

Occupational allergic contact dermatitis from drugs in healthcare workers

K. GIELEN AND A. GOOSSENS

Department of Dermatology, Katholieke Universiteit Leuven, B-3000 Leuven, Belgium

Contact sensitivity to drugs administered systemically occurs mainly among healthcare workers, pharmaceutical operatives, and veterinary surgeons. Of the 14,689 patients suspected of contact allergy examined in our department from 1978 to 2001, occupational allergic contact dermatitis from drugs in healthcare workers was diagnosed in 33, the first in 1980. The most common sensitizers were antibiotics such as penicillins, cephalosporins, and aminoglycosides. They accounted altogether for 35 positive patch tests, followed by propacetamol hydrochloride, and ranitidine hydrochloride, which elicited 10 and 7 positive reactions, respectively. The aim of this report is to draw attention to the importance of occupational contact allergy to drugs in healthcare workers. By far the greatest number of the sensitized patients in this series were nurses, there being 26 nurses, 4 veterinarians, 2 pharmacists, and 1 medical doctor.

Key words: allergic contact dermatitis; drugs; facial; occupational; healthcare workers; hands; airborne; antibiotics; penicillins; cephalosporins; aminoglycosides. © Munksgaard, 2001.

Accepted for publication 25 July 2001

Work-related dermatitis, in particular hand dermatitis, is still among the most prevalent of the occupational diseases. It is also still a frequent cause of sickness absence (1). Contact dermatitis is the commonest type of occupational dermatitis, accounting for 97.2%, with irritant contact dermatitis being more common than allergic contact dermatitis (a ratio of 1.7:1) (2). Contact urticaria from the natural rubber latex of rubber gloves, in particular, has become an increasingly serious problem for healthcare workers over the last decade, but certain systemically administered drugs can cause allergic contact dermatitis.

Occupationally-induced reactions to medications occur mainly in 2 exposed groups. The 1st group consists of employees of pharmaceutical and chemical companies involved in the production of drugs. The chemically reactive intermediates of these drugs are often responsible for the development of allergic contact dermatitis (3, 4). The 2nd group consists of professionals who use the drugs in a therapeutic setting: the healthcare workers (5).

We describe 33 patients, most of them nurses, who developed allergic contact dermatitis from drugs. The aim of this study is to focus attention on the increasing importance of occupational allergic contact dermatitis from drugs in healthcare workers. For these patients, after taking a careful

history and conducting the clinical examination, it is important to apply patch tests with the drugs to which they have been exposed.

The diagnosis of an occupational allergy and the identification of the allergen are necessary so that appropriate control and prevention measures may be taken in many situations (6).

Patients and Methods

Between 10 January 1978 and 6 April 2001, the Contact Allergy Unit of the Dermatology Department of the Katholieke Universiteit Leuven patch tested 14,689 patients. These patch tests were administered with Van Der Bend® patch-test chambers applied to the back of the patient with Micropore® and fixed with Fixomull® (Beiersdorf), and later with Mefix® (Mölnlycke), as adhesive tape. The patch-test chambers were removed after 2 days (D). Readings were made at D2 and at D3 or D4, and sometimes later. A standard series, to which certain substances were added, was used for all patients. Depending on the patient's individual history, other series, as well as substances with which the patient came in contact at work, were included if they seemed relevant (7).

Table 1. Characteristics of the patients affected

Patient no.	Sex	Age (years)	Occupation	Diagnosis (year)	Drug	Patch test			Localization	
						D2	D3	D4	Primary	Secondary
1.	F	29	nurse	1980	chlorpromazine	—		++	fingers	face
2.	M	30	veterinarian	1981	penicillin	—		++	fingers	arm, face
3.	F	55	nurse	1983	pyrithioxine	++		++	palm of both hands, face, neck	
4.	M	24	nurse	1983	meglumine diatrizoate	++		++	fingers	wrist
5.	F	30	nurse	1986	penicillin	++	++		fingers	arm, head, face, eyes
					flucloxacillin	++	++			
					dicloxacillin		++			
					oxacillin		++			
					ampicillin		++			
6.	F	52	nurse	1988	cefuroxime	++		++	palms of both hands, fingers	face, neck
7.	F	26	nurse	1990	cephazolin	+		+	fingers, fingertips,	
8.	M	54	veterinarian	1990	cephazolin	—	+		fingers, fingertips,	
					penicillin	++		++	palms of both hands, wrist	arm, face
9.	F	24	pharmacist	1992	papain	++	—		fingers	head, face, mouth, eyes, neck
10.	F	49	nurse	1993	cefuroxime	—	+++		fingers	eyes
					cephazolin	—	++			
					ceftriaxone	—	+++			
					cefaronide	—	++			
					amoxycillin	—	+			
					flucloxacillin	—	+			
11.	F	34	nurse	1993	ampicillin	—	+		back of left hand, fingers, interdigital	
					amoxycillin	—		+		
12.	M	46	veterinarian	1993	penicillin	+		++	back of both hands, wrist	face
13.	M	50	veterinarian	1994	penicillin	+	+(+)		fingers	back of both hands, arm, wrist, leg, face, mouth, eyes, trunk
14.	F	24	nurse	1995	flucloxacillin	+		+	fingers	face, mouth, eyes
15.	F	53	nurse	1996	penicillin	+		+	back of both hands, fingers, fingertips,	
					amikacin	+		(+)	wrist, mouth	
16.	F	60	nurse	1997	cefuroxime	++		++	back of both hands, fingers	foot top, face, eyes
17.	F	36	nurse	1997	dipyridamole	+		+	back of both hands, fingers, interdigital, arm, mouth	
18.	M	42	nurse	1997	penicillin	—		+	face, eyes	neck
					cefotaxime	—		+		
19.	F	31	nurse	1997	propacetamol	—		+	back of both hands, fingers, interdigital	
20.	F	25	nurse	1997	hydrochloride	+		+	palms of both hands, back of both hands, fingers, fingertips	
					propacetamol	+		+	back of both hands, fingers, fingertips	
21.	F	46	nurse	1997	hydrochloride	(+)		++	fingertips, interdigital	
					ranitidine	+	++			
					hydrochloride					
22.	F	38	nurse	1997	ranitidine	++		+++	fingers	
					hydrochloride					
					amikacin	—		+		
					methyl-	+		++		
					prednisolone					
23.	F	44	pharmacist	1998	tylosin	—		++	eyes	arm, face, neck, trunk
					boldo	+				
					casaca	++				
24.	F	24	nurse	1998	cefuroxime	—		+	back of both hands, fingers, wrist	face, mouth, eyes, neck
					cephazolin	+		+		

Table 1. (cont'd)

Pa- tient no.	Sex	Age (years)	Occupation	Diagnosis (year)	Drug	Patch test			Localization	
						D2	D3	D4	Primary	Secondary
25.	F	54	nurse	1999	propacetamol hydrochloride	+		++(+)	face, mouth, eyes	
26.	F	49	nurse	1999	propacetamol hydrochloride	—		+	palms and back of both hands, fingers,	
					ranitidine hydrochloride	—		+	interdigital, wrist,	
27.	F	25	nurse	1999	cefuroxime ranitidine hydrochloride	—		++(+)	back of hands, fingers, fingertips,	
28.	F	32	nurse	1999	gentamycin ranitidine hydrochloride	—		+(+)	arm, wrist face, mouth	back of both hands, fingers trunk
29.	F	35	nurse	2000	propacetamol hydrochloride	+		++	fingertips, interdigital, wrist	
					ranitidine hydrochloride	+		++		
30.	F	34	nurse	2000	propacetamol hydrochloride	++		++	back of both hands, fingers, interdigital,	
					ranitidine hydrochloride	+		+	wrist	
31.	F	25	nurse	2000	propacetamol hydrochloride	+	++		back of both hands	wrist
32.	M	36	medical doctor	2000	propacetamol hydrochloride		+	++	face, mouth, eyes	
33.	F	38	nurse	2001	propacetamol hydrochloride	++		+++	back of both hands, fingers, interdigital	face
					flucloxacillin	?+		++		
					oxacillin	?+		+		
					cloxacillin	?+		+		
					ampicillin	?+		+		

Results

Of all the patients in whom patch tests were conducted, 7857 (53.5%) showed a contact allergy to 1 or more substances.

The main characteristics of the 33 patients diagnosed with occupational allergic contact dermatitis from drugs are given in Table 1. We diagnosed the 1st patient, a nurse, in 1980 with allergic contact dermatitis from chlorpromazine (Largactil®). Practically all of these patients presented with a hand dermatitis with secondary localization on the face. The dermatitis most often first appeared on the hand that held the vial while drawing the drug up into a syringe.

The allergens responsible for the positive patch tests are shown in Table 2. Antibiotics (penicillins, cephalosporins, and aminoglycosides) were responsible for 35 of the 61 positive patch tests (57.3%). Propacetamol hydrochloride was also an important allergen and gave 10 positive patch tests (16.4%).

The majority of patients were diagnosed in the 1990s, and in 1997, we recorded the largest number of patients (Fig. 1). Only 7 of the 33 patients were

Table 2. Drugs responsible for occupational contact dermatitis

Drug	No. positive patch tests	% positive patch tests
1. propacetamol hydrochloride	10	16.4
2. penicillin	7	11.5
3. ranitidine hydrochloride	7	11.5
4. cefuroxime	5	8.2
5. cephazolin	4	6.5
6. flucloxacillin	4	6.5
7. ampicillin	3	4.9
8. amoxycillin	2	3.3
9. cloxacillin	2	3.3
10. oxacillin	2	3.3
11. amikacin	2	3.3
12. ceftriaxone	1	1.6
13. cefaronide	1	1.6
14. cefotaxime	1	1.6
15. pyriothione	1	1.6
16. meglumine diatrizoate	1	1.6
17. papain	1	1.6
18. dipyrindamole	1	1.6
19. tylosin	1	1.6
20. boldo	1	1.6
21. cascara	1	1.6
22. gentamycin	1	1.6
23. chlorpromazine	1	1.6
24. methylprednisolone	1	1.6
total	61	

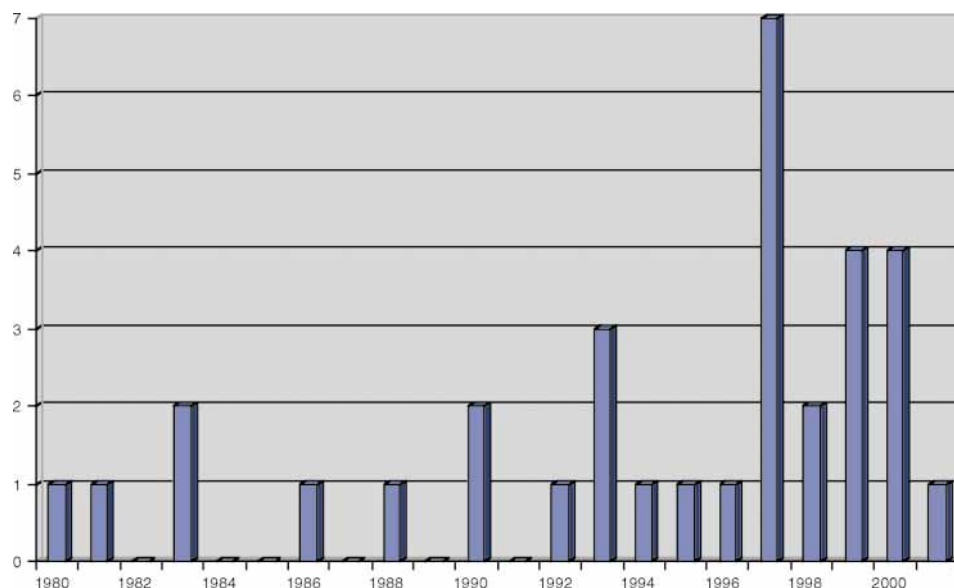


Fig. 1. Evolution of the numbers of patients with occupational dermatitis from drugs.

men. The average age of our patients was 38 years. Most of them were nurses, i.e., in 26 cases, but we also saw 4 veterinarians, 2 pharmacists, and 1 medical doctor.

2 patients reacted both to penicillins (natural and semi-synthetic) and to cephalosporins. Cross-reactions are possible, but concomitant sensitization cannot be ruled out, since they had contact with both types of drugs. Only 1 patient showed a positive reaction to natural and to semi-synthetic penicillins. However, not all subjects were tested with all derivatives.

Discussion

Propacetamol hydrochloride

Since 1950, the therapeutic use of paracetamol (acetaminophen) as an antipyretic analgesic has expanded throughout the world. Propacetamol hydrochloride has been proposed as a prodrug for parenteral use. It is a water soluble *N,N*-diethylglycidyl ester of paracetamol. After i.v. administration, it is hydrolyzed into paracetamol and *N,N*-diethylglycine by non-specific plasma esterases.

Occupational allergic contact dermatitis cases were first reported by Barbaud et al. in Nancy, France (8), but other cases soon followed, both in France and in Belgium (9–11). It has been shown by Berl et al. (12) that the *N,N*-diethylglycidyl ester function of the propacetamol molecule is the most reactive part, and thus allergic contact dermatitis from propacetamol is not related to sensitization to paracetamol but to *N,N*-diethylglycine.

Penicillins

The natural and the semi-synthetic penicillins are some of the main allergens responsible for occupational allergic contact dermatitis in healthcare workers. Allergic reactions to penicillin can be triggered by immediate or delayed hypersensitivity or both. Immediate-type reactions may present as urticaria or as a severe anaphylactic reaction. As already reported for immediate responses, minor differences in β -lactam side chains may also result in important antigenic diversity in delayed hypersensitivity (13–16).

Since most of our patients had contact with many of the antibiotics tested, we could not establish whether sensitivity to natural and semi-synthetic penicillins was due to multiple sensitization or to cross-reactions.

Ranitidine hydrochloride

Ranitidine (Zantac®) is a commonly used H₂-receptor antagonist for the treatment of peptic ulcers. It is structurally related to cimetidine and famotidine. The differences in chemical structure between the 3 H₂-receptor antagonists are too great for cross-reaction to occur. There are 2 groups that could function as haptens: the terminal not-substituted aminogroup or the furangroup (17, 18).

Cephalosporins

The 1st case of allergic contact dermatitis from cephalosporins was described in 1986 by Conde-Sal-

azar et al. (19). Cephalosporins belong to the β -lactam antibiotics, which are responsible for approximately 75% of all allergies to antibiotics. They are similar to penicillin and possess a β -lactam ring. The problem of cross-reactivity is more complex, since the antigenic determinants for cephalosporins in IgE and T-cell-mediated reactions are not known (20–25). In only 2 of our patients was a positive reaction to cephalosporins as well as to penicillin recorded. According to Foti et al. (22) this strongly suggests that it is not the β -lactam ring but the side chain in cephalosporins that causes sensitization.

Pyrithioxine

Pyrithioxine (pyritinol hydrochloride), the active ingredient in Encephabol[®], is the dihydrochloride monohydrate of pyritinol. Originally developed as a cerebroactivating agent, pyritinol is a compound of 2 molecules of pyridoxine (vitamin B₆). The free sulfhydryl (SH-)group in thiol drugs may contribute to the induction of skin lesions. 2 cases have been reported (26, 27); in one of them (26), the allergic contact dermatitis developed in a nurse who had to crush Encephabol[®] tablets between 2 spoons prior to administration.

Meglumine diatrizoate

Meglumine diatrizoate is used in Angiografine[®] and Urografine[®], which are contrast media. Our case of allergic contact dermatitis in a nurse has been reported earlier (28).

Papain

Papain is a microcrystalline powder enzyme extracted from the green fruits of *Carica papaya*, and hydrolyses proteins to peptones. It is used to remove protein deposits from hydrophilic soft contact lenses. Allergic reactions to papain, either immediate or delayed, have been reported in workers in the pharmaceutical industry who produce the enzyme (29). In our case it was a pharmacist who had compounded a preparation containing it.

Aminoglycosides

Aminoglycosides are a closely related group of bactericidal antibiotics derived from bacteria of the genus *Streptomyces*. Cross-reactions between aminoglycosides have been described in the literature. A common feature of the aminoglycosides is the presence in their chemical structure of a disaccharide containing glucosamine and desoxy-strep-

tamine bound together with a glycoside bond (30, 31).

We recorded 2 nurses with a positive patch test to aminoglycosides (amikacin and gentamycin).

Dipyridamole

Dipyridamole has anti-platelet activity. Oral dipyridamole is used in association with an oral anticoagulant for the prophylaxis of thrombo-embolism following cardiac valve replacement (32). To our knowledge, ours is the 1st case of occupationally-induced allergic contact dermatitis from dipyridamole in a nurse.

Tylosin

Tylosin is a macrolide antibiotic obtained from fermentation by *Streptomyces fradiae*. Tylosin and its phosphate and tartrate salts are usually used in veterinary medicine in the prophylaxis and treatment of various infections. Tylosin and tylosin phosphate are also added to animal feedstuffs as growth promoters for pigs. It is administered in 2 forms: a water-soluble and a non-water-soluble form (33, 34). Tylosin often causes allergic contact dermatitis in farmers, animal caretakers, and veterinary surgeons (1). Here we report a pharmacist who used it in compounding, which was also the cause of the concomitant contact allergies to boldo and cascara (cf. below).

Boldo

Boldo is employed in herbal medicine as a diuretic and in the treatment of gallstones. In Belgium, it is marketed under the name Stago N.F.[®] (32).

Cascara

Cascara is an anthraquinone stimulant laxative (herbal medicine) with mild action used in the treatment of constipation. The active anthraquinones are liberated into the colon from the glycosides by colonic bacteria (32).

Chlorpromazine

Chlorpromazine (Largactil[®]) is a phenothiazine neuroleptic used for the control of psychoses, including schizophrenia and mania and severely disturbed or agitated behavior (32). The phenothiazine group of drugs can produce allergic contact dermatitis and photoallergic reactions (35). Cross-reactions take place between phenothiazines and related antihistamines such as promethazine (Phenergan[®]).

Methylprednisolone

Methylprednisolone is a glucocorticoid administered orally as the free alcohol or in esterified form, parenterally, by local injection, or topically in the management of various disorders for which corticosteroids are indicated. To our knowledge, ours is the 1st case of occupational allergic contact dermatitis from methylprednisolone in a nurse to be described in the literature.

Conclusions

There are many causes of occupational skin disease in healthcare workers, the prevalence having been suggested to be about 30% (36). 90% of such dermatoses are localized on the hands and one may assume that various factors favor the development of hand dermatitis (37). The evolution of occupational contact dermatitis is determined by a combination of endogenous and exogenous factors. The probability of a reaction depends on the type and intensity of exposure to irritants and/or allergens. The most important risk factor for occupational contact dermatitis is exposure to irritants (water, detergents, etc.). Wet work in hospitals greatly increases the chances of developing dermatitis. Second, those with a history of atopic dermatitis develop more severe hand dermatitis than do individuals with only atopic mucosal symptoms or those with no atopic history (38). While irritant contact dermatitis accounts for the vast majority of occupational dermatoses, allergic contact dermatitis, contact urticaria, and other disease processes also significantly contribute to occupational morbidity (1).

Of all the drugs tested, the most important were propacetamol hydrochloride, penicillins, and ranitidine hydrochloride. We observed, most frequently, dermatitis caused by antibiotics (35 positive patch tests).

The allergens we describe here are very similar to those that have already been described in the pharmaceutical industry. Not only papain and tylosin but also penicillins, cephalosporins, aminoglycosides, chlorpromazine and ranitidine hydrochloride, as well as its chemical intermediates, have been reported to be potential causes of occupational contact dermatitis in pharmaceutical workers. Chemists and laboratory technicians are exposed to these drugs, and the conditions that they work in are similar to those of medical personnel (4).

We diagnosed the largest number of patients in 1997. Before 1997, healthcare workers with a possible occupational dermatitis were not routinely tested with allergens such as penicillin, propaceta-

mol hydrochloride, and ranitidine hydrochloride. The reason for this was that it was then thought that the most common allergens in healthcare workers were antiseptics, preservatives, and latex (39). Thus we may have missed several other cases in the past.

As regards the male:female ratio, it can be noted that the vast majority of our patients were women, mostly nurses, probably because of the higher proportion of women in this profession. Exposure to systemically administered agents (substances in powdered form) may occur by negligence or by accident and involves direct or airborne contact (induced by droplets spattered on the face) with the skin (3, 25). This occurs typically during the preparation of animal feed by farmers, the manufacturing of medication by pharmacists, or the crushing of tablets or preparation of injections by nurses. Typical clinical manifestations include allergic and irritant contact dermatitis, immunologic and non-immunologic contact urticaria, rhinoconjunctivitis, and asthma. Anaphylaxis may occur but rarely.

Systemic exposure to an allergen to which the patient has been sensitized by epidermal contact may result in a flare-up at formerly affected sites or in a maculopapular rash (3). For example, 1 of our patients with allergic contact dermatitis from propacetamol hydrochloride developed a maculopapular rash after i.v. administration of Prodafalgan®. Another patient with allergic contact dermatitis from ranitidine hydrochloride developed burning swollen lips after oral intake of Zantac®. Therefore, the implications of such a contact dermatitis reach far beyond matters of occupational safety.

Detailed patch testing is necessary to determine whether sensitization to certain agents has occurred, but even then it is sometimes uncertain as to whether the contact dermatitis is of allergic origin (1). Strategies of prevention include avoidance of irritants and allergens, wherever possible, and personal protection such as gloves (40, 41).

A considerable number of drugs have been reported to be occupational allergens (3, 4). Systemically administered drugs may not be the most important allergens in healthcare workers but they remain of considerable importance, mainly because of the possibility of re-exposure of a sensitized individual to a particular drug. Thus, it is important to recognize and to diagnose such cases.

References

1. Diepgen T L, Coenraads P J. The epidemiology of occupational contact dermatitis. In: Kanerva L, Elsner P, Wahlberg J E, Maibach H I (eds): *Handbook of occupational dermatology*. Berlin: Springer, 2000, ch 1, 3–16.

2. Goon T-J A, Goh C-L. Epidemiology of occupational skin disease in Singapore 1989–1998. *Contact Dermatitis* 2000; 43: 133–136.
3. Bircher A J. Pharmaceutical drug allergens. In: Kanerva L, Elsner P, Wahlberg J E, Maibach H I (eds.): *Handbook of occupational dermatology*. Berlin: Springer, 2000, ch 61, 479–489.
4. Goossens A, Geusens L. The pharmaceutical and cosmetic industries. In: Kanerva L, Elsner P, Wahlberg J E, Maibach H I (eds.): *Handbook of occupational dermatology*. Berlin: Springer, 2000, ch 163, 1041–1052.
5. Belsito D V. Healthcare workers. In: Kanerva L, Elsner P, Wahlberg J E, Maibach H I (eds.): *Handbook of occupational dermatology*. Berlin: Springer, 2000, ch 141, 969–973.
6. Morthier R. Contactallergie voor propacetamol: een gevalstudie. *Tijdschr voor Geneeskunde* 2001; 57: 375–378.
7. Dooms-Goossens A. Patch testing without a kit. In: Guin J (ed): *Practical contact dermatitis. A handbook for the practitioner*. NY: McGraw-Hill, Inc., 1995: 63–74.
8. Barbaud A, Tréchet P, Bertrand O, Schmutz J-L. Occupational allergy to propacetamol. *Lancet* 1995; 346: 902.
9. Lehnert-Weber C, De la Brassine M. Allergie au pro-dafalgan. *La Lettre du GERDA* 1996; 13: 4–5.
10. Szczurko C, Domp Martin A, Michel M, Castel B, Leroy D. Occupational contact dermatitis from propacetamol. *Contact Dermatitis* 1996; 35: 299–301.
11. Barbaud A, Reichert-Penetrat S, Tréchet P, Cuny J-F, Weber M, Schmutz J-L. Occupational contact dermatitis to propacetamol. *Dermatology* 1997; 195: 329–331.
12. Berl V, Barbaud A, Lepoittevin J-P. Mechanism of allergic contact dermatitis from propacetamol: sensitisation to activated N,N-diethylglycine. *Contact Dermatitis* 1998; 38: 185–188.
13. Rudzki E, Rebandel P. Occupational contact urticaria from penicillin. *Contact Dermatitis* 1985; 13: 192.
14. Pecegheiro M. Occupational contact dermatitis from penicillin. *Contact Dermatitis* 1990; 23: 190–191.
15. Rudzki E, Rebandel P. Hypersensitivity to semisynthetic penicillins but not to natural penicillin. *Contact Dermatitis* 1991; 25: 192.
16. Gamboa P, Jäuregui I, Urrutia I. Occupational sensitisation to aminopenicillins with oral tolerance to penicillin V. *Contact Dermatitis* 1995; 32: 48.
17. Camarasa J G, Alomar A. Contact dermatitis to an H2-antagonist. *Contact Dermatitis* 1980; 6: 152–153.
18. Goh C L, Ng S K. Allergic contact dermatitis to ranitidine. *Contact Dermatitis* 1984; 11: 252.
19. Condé-Salazar L, Guimaraens D, Romero L V, Gonzalez M A. Occupational dermatitis from cephalosporins. *Contact Dermatitis* 1986; 14: 70–71.
20. Miyahara H, Koga T, Imayama S, Hori Y. Occupational contact urticaria syndrome from cefotiam hydrochloride. *Contact Dermatitis* 1993; 29: 210–219.
21. Filipe P, Soares Almeida R S L, Guerra Rodrigo F. Occupational allergic contact dermatitis from cephalosporins. *Contact Dermatitis* 1996; 34: 226.
22. Foti C, Bonamonte D, Trenti R, Veña G A, Angelini G. Occupational contact allergy to cephalosporins. *Contact Dermatitis* 1997; 36: 104–105.
23. Straube M D, Freitag M, Altmeyer P, Szliska C. Occupational airborne contact dermatitis from cefazolin. *Contact Dermatitis* 2000; 42: 44.
24. Rudzki E, Rebandel P. Contact sensitivity to antibiotics. *Contact Dermatitis* 1984; 11: 41–58.
25. Rudzki E. Contact sensitivity to systemically administered drugs. *Dermatol Clin* 1990; 1: 177–180.
26. Dooms-Goossens A, Debusschere K, Gevers D, Dupré K, Degreef H, Loncke J, Snauwaert J E. Contact dermatitis by airborne agents. *J Amer Acad Dermatol* 1986; 15: 1–10.
27. Wigger-Alberti W, Elsner P. Occupational contact dermatitis to pyritinol. *Contact Dermatitis* 1997; 37: 91.
28. Verschaeve A, Loncke J, Dooms-Goossens A. Occupational contrast media dermatitis: meglumine diatrizoate. *Contact Dermatitis* 1984; 11: 318–319.
29. Santucci B, Cristaudo A, Picardo M. Contact urticaria from papain in a soft lens solution. *Contact Dermatitis* 1985; 13: 233.
30. Jerez J, Rodriguez F, Jimenez I, Martin-Gil D. Cross-reactions between aminoglycoside antibiotics. *Contact Dermatitis* 1987; 17: 325.
31. Rudzki E, Zakrzewski Z, Rebandel P, Grzywa Z, Hudy-mowicz W. Sensitivity to amikacin. *Contact Dermatitis* 1989; 20: 391.
32. Martindale. *The complete drug reference*. 32nd edition. Kathleen Parfitt, London: Pharmaceutical Press, 1999.
33. Caraffini S, Assalve D, Stingeni L, Lisi P. Tylosin, an airborne contact allergen in veterinarians. *Contact Dermatitis* 1994; 31: 327–328.
34. Danese P, Zanca A, Grazia Bertazzoni M. Occupational contact dermatitis from tylosin. *Contact Dermatitis* 1994; 30: 122–123.
35. Lovell C R, Cronin E, Rhodes E L. Photocontact urticaria from chlorpromazine. *Contact Dermatitis* 1986; 14: 290–291.
36. Schnuch A, Uter W, Geier J, Frosch P J, Rustemeyer T. Contact allergies in healthcare workers. Results from the IVDK. *Acta Dermato-venereologica* 1998; 78: 358–363.
37. Van Der Burg C H K, Bruynzeel D P, Vreeburg K J J, Von Blomberg B M E, Scheper R J. Hand eczema in hairdressers and nurses: a prospective study. *Contact Dermatitis* 1986; 14: 275–279.
38. Adams R M, Robert M. *Occupational skin disease*. 3rd edition. Appendix: Job descriptions with their irritants and allergens, 3rd edition, 1999. W.B. Saunders Company.
39. Strauss R M, Gawkrödger D J. Occupational contact dermatitis in nurses with hand eczema. *Contact Dermatitis* 2001; 44: 293–296.
40. Stingeni L, Lapomarda V, Lisi P. Occupational hand dermatitis in hospital environments. *Contact Dermatitis* 1995; 33: 172–176.
41. Rustemeyer T, Pilz B, Frosch P J. Kontaktallergien in medizinischen Berufen. *Hautarzt* 1994; 45: 834–844.

Address:

A. Goossens
 Department of Dermatology
 Katholieke Universiteit Leuven
 B-3000 Leuven
 Belgium