

An update on airborne contact dermatitis: 2007–2011

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Summary

Background. Reviews on irritant and allergic airborne contact dermatitis have been previously reported in the literature.

Materials and methods. Here, we present an update based on recently published airborne-induced skin reactions. For this survey, we screened the journals *Contact Dermatitis*, *Dermatitis*, and included relevant articles from other journals during the period January 2007 to December 2011. We also present the airborne cases observed in our department during the same time period.

Results. This survey provides an updated list of causal agents that have produced airborne allergic contact dermatitis, and briefly mentions some other types of skin reaction induced by airborne exposure. The sources of the reactions are multiple: drugs; plants, natural resins, and wood allergens; plastics, rubbers, and glues; preservatives and other chemicals; and metals.

Conclusions. Airborne contact dermatitis is frequent, and most of the airborne allergens (and irritants) identified are in occupational settings. Drugs and preservatives have recently become more important causes. Dermatologists and occupational physicians need to be aware of them.

Key words: airborne; allergic; contact dermatitis; drugs; healthcare workers; irritant; occupational; preservatives.

Skin reactions induced by airborne agents may be of occupational (most often) or non-occupational origin. Besides allergic contact dermatitis, an airborne agent can cause other skin reactions, such as airborne irritant dermatitis [e.g. fibreglass (1, 2) or woods (3)], phototoxic and photo-allergic reactions (4), (photo)contact urticaria, acne, exfoliative dermatitis, fixed drug eruption, hyperpigmentation and hypopigmentation, lichenoid eruptions, lymphomatoid contact dermatitis, paraesthesia, pellagra-like dermatitis, purpura, pustular reactions, telangiectasia, and erythema multiforme-like eruptions (5). Also,

erythroderma after repeated exacerbations of continued exposure to an airborne allergen may occur (6).

The most common sites of airborne dermatitis are the parts of the body that are directly exposed to the air: the face, neck, upper part of the chest, hands, wrists, and forearms. In the face, the upper eyelids are particularly susceptible to airborne allergens, because the skin is thin in this area, and allergens penetrate more easily; sometimes, they are the only affected sites. Other areas that may be involved are the covered parts of the body, for example the lower legs, where materials may be trapped under clothing (5). This can especially be seen when wood sawdust is deposited on the clothes of sensitized subjects, and, together with sweat retention, causes dermatitis in occluded areas (7). The body folds may be affected, often also induced by inhalation causing a systemic reaction. In males, genital lesions might be caused by 'hand transportation' of the allergens ('ectopic' contact dermatitis) as well.

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Table 1. The causal agents of airborne-induced skin reactions found in a literature search from 2007 to 2011

	No. of patients	References
Allergic contact dermatitis	155	
Drugs	43	
Apomorphine hydrochloride	1	(13)*
Azithromycin	1	(14)
Budesonide	16	(15*, 16)
Captopril	1	(17)*
Carvedilol	1	(18)
Morphine	1	(19)
Olanzapine	3	(20, 21)
Omeprazole	3	(22, 23)
Pantoprazole	1	(24)
Procaine	1	(25)
Tetrazepam	8	(26, 27)
Statins:		
Atorvastatin	2	(28)
Simvastatin	3	(18, 28, 29)
Zolpidem	1	(18)
Plants, natural resins and wood allergens	42	
Cinnamon	1	(30)
Compositae		
<i>Dittrichia graveolens</i> (stinkwort)	1	(31)
<i>Parthenium hysterophorus</i>	6	(6*, 32)
<i>Tanacetum parthenium</i> (feverfew)	12	(33)
<i>Dianthus caryophyllus</i> (carnation)	1	(34)
<i>Elaeagnus</i> plant (oleaster)	1	(35)*
Incense	1	(36)
Limonene in citrus fruits, particularly lemons	1	(37)
<i>Meconopsis cambrica</i> ('Welsh poppy')	1	(38)*
Saffron	1	(39)
Tobacco	1	(40)*
<i>Tradescantia albiflora</i> ('Pink Joy')	1	(41)
Violet fragrance	1	(42)
Wood	7	(43)
Dalbergia		
<i>Eucalyptus pulverulenta</i> ('Baby Blue')	1	(44)
<i>Machaerium scleroxylon</i>	1	(45)
<i>Pinus roxburghii</i>	1	(46)
<i>Pterocarpus dalbergiodes</i> (padouk)	1	(47)
Purpleheart	1	(47)
Timbo tree	1	(48)
Plastic, rubber, and glue components	37	
Acrylates/methacrylates		
2-Hydroxyethyl acrylate	1	(49)*
Trimethylolpropane triacrylate	1	(50)
Triethylene glycol diacrylate	1	(51)
Pentaerythritol triacrylate	1	(52)
2-Hydroxyethyl methacrylate	2	(49*, 53)
Triethylene glycol dimethacrylate	1	(53)
Ethylene glycol dimethacrylate	1	(53)
Bis-GMA**	1	(53)
Epoxy resin	22	(54, 55, 56, 57), (58)*, (59)
Isocyanates:		
Toluene diisocyanate	1	(60)

Table 1. Continued

	No. of patients	References
Diphenyl methane diisocyanate	2	(60, 61)
Polyfunctional aziridine crosslinker	1	(62)
Thiurams	1	(63)
Tosylamide/formaldehyde resin	1	(49)*
Preservatives and other chemicals	21	
Benzalkonium chloride	1	(64)
Benzophenone-4	1	(65)
4-(Bromomethyl)benzoic acid	1	(66)
6,8-Dibromoimidaz[1,2-a]pyrazine	1	(67)
Formaldehyde	1	(68)*
o-(benzotriazol-1-yl)-N,N,N',N',-tetramethyluronium	1	(69)
Methylchloroisothiazolinone/methylisothiazolinone	10	(70), (71,72)*
N-(3-trifluoromethyl-4-nitrophenyl)phthalimide	1	(73)
p-Phenylenediamine	1	(74)*
Polyvinylamine	1	(75)
Potassium metabisulfite	1	(76)
2,4,4'-Trichloro-2'-hydroxydiphenyl ether (triclosan)	1	(77)
Metal (salts)	12	
Cobalt	1	(78)
Gold	3	(79, 80)
Mercury	4	(81–83)*
Palladium	1	(80)
Platinum	1	(80)
Rhodium	2	(84)
Irritant contact dermatitis	26	
Chlorothalonil	11	(85)
Fibreglass	14	(1, 2)*
<i>Manilkara bidentata</i>	1	(86)
Photoallergic reactions	2	
Chlorpromazine	1	(4)
Olaquinox	1	(4)
Contact urticaria	4	
Didecyl dimethyl ammonium chloride (DDAC)	1	(87)
Diphenylmethane-4,4'-diisocyanate	1	(61)
o-(benzotriazol-1-yl)-N,N,N',N',-tetramethyluronium	1	(69)
Fluoxetine	1	(23)
Protein contact dermatitis and anaphylaxis	1	
<i>Cichorium intybus</i> (common chicory)	1	(88)

* All references with an asterisk are non-occupational.

** bis-GMA, 2,2-bis[4-(2-hydroxy-3-methacryloxypropoxy)phenyl]propane.

Previous literature reviews on airborne allergic dermatitis have been published, covering the period 1975–2006 (8–11), and airborne irritant contact dermatitis has been discussed by Lachapelle (12).

This article focuses on allergic contact dermatitis, but also refers to some other skin reactions induced by airborne agents.

Table 2. The airborne allergens identified in 81 patients observed in our department between 2007 and 2011

Sources	No. of cases	Allergens	Occupational	References
Perfume sprays	28	Fragrance components	1 yes	
Drugs	23			
	16	Tetrazepam	Yes	(26)
	7	Zolpidem	Yes	
	5	Lorazepam	Yes	
	2	Alprazolam	Yes	
	2	Budesonide	Yes, except 1 (Fig. 1)	
	2	Ranitidine	Yes	
	2	Trazodone hydrochloride	Yes	
	1	Altizide + spironolactone	Yes	
	1	Captopril	Yes	
	1	Diazepam	Yes	
	1	Isopropanol	Yes	
	1	Risperidone	Yes	
	1	Tetraethylthiuram disulfide	No (Fig. 2)	
	1	Thiomersal	Yes	
	1	Tylosine	Yes	
Paints	14			
Glues/adhesives	7	Methylisothiazolinone	No	(71)
	7	Epoxy resins	Yes, except 1	
Automobile industry	1	Hydroxymethyl acrylate + hydroxyethyl acrylate + polyester resin + cobalt naphthenate + benzoyl peroxide	Yes	
Nail cosmetics	1	Hydroxymethyl acrylate + hydroxyethyl acrylate	Yes	
Chemical laboratory	1	Isocyanate + diaminodiphenyl methane	Yes	
Rubber materials	1	Thiuram + carbamix	Yes	
Cement dust	1	Chromium	Yes	
Radiographic liquid developer	1	Chromium	Yes	
Jewelry	1	Rhodium	Yes	
Metal refinery	1	Rhodium	Yes	(84)
Disinfectant	2	Glutaraldehyde (1 type I, prick test positive)	Yes	
Hair bleach	1	Ammonium persulfate (type I, prick test positive)	Yes	
Proteins (all prick test positive)	5			
	1	Cat	Yes	
	1	Cow's hair	Yes	
	1	Flour	Yes	
	1	Fodder	Yes	
	1	Pig	Yes	

Materials and methods

For the present update, we screened *Contact Dermatitis* (January 2007 to December 2011), *Dermatitis*, and also included relevant articles from other journals published during the same period. An allergen was judged to be airborne on the basis of the authors' use of terms such as dust or volatile, the distribution pattern of the dermatitis (see above), the nature of the lesions, the history, the follow-up of the patients, and the results of patch (sometimes prick) testing. Atopic patients with head and neck dermatitis mimicking airborne contact dermatitis were not taken into consideration in this review. The allergens retrieved in our survey, which does not pretend to be exhaustive, are listed in Table 1.

We also present the airborne cases observed in our department in a population of 2548 subjects patients tested between 2007 and 2011.

Results and Discussion

Almost all published causes of reactions induced by airborne agents were occupationally related (Table 1; if not, the references are indicated with an asterisk). These concerned 155 cases of airborne allergic dermatitis, the sources being drugs, plants, natural resins and woods, plastic, rubber and glue components, preservatives and other chemicals, and metals. In contrast to previous reviews on this subject (8, 9), we did not find reports on pesticides or animal feed additives as causal agents. Drugs as causes of airborne dermatitis seem to be



Fig. 1. Airborne allergic contact dermatitis caused by non-occupational exposure to a budesonide-containing aerosol used by a family member.



Fig. 2. Airborne allergic contact dermatitis in a patient crushing Antabuse® tablets (Sanofi Aventis, Paris, France) containing tetraethylthiuram disulfide for his spouse.

playing a more important role than in the past: we now found 14 reports concerning 43 patients, in contrast to previous reviews, in which we found 9 (8) and 6 reports (9), respectively. The proportion of plants as causes of airborne dermatitis remained stable. Moreover, the number of non-occupationally related cases did not change significantly either: there were 18 references, 20 by Santos and Goossens (8), and 10 by Huygens and Goossens (9).

Table 2 lists the airborne allergens identified in the 2548 patients tested in our department, of whom 1410 (1040 females and 370 males) presented with at least



Fig. 3. The positive patch test reaction to thiuram mix in the same patient.

one positive patch test reaction. Of these, 81 patients (54 women and 27 men) presented with an airborne dermatitis, 45 of the cases being occupationally related. The most frequent sources were fragrances, preservatives, and (systemic) drugs, and two examples of the last of these are illustrated here: Fig. 1 shows airborne contact dermatitis caused by non-occupational exposure to a budesonide-containing aerosol used by a family member, and Fig. 2 shows airborne contact dermatitis in a patient crushing Antabuse® tablets (Sanofi Aventis, Paris, France) containing tetraethylthiuram disulfide for his spouse. The positive patch test result to thiuram mix is shown in Fig. 3.

Our patients' data are in agreement with the literature; that is, 'classical' contact allergens, such as epoxy and (meth)acrylate resins, still play their part, but preservatives, for example methylchloroisothiazolinone and, recently, more often methylisothiazolinone in paints, in particular, and drugs such as tetrazepam in healthcare workers crushing tablets for disabled people, are increasingly being observed as causes of occupational airborne allergic contact dermatitis.

Moreover, clinicians must also be aware of alternative clinical patterns, so that the diagnosis of an airborne-related dermatitis will not be missed.

The following are case reports that are worth mentioning separately:

- Another 3 cases of baboon syndrome (synonym: SDRIFE, a systemic allergic dermatitis with a characteristic distribution pattern – bright-red itchy erythema involving the buttocks, anogenital area, upper inner surface of the thighs, and major flexures) caused by inhalation of metallic mercury vapour (81, 82)

- Allergic airborne contact dermatitis caused by Parthenium, in which continued exposure caused repeated exacerbations progressing to erythroderma (6)
- Systemic dermatitis triggered by airborne contact through inhalation of cobalt (78), and inhalation of airborne nickel being a major risk factor for sensitization (89)
- Airborne dermatitis in the seborrhoeic areas mimicking a seborrhoeic dermatitis in 2 patients with Parthenium dermatitis (32).

Other skin reactions induced by air exposure have also been observed and published: irritant contact dermatitis, photo-allergic reactions, contact urticaria (syndrome), and protein contact dermatitis (Table 1). Examples are cases of type I allergies caused by airborne pollen in

India (90) and cedar pollen in Japan (91). Some authors have continued to report on inhalation of airborne latex proteins from powdered gloves, sensitizing both clinicians and their patients (92).

Conclusion

This survey provides an updated list (from 2007 to 2011) of airborne dermatitis causes, particularly of allergic contact dermatitis. The sources of the reactions may be multiple, but most of the allergens identified concern an occupational setting, in which drugs and preservatives, in particular, have recently become more frequent. Last, but not least, this article is intended to remind the medical profession to be aware of the frequency of the airborne nature of the causal agents.

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