Juvenile Plantar Dermatosis

A Clinicopathologic Study

Richard E. Ashton, MRCP; Robin Russell Jones, MRCP; Andrew Griffiths, MD, MRCP

- Fifty-six patients had juvenile plantar dermatosis (JPD). The plantar surface of the toes and the anterior third of the sole were the sites most commonly affected. Less commonly affected were the dorsal surface of the toes and the fingertips. No seasonal variation was found, and treatment was generally ineffective. Preventative measures had no influence on the course of the condition. Histopathologic features included psoriasiform acanthosis, with focal loss of granular cell layer, and uniform parakeratosis. Distinctive features included a tendency for the dermal infiltrate to localize around sweat ducts at their point of entry into the epidermis. In addition, inflammatory changes within the epidermis were localized mainly to the acrosyringium and included paranuclear vacuolization of epidermal keratinocytes, spongiosis, and slight spongiotic vesication. These changes are similar to those described in other eczematous conditions, and there is little evidence to suggest that disordered sweating plays a primary role in the pathogenesis of JPD.

(Arch Dermatol 1985;121:225-228)

During the past decade, a distinctive dermatosis of children's feet has been recognized. It was first described in 1972 by Enta in Canada and by Möller in Europe. Various names have been given to this condition: peridigital dermatitis in children, atopic winter feet, and recurrent juvenile eczema of hands and feet. However, the name given it by Mackie and Husain of juvenile plantar dermatosis (JPD) has become generally accepted in Europe. Most previous investigators identified the condition during referral for patch testing, as the pattern of the dermatitis suggested a contact allergic dermatitis. In fact, most cases prove to be patch test negative. We report our findings in a study of the epidemiology of a series of 56 patients referred specifically to St John's Hospital, London. Our studies included examination of biopsy specimens from six patients to clarify the histologic changes found in JPD.

SUBJECTS AND METHODS
Clinical Survey

The 56 patients included 32 boys and 24 girls. They ranged in age from 4 to 15 years (mean, 9.6 years). Patients were identified by the following clinical features: a symmetrical, smooth, red, glazed appearance on the soles of the feet, with fissuring, loss of the epidermal ridge pattern, and fine scaling that could be removed in sheets to leave a thin, erythematous base (Fig 1). The sites of involvement were as follows:

<table>
<thead>
<tr>
<th>Site</th>
<th>No. (%) of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball of big toe</td>
<td>52 (93)</td>
</tr>
<tr>
<td>Ball of foot</td>
<td>43 (77)</td>
</tr>
<tr>
<td>Flexure underside of toes</td>
<td>28 (50)</td>
</tr>
<tr>
<td>Heel</td>
<td>13 (23)</td>
</tr>
<tr>
<td>Instep</td>
<td>4 (7)</td>
</tr>
<tr>
<td>Dorsum of toes and foot</td>
<td>11 (20)</td>
</tr>
<tr>
<td>Fingertips</td>
<td>3 (5)</td>
</tr>
<tr>
<td>Other sites of eczema</td>
<td>9 (16)</td>
</tr>
</tbody>
</table>

The tabulation shows that the plantar aspect of the toe and ball of the foot were involved in most cases. Unlike tinea, the toe clefts were never involved, but we did find that in half of the cases the flexural undersurface of the toes showed peeling and sometimes fissures. The heel was involved in only 25%. Other areas of the foot were affected less often and lacked the specific features of JPD. The instep was involved rarely, but 20% did show eczema on the dorsum of the toes. Fingertip changes were seen in 5% of the cases and were similar to those found on the toes, with peeling and loss of the epidermal ridge pattern.
Finally, 16% showed evidence of eczema elsewhere, usually on the face or flexures. The average age at onset was 5.6 years. The first symptoms noted by parents or children were as follows:

<table>
<thead>
<tr>
<th>Symptom</th>
<th>No. (%) of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peeling</td>
<td>32 (57)</td>
</tr>
<tr>
<td>Fissuring</td>
<td>15 (27)</td>
</tr>
<tr>
<td>Pruritus</td>
<td>7 (12)</td>
</tr>
<tr>
<td>Erythema</td>
<td>2 (4)</td>
</tr>
</tbody>
</table>

The site of initial involvement was usually the ball of the big toe (31 patients [55%]), but 14 (25%) noticed initial involvement on the ball of the foot. Nine (16%) first noticed peeling under the flexor aspect of the toes, and one patient (2%) noticed involvement of the dorsum of the toes.

There was no marked seasonal variation of the condition found in our survey. Under half (43%) believed that it was worse in summer, but 33% expressed no preference for any time of year. A few (16%) found the condition worse in winter.

Many treatments (Table) had been tried prior to the children’s appearance in our clinic. Potent steroid creams had been used by 44, of whom two thirds believed that there was no improvement. These steroids were used on a twice-daily basis without the use of occlusion. Fewer had used emollients and half found them helpful. Only seven patients had used tar products, four of these finding them of benefit. The conventional advice of changing to shoes with leather uppers and cotton socks had not proved helpful.

**Histopathologic Study**

Elliptical biopsy specimens from the plantar surface of the great toe were obtained in six patients. In each case, 30 vertical serial sections were prepared for histopathologic examination; 15 were stained with hematoxylin-eosin and 15 were stained with PAS reagent. The following features were recorded: the density and location of the dermal infiltrate, exocytosis, the type of acanthosis, the presence...
or absence of a granular cell layer, and the extent of parakeratosis. Inflammatory changes localized to the acrosyringium were recorded separately from those involving other areas of the epidermis. The presence of vacuolized keratinocytes, spongiosis, and spongiotic vesiculation were recorded in each case.

In all cases, a sparse, predominantly mononuclear cell infiltrate was present in the upper dermis. Localization around the intradermal portion of the sweat duct below the level of the epidermis was seen in two cases (Fig 2). In most cases, the infiltrate was centered on the sweat duct at or just below its point of entry into the epidermis (Fig 3). Epidermal changes included acanthosis, which was irregular in two cases, and psoriasiform in four cases (Fig 4). Most cases showed granular cell changes, with focal loss in four and total absence in one case. There was an inverse relationship between the degree of parakeratosis and the presence of the granular cell layer. In one case, which showed an intact granular cell layer, parakeratosis was separated from the granular cell layer by a layer of orthokeratosis.

Inflammatory changes within the epidermis were localized mainly to the acrosyringium. Most cases showed paranuclear vacuolization of keratinocytes, spongiosis, and a sparse mononuclear cell infiltrate (Fig 3). Spongiotic vesiculation was seen only rarely and was limited in extent (Fig 5). Areas between the sweat ducts showed paranuclear vacuolization, but spongiosis if present was minimal (Fig 6).

Multiple serial sections stained with PAS were used to identify sweat ducts within the stratum corneum. No evidence of dilation or blockage with PAS-positive material could be demonstrated.

**COMMENT**

Juvenile plantar dermatosis is a condition primarily affecting prepubertal children, and there does seem to be a slight male preponderance in most other series. The condition usually starts and is most intense over the ball of the great toe, spreading posteriorly to involve the ball of the foot and occasionally the heel. Some investigators have stated that it was restricted to the soles. Others have reported dorsal involvement, and we observed this feature in one fifth of our cases. However, the series reported by Silvers and Glickman had primary involvement of the dorsal aspect of the toes in 12 of 15. Their findings suggest that most of their patients may not have had JPD. Fingertip involvement has also been recognized by others, in four of 23 by
Neering and van Dijk, nine of 52 by Enta, and in all 21 by Schultz and Zachariae. The presence of hand involvement and the presence of changes at nonfrictional sites argues against a causal role for footwear in the etiology of this condition.

Juvenile plantar dermatosis is a chronic condition. The duration of the condition on average ranges from 2½ years to our figure of 4½ years. Although a few patients reported slight worsening in the summer, there was no marked seasonal pattern in our study. Other British investigators have confirmed this characteristic, but those in Europe believe that the condition is worsened by cold weather.

Treatment is unrewarding. The conventional advice to change from nylon to cotton socks and to wear shoes with leather uppers is rarely successful. Emollients, steroid creams, or tar products may be beneficial initially, but probably have no effect on outcome. Emollients are likely to be as beneficial as anti-inflammatory agents in the long-term management of this disorder.

The number of histologic reports is few. Stewart reported sweat duct occlusion and subsequent sweat retention. Shrank demonstrated mild acanthosis, little or no parakeratosis or dermal infiltrate, but definite evidence of focal spongiosis around the sweat duct as it crosses the malpighian layer. He also reported narrowing of the acrosyringium and blockage by PAS-positive material in the stratum corneum and suggested that disordered sweating was of primary importance in the pathogenesis of this condition. Although we agree with some of his findings, we are less confident about his interpretation. There was certainly a predilection for the dermal infiltrate to be centered on sweat ducts, especially at their point of entry into the epidermis. In addition, the inflammatory changes within the epidermis tended to be centered on the acrosyringium, and this feature raises the question whether JPD represents a localized form of miliaria rubra. However, this possibility seems unlikely for several reasons. First, there is no clinical resemblance between the two conditions either in the morphologic features of individual lesions or in their distribution. Second, no evidence of sweat duct occlusion by PAS-positive material was seen despite cutting serial sections in all cases. Third, measures to facilitate sweat dispersal, such as changing to leather shoes and cotton socks, were generally ineffective. In conclusion, the hypothesis that JPD results from sweat duct occlusion seems most unlikely.

At the same time, the changes around the sweat duct need some explanation. Essentially they are similar to those described in other types of eczematous disorders, where they have been classified into three types on the basis of electron microscopic observations: (1) vacuolization of individual keratinocytes, which is associated with a paranuclear vacuole lying between the nucleus and the tonofilaments; (2) spongiosis, which is associated with edema located mainly at the cell periphery and lying between the tonofilaments and the cell membrane; and (3) spongiotic vacuolization, which is associated with cell membrane rupture and expansion of the extracellular space.

These three features were identified by light microscopy in patients with JPD, which justifies its classification as an eczematous process. The pattern differs from dyshidrotic eczema in that the latter specifically spares the acrosyringium. Obviously one cannot claim that the sweat duct is not of importance in localizing inflammatory changes in this condition, but this localization may reflect the distribution of the vascular supply of cutaneous appendages in this area of the skin rather than any pathologic process primarily involving the sweat duct itself.

References