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Short reports

Occupational asthma due to heated freon

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We describe a subject who developed an increase in symptoms of asthma at work, where he was exposed to heated fluorocarbon (freon). Specific inhalation challenges confirmed the diagnosis.

Case report

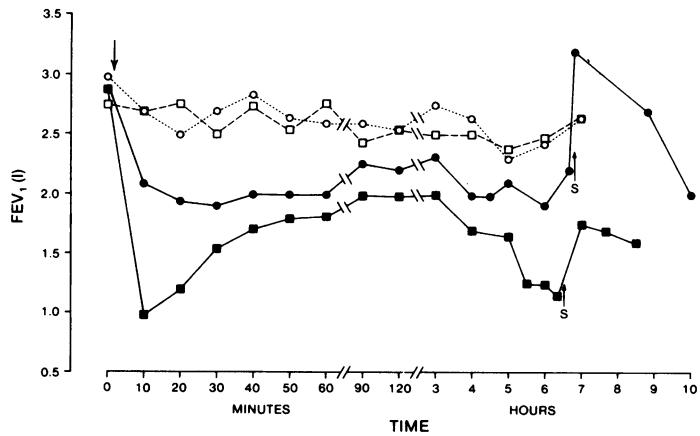
A 46 year old asthmatic man reported an exacerbation of symptoms over the previous two years. He had first developed asthma when he was 15 years of age. After the age of 20 asthma was present only on exercise and he never required regular bronchodilator treatment. He had no previous history of rhinitis, infantile eczema, migraine, or urticaria. He was a non-smoker. He had started working in the maintenance department of a refrigeration company eight years before, and had noticed asthmatic attacks at work in the past two years. His work consisted of soldering with acetylene and wire made of copper, silver, and phosphorus (without flux) on copper pipes. During this process freon circulating in the pipes was heated and released into the air. After a few minutes of soldering the man experienced dyspnoea and wheezing. These symptoms persisted during the afternoon and on the day after leaving work. He used an isoprenaline inhaler if needed but took no other treatment. Skinprick test responses to a battery of 15 commonly inhaled allergens were all negative.

Investigations were begun after the patient had been away from work for three weeks. His initial FEV_1/forced vital capacity (FVC) ratio measured on a Collins spirometer (W E Collins Incorporated, Braintree, Mass) was 3·5 l/5 l (71%) (82% of the predicted value[1]). Histamine phosphate inhalation challenges were performed according to a standardised procedure.[2] The concentration of histamine causing a 20% change in FEV_1 (PC_{20}) was 0·14 mg/ml. The following specific inhalation challenges were carried out in a large (15 × 20 ft) soldering room in the hospital workshop (results are shown in the figure):

1 A 17 minute exposure to soldering with acetylene and wire on a copper wire with release of the heated freon circulating in the pipe produced a 66% fall in FEV_1 10 minutes after the end of exposure. The FEV_1 improved thereafter and was back to 23% below baseline three hours later. Subsequently, FEV_1 again fell progressively and was at 60% below baseline six and a half hours after the end of challenge. On a previous control day (not included in the figure) there was no significant change in FEV_1 for a similar period.

2 One week later, when baseline FEV_1 was back to ±10% of the challenge day baseline and PC_{20} was 0·19 mg/ml, the subject was exposed on two different days to soldering with acetylene and wire—without freon on one day and with unheated freon on the other day. There were no significant changes in FEV_1 after these challenges.

3 On a different day the subject used the same acetylene torch to heat for 5 minutes a copper pipe through which freon circulated and was released. An asthmatic reaction



Changes in FEV_1 (ordinate) with time (abscissa) after challenges (arrow). ■——■ seventeen minutes' soldering with acetylene and wire, with release of heated freon; ●——● five minutes' soldering with acetylene, with release of heated freon; □——□ seventeen minutes' soldering with acetylene and wire; ○——○ seventeen minutes' exposure to unheated freon.

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similar to the one induced by the first challenge, though somewhat weaker, was documented.

Discussion

Acute airway obstruction after inhalation of a fluoropropellant contained in commercial pressurised bronchodilator aerosols[3] and hair sprays[4 5] have been described. This effect is short term and is generally thought to be due to a direct effect on irritant receptors of the bronchial tract. The bronchoconstriction described in our patient was of a different type. A dual (immediate and non-immediate) temporal pattern was observed. Such a reaction has been described after antigenic inhalation challenges[6] and, more recently, after exercise.[7] Although the exact mechanism of the reaction seen in our patient is uncertain, we consider that the dual temporal pattern excludes non-specific bronchial irritation. An irritant mechanism can also be ruled out on the ground that exposure to soldering with acetylene with the release of fumes did not cause bronchoconstriction. The fact that unheated freon did not produce bronchoconstriction whereas heated freon did is interesting. This suggests that freon can be activated by heating and cause bronchoconstriction in a specific way, either alone or when combined with acetylene.

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