Bronchoalveolar lavage findings in a patient with the organic dust toxic syndrome

E Raymenants, M Demedts, B Nemery

Abstract

A previously healthy student developed the organic dust toxic syndrome after unloading a grain silo for one day. Bronchoalveolar lavage seven days later showed a total cell count six times normal with 70% lymphocytes. This suggests that the previously described acute neutrophil influx into the alveolar spaces in this syndrome is rapidly replaced by a lymphocyte dominated infiltration.

The organic dust toxic syndrome,[1] also known as pulmonary mycotoxicosis,[2] is a non-allergic, non-infectious, influenza like illness. It may follow a single heavy exposure to various agricultural dusts, which are often contaminated with fungi, and it often occurs after the unloading of silos, which has led to the name silo unloader's syndrome.[3] Clinically the organic dust toxic syndrome is an acute febrile illness, beginning a few hours after the exposure, with respiratory and systemic symptoms resembling acute farmer's lung (extrinsic allergic alveolitis or hypersensitivity pneumonitis).[3,4] Although epidemiological data are few,[3–5] the organic dust toxic syndrome is probably more common and less serious with regard to long term prognosis than farmer's lung: it usually causes lesser radiographic changes and pulmonary function abnormalities, and is thought not to lead to fibrotic lung disease.[3–5]

The pathogenesis of the pulmonary manifestations of the organic dust toxic syndrome is not fully understood. Bronchoalveolar lavage in two patients[6] has shown an increase in neutrophils and a normal proportion of lymphocytes in the acute phase (days 1–3) and persistent mild lymphocytosis, of 24% in one and 32% in the other, on day 32 and day 40 respectively.[6]

We describe a patient who had bronchoalveolar lavage soon after the acute phase of the organic dust toxic syndrome, when we found evidence for a pronounced lymphocytosis in the alveolar spaces.

Division of Pneumonology, University Hospital Pellenberg, Leuven, Belgium
E Raymenants
M Demedts
B Nemery

Address for reprint requests: Dr B Nemery, Lung Toxicology, Kapucijnenvoer 35, B-3000 Leuven, Belgium

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Case report

A previously healthy 18 year old student and his friend of the same age became ill after starting a holiday job, in which they were unloading grain from a silo where it had been stored for years. The environment was extremely dusty, forcing them to interrupt work repeatedly because of burning eyes and cough.

After nine hours of this work our patient went home feeling well. A few hours later he developed a dry cough, shortness of breath, muscle pains, and sweats. His temperature rose to 39°C. He was treated with a cough mixture and his symptoms subsided a little but he had to remain in bed the following day. On the next day (day 2) he was referred to us because of persistent cough, increased chest tightness, and extreme malaise. His friend had similar complaints but was not referred to us.

On admission the patient looked ill and coughed a lot. His temperature was 38°C, pulse rate 84/min, blood pressure 120/80 mm Hg, and breathing rate 16/min. Auscultation of his chest showed that there were decreased breath sounds and fine basal crackles. Peripheral blood analysis gave an erythrocyte sedimentation rate of 50 mm in one hour, a white blood cell count of $14{\cdot}7 \times 10^9$/l (87% neutrophils, 3% eosinophils, 4% lymphocytes, 6% monocytes), and a C reactive protein concentration of 11·6 mg/dl. Arterial blood gas analysis showed a normal oxygen tension (Pa_{O_2}) of 88 mm Hg (11·6 kPa) and a carbon dioxide tension (Pa_{CO_2}) of 40 mmHg (5·3 kPa). The chest radiograph was normal. Precipitating antibodies to common farmer's lung antigens (*Aspergillus, Streptomyces, Penicillium, Thermopolyspora*) were absent. Total IgE was 298 U/ml and radioallergosorbent tests with *Dermatophagoides pteronyssinus*, cat epithelium, and mixtures of fungi or of grass or tree pollens all gave negative results. There was a history of adverse reactions to aspirin.

Spirometry (table 1) showed normal lung volumes in relation to predicted values[7] but a restrictive pattern by comparison with the values obtained at follow up visits. The transfer factor for carbon monoxide (T_{LCO}) was 69% of predicted[7] at admission and had increased to 92% two weeks later and 100% five months later.

Bronchoalveolar lavage was carried out by fibreoptic bronchoscopy[8] on the seventh day after exposure. The bronchial mucosa appeared normal. The lavage fluid (table 2) showed the total cell number to be six times higher than normal,[8] with 70% lymphocytes (T4:T8 ratio reduced to 0·7). The increase in lavage fluid lymphocytes was therefore very pronounced. In the peripheral blood the T4:T8 ratio was also low (0·9). Unfortunately no microbiological assessment of the lavage fluid was carried out.

The patient became afebrile and felt well within 24 hours of admission. The peripheral leucocyte count fell to $8{\cdot}2 \times 10^9$/l (80% neutrophils) on day 3 after exposure and to $5{\cdot}8 \times 10^9$/l (58% neutrophils, 11% eosinophils, 26% lymphocytes, 3% monocytes) on day 4. The patient was discharged five days after admission in good general condition apart from a slight cough, which subsided during the following weeks. When seen five months later

Table 1 Lung function three days (admission), two weeks, and 20 weeks after massive exposure to grain dust (percentages of predicted values[7] in parentheses)

	Admission	2 weeks	20 weeks
FVC (l)	6·28 (99)	7·24 (114)	7·32 (116)
FEV_1 (l)	4·98 (99)	6·44 (128)	6·14 (122)
FEV_1/FVC	0·79	0·89	0·84
RV (l)	1·97 (109)	2·00 (111)	1·56 (86)
TLC (l)	8·25 (101)	9·24 (114)	8·88 (109)
TLCO (mmol/min/kPa)	9·24 (69)	12·52 (92)	13·67 (100)

FVC—forced vital capacity; FEV_1—forced expiratory volume in one second; RV—residual volume; TLC—total lung capacity; TLCO—carbon monoxide transfer factor.

Table 2 Bronchoalveolar lavage fluid cells in the organic dust toxic syndrome seven days after massive exposure to grain dust

	Observed	Normal value (mean (SD) or limit)[8]
Fluid (ml) recovered (150 ml instilled)	96 ml	
Total number of cells × 10^6	52·8	9·5 (5·2)
Macrophages (%)	28	>90
Neutrophils (%)	2	<3
Lymphocytes (%)	70	<20
T4 (% of lymphocytes)	35	44 (10)
T8 (% of lymphocytes)	47·5	34 (10)
T4:T8	0·7	1·44 (0·54)

he had had no further respiratory problems. He still had a high eosinophil count (12%, total leucocytes 6·6 × 10^9/l), which was not pursued.

Discussion

Although an acute (viral) infection could not be entirely excluded, the circumstances of exposure and clinical presentation of this case strongly suggest that this was the organic dust toxic syndrome. Of particular relevance are the history of a single, first ever exposure to a high concentration of presumably mouldy grain dust during the unloading of a silo and the fact that a similarly exposed workmate was also affected; this makes the diagnosis of hypersensitivity pneumonitis extremely unlikely.

The clinical signs and symptoms, the normal chest radiograph, the peripheral leucocytosis, and the transiently restrictive lung function with lowered TLCO and normal Pao_2 are all compatible with reported features of the organic dust toxic syndrome.[3 4] We do not think that the high eosinophil count and the slightly increased total IgE were relevant to this condition.

The organic dust toxic syndrome is a relatively frequent condition, with an estimated yearly incidence of 1 in 100 farmers in a recent Swedish survey.[5] The illness is probably unrecognised on many occasions by the medical profession, as it is self limiting and is easily considered by patient and doctor as a simple bout of influenza.[9] On the other hand, some instances of this syndrome are probably wrongly diagnosed as acute farmer's lung, which requires different and more drastic preventive and therapeutic measures, including strict avoidance of antigen exposure and possibly corticosteroid treatment.

Lavage fluid findings have been described in only two cases of the organic dust toxic syndrome; they showed early neutrophilia and later mild bronchoalveolar lymphocytosis.[6] Our data suggest that the transition between the acute neutrophil influx and lymphocytic inflammatory profile occurs quite early, as we found a very high proportion (70%) and absolute number of lymphocytes on the seventh day after exposure.

The pathogenesis of the organic dust toxic syndrome and the associated picture of alveolar inflammation are still not clear. It is presumably a non-allergic, inflammatory reaction to toxic (for example, complement activating) components of plant material[10] or bacterial or fungal contaminants.[11] The similarity between the organic dust toxic syndrome and metal fume fever with regard to the lavage fluid cells[12] suggests that the mechanisms underlying the two alveolar inflammatory conditions might be similar.

1 Do Pico GA. Health effects of organic dust in the farm environment. Report on diseases. *Am J Ind Med* 1986;**10**:261–5.
2 Emmanuel DA, Wenzel FJ, Lawton BR. Pulmonary mycotoxicosis. *Chest* 1975;**67**:293–7.
3 Pratt DS, May JJ. Feed-associated respiratory illness in farmers. *Arch Environ Health* 1984;**39**:43–8.
4 May JJ, Stallones L, Darrow D, Pratt DS. Organic dust toxicity (pulmonary mycotoxicosis) associated with silo unloading. *Thorax* 1986;**41**:919–23.
5 Malmberg P, Rask-Andersen M, Haglund S, Kolmodin-Hedman B, Guernsey Read J. Incidence of organic dust toxic syndrome and allergic alveolitis in Swedish farmers. *Int Arch Allergy Appl Immunol* 1988;**87**:47–54.
6 Lecours R, Laviolette M, Cormier Y. Bronchoalveolar lavage in pulmonary mycotoxicosis (organic dust toxic syndrome). *Thorax* 1986;**41**:924–26
7 Quanjer Ph H, ed. Standardized lung function testing. *Bull Eur Physiopathol Respir* 1983;**19**(suppl 5).
8 Ceuppens JL, Lacquet LM, Marien G, Demedts M, Van Den Eeckhout A, Stevens E. Alveolar T-cell subsets in pulmonary sarcoidosis. *Am Rev Respir Dis* 1984;**129**: 563–8.
9 Rask-Andersen A. Organic dust toxic syndrome among farmers. *Br J Ind Med* 1989;**46**:233–8.
10 Skea DL, McAvoy D, Broder I. Grain dust contains a tannin-like material which fixes complement. *Environ Res* 1988;**46**:181–9.
11 Edwards JH, Baker JT, Davies BH. Precipitin test negative farmer's lung. Activation of the alternative pathway of complement by mouldy hay dusts. *Clin Allergy* 1974; 4:379–88.
12 Vogelmeier C, König G, Benoze K, Fruhmann G. Pulmonary involvement in zinc fume fever. *Chest* 1987;**92**:946–8.