

Unexpected sensitization routes and general frequency of contact allergies in an elderly stented Swedish population

SVEDMAN CECILIA¹, EKQVIST SUSANNE¹, MÖLLER HALVOR², BJÖRK JONAS³, GRUVBERGER BIRGITTA¹,
HOLMSTRÖM EVA² AND BRUZE MAGNUS¹

¹Department of Occupational and Environmental Dermatology, University Hospital MAS, Malmö, Lund University, ²Department of Dermatology, University Hospital MAS, Malmö, Lund University, and

³Competence Centre for Clinical Research, Lund University Hospital, Lund, Sweden

Contact allergy to stent material has been proposed to be a risk factor for restenosis, after percutaneous transluminal coronary angioplasty (PTCA) and stenting. Information on the general frequency of contact allergy in the elderly population is scarce and knowledge of possible sensitization routes is important to investigate. The aim of this study was to investigate contact allergy to stent materials and other allergens. Here we report our findings on the frequency of contact allergies apart from those from stent material. In this retrospective study, we patch tested an elderly population, treated with PTCA and stented, with our standard series. A dermatitis population served as controls. We found a high frequency of contact allergy in both groups but a greater 'contact allergy burden', with generally higher frequencies for contact allergens, in the dermatitis patients as expected. *Myroxylon pereirae* and caine mix were apart from metals exceptions with statistically significant higher frequencies ($P < 0.01$) for the stented patients. Contact allergy to nonmetal sensitizers is common in an elderly Swedish stent population although, on the whole, substantially less than in an age and sex-matched dermatitis population. The findings indicate the importance of the oral mucosa for sensitization. In a general population that has been treated with a special medication/treatment procedure, contact allergies not suspected (such as to *M. pereirae* and to the metals) might suddenly peak. This underlines the importance of a careful evaluation of new products and routines with regard to contact allergies in the population.

Key words: contact allergy; dental restoration; elderly; *Myroxylon pereirae*; stent. © Blackwell Munksgaard, 2007.

Accepted for publication 28 January 2007

The patients in this research project participated in a retrospective study where the frequency of contact allergy to stent material and the frequency of restenosis were studied. All the patients had arteriosclerosis and had been treated with percutaneous transluminal coronary angioplasty (PTCA) and stented with metal stents. Recently, metal stents have been suspected to induce contact allergy to metals and metal ions released from metal stents in those hypersensitive to the metal have been suggested to possibly be a risk factor for in-stent restenosis (1, 2). Within the project, a control material was needed to enable comparison with a sex- and age-matched population. For practical reasons, a dermatitis population was chosen. The stent patients (SP) and dermatitis controls (DC) were epicutaneously tested with our

standard series as well as with metals used in the stent material. The decision to test the patients with the whole standard series was based on the presumption that the DC should have higher frequencies of contact allergies in general and possibly also against metals. This might have an impact on the analysis, e.g. the same contact allergy rates to metals in the SP and the DC may indicate a stent-related induction of contact allergy to metal in case the 'contact allergy burden' with regard to nonmetal sensitizers was significantly higher in the DC. When analysing the data, several interesting facts were found apart from the initial aims of the study (3, 4, 5) and therefore this report was written.

Most information on the prevalence of contact allergies is derived from information from patch

testing patients with dermatitis. Extrapolation of the pattern of contact sensitization to the general population is therefore difficult. In different age groups, the contact allergy patterns will differ (6) as will the frequencies. For the elderly, there are only few data collected on the frequency of contact allergies in a non-dermatitis population (6–9). We found several differences when comparing our 2 populations and also results indicating the importance of investigating all possible sensitization routes.

Material and Method

Experimental design

The SP had been treated at the Department of Thoracic Surgery, Blekinge Hospital, Karlskrona. The hospital has a large referral area and therefore the patients were epicutaneously tested in the hospitals of Ljungby, Växjö, Karlskrona, Karlshamn and in the Department of Occupational and Environmental Dermatology in Malmö from November 2003 to May 2004. The DC were all tested in Malmö. A detailed description of the study design is given elsewhere (3).

Patients

Stent patients. 715 consecutive patients PTCA-treated and stented during 1997–2002 were asked to participate. With the invitation to participate in the study, a questionnaire was sent out with questions regarding exposure to gold and nicotine habits.

628 (87.9%) patients agreed to participate in the study. Of these, 144 (22.9%) patients agreed to answer only the questionnaire and 484 (77.1%)(SP) answered the questionnaire and underwent the clinical investigation.

The SP who agreed to undergo clinical investigation consisted of 103 (21.2%) women and 381 (78.8%) men. The mean age was 67.7 years (range 42–89).

The SP had been treated with 2 stent types (manufactured by Medinol Ltd, Jerusalem, Israel), made of stainless steel (316L) but where one was gold plated (99.9% gold) (3).

Dermatitis controls. 447 patients served as age- and sex-matched controls (women:men 103:344; DC). These being part of a patch tested population referred for suspected allergic contact dermatitis between 1995 and 2004 to the Department of Dermatology and the Department of Occupational and Environmental Dermatology.

Clinical investigation

At the first visit, the SP answered questions regarding their medical history, whether they had

any skin diseases and any known allergies. In the information about allergy, no difference was made between allergy type I or IV, and in some cases, the patients also included general hypersensitivity reactions.

Prior to the epicutaneous testing, venous blood was drawn and the SP then underwent testing with our standard series, which is equivalent to the European standard series (ESS) (10) supplemented with test preparations representing metals [for detailed description see Ekqvist et al (3)], preservatives, plastics, fragrances, and corticosteroids.

The test technique used was IQ Chamber[®] (side 9 mm; Chemotechnique Diagnostics, Vellinge, Sweden; 20 µl on each patch unit for liquid preparations, 25 mg/cm²) attached to Scanpor[®] (Norgesplaster, Vennesla, Norway) tape. The patch tests were removed from the back after 2 days, and readings according to International Contact Dermatitis Research Group (ICDRG) guidelines (10) were recorded on day 3 (D3) and D7 (3).

The controls had been tested with the same series as above. The test technique used in the control group was the traditional technique used in our laboratory, Finn Chamber[®] (diameter 8 mm; Epitest Ltd, Oy, Finland) on Scanpor[®] (Norgeplaster, Vennesla, Norway; 15 µl on each patch unit for liquid preparations, 30 mg/cm²). The 2 different test techniques were chosen for practical reasons and have been found equivalent in regular use (unpublished observation from our department).

Ethics

The study was approved by the Ethics Committee of the Faculty of Medicine, Lund University. The SP gave written informed consent to the study.

Statistics

The statistical analyses were conducted using SPSS release 12.0.1 (SPSS Inc., Chicago, IL, USA). $P < 0.05$ was considered to be statistically significant. In order to investigate the possible difference in 'contact allergy burden' between the 2 groups, 2 principally different methods were used. Firstly, systematic differences between the 2 groups, the SP and the DC, with respect to the number of positive contact allergic reactions recorded for each patient were tested using the Mann–Whitney *U*-test. Secondly, differences in the prevalence of contact allergies in general between the SP and the DC were investigated by calculating the Z-score for the patient–control difference in prevalence for 33 contact allergens (metals excluded). A Z-score above 1 in any direction was considered as a marked difference in

prevalence. The difference in the proportions of marked positive (higher prevalence among SP) and marked negative Z-scores (higher prevalence among DC) was tested using McNemar's test for correlated proportions. Differences in the prevalence of single contact allergies between patients and controls were investigated using Fisher's exact test. This test was also used to study the relation between contact allergy, sex, and dental gold within the group of SP. Significant associations with dental gold were investigated further using logistic regression and controlling for age as continuous covariate and sex.

Results

The questionnaire and medical history

Among SP (484) there were 34 patients who had psoriasis or a history of psoriasis. 55 had a history of eczema at various locations, and of these, 13 had, or had a history of, hand eczema only. Other dermatoses reported by the SP were: pustulosis palmoplantaris ($n = 2$), dermatitis herpetiformis ($n = 1$) and lichen planus ($n = 1$). Among the SP, 302 (60.4%) reported of dental gold restorations.

Dermatitis controls

The DC had been referred for suspected contact dermatitis. The main reason for referral was hand eczema. The frequency of dental gold restorations in this group is not known.

Patch test results

The contact allergies found are given in Table 1. Contact allergies to metals are reported in detail elsewhere (3), but in order to enable comparison, the figures are also included in Table 1. At least 1 contact allergy was shown in 279 (57.6%) SP and 238 (53.2%) DC, including contact allergy to metals. When disregarding the allergy to metals, the numbers were 174 (35.9%) and 170 (38.0%), respectively.

When comparing the patients with regard to how many positive reactions they had, there was no statistically significant difference between the 2 groups (Table 1, $P > 0.30$; Mann–Whitney U -test). Among the 33 nonmetal sensitizers, there were marked differences that were generally such that the controls had higher prevalence than the patients. Among the 21 differences that were marked, 17 were such that the controls had higher prevalence than the patients ($P = 0.007$, McNemar's test for correlated proportions).

The only statistically significant differences where the frequencies were higher among SP,

not considering metals, were *Myroxylon pereirae* (balsam of Peru) [74/484 (15.3%) versus 44/447 (9.8%); $P = 0.01$; Fisher's exact test] and caine mix [32/484 (6.6%) versus 11/447 (2.5%) $P = 0.003$; Fisher's exact test].

With *M. pereirae*, the most common contact allergen in both the stented and the control population, there was also a difference between men and women in the stented population, 13.4% (51/381) men and 22.3% (23/103) women ($P = 0.03$; Fisher's exact test), a difference not found among DC [8.4% (29/344) men, 14.6% (15/103) women, $P = 0.088$]. Among SP, the prevalence of contact allergy to *M. pereirae* was positively associated with dental gold [53/288 (18.4%) versus 18/174 (10.3%); $P = 0.02$; Fisher's exact test]. This association did not change noticeably when adjusting for age and sex using logistic regression (odds ratio: 1.9, 95% confidence interval: 1.1–3.5; $P = 0.02$). For caine mix, no association with dental gold was discerned within the group of SP ($P > 0.30$; Fisher's exact test).

Discussion

A high frequency of contact allergies was found in the SP as well as among the DC. Considering all tested substances, thus including the metals, 57.6% of the SP had at least 1 positive reaction. The corresponding figure for the DC was 53.2%. In the SP, the number of individuals with at least 1 positive reaction, not including metals, was 35.9%, whereas among the controls the number was 38.0%. Most contact allergy rates were lower in the SP compared to the controls. However, interestingly, the contact allergy rates to caine mix and *M. pereirae* were statistically significantly higher among the SP. The SP are, from a cardiological point of view, highly selected because everyone had been treated with PTCA and stented, thus exposed to metals. Among the SP, a high frequency of metal allergies, especially to gold, was shown. Also a different pattern in frequency of contact allergy to nickel sulfate, palladium chloride, cobalt chloride, and potassium dichromate was found between the 2 groups (3). The metal contact allergies have thus been reported elsewhere (3).

Although the patients were cardiological patients they did have several skin diagnoses. Still, the SP can be regarded as a general population from a dermatological point of view because skin diseases within the community at large are frequent.

The controls had actively consulted a general practitioner, often even a dermatologist, for their skin disease and had been referred to the

Table 1. Number and frequency of positive patch tests in 484 SP (381 men, 103 women) and 447 DC (344 men; 103 women) by allergen and sex (M, men; W, women)

Patch test preparation/ concentration/vehicle	DC, n (%)			SP, n (%)			P-values, DC versus SP		
	M	W	All	M	W	All	M	W	All
Amerchol L 101, 100.0%	6 (1.7)	1 (1.0)	7 (1.6)	9 (2.4)	3 (2.9)	12 (2.5)	>0.3	>0.3	>0.3
Benzocaine 5.0% pet.	2 (0.6)	1 (1.0)	3 (0.7)	2 (0.5)	0	2 (4.1)	>0.3	>0.3	>0.3
Bisphenol-F-resin, 0.5% pet.	3 (0.9)	3 (2.9)	6 (1.3)	5 (1.3)	1 (1.0)	6 (1.2)	>0.3	>0.3	>0.3
Black rubber mix, 3 × 0.2% pet.	2 (0.6)	1 (1.0)	3 (0.7)	0	0	0	0.2	>0.3	0.1
Budesonide 0.01% pet.	0	1 (1.0)	1 (0.2)	2 (0.5)	0	2 (0.4)	>0.3	>0.3	>0.3
4-tert-butyl phenol-formaldehyde resin 1.0% pet.	3 (0.9)	1 (1.0)	4 (0.9)	4 (1.0)	1 (1.0)	5 (1.0)	>0.3	>0.3	>0.3
Caine mix 2 × 2.5% + 5.0% pet.	7 (2.0)	4 (3.9)	11 (2.5)	21 (5.5)	11 (10.7)	32 (6.6)	0.02	0.1	0.003
Cl+Me-isothiazolinone,KathonCG, 0.02% aq.	9 (2.6)	2 (1.9)	11 (2.5)	1 (0.3)	0	1 (0.2)	0.008	>0.3	0.002
Colophony 20.0% pet.	15 (4.4)	4 (3.9)	19 (4.3)	4 (1.0)	3 (2.9)	7 (1.4)	0.009	>0.3	0.02
2,5-diazolidinyl-urea 2% aq.	6 (1.7)	1 (1.0)	7 (1.6)	3 (0.8)	0	3 (0.6)	0.2	>0.3	0.2
Epoxy resin 1.0% pet.	8 (2.3)	4 (3.9)	12 (2.7)	7 (1.8)	1 (1.0)	8 (1.7)	>0.3	>0.3	>0.3
Ethylenediamine dihydrochloride 1.0% pet.	7 (2.0)	1 (1.0)	8 (1.8)	2 (0.5)	1 (1.0)	3 (0.6)	0.1	>0.3	0.1
Fragrance mix 8 × 1.0% pet.	23 (6.7)	13 (13)	36 (8.1)	19 (5.0)	5 (4.9)	24 (4.9)	0.3	0.08	0.06
Formaldehyde 1.0% aq.	9 (2.6)	1 (1.0)	10 (2.2)	2 (0.5)	2 (1.9)	4 (0.8)	0.03	>0.3	0.1
Imidazolidinylurea 2.0% aq.	6 (1.7)	1 (1.0)	7 (1.6)	2 (0.5)	0	2 (0.4)	0.2	>0.3	0.1
Lichen acid mix 3 × 0.1% pet.	6 (1.7)	2 (1.9)	8 (1.8)	8 (2.1)	2 (1.9)	10 (2.1)	>0.3	>0.3	>0.3
Lyril 5.0% pet.	2 (0.6)	1 (1.0)	3 (0.7)	2 (0.5)	1 (1.0)	3 (0.6)	>0.3	>0.3	>0.3
Methyldibromoglutaronitrile 0.5% pet.	12 (3.5)	4 (3.9)	16 (3.6)	9 (2.4)	3 (2.9)	12 (2.5)	>0.3	>0.3	>0.3
Mercaptomix 4 × 0.5% pet.	0	0	0	2 (0.5)	0	2 (0.4)	>0.3	>0.3	>0.3
Mercaptobenzothiazole 2.0% pet.	1 (0.3)	1 (1.0)	2 (0.4)	2 (0.5)	1 (1.0)	3 (0.6)	0.2	>0.3	>0.3
Myroxylon pereirae 25.0% pet.	29 (8.4)	15 (14.6)	44 (9.8)	51 (13.4)	23 (22.3)	74 (15.3)	0.04	0.2	0.01
Neomycin sulfate 20.0% pet.	9 (2.6)	8 (7.8)	17 (3.8)	3 (0.8)	0	3 (0.6)	0.08	0.007	0.001
Primin 0.01% pet.	0	2 (1.9)	2 (0.4)	1 (0.3)	4 (3.9)	5 (1.0)	>0.3	>0.3	>0.3
Sesquiterpene lactone mix 0.1% pet.	5 (1.5)	1 (1.0)	6 (1.3)	0	0	0	0.02	>0.3	>0.3
Tixocortol-21-pivalate 0.1% pet.	7 (2)	2 (1.9)	9 (2.0)	1 (0.3)	0	1 (0.2)	0.03	>0.3	>0.3
Thimerosal 0.1% pet.	12 (3.5)	4 (3.9)	16 (3.6)	20 (5.2)	2 (1.9)	22 (4.5)	>0.3	>0.3	>0.3
Thiuram mix 4 × 0.25% pet.	6 (1.7)	2 (1.9)	8 (1.8)	8 (2.1)	2 (1.9)	10 (2.1)	>0.3	>0.3	>0.3
Toluenesulfonamide formaldehyde resin 10.0% pet.	1 (0.3)	1 (1.0)	2 (0.4)	0	0	0	>0.3	>0.3	0.2
Paraben mix 5 × 3.0% pet.	0	1 (1.0)	1 (0.2)	4 (1.0)	0	4 (0.8)	0.1	>0.3	0.4
PFR 2, phenol-formaldehyde resin 1.0% pet.	8 (2.3)	1 (1.0)	9 (2.0)	0	1 (1.0)	1 (0.2)	0.002	>0.3	>0.3
4-phenylenediamine base 0.25% pet.	4 (1.2)	4 (3.9)	8 (1.8)	0	0	0	0.05	0.1	0.003
Quinoline mix 2 × 3.0% pet.	5 (1.5)	1 (0.8)	6 (1.3)	0	1 (1.0)	1 (0.2)	0.02	>0.3	0.06
Quaternium 15 1.0% pet.	2 (0.6)	2 (1.9)	4 (0.9)	0	0	0	>0.3	>0.3	>0.3
Metals									
Nickel sulfate 5.0% pet.	19 (5.5)	21 (20.4)	40 (8.9)	22 (5.8)	30 (29.1)	52 (10.7)	>0.3	0.2	>0.3
Palladium chloride 2.0% pet.	5 (1.5)	8 (7.8)	13 (2.9)	4 (1.0)	13 (12.9)	17 (3.5)	>0.3	>0.3	>0.3
Potassium dichromate 0.5% pet.	24 (7.0)	8 (7.8)	32 (7.2)	15 (3.9)	3 (2.9)	18 (3.7)	0.2	0.2	0.03
Gold sodium thiosulfate 2% pet.	58 (16.9)	27 (26.2)	85 (19)	106 (27.8)	44 (42.7)	150 (31.0)	<0.001	0.002	<0.001
Cobalt chloride 0.5% pet.	19 (5.5)	3 (2.9)	22 (4.9)	5 (1.3)	5 (4.9)	10 (2.1)	0.002	>0.3	0.02
Total number of allergies	340	158	498	346	163	509	>0.3	>0.3	>0.3

SP, stented patients; DC, dermatitis controls; n, number; pet., petrolatum.

Department of Occupational and Environmental Dermatology and Department of Dermatology for evaluation of a possible contact allergy and therefore, higher frequencies of contact allergy might be expected.

The statistically significantly higher 'contact allergy burden' in the DC, as compared to the SP, as shown by calculating the Z-score for the patient-control difference in prevalence for contact allergens (metals excluded) was thus not surprising.

There are only a few studies where the frequency of contact sensitization in the general

population is studied. A study from Denmark showed a prevalence of an overall sensitization of 15.9% and 18.6% when performing cross-sectional surveys in 1992 and 1998, respectively (12). These data were based on a population in the age group of 15–41 years. A German study on a general population of 1141 adults (50.4% women, median age 50 years) reported an overall sensitization rate to at least 1 test preparation in 40.0% (13). In another study (14) where the incidence of allergic contact dermatitis was estimated based on indirect proofs through sales data of test material and test results from clinics in Germany,

it was estimated that the incidence of allergic contact dermatitis should range from about 1.7 to 7 per 1000 per year. In a study of all employees and thus including both production and office workers in a plant producing binders for glues and paints (15) it was found that 17.1% had allergic contact dermatitis, whereas the corresponding figure for patients (aged >56 years) in a contact dermatology unit was 60.0% (9). When comparing these figures, the number of tested preparations, the test technique and reading days, and how the results are read have to be taken into consideration. Furthermore, there is a fundamental difference between contact allergy and allergic contact dermatitis, where the latter diagnosis besides contact allergy requires the demonstration of a present exposure to the sensitizer, or possibly cross-reacting substances, which explain the dermatitis under investigation with regard to type, localization, and course of dermatitis (16, 17). In the elderly, there is often seen sensitization to allergens found in topical remedies used for treating age-related diseases, e.g. leg ulcers and xerosis (7–9, 18). This is also the case in the DC where we found an increased frequency of contact allergy to neomycin, corticosteroids, and preservatives, substances that are present in topical preparations (Table 1).

On the whole, the contact allergy frequency for the different preparations is usually similar or lower among the SP compared to that among the controls. *M. pereirae* and caine mix are exceptions, where the SP showed statistically significantly increased levels, not only when compared to the controls but also when comparing with earlier performed studies.

In a study monitoring the European standard series (ESS) in 10 centres (19) from 1996 to 2000, *M. pereirae* had an overall frequency of 6% and was one of the 10 most frequent sensitizers.

In a study from Germany (14), a frequency of contact allergy to *M. pereirae* of 3.8% was found in a general population (median age 50 years). In a population referred for patch testing in Spain (20), the prevalence in a retrospective study was found to be 5.79%. In the United States (21), when studying a population referred for patch testing (mean age 43.9 years), the prevalence was found to be 8.3%. In our control population, the frequency was somewhat higher (9.8%), but so was the mean age. The contact allergy frequency for *M. pereirae* has been found to increase with age (22). In the present study, the frequency for the SP was much higher (15.3%) than that found in the studies of individuals with or without dermatitis, a result that cannot be explained by age alone.

With regard to contact allergy, *M. pereirae* is a known marker for, among others, perfumes and

flavouring. Contact allergy to fragrances is increasingly common and has been found to increase with age with a peak in the 60s/70s and then a slow decline (23). We found a frequency of 8.1% of fragrance allergy among the DC and in the SP a lower rate at 4.8%, which does not support the interpretation that a higher contact allergy rate to *M. pereirae* in the SP is a marker of fragrance allergy. The figures from our dermatitis material is comparable to those found in other studies (13, 20, 21).

Besides for fragrances, simultaneous statistically significant over-representation of contact allergy to phenol-formaldehyde resin and/or colophony on the one hand and *M. pereirae* on the other has been reported (24). However, again lower contact allergy rates to phenol-formaldehyde resin and colophony were noted in the SP, which is why there must be another explanation to the high contact allergy rate to *M. pereirae* in the SP. *M. pereirae* is, however, known to be used in medicine and in dentistry, e.g. in dental cement. A correlation between contact allergy to *M. pereirae* and dental gold was found. This indicates that in our stented population a probable sensitization site is the oral mucosa and that the patients, because of poorer dental status/major dental gold restoration work, could thus have been exposed to *M. pereirae*.

The SP had statistically significantly more contact allergy to caine mix. Caine mix contains dibucaine, lidocaine, and tetracaine, found in topical treatments as well as in local anaesthetics. Also, these substances are commonly used in dentistry as well as in tablets for sore throat, but in this study there was, when performing a multivariate analysis, no statistically significant correlation between dental gold restorations and contact allergy to caine mix or between contact allergy to caine mix and *M. pereirae*. Is there any other exposure to caines, which can be expected to be higher in the stented population and thus explain a higher contact allergy rate? Around 10 ml carbocaine (mepivacaine) is injected for local anaesthesia as a first step of the PTCA in Karlskrona. But the patients very rarely seem to develop a rash at the injection site (personal communication), which would have been suspected had the patients been sensitized at this stage. A silent sensitization such as often seen for nickel and gold might of course be a possibility.

In summary, this study shows that contact allergy to nonmetal sensitizers is common in an elderly Swedish stent population although, on the whole, substantially less than in an age and sex-matched dermatitis population. Surprisingly, significantly more contact allergy to *M. pereirae* and caine mix was found among SP, which at least

for *M. pereirae* may be due to sensitization in the oral mucosa from *M. pereirae*-containing products. The findings, considering also those regarding metal allergies (3), indicate the importance of the oral mucosa for sensitization. In a general population that has been treated with a special medication/treatment procedure, contact allergies that are not suspected (such as to *M. pereirae* and to the metals) might suddenly peak. This underlines the importance of a careful evaluation of new products and routines with regard to contact allergies in the population.

Acknowledgements

The study was supported by grants from the Swedish Asthma and Allergy Association, research grant from foundations and donations administered by University Hospital MAS, governmental funding of clinical research within Services of the National and Skane county council's research and development foundation. We thank laboratory technicians Monica Andersson, Karin Ohlsson and Lena Persson for skillful assistance and invaluable help during the study.

References

- Köster R, Vieluf D, Kiehn M et al. Nickel and molybdenum contact allergies in patients with coronary in-stent restenosis. *Lancet* 2000; 356: 1895–1897.
- Svedman C, Tillman C, Gustavsson C G, Möller H, Frennby B, Bruze M. Contact allergy to gold in patients with gold-plated intracoronary stents. *Contact Dermatitis* 2005; 52: 192–196.
- Ekqvist S, Svedman C, Möller H et al. High frequency of contact allergy to gold in intracoronarily stented patients. (submitted)
- Svedman C, Ekqvist S, Möller H et al. A correlation found between contact allergy to stent material and restenosis of the coronary arteries. (submitted)
- Ekqvist S, Svedman C, Lundh T, Möller H, Björk J, Bruze M. Gold concentration in blood in patients treated with intracoronary stents. (submitted)
- Wohrl S, Hemmer W, Focke M, Gotz M, Jarisch R. Patch testing in children, adults, and the elderly: influence of age and sex on sensitization patterns. *Pediatr Dermatol* 2003; 20: 119–123.
- Piaserico S, Larese F, Recchia G P et al. Allergic contact sensitivity in elderly patients. *Aging Clin Exp Res* 2004; 16: 221–225.
- Uter W, Geier J, Pfahlberg A, Effendy I. The spectrum of contact allergy in elderly patients with and without lower leg dermatitis. *Dermatology* 2002; 204: 266–272.
- Önder M, Öztas M O. Contact dermatitis in the elderly. *Contact Dermatitis* 2003; 48: 232–233.
- Bruze M, Goossens A, Gruvberger B. Recommendation to include methyldibromoglutaronitrile in the European standard patch test series. *Contact Dermatitis* 2005; 52: 24–28.
- Wilkinson D, Fregert S, Magnusson B. Terminology of contact dermatitis. *Acta Derm Venereol* 1972; 50: 287–292.
- Nielsen N, Linneberg A, Menné T. Allergic contact sensitization in an adult Danish population: two cross-sectional surveys eight years apart (the Copenhagen Allergy Study). *Acta Derm Venereol* 2001; 81: 31–34.
- Schäfer T, Böhler E, Ruhdorfer S, Weigl L, Wessner D, Filipiak B, Wichmann H E, Ring J. Epidemiology of contact allergy in adults. *Allergy* 2001; 56: 1192–1196.
- Schnuch A, Uter W, Geier J, Gefeller O. Epidemiology of contact allergy: an estimation of morbidity employing the clinical epidemiology and drug utilization research (CE-DUR) approach. *Contact Dermatitis* 2002; 47: 32–39.
- Gruvberger B, Bruze M, Almgren G. Occupational dermatoses in a plant producing binders for paints and glues. *Contact Dermatitis* 1998; 38: 71–77.
- Bruze M. What is a relevant contact allergy? *Contact Dermatitis* 1990; 23: 224–225.
- Bruze M, Conde-Salazar L, Goossens A, Kanerva L, White I R. Thoughts on sensitizers in a standard patch test series. The European Society of Contact Dermatitis. *Contact Dermatitis* 1999; 41: 241–250.
- Edman B, Möller H. Medicament contact allergy. *Derm Beruf Umwelt* 1986; 34: 139–143.
- Bruynzeel D P, Diepgen T L, Andersen K E et al. Monitoring the European standard series in 10 centres 1996–2000. *Contact Dermatitis* 2005; 53: 146–152.
- Avalos-Peralta P, Garcia-Bravo B, Camacho F M. Sensitivity to *Myroxylon pereirae* resin (balsam of Peru). A study of 50 cases. *Contact Dermatitis* 2005; 52: 304–306.
- Michael R A, Chang Y, Gonzalez E. Concomitant positive reactions to allergens in a patch testing standard series from 1988–1997. *Am J Contact Dermat* 1999; 10: 219–223.
- Schnuch A, Lessmann H, Geier J, Frosch P J, Uter W. Contact allergy to fragrances; frequencies of sensitisation from 1996 to 2002. Results of the Information Network of Departments of Dermatology (IVDK). *Contact Dermatitis* 1996; 50: 65–76.
- Buckley D A, Rycroft R J, White I R, McFadden J P. The frequency of fragrance allergy in patch-tested patients increase with their age. *Br J Dermatol* 2003; 149: 986–989.
- Bruze M. Simultaneous reactions to phenol-formaldehyde resins, colophony/hydroabietyl alcohol and balsam of Peru/perfume mixture. *Contact Dermatitis* 1986; 14: 119–120.

Address:

Cecilia Svedman, MD, PhD
 Department of Occupational and Environmental Dermatology
 University Hospital MAS
 Malmö
 Lund University
 Sweden
 Tel: 0046 40 337817
 Fax: 0046 40 331192
 e-mail: cecilia.svedman@skane.se