

SHOE-ALLERGIC DERMATITIS AFFECTING A SANITATION WORKER

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ABSTRACT

Occupational skin disease is a common condition globally, affecting men and women of all ages. The majority of cases are due to irritant and allergic contact dermatitis (ACD) of the hands and feet. Sanitation workers are an occupational group commonly affected by shoe dermatitis. The prevalence of shoe-allergic dermatitis varies from region to region and is between 1.5% to 25% of those attending specialist contact dermatitis clinics, depending on the types of shoe allergen commonly found in a region. The prevalence also varies depending on the nature of the work performed, the type and style of the shoes worn, pre-existing medical conditions, social disparity, and climatic and geographical conditions. Sanitation workers are exposed to a variety of hazards, including sun exposure, infective organisms, sewage, dirt and sharp objects, which necessitate the consistent use of impervious safety shoes. The prolonged use of these safety shoes creates an occlusive, moist environment, with the retention of perspiration from heat, physical activity and hyperhidrosis contributing to skin irritation, maceration and barrier dysfunction, which then facilitates exposure to shoe allergens present in leather, rubber, dyed fabric, plastic and adhesives. This article highlights a case of a non-atopic sanitation worker with shoe-allergic dermatitis and a fungal infection, and emphasises how to approach the diagnosis and management of shoe dermatitis.

Keywords: allergic contact dermatitis; shoe-allergic dermatitis, allergens, occupational skin disease

INTRODUCTION

Occupational skin disease (OSD) is common globally and accounts for up to 34% of reported occupational diseases (ODs).^{1,2} In South Africa, OSD outside the mining industry accounted for 14% reported ODs in 1999³ and 6% between 2000–2005.⁴

Of all OSDs, the majority (90–95%) are due to irritant contact dermatitis and ACD.^{2,5} Burdzik et al found that 81% of 31 patients attending the Occupational Dermatology Clinic at Groote Schuur Hospital (Cape Town) with OSD had either allergic (68%) or irritant (13%) contact dermatitis. The most common primary site of involvement was the hands and/or the forearms (76%) followed by the hands and the feet (8%).⁶

Foot dermatitis can be classified as exogenous if it is caused by an external agent such as an infection, contact allergens and/or irritants, or endogenous if it is caused by an underlying skin condition such as atopic eczema or psoriasis.⁷

The prevalence of OSD varies from region to region and is between 1.5% to 25% of those attending specialist contact-dermatitis clinics, depending on the types of shoe allergen commonly found in a region.^{7–11} OSD affects both sexes and any age group. It is difficult to compare prevalence rates between countries owing to a number of factors:

- the wide variety of shoe fashion trends in different regions of the world;
- the closely guarded shoe-production techniques and raw materials of differing quality;
- the components of the socks and stockings worn;
- daily foot- and shoe-care techniques, such as washing and maintenance;
- the use of treatment, especially topical antifungal foot powders and antibiotic preparations, and
- the wide-ranging climatic and geographical conditions in which shoes are worn.^{7–10}

These discrepancies furthermore pose a therapeutic challenge in the diagnosis and treatment of shoe dermatitis.^{7,13} Freeman notes that diagnosis becomes even more challenging when the shoe dermatitis is superimposed on a pre-existing underlying skin disease.¹⁴

Shoe dermatitis can be of either irritant or allergic type. Shoe-allergic dermatitis is a form of delayed type-IV hypersensitivity reaction which arises after feet come into contact with potentially sensitising substances such as those used in the processing of leather, rubber, dyes and adhesives.^{5,7} These substances can be found in shoe components comprising the uppers (the shoe straps, vamp and tongue), the cap (made of steel in safety shoes), the soles (inner and outer sole), the sock found within



Figure 1: Anatomy of a safety shoe, showing the inner mesh lining (Source: Google Images)

the shoe, the materials used to make the heel and, occasionally, metal buttons and ornaments, as illustrated in Figure 1.⁵

Despite accurate diagnosis and treatment, shoe dermatitis can be chronic and debilitating, resulting in difficulties with walking during a period of greatest physical activity in adolescence and adulthood.^{14,15} Rose and Rees of the National Institute of Occupational Health (NIOH) in South Africa interviewed 93 of 128 patients, seen between October 2006 and March 2008 with occupational contact dermatitis, and found that it was associated with job insecurity, difficulty completing work, financial loss and a poor self-esteem compounded by stigmatisation from colleagues and the employer.¹⁶

The following case report highlights a case of a non-atopic sanitation worker with a shoe-allergic dermatitis superimposed on a fungal infection referred to the Occupational Dermatology Clinic at a tertiary Cape Town hospital because of poor response to topical anti-fungal treatment.

CASE REPORT

A 55-year-old, non-atopic, previously well gentleman presented with a three-month history of severe tinea pedis with associated itch, mild swelling and interdigital maceration, pain and difficulty in walking – which improved after a month on an antifungal ointment prescribed by his general practitioner. The symptoms recurred within a month of completing the topical treatment, with increased dryness and fissuring of the feet, itch, moderate scaling and hyperkeratosis of both feet but now also involving the hands and sparing the rest of his skin. He was referred to a dermatologist for an opinion. At the time he was seen, he had developed crusting, redness, erosions and weeping over the dorsum of both feet, suggesting a secondary bacterial infection. He was therefore admitted for systemic antibiotic treatment with ciprofloxacin and potassium permanganate soaks.

He is employed as a municipal sanitation worker and performs a wide variety of tasks, including street sweeping, drain cleaning, road tarring (with exposure to tar and cement hardener), paving,

and spraying insecticides and pesticides. He wears protective clothing consisting of an overall, leather safety boots, gloves and cotton socks, which he washes and changes on alternate days. The gloves were of the rubber-dipped, cotton, wrist-length type usually issued for crayfish handlers. He asserts that the onset of his skin symptoms followed the receipt of a new pair of leather safety boots provided in the workplace. He has a ninepack per year smoking history and he does occasional maintenance work including appliance repairs and painting using acrylic paint.

A diagnosis was made of a secondarily infected, partially treated inflammatory fungal infection of the feet with an id reaction involving the hands. The closed environment of the safety boots, vigorous manual work under warm weather conditions, perspiration and constantly wet feet from the prolonged exposure to drain spillage encountered when unblocking and cleaning municipal sewers/drains provided the ideal environment for the development of irritant contact dermatitis and microbial growth. ACD to components of his shoes could not be excluded, especially as he reported developing the lesions after he had been provided with a new pair of safety boots in the workplace.

He was discharged after four days on fluconazole 200 mg weekly for a month and Augmentin® (Amoxicillin + Clavulanic acid) 1 g twice daily for a week, to continue potassium permanganate soaks for infection and exudate control and liquid paraffin soaks to soften and hydrate the hyperkeratosis. A request that he be accommodated away from duties that required the use of safety boots was made to his employer, while acute management and investigations continued.



Figure 2: Patchy erythema, infiltration and scale crust on the dorsum of the feet, peri-ungual skin and the odd webspace. Individual dystrophic and discoloured toenails. Hyperkeratotic scaly plaques with fissures and the odd dry vesicle of both soles.

He was reviewed at the Occupational Dermatology Clinic, where a marked improvement was noted with no maceration between the toes. Ongoing patchy erythema, infiltration and scale crust was noted on the dorsum of the feet, peri-ungual skin and the odd webspace. Also noted were individual dystrophic and discoloured toenails and patchy residual dry vesicles, fissures and hyperkeratotic scaly plaques of both soles (see Figure 2).

A standard battery of 46 common commercial skin allergens was performed and graded according to the International Contact Dermatitis Research Group Guidelines³⁴ and left *in situ* for 48 hours. A weak (+1) reaction for neomycin, wool alcohol and lanolin was recorded 72 hours after application. These compounds are known shoe allergens (see Table I) but their relevance to this gentleman's presentation has not been conclusively demonstrated. To investigate further a diagnosis of an ACD to shoes, a specific patch test with samples from the safety boots and shoes he had used and those proposed for future use was performed. Pieces of leather, inner sole, breathable inner mesh and tongue, 1 cm² in size, were placed in individual Finn patch-test chambers and water-pre-moistened filter paper discs overlaid on each sample. The loaded chambers were applied to the back skin, after 48 hours of occlusion the patch tests were removed, and the reactions were then read 24 hours later (see Figure 3). Irritant reactions to several samples from the used safety boot and shoe were noted. A doubtful reaction ($\pm$) to the mesh from the used safety shoe and a weak (+1) reaction to the mesh from the Fuel safety boot proposed for future use were recorded. The findings from the specific patch test suggested a diagnosis of an occupational contact dermatitis with possible sensitisation to components of the safety boot mesh. The shoe allergy was superimposed on an irritant dermatitis and presumed fungal infection of the feet with an id reaction of the hands. No fungal cultures were done.

He was to continue with his prescribed treatment which, following confirmation of shoe dermatitis, included salicylic acid 10% as a keratolytic, Lassar's paste for sealing fissures and potent corticosteroid ointment for controlling the eczema. He was to keep his skin moisturised to limit the hyperkeratotic areas' fissuring. Socks should be cotton and changed daily in order to limit foot maceration and they should be washed with bland soap, preferably in hot water. He was advised that all safety boots proposed for use in the future should be evaluated for allergens with patch tests if necessary. In addition, the employer and the patient were provided with a resource on

the products available to be used in instances of shoe-allergic contact dermatitis (see Table II).

His condition improved following workplace accommodation that reduced the time spent doing wet work and wearing the safety boots. However, he expressed a desire to return to his normal duties due to a lack of stimulation in his accommodated role as a gardener. Considering the occupational hazard of exposure to polluted water, impervious gloves and safety boots of the necessary length and material are essential personal protection equipment should he resume his work in the sanitation unit. Those he was using previously were inadequate as they allowed him to be contaminated by polluted waste. New Fuel safety boots for future use were tested in the special patch test; however, the mesh lining produced a positive reaction. It was impressed upon the employer and worker that permanent accommodation in areas that do not require the use of safety shoes should be considered.

EPIDEMIOLOGY OF SHOE DERMATITIS

Sanitation workers are responsible for maintaining cleanliness in many urban areas across the world.¹⁷ In the developing world, however, this work is often done manually and exposes the workers to a variety of hazards, including sun exposure, infective organisms, sewage, sharp objects, and chemicals and substances released into the environment from industries (such as the construction, electroplating, tanning, dyeing and food- and drug-manufacturing industries) or households (cleaning agents, medications and gardening materials, including pesticides).¹⁷ These exposures necessitate the consistent use of personal protective equipment such as impervious safety shoes, aprons, overalls, gloves and masks.^{17–18}

A survey and general dermatologic evaluation of 87 street sanitation workers in India found the most common general skin problems included tinea versicolor (18%), dermatophytosis (16%) and contact dermatitis (10%). Some had more than one skin problem and there was inconsistent use of gloves, masks and footwear. No specific mention was made of foot or shoe dermatitis.¹⁷ Yan et al found a statistically significant higher rate of occupational skin disease in the 273 sanitation workers in China compared to the 113 controls (administrative staff).¹⁹ The most common skin problems related to overexposure to UV radiation and included 'prickly heat' (26% versus 8%) and dermatitis aestivale (15% vs 5%). In this case, no specific

TABLE I: PATIENT'S POSITIVE PATCH-TEST RESULTS

STANDARD BATTERY OF 46 ALLERGENS		
1+	Neomycin	Potent allergen; found in prescribed topical medication
1+	Wool alcohol and lanolin	Weak allergen; derived from sheep fleece used as textile finisher, shoe polish and on leather
PATCH TEST WITH OWN SHOE SAMPLES		
IR*	Shoe mesh (safety boot)	Possible exposure from dyes, biocides and fabric finishers used to produce mesh
IR*	Shoe mesh (safety shoe)	Possible exposure from dyes, biocides and fabric finishers used to produce mesh
Doubtful	Inner sole & leather (safety shoe)	Possible exposure from inner-sole adhesives, dyes, biocides and fabric finishers used to produce inner soles and leather chemicals
+1	Shoe mesh (Fuel safety boot)	Possible exposure from dyes, biocides and fabric finishers used to produce mesh

*Irritant reaction

TABLE II: ALTERNATIVE PRODUCTS AVAILABLE FOR PATIENTS WITH SHOE-ALLERGIC CONTACT DERMATITIS*

MANUFACTURER AND CONTACT DETAILS	PRODUCT OFFERING
Askin Shoes www.askin.it; info@askin.it	Products excluding the following materials: Metal tanning agents: chromium salts, aluminium, zirconium, titanium, nickel, lead, copper, cadmium Acids: sulphuric, formic, oxalic, hydrochloric Biocides: trichlorophenol, pentachlorophenol, tributyltin oxide Formaldehyde resins Epoxy resins Amine catalysers Azoic catalysers Bactericides Isocyanides Carbamates
Ausangate Socks www.ausangatesocks.com/default.asp	Lanolin-free socks made of breathable alpaca fibre
Birkenstock Express www.birkenstockexpress.com	Cork and polyurethane foot-bed replacements
Birkenstock USA, LP info@birkenstockusa.com	Sandals and shoes do not use carba mix or allergens related to carba mix: zinc diethyldithiocarbamate diphenylguanidine zinc dibutyldithiocarbamate Products do not use: abitol, abietic acid, colophony, phthalate, p-tert-butylphenol formaldehyde resin (PTBP-FR) or thiuram mix Chrome VI is not used in the tanning process of leathers Soles do not contain mercaptobenzothiazole (MBT) Birkenstock buckles, rivets and staples are all made of steel and nickel free
The Cordwainer Shop info@cordwainershop.com	Glue-free linings for allergy-sensitive customers
Loveless Orthopedic Appliance contact@lovelessboots.com	Hypoallergenic liners for shoes and boots are offered
Microair Barrier Socks Alpretec www.alpretec.com/eng (for the list of distributors)	Barrier socks prevent skin from coming in contact with allergens
Multnomah Leather Shop www.multnomahleather.com/Allergy	Offers clogs made of chromate-free vegetable-tanned cowhide For those with rubber allergy; they use a wood midsole, isolating the wearer's feet from the cemented outsole
Po-Zu ww.po-zu.com; contact@po-zu.com	Use natural materials such as hemp, cork, coir and latex (from pure vegetable rubber), wool (100% unbleached and often undyed) and organically tanned leather Avoid glues
PW Minor and Son, Inc consumerhotline@pwminor.com	Offers hypoallergenic footwear, including chrome-free leather and the minimal use of adhesives
Simple Way, The Leather Kit People www.simpleway.co.uk	Can make shoes to order without adhesives
Snipe http://www.snipe-shop.de/	Offers chrome-free tanned leather, natural cotton uppers, nickel-free metal, soles and laces made of natural materials
West Coast Shoe Company info@wescoboos.com	Offers chrome-free vegetable-tanned leather products

*Copied from Matthys et al²⁰

mention was made of foot or shoe dermatitis. The sanitation workers were supplied with gloves, broad-brimmed hats and long-sleeved clothes before the survey and it was found that younger workers used this protective equipment significantly more than older workers.¹⁹

Other occupations making use of heavy occlusive shoes, such as factory workers, security guards and military personnel, are prone to developing shoe-allergic contact dermatitis.^{5,20}

Shoe dermatitis has been found to occur in all age groups; however, individuals between the second and fifth decade have been found to be most vulnerable, probably due to the increased frequency and duration of footwear use in this economically active group.^{5,21} A prospective cross-sectional study at a dermatology outpatient clinic in India found that 81% (87/108) of patients with shoe dermatitis were between the ages of 20 and 50 years of age, which was in keeping with other studies from India.^{7,22–24}

An increased prevalence of shoe-allergic dermatitis has been found in females compared to males (3 : 1) in Indonesian patients who were patch-tested. This is attributed to more frequent use of shoes of various types in females and the direct exposure of shoes to skin in warmer months when stockings are not worn.¹³ The higher prevalence may also be because of better health-seeking behaviour in females compared to males and more regular exposure to water and household cleaning agents when doing household chores with bare feet in slippers.¹³

Shackelford et al reported a bimodal age distribution in American patients, noting that ACD of the foot was most common in those under 19 years of age and those between 41 and 60 years of age and in those who were atopic and male.⁹

AETIOLOGY AND RISK FACTORS

The major factors that contribute to the development of shoe-allergic contact dermatitis relate to the environment within shoes and the type and duration of exposure to shoe allergens.^{15,20} The prolonged, occlusive, moist environment of shoes promotes skin contact with potentially immunogenic/allergenic substances/chemicals leached from the leather, rubber, fabric, plastic and adhesives used in their manufacture.

The retention of perspiration from heat, physical activity and hyperhidrosis contributes to skin irritation and maceration, which then facilitates the skin penetration of these substances/chemicals.^{8,15} Srinivas et al demonstrated that the chrome used for tanning leather is leached from the leather in the presence of perspiration.²⁵ It is postulated that it is probable that other chemicals from shoes may also be released by perspiration.¹⁵ Other risk factors to consider are a history of eczema or skin disease, friction and medical conditions such as chronic venous insufficiency or those patients predisposing to hyperhidrosis.^{8,20}

CONTACT ALLERGENS

Common shoe allergens are summarised in Table III. A North American retrospective, cross-sectional analysis of patch-test results documented between 2001 and 2004 aggregated patch-test data according to allergen groups. They found rubber additives to be the most common allergens (40.4%), followed by adhesives (32.5%) and leather components (20.1%).⁵ The most common individual allergen was the adhesive, p-tertiary butylphenol formaldehyde resin (PTBFR), which accounted for 24.7% of positive patch-test results, followed by potassium dichromate (17.5%) used for tanning leather, and carba mix

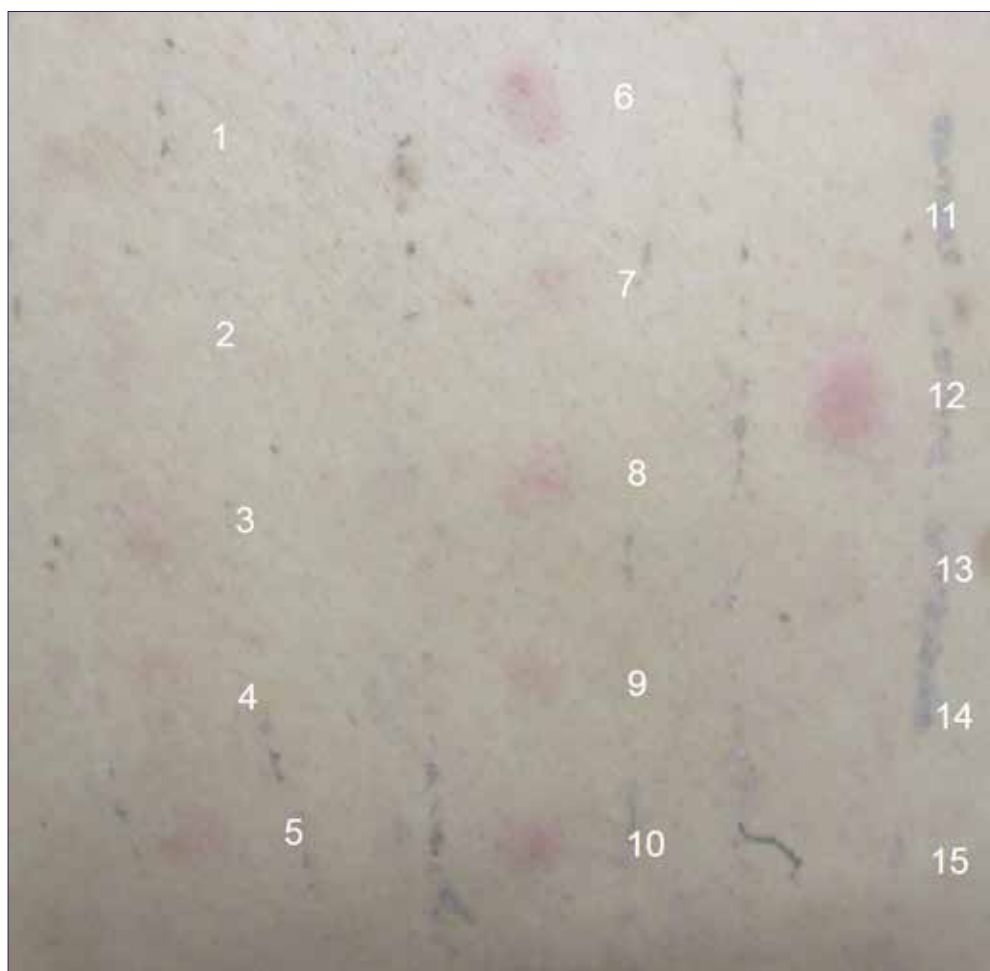


Figure 3: Patch-test results using pieces of safety shoes.

Safety boot: 1 polyurethane tongue; 2 boot leather; 3 blue inner sole; 4 tongue mesh; 5 yellow inner sole; 10 grey inner sole

Safety shoe: 6 mesh (±); 7 leather tongue; 8 white inner sole; 9 grey inner sole; 11 Empty

Fuel safety boot: 12 red mesh (+); 13 leather tongue; 14 red inner sole; 15 black inner sole

(11.7%), a fungicide and rubber additive found in rubber adhesives.⁵

Landeck et al found that among 2 671 foot-dermatitis patients, potassium dichromate, PTBFR, colophony, mercapto mix and mercaptobenzothiazole were significantly associated with foot dermatitis when compared to other body sites.⁸ Nardelli et al, who patch-tested 1 168 Belgium patients with foot dermatitis, reported that of the 474 (5.5% of the total group) who had at least one positive reaction, potassium dichromate, cobalt chloride, p-phenylenediamine and rubber components were the most common shoe allergens.¹⁰

Landeck et al caution that significant variations in top-ranking shoe allergens should be expected as a consequence of distinct local shoe styles and customs, differing concentrations of chemicals and additives used in the production of shoes and polishes, including distinct environmental and weather patterns.⁸ For example, in Africa, India and Europe, potassium dichromate predominates,^{10,23,26–27} whereas rubber additives and adhesives appear to predominate in North America and Pakistan.^{5,28} Chowduri and Ghosh argue that potassium dichromate allergy predominates in India due to the infrequent use of chrome-free leather because it is unavailable and expensive, whereas in Western countries rubber chemicals are more widely used and these countries are also moving towards using chrome-free leather.²³

TABLE III: COMMON AGENTS CAUSING FOOT AND SHOE-CONTACT DERMATITIS^{5,7,15,23}

AGENT	ALLERGENS
Leather chemicals	*Potassium dichromate *Formaldehyde *Glutaraldehyde
Rubber chemicals	*2-Mercaptobenzothiazole *Mercapto mix *Thiuram mix *Carba mix *Black rubber mix Dibutylthiourea Diphenylguanidine N-Cyclohexyl-2-benzothiazyl sulfenamide
Plastics	Hydroquinone monobenzylether Diocetyl phthalate
Dyes	*4-Phenyldiamine base 4-Aminobenzene
Adhesives	*Para-tertiary butylphenol *Epoxy resins *Colophony *Balsam of Peru Dodecyl mercaptan
Metals	*Nickel sulphate *Cobalt chloride
Textiles and fabrics	Socks and stockings
Topical medications	*Neomycin Monobenzylether of hydroquinone
Other accessories	Shoe polishes

* Shoe allergens in the standard commercial patch-test series

CLINICAL APPROACH TO SHOE-ALLERGIC DERMATITIS AND THE EXCLUSION OF COMMON FOOT CONDITIONS

The diagnosis of shoe-allergic dermatitis is based on a history, the presence of suggestive skin lesions on examination and positive patch-test results, indicating sensitisation to one or more shoe allergens.

PATIENT HISTORY

A detailed history should be taken regarding the symptoms and duration of the dermatitis. Symptoms frequently include mild-to-severe itch together with redness and pain. As a delayed hypersensitivity reaction, shoe-allergic dermatitis can start within hours to as late as a week after exposure.²¹ It is important to enquire about the type of shoes used (rubber, plastic, leather), the frequency and duration of use, and whether the onset of symptoms can be linked to a particular pair of shoes; this is because a temporal relationship would suggest shoe allergy and help to exclude other forms of dermatosis due to perhaps socks or topical medications.^{7,14,21} Remission from or relief of symptoms upon removal of the shoes and exacerbation when shoes are used or during certain seasons where the weather is hot, humid or wet is also suggestive; however, this could also be due to an irritant contact dermatitis or tinea pedis.²¹

A personal and family background of atopy and other medical conditions such as hyperhidrosis and chronic venous insufficiency should be explored.²¹ Atopic individuals have been found to have increased susceptibility to developing shoe-contact dermatitis while excessive perspiration in hyperhidrosis may increase the leaching out of shoe chemicals and subsequent sensitisation. Rasool and Sehgal found that in a cohort of 108 outpatients with shoe dermatitis, 31% had a personal and/or family history of atopy whereas the remaining 69% had no history of atopy.⁷

A social and occupational history on the type of work done and the use of occlusive protective footwear, exposure to water and chemicals at work and in the household and participation in hobbies such as fishing could provide a clue to the aetiology of the foot dermatitis. It may be helpful to enquire about toiletries used and the use of topical medication, as these have also been found to cause sensitisation (eg neomycin on patch test).^{5,7}

PHYSICAL AND SKIN EXAMINATION

A meticulous physical examination will often reveal characteristic shoe-allergy morphology, namely, eczema, which includes erythema, vesico-papules and blisters of varying sizes, weeping, crusting and peeling at the site of contact. Left untreated, spread to adjacent areas, superadded infection, and features of chronicity including dry leathery skin with increased skin markings, hyperkeratosis, scale and altered pigmentation may develop. Shoe-allergic dermatitis is mostly bilateral and symmetrical, with a pattern that corresponds to the design of the footwear.²¹ The dorsal aspect of the foot is the most commonly affected, usually starting with involvement of the big toe and extending to the rest of the foot.

An Indonesian prevalence study found the dorsum was affected in 47.6% of the patients.¹³ A hallmark finding is the relative sparing of areas not in contact with the shoe, including the sparing of

the interdigital spaces and instep.^{14,21,24} The involvement of other areas of the body should be examined, because ACD of the feet may also involve the hands, and *vice versa*.²⁹ Feet and hands may be exposed to the same allergy-causing agent such as leather chemicals in shoes and gloves or may be due to an infective process, as in the case presented where a fungal infection of the feet led to an id reaction (or autoeczematization, a generalised acute cutaneous reaction to a variety of stimuli, including infectious and inflammatory skin) involving the hands.^{14,29} A similar id reaction can occur with contact dermatitis affecting the feet. Shackelford and Belsito – in a five-year, retrospective, cross-sectional study – found that of the 70 patients with foot dermatitis at an American tertiary outpatient clinic, 29% had dermatitis confined to the foot whereas 71% had foot dermatitis plus the involvement of other areas (foot and hands at 40%).⁹

THE VALUE OF PATCH-TESTING

Patch-testing is ideal for testing for type-IV hypersensitivity reactions and is regarded worldwide as the gold standard for diagnosing and managing contact dermatitis. Freeman notes that the diagnosis of shoe allergy is often difficult to make without patch-testing, especially when superimposed endogenous foot dermatitis is present.¹⁴ Disease-free skin should be used for patch-testing if the offending allergen is to be identified.¹⁴

Chemicals from a commercial battery of common allergens should be tested and expanded to include a shoe series. Thin samples (1–2 cm²) taken from various parts of the patient's shoes are placed in patch-test chambers under 2 mm-thick filter paper discs moistened with saline. This has been found to reduce false negative results.³⁰ The filled chambers are applied to the skin and kept under occlusion for 48 hours. Reactions are read at 48, 72 and 96 hours after application. Less common is the extraction of chemicals from shoe materials using methods which include ultrasonic baths that enable the testing when a chemical is suspected but patch-testing is negative.²⁰ Common shoe allergens are listed in Table III.

DIFFERENTIAL DIAGNOSIS

Despite a thorough history and examination, shoe allergy can be difficult to diagnose clinically.¹⁴ Consequently, other foot dermatoses should be considered, including fungal infections (tinea pedis), atopic dermatitis, psoriasis, dyshidrotic eczema, nummular eczema and juvenile plantar dermatitis.^{9,31} Irritant dermatitis should also be considered, especially because of the occlusion, heat and friction that are associated with shoes. Shackelford and Belsito – in a five-year, retrospective, cross-sectional study – found that only 33% of their patients with foot dermatitis had ACD after patch-testing, whereas 43% had psoriasis.⁹ Additional investigations, such as a skin scraping for fungal identification or skin biopsy, may be warranted.²¹

TREATMENT

Once it has been diagnosed, shoe-allergic dermatitis should be treated similarly to the treatment of contact dermatitis involving other parts of the body (see Table IV).^{11,12}

Although these topical and systemic treatment options may be useful in the control of the eczema, the patient should be empowered to avoid using shoes, socks, toiletries or medicaments that contain the offending allergen, once identified. However, avoidance may be a challenge, particularly where no definitive cause has been identified.^{11,12} Important adjunct control measures include the avoidance of products with unnecessary excipients; these include perfume, fragrances, preservatives and dyes.²¹

PREVENTION

The cardinal preventive measure for shoe-allergic dermatitis involves the use of products with little to no potential allergen exposure, such as chrome-free leather shoes, or the replacement of the normal leather shoes every few months in order to prevent chromium leaching out from the shoe onto the skin.²⁰ The patient should be provided with information on the various shoes available made with substitute material that do not cause allergic reactions. Matthys et al compiled a list of available products for shoe-allergic contact dermatitis that may be a useful resource for practitioners; this is summarised in Table II.²⁰ In the occupational

TABLE IV: TREATMENTS FOR VARIOUS FOOT DERMATOSES

PRESENTATION	TREATMENT
Acutely weeping lesions	The use of moist compresses, followed by air drying, has been found to be beneficial in reducing the drainage. ^{21,24}
Inflammation and itch	Can be reduced through the application of emollients and topical corticosteroids in an appropriate delivery vehicle ²¹ – the vehicle plays a vital role in the topical corticosteroid absorption and can improve its efficacy. ³²
Acute, wet dermatitis and hairy skin areas	Water-based lotions are ideal.
Moist or weeping lesions	Creams are appropriate.
Dry, scaly lesions that may also be thick and fissured	Ointments.
Hairy areas	Gels are most effective. ²⁴
Chronic lichenified dermatitis	Most effectively managed with regular steroid-containing ointments. ^{21,24,32}
Pruritis	Oral antihistamines may be effective. ²⁴
Secondary bacterial infection, the most common being β -haemolytic streptococci (group A, B, C, F and G), <i>Staphylococcus aureus</i> , <i>Streptococcus pneumoniae</i> and gram-negative bacilli, especially those of the <i>Pseudomonas</i> species ³¹	Systematic antibiotics may be indicated. ³¹

setting, personal protective equipment must be chosen in relation to the task and the potential hazards. No single shoe meets all the requirements, and different shoes may be needed for different tasks. Damaged, ill-fitting or tight shoes and those that are re-dyed should be avoided. Excessive perspiration can be controlled through regularly (two to three times a day) changing cotton socks, taking breaks to air-dry the feet and using antihydrotics such as aluminium chloride hexahydrate to control foot perspiration.^{21,24} A recent innovation in textile engineering has led to the development of a technological fabric, Microair®. Socks made from this three-layered fabric are designed as a barrier to prevent skin contact with shoe allergens and irritants but to provide good perspirability.¹¹ An improvement in quality of life (QoL) and a reduction in pain and itch in patients who tested these barrier socks was noted.¹¹

CONCLUSION

Sanitation workers are exposed to a variety of hazards that require them to use personal protective clothing, including safety shoes, for prolonged periods. This case illustrates the role an occlusive shoe environment plays in promoting fungal growth and the leaching of shoe chemicals onto macerated skin,

resulting in sensitisation. A definitive diagnosis of shoe-allergic dermatitis remains difficult in the absence of patch-testing, especially when there are other underlying skin diseases. The gentleman's initial suboptimal response to treatment was most likely due to undiagnosed shoe dermatitis being treated as a fungal infection only, without other causes such as shoe-allergic dermatitis, being considered. Other foot-skin diseases should also be considered, including fungal infections and psoriasis. The mainstay of management involves using products with little to no shoe-allergen exposure and addressing the risk factors specific to each patient.

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DECLARATION OF CONFLICT OF INTEREST

The author declares no conflict of interest.

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