



Original Article

Results of patch tests (using Indian standard battery of allergens) in cement workers with clinically diagnosed allergic contact dermatitis to cement: A cross-sectional study

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ABSTRACT

Objectives: The objective of the study was to identify the allergens showing positive patch test reaction (using Indian standard battery of allergens) in cement workers with clinically diagnosed allergic contact dermatitis (CD) to cement attending a tertiary referral center.

Materials and Methods: We included cement workers with clinically diagnosed allergic CD to cement who attended the dermatology outpatient clinic of our tertiary referral center from January 2013 to December 2013. We did patch testing in all the cases (after subsidence of active dermatitis) with Indian standard battery of patch test allergens and documented the allergens that showed a positive reaction.

Results: Forty-seven (94%) of the 50 study participants showed a positive reaction to one or more of the allergens. The most common allergen that showed a positive reaction was potassium dichromate (43/50, 86%). Twenty-five patients (50%) showed positive reactions to more than 1 allergen. Four patients (8%) showed positive reactions only to allergens that were not seen in cement.

Limitations: Small sample size and lack of information on clinical response of dermatitis to avoidance of identified allergen were the major limitations.

Conclusion: Twenty-five (50%) patients showing positive reactions to more than 1 allergen tested and 4 (8%) showing positive patch test reaction to none of the allergens in cement (but to other allergens) highlight the role of patch testing in identifying the probable allergens in patients with clinically diagnosed allergic CD to cement.

Keywords: Allergic contact dermatitis, Cement, Patch test, Allergen, Potassium dichromate

INTRODUCTION

Occupational contact dermatitis (CD) is the most prevalent occupational skin disease.^[1] Cement is one of the most important causes of occupational skin disease, especially in construction workers. Cement can produce irritant as well as allergic CD with potassium dichromate being the principle allergenic component.^[2,3] Other important contact allergens in cement are nickel and cobalt.^[2]

Even though not life threatening, allergic dermatitis due to cement can have serious adverse impact on the quality of life and the daily functions. It has important social implications for the patients and

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their families, since often the affected is forced to find another job (which may not be feasible). Identifying the allergen through patch testing is important, since often, avoidance of exposure to the particular offender can reduce the dermatitis. Moreover, occasionally, the patient may be sensitive to some other agent in his day-to-day environment and cement may not be the culprit. An accurate identification of the offender in such cases can avoid the need for occupational rehabilitation.

In this cross-sectional study conducted in our tertiary referral center, we have tried to find the clinical pattern of dermatitis and the offending agents identified (through patch testing) in cement workers with clinically diagnosed allergic CD to cement.

MATERIALS AND METHODS

We included cement workers (with a history of occupational exposure to cement during the past 1 month) who attended the dermatology outpatient department of our tertiary care center from January 2013 to December 2013 and who received a clinical diagnosis of allergic CD to cement. We made a clinical diagnosis of allergic CD to cement when a patient presented with dermatitis associated with pruritus that aggravated or started for the first time after occupational exposure to cement. Patients with atopic dermatitis were not excluded, if the patient noted a clear aggravation of pruritus and dermatitis following occupational exposure to cement. We excluded patients with psoriasis, lichen planus and infective diseases like scabies, fungal infections and bacterial infections. We excluded those below 15 years, pregnant females, patients receiving systemic immunosuppressive medication or phototherapy, patients suffering from diseases causing immunosuppression, and patients not willing to participate in the study.

Using a pre-set proforma, we collected information on the patient characteristics, the occupational history, the onset and the duration of the disease, and the clinical examination findings. We did a patch test in all the cases with Indian standard battery of 25 patch test allergens (Finn chamber method). We obtained the allergens from Systopic Laboratories Private Limited, New Delhi. The patch test was performed when there was no active dermatitis. The patch testing was timed in such a way that the participant had no history of sunburn within the previous 2 weeks and had no history of intake of antihistamines or application of topical steroids at the site of patch testing, during the preceding 1 week.

Allergens were put into aluminum chambers. Patch was applied over the non-irritant, uninflamed normal skin of the upper back of the patients and occluded for 48 hours. The patches were numbered to avoid confusion.

After applying the patch, patients were advised not to take bath or do vigorous exercise for 48 hours and not to consume alcohol and to avoid activities and circumstances that can increase sweating.

The test sites were examined at 48 hours (30 minutes after the removal patches) and then on the 4th day. We scored patch test readings according to the reaction seen at the test site. Patients who showed a negative result on the 4th day were re-examined on the 7th day. The reaction was graded according to the international contact dermatitis research group (ICDRG) scoring system.^[4] The reactions were considered as positive when the patients showed erythematous, infiltrated, small papules, vesicles, or coalescing bullae. Itching, when present, was documented.

Reactions that appeared immediately after the patch testing, those which did not manifest infiltration or itching, and those which showed a sharp delineation corresponding to the margins of the chambers were considered as irritant dermatitis and discarded.

We entered the data in Microsoft Excel. Data were analyzed in terms of frequency, proportions, and percentage in SPSS Inc., IBM company version 16 Chicago, SPSS Inc. (United States of America). Institutional Ethics Committee approved the study. Individual study participant gave written informed consent.

RESULTS

During the 1 year study period, 50 patients, who attended our dermatology outpatient department, received a clinical diagnosis of occupational allergic CD to cement. The study participants included 44 (88%) males and 6 (12%) females with a male-to-female ratio of 7.3:1. The age ranged from 20 to 63 years. Most of the affected belonged to the age group of 40–60 years (32/50, 64%). Sixteen patients (32%) were in the age group of 21–40 years. One patient (2%) was 20 years old and another (2%) was 63 years old.

The duration of the disease ranged from 3 months to 20 years (mean duration – 4.4 years). The duration between the occupational exposure to cement and the onset of the disease varied from 6 months to 43.8 years (mean interval between the occupational exposure to the cement and the onset of the dermatitis – 11.1 years).

Twenty-six patients (52%) worked as masons and 24 were helpers (48%). Forty-six (92%) patients had exposure to both dry and wet cement. The remaining 4 (8%) had exposure only to dry cement. The duration of exposure to cement ranged from 2 years to 45 years in the study participants (mean duration of exposure – 15.5 years). Thirty-four cases (68%) were exposed to cement for >21 days/month, 9 (18%) were exposed to cement for 11–20 days/month, and 7 (14%) patients had a frequency of exposure of <10 days/month.

Thirty-five patients (70%) noted an improvement of dermatitis when not exposed to cement, 10 patients (20%) did not experience any improvement, even when there was no exposure to cement, and 5 (10%) others said that they were unable to avoid contact with cement for a period long enough to assess the effect.

Eighteen (36%) patients were using protective measures to avoid exposure to cement – 15 (30%) were using rubber gloves, 2 (4%) were using boots, and 1 (2%) was using both gloves and boots. However, only four out of the 18 patients (22.2%) noted an improvement of symptoms with protective measures.

Twenty-two (44%) patients gave a definite history suggestive of atopy.

The initial site of the lesion was hand in 25 (50%), feet in 17 (34%), forearm in 3 (6%), and thigh in 1 (2%) patients. Both hands and feet were involved simultaneously in 4 (8%) patients.

Twenty-two (44%) patients presented with eczematous lesions while 28 patients (56%) presented with pruritic, dry, scaly, papules, and plaques. The sites affected were feet (49, 98%), hands (48, 96%), forearms (37, 74%), legs (34, 68%), thighs (17, 34%), trunk (16, 32%), arms (2, 4%), and scalp (2, 4%).

Nail changes were seen in 42 (84%) cases and included longitudinal ridging (41, 82%), subungual hyperkeratosis (35, 70%), loss of cuticle (25, 50%), transverse lines (14, 28%), pigmentation (14, 28%), thickening of nail plate (5, 10%), thinning of nail plate (5, 10%), pitting (2, 4%), and clubbing (2, 4%).

All the study participants underwent patch testing [Table 1]. Forty-seven (94%) patients gave a positive reaction to at least one allergen in Indian standard battery of 25 allergens, while the remaining 3 cases (6%) did not give a positive reaction to any of the allergens tested. None of the patients showed a late reaction.

Forty-three (86%) patients gave positive reactions to potassium dichromate [Figure 1], 12 (24%) to cobalt chloride, and 2 (4%) to nickel sulfate. All cases positive for cobalt chloride and nickel sulfate also gave a positive reaction to potassium dichromate.

Table 1: Profile of patch test positivity in cement workers with clinically diagnosed allergic CD to cement.

Allergen	Number of patients (percentage of total) N=50 (100)
Potassium dichromate	43 (86)
Cobalt chloride	12 (24)
Nickel sulfate	2 (4)
Neomycin sulfate	7 (14)
Paraphenylenediamine	3 (6)
Colophonium	2 (4)
Gentamycin sulfate	5 (10)
Mercapto mix	1 (2)
2-MBT	2 (4)
Thiuram mix	10 (20)
Clioquinol	1 (2)
Parthenolide	4 (8)

CD: Contact dermatitis, MBT: Mercaptobenzothiazole

Twenty-five (50%) patients showed allergic reactions to more than 1 allergen [Figure 2] on patch testing [Table 2]. Twenty-two patients (44%) showed a positive reaction to only one allergen, which was potassium dichromate in 21 cases (21/22, 95.5%) and paraphenylenediamine in 1 patient (1/22, 4.5%).

Among the 10 (10/50, 20%) patients who gave a positive reaction to thiuram mix, 7 (7/10, 70%) were using rubber gloves as protective measures against exposure to cement. Among the three patients who showed positive reactions to 2-mercaptobenzothiazole (MBT) or mercapto mix, 2 patients (2/3, 66.7% - one patient showed a positive patch test reaction to 2-MBT and the other to mercapto mix) were using rubber gloves as protective measures. These two patients also gave a positive reaction to thiuram mix. Seven of the 18 patients (38.9%) who used rubber gloves/boots as



Figure 1: Patch test reading showing +3 reaction to potassium dichromate in a patient with clinically diagnosed allergic contact dermatitis to cement.



Figure 2: Patch test reading showing multiple antigen positivity in a patient with clinically diagnosed allergic contact dermatitis to cement.

Table 2: Profile of patch test positivity in cement workers with clinically diagnosed allergic CD to cement who showed positive reactions to more than 1 allergen.

Allergens that showed positive patch test reactions in the same patient	Number of patients (percentage of total) n=25 (100)
Potassium dichromate and cobalt chloride	6 (24)
Potassium dichromate and nickel sulfate	1 (4)
Potassium dichromate and thiuram mix	4 (16)
Potassium dichromate, thiuram mix and cobalt	2 (8)
Potassium dichromate, thiuram mix, PPD, and parthenolide	1 (4)
Potassium dichromate, thiuram mix, clioquinol, and neomycin sulfate	1 (4)
Potassium dichromate, cobalt, and PPD	1 (4)
Potassium dichromate, cobalt, and parthenolide	1 (4)
Potassium dichromate, neomycin sulfate, and gentamycin sulfate	2 (8)
Potassium dichromate, neomycin sulfate, and nickel sulfate	1 (4)
Potassium dichromate, cobalt, neomycin sulfate, gentamycin sulfate, parthenolide, colophonium, and thiuram mix	1 (4)
Potassium dichromate, cobalt, neomycin sulfate, gentamycin sulfate, and MBT	1 (4)
Colophonium and parthenolide	1 (4)
Mercapto mix, MBT, and thiuram mix	1 (4)
Neomycin sulfate and gentamycin sulfate	1 (4)

CD: Contact dermatitis, PPD: Paraphenylenediamine; MBT: Mercaptobenzothiazole

protective measures showed positive patch test reactions to allergens in rubber.

Six cases (12%) were sensitized to neomycin sulfate and four of them showed positive reaction to gentamycin sulfate (4/6, 66.7%) also.

Four patients did not show a positive reaction to potassium dichromate, but manifested positive reactions to other allergens in the series. The allergens identified in these four patients were paraphenylenediamine, colophonium, parthenolide, mercapto mix, MBT, thiuram mix, neomycin sulfate, and gentamycin sulfate. One of them was a manual laborer who had a history of occupational exposure to

cement, but he was also doing other jobs (cutting grass). He gave positive patch test reactions to colophonium and parthenolide. The patient who showed positive reaction to paraphenylenediamine had a history of allergic CD to hair dye in the past. The patient who showed positive patch test reactions to mercapto mix, thiuram mix, and 2-MBT gave a history of using protective rubber gloves (covering up to wrist) and complained of exacerbation of dermatitis while using the gloves. The fourth patient gave positive reactions to neomycin sulfate and gentamycin sulfate.

DISCUSSION

The male predominance observed among the study participants was comparable to similar studies in the past and could be attributed to the gender profile of construction workers.^[5-7] More than 60% of the participants belonging to the age group of 40–60 years as noted by us was comparable to the observation of Sadagopan *et al.*, but was higher than the age range of 19–34 years reported by Sarma.^[5,7]

The mean interval between the occupational exposure to cement and the onset of the dermatitis noted by us (11.1 years), was comparable to the finding of Iraj *et al.* (10–15 years).^[8] History of atopy noted in 44% of our patients was consistent with the frequency of atopy noted in a previous study (37.5%).^[7]

The commonly affected sites and the morphology of the lesions noted by us were comparable to the previous studies.^[6,7] The high frequency of positive patch test reactions to allergens in cement as observed by us, was comparable to the findings of Sarma, but was higher than the observations of others.^[6,7] The high frequency noted in our study could be attributed to the fact that the study participants were cement workers with clinically diagnosed allergic CD to cement who sought treatment in a tertiary referral center.

Potassium dichromate identified as the most common allergen in cement was consistent with the previous studies.^[5,7] This was contrary to the observations from a CD clinic of a tertiary referral center, where nickel was identified as the most common allergen.^[9] This was expected considering the high prevalence of nickel sensitivity in general population.^[10]

Our observation of all those showing positive reactions to cobalt and nickel on patch testing, showing a positive reaction to potassium dichromate as well, was consistent with literature.^[7] This is attributed to the very low sensitization potential of nickel and cobalt due to their presence in cement in the insoluble form. Hence, allergy to them is often seen only in those with skin damage induced by chromate allergy.^[11] The other allergens that showed positive patch test reactions in our cohort were consistent with the findings of others.^[3,6,7]

Twenty-five patients (50%) showing positivity on patch test to more than 1 allergen and nearly 40% of patients using protective equipment made of rubber showing positive patch test reactions to allergens in rubber underscore the importance of patch testing in the proper management of CD. A patient with allergic CD to cement, could be sensitive to other allergens in the environment as well. Avoiding contact with cement without avoidance of the other sensitizers can result in recalcitrant dermatitis.

Four patients manifesting positive patch test reactions only to unrelated allergens (allergens not seen in cement) suggests that, in some instances of perceived allergic CD to cement, cement may not be the offender. But an accurate identification of the allergen can be made only by avoiding exposure to the allergen identified through patch testing and doing an occupational re-challenge with cement (after subsidence of dermatitis), since false-negative and false-positive patch test reactions are not uncommon.^[12] If it is found that the patient is not allergic to cement, on re-exposure in an occupational environment, it can be considered that the allergen is unrelated to cement. This can avoid unwarranted occupational rehabilitation for such patients. Six and four patients showing positive patch test reactions to neomycin sulfate and gentamycin sulfate, respectively (which are commonly used antibiotics for wounds and skin infections or as the antibiotic component of many commonly used topical steroid-antibiotic combinations), indicate the role of patch testing in choosing the appropriate treatment for individual patient.

Three patients (6%) showing a positive patch test reaction to none of the allergens tested, could be due to one of the several reasons like an untested allergen in the environment being the offender or a false-negative patch test reaction or an alternate clinical diagnosis (other than allergic CD) being the cause of the dermatitis. Such patients may be carefully re-evaluated to arrive at the correct diagnosis.

Limitations

Study conducted in a tertiary referral center (excluding many cases in the community), lack of information on clinical response of dermatitis to avoidance of identified allergen and small sample size were the major limitations.

CONCLUSION

Twenty-five (50%) patients showing positive reaction to more than 1 allergen tested and 4 (8%) showing positive patch test reactions to none of the allergens in cement (but to other allergens) highlight the role of patch testing, in the appropriate management of patients with clinically diagnosed allergic CD to cement.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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