

## Cement burns

H. R. VICKERS AND D. H. EDWARDS

The Radcliffe Infirmary, Oxford, Great Britain

Four cases are presented of men who sustained burns after contact with premixed concrete. The pathogenesis of the condition is discussed.

*Key words:* calcium oxide – cement – concrete – lime.

*Received for publication September 8, 1975*

Cement must be one of the most widely used substances throughout the world. The usual dermatological hazards are well recognized. These are: primary irritant dermatitis caused by either the alkaline content of the cement or the gritty particles of the dry cement or a mixture of these; and sensitization dermatitis caused by the patient becoming specifically sensitized to the hexavalent chromate which is present in many varieties of cement (Calnan 1960). The alkalinity of cement is due to its lime (calcium oxide) content. The addition of water "slakes" the lime giving a highly alkaline solution but in spite of this, and considering the enormous numbers of men who must be working with wet cement, alkaline burns occurring in cement workers are very uncommon. We report four cases occurring in Oxford. Unfortunately, by the time the skin changes occur the wet cement which the patient handled has dried out and set so that estimation of its alkalinity is impossible. Nor has it been possible to ascertain whether or not the alkalinity of different batches of cement when wetted varies very much.

### *Case histories*

*Cases 1 and 2.* A 37-year-old physicist (B. W.H.) and his neighbour, a 34-year-old

sales director (D.K.T.), were laying concrete for the foundations of a new house. It was a dry mild day and wet concrete previously mixed by the supplier was delivered in the early afternoon. B.W.H. was wearing an old pair of grey worsted trousers, a shirt, long-sleeved sweater, socks and Wellington boots which came up to just below the knee and into which his trousers were tucked. Gloves were not worn. D.K.T. wore similar clothes but his Wellington boots were shorter. The trenches were about 2 feet 6 inches deep and the concrete had to be spread evenly to a depth of at least 9 inches. Three loads in all were delivered into the trenches.

On delivery of the first load they moved the concrete along the trenches with shovels. This was not easy and when the second load was delivered the delivery man suggested that the usual way to do this was to stand in the trenches and "walk" the concrete along using feet and lower legs. It was when doing this that wet concrete spilled over the top of the Wellington boots and within a short time B.W.H. noticed burning of his legs. He continued to spread the cement but as soon as it was reasonably level he took off his Wellington boots and emptied out the wet cement. At this time there was no apparent change in his skin. D.K.T. did not take off his boots at the time since he had not no-



Fig. 1. B.W.H. Photographs of legs on 9th day. a) anterior view; b) posterior view.

ticed anything abnormal. When the driver returned with the third load, B.W.H. asked him to wash down his bare legs and feet with water from the reservoir on his truck. The water was cold and he also washed out his Wellingtons. He put on his Wellingtons and spread the third and last load which was smaller than the two previous loads. It was when spreading this third load that D.K.T. also complained of burning pain in his legs and feet. They had to continue to finish the job because the cement was drying. B.W.H. drove home as quickly as possible and on arriving home removed his clothes quickly and got straight into a hot bath. At this time he had severe pain in his legs and had brandy while still in the bath. His wife, a State Registered Nurse, cleaned his legs and feet and by this time the skin was bright red.

Dry dressings were applied and he went to see how his neighbour was faring, and his legs were blistered.

He then went to bed, had a restless night and on the next morning he went to see his General Practitioner, who dressed his legs and further dressings were carried out at a local hospital. The condition of both patients gradually became worse and on the fourth day they were admitted into the Accident Service at The Radcliffe Infirmary.

*B.W.H.* The burns appeared to be clean, but there were some areas of apparent full thickness skin loss (fig. 1). The burns were treated by bed rest and elevation, intermittent dressings, and Ampicillin. By the tenth day the burns were healing, though healing was retarded on the medial side of the upper right calf. He went home on the eleventh



Fig. 2. D.K.T. Photographs of legs on 9th day. a) anterior view; b) posterior view.

day. By seventeen days all the burnt areas had healed.

He was seen for review one year after the incident. His only complaint was of

itching of the scars in hot weather. On both lower legs there were well-defined, well-healed, depigmented areas scattered on the legs from below the knees to the ankles.

These depigmented areas were irregularly oval in outline and 5 cm by 3 cm in size. On the right leg, the uppermost mark was a horizontal linear scar corresponding to the top of the Wellington boot. The areas tended to be situated either over the ankle bones or on sites subject to pressure. There was a well-healed linear scar on the outer aspect of the dorsal surface of the left foot.

Patch tests to the following substances were applied to the skin of the back and then were examined after 48 hours; all the tests were negative:

*Rubber chemicals*

|                                                 |       |
|-------------------------------------------------|-------|
| Diethyl-thiourea                                | 1 %   |
| Cyclohexylbenzothiazylsulphonamide              | 1 %   |
| Hydroquinone monobenzyloether                   | 1 %   |
| 1,3-diphenylguanidine                           | 1 %   |
| Phenyl-beta-naphthylamine                       | 1 %   |
| Isopropylaminodiphenylamine                     | 0.1 % |
| 4,4'-dihydroxydiphenyl (DOD)                    | 0.2 % |
| 2-mercaptobenzimidazole (2-benzimidazol-ethiol) | 1 %   |
| Hexamethylenetetramine (menthenamine)           | 1 %   |
| Tetramethylthiurammonosulfide                   | 1 %   |
| Potassium bichromate                            | 0.5 % |

*D.K.T.* On admission to the Accident Service he had a fever of 38.6°C. There were patchy chemical burns of both legs (fig. 2), which were dressed repeatedly with chlorhexidine cream for two days, followed by exposure for one week. Swabs taken from both shins contained Gram positive cocci, but scanty growths of yeasts were the only organisms cultured. By three weeks the burns were healing slowly. The scabs around the ankles were slower to separate. He was discharged from the Burns Clinic after six weeks.

Seven months later he was seen in the Department of Dermatology complaining of pain in the scars on standing. They were livid purple scars with hair loss, the scars over the ankles being hypertrophic. He had no hypertrophic scars elsewhere. Some relief was afforded by the use of betamethasone cream and pressure bandages. When last seen, two years after the incident, his scars were fading and treatment was stopped.

*Case 3.* This 41-year-old builder, D.C.K.,



Fig. 3. D.C.K. Photograph of feet on 2nd day.



Fig. 4. A.D. Photograph of left knee on 5th day.

dropped some premixed concrete inside his Wellington boots. Two days later he felt burning and irritation of both his feet and attended the Accident Service. He was found to have scattered areas of skin necrosis on the dorsum of both feet, and around the ankles (fig. 3). He was afebrile. He was admitted to hospital, and the burns were treated by bed rest and elevation, and dressed with chlorhexidine cream and paraffin gauze. He went home on the fifth day, and by three weeks the areas had healed completely.

*Case 4.* A 31-year-old office worker, A. D., on the staff of the Regional Health Authority, was levelling premixed concrete and knelt on the cement to reach the area of work. He noticed no irritation at the time; he was wearing cavalry twill trousers. Dur-

ing the course of a 200-mile drive later that day, he experienced itching of both knees. On arrival at his destination he found the anterior aspects of both knees to be red and inflamed. The following day, the areas had become blistered and he attended the Accident Service. Both knees had burns 3 inches in diameter (fig. 4), which appeared to be infected, but no pathogens were found on bacteriological culture. He was detained in hospital for six days. When seen again on the fourteenth day, the burns had healed completely.

### Discussion

Cement can damage the skin in three ways. Firstly, dry cement rubbed into the skin can cause abrasions by the gritty nature of the powder. Secondly, wet cement is an alkali and the alkaline liquid can "burn" the skin. Thirdly, cement commonly contains chrome salts as a contaminant and people handling cement can become specifically sensitized to these salts and when this state of sensitization occurs, contact with chromate-containing cement produces a contact sensitization dermatitis of the areas in contact with the substance.

*Cases 1 and 2.* The cement was wet and was not in direct contact with the skin of their legs since they were protected by socks and trousers, so that the "gritty" action does not apply. Also, the skin of Case 1 was patch-tested to 0.5 % potassium bichromate solution and to a series of chemicals present in many manufactured rubbers. These tests were negative, so his trouble was not caused by his having become specifically sensitized either to chrome salts in the cement or to some constituent of the rubber in his Wellington boots. However, the liquid in the wet cement which spilled into his Wellington boots would soak through his trousers and socks and would come into

contact with his skin. This liquid is alkaline and was probably responsible for his burns. It is of significance in this respect that the maximum incidence of residual scarring is situated mainly on those areas of the lower legs which would be pressed against the inside of the Wellington boots and therefore the alkaline soaked clothing would there be in greatest contact with the skin.

The history of the event and the subsequent scarring is consistent with having been caused by contact with an alkaline liquid. It is unlikely that both these men had skins which were peculiarly susceptible to contact with alkaline liquids. If it is a fact that this method of "treading" cement is common in the building industry, as indicated by the cement truck driver, it must be true that cement often spills into Wellington boots and it also follows from the nature of the time factor in spreading cement, in so far that the job has to be finished before the cement sets, that it is not always possible for a workman to stop work as soon as cement gets into his boots. However, this type of injury sustained by three men all at the same time must be extremely uncommon. One must therefore draw the conclusion that the cement contained an abnormal-

ly high quantity of alkali, presumably in the form of lime, and the liquid in the wet cement had an unusually high alkalinity. The fact that their hands, in Cases 1 and 2, were not affected is not relevant since they were not wearing woollen gloves so that an alkaline liquid was not pressed against the skin of the hands.

#### Acknowledgements

We wish to thank the Surgeons of the Accident Service, The Radcliffe Infirmary, for permission to study patients who were admitted under their care; the Department of Medical Illustration for the photographs; Mrs. Olive Kingsworth for secretarial assistance.

#### Reference

Calnan, C. D. (1960) Cement Dermatitis. *The Journal of Occupational Medicine* 2, 15.

#### Address:

H. R. Vickers, M. A., M. Sc., M. D., F.R.C.P.  
Consultant Dermatologist  
The Radcliffe Infirmary  
Oxford OX3 7JH  
Great Britain

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.