

truck driver outside the foundry. His nonspecific reactivity returned to normal, and his serial PEF record showed no work-related effect (OASYS-2 score 1.73), but he still had asthmatic symptoms in relation to nonspecific stimuli.

This is the first case of a worker with fully documented occupational asthma due to an aluminium salt. Serial PEF measurements showed low diurnal variation, as seen in some potroom workers (4), and an OASYS-2 score of 2.67 (specificity 94%) (2). The challenge testing showed a dual reaction to aluminium chloride with a 34% late fall in FEV₁, documenting asthma as well as a reaction to the aluminium chloride, and this was controlled with potassium chloride at the same pH. Aluminium welding (5), and cable jointing, using aminoethylethanolamine as a flux (6), have also caused occupational asthma.

*Occupational Lung Disease Unit
Birmingham Heartlands Hospital
Bordesley Green East
Birmingham B9 5SS
UK

Accepted for publication 20 March 2000
Allergy 2000; 55:779–780
Copyright © Munksgaard 2000
ISSN 0105-4538

References

1. FROSTAD AW. Fluorine intoxication in Norwegian aluminium plant workers. *Tidsskr Nor Laegeforen* 1936;**56**:179–182.
2. GANNON PFG, NEWTON DT, BELCHER J, PANTIN CF, BURGE PS. Development of OASYS-2: a system for the analysis of serial measurement of peak expiratory flow in workers with suspected occupational asthma. *Thorax* 1996;**51**:484–489.
3. YAN K, SALOME CM, WOOLCOCK AJ. Rapid method for measurement of bronchial responsiveness. *Thorax* 1983;**38**:760–765.
4. KONGERUD J, SOYSETH V, BURGE PS, BURGE S. Serial measurements of peak expiratory flow and responsiveness to methacholine in the diagnosis of aluminium potroom asthma. *Thorax* 1992;**47**:292–297.
5. VANDENPLAS O, DELWICHE JP, VANBILSEN ML, JOLY J, ROOSELS D. Occupational asthma caused by aluminium welding. *Eur Respir J* 1998;**11**:1182–1184.
6. PEPYS J, PICKERING CAC. Asthma due to inhaled chemical fumes – aminoethylethanolamine in aluminium soldering flux. *Clin Allergy* 1972;**2**:197–204.

Air purification and indoor biologic pollutants

R. Albertini*, P. Ciancianaini, S. Pinelli,
P. Lunghi, E. Ridolo, P. Dall'Aglia

Key words: air purification; indoor pollutants.

● SENSITIZING stimulants are numerous and of many kinds, and among these we can include contaminants of biologic origin represented by airborne organic particles such as bacteria, pollen grains, dust mites, and fungal spores, which constitute the major problem in confined spaces for those who suffer from respiratory diseases and allergies. Some of the major allergens are encountered not outdoors but indoors (1–4). Moreover, improved methods of constructing and ventilating houses, public buildings, and factories need to be found to decrease the risk of exposure to perennial or occupational allergens. It is therefore of primary importance to keep the environment under constant control as a preventive measure against such allergies, thus benefiting domestic and business premises in which airborne pollutants can be readily dispersed (5, 6).

The aim of our study was to examine how the total concentration of biologic indoor pollutants can be reduced with an air purifier: the Ecomed[®] Ghibli/Byomek (Leiber Italia s.r.l.), a biomechanical appliance for cleaning the air by means of a

wet disk system (power consumption 15 W and delivery capacity 98 m³/h). Aerobiologic sampling was done with the VPS1000 Lanzoni spore trap. To minimize the effects due to variable conditions of the outdoor atmosphere, we monitored simultaneously two adjacent rooms of the same form, amplitude, and window apertures, each with a spore trap, but only one (room 1) with the air purifier functioning during the periods indicated in Fig. 1. From rooms selected in the houses of each of nine volunteers, seven samples of household dust were drawn onto Mitest filters (ALK) by a vacuum cleaner. Dust was collected at fixed times without further cleaning during the days between one sample collection and the next (4 days). The samples drawn were analyzed, after extraction, for the presence of Der p 1 (*Dermatophagoides pteronyssinus*), Der f 1 (*D. farinae*), Fel d 1 (cat), Bla g 2 (*Blattella germanica*) by the Elisa-Dust Screen (ALK). From days 7 to 21 of each period of observation, the air cleaner was made to function 24 h a day.

The aerobiologic data collected during the course of our study show how the air purifier can reduce significantly the concentration of indoor allergens ($P < 0.001$). Moreover, our study shows that the principal dust mite found in houses, as determined by the presence of the antigen, was *D. farinae*. The cat allergen Fel d 1 was also present, even if at low concentrations or merely traces, in eight out of nine of the houses despite the fact that none of these had ever sheltered a cat. The cockroach allergen Bla g 2 did not appear to be present in any of the homes examined. The air-purifying appliance can reduce significantly ($P < 0.05$) the presence of the analyzed allergen Der f 1 in household dust.

In indoor living conditions, the situations at risk are present especially in communities where airing may be insufficient if not impossible, and where, due to inadequate or lack of maintenance, air-conditioning

systems can function as concentrators, or even as culture media, for noxious agents (7, 8). Universally recognized standards of efficiency for comparing the degree of effectiveness of appliances employed for the depuration of indoor pollutants have not, as yet, been identified (9). Our study intends to provide a useful contribution to the identification, in this field, of efficient appliances that can reduce more thoroughly and effectively the concentration of indoor pollutants. The data obtained during the course of our research show that the air-purifying system Ghibli/Byomek can reduce significantly environmental contamination caused by biologic indoor pollutants. Our results are particularly interesting in that they have been obtained from "field-tests", that is to say, under actual working conditions, as encountered by the air-purifying appliance situated in the rooms analyzed, and not under controlled, optimum laboratory conditions.

*Istituto di Patologia Medica
Scuola di Specializzazione in Allergologia ed Immunologia Clinica
Università di Parma
Via Gramsci 14
43100 Parma
Italy
Tel. 0521991387
Fax: 0521982519
E-mail: paonazza@ipruniv.cce.unipr.it

Accepted for publication 6 April 2000
Allergy 2000; 55:780-782
Copyright © Munksgaard 2000
ISSN 0105-4538

References

1. GAGE-WHITE I. Practical environmental modifications for the inhalant allergy patient. *Otolaryngol Clin North Am* 1998;**31**:83-90.
2. WARNER JO, LITTLE SA, POLLOCK I, LONGBOTTOM J. The influence of exposure to house dust mite, cat, pollen and fungal allergens in the home on primary sensitisation in asthma. *Pediatr Allergy Immunol* 1998;**1**:79-86.

3. SPORIK R, HOLGATE S, PLATTS-MILLS TAE, COGSWELL JJ. Exposure to house-dust mite allergen (*Der p 1*) and the development of asthma in childhood. *N Engl J Med* 1990;**323**:502-507.
4. MUNIR AKM. Environmental factors influencing the levels of indoor allergens. *Pediatr Allergy Immunol* 1995;**6 Suppl 7**: 13-21.
5. LUCZYNSKA CM. Risk factors for indoor allergen exposure. Environmental measures in the prevention of allergy. Belgium, UCB Institute of Allergy, 1994:35-42.
6. KOSKINEN OM, HUSMAN TM, MEKLIN TM, NEVELAINEN A. The relationship between moisture observations in houses and inhabitants' state of health. I. Adults. *Indoor Air* 1996;**3**:421-425.
7. DELFINO RJ, ZEIGER RS, SELTZER JM, et al. The effect of outdoor fungal spore concentrations on daily asthma severity. *Environ Health Perspect* 1997;**105**:622-635.
8. OLIVER LC, SHACKLETON BW. The indoor air we breathe. *Public Health Rep* 1998;**113**:398-409.

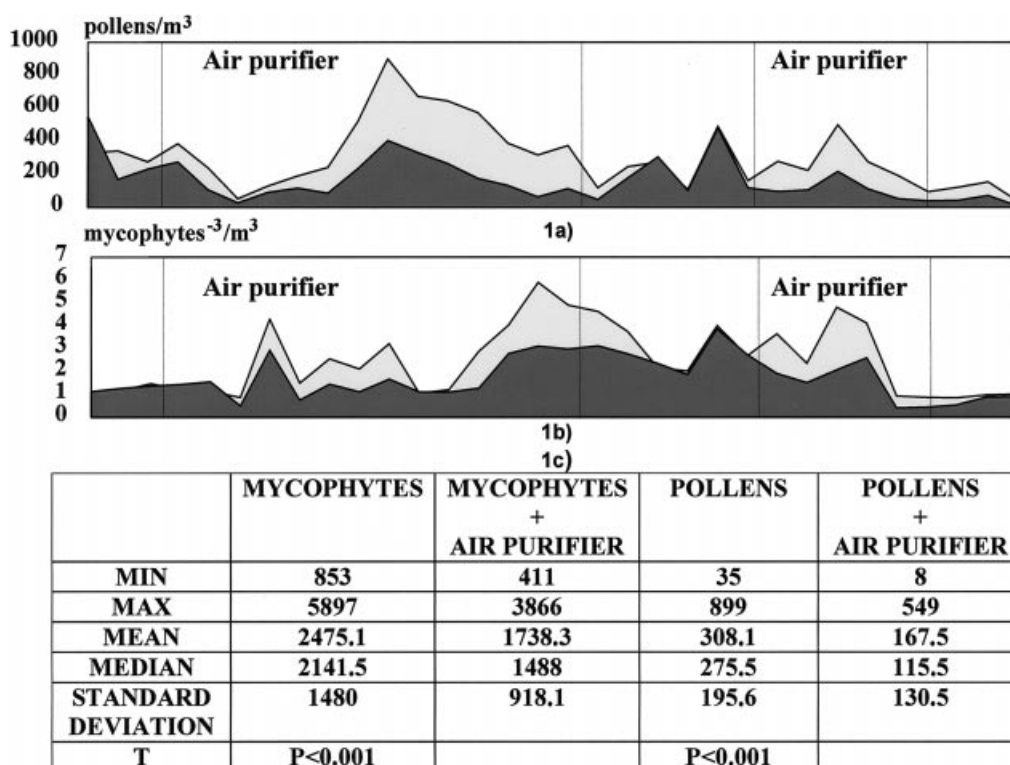


Figure 1. a,b) Trend of pollutants during observations. Air purifier in room 1 (dark area) functioned during periods indicated. c) Descriptive statistical data of indoor pollen grains and mycophyte concentrations. Values are expressed as number of particles/m³ air.

9. REISMAN R, MAURIELLO P, DAVIS G. A double-blind study of the effectiveness of high-efficiency particulate air (HEPA) filter in the treatment of patients with perennial allergic rhinitis and asthma. *J Allergy Clin Immunol* 1990;**85**:1050–1059.

Swimming-pool pneumonitis

E. González-Mancebo*, M. L. Díez Gomez, Z. Pulido, T. Alfaya, F. León

Key words: *Candida albicans*; fungi; hypersensitivity pneumonitis; indoor swimming pool.

● HYPERSENSITIVITY pneumonitis (HP) is well known worldwide, but we are constantly discovering more antigens involved in this disease. There are several cases of HP associated with sauna-takers (1–3), but there have been only two publications about HP related to indoor swimming pools (4, 5).

Our patient was a 43-year-old man who, 4 months before, had suffered an episode of fever of 40°C, headache, myalgia, nonproductive cough, chest tightness, and dyspnea. These symptoms appeared 4–6 h after he swam in a covered swimming pool, lasted for 24 h, and disappeared after acetaminophen administration. The patient remained asymptomatic for 1 month without using the swimming pool, but he presented the same symptoms when he used the pool again. After that, the patient had not visited the swimming pool for 3 months, and he had not suffered further episodes.

We performed microbiologic studies for mold growth with samples from this swimming pool. *Candida albicans* and *Aspergillus fumigatus* were isolated from swimming-pool environment samples.

Skin prick tests with a battery of common aeroallergens including *Alternaria tenuis*,

A. fumigatus, *Cladosporium herbarum*, and *Penicillium notatum* (Bial Aristegui, Bilbao, Spain) were carried out, with negative result.

Intradermal tests with *A. fumigatus* and *C. albicans* were also performed, yielding a positive result with *C. albicans* extract at 24 h.

Total serum IgE was 32 kU/l and specific IgE determinations to *A. tenuis*, *C. herbarum*, *P. notatum*, *A. fumigatus*, and *C. albicans* (Pharmacia CAP System, Sweden) were all negative.

Specific IgG antibodies were investigated by ELISA, with a positive result for *A. fumigatus* and *C. albicans* and a negative result for *Thermoactinomyces* spp. and *Micropolyspora* spp.

We performed a specific bronchial provocation test (PIPT) with 5 ml *A. fumigatus* extract (10 mg/ml) and 1 month later with 5 ml *C. albicans* extract (10 mg/ml) (6). PIPT with *A. fumigatus* extract was negative. PIPT with *C. albicans* extract was positive 30 h after challenge, reproducing the same symptoms in the patient. We also found medium and basal pulmonary field crackling in lung auscultation, leukocytosis of 11 900 cells/mm³ (neutrophils: 8900 cells/mm³), a decrease in *PaO₂* blood gasometry (*PaO₂* 67 mmHg), and chest radiography with basal and bilateral pulmonary interstitial infiltration. The patient required systemic corticosteroid and oxygen administration. We also performed PIPT with *C. albicans* on two healthy volunteers (swimming-pool workers) with negative result.

SDS–PAGE/IgG immunoblotting (7) and inhibition assays with *A. fumigatus* and *C. albicans* extracts were carried out. IgG immunoblotting showed bands with molecular masses of 30, 46, 55, 90, and >100 kDa in *A. fumigatus* extract and 46, 60, 90, and >100 kDa in *C. albicans* extract. Two of the proteins responsible for these reactivities (46 and >100 kDa) seemed to be the same protein in both extracts, since cross-reactivity was demonstrated by cross-inhibition.

In our patient, HP related to an indoor swimming-pool environment, and caused by *C. albicans*, was diagnosed. We could reproduce the clinical and laboratory findings through specific PIPT with the suspected agent. To the best of our knowledge, there is only one previous publication on *Candida* as the cause of HP (in a farmer exposed to wet hay [8]). The results of SDS–PAGE and IgG immunoblotting showed a 46-kDa protein in *A. fumigatus* and *C. albicans* extracts, already described in earlier studies (7, 9). There are no previous reports of the high-molecular-mass antigens (>100 kDa) that we observed in *A. fumigatus* and *C. albicans* and of the cross-reactivity among them. We also emphasize the value of a site visit in the diagnosis of HP (4). A previous publication describes endemic granulomatous pneumonitis in an indoor swimming pool and suggests the term “lifeguard lung” (5), but we note that this could be a problem that also affects users of swimming pools, who are not as frequently exposed to antigens.

*C/ Witerico 5, port 6, 3° D
28025 Madrid
Spain

Accepted for publication 3 April 2000
Allergy 2000; 55:782–783
Copyright © Munksgaard 2000
ISSN 0105-4538

References

1. METZGER WJ, PATTERSON R, FINK J, SEMERDJIAN R, ROBERTS M. Sauna-takers' disease. Hypersensitivity pneumonitis due to contaminated water in a home sauna. *JAMA* 1976;**236**:2209–2211.
2. EMBIL J, WARREN P, YAKRUS M, et al. Pulmonary illness associated with exposure to *Mycobacterium avium* complex in hot tub water. *Chest* 1997;**111**:813–816.
3. PATTERSON R. Studies of hypersensitivity lung disease with emphasis on a solid-phase radioimmunoassay as a potential diagnostic aid. *J Allergy Clin Immunol* 1978;**61**:216–219.