

ORIGINAL ARTICLE

Comparison of patch test results among white Europeans and patients from the Indian subcontinent living within the same community

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Keywords

allergic contact dermatitis, ethnicity, patch tests, race

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Received: 10 December 2007,
accepted 18 March 2008

DOI: 10.1111/j.1468-3083.2008.02787.x

Abstract

Background There are few studies comparing the incidence of allergic contact dermatitis among different racial groups living within the same community.

Objectives The objectives of this study were to compare white European patients with Fitzpatrick's skin phototypes (FSP) I to IV and patients from Indian, Pakistan and Bangladesh with FSP V living within the same community. Referral rates for patch testing, incidence of contact allergies and differences in contact allergens found were assessed.

Method All patients referred to the Contact Dermatitis Unit at Dewsbury and District Hospital between 2004 and 2006, inclusive, were included in the study. All patients were patch tested to the British Contact Dermatitis Society standard series, plus other series according to their clinical history, occupational history and clinical findings.

Results Four hundred and thirty-five consecutive patients from the patch testing clinic were included in the study. Fewer patients from the Indian subcontinent underwent patch testing (11.5%) than would have been expected for the size of the local population (18%). Fewer patients from the Indian subcontinent (44%) had one or more positive reactions compared with the white European patients (56%). No significant differences in the contact allergens responsible were detected between the two racial groups.

Conclusion There is a lower incidence of positive patch test results among patients with racial origins from the Indian subcontinent compared with white Europeans. This modest difference could be explained by a lower average age within the study population, and increased or differing exposure to contact allergens rather than demonstration of variability in the susceptibility to develop contact sensitivities following equal exposure.

Introduction

Allergic contact dermatitis (ACD) is a common skin disorder occurring in both white Europeans and patients from the Indian subcontinent. Previous studies in India have shown that the incidence of contact sensitivity on patch testing is similar to that found in European studies, with up to 65% of patients tested having positive reactions^{1,2} and 46% having relevant positive reactions.^{3,4}

Ethnic differences in skin physiology and pathophysiology exist.⁵ There are numerous reports comparing the susceptibility of different racial groups to irritant contact dermatitis.^{6,7} Asian patients have been reported to be more reactive than Caucasians, but rarely has the data reached statistical significance.⁶

Most published data on ACD are based on single racial groups.^{1,2} There are limited published data comparing allergen sensitivity between differing racial groups.

Previous work⁸ to experimentally induce sensitivities in a controlled manner, in differing racial groups, found that black African patients are less likely to become sensitized than white patients. The reason for this difference was unknown. The author and reviews stated that they doubted that pigment had any role in the lessened tendency to become sensitized, but no evidence for this was given. Differences related to a mechanical effect caused by increased thickness of the horny layer were suggested. Later work by Kligman⁹ again showed that in controlled experimental settings, black African patients were more readily sensitized than white patients. Significant differences were particularly noted with 'weaker' allergens, while similarly high sensitization rates were found with 'strong' allergens. A retrospective review by DeLoe *et al.* reported a similar incidence of ACD between black and Caucasian patients,¹⁰ but differences in the most frequent contact allergens.

There are no data comparing contact allergies in patients from the Indian subcontinent and Caucasian patients living within the same community. Dewsbury and District Hospital serves a population of 350 000 patients. Census data report that 18% of these patients are of Indian, Pakistani or Bangladeshi decent. This enabled us to assess differences in patch test results between these patients, with Fitzpatrick's skin phototype (FSP) V, and white Europeans with FSP I to IV living within the same community.

Methods

All patients referred for patch testing to Dewsbury and District Hospital between 2004 and 2006, inclusive, were included in the study. All patients were tested to the British Contact Dermatitis Society standard series, plus other series according to their clinical history, occupational history and clinical findings. Patch testing was performed to standard methods with allergens applied to the back for 48 h. Skin reactions to the patch tests were recorded at 48 h and 96 h.

Demographic data were examined for each patient including the site(s) of the presenting 'dermatitis' and any previous history of atopy. Any positive reactions on patch testing were recorded along with a final diagnosis.

Patients with FSP V with racial origins from India, Pakistan or Bangladesh were grouped together as 'patients from the Indian subcontinent'. This group included patients that had emigrated here from India, Pakistan or Bangladesh, and patients born in the UK. Patients with FSP I to IV were grouped together as white Europeans. Two patients of Chinese origin and one black African patient were excluded from the analysis.

Statistical analysis of the collected data was performed with SPSS, version 14 (SPSS Inc., Chicago, IL, USA).

Table 1 Site of presenting dermatitis by sex

Site of involvement	Sex		
	Female (285)	Male (150)	Total
Arms	26	12	38
Ears	6	1	7
Eyes/Eyelids	15	6	21
Face	67	30	97
Feet	30	23	53
Generalized	47	44	91
Groin	0	1	1
Hands	117	56	173
Legs	29	18	47
Neck	2	1	3
Oral/Perioral	6	4	10
Perianal	4	6	10
Scalp	9	0	9
Trunk/Back	13	6	19
Vulvar	21	0	21

Results

Four hundred and thirty-five patients with suspected ACD underwent patch testing between January 2004 and December 2006. Three hundred and eighty-five of the patients tested were white Europeans and 50 patients were from the Indian subcontinent. Fewer patients from the Indian subcontinent underwent patch testing (11.5%) than would have been expected for the size of the local population (18%), $P \leq 0.001$ (chi-squared test).

There was an identical sex distribution between the groups, with 65% of patients from each ethnic group being female. Differences in the site of the presenting dermatitis were noted between the sexes (Table 1). In particular, men were more likely to have a generalized dermatitis (29%) than the female patients (16%), $P = 0.002$ (chi-squared test). Overall, the site of presenting dermatitis varied between the sexes (when vulval dermatitis was excluded), $P = 0.003$ (Fisher's exact test).

The mean age of patients from the Indian subcontinent was 33 years. This was significantly younger than that of the white European patients tested, who had a mean age of 45 years. Significance was detected both with the t -test ($P \leq 0.001$) and via non-parametric testing.

Twenty-nine per cent of patients from the Indian subcontinent were known to have atopic eczema prior to testing as were 34% of white Europeans. Furthermore, there were similar rates of atopy between the groups with 45% and 50% of patients affected, respectively. On average, white patients reported that the duration of their symptoms prior to patch testing (4.9 years) was longer than that of patients from the Indian subcontinent (3.5 years).

Table 2 Site of presenting dermatitis by ethnic origin

Site of involvement	Ethnic origin		Total
	Indian (50)	White (385)	
Arms	4	34	38
Ears	0	7	7
Eyes/Eyelids	4	17	21
Face	12	85	97
Feet	6	47	53
Generalized	12	79	91
Groin	0	1	1
Hands	12	161	173
Legs	6	41	47
Neck	1	2	3
Oral/Perioral	2	8	10
Perianal	1	9	10
Scalp	1	8	9
Trunk/Back	3	16	19
Vulvar	0	21	21

Indian, patients from the Indian subcontinent; white, white Europeans.

In the study population as a whole, the commonest specified sites of dermatitis at presentation were hands (40%) and face (22%). There was a marked difference between the two racial groups with respect to hand dermatitis (Table 2). Forty-two per cent of white Europeans presented with hand dermatitis compared with 24% of patients from the Indian subcontinent ($P = 0.03$, Fisher's exact test). A similar percentage of white patients presented with dermatitis to the face (22%) compared with patients from the Indian subcontinent (24%). There were no differences with respect to foot dermatitis, with 12% of patients in each group having this presentation. Eight per cent of female white European patients tested presented with vulvar dermatitis. Thirty-three per cent of these patients had one or more positive reactions. No patients from the Indian subcontinent had this presenting complaint, although the difference failed to reach significance. Twenty-one per cent of the study population presented with 'generalized' dermatitis. There was no significant difference in this presentation across the racial groups.

Fifty-six per cent of white patients were found to have one or more positive reactions to contact allergens, with a total of 536 positive reactions. Only 44% of patients from the Indian subcontinent had one or more positive reactions with a total of 64 reactions ($P = 0.037$; Mann-Whitney test).

Stepwise logistic regression showed that overall the regression model (entering age, sex and racial group) was significant, $P = 0.027$. However, of these factors, only age was individually significant and the effect was very weak.

Differences were noted between the two racial groups regarding the allergens responsible for contact dermatitis in this study. However, no significant differences were noted between the groups when comparing individual allergens. In both groups, the most common reaction was to nickel sulphate (Table 3).

Discussion

Racial variability in the development of skin diseases has been widely reported. There are numerous reports on the varying incidence of irritant contact dermatitis among different racial groups, with inconsistent results.^{6,7,11} Asian patients have been reported to be more reactive than Caucasians, but rarely has the data reached statistical significance.⁶ There have been few studies reporting differences in patch test results among different racial groups, especially involving patients from the Indian subcontinent.

The European standard series has been shown to be suitable for the detection of contact allergies in India.¹ The British Contact Dermatological Society standard series is used for the detection of contact allergies in patients from the Indian subcontinent in the UK, although there have been no studies to confirm it suitably in these patients.

In this study, fewer patients from the Indian subcontinent were patch tested than expected (11.5%), given the size of the local population (18%). Previous studies have shown that ethnic minorities are under-represented at patch testing,¹⁰ despite equal access to services. Reasons for this are unclear. It does lead to concerns that these patients may be less likely to either seek a referral for patch testing or that the indication for patch testing is not recognized within primary or secondary care, within this patient group.

Of the patients referred for patch testing, fewer patients from the Indian subcontinent (44%) had one or more positive reactions than Caucasian patients (56%). This low incidence of ACD is at variance to previous studies involving entirely Indian patients.^{1,2} Furthermore, Goh found similar rates of ACD when comparing Indian patients living in Singapore compared with the majority racial groups of that population.¹²

In our study population, the two groups were sex matched. However, the mean age of the white European patients was higher (45 years) than that of the patients from the Indian subcontinent (33 years). It is known that the prevalence of contact allergy increases with increasing age.^{12,13} This is most likely as a result of increasing exposure to potential contact allergens over time. Patients from the Indian subcontinent were noted to be younger and have fewer reactions than white patients in this study.

Table 3 Frequency of positive reactions to contact allergens by racial group

Most frequent contact allergens identified on patch testing	Patients from Indian subcontinent		Caucasian patients	
	%	No. of reactions	%	No. of reactions
Nickel sulphate (5% pet)	22.0	11	22.3	86
Cobalt chloride (1% pet)	4.0	2	9.0	35
Potassium dichromate (0.5% pet)	2.0	1	6.8	26
Thiomersal (0.1% pet)	4.0	2	5.5	21
Balsam of Peru (25% pet)	4.0	2	5.5	21
Phenylmercuric acetate (0.01% aq)	4.0	2	2.9	11
Paraphenylenediamine (1% pet)	10.0	5	4.7	18
Thiuram mix (1% pet)	0.0	0	3.4	13
Fragrance mix (8% pet)	2.0	1	4.9	19
Methylchloro- and methylisothiazolinone (0.01% aq)	5.9	3	6.0	23
Formaldehyde (1% aq)	0.0	0	4.7	18
Colophonium (20% pet)	0.0	0	2.9	11
Epoxy resin (1% pet)	0.0	0	1.6	6
Sesquiterpene lactone mix (0.1% pet)	0.0	0	1.6	6
Caine mix (7% pet)	0.0	0	1.3	5
Benzalkonium chloride (0.1% pet)	0.0	0	1.3	5
Ethylenediamine (1% pet)	0.0	0	1.3	5
Imidazolidinyl urea (2% pet)	0.0	0	1.0	4
Neomycin (20% pet)	0.0	0	1.0	4

pet, in petroleum; aq, aqueous.

Most frequently observed allergens listed.

The effect of age on the number of reactions was shown to be weak, suggesting that factors other than age are contributing to these differences.

Within this study population, fewer patients from the Indian subcontinent had one or more positive reactions when patch tested. However, from this single study, it is not possible to draw conclusions as to whether or not patients from the Indian subcontinent have a decreased capacity to develop contact allergies compared with white patients living within the same community. It would be wrong to presume that patients of differing racial groups have equal exposure to potential allergens. In our study population, patients from the Indian subcontinent were under-represented in so-called 'high risk' occupations such as hairdressing, food handling, cleaning and healthcare professionals.^{14,15}

There was a significantly lower incidence of hand dermatitis in patients from the Indian subcontinent compared with white patients. The reasons for this are unclear but could be related to differing exposure to potential allergens as discussed earlier. There were no other significant differences in the presenting dermatitis across the racial groups. However, it was noted that no patients of Indian origin presented with vulval dermatitis,

compared with 8% of white European women. In this study, this difference did not reach statistical significance because of the small number of patients having this presentation. There are no previous reports of vulval dermatitis in patients from the Indian subcontinent specifically. It remains to be seen whether or not these patients are less likely to report such symptoms or whether the incidence of such problems is lower in this racial group. Thirty-three per cent of white patients presenting with vulval dermatitis in this study had one or more positive reactions. Similar rates of contact allergy detection have been noted in previous studies of patients with vulval dermatitis.¹⁶

Nickel sulphate is the most common contact sensitizer in Western countries. Furthermore, it has been shown to be a common contact allergen in studies performed in India.^{1,17} In this study, nickel was again found to be the most common contact allergen in both racial groups. Other common contact allergens previously reported in Indian studies¹ were also identified in our study population including paraphenylenediamine (10%) and cobalt (4%).

Overall, our study has shown that, within our region, there is a lower incidence of positive patch test results among patients with racial origins from the Indian

subcontinent compared with white Europeans. This modest difference could be explained by a lower average age within the study population, and increased or differing exposure to contact allergens rather than demonstration of variability in the susceptibility to develop contact sensitivities following equal exposure.

Acknowledgement

The authors would like to thank Mr Phil McShane, Clinical Trials Research Unit, University of Leeds, for his assistance in the statistical analysis.

References

- 1 Sharma VK, Chakrabarti A. Common contact sensitizers in Chandigarh. *India Contact Dermatitis* 1998; **38**: 127–131.
- 2 Mehta SS, Reddy BS. Pattern of cosmetic sensitivity in Indian patients. *Contact Dermatitis* 2001; **45**: 292–293.
- 3 Bhushan M, Beck MH. An audit to identify the optimum referral rate to a contact dermatitis investigation unit. *Br J Dermatol* 1999; **141**: 570–572.
- 4 Rietschel RL. Is patch testing cost-effective? *J Am Acad Dermatol* 1989; **21**: 885–888.
- 5 Berardesca E, Maibach H. Racial differences in skin pathophysiology. *J Am Acad Dermatol* 1996; **34**: 667–672.
- 6 Modjtahedi SP, Maibach HI. Ethnicity as a possible endogenous factor in irritant contact dermatitis: comparing the irritant response among Caucasians, blacks and Asians. *Contact Dermatitis* 2002; **47**: 272–278.
- 7 Foy V, Weinkauff R, Whittle E, Basketter DA. Ethnic variation in the skin irritation response. *Contact Dermatitis* 2001; **45**: 346–349.
- 8 Rostenberg A, Kanof NM. A comparison between the sensitizing capacities of two allergens and between two different strengths of the same allergen and the effect of repeating the sensitizing dose. *J Invest Dermatol* 1941; **4**: 505–516.
- 9 Kligman AM. The identification of contact allergens by human assay. *J Invest Dermatol* 1966; **47**: 393–408.
- 10 DeLoe VA, Taylor SC, Belsito DV. The effect of race and ethnicity on patch test results. *J Am Acad Dermatol* 2002; **46**: S107–S112.
- 11 Robinson MK. Population differences in acute skin irritation responses – race, sex, age, sensitive skin and repeat subject comparisons. *Contact Dermatitis* 2002; **46**: 86–93.
- 12 Goh CL. Prevalence of contact allergy by sex, race and age. *Contact Dermatitis* 1986; **14**: 237–240.
- 13 Green CM, Holden CR, Gawkrödger DJ. Contact allergy to topical medicaments becomes more common with advancing age: an age-stratified study. *Contact Dermatitis* 2007; **56**: 229–231.
- 14 Saunders H, Keegal T, Nixon R, Frowen K. Career counselors and occupational contact dermatitis. *Contact Dermatitis* 2003; **48**: 189–190.
- 15 Rietschel RL, Mathias CG, Fowler JF Jr, Pratt M, Taylor JS, Sherertz EF *et al.* North American Contact Dermatitis Group. Relationship of occupation to contact dermatitis: evaluation in patients tested from 1998 to 2000. *Am J Contact Dermat* 2002 Dec; **13**(4): 170–176.
- 16 Marren P, Wojnarowska F, Powell S. Allergic contact dermatitis and vulval dermatoses. *Br J Dermatol* 1992; **126**: 52–56.
- 17 Suman M, Reddy BS. Pattern of contact sensitivity in Indian patients with hand eczema. *J Dermatol* 2003; **30**: 649–654.