CASE REPORT

Occupational asthma after exposure to plaster casts containing methylene diphenyl diisocyanate

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Background

The case of a 34-year-old female nurse is presented. She worked in an accident and emergency department in a district general hospital, with methylene diphenyl diisocyanate (MDI)-containing synthetic plaster casts. She worked with MDI on a daily basis for 4 years. She was out of the department for 1 year and on her return developed cough, wheeze and dyspnoea within 5 min of exposure to MDI-containing synthetic casts.

Method

A bronchial provocation test was performed and confirmed an early asthmatic response.

Results

There was a 39% decrease in the forced expiratory volume in 1 s 15 min after exposure, which required the administration of a bronchodilator on two occasions. The patient has subsequently avoided MDI-containing synthetic plaster casts and has experienced no further respiratory symptoms.

Conclusion

This case illustrates that respiratory sensitization can occur as a result of exposure to MDI-containing synthetic casts and highlights the need for vigilance when health care workers are using isocyanate-containing synthetic casts.

Keywords

Health care workers; isocyanates; methylene diphenyl diisocyanate; occupational asthma.

Introduction

Health care workers are at risk of developing occupational asthma from both high- and low-molecular-weight compounds, including latex and glutaraldehyde. Although isocyanates are the most common cause of occupational asthma in the community, they were not mentioned in a previous review of occupational asthma in health care workers [1]. Methylene diphenyl diisocyanate (MDI) is solid at room temperature but can cause occupational asthma when it becomes volatile on heating. It is present in synthetic plaster casts that are widely used in emergency departments.

Case report

A 34-year-old nurse, who worked in a district hospital, was referred for investigation. She had been using a synthetic cast containing MDI on a daily basis for 4 years. During this period she had no respiratory symptoms. She was then out of the department for 1 year, and shortly after her return developed cough, wheeze and dyspnoea, beginning within 5 min of exposure. The symptoms would subside spontaneously after ~1 h. She noticed that her symptoms were more severe and prolonged if she applied a second plaster. The wheeze would subside, but she would awaken early in the morning with the sensation of breathlessness. She attributed her symptoms to working with a specific bandage called ‘Dynacast P II’, which contains MDI. There was no previous history of respiratory disease or atopy. There was no family history of asthma, but two sisters had eczema. On clinical
examination, palpation, percussion and auscultation of the chest were normal. Spirometry was normal.

Bronchial provocation testing (BPT) was performed. The exposure was simulated by the patient applying the plaster to a semi-rigid corrugated hose (55 mm diameter). Peak expiratory flow rate and forced expiratory volume in 1 s (FEV1) were monitored before and after exposure. Advice was given to terminate the challenge if symptoms developed. She stopped the challenge after 15 min as advised, with the onset of cough and wheeze. Post-exposure, the FEV1 showed a 39% decrease requiring the administration of a bronchodilator on two occasions. Lung function returned to pre-exposure values after 120 min. The full results are shown in Figure 1. The presence of an early asthmatic response was confirmed by a decrease of >15% in FEV1 [2]. There were no further symptoms during the 24 h following the test, but peak flow readings were not kept as advised.

Following the challenge, advice was given to avoid further contact with synthetic plaster casts. This has been followed and the patient has experienced no further respiratory problems.

Discussion
This case demonstrates the possibility of occupational asthma developing following exposure to MDI-containing synthetic casts. The company who make the cast were not aware of any previous cases. We were able to find in the literature two other cases of asthma secondary to MDI-containing synthetic casts. In 1994, Tanaka et al. [3] described a 38-year-old male orthopaedist who developed an early asthmatic response after 1 year of exposure to MDI-containing synthetic casts. He had a history of bronchial asthma and atopic dermatitis. A positive early response was observed on bronchial challenge testing. Enzyme-linked immunosorbent assay testing confirmed the presence of specific immunoglobulin G for MDI.

In 2000, Sommer et al. [4] described a 35-year-old female nurse, without a history of atopy, who complained of nightly wheeze, rhinitis and itchy eyes during employment in an emergency room. She applied MDI-containing synthetic casts up to three times daily and first developed a serious asthmatic attack after her husband used MDI-containing insulation foam. A BPT was performed with the MDI-based synthetic cast material. After 7 h, she had an asthma attack with a 48% fall in FEV1, consistent with a late response implicating MDI as the causative agent.

The data sheet for ‘Dynacast PII’ comments that, at temperatures of >50°C, MDI fumes may be generated which may cause ‘breathing difficulties and sensitisation’. Activation of the plaster is associated with an exothermic reaction. Factors influencing the extent of this are the temperature of the water bath and the degree of mechanical agitation imparted to the plaster. This can serve to increase the local temperature significantly, resulting in an increase in vaporization of MDI.

These cases show that both early- and late-phase asthmatic reactions can be caused by occupational exposure to MDI-containing plaster casts. In any situation where MDI is used the possibility of respiratory sensitization should be considered and the relevant safety data sheets carefully studied. Isocyanates, regardless of molecular form or volatility, are potentially hazardous.
This report illustrates that respiratory sensitization can occur as a result of exposure to MDI and highlights the need for vigilance when health care workers are using isocyanate-containing synthetic casts.

References


