

Common contact sensitizers in the Czech Republic. Patch test results in 12,058 patients with suspected contact dermatitis*

A. MACHOVCOVA¹, E. DASTYCHOVA², D. KOSTALOVA³, A. VOJTECHOVSKA⁴, J. RESLOVA⁵, D. SMEJKALOVA⁶, J. VANECKOVA⁷
AND A. VOCILKOVA⁸

¹Department of Dermatology, Faculty Hospital Motol, Praha 5, ²Department of Dermatology, Masaryk University, Brno, ³Department of Dermatology, Charles University, Plzen, ⁴Department of Dermatology, Faculty Hospital, Ostrava, ⁵Department of Dermatology, Masaryk Hospital, Usti nad Labem, ⁶Department of Dermatology, České Budejovice, ⁷Department of Dermatology, Faculty Hospital, Hradec Kralove, and ⁸Department of Dermatology, Praha, Czech Republic

The patch test results of 12 058 patients (4416 male and 7642 female) referred to 9 clinics in the Czech Republic between January 1997 and December 2001 were evaluated. Patients were tested with the same series of allergens by using the standardized patch testing method. The current standard tool for diagnosing allergic contact dermatitis (ACD) in the Czech Republic is the Trolab[®] test panel (Hermal, Reinbeck, Germany) which consists of 23 allergens. Only a few data exists on ACD in the Czech Republic. All patients were tested with the 23 allergen European standard series. Of these patients, 7661 (63.5%) had 1 or more positive reactions. On average, there were 2.8 positive reactions per patient. ACD, according to clinical relevance, was diagnosed in 5339 (69.7%) of these patients. The most frequent allergens were metals (22.9%), especially nickel sulfate (13.8%), and followed by Myroxylon pereirae resin (balsam of Peru) (7.3%), fragrance mix (5.8%), formaldehyde (4.2%) and lanolin alcohol (3.0%). Our results were compared with results from other countries. We conclude that the European standard series is suitable for detection of ACD in the Czech Republic.

Key words: allergic contact dermatitis; European standard series; most common allergens, patch testing. © Blackwell Munksgaard, 2005.

Accepted for publication 2 June 2005

Allergic contact dermatitis (ACD) accounts from 4% to 7% and in some studies from 6.3% to 10.6%, of all dermatological disorders (1). For the diagnosis of ACD, patch testing is the preferred routine standardized procedure. The history and examination of a patient with suspected ACD will usually give clues to possible sensitizers (2). Patch testing allows the identification of the causative allergen, so that it can be avoided or eradicated in the patient's environment. Positive reactions can be influenced by many factors (sex, age, atopy, occupation, etc.) (3). Patch testing with standard test series usually detects between 70% and 80% of all contact allergies (4).

Our study aimed to find out the most common contact sensitizers in the Czech Republic, in order to determine the suitability of the European standard series for our patients. The standardized patch test

series has been available in the Czech Republic since 1994 (4).

Patients and Methods

Over a period of 5 years (1997–2001), 12 058 patients (7642 female and 4416 male; female : male ratio is 2 : 1; mean age 41.7 ± 12.6 years and age range is 6–75 years) were patch tested by 9 dermatologists associated with the Czech Contact Dermatitis Group. Patch testing was performed in patients presenting with skin manifestations possibly related to contact dermatitis. A detailed history, careful examination of the patient's skin disease and suspected allergens were recorded.

Substances

From January 1997 to December 2001, the same European standard test series (ESS) was used on all patients. The allergens were obtained from Trolab[®] (Hermal, Reinbeck, Germany) and comprised 23 tests. The allergens were applied using Curatest[®] (Lohmann & Rauscher, Rengsdorf, Germany) or Leukotest[®] (Beiersdorf, Hamburg, Germany).

Patch testing

Patch tests were applied to a dermatitis-free area on the patients' upper backs. The patient was subsequently instructed to keep the test area dry and to return in 2 days. The patches were removed, and the initial reading was performed at day (D) 2. The final interpretation was performed the next day (D3), the better to assess irritant reactions, possible delayed reactions and false-positive reactions. All test results were read by the same respective dermatologist. Test sites were evaluated according to the criteria of the International Contact Dermatitis Research Group (ICDRG). Results were recorded as negative, doubtful, and +, ++, +++, for weak, moderate and strong, respectively (1). After patch testing, the clinical relevance of the positive patch test reactions were evaluated.

Results

In about 12 058 patients, 7642 female (63.4%) and 4416 male (36.6%), were patch tested with 23 allergens. The average age of the patients was 41.7 years (range: 6–75 years). Of these patients, 7661 (63.5%) had at least 1 positive allergic reaction. On average, there were 2.8 positive reactions per patient. The distribution of sensitization to the allergens is summarized in Table 1. Positive reactions were noted to all allergens in the ESS.

Occupational contact dermatitis was diagnosed in 2335 patients (19.4%), most of these being construction workers and metal workers (55.2%) who showed relevant sensitizations to metals and thiuram mix. Hospital workers (18.6%) and hairdressers followed next. Hospital workers were most frequently sensitized to thiuram mix from rubber gloves.

About 3183 patients (26.4%) were assessed as atopic, comprising 2062 (17.1%) patients with atopic dermatitis, 280 with atopic skin diathesis and 841 patients with mucosal atopy.

The most frequently reported clinical diagnosis was dermatitis (91.8%), especially ACD (51.3%), irritant contact dermatitis (21.7%), atopic

dermatitis (17.1%) and other dermatitis (9.9%). 8.2% patients (989 patients), however, were tested for other skin diseases, especially pruritus without evidence of specific lesions. The dermatitis was mainly localized on the hands (48.3%), followed by the face and neck (18.1%), legs (16.3%) and other sites (17.3%).

The most frequent allergens were metals (22.9%), e.g. nickel sulfate, potassium dichromate and cobalt chloride. The most common allergen was nickel sulfate (13.8%) followed by balsam of Peru in 7.3% and fragrance mix (FM) in 5.8%. These allergens were followed in order of frequency by cobalt chloride (5.2%), formaldehyde (4.2%), potassium dichromate (4.0%), colophonium (2.9%), lanolin alcohol (3.0%) and thiuram mix (2.1%). Reactions to other allergens were less than 2.0%.

Current clinical relevance was most frequently seen with nickel sulfate (71.2%), epoxy resin (58.3%) and potassium dichromate (53.1%), whereas the rate was low for *p*-tert-butylphenol-formaldehyde resin (16.4%).

Nickel sulfate (19.0%) was the most common allergen in women, followed by balsam of Peru (7.8%) and FM (6.8%). In men, balsam of Peru (6.3%) and potassium dichromate (5.9%) were the most frequent sensitizers, followed by nickel sulfate (4.7%) and cobalt chloride (3.6%).

The MOAHLFA index in percentage was—male sex: 16.6, occupational causation of dermatitis: 19.4, atopy: 26.4, hand dermatitis: 48.3, leg dermatitis: 16.3, face dermatitis: 18.1, 46.3 (5).

Discussion

Nickel sulfate was the most common allergen in our study (13.8%), reflecting the German study incidence (15.5%) (6), our previous study (14.8%) (4) and other national studies (7–9). The pattern of nickel contact sensitivity in our country differs from some centres (10–18). In most of these centres (7, 9, 10, 13, 14, 17, 18, 19), when the ESS or similar series have been used for patch testing, nickel sulfate has been the most common allergen, whereas it was the 2nd most common allergen in Delhi, India and in Hong Kong (8, 11, 15) (Table 2). Nickel allergy was observed significantly more frequently among women, which corresponds to previous reports (4, 6). Nickel is a typical sensitizer in female populations. The vast majority of nickel-allergic women are sensitized through ear piercing with cheap jewellery, often in childhood. In addition, body piercing has become a widely popular fashion. The EU Nickel Directive (20)

Table 1. Patch test result

Chemical (concentration percentage and vehicle)	Number of positive patch tests					
	Total (<i>n</i> = 12 058)		Men (<i>n</i> = 4416)		Women (<i>n</i> = 7642)	
	Number	%	Number	%	Number	%
Potassium dichromate (0.5, pet.)	477	3.95	262	5.93	215	2.81
Neomycin sulfate (20, pet.)	234	1.94	63	1.00	171	2.23
Thiuram mix (1, pet.)	255	2.11	71	1.60	184	2.40
Para-phenylenediamine free base (1, pet.)	242	2.00	75	1.69	167	2.18
Cobalt chloride (1, pet.)	630	5.22	160	3.62	469	6.13
Benzocaine (5, pet.)	57	0.47	20	0.45	37	0.48
Formaldehyde (1, aq.)	501	4.15	139	3.14	362	4.73
Colophonium (20, pet.)	346	2.86	106	2.40	234	3.06
Clioquinol (5, pet.)	69	0.57	21	0.47	48	0.62
Balsam of Peru (25, pet.)	878	7.28	280	6.34	598	7.82
<i>N</i> -Isopropyl- <i>N</i> -phenyl para-phenylenediamine (0.1, pet.)	236	1.95	147	3.32	89	1.16
Lanolin alcohol (30, pet.)	360	2.98	138	3.12	232	3.03
Mercapto mix (1, pet.)	98	0.81	42	0.95	56	0.73
Epoxy resin (1, pet.)	232	1.92	108	2.44	135	1.76
Paraben mix (16, pet.)	158	1.31	52	1.17	106	1.38
Paratertiarybutyl phenol-formaldehyde resin (1, pet.)	65	0.53	19	0.43	46	0.60
Fragrance mix (8, pet.)	697	5.78	180	4.07	517	6.76
Quarternium-15 (1, pet.)	82	0.68	24	0.54	58	0.75
Nickel sulfate (5, pet.)	1659	13.75	206	4.66	1453	19.01
5-Chloro-2-methyl-4-isothiazolin-3-one + 2-Methyl-4-isothiazolin-3-one [3 : 1 in water (0.01, aq.)]	174	1.44	54	1.22	120	1.57
Mercaptobenzothizole (2, pet.)	115	0.95	69	1.56	46	0.60
Sesquiterpene lactone mix (0.1, pet.)	63	0.52	24	0.54	39	0.51
Primin (0.01, pet.)	33	0.27	10	0.22	23	0.30

aq. = aqua; pet. = petrolatum.

limits nickel in some types of products. In the Czech Republic, we have an official announcement which like the Nickel Directive in the EU, defines the amount of nickel and free nickel in metal objects coming into contact with skin and mucous membranes. Nevertheless, especially some types of costume jewellery and fancy goods release nickel more than 44 times, or have a content of nickel more than 56 times, above this amount (21, oral information from Glass Institute, Hradec Kralove).

Multiple positive patch test reactions to metals like nickel sulfate, cobalt chloride and potassium dichromate are a well-known finding (9, 11, 17).

Metal instruments are usually made of various alloys of these metals, so that considerable contact with nickel, for example, implies correspondingly heavy contact with other metals. In our study, metals (nickel sulfate, potassium dichromate and cobalt chloride) in the ESS were the most frequent allergens (22.9%), but this was lower than in the study by Serra-Baldrich (17).

Potassium dichromate (4.0%) was the 6th most frequent sensitizer in our study, while it ranked 1st (8, 10) or 2nd in all other centres (Table 2). In our study, potassium dichromate was the 2nd most common allergen in men (5.9%) to produce a positive reaction on patch testing, surpassing

Table 2. Common allergens (%) in different countries

Chemical (concentration percentage and vehicle)		Country/City							
		UAE (7)	India (11)	Turkey	Kong (14)	Hong (15)	USA (9)	Delhi (8)	Germany (18)
1	Nickel sulfate (5, pet.)	15.0	16.5	19.1		16.4	14.3	12.0	9.2
2	Potassium dichromate (0.5, pet.)	7.2	20.5	11.8		—	2.0	16.0	4.3
3	Cobalt chloride (1, pet.)	6.4	8.0	8.5		11.3	8.3	—	4.7
4	Fragrance mix (8, pet.)	8.0	7.5	5.5		19.3	14.0	—	8.9
5	Balsam of Peru (25, pet.)	4.0	1.5	2.0		—	10.4	—	6.3
6	Formaldehyde (1, aq.)	2.9	6.5	0.6		—	9.2	—	—
7	Lanolin alcohol (30, pet.)	2.4	4.0	0.7		—	3.3	—	4.3
8	Colophonium (20, pet.)	4.8	5.5	1.3		—	2.6	—	—

aq. = aqua ; pet. = petrolatum.

even nickel (4, 8). In the Czech population, especially in men, allergy to chromium is related not only to the cement and construction industry. Another significant source of exposure to chromium is leather products and there are other sources too. Cement is the major cause of chromium dermatitis. In the Czech Republic, the content of water-soluble chromate in bagged, and bulk cement has recently been regulated and is now not more than 2 p.p.m. (from January 2005, according to a EU Directive). Ferrous sulfate has been added to cement to achieve this (20, 21). The incidence of chromate sensitivity (4.0%) is similar to our previous study (4.4%) (4) and is rather lower, especially in women, in comparison with the other centres ranging between 7.2% and 20.5% (7, 11, 14). In Delhi (8) and elsewhere in India (11), chromate sensitivity was the most common contact allergy (16.0% and 20%, respectively).

Balsam of Peru was the 2nd most common allergen in our patients. Small sex differences (male 6.3% and female 7.8%) were recorded in contact sensitivity to balsam of Peru. The incidence of balsam of Peru sensitivity in our study is higher (7.3%) than in other studies, but it is lower than in our previous study (8.4%) (4). It has given positive reactions from 1.5% (11) to 5.4% (7, 14, 19). Balsam of Peru is a marker for perfume allergy. The high incidence is attributed to widespread use of perfumes in cosmetics, topical preparations and household products. The frequency of contact allergy to FM was 5.8%. The rate decreased in both female and male patients during the observation time period and was obtained in 4.1% of males and 6.8% of females when comparing 1994 and our study. Decreased sensitization to FM (5.8% versus 13.4%) (4) and to some of the cosmetic preservatives, in particular quaternium-15 (0.8% versus 1.3%), Kathon CG (1.6% versus 2.0%) and parabens (1.4% versus 5.7%) is a striking finding when compared with other studies (Table 2). FM gave positive patch test reactions in 11.8% of the North American Contact Dermatitis Group (NACDG) patients (9). FM detects about $\frac{3}{4}$ of patients with fragrance sensitivity, balsam of Peru detecting about $\frac{1}{2}$ (22).

We found that 3.1% of males and 4.7% of females (4.2% of all patients) were allergic to formaldehyde. The trend of contact allergy to formaldehyde is rising, but it is not as high as in the study of NACDG patients. About 9.3% of the patch test clinic patients from the NACDG had positive reactions to formaldehyde, and this was 6th of the 12 most frequent allergens to cause positive reactions (22). Exposure to formaldehyde in our country is especially from cosmetics

(shampoos, preservatives and anti-perspirants), cleaning products, household products, industrial sources and other sources.

The allergens with the lowest positive rates in the ESS were benzocaine (0.5%), clioquinol (0.6%), phenol-formaldehyde resin (0.5%), sesquiterpene lactone mix (0.5%), primin (0.3%) and mercapto mix (0.8%).

Among our patients with positive responses to the allergens of the ESS, 69.7% of such responses were considered of present or past relevance.

Conclusion

Standard series are widely used as a primary screening for the diagnosis of contact dermatitis. In our study, we have recorded new data on ACD and its responsible allergens in the Czech population. The ESS is suitable for the detection of ACD in the Czech Republic.

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Address:

Alena Machovcova, MD
Department of Dermatology, Faculty Hospital Motol
V Uvalu 84
150 06 Prague 5
Czech Republic
Tel: + 420 2 2443 8752
Fax: + 420 2 2443 8720
e-mail: alena.machovcova@fnmotol.cz