

CASE REPORT

Irritant contact dermatitis due to 1-bromo-3-chloro-5,5-dimethylhydantoin in a hydrotherapy pool. Risk assessments: the need for continuous evidence-based assessments

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A physiotherapist working in hydrotherapy presented to occupational health with irritant contact dermatitis. Subsequent investigation revealed that the likely causative agent was 1-bromo 3-chloro 5,5 dimethylhydantoin which was used to disinfect the hydrotherapy pool. A COSHH risk assessment had been performed which failed to take full account of current knowledge and this agent had been introduced into the workplace. The development of adverse health effects among staff and other pool users lead to a review of this risk assessment and eventually a return to less hazardous chlorine-based disinfection. Had an evidence-based approach been combined with an appropriate COSHH assessment prior to and following changes in the workplace then unnecessary risk to employees would not have occurred.

Key words: Bromine; contact dermatitis; evidence-based practice; risk assessment.

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CASE REPORT

History

A 46-year-old physiotherapist working for an NHS Trust presented to the occupational health department with skin problems.

The client had worked as a physiotherapist for many years and had specialized in hydrotherapy work during the preceding five years.

Six weeks prior to presentation he had noticed intense itching and redness of his thighs immediately on immersion in the pool. The symptoms progressed to persistent itching of the skin with a generalized dry skin condition.

He became unable to enter the pool and sought advice from occupational health.

The client had no history of atopy and no significant family history. He was not on any medications and had only a single episode of contact allergy to poison oak in childhood. His hobbies included scuba diving, regular swimming and woodwork.

Physical findings at the time of presentation were of asteatotic eczema with severe excoriation and lichenification affecting his upper and lower limbs, predominantly on the flexor surfaces. His trunk was also affected by changes suggestive of irritant dermatitis. There were no signs of facial involvement or nail changes. General examination revealed no other abnormality.

A detailed occupational history revealed a pattern of work which could have contributed to his problems. His post involved three sessions per week in the pool (3 h per session) treating spinal injuries patients. During each session approximately 10 patients were treated, each being immersed in the pool for 20 min. During each session

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the lead therapist remained in the pool. Following the treatment session each patient was showered but the therapists showered only at the end of the completed session.

Prior to September 1995 the disinfection method employed by this hydrotherapy pool had involved manual dosing using sodium hypochlorite solution. This process required the pool assistant to pour liquid sodium hypochlorite into the pool dosing system. Following a risk assessment in line with Control of Substances Hazardous to Health Regulations 1994 (COSHH) the risks of exposure to irritant chemicals and accidental chlorine gas release were identified. The manager, having consulted the manufacturer and the estates department introduced a new disinfection system which both eliminated the use of sodium hypochlorite and removed the manual dosing mechanism. Occupational health specialists were not consulted.

A closed dosing system using bromine-based disinfection was selected and installed. This was based on dissolving the compound 1-bromo-3-chloro-5,5-dimethylhydantoin (BCDMH) in water leading to the formation of hydrobromous acid and hypochlorous acid.

Following initial assessment the client was advised to remain out of the pool and was referred to a consultant dermatologist.

A diagnosis of irritant contact dermatitis was made by the dermatologist and appropriate treatment with topical steroids and emulsifying agents commenced.

Patch testing was not carried out as the association of irritant dermatitis with bromine-based disinfectants is well-recognized among clinical dermatologists and reported in medical literature.¹

Workplace assessment

The hydrotherapy pool is situated in a small physiotherapy department adjacent to a long-stay care of the elderly hospital. Services are provided for NHS trusts, local education and local authorities.

A senior occupational health nurse and the author carried out a workplace visit and skin surveys of other staff using the pool.

The pool is cuboidal in shape and has a fixed base. It was completely relined in 1995. There is a sand filtration system and as mentioned earlier the disinfection method at the time of assessment utilized BCDMH.

Monitoring of the pool is performed each day by a physiotherapy assistant with measures of pH, free and total bromine being made. Bacterial monitoring is performed once per month by the local government environmental health officer.

Fifteen physiotherapists use the pool intermittently; however, the majority of the work is carried out by three members of staff, one of whom was the client.

Workplace visits and interviews with staff revealed six out of 15 pool users had mild symptoms of skin irritation on immersion in the pool and one other had developed severe discoid eczema. The work pattern was similar to that described previously for most staff members.

Risk identification and reduction

A Medline CD ROM literature search revealed documented cases of irritant dermatitis in association with exposure to brominated swimming pools.^{1,2} There was anecdotal evidence from the consultant dermatologist and environmental health officer that brominated pools are associated with increased incidence of skin irritation. As the client was the main pool user the service implications were significant. The pool was also used by local schools and other children's rehabilitation groups so consideration of public health risks was necessary.

Following discussions with our risk assessment group members a decision was made to remove the hazardous agent and install a closed dosing chlorine-based disinfection system.

Rehabilitation

The client was excluded from both recreational and work-related pool use until satisfactory control of his dermatitis had been achieved. He was gradually reintroduced to pool use. However, he experienced irritation and pruritus immediately on re-entering the hydrotherapy pool. Swimming in chlorinated leisure pools appeared to pose no difficulties.

To date he has been unable to fully immerse in the pool; however, he is able to perform supervisory duties from the pool side.

DISCUSSION

Hydrotherapy pools have similar risks to health as do other pools including infection due to mycobacteria, *psuedomonas* and *legionella* and rashes due to either irritants or infection.³ They also have some more specific problems such as thermal burns and reports of green hair.⁴

The original reports of irritant contact dermatitis due to brominated pools were made in 1983 with subsequent correspondence supporting the view that these symptoms were related to irritant rather than allergic dermatitis.^{1,2}

Patch tests were consistently negative in these cases and symptoms usually resolved following treatment and removal from exposure.

Penny⁵ reviewed the health problems of physiotherapists using hydrotherapy pools and highlighted predisposing factors: heat and humidity (out of water), heat and wetting (in water), wetting and drying agents, degreasing agents, infections and chemicals.

The working environment in this case had been remarkably stable with regard to all but the last of these factors. Average pool temperature was 33°C and pH 7.6. There was no evidence of microbiological contamination of the pool and the clinical picture did not fit with that of *psuedomonas* folliculitis.

Degreasing of the client's skin had occurred as a result of a combination of factors such as age, wet water hobbies and poor showering facilities. This could have

made the individual susceptible to the irritant effects of the different chemicals introduced. Penny found five subjects out of 43 with bromine pool-associated rashes who were unable to return to chlorinated pools suggesting a cumulative trauma irritant dermatitis. It is believed that skin defences are damaged and subsequent exposure to weaker irritants may cause problems.

Bromine disinfection is largely confined to use in leisure pools where exposure is for relatively short periods at lower temperatures. This case illustrates the problems associated with prolonged exposure at higher temperatures in the hydrotherapy environment and demonstrates a failure of risk assessment procedures. Following a COSHH risk assessment the working environment in this case was altered to the detriment of both employees health and the financial status of the service. Occupational health professionals were not consulted prior to the significant changes in working environment but were instrumental in removing a subsequently recognized hazard from the workplace. We would hope that further cases should not arise following our report.

The importance of competent persons performing risk assessments is well-illustrated here. Prior to the change in disinfection methods there had been no complaints of skin problems and no recorded incidents or accidents

relating to the use of liquid hypochlorite. Advice had been sought solely from the manufacturer of the bromine-based system.

Protocols for supervision of hydrotherapy pools often focus on the well-recognized biological hazards but require an integrated approach in order to address the full range of potential hazards.^{6,7}

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