

REHABILITATION OF WORKERS WITH CEMENT ECZEMA DUE TO HYPERSENSITIVITY TO BICHROMATE

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ABSTRACT. The study comprised 77 building workers with allergic eczema due to cement. The patients had attended the out-patient clinic of the Institute of Occupational Health during 1960-62 or 1965-67. Of the 77 patients 43 had a strong and 34 a weak hypersensitivity to bichromate. Thirty-two patients showed a simultaneous hypersensitivity to cobalt. Follow-up examinations performed in 1965-67 by two occupational dermatologists, a vocational counselor and a social worker revealed that patients with a weak, monovalent hypersensitivity to bichromate as a rule had been capable of continuing their work under proper protective measures. Occupationally qualified workers had seldom given up their old occupation in spite of a strong multiple hypersensitivity. Unskilled building workers of moderate age with a strong, perhaps multiple hypersensitivity seemed to constitute the most suitable group for vocational rehabilitation.

Occupational dermatoses represent about two-thirds of the cases of occupational diseases compensated for. Among their causes in Finland, cement and lime occupy third place (13). The high proportion of cement eczema is partly explained by the fact that the building industry is one of the largest trades in Finland, employing about 200,000 workers, 70,000 of whom are directly exposed to cement, in a country with somewhat more than 4.5 million inhabitants, and partly by the fact that both cement itself and its impurities are active agents for the skin.

Toxic eczema due to cement as a rule heals during a relatively limited time spent out of contact with cement, and a relapse can be prevented by proper protective measures. However, in the case of allergic cement eczema with hypersensitivity to bichromate, possibly also to cobalt, both included in cement as impurities in varying amounts, a return to the old vocation is ordinarily followed by a relapse of the skin disorder. The patient has to choose between staying in the same

job, which will prolong his illness, or taking a new job, which usually results in a lower standard of living. Particularly when the hypersensitivity to bichromate affects qualified building workers, such as masons, plasterers and mosaic layers, vocational rehabilitation meets special problems.

The present study was made in order to penetrate dermatological, sociological, psychological and other factors which influence the ability of a patient to return to his previous job or to get along successfully in a new one. The investigation is a continuation of a pilot study previously published (12).

MATERIAL AND METHODS

The series consisted of 77 building workers with cement eczema due to hypersensitivity to bichromate. Of them 38 attended the out-patient clinic of the Institute of Occupational Health for the first time during the years 1960 to 1962 and 39 during the years 1965 to 1967. Seventy-one were males and six were females. The mean age of the patients was 45 years.

As regards occupational skill and the degree of contact with cement the patients could be classified as follows:

- Group I: Masons, plasterers, mosaic layers
- Group II: Cement workers and their helpers, cement millers, levellers
- Group III: Cleaners, iron workers, boring workers, unskilled construction labourers

Of the patients, 57 lived in or near Helsinki (in the southern part of Finland), and only four were from the northern or eastern part of the country.

Routine patch tests with more than 20 substances were performed on all patients at the first examination. The test series included potassium bichromate 0.5% and cobalt chloride 2%. The patches were fixed to the skin for 24 hours, and the reactions were read personally by the authors half an hour after the removal of the patches and again 48 hours later. After receiving a posi-

Table I. *Distribution of the patients and workers in the building industry in Finland into classifications according to the degree of exposure to cement*

Degree of exposure to cement	Present series of patients		Workers in the building trade
	No.	%	%
Group I	17	22	9
Group II	33	43	3
Group III	27	35	88
Total	77	100	100

tive result with bichromate or cobalt, the substance in question was tested in serial dilutions to exclude toxic reactions and to allow conclusions as to the degree of hypersensitivity. In 46 instances patch tests with trivalent chromium chloride in 5, 2 and 1% solutions were performed.

At the follow-up examinations in the years 1965 to 1967 all the patients were interviewed by a team consisting of two occupational dermatologists, a vocational counselor and a social worker.

RESULTS

The distribution of our patients into classifications according to occupational skill and the degree of contact with cement differed greatly from the corresponding distribution of workers in the building industry in Finland, as seen in Table I. The first two groups, being exposed to cement more than other building workers, were highly overrepresented in the patient series.

Patients reacting to an 0.05% or weaker solution of potassium bichromate were classified as

Table II. *Sites of the eczema upon arrival at the Institute of Occupational Health*

Site of eczema	Hypersensitivity to bichromate				Total
	Strong		Weak		
	Co+	Co-	Co+	Co-	
Dorsal surface of hands only	12	9	4	16	41
Dorsal and volar surfaces of hands	4	3	2	2	11
Dorsal surface of hands + feet	4	3	-	6	13
Dorsal and volar surfaces of hands + feet	5	3	1	3	12
Total	25	18	7	27	77

Table III. *Frequency of hypersensitivity to trivalent chrome by different locations of the eczema*

Result of test with trivalent chrome	No. of cases tested	Volar surface of hands		Volar surface of feet	
		Af-fected	Not affected	Af-fected	Not affected
Positive	23	6	17	10	13
Negative	23	6	17	6	17
Total	46	12	34	16	30

strong reactors, and patients reacting to higher concentrations only, as weak reactors. Of the 77 patients 43 had a strong and the remaining 34 a weak hypersensitivity to bichromate (Table II). Thirty-two patients showed a simultaneous hypersensitivity to cobalt, the majority of these reacting strongly to bichromate.

Most of the patients (53 cases) were seen within one year after the onset of their eczema. Of the six patients with a duration of the eczema of more than five years, five were weak reactors, and they had a negative test with cobalt.

In Table II the sites of the eczema at the time of the first visit have been correlated with the degree of hypersensitivity to bichromate as well as with the result of the cobalt test. As to the distribution of the eczema it can be seen that patients with a strong hypersensitivity to bichromate combined with cobalt sensitivity did not differ significantly from those with a weak hypersensitivity to chromate only. Spreading to the feet occurred in weak reactors almost as often as in strong reactors.

Of the 46 patients tested with a 5 to 1% solution of trivalent chrome, 23 gave a positive test result interpreted as allergic. The hypersensitivity to trivalent chrome did not significantly correlate with the degree of hypersensitivity to bichromate or with the result of the cobalt test. On the other hand, as seen in Table III, the feet of patients reacting to trivalent chrome were slightly more often affected, whereas no difference could be seen as to the location of the eczema on the volar surface of the hands.

Table IV shows that the degree of hypersensitivity to bichromate did not correlate with the type of cement work. The rate of strong and/or multiple hypersensitivity among qualified workers,

Table IV. Nature of the work in which eczema developed and of that now done

Work in which eczema developed	Hypersensitivity to bichromate								Total
	1960-1962				1965-1967				
	Strong		Weak		Strong		Weak		
	Co+	Co-	Co+	Co-	Co+	Co-	Co+	Co-	
Group I	2	2	—	3	2	—	1	7	17
Group II	4	7	3	4	6	1	3	5	33
Group III	6	4	—	3	5	4	—	5	27
Total	12	13	3	10	13	5	4	17	77
<i>Present work</i>									
Group I	1	—	—	3	2	—	—	4	10
Group II	—	4	2	1	1	—	—	1	9
Group III	3	3	1	4	2	3	—	3	19
Cement-free work	3	4	—	1	5	1	2	3	19
No work: retraining under way	—	1	—	—	1	—	1	4	7
Retired or continuously unable to work	5	1	—	1	2	1	1	2	13
Total	12	13	3	10	13	5	4	17	77

such as masons, plasterers and mosaic layers, did not significantly differ from that observed among unskilled building workers. Neither could a correlation between the duration of the exposure to cement and the degree of hypersensitivity be demonstrated. The patients had been employed in cement work for an average of 14 years.

The same table depicts that the more skilled men of the trade seldom gave up their old occupation, in spite of a strong, and multiple, hypersensitivity. Of four such cases, three continue their old work using—as much as possible—protective gloves. The remaining fourth patient, who in addition is hypersensitive to nickel, ursole, colophony and oil of turpentine, is—at present—unable to work at all because of his severe eczema. He has tried construction work of different kinds and store and chauffeur work, but has had to interrupt them all because of an aggravation of the eczema.

Table IV shows also that eleven out of thirteen weak reactors from the years 1960 to 1962 have been able to continue working in their old occupation. The majority of them was not hypersensitive to cobalt.

Nowadays a greater proportion of the patients than five years ago take up work free from cement. However, vocational rehabilitation is a slow process. Only two patients have completed it within two years and the retraining of seven patients

is under way. In addition, 17 patients have been energetic enough to find a new occupation without the aid of the retraining opportunities offered by the Vocational Rehabilitation Act of Accident Insurance. As a consequence of advanced age, persisting cement eczema or severe diseases other than eczema, 13 patients are continuously unable to work at all.

The ability of the patient to continue his old work, as estimated by the dermatologist during the acute stage of the eczema, has been shown in Table V. When comparing the group diagnosed from 1960 to 1962 with that diagnosed from 1965 to 1967, we found that considerably fewer patients in the latter group have been expected to continue their previous work than in the former. This is in part due to the shorter follow-up period, on the basis of which the working capacity has had to be estimated, and in part to the new law on rehabilitation, which tends to encourage early retraining. Of the 17 weakly bichromate-positive and cobalt-negative patients diagnosed during the years 1965 to 1967, 16 were unable to continue their cement work according to the early opinion of the dermatologists. This conclusion was in twelve cases based on the fact that the patient had tried (more than once) to return to his previous occupation and the eczema had relapsed necessitating an interruption in his work. Likewise, twelve patients had had long-last-

Table V. Working capacity as estimated by the dermatologist at the time of the acute stage of the eczema

Working capacity (estimated)	Hypersensitivity to bichromate								Total
	1960-1962				1965-1967				
	Strong		Weak		Strong		Weak		
	Co+	Co-	Co+	Co-	Co+	Co-	Co+	Co-	
Able to do cement work	1	2	2	8	1	1	—	1	16
Unable to do cement work	11	11	1	2	12	14	4	16	61
Total	12	13	3	10	13	15	4	17	77
<i>Reason for disability in addition to the hypersensitivity found</i>									
Tried but eczema reoccurred	9	8	1	2	6	3	3	12	44
Long or frequently recurring sick leaves	8	7	—	2	10	3	3	12	45
Eczema continues in spite of cement-free work or time off	6	4	1	2	3	2	—	8	26
Other disorder causing disability	1	1	—	—	—	—	—	—	2

ing (more than two and a half months) or shorter but frequently recurring sick leaves. In eight patients the eczema continued although contact with the causative agent had ceased.

Table IV shows the need of rehabilitation as estimated by the vocational counselor at the end of the follow-up period. Group A included cases who 1) were capable of doing their previous work, 2) had already changed jobs, 3) were incapacitated for work. Sixteen of the total seventy-seven patients had other handicaps also, and for nine persons they presented rehabilitation obstacles of a higher or lower degree. Group C included cases who were not able to use rehabilitation services because of advanced age or some similar cause. Some kind of obstacle existed for the cases in

Table VI. Need of vocational rehabilitation, as estimated by the vocational counselor at end of the follow-up period

Need of rehabilitation	No. of patients
A. Not needed	25
B. Needed, but the patient unmotivated	3
C. Needed, but no realistic possibilities	5
D. Needed and possible	28
(a) New work planned	8
(b) Vocational schooling planned	13
(c) Plans unfinished	7
E. Potential rehabilitation cases (first they will try to continue their previous work)	16
Total	77

Group E as well. Many of them had a high level of earning in their present profession.

The patients in Group D, who were considered to have realistic possibilities to use rehabilitation services, represented 36% of the whole patient series.

Ten patients had received occupational training previously to the onset of their eczema, but none of them for the building trade.

DISCUSSION

Rehabilitation in traumatology and orthopedics already has old traditions and practices, and many authors have also stressed the importance of vocationally rehabilitating patients with skin disorders (1, 3, 15). On the other hand, follow-up examinations performed by different investigators have given controversial results as to the usefulness of changing jobs when occupational eczema is concerned. On the basis of such follow-up studies Hunziker & Musso (4), Koch & Peters (5) and Neumann (10) doubted its value, whereas Gomez-Orbaneja & Barrientes (2), Peter (11), Rajka (14) and Skog & Tottie (19) obtained significantly better curative results with patients, for whom a transfer had been made. According to Peter (11) the cement eczema did not in this respect differ from other occupational eczema.

Robinson (15) has pointed out that the services in medical, psychological, social and vocational areas should be concentrated in a single facility

so that the activities of the centre could be well co-ordinated. Nowadays such an ideal situation exists with us at the Institute of Occupational Health. In earlier years, however, the possibilities for the active retraining of patients with occupational dermatoses were, for economical reasons, limited, and the rehabilitation measures depended solely on the activity of the physician and on the attitudes of the patient and his employer. Since the year 1963 a new law "Vocational Rehabilitation Act of Accident Insurance" has provided a good basis for the organisation of rehabilitation for these cases in Finland. For this reason, the patients were divided into two groups, one of which was diagnosed prior to 1963 and the other after this law became effective.

When the patients diagnosed in the years 1960 to 1962 attended the Institute, they had—contrary to the advice of their physician—after a shorter or longer sick leave to continue their work, although it was expected that the eczema would get worse giving reason for long-lasting disability. Then it was found that patients weakly sensitive to chromate and nonsensitive to cobalt were capable of continuing their work under proper protective measures. The delay regarding the first visit to the Institute in some cases was likewise explained by a weak hypersensitivity and a relatively mild eczema. Thus the present study shows that the capacity of a patient with allergic cement eczema for continuing his previous work, at least in part, depends on the degree of his hypersensitivity to bichromate and his possible hypersensitivity to cobalt.

The chromium compounds extracted by sweat from shoe leather have been shown by polarographic studies to be both hexavalent and trivalent (16, 17, 18). The present study confirms earlier findings (6, 7, 8) that trivalent chrome in shoe leather may play some role in the spreading of the eczema to the feet. However, the bichromate content of the shoes seems to have little, if any, effect in this respect. The lack of correlation between the degree of hypersensitivity to hexavalent chromium and eczema of the feet is in agreement with the fact that most of the chromium content in leather is in the trivalent form.

The patients diagnosed in the years 1965 to 1967 had come to us for treatment after the new law on rehabilitation began to offer greatly improved possibilities for vocational retraining. Si-

multaneously with the establishment of the law, the community was rendered more rehabilitation-minded, which explains why nowadays considerably more patients have been retrained than five years ago. It is obvious that the effort to rehabilitate early, which in itself is well motivated by its avoidance of wasting time, has influenced the estimation of working capacity in a too pessimistic direction. During the short period preceding rehabilitation the eczema has not had time enough to heal; neither has there been time to modify the work of the patient to such a degree that a successful return would be possible. It seems now probable that a great deal of the weak reactors nonsensitive to cobalt should have been able to continue in their old occupation.

Ten patients had received occupational training for another profession earlier, but none of the patients had received training for the building profession. The vocational rehabilitation or the changing of jobs is easier for these cases than for those who have worked in the building trade exclusively.

It is obvious that, besides psychological, social and educational facts, the age of the patient is of great importance when estimating the suitability for taking rehabilitation measures. The traditional age limit for vocational schools is 40 years. In the present patient series more than 50% had reached this age. According to Carrié & Kühl (1) more than 70% of their patients aged 50 or more found themselves, after a change of work, in an economically and socially poorer position. Neumann (9) furthermore observed a certain correlation between age and the standard of education among labourers in the building trade. Thus, two simultaneous factors render the retraining of aged patients difficult.

Although the reasons for retraining presented in Table V are strong, they obviously are not strong enough. We think that, when estimating the need for rehabilitation, one must not pay too much attention to the persistence of the eczema while working in the old occupation or to the duration of the disability in the acute phase. This is, of course, especially true for cases which are less suitable for vocational retraining due to advanced age or other factors. For patients with a weak hypersensitivity to chromate a certain temperance regarding rehabilitation measures is well-grounded. The same applies to occupationally

qualified or aged persons with a good income, often even in cases with a strong hypersensitivity. As a consequence of the foregoing, unskilled building workers of moderate age but with a strong, perhaps multiple, hypersensitivity constitute the most suitable group for vocational rehabilitation, provided that psychological factors render such measures possible. If it becomes clear with reasonable certainty that rehabilitation is indicated, the program should be started as early as possible. The more time the individual loses from his job, the more difficult it becomes to get him to return to any kind of gainful employment.

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Key words: Chromates, eczema, occupational dermatitis, rehabilitation

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