

ORIGINAL ARTICLE

Patch test results of hand eczema patients: relation to clinical types

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Abstract

Background Allergic contact dermatitis is a well-known cause of hand eczema, although the influence of contact allergens on different clinical types of hand eczema remains still unclear.

Objective To identify most common positive tested allergens among hand eczema patients and to define the relation between specific contact allergies and clinical types of hand eczema according to the guidelines of the Danish Contact Dermatitis Group (DCDG).

Methods We included 1571 hand eczema subjects who were patch tested from 1 January 2002 to 31 December 2013. They were retrospectively classified according to the guidelines of the DCDG into six clinical types: recurrent vesicular hand eczema, chronic fissured hand eczema, hyperkeratotic palmar eczema, pulpitis, interdigital eczema and nummular hand eczema according to a newly developed flow chart. The prevalence of sensitizations and association with clinical type, atopic dermatitis, age and gender were studied.

Results A total of 1395 subjects were classified into one of the six clinical types. The most frequently found clinical types were recurrent vesicular hand eczema (39.7%) and chronic fissured hand eczema (35.5%). Subjects with recurrent vesicular hand eczema were significantly more likely to have a contact allergy (OR 1.55), whereas subjects with hyperkeratotic palmar eczema and pulpitis were less likely to be sensitized (OR 0.51; OR 0.44). Overall, metals (nickel sulphate, cobalt chloride), fragrances and preservatives (methylchloroisothiazoline/methylisothiazoline, methyldibromoglutaronitrile) were the most frequent sensitizers in patients with hand eczema. This did not deviate in the different clinical types, although subjects with recurrent vesicular hand eczema were significantly more frequently sensitized to nickel sulphate and other allergens compared to other clinical types of hand eczema.

Conclusion In the diagnostic work up of hand eczema subjects with recurrent vesicular hand eczema should be patch tested, especially women of older age, although the need for patch testing in males with hyperkeratotic palmar eczema might be less imperative.

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Conflicts of interest

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Introduction

Hand eczema is a common condition, with a 1-year prevalence up to 10%, depending on the definition used.¹ The pathogenesis of hand eczema is multifactorial, with contribution of internal factors such as an atopic status and external factors, such as allergens and irritants.

The precise impact of allergic contact dermatitis remains unclear, although patients often suspect an allergy and recently published guidelines stress the importance of patch testing.^{2,3}

Up till now, few studies have been published on the role of contact allergies in different clinical subgroups of hand eczema.^{4–7} However, since consensus regarding the (clinical) classification of hand eczema is lacking, these results are difficult to compare.

Recently, the Danish Contact Dermatitis Group (DCDG) published a clear clinical classification system for hand eczema.² Subsequently, Johansen *et al.* conducted a prospective study according to this system in which they classified 508 patients in six clinical types and aetiological types.⁴ In this study, less than 40% had at least one positive patch test reaction and in 24.4% of the patients the final diagnosis was allergic contact dermatitis.

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Johansen *et al.* did not differentiate between specific contact allergies, such as nickel or fragrance mixes.

To assess the spectrum of allergens related to hand eczema, we conducted a retrospective analysis of patch test data in hand eczema patients. We hypothesize that specific groups of contact allergies are associated with different clinical types. The aim of this study was to identify most common positive tested allergens among all hand eczema patients and to define the relation between specific contact allergies and clinical types of hand eczema according to the guidelines of the Danish Contact Dermatitis Group in a large retrospective cohort of hand eczema patients.²

Materials and methods

Patients

In this retrospective study, 1835 unique subjects who were patch tested at the Dermatology department of the University Medical Center Groningen between 1 January 2002 until 31 December 2013 were extracted from our patch test database. Only subjects in which the hands were affected were selected. Subjects who were not tested with the European Baseline series ($n = 51$) or subjects with other missing data ($n = 129$) were excluded. Finally, subjects with other dermatoses on the hands ($n = 84$) such as dermatomycosis ($n = 22$), psoriasis ($n = 14$), urticaria ($n = 8$) and drug reactions ($n = 8$) were excluded. After excluding these subjects, a total of 1571 patients with hand eczema were included in this study.

Patch testing

Patch tests were performed with the TRUE Test (Thin-layer Rapid Use Epicutaneous Test, Mekos Laboratories, Hillerød, Denmark) and additional allergens patch tested in van der Bend square chambers[®] (Van der Bend BV, Brielle, The Netherlands). Patch tests were applied to the upper back for 48-h occlusion. All subjects were patch tested with the European Baseline series and a baseline extension series. Based on the patient's history, additional series such as a cosmetic series or a (meth)acrylate series were also patch tested. Results were read on day 2 and day 3 from January 2002 till November 2008, in which the reading at day 3 was conclusive. In November 2008, the day 2 reading was replaced by a day 7 reading to pre-empt late reactions. A reaction was regarded as 'positive' if erythema and infiltration developed and covered the whole patch test area,⁸ which was later adopted by the guidelines of the International Contact Dermatitis Group.

The patch test results and demographic characteristics of subjects were prospectively registered in the European Surveillance System of Contact allergies (ESSCA).⁹ For all subjects MOAHLFA characteristics were recorded, which represents the percentages of males, occupational factors, a history of atopic dermatitis, primary site hand, leg or face and an age over 40 years.¹⁰ Polysensitization was considered as positive reactions to three or more contact allergens in the European Baseline series.¹¹

Classification of hand eczema

The diagnosis hand eczema was retrospectively classified based on medical records and photographic documentation according to the criteria of the DCDG. Based on these criteria, hand eczema was classified in six different clinical types: chronic fissured hand eczema, recurrent vesicular hand eczema, hyperkeratotic palmar eczema, pulpitis, interdigital eczema and nummular hand eczema, alongside a non-classifiable category. To facilitate the classification of hand eczema in different clinical types, a flow chart was developed based on the criteria of the DCDG (Fig. 1). In this flow chart the primary location on the hand was combined with the morphology, which results in a final clinical type of hand eczema. The flow chart was developed to retrieve the data from the medical records in a structured way.

Statistics

Data analyses were performed with IBM SPSS Statistics (SPSS, Chicago, IL, USA) for Windows (version 22.0). Data are presented as absolute numbers and in percentages for categorical variables and as median values for continuous variables. The chi-squared test was used for comparison between different clinical types. By means of logistic regression the influence of clinical subgroups among other factors on the presence of a contact allergy was studied and odds ratios (OR) were calculated.

Results

General description

A total of 1571 subjects were included. About half of the included population was male (45.2%) and the mean age was 38.1 years (range 9.3–80.4). About one-third of the subjects had a personal history of atopic dermatitis. Occupational factors were involved in 52.7% of the cases. In 84.1%, the hands were the primary site of dermatitis, in 0.6% the legs and in 2.7% the face were the primary site (Table 1).

The majority of the cases ($n = 623$) were classified as recurrent vesicular hand eczema. Chronic fissured hand eczema was diagnosed in 557 subjects, hyperkeratotic palmar eczema in 119, pulpitis in 63, nummular hand eczema in 21 and interdigital eczema in 12 subjects. In 176 subjects, it was not possible to classify the hand eczema into a clinical subtype. In the hyperkeratotic and pulpitis group, the mean age was statistically significantly higher with a mean age of 50.1 and 46.1 years. Although more than half of the total group was female, in the hyperkeratotic palmar eczema group, males were significantly overrepresented (69.7% vs. 30.3%).

Contact sensitizations

A total of 1709 positive patch test reactions were found in the European Baseline series. In addition, 879 positive reactions were found in additional series. Half of the subjects with hand eczema (50.7%) had a contact sensitization to one or more of

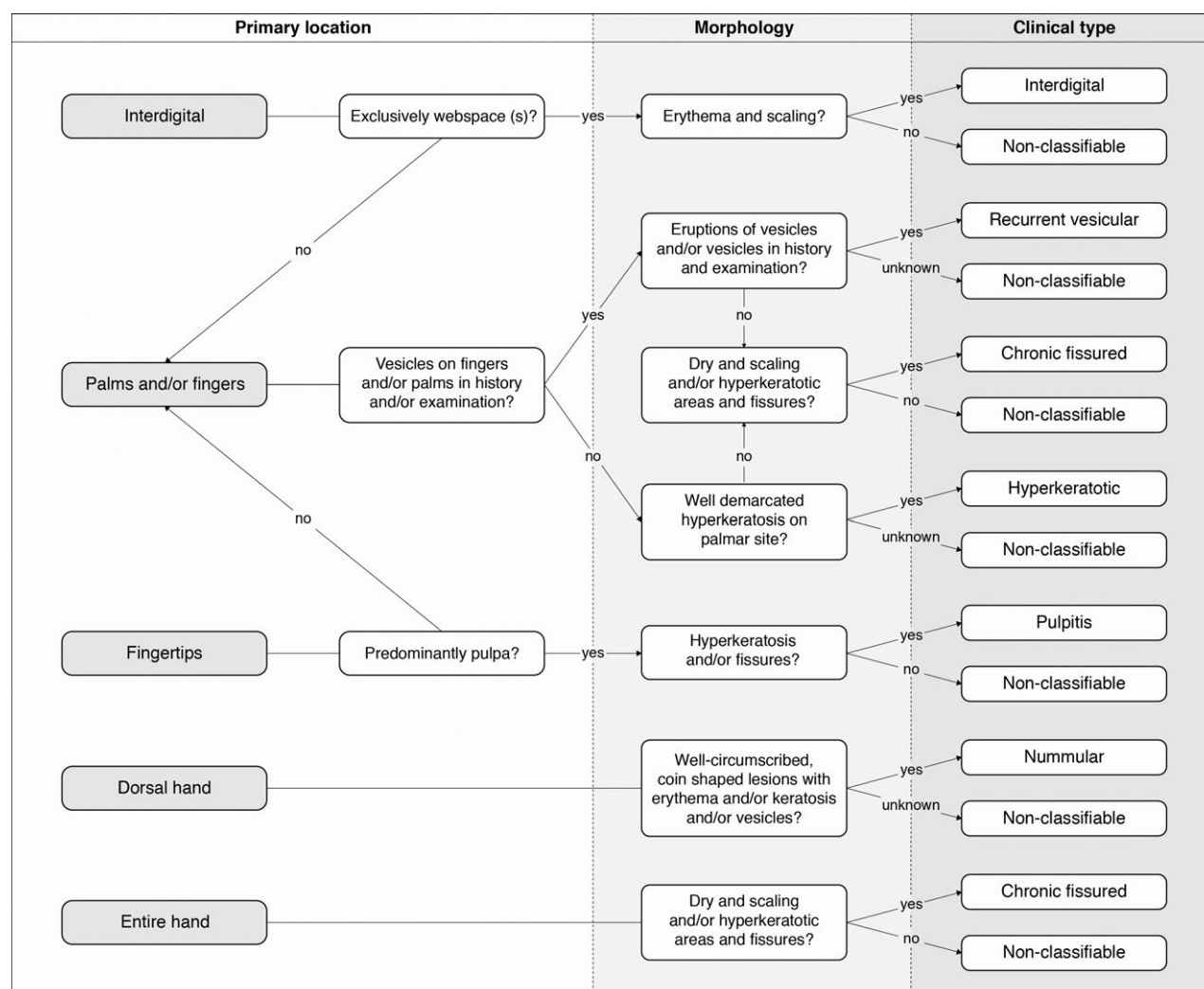


Figure 1 Flow chart clinical type. To classify the clinical type of hand eczema first select your primary location and subsequently assess the morphology. This will result in a clinical type.

the tested allergens in the European Baseline series and 15% was polysensitized. Males were less often sensitized to one or more allergens in the European Baseline series (37.1% men, OR 0.48, $P < 0.001$) and sensitization was associated with age over 40 years (OR 1.58, $P < 0.001$). Polysensitization to allergens in the European Baseline series was significantly less frequently found in males and more often in subjects with higher age (OR 0.45, $P < 0.001$; OR 2.32, $P < 0.001$ respectively).

No relationship between a history of atopic dermatitis and the presence of at least one contact sensitization was found, not for the whole group of hand eczema patients nor for any clinical subtype of hand eczema. However, subjects with a history of atopic dermatitis were more likely to be polysensitized to allergens

in the European Baseline series (OR 1.43, $P = 0.019$) when adjusted for the same characteristics.

Subjects with recurrent vesicular hand eczema were more likely to be sensitized to one or more allergens in the European Baseline series compared to sensitization in all other subjects with hand eczema, even after adjustment for gender, age, atopic dermatitis and occupational factors (OR 1.41, $P = 0.001$). This difference remained for sensitizations in additional test series included in the analyses (OR 1.55, $P < 0.001$). Subjects with hyperkeratotic palmar eczema and pulpitis were less likely to have positive reactions to one or more allergens in the European Baseline series after adjustment for the same characteristics (OR 0.51, $P < 0.001$; OR 0.44, $P = 0.003$) or in additional series (OR 0.46, $P < 0.001$; OR 0.46 $P = 0.005$).

Table 1 Demographic characteristics of included subjects and the characteristics in the different clinical types

	Overall hand eczema n (%)	Chronic fissured n (%)	Recurrent vesicular n (%)	Hyperkeratotic eczema n (%)	Pulpitis n (%)	Interdigital eczema n (%)	Nummular eczema n (%)	Non-classifiable n (%)
Total	1571 (100)	557 (35.5)	623 (39.7)	119 (7.6)	63 (4.0)	12 (0.8)	21 (3.1)	176 (11.2)
Men	710 (45.2)	247 (44.3)	274 (44.0)	83* (69.7)	32 (50.8)	4 (33.3)	12 (57.1)	58* (33.0)
Occupational	828 (52.7)	352* (63.2)	288* (46.2)	43* (36.1)	28 (44.4)	7 (58.3)	11 (52.4)	99 (56.3)
Atopic dermatitis	571 (36.3)	228* (40.9)	233 (37.4)	20* (16.8)	11* (17.5)	4 (33.3)	4 (19.0)	71 (40.3)
Primary site hand	1321 (84.1)	484* (86.9)	517 (83.0)	101 (84.9)	62* (98.4)	7* (58.3)	17 (81.0)	133* (75.6)
Primary site leg	10 (0.6)	3 (0.5)	2 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	1* (4.8)	4* (2.3)
Primary site face	43 (2.7)	19 (3.4)	6* (1.0)	1 (0.8)	0 (0.0)	2* (16.7)	1 (4.8)	14* (8.0)
Age over 40	672 (42.8)	212* (38.1)	257 (41.3)	95* (79.8)	42* (66.7)	2 (16.7)	5 (23.8)	59* (33.5)
≥1 positive reactions in EBS	797 (50.7)	280 (50.3)	344* (55.2)	42* (35.3)	21* (33.3)	6 (50.0)	9 (42.9)	95 (54.0)
≥3 positive reactions in EBS	235 (15.0)	86 (15.4)	106 (17.0)	8* (6.7)	4 (6.3)	1 (8.3)	2 (9.5)	28 (15.9)
≥1 positive reactions at all	888 (56.5)	311 (55.8)	385* (61.8)	45* (37.8)	25* (39.7)	8 (66.7)	10 (47.6)	104 (59.1)
≥3 positive reactions at all	364 (23.2)	134 (24.1)	158 (25.4)	11* (9.2)	8* (12.7)	4 (33.3)	3 (14.3)	46 (26.1)

* $P < 0.05$: statistically significantly different from all other clinical types by chi-squared test.
EBS, European Baseline Series and a baseline extension series.

Frequent sensitizers

Table 2 displays most common positive tested allergens in all patients with hand eczema; allergens with at least 1% positive reactions are shown. The most frequent sensitizer was nickel sulphate (18.8%). Subsequently, methylchloroisothiazolinone/

Table 2 The most frequent sensitizers in hand eczema patients with their prevalence

Rank	Overall hand eczema n = 1571	
	Allergen	n (%)
1	Nickel sulphate	296 (18.8)
2	MCI/MI	144 (9.2)
3	Cobalt chloride	107 (6.8)
4	Fragrance mix I	97 (6.2)
5	MDBGN	95 (6.0)
6	Potassium dichromate	79 (5.0)
7	Fragrance mix II	77 (4.9)
8	Carba mix	75 (4.8)
9	Colophony	72 (4.6)
10	Thiuram mix	69 (4.4)
11	CAPB	66 (4.2)
12	PPD	53 (3.4)
13	Quaternium	44 (2.8)
14	Balsam of Peru	43 (2.7)
15	Epoxy resin	42 (2.7)
16	Formaldehyde	42 (2.7)
17	Lyril	39 (2.5)
18	Mercapto mix	33 (2.1)
19	Compositae mix	32 (2.0)
20	MBT	31 (2.0)
21	Ammonium persulphate	30 (1.9)
22	PTBFR	26 (1.7)
23	4-Aminoazobenzene	26 (1.7)
24	Wool alcohols	25 (1.6)
25	Disperse orange	24 (1.5)
26	Thiomersal	23 (1.5)
27	TETD	23 (1.5)
28	SL mix	23 (1.5)
29	Isoeugenol	22 (1.4)
30	PTD	20 (1.3)
31	Hydroxycitronellal	19 (1.2)
32	Oakmoss	19 (1.2)
33	DPG	17 (1.1)
34	Black rubber mix	17 (1.1)
35	Treemoss	16 (1.0)
36	Thiolactic acid	15 (1.0)
37	Budesonide	15 (1.0)

CAPB, cocamidopropyl betaine; DPG, 1,3-diphenyl guanidine; MBT, 2-mercaptobenzothiazole; MCI/MI, methylchloroisothiazolinone/Methylisothiazolinone; MDBGN, methylchloroisothiazolinone/2-mercaptobenzothiazole; PPD, *p*-phenylene diamine; PTBFR, *p*-*tert*-butylphenol formaldehyde resin; PTD, *p*-toluene diamine; SL mix, Sesquiterpene lactone mix; TETD, Tetra-ethylthiuram disulphide.

Table 3 Most frequent sensitizers in the different clinical types of hand eczema patients

Rank	Chronic fissured hand eczema <i>n</i> = 557		Recurrent vesicular hand eczema <i>n</i> = 623		Hyperkeratotic palmar eczema <i>n</i> = 119	
	Allergen	<i>n</i> (%)	Allergen	<i>n</i> (%)	Allergen	<i>n</i> (%)
1	Nickel sulphate	92 (16.5)	Nickel sulphate	141* (22.6)	Nickel sulphate	15 (12.6)
2	MCI/MI	58 (10.4)	MCI/MI	61 (9.8)	MCI/MI	8 (6.7)
3	Cobalt chloride	35 (6.3)	Cobalt chloride	57* (9.1)	MDBGN	7 (5.9)
4	FMI	34 (6.1)	FMI	42 (6.7)	Potassium dichromate	6 (5.0)
5	FMII	33 (5.9)	Potassium dichromate	42* (6.7)	Cobalt chloride	5 (4.2)
6	Thiuram mix	31 (5.6)	MDBGN	42 (6.7)	Carba mix	4 (3.4)
7	Carba mix	31 (5.6)	Colophony	36 (5.8)	FMI	4 (3.4)
8	MDBGN	30 (5.4)	FMII	32 (5.1)	CAPB	3 (2.5)
9	CAPB	27 (4.8)	CAPB	29 (4.7)	PTBFR	3 (2.5)
10	Potassium dichromate	24 (4.3)	Carba mix	29 (4.7)	Peru balsam	3 (2.5)
11	Colophony	23 (4.1)	Quaternium	23 (3.7)	Thiuram mix	2 (1.7)
12	PPD	21 (3.8)	Thiuram mix	22 (3.5)	PPD	2 (1.7)
13	Formaldehyde	20 (3.6)	Compositae mix	21* (3.4)	Neomycin	2* (1.7)
14	Quaternium	16 (2.9)	PPD	20 (3.2)	FMII	2 (1.7)
15	Ammonium persulphate	15 (2.7)	Mercapto mix	19* (3.0)	2-methyl-4-isothiazolinone	2 (1.7)
16	Peru balsam	15 (2.7)	Lyril	19 (3.0)	Epoxy resin	2 (1.7)

**P* < 0.05: statistically significantly different from all other clinical types by chi squared test.

CAPB, cocamidopropyl betaine; FM, fragrance mix; MCI/MI, methylchloroisothiazolinone/methylisothiazolinone; MDBGN, methylidibromo glutaronitrile; PPD, *p*-phenylene diamine; PTBFR, *p*-tert-butylphenol formaldehyde resin.

methylisothiazolinone (MCI/MI), cobalt chloride and fragrance mix I caused a substantial amount of positive reactions.

Overall, the most frequent sensitizers did not deviate between the different clinical types (Table 3). Although subjects with recurrent vesicular hand eczema were more likely to react to nickel sulphate (OR 1.50, *P* = 0.002), potassium dichromate (OR 1.78, *P* = 0.012), cobalt chloride (OR 1.81, *P* = 0.003), compositae mix (OR 2.97, *P* = 0.004) and mercapto mix (OR 2.10, *P* = 0.037), compared to the other clinical types. Subjects with pulpitis reacted more often to acrylates.

Discussion

Subjects with recurrent vesicular hand eczema were significantly more likely to have a contact allergy, whereas subjects with hyperkeratotic palmar eczema and pulpitis were less likely to be sensitized. Subjects with chronic fissured and non-classifiable hand eczema did not show more frequent contact allergies compared to all other types of hand eczema. Present findings are in line with Johansen *et al.* as they encountered contact allergies more often in recurrent vesicular hand eczema.⁴ They also reported that the role of contact allergies was less pronounced in pulpitis and hyperkeratotic palmar eczema, although the subgroups were small (12 and 41 patients respectively). Thus, the current relatively large retrospective study supports the results of Johansen *et al.* with regard to sensitizations in different clinical types of hand eczema.

Diepgen *et al.* investigated the percentage of patients with contact sensitization in different subtypes of hand eczema

including vesicular and hyperkeratotic hand eczema among aetiological subtypes.⁵ In more than 60% of the subjects with vesicular hand eczema and less than 40% with hyperkeratotic hand eczema, contact sensitizations to one or more allergens in the European Baseline series and additional series were found. These results are in agreement with the current results of recurrent vesicular hand eczema and hyperkeratotic palmar eczema (i.e. 61.8% and 37.8%). However, these results are difficult to compare since Diepgen *et al.* gave no clear definitions of vesicular and hyperkeratotic hand eczema. Moreover, they included aetiological diagnoses. Since the aetiology of hand eczema is a complex combined action of major causes and other factors, where the degree of influence of each factor is virtually impossible to determine and where this influence may even vary over time, it is challenging to classify hand eczema into subgroups based on aetiological types. The addition of two clinical types makes this classification system perhaps even more difficult to apply in daily practice. Therefore, we prefer a classification system based on clinical types.

According to our data, a history of atopic dermatitis does not seem to be a risk factor for sensitization in patients with hand eczema. However, we did show that a history of atopic dermatitis was a risk factor for polysensitization in hand eczema patients to allergens in the European Baseline series when corrected for age and gender (OR 1.43, *P* = 0.019). Agner *et al.* found a borderline decreased frequency of contact sensitization in hand eczema patients with a history of atopic dermatitis.¹² Handa investigated the association between sensitization and an atopic

status in hand eczema patients and showed that being atopic was not a risk factor for contact allergies in patients with hand eczema.¹³ Study results on the relationship between contact sensitization and a history of atopic dermatitis are also conflicting.^{12,14,15} Clemmensen found similar frequencies of positive patch test reactions in patients with and without atopic dermatitis.¹⁴ Thyssen *et al.* found a significant association between atopic dermatitis and contact sensitization to at least one allergen in the general population of Copenhagen, with the exception of nickel and thiomersal.¹⁵ Carlsen *et al.* found an OR of 1.43 for atopic eczema in polysensitized patients.¹¹ These conflicting results illustrate the ongoing debate on the relation between atopic dermatitis and contact sensitizations.

The female gender and an older age were risk factors for the development of contact allergies. These findings are supported by various studies.^{16,17}

Contact sensitizations in clinical types of hand eczema

Subjects with recurrent vesicular hand eczema were significantly more frequently sensitized to nickel sulphate, potassium dichromate, cobalt chloride, compositae mix and mercapto mix compared to the other clinical types of hand eczema.

Nickel is a well-known sensitizer and various efforts have been made to reduce the number of sensitizations in the general population. The role of nickel sensitizations in vesicular hand eczema is controversial and some authors suggested that oral challenge with nickel sulphate in nickel-sensitive patients exacerbates vesicular hand eczema.¹⁸ Although skin contact with nickel does not seem to result in an increased number of vesicles, as was demonstrated by Bryld *et al.*,¹⁹ Bryld found no association between nickel sensitization and recurrent vesicular attacks (relative risk 0.45, confidence interval 0.06–3.36). An explanation for the overrepresentation of nickel sensitization in the recurrent vesicular type might be the female preponderance in this type, as women are more often exposed to nickel in, for example, jewellery. However, even after correction for age and gender, nickel sensitization was significantly more present in patients with vesicular hand eczema compared to the group of other types of hand eczema in our study. The metals nickel sulphate, potassium dichromate and cobalt chloride are known to give concomitant positive patch test results.²⁰

Compositae mix is a combination of chemicals from different plants. Paulsen *et al.* describe a subgroup of patients with compositae dermatitis,²¹ which suffered from vesicular hand eczema.

Mercapto mix is a mixture of three curing additives used as accelerators in the manufacture of, for example, rubber gloves. A typical feature of allergic contact dermatitis to rubber additives in hand eczema is the localization of eczema on the dorsal side of the hand and fingers and on the flexor or extensor surfaces of the forearms, not extending to the area outside glove contact. In this study, we found an association between sensitization to mercapto mix and recurrent vesicular hand eczema; however,

vesicular eczema was defined as recurrent vesicles on the palms and/or sides/palmar aspects of the fingers. Other sources than rubber gloves such as glues, cutting oils, household products and sports equipment made with natural rubber should be considered. A clinical relevant association between contact allergy to mercapto mix and recurrent vesicular hand eczema remains unclear.

Agner *et al.* found no significant association between hand eczema subgroups, i.e. vesicular and hyperkeratotic hand eczema and specific allergens or allergen groups including nickel sulphate, potassium dichromate, cobalt chloride, compositae mix and mercapto mix.¹² Again, no definitions for vesicular and hyperkeratotic hand eczema were given which makes these results hard to compare.

In our study, subjects with pulpitis were more often sensitized for (meth)acrylates compared to subjects without pulpitis, although the additional (meth)acrylate series was also more often patch tested in subjects with pulpitis and this group was relatively small ($n = 63$).

Frequent sensitizers in all hand eczema patients

Metals, fragrances and preservatives are important sensitizers in the general patch test population.^{22,23} As shown in Table 2, the frequent sensitizers in our cohort of hand eczema patients are comparable to the general patch test population.

Nickel sulphate is a well-known sensitizer in the European Baseline series with a prevalence between 11.9% and 27.4% in European countries.²² We found a similar sensitization rate of 18.8% in subjects with hand eczema. The prevalence of the second most frequent found allergen, the preservative MCI/MI, is much higher in our hand eczema cohort than in the most recent publication on the general European patch test population (1%–4% vs. 9.2%). Although this low rate of MCI/MI sensitizations dates from 2007 to 2008, while methylisothiazoline (MI) is an upcoming allergen which underwent an alarming increase over the last years.²⁴ Our results support the fact that the use of MCI and MI should be restricted further to stop this epidemic.

A few studies primarily focused on specific contact allergens in hand eczema patients.^{6,12,25,26} Overall all the results were comparable with our findings with nickel sulphate, cobalt chloride and potassium dichromate as major allergens in the metal groups. Fragrances are important sensitizers, with fragrance mix II as upcoming allergen mix. Since the fragrance mix II was introduced in our standard series in 2005, it is remarkable that the fragrance mix II gained the seventh position in our overall list of frequent sensitizers.

Limitations of the study

The major limitation of this study is its retrospective nature. Although we included a large population and were able to classify 1395 of the 1571 subjects in one of the six clinical types of hand eczema, despite this retrospective approach. This may be

attributed to the detailed medical records in our hospital and the newly developed flow chart, which facilitated the retrospective classification and the reproducibility of our results.

Due to the retrospective nature of the study, it was for each sensitization not possible to retrieve the clinical relevance to the hand eczema.

One of the difficulties we encountered was the classification of chronic fissured hand eczema. When closely studying the definition of this subtype, the group can be very divers. Although the DCDG classification is very clear, we would like to recommend fine tuning of the chronic fissured type.

The subjects in our study were drawn from a tertiary hospital population. This might have resulted in more severe cases of hand eczema, in which a higher prevalence of sensitizations may be present. In our centre, various additional series are available such as a hairdresser's series or a bakery series. Since this might result in more positive reactions and more cases of polysensitization, we therefore mainly focused on the European Baseline series.

Some type of selection bias might have occurred, since physicians might have been more prone to patch test vesicular types of hand eczema. Subjects with hyperkeratotic palmar eczema might have been less frequently patch tested, which might explain the predominance of recurrent vesicular hand eczema ($n = 623$) in our study population and the relatively small number of hyperkeratotic palmar eczemas. However, the prospective study of Johansen *et al.* found a similar ratio between recurrent vesicular and hyperkeratotic palmar eczema.⁴ Overall, our findings are in line with the study of Johansen, but add additional insight into specific contact allergens.

Conclusion

Subjects with recurrent vesicular hand eczema are more likely to have positive patch test reactions to the European Baseline series compared to other types of hand eczema. Therefore, all subjects with recurrent vesicular hand eczema should be patch tested, especially women of older age, in the diagnostic work up of hand eczema. Moreover, we opine that a diagnostic patch test in males with hyperkeratotic palmar eczema might be less imperative.

The newly developed flow chart contributes to the classification of clinical types and increases the reproducibility of the results. However, there is an urgent need for consensus regarding a single classification system of hand eczema in which the guidelines of the DCDG could be the foundation.

Author contributions

All authors have participated sufficiently to take public responsibility for appropriate portions of the work.

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