

# Air Conditioning Systems as Non-Infectious Health Hazards Inducing Acute Respiratory Symptoms

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**Abstract:** Chronic and acute exposure to toxic aerosols belongs to frequent causes of airway diseases. However, asthma attacks due to long-distance inhalative exposure to organic solvents, transmitted via an air condition system, have not been reported so far. The present case illustrates the possibility of air conditioning systems as non-infectious health hazards in occupational medicine. So far, only infectious diseases such as legionella pneumophila pneumonia have commonly been associated to air-conditioning exposures but physicians should be alert to the potential of transmission of toxic volatile substances via air conditioning systems. In view of the events of the 11th of September 2001 with a growing danger of large building terrorism which may even use air conditioning systems to transmit toxins, facility management security staff should be alerted to possible non-infectious toxic health hazards arising from air-conditioning systems.

**Key words:** Organic solvent, Inhalative, Accidental exposure, Asthma, Air conditioning

The risk of air conditioners as potential sources of contaminated aerosols is known for a long time. Recently, the appearance of the severe acute respiratory syndrome caused by a novel SARS coronavirus (SARS-CoV) highlighted the dangers of airborne infectious agents<sup>1–3</sup>) In this respect, the legionella pneumophila associated pneumonia<sup>4</sup>), even in large public places such as the Picadilly Circus in London<sup>5</sup>) or lethal pulmonary aspergillosis<sup>6</sup>) have been reported. Therefore, to protect patients from air condition-transmitted nosocomial infections at intensive care units, operating theatres and other medical wards, air-filters should be checked and disinfected regularly. However, air conditioning systems are currently not considered as common distributors of non-infectious toxic aerosols leading to the induction of acute airway diseases. Here we report a case of a bank manager presenting with acute airway reactions caused by exposure to toxic substances.

A 35 year old male Caucasian bank-manager with a history of bronchial asthma from the age of 14 presented with an acute asthma attack. The current asthma medication was 2 puffs of fenoterol and 2 × 2 puffs budesonide daily. He had not had any exacerbations of asthma

or severe respiratory symptoms for the last year but had shown bronchial hyperresponsiveness in methacholine challenge in 2002.

History talking revealed that the patient had sensed a slight smell of solvents at noon in his office, followed by a general unwellness with irritation of the conjunctivae and later shortness of breath, cough and dyspnoe. The attack was treated successfully with a standard therapeutic regimen and there were no further complaints noticed in the following 4 months. The blood and biochemical parameters were within normal limits beside an increased eosinophil count and elevated cholesterol.

A direct origin of toxic substances could not be detected at his office, but exploration of the whole bank building revealed that in the upper floors, painters had been using a special sealing for two days to seal the floors. The sealing consisted of a mixture of the dissolved substances 2,4- and 2,6- diisocyanate and the organic solvents light naphtha, n-butyl acetate, 2-methoxy-1-methylacetate, propylbenzene, and mesitylene (1,2,4- trimethylbenzene).

The painters did not complain about any disorders as they carried safety suits and masks, but apparently aerosols developed from the volatile substances which were then transmitted via air-condition to the office of the

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bank manager and other floors of the building. At the first day the painters worked from nine o'clock a.m. till five o'clock p.m. The patient noticed the smell at noon of the first day but continued to work till four o'clock p.m. The symptom of conjunctival irritation began in the evening. Several employees affirmed the perception of varnish smell and complained of headache but decided not to open the windows for reasons of security. Next morning the air was still not free of aerosols. At about two o'clock p.m. the respiratory symptoms occurred. In this respect the patient was working for one and a half day in his office while he was exposed to the toxic aerosols. In total, he was exposed to aerosols of organic solvents for about 11 h. Beside the bank-manager, two female bank employees, working at the same floor, aged 22 and 23 were admitted due to transient neurological symptoms at the department for occupational medicine. On physical examination, one of them still complained of increasing vertigo caused by eye movement, slight ataxia while the eyes are closed and a sore throat.

Inhalation is a very common and important way of exposure to allergens and toxic substances and long-term low-dose occupational exposure to organic solvents, especially isocyanate-based volatile organic compounds, is a well recognized cause of asthma. In Japan, 15 percent of all adult male asthmatics and in the USA 2 percent of all cases of asthma are estimated to be of occupational origin<sup>7</sup>. Chronic low-dose exposure is not the only condition on that occupational airway diseases develop and accidental inhalative exposure to fleeting substances, which may lead to intoxication or central nervous system symptoms rather than asthma attacks, probably occurs more frequent<sup>8</sup>. Due to a large number of reports on acute and chronic occupational intoxication of painters and other workers due to organic solvent exposition, a variety of precautions like suits, masks and exhausters for workers were established in the past years to reduce the risk of occupational exposure. In the present case a low-dose exposure which was transmitted via an air-conditioning system induced an acute asthma attack. The case illustrates that improper use of materials containing volatile chemicals without exhausters and in combination

with an air conditioning system may lead to incidents of inhalative occupational exposure/intoxication to non-involved employees in other areas of the building, even if the primarily involved workers stick to basic precautions such as suits and masks. To date, air conditioning systems are generally accepted as potential transmitters for infectious diseases such as legionella pneumophila-induced pneumonia and therefore, a focus was put on the prevention of microbial transmission.

Although a similar report on asthma induction has not reported so far, we presume that the transmission of toxic aerosols via air conditioning systems is more frequent than expected.

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