Epidemiological characteristics and identification of specific allergens in patients with footwear contact dermatitis attending the Dermatology Clinic, Base Hospital Karawanella

I P Kahawita[1], L A M L Wimalaratne[2], P D S C Gunasekara[3], M G K Iraj[4], T M J C Madatuwa[5]

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Abstract

Footwear contact dermatitis is a common type of allergic contact dermatitis in Sri Lankan patients attending dermatology clinics. Only a few studies have looked at the specific allergens causing footwear contact dermatitis in Sri Lanka.

Our objective was to identify the specific allergens responsible for footwear contact dermatitis in a population of patients attending a dermatology clinic in Sri Lanka.

Sixty nine consenting adults with a clinical diagnosis of footwear contact dermatitis at the Dermatology Clinic, Base Hospital Karawanella, were enrolled. Following clinical examination and counseling they were subjected to a patch test using the European Baseline series by Chemotechnique Laboratories, Sweden. The 96 hour reading was used for the analysis.

Sixty nine participants, the majority (51.6%) aged between 31 and 50 years, were included with 40 (57.9%) females and 29 (42.1%) males. 29.7% were housewives.

Only the feet were involved in 75%. Other atopic manifestations were found in 40%. The commonest type of footwear was black rubber slippers (76%) and the majority wore footwear for less than 8 hours a day.

There were 9 negative patch tests. The commonest haptens in order of frequency were mercaptobenzothiazole (65.21%), mercapto mix (53.62%), thiuram mix (31.88%), potassium dichromate (24.63%) and nickel II sulphate hexahydrate (18.84%).

The commonest allergens in patients with footwear contact dermatitis are rubber related products indicating the practices of footwear usage in the population.

Keywords: footwear contact dermatitis, allergens, rubber related products

Introduction

Footwear contact dermatitis is a common presentation of allergic contact dermatitis (ACD), manifesting as an eczematous reaction over the area in contact with the footwear. The clinical presentation and the contact allergens (haptens) responsible for the dermatitis vary according to the practice of footwear usage.

Patch testing is a method of identifying the specific allergens (haptens) causing allergies in an individual. An analysis of the patterns of haptens responsible for a specific type of ACD will help the clinician to advise patients on avoidance of the allergens even when patch testing is not available.

The objectives of the present study were to describe the epidemiological characteristics of patients with footwear contact dermatitis among patients attending a dermatology clinic in Sri Lanka and to identify the specific allergens responsible for the dermatitis.

Materials and methods

A cross sectional study was carried out with 69 consenting adults being patch tested using the European Baseline Series (Chemotechnique Laboratories, Sweden). The 96 hour reading was used in the analysis.

Ethical clearance was obtained from the Ethical Review Committee of the Sri Lanka Medical Association ERC/13-015.

Results

There were 69 participants, with 40 (57.97%) females and 29 (42.03%) males. The average age was 48.68 years. The majority were either housewives, 26 (37.68%) or manual workers, 21 (30.43%).

The vast majority (65/69) used rubber slippers (flip flops). Black was the predominantly used colour (95.65%). Fifty four percent wore footwear for more than four hours a day.

The average duration of the footwear contact dermatitis was 4.72 years. Only the feet were involved in 53 (76.81%). Figure 1 shows the typical distribution of the dermatitis, together with the commonest type of footwear used.

[1]*Consultant Dermatologist, Base Hospital, Homagama,* [2]*Medical Officer, Base Hospital, Avissawella,* [3]*Medical Officer, Base Hospital, Karawanella,* [4]*Medical Officer, Base Hospital, Avissawella,* [5]*Medical Officer of Health, Dehiowita, Sri Lanka.*

Figure 1. *Distribution of the dermatitis with the commonest type of footwear used.*

There were nine (13.04%) negative patch tests. Positive patch tests for three or more allergens were seen in 26% of participants. The commonest allergens were mercaptobenzothiazole (MBT) (66.67%), mercapto mix (55.07%) and thiuram mix (31.88%). The ten most common allergens and their significance in footwear contact dermatitis are summarized in Table 1.

Discussion

Our work on footwear contact dermatitis is comparable to previous work done in the region, but shows some peculiarities due to the pattern of footwear usage.

The majority in our series were women (58%) and the mean age was 48.68 years (5th decade). The series by Chowdhury *et al* also comprised a similar group of people[1]. The participants of our series were mainly from a rural population with the majority being housewives and manual labourers. The type of labour included work in rubber and tea estates.

In our study the majority of participants used black rubber slippers. This is the commonest type of footwear used by rural Sri Lankans, at home or work. Only persons in "white collar" occupations and students wear shoes on a regular basis. Many Sri Lankans are used to walking barefoot, using footwear only occasionally. This is in contrast to the Indian practice of wearing leather shoes and sandals without socks[1].

Our patch test result showed that the vast majority had sensitivity to rubber related products. Approximately 25% showed sensitivity to potassium dichromate, which is used in tanning of leather products and in shoe polish. Allergy to nickel sulphate (shoe accessories), paraphenylenediamine (PPD), black dye, and 4-tert-butylphenoformaldehyde resin (shoe adhesive) were seen in a minority. Even though black was the preferred colour of footwear used, allergy to PPD was relatively low (7%).

The commonest allergens in our study are rubber accelerators. Mercapto mix (40%) was the commonest allergen found in the series by Ragunathan in Galle, a suburban area in Sri Lanka. This study showed chromate, formaldehyde, epoxy resin and IPPD to be the common allergens[2].

A comparison of findings of patch test results in footwear contact dermatitis in Sri Lankan studies is given in Table 2.

Two Indian studies in 1993 and 2007 showed that potassium dichromate was the commonest allergen. Chowdhury *et al* reported that the most common allergens were potassium dichromate, cobalt chloride, and PPD[1]. The relatively high incidence of cobolt sensitivity was due to its use in buckles and islets in shoes. The patch test positivity to cobolt chloride (5.79%) in our study could also be due to this reason.

Saha *et al* reported that the commonest allergens were potassium dichromate and colophony[3]. Data from the North American Contact Dermatitis group between 2001 and 2004 showed that rubber chemicals were the most common group of chemicals, accounting for 40% of the positive patch tests[4].

A multi centre review of the footwear allergens in the United Kingdom reported that the allergens with the highest relevance were; aminobenzene (pigment), diphenyl guanidine (rubber related product), area formaldehyde resin (heat setting resin), gum resin (adhesive) and disperse orange (dye)[5]. Table 3 compares the results of our study with the studies from UK and USA.

In spite of the wide variation in footwear usage and use of different series of allergens, the presence of rubber related products is seen in all the studies. This may be due to the fact that rubber related products are used universally for the manufacturing of footwear.

Conclusion

Our study concludes that rubber related products are the commonest allergens responsible for footwear contact dermatitis in Sri Lankan patients.

Table 1. The ten most common allergens and their significance

Allergen	*Significance*	*Percentage*
Mercaptobenzothiazole (MBT)	Rubber accelerator	66.67
Mercapto mix	Rubber accelerator	55.07
Thiuam mix	Rubber accelerator	31.88
Potassium dichromate	Tanning of leather/ shoe polish	24.63
Nickel (II) sulphate hexahydrate	Nickel accessories in shoes	18.84
Neomycin sulphate	Not related	10.14
P-phenylene diamene (PPD)	Black dye/ rubber accelerator	7.24
Cobolt (ii) sulhate hexahydrate	Shoe accessories	5.79
Myroxylon pereirae resin	Not related	4.34
4-tert-butylphenoformaldehyde resin	Shoe adhesive	4.34

Table 2. Comparison of findings of patch testing in Sri Lanka and India

Karawanella 2013	*Galle 2004*	*India 2007*	*India 1993*
MBT	Rubber constituents	Potassium dichromate	Potassium dichromate
Mercapto mix	Potassium dichromate	Cobolt chloride	Colophony
Thiuram mix	Epoxy resin	PPD	MBT
Potassium dichromate	Formaldehyde	Epoxy resin	Diphenylguanidine
Nickel sulphate	IPPD	Black rubber mix	P-aminobenzene

Table 3. Comparison of findings of patch testing from UK and USA

Karawanella 2013	*North American study 2004*	*UK 2005*
MBT	P-tertiary butylphenol formaldehyde resin	Aminobenzene
Mercapto mix	Potassium dichromate	Diphenyl guanidine
Thiuram mix	Carba mix (11.7%)	Area formaldehyde resin
Potassium dichromate		Gum resin
Nickel sulphate		Disperse orange 3

Limitations

This study was conducted using the European Standard Series of allergens as the shoe series is of limited availability in Sri Lanka. Even though the two series share approximately 12 allergens, testing for certain allergens have not been carried out.

The data from this study cannot be generalized for the whole country due to the wide variation in footwear usage in different regions.

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