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Original Research Article

Role of footwear allergens in juvenile plantar dermatosis

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ABSTRACT

Background: Juvenile plantar dermatosis (JPD) is characterized by shiny dry fissured dermatitis of the plantar surface of the foot, affecting children aged 3-14years. The most accepted theory is that JPD is a frictional contact dermatitis of the forefoot in which atopics are more prone to develop. Allergic contact dermatitis remains a close differential diagnosis; it can aggravate the predisposing JPD. In this background we carried out a study among children aged fourteen years and below with clinically diagnosed JPD to know the age and sex profile, aggravating factors and clinical features in this part of the country.
Methods: All children aged 14 years and below with JPD attending our outpatient department from November 2006 to November 2007 were included in this study. Using a preset proforma, data regarding age and sex, information on any relation to footwear, past history of allergic disorders in person or family members was collected. All the 40 patients were patch tested using the footwear allergen series in petrolatum base. Patch test unit was removed after 48hours and the results were interpreted using criteria laid down by International Contact Dermatitis Group (ICDRG). The data was analyzed and made an attempt to understand the role of footwear allergy in JPD.
Results: 22 girls and 18 boys attended our OPD with JPD between the age group of 4-14 years. 52.5% were using footwear made of plastic; 25%used leather; 12.5% rubber footwear. Patients presented with erythema and glazed appearance of foot along with fissuring. The areas of involvement were distal soles and toes in 70%, distal sole alone in 7.5% and distal sole and dorsum of toes in 22.5% of patients. Personal history of atopy was documented in 15% of patients and family history of atopy was present in 20% of cases. 20% of patients complained of exacerbation with footwear. Of the 40 patients who underwent patch testing, 10% only showed positive patch test reaction mainly to potassium dichromate (5%).
Conclusions: JPD is not an uncommon disease and it predominantly affects school going children. Seasonal variation was associated with aggravation of disease. Specific footwear was identified to cause flare ups in a significant percentage of study population (20%) and this was proven by patch test results in half of them. Though nearly one fifth of the affected had an atopic diathesis in person or family, the present data suggests that JPD is not exclusive to atopics. A large sized study is required to evaluate the role of footwear in JPD.

Keywords: Juvenile plantar dermatosis, Patch testing, Allergens

INTRODUCTION

Juvenile plantar dermatosis is characterized by shiny dry fissured dermatitis of plantar surface of the forefoot that mainly affects children aged 3–14 years. [1]

Atopic winter feet, dermatitis plantaris sicca, peridigital dermatitis in children, sweaty sock dermatitis are some of the synonyms used to describe this entity. [2, 3]

Though several theories are proposed, the exact etiology of juvenile plantar dermatoses remains unclear to this

date. Atopy, frictional factors [mechanical trauma, occlusive foot wear (shoes and socks)] and frequent alteration between a hot and wet climate and dry climate are the suggested factors that favour this dermatosis.[4] Other factors implicated in disease causation are bacterial colonization and use of man-made leather substitutes and fibers.[2] One of the most accepted theories is that JPD is a frictional contact dermatitis of the forefoot to which atopics are prone; but scientific data indicates that it can also occur in non-atopics.[5]

Allergic contact dermatitis remains a close differential diagnosis; moreover it can aggravate the preexisting JPD.[2] In this background, we carried out a study among children aged 14 years and below attending our institution with clinically diagnosed juvenile plantar dermatosis to study the age and sex profile, aggravating factors and clinical features of the disease in these parts of the country and to identify any association with the foot wear used.

METHODS

After obtaining clearance from the institutional ethics committee and written informed consent from the guardian of the individual study subject, all children aged 14 years and below with clinically diagnosed juvenile plantar dermatosis attending the outpatient department of our tertiary care institution from November 2006 to November 2007 were included in this study.

All patients were examined in detail. Using a preset proforma, data regarding age and sex, information on any relation to footwear or other exacerbating factors, past history of allergic disorders in person or family members with special reference to atopy and were collected.

Detailed dermatological examination and the pattern of dermatological disorder were recorded and representative lesions were photographed.

KOH smear was done in all cases. All the 40 patients were patch tested using the footwear allergen series in petrolatum base (Aluminum Finn chamber method), keeping petrolatum as the control.

The patch test unit consisted of antigens of footwear series (Table 1).

Table 1: Foot wear antigens used for patch testing in the study.

Serial No	Material containing allergen	Allergen used for patch testing
1	Leather	Potassium dichromate (0.5%) pet Formaldehyde (1%) aq Glutaraldehyde (0.2%)pet
2	Rubber	Thiuram mix (1%) pet Black rubber mix (0.6%) pet Mercaptobenzathiazole (2%) pet
3	Plastics	Hydroquinone monobenzyl ether (1%) pet Dioctyl phthalate (5%) pet Epoxy resin (1%) pet
4	Dyes	Disperse orange 3 (1%) pet Disperse blue 124 (1%) pet
5	Glues	Colophony (20%) pet
6	Antimicrobials	Neomycin sulphate (20%) pet Kathon C G (0.2%) aq
7	Others	Nickel sulphate (5%) pet

Microporous tape and aluminium patch test chamber with 9 mm internal diameter and depth of 0.7 mm were used. Aluminium patch test chambers were placed facing up with 2 cm distance from centre of each other.

After getting informed consent the patch test unit was applied over the upper back of the trunk. The test unit was kept in place for 48 hours. During this period patients were instructed to avoid bath, exercise and excessive sweating, and to report after 48 hours for patch test reading. Patch test unit was removed after 48 hours and the area was kept open for 30-45 minutes to avoid pressure effects.

Results were interpreted using criteria laid down by international contact dermatitis research group (ICDRG).[6] The reading was repeated at 72 and 96 hours.

The data was analyzed to study the demography of the affected individuals and to identify any exacerbating factors for the disease. We also made an attempt to understand the role of foot wear allergens in contributing to JPD.

RESULTS

During the one year study period, 40 patients, aged between 4-14 years attended our OPD with juvenile

plantar dermatosis. Twenty two were females and there were eighteen boys.

The age group of the affected varied between four to fourteen years with majority (18 patients, 45%) in the 7-9 year age group (Table 1).

The youngest and the oldest patients were 4 years and 14 years respectively.

Commonly used footwear by study subjects were made of plastic, leather and rubber. Four patients used footwear made of other material (Figure 1).

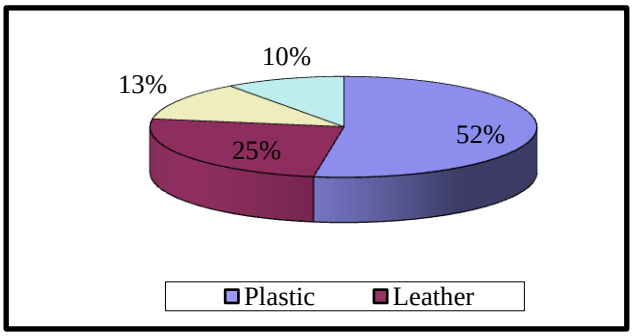

Figure 1: Foot wear used by study population.

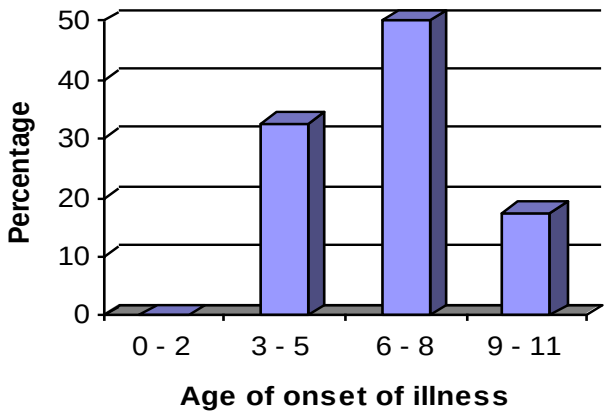

Figure 2: Age of onset of juvenile plantar dermatosis in the study group

The dermatosis manifested as early as 2 ½ years and as late as 12 years in the study population (Figure 2). Area of the sole affected varied in the study group (Table 3). Patients presented with erythema and glazed appearance of the forefoot along with fissuring of these areas.

Table 2: Age distribution of study group.

Age (in years)	Number of patients	Percentage
4-6	4	10
7-9	18	45
10-12	10	25
13 – 15	8	20
Total	50	100

Table 3: Area of sole affected in the study population.

Area of sole affected	Number of patients	Percentage
Distal part of sole and toes	28	70
Distal part of sole and dorsum of toes	9	22.5
Distal part of soles alone	3	7.5

Disease duration ranged from 0-6 years in the study group (Table 4). Five patients (12.5%) had history of similar illness in family members.

Table 4: Disease duration of juvenile plantar dermatosis in the study group.

Duration (years)	Number of patients	Percentage of patients
0-2	15	37.5
2-4	22	55
4-6	1	2.5
>6	2	5
Total	40	100

Personal history of atopy was documented in six patients (15%) as shown in Table 5. Family history of atopy was present in eight (20%) cases.

Table 5: Personal history of atopy in the study population

Atopic diathesis	Number	Percentage
Nil	**24**	**85**
Bronchial asthma	**3**	**7.5**
Allergic rhinitis	**2**	**5**
Combined	**1**	**2.5**
Total	**40**	**100**

Eight patients (20%) complained of exacerbation following contact with specific footwear and seasonal exacerbation was documented in 20 patients (50%). No exacerbating factors were noticed by 30% patients (Table 6).

Pruritus was the most common symptom (28 patients, 70%). Pain was complained by 55% (22 patients) of the affected. Common clinical features were dry and glazed appearance of sole (100%) and fissuring of feet (80%).

Of the 40 patient, who underwent patch testing, two patients (5%) showed positive reactions to potassium dichromate and one each (2.5% each) to thiuram mix and colophony respectively. No reaction was noted in 90% of the patients (Table 7). Delayed patch test reading was obtained in one case of potassium dichromate allergy. None of the study subjects showed any irritant reaction or angry back syndrome. Only one of the six atopics

(16.7%) as in Table 7 showed positivity on patch testing which was to potassium dichromate.

Table 6: Exacerbating factors observed in the study population.

Exacerbating factors		No. of patients	Total
Exacerbation following use of specific footwear	Leather footwear	1 (2.5%)	8 (20%)
	Plastic footwear	4 (10%)	
	Rubber footwear	3 (7.5%)	
Seasonal exacerbation	Exacerbation in summer	1 (2.5%)	20 (50%)
	Exacerbation in winter	7 (17.5%)	
	Exacerbation in rainy season	12 (30%)	
No exacerbating factors		12 (30%)	12 (30%)
Total		40 (100%)	40 (100)

Table 7: Patch test result in the study group.

Patch test result	No. of patients (% in brackets)		Total no. of patients (% in brackets)
	Negative	positive	
Atopics	5 (83.3%)	1 (16.7%)	6 (15%)
Non atopics	31 (91.2%)	3 (8.8%)	34 (85%)
Total	36 (90%)	4 (10%)	40 (100%)

DISCUSSION

The slight female predominance (1.2:1) for JPD observed by us was consistent with previous studies, but a male predilection was reported by Kumar et al.[7, 8]

The most common age group affected in our study (7-9 years) was comparable to existing data.[9]

In an earlier study, the plantar surface of toes and anterior third of the sole were the sites most commonly involved which showed concordance with our study, but we noted a greater percentage of our study group manifesting lesions dorsal aspect of toes and feet.[9] A similar observation is documented by Kumar et al.[8]

In 55% of the patients, duration of illness was between 3-4 years in our study, which was longer than the duration of the same in one study, but was comparable to the findings in another.[8,10]

In our study 2.5% of patients reported summer exacerbation, 30% had exacerbation during rainy season and 17.5% during winter season which was somewhat consistent with the observations of Brar et al, who reported that 45.2% of their study group had deterioration of clinical symptoms during rainy or winter season and relative improvement during the summer.[8,9] But some other studies reported summer aggravation with improvement in cooler months.[11]

Similar to other studies we too noted pruritus to be the main symptom among our patients (70% in our study and 61.9% in previous study).[8,9] The common clinical features noted by us were also consistent with existing literature.[8]

Literature report that the use of leather, plastic or rubber footwear, contact with detergents and prolonged contact with water as aggravating factors.[8,9] We noted foot wear as an aggravator in one fifth of the study group.

Our finding of personal history and family history of atopy in 15% and 20% of the affected respectively underscores the fact that juvenile plantar dermatosis is a frictional contact dermatitis of the forefoot to which atopics are prone, but which can occur in non atopics as well.[5,8,12] This was contrary to the findings of certain other studies that documented that 50% - 90% of those with JPD had an atopic background.[13,14]

Patch testing to identify foot wear allergen was not rewarding according to some of the previous studies.[13, 16] In the study by Kumar et al the allergens identified (in patch testing) to aggravate JPD were nickel and gentamicin.[8] But Brar et al, carrying out patch testing with Indian Standard series identified nickel sensitivity in 15.7% and sensitivity to gentamicin and framycetin in 10% each.[9] A similar observation was made by us also, though the identified allergens were potassium dichromate, colophony, and thiuram mix. Previous authors including Choudhary et al found potassium dichromate to be the commonest allergen which was identical to our observation.[16-18] It was noted in one study that when lesions were localized to soles, rubber additives, chiefly mercaptobenzathiazole was predominant allergen.[19] There was no statistically significant association between atopy and positive patch test reaction in this study [p =0.751] which was in concordance with other studies.[1,9]

CONCLUSION

Juvenile plantar dermatosis is not an uncommon disease and it predominantly affects school going children. A seasonal variation was noted to aggravate the dermatosis in the present study. Though nearly one fifth of the affected had an atopic diathesis in person or in family, the present data suggest that juvenile plantar dermatosis is not exclusive to atopics. Specific foot wears were identified to aggravate the disease in a significant percentage of the study population (20%) and this was proven by positive patch test report in half of them. Our

observation of potassium dichromate as the most common foot wears allergen in patients with juvenile plantar dermatosis indicates the need for more studies with large sample size to evaluate the role of foot wear in precipitating and perpetuating this disease.

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