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An outbreak of pruritic skin lesions in a group of laboratory workers—A case report

M. R. Sim* and A. Echt†
**Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia and †Hazard Evaluations and Technical Assistance Branch, Division of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health, Cincinnati, Ohio, USA.*

In May 1993, an outbreak of pruritic skin lesions occurred among a group of employees located in four laboratories in the basement of an office building. Medical interviews with the affected workers were performed and an industrial hygiene survey of the site was conducted. Workers commonly reported a prickling sensation on exposed skin. Four of the workers had small (< 5mm) erythematous papules on their forearms. Just prior to the outbreak, the installation of fibrous glass insulation had commenced in the mechanical rooms which provided air to the basement of the building. Because of the nature of the symptoms and the temporal relationship with the nearby insulation work, direct skin contact with fibrous glass fibres was thought to be the cause of the outbreak. The poorly maintained air handling unit supplying air to the laboratories probably contributed to this outbreak by inefficient filtering of the circulating air.

Key words: Dermatitis; fibrous glass; laboratory workers.

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INTRODUCTION

Complaints of pruritic rashes and other skin disorders are commonly made by office workers and other employees in non-industrial work environments.[1] In many cases no cause can be found for these symptoms, which are often part of a constellation of symptoms associated with building-related illnesses.[2]

In June 1993, the National Institute for Occupational Safety and Health (NIOSH) received an employer request for a health hazard evaluation at a laboratory located in the basement of an office building. Approximately 30 people were usually employed in the basement, which contained an animal house and offices, as well as the laboratories. Air-conditioning was provided by three air handling units (AHUs) located in separate mechanical rooms (MRs) in the basement. Asbestos insulation had been removed from these MRs during 1992 and installation of fibrous glass insulation had commenced in April 1993.

Correspondence and reprint requests to: M. R. Sim, Department of Epidemiology and Preventive Medicine, Monash Medical School, Alfred Hospital, Commercial Rd, Prahran, Victoria 3181, Australia.

The request to NIOSH was prompted by complaints of pruritic symptoms, primarily among workers in four laboratory rooms in the basement. Four of these laboratory workers had been advised by their personal physicians to leave work because of recurring symptoms and the presence of pruritic skin lesions. Although the exact nature of the skin disorders and causative agent were unknown, the employees had implicated a new batch of paper laboratory requisition forms. The forms contain carbonless copy paper which is a known cause of contact dermatitis.[3]

This paper presents a case report describing the investigation methods and findings of an important and fairly common problem in occupational medicine–skin complaints in a non-industrial population.

METHODS

NIOSH investigators visited the facility in June, 1993. The medical portion of the investigation included semi-structured interviews with 16 employees working in the basement, including all 10 employees working in four laboratories. The interviews were conducted

by one of the authors (M. S.) who is an Occupational Physician. The four employees who had been advised to temporarily leave work because of their skin problems were in this group. The location of the four laboratories is shown in Figure 1. The other six interviewed employees had also reported symptoms, but worked in offices at the other end of the basement. The other 14 office workers in the basement were not interviewed in detail as preliminary enquiries revealed that they had no reported skin symptoms. Health records held by the employee health nurse were also examined.

The industrial hygiene portion of the evaluation consisted of an inspection of the AHUs in the three mechanical rooms in the basement. Air and surface sampling for fibrous glass and measurements of temperature, relative humidity (RH), and carbon dioxide (CO_2) concentration was carried out in the four laboratories. Air samples were collected on mixed cellulose ester filters in three-piece cassettes with extension cowls and were analyzed by phase contrast microscopy in accordance with NIOSH Method 7400.[4] Information on recent changes to the laboratory forms was obtained from the manufacturer, and work schedules for installation of the fibrous glass insulation were reviewed.

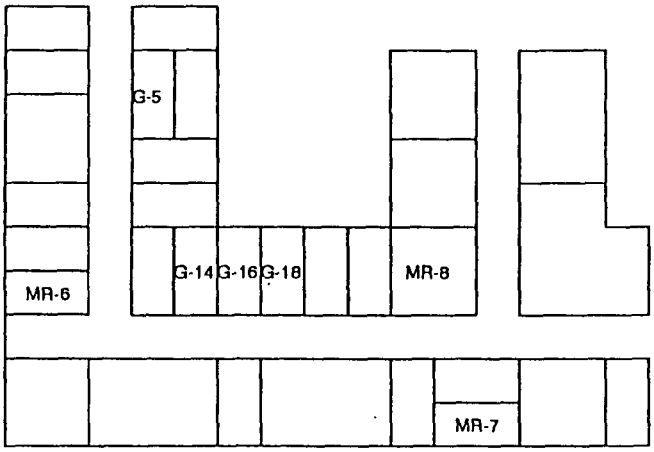
RESULTS

Eight of the 10 employees working in the four laboratories began to complain of pruritis in the first week of May 1993. Four of these eight reported the onset of rashes to the employee health nurse over two days at the end of May. These four employees were subsequently assessed by their personal physicians and were removed from work in early June because of persisting skin complaints. One of these four employees worked in laboratory G-5, two in G-14, and one in G-18 (see Figure 1). The other 6 interviewed employees, who worked in offices away from the four laboratories, complained of very minor pruritus with no visible skin lesions. Their symptoms were reported following the reports of severe pruritus in the laboratory workers.

In summary, of the 30 employees in the basement, 14 reported symptoms, including eight of the 10 employees working in the four laboratories. Of these eight workers, four developed skin lesions. Although there were very mild symptoms reported in six workers in the offices, these reports followed the initial complaints and there were no visible skin lesions.

For the laboratory workers with symptoms, the most consistent symptom at interview was a prickling sensation on exposed skin, such as the forearms, face and backs of hands, and areas where rubbing with clothing may occur, such as the neck. Several employees reported an associated pruritis in these areas. Four employees developed small (<5mm), red, papular lesions on the forearms and back of the hands. Two employees also reported the presence of hives, characterized by a wheel and flare reaction, after

Figure 1. Floor plan of the basement showing the four laboratories where the most severe symptoms were reported (G-5, G-14, G-16 and G-18). The three mechanical rooms are indicated by MR-6, MR-7 and MR-8.



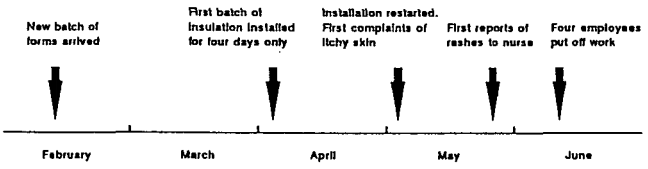
scratching the affected areas. Symptoms and rashes were experienced more often and more severely early in the day and in the early part of the week, and usually resolved on weekends. They tended to recur when the employee returned to work at the start of the following week. All skin lesions had resolved by the time of the NIOSH visit, as the four affected employees had been away from the workplace for at least a week.

None of the affected employees in the laboratories had a past history of any dermatological problems, although two reported allergic symptoms consistent with atopy. No further objective medical information was available. No medical assessments had been done at the workplace as all visits to the occupational health centre had involved consultations with the occupational health nurse only. No medical records from the treating doctors were available for review.

Three of the employees reporting skin symptoms did not handle the laboratory forms. The manufacturer of the forms reported that no change to the paper or the process used to make these forms had recently occurred. A new batch of forms, unchanged except for modified wording, had been used in the laboratory since February, 1993. There had been no other recent changes in work practices in the laboratories. In addition, there were no laboratory chemicals which were common to the work of all affected employees and none reported working in the animal house.

Following an asbestos abatement project in the basement mechanical rooms in 1992, installation of fibrous glass insulation commenced in early April of 1993. This work ceased four days later due to employee complaints of an unpleasant odor from a xylene-based adhesive used to attach the insulation material. After substituting a water-based adhesive, weekend-only insulation work recommenced at the start of May. Weekday installation of the insulation material began

Figure 2. Temporal relationship between the outbreak of skin disorders, use of the new laboratory forms and start of fibrous glass insulation in the mechanical rooms during 1993.



again in the third week of May and continued up until the dates of the NIOSH visit. The temporal relationship between the outbreak of skin disorders, fibrous glass installation, and use of the new batch of laboratory forms is outlined in Figure 2.

The 10 interviewed employees in the laboratories reported that the fibrous glass insulation was often cut by the contractors in the corridor adjacent to the laboratories. Rubbish bins containing discarded pieces of cut fibrous glass were often left in the corridor outside MR-6 during this time.

Inspection of the AHU in MR-6 revealed several deficiencies in the cleaning and circulation of air to the four laboratories; including a metal sheet blocking the return of air to the AHU (installed during the asbestos abatement and not removed), dirty cooling coils and condensate pans, organic matter including a dead bird in the ductwork, the mixture of returning and outside air bypassing the roll filter and microbial growth in the sound liner. Several pieces of cut fibrous glass insulation material were present on the floor of MR-6. Air to the office areas was provided by another AHU in MR-8.

Analysis of the four laboratory air samples by phase contrast microscopy revealed fibre loading below the limit of quantitation (0.03 fibres per milliliter) for the analytical method. Most of the fibres were in excess of 3 microns in diameter. The air concentrations were well below any current exposure criteria.[5] Room temperatures, RH and CO_2 measurements all fell within the range of acceptable values recommended by the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) for indoor environments.[6,7]

DISCUSSION

It was concluded that the most likely cause of this outbreak of skin disorders among laboratory employees was due to an irritant effect from contact with fibrous glass fibres during the time of fibrous glass installation in an adjacent mechanical room. Glass fibres with diameters greater than 3.5 micrometers are known to cause dermatitis through skin irritation.[8] For most people, symptoms disappear within a week or two following the cessation of exposure, but may persist for longer in some individuals. Contact with fibrous glass can also cause eye and upper respiratory tract irritation,[8,9] although these symptoms were not reported in the present case.

Although there are no previous published reports of fibrous glass dermatitis in laboratory workers, there have been several studies of skin irritation in office employees resulting from contact with glass fibres.[10–14] In these studies, exposed employees reported a prickling sensation, and itching and rashes on exposed surfaces such as the forearms, neck, and face. The rashes were most severe where there was rubbing against clothing, such as around the collar. Symptoms were usually most severe following first exposure to the glass fibres.[15] Individuals who handle fibrous glass repeatedly may develop a tolerance to its irritant effects, while symptoms usually recur in employees who have intermittent exposure. Skin symptoms usually quickly resolved following cessation of exposure. In three of these studies, employees were exposed to glass fibres falling from ceiling spaces or circulating through the air conditioning system.[10–12]

In the current outbreak among laboratory workers, the nature of the reported skin symptoms was consistent with the clinical features outlined in previous studies. In addition, there was a strong temporal relationship between the installation of the fibrous glass insulation and the onset of skin symptoms. The poor work practices reported during installation of the fibrous glass insulation are likely to have generated fibres in the vicinity of the affected workers. The poorly maintained AHU in MR-6 probably contributed to the severity of this outbreak by inefficient filtering of the contaminated circulating air.

Although contact with glass fibres is the most likely cause of this problem, there is some uncertainty in this conclusion. Firstly, the presence and nature of the skin lesions could not be objectively verified by the NIOSH investigators, who had to rely on self-reporting. This makes the diagnosis uncertain. Secondly, the number of affected workers was small, but this is not an uncommon scenario in this kind of outbreak in

small workplaces. Thirdly, information bias may have been operating due to the overt presence of the fibrous glass contamination in the hallway, although most initial suspicion was directed towards the forms containing carbonless copy paper.

Although six employees working in offices served by a different AHU in a different MR, sited away from the laboratories, had also reported pruritus, these symptoms were very mild with no skin lesions, the workers were vague as to the distribution on the skin, they were only reported after the initial symptoms were reported by the laboratory workers and they resolved quickly. There was no readily apparent cause for the mild symptoms in this group and psychogenic factors related to the initial reports from the laboratory workers may have played a role in their aetiology.

It is unlikely that the skin disorders were related to handling the laboratory forms containing carbonless copy paper, because the new batch of forms was unchanged from those previously used, several affected employees did not handle the forms, and there was a time lag of three months since first use of the new batch of forms and the onset of the outbreak. Symptoms relating to the eyes, nose, and mouth (not present in the current outbreak) are reported to be more prominent than skin symptoms and occur soon after exposure to carbonless copy paper.[16]

Several recommendations were made to the employer to improve air handling by the AHU in MR-6. These included removing the sheet metal blanks, ensuring that roll filters are fitted securely in their frames, cleaning coils and pans on an annual basis, and replacing the sound liners downstream of the cooling coils with a non-porous insulation material. If further fibrous glass work was to be undertaken, it was recommended that this should be carried out at times when other people are not working in the building, such as during evenings or on weekends. Further reports by the laboratory workers of skin rashes consistent with fibrous glass or other industrial dermatitis should be promptly investigated to identify any further source of contamination.

Following this investigation, three of the four affected workers who had been off work returned to work, initially in areas of the building above the basement. No further skin rashes consistent with fibrous glass dermatitis have been reported.

There are several lessons which can be learned from the investigation and findings of this particular outbreak. Firstly, it is important to take the reporting of such skin symptoms seriously and to undertake a prompt and full investigation of both medical and industrial hygiene aspects. Secondly, the findings highlight the importance of checking and regularly maintaining air handling systems, especially after asbestos abatement projects have been completed. Thirdly, appropriate work procedures should be used when installing fibrous glass insulation, a known cause of skin irritation, to protect neighbourhood workers.

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