdressers with self-reported occupational hand eczema had been reported to the National Board of Industrial Injuries (8), and Bregnhøj et al. found that only a fraction of hairdressing apprentices had their occupational allergic contact dermatitis reported to the National Board of Industrial Injuries (13). Another limitation is the lack of data on the severity of (hand) eczema.

In the present study, we defined irritant contact dermatitis as an absence of allergic contact dermatitis, as we wanted to focus on the effect of contact sensitization. In real life, irritant and allergic contact dermatitis are most often co-players, and in the present study the importance of irritant contact dermatitis may therefore be underestimated.

In conclusion, occupational contact dermatitis in hairdressers constitutes a significant problem, and apprentices, in particular, are involved. More than half of

Table 3. Non-occupational contact allergies in hairdressers recognized as having occupational contact dermatitis

Diagnosis	Hairdressing apprentices (n = 247)	Fully trained hairdressers (n = 134)	Total (N = 381)	OR (95%CI)*	p-Value*
Rubber additives	0	0	0	–	–
Biocides	10 (4.0)	4 (3.0)	14 (3.7)	0.729 (0.224–2.371)	0.79**
Nickel sulfate /cobalt chloride	59 (23.9)	48 (35.8)	107 (28.1)	1.779 (1.124–0.813)	0.013
Potassium dichromate	2 (0.8)	2 (1.5)	4 (1.0)	1.856 (0.259–3.842)	0.44
Hairdressing chemicals	12 (4.9)	5 (3.7)	17 (4.4)	0.759 (0.2616–2.02)	0.61
Perfume	5 (2.0)	5 (3.7)	10 (26.2)	1.876 (0.533–6.600)	0.32
Colophonium	0	0	0	–	–
Other chemicals	17 (6.9)	4 (3.0)	21 (5.5)	2.402 (0.792–7.291)	0.055

CI, confidence interval; OR, crude odds ratio.

Stratified with respect to job position, that is, apprentice or fully trained hairdresser.

Each patient may have more than one occupational contact allergy.

Numbers in parentheses are percentages of all 381 included patients.

*Chi-square test.

**Fisher's exact test.

the cases were hairdressing apprentices, and the prevalence of atopic dermatitis was significantly higher in apprentices than in fully trained hairdressers. Allergic contact dermatitis was found to constitute a higher proportion of cases than previously reported among patients

with occupational contact dermatitis in general. Our data strongly support the idea that preventive efforts should be directed at the hairdresser profession, in particular at the apprentices, and that contact allergens in the profession should be one focus.

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