Piezogenic pedal papules are skin-colored lesions on the heels caused by herniation of fat through the connective stroma. They are induced by weight bearing or pressure to the soles. We report a case of a 51-year-old female who had multiple painful skin-colored papules on the medial and lateral aspects of the left heel when applying force on it. Microscopically, the collagen bundles of the trabeculae around the fat lobules were looser than normal. Verhoeff-Van Gieson stain revealed a remarkable decrease in the elastic fibers in the reticular dermis. The pathologic picture was similar to that of anetoderma. Few articles referred to the absence of elastic tissue in the connective tissue trabeculae rather than in the reticular dermis in our case. We herein report a case of piezogenic pedal papules and discuss the clinical, histopathologic change, and related etiologies. (Dermatol Sinica 23: 217-221, 2005)

Key words: Piezogenic pedal papules, Anetoderma, Elastic fiber, Collagen fiber

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INTRODUCTION

In 1968, Shelley and Rawnsley first described a 20-year-old student with painful papules appearing on the medial ankle above the heel when weight was placed on the foot. They speculated that the papules were caused by herniation of fat through connective tissue defects. Because the papules appeared only when weight was placed on the foot, they choose the term “piezogenic” to describe them (piezo, meaning pressure; and genic, meaning give rise to). Piezogenic pedal papules are common but rarely symptomatic.

We report a case of piezogenic pedal papules and postulate a new explanation of the etiology according to our histopathologic findings. We also introduce the use of foot pressure measurements to evaluate weight distribution in patients with piezogenic pedal papules.

CASE REPORT

A 51-year-old female had noted left heel pain for 2 months, occurring after prolonged standing or walking. She consulted rehabilitation and orthopedic doctors, but the problem remained. She then speculated that the pain might be related to papules she had had on the left heel for more than 5 years. For this reason, she came to our clinic. We found multiple round skin-colored papules, 3 to 10 mm in diameter, on both the medial and lateral surfaces of the left heel. The papules were present only when the patient was standing or force was applied to the sole of the foot (Fig. 1A-1C). The largest papule was incised for pathologic examination (Fig. 1C).

Microscopically, the epidermis and upper dermis were relatively normal. In the deep dermis down to its junction with the subcutis, the collagen bundles were thinner than normal with loose spaces between the bundles. There were focal areas where the stroma appeared myxoid. The amount of neurovascular tissue was slightly increased in the deep dermis (Fig. 2). However, the elastic fibers were decreased in number in the upper and middle reticular dermis on Verhoeff-van Gieson and orcein stains (Fig. 3). The findings were consistent with both piezogenic pedal papules and anetoderma. Because of the association with weight-bearing, the diagnosis of piezogenic pedal papules including features of anetoderma was made.

Further information was obtained on the patient’s second visit to our clinic. Her work

Fig. 1
(A) Skin-colored round papules on left heel when standing. (B) These papules disappeared when there was no exogenous force on the same left heel. (C) Closer view of these papules. The largest papule (arrow) was excised for pathologic examination. (D) Papules on both her wrists when applying force against them.

Fig. 2
Relatively normal epidermis and upper dermis without inflammatory cells. The connective tissue stroma is loose in deep dermis and subcutis. The collagen bundles adjacent to fat lobule are thinner with loose interbundle spaces and appear myxoid in focal areas (H & E, 40X).
required her to stand a long period of time. She was 160 centimeters tall and weighed 73 kilograms, and thus was overweight (BMI = 28). She had engorged varicose veins in both lower leg but no evidence of abnormalities of venous return on plethysmograpgy. When force was applied to her palms, she was found to have papules on both wrists similar to those on her foot (Fig. 1D). These papules were asymptomatic. One of her children also had painless piezogenic pedal papules on the medial side of the right heel. There was no evidence of Ehlers-Danlos syndrome in the patient or her family.

Because of the piezogenic characteristic of the skin lesions, we measured the patient’s foot pressure with a Mingscan foot pressure measurement system (Vers technological company, Taiwan). This revealed an unbalanced weight distribution (Fig. 4A), with greater weight loaded on the left heel. We also calculated her arch index (AI), defined as the ratio of the area of the middle third of the footprint to the entire footprint area excluding the toes. The patient’s AI on the right was 0.35 and on the left 0.4 (Fig. 4B), she was flat footed (an AI greater than 0.26 suggests a flat arch). She was advised to wear shoes that redistributed her weight to the anterior part of her feet. Her symptoms were much improved when she visited our clinic one month after she started wearing suitable air cushion shoes.

DISCUSSION

The reported prevalence of piezogenic pedal papules varies widely in the literature, ranging from 2.4% to 100%.2–4, 6 Most authors have reported relatively high prevalence rates: around 60% for adults and 70% for children.2, 3 The differences in prevalence may due to variability in papule size and bias in deciding whether small protuberances are piezogenic pedal papules or not. Gibney and Glasser compiled four previous reviews and found that only 2 of the 554 persons with piezogenic pedal papules were symptomatic.2,4, 6 Therefore it’s a relatively common condition but usually overlooked because of symptomless. It is pain that brings the papules to the patients’ attention.7

Harman and Matthews showed protrusion of an encapsulated fatty nodule into the dermis histologically,8 confirming the hypothesis proposed by Shelley and Ransley. However, the protrusions are dynamic that are not easily seen.
in excised specimens. The exact cause of the structural defects is unknown. Various factors have been suggested to contribute to the condition, including frequent vigorous physical activity, hereditary or familial factors, years of repeated pressure in susceptible persons, and collagen defects in the Ehlers-Danlos syndrome. The latter is of particular note, as painful papules have been reported in 34.5% of patients with Ehlers-Danlos syndrome. There was a family association in our case, with both mother and child having the papules. Family associations have been reported in two literatures. This may relate to genetic susceptibility or exposure to a common risk factor, or it may merely be a coincidence, given the relatively high prevalence of these lesions.

In our case, the Verhoeff-van Gieson stain for elastin revealed a decrease in elastic fibers in the upper and middle reticular dermis. This finding has not been previously mentioned in the literature we reviewed. Schlappner et al. and Lebovits et al. observed absence of elastic tissue only in the trabeculae. The findings in our case could not be differentiated from anetoderma without clinical information. We therefore postulate that, in addition to collagen defects, a decrease of elastic fibers in reticular dermis might also play a role in causing piezogenic pedal papules. The decrease of elastic fibers in the dermis or trabeculae may result from degeneration of elastic tissue by long term repeated mechanical force. However, further evidences and reports are necessary to support the postulation.

Piezogenic wrist papules were observed in both our patient and her child. These papules became apparent by having the subjects press their palms together with the wrists at a 90° angle. Valerie and Fleischer first described piezogenic wrist papules in 25 of 29 subjects (86%) examined. These authors believe that both wrist and pedal papules are a normal finding. We found no reports in the literature of wrist papules that were symptomatic.

The cause of pain in some cases of piezogenic pedal papules is still obscure. Shelley and Rawnsley presumed that extrusion and entrapment of fat with its vasculature and associated nerves resulted in anoxic pain. This may be the reason why the painful pedal papules are generally larger than non-painful ones. We postulated that the pain our patient experienced was related to abnormal distribution of weight on the heel or perhaps structural instability or deformity. A rapid, non-invasive foot pressure measurement was arranged to evaluate this possibility. The fact that she put a greater proportion of weight on the left heel explains in part why her symptoms were confined to the left heel. Structural instability secondary to her low arch may have contributed to the abnormal weight distribution. The use of foot pressure measurements in evaluating pressure-induced skin lesions is helpful in indicating where pressure needs to be relieved by orthotics. X-ray is also helpful to evaluate for abnormalities of bony alignment.

Treatments for piezogenic pedal papules range from simple conservative measures to surgery. Shelly and Rawnsley stated that avoidance of standing for long periods as a conservative treatment. Burkhart recommended foam rubber and/or plastic heel cups. Treatments aimed at redistributing the weight to the anterior part of the foot by raising the heel of the shoes and providing heel support by some form of orthosis such as a Helfet heel-seat or University of California Biomechanics laboratory shoe insert (UCBL shoe insert) have been reported to be effective. Successful control the pain by local electro-acupuncture has also been reported. When the pain is not relieved by conservative means, surgery is indicated. Deep punch or a limited excision is an adequate treatment for most painful papules. Extensive excision is not recommended, as it’s best to preserve the anatomical structure and normal function of this area.

REFERENCES
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