fault occurred in the heat reclamation system and simple air extraction was used.

For intensively used public swimming pools there are no obvious alternatives to chlorine based disinfectants. A survey of bather comfort showed that problems with chlorinous smells are virtually non-existent when the organic contaminants are removed by the powerful oxidising action of ozone.³ In this process swimming pool water is treated with ozone during filtration, the ozone is removed by a carbon filter before the water is returned to the pool, and a small free chlorine residue is maintained as a disinfectant in the pool. Unfortunately, the process is expensive to install in existing pools.

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Dermatoses associated with brominated swimming pools

In recent years a small but increasing number of public swimming pools in the United Kingdom have been disinfected with a solid brominated compound rather than chlorine. This product has two proprietary names, Di-halo and Aquabrome, and its active constituent is 1-bromo-3-chloro-5,5-dimethyl-hydantoin. We present evidence that dermatoses have become more commonly associated with brominated pools than with chlorinated pools.

Case reports

We saw 48 patients who developed dermatoses after swimming in pools. Two case reports are given below.

Case 1—The disinfectant used in a swimming pool was changed from chlorine gas to Di-halo. A month later a 32 year old male attendant began to develop widespread itchy red papules after being in the pool. Eczema subsequently erupted on his hands and patchily on his body; it improved away from work and relapsed rapidly on return. He could swim without symptoms in a chlorinated pool, but a rescue dive into the brominated pool resulted in an itchy red papular eruption within 20 minutes. He had no personal or family history of eczema, asthma, or hay fever. Clinically, he had a discoid (nummular) eczema of the trunk and limbs with a vesicular eczema of the palms and fingers. Patch tests with the International Contact Dermatitis Research Group standard series of allergens and with Di-halo (1% in water and 1% in petrolatum) gave negative results, as did prick tests with Di-halo (1% in water and 1% in petrolatum). No reactions occurred in eight other symptomatic patients patch tested with Di-halo at the same concentration.

Case 2—A 40 year old swimming instructor presented a similar picture. Her rash cleared when the pool changed to using a solid chlorine disinfectant (dichlorisocyanurate) but relapsed when she began to work in another pool treated with Di-halo.

OTHER CASES

One of us (RJGR) has had eight independent reports, five from consultant dermatologists, of dermatoses associated with brominated pools. These dermatoses included pruritus, urticaria, patchy or discoid eczema, and more diffuse eczema.

We visited 19 brominated pools because of reports of rashes. At least 5% of users of a pool treated with Di-halo had recently experienced pruritus after swimming and had then developed rashes. A hot whirlpool bath treated with Di-halo was also used by some of these subjects. The most common dermatoses seen were discoid and asteatotic eczemas. Visits to pools indicated

that high proportions of the staff were affected, which suggested that frequent exposure was relevant. Older age groups were affected much more commonly than children.

Postal surveys were made among the readers of the *Journal of the Institute of Baths and Recreation Management and Swimming Times*. As a result we received reports from 70 people who had suffered more than trivial rashes, 65 of which were associated with pools treated with Di-halo. Other symptoms particularly associated with such pools included soreness of the mouth, throat, vulva, female urethra, and breasts. Complaints of respiratory symptoms and eye irritation came from users of both brominated and chlorinated pools. Although the great majority of public swimming pools in the United Kingdom are chlorinated, in general only trivial rashes were associated with them. Of the 65 patients with rashes associated with pools treated with Di-halo, 58 developed the rash within 12 hours of swimming. None of these patients was affected by chlorinated pools unless the rash was severe and chronic.

Comment

This report summarises the strong circumstantial evidence that swimming in pools disinfected with Di-halo or Aquabrome is associated with dermatoses, mainly eczematous in nature.

Bromine and chlorine ions are released into water from 1-bromo-3-chloro-5,5-dimethyl-hydantoin to leave 5,5-dimethyl-hydantoin (DMH). Accompanying reactions with pool contaminants such as urea and creatinine produce other chemicals including bromamines, chloramines, and complex organic bromine and chlorine compounds. The manufacturers' data on toxicity and results of our patch and prick tests indicate that allergy to the parent chemical or DMH is unlikely to be responsible; *Pseudomonas aeruginosa* infection is also unlikely. Brominated pools with the highest incidence of dermatoses tended to have the highest levels of total bromine residue (as measured with diethyl-p-phenylenediamine as an indicator) and hence the lowest bacterial counts. Dermatoses caused by *P aeruginosa* are clinically follicular and usually occur later than 12 hours after swimming. Several other factors that contribute to swimming pool rashes include wetting, wetting and drying cycles, previous skin disease, and dry skins, but these apply equally to brominated and chlorinated pools.

New products tend to receive an initial flurry of complaints that soon subsides, but complaints about Di-halo appear to be continuing. The evidence suggests that dermatoses occurring among users of pools treated with Di-halo may be forms of cumulative irritant contact dermatitis subject to acute exacerbations. The precise irritant or irritants have yet to be identified. It remains possible, though less likely, that sensitisation may be taking place.

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Intranasal glucagon raises blood glucose concentrations in healthy volunteers

Polypeptide hormones are usually given parenterally, either by subcutaneous, intramuscular, or intravenous injection, since proteolytic digestion remains a limiting factor to administration by mouth.¹ The mucosa of the respiratory system is able to absorb some inhaled materials such as vasopressin² and luteinising hormone releasing hormone.³ In addition, insulin is well absorbed through the nasal mucosa and lowers blood glucose concentrations in normal subjects as well as in patients with insulin dependent diabetes mellitus.^{4,5} Hypoglycaemic episodes are a common emergency in the daily management of insulin dependent diabetes and glucagon, given subcutaneously or intramuscularly, is an effective remedy.