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A novel application of high-dose rate brachytherapy for severe, recalcitrant palmoplantar pustulosis

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Abstract

Palmoplantar pustulosis is a chronic pustular dermatitis of the palms and soles, which is frequently associated with significant pruritus and pain that often limit daily activities. We present the case of a 36-year-old man with severe palmoplantar pustulosis who failed multiple medical therapies and demonstrated marked improvement with high-dose rate brachytherapy. Brachytherapy has the advantage of providing a conformal dose distribution over complex curved surfaces, such as the foot and ankle. Our observation suggests that brachytherapy may be a well-tolerated treatment option for patients with severe, refractory palmoplantar pustulosis.

Keywords

palmoplantar pustulosis; brachytherapy; psoriasis

Introduction

Palmoplantar pustulosis (PPP) is a chronic, refractory dermatitis primarily affecting individuals between 20 and 60 years of age. Clinically, individuals present with erythematous scaly plaques studded with pustules, frequently accompanied by painful acral fissures. Palmoplantar pustulosis is a form of localized pustular psoriasis and occurs with increased frequency in middle-aged women, smokers, and individuals with gluten sensitivity

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or diabetes mellitus.¹ The symptoms associated with PPP can range from mild discomfort and burning to severe pruritus and pain that limit daily activities.

First-line treatment for PPP includes potent topical corticosteroids, which can be used under occlusion. Second-line therapies include ultraviolet therapy, topical vitamin D analogues, topical or systemic retinoids, methotrexate, ciclosporin, and dapsone, all of which demonstrate variable efficacy. Anti-TNF therapies have thus far been the main treatment option for recalcitrant cases; however, discontinuation of therapy often occurs due to loss of efficacy, cost, or adverse effects.² Few options remain after these interventions fail. Radiation therapy may be an alternative or adjuvant treatment for refractory PPP given reports of its successful use in managing other chronic, inflammatory skin diseases.^{3, 4}

Report

A 36-year-old man presented for clinical evaluation of recalcitrant PPP that developed on the bilateral hands and feet three years prior. His past medical history was notable for hidradenitis suppurativa, smoking (20-pack-years), asthma, obesity, and diabetes mellitus. On examination, he had painful erythematous, scaly plaques with deep-seated pustules on the bilateral palms and dorsal and plantar feet. A skin biopsy was performed which showed a psoriasiform dermatitis with inflamed parakeratosis, consistent with PPP. Joint examination and imaging demonstrated no evidence of psoriatic arthritis.

Initially, the patient was started on clobetasol ointment under occlusion with minimal improvement. A course of acitretin, both as a monotherapy and later in combination with narrowband UVB phototherapy, was also unsuccessful. Methotrexate was subsequently utilized, but the patient's PPP continued to worsen. Patch testing excluded a component of allergic contact dermatitis.

Over the course of the next 30 months, the patient's painful, pruritic eruption failed to demonstrate clinical benefit from trials of ciclosporin, etanercept, infliximab, adalimumab, and ustekinumab used in combination with dapsone and acitretin (Fig. 1). Given progression of his recalcitrant PPP resulting in significant activity-limiting foot pain and pruritus along with difficulty sleeping, the patient was referred for consideration of radiation. He was initially treated with open field photon external beam radiation with 0.8 gray (Gy) per foot in 4 treatments. Within one month of external beam radiation therapy, he demonstrated marked improvement evidenced by near resolution of his plantar psoriatic plaques.

Two months following radiation, the plantar aspects of his feet remained clear, but plaques and pustules returned on his dorsal feet and ankles. The recurrence noted in these specific contoured areas was likely secondary to poor dose delivery to these sites by the open field photon beam. Given the patient's initial improvement with open field photon radiation therapy, he was subsequently treated with high-dose rate brachytherapy (HDR) with 0.8 Gy in 2 fractions to the left foot (Fig. 2). This treatment was used because it allows a custom surface mold applicator with a Freiburg Flap to be affixed to the superficial complex curvature of the skin. A computer graphics optimization algorithm permits delivery of a carefully defined dose at the level of the dermis with minimization of irradiation to deeper

tissue because of the short range of HDR. Therefore, a relatively lower total radiation dose is used with HDR compared to open field external beam radiation therapy because of the selective targeting of the superficial dermis combined with a more uniform and calculated radiation distribution to the complex curvature of the foot. With HDR brachytherapy, the patient achieved sustained clinical improvement for more than 6 months, including over the left dorsal foot and ankle (Fig. 3). Brachytherapy was well-tolerated, with the only side effect being mild erythema at the treatment site.

Discussion

Our patient's pustular eruption was present only on the hands and feet, which was most consistent with a diagnosis of PPP or localized pustular psoriasis. Although overlap of symptoms of acrodermatitis continua of Hallopeau is possible in our patient, a diagnosis of PPP was favored given that the eruptions involving the patient's palms, feet, and ankles were considered more severe than the patient's nail findings.

Palmoplantar pustulosis often presents as a refractory chronic dermatitis associated with significant patient disability and morbidity that can pose a therapeutic challenge to clinicians.⁵ In patients with disease that is recalcitrant to standard treatment, radiation therapy may be an effective alternative. Radiation therapy was first described as a treatment for cutaneous disorders in the late 1890s⁶, and was subsequently widely used for various inflammatory skin diseases including eczema and psoriasis.⁷ Following increased awareness of the adverse effects of ionizing radiation, along with the development of advanced systemic therapeutics, radiation therapy became less frequently utilized in dermatology. However, with the advent of improved radiation delivery techniques and dosing accuracy, radiation-based therapy has been used successfully to treat patients with therapy-resistant dermatoses. In one study evaluating 6 individuals with psoriasis and 22 with eczema, radiotherapy resulted in significant symptom improvement.⁴ Case reports describing remission of refractory dyshidrotic eczema with the use of radiation therapy have also been reported.³ Larger studies and randomized controlled trials of psoriasis or PPP treated with radiation therapy are lacking. When compared to open field electron or photon external beam therapy, brachytherapy has the advantage of providing a superior conformal dose distribution over complex curved surfaces with a relatively lower dose of radiation.⁸

Despite the advantages of brachytherapy, the use of ionizing radiation especially in younger patients, for the treatment of a benign disease should be carefully considered as it may increase the long term risk of malignancy at the administration site. This risk should be weighed against the potential benefit of symptom relief, particularly when more conventional treatments are ineffective. Given the enhanced delivery as well as the low radiation doses required to reduce morbidity and potentially induce remission, brachytherapy may be considered in select individuals with treatment-refractory PPP. This case presents a novel application of high-dose rate brachytherapy for the treatment of patients with refractory PPP.

References

1. Mrowietz U, van de Kerkhof PC. Management of palmoplantar pustulosis: do we need to change? The British journal of dermatology. 2011 May; 164(5):942–6. [PubMed: 21275942]
2. Yeung H, Wan J, Van Voorhees AS, et al. Patient-reported reasons for the discontinuation of commonly used treatments for moderate to severe psoriasis. Journal of the American Academy of Dermatology. 2013 Jan; 68(1):64–72. [PubMed: 22846688]
3. Stambaugh MD, DeNittis AS, Wallner PE, Heymann WR. Complete remission of refractory dyshidrotic eczema with the use of radiation therapy. Cutis. 2000 Apr; 65(4):211–4. [PubMed: 10795080]
4. Sumila M, Notter M, Itin P, et al. Long-term results of radiotherapy in patients with chronic palmo-plantar eczema or psoriasis. Strahlentherapie und Onkologie : Organ der Deutschen Rontgengesellschaft [et al]. 2008 Apr; 184(4):218–23.
5. Naldi L, Svensson A, Diepgen T, et al. Randomized clinical trials for psoriasis 1977–2000: the EDEN survey. The Journal of investigative dermatology. 2003 May; 120(5):738–41. [PubMed: 12713574]
6. Schmitz R. History of roentgenotherapy in dermatology. Strahlentherapie. 1950; 82(3):401–18. [PubMed: 14782080]
7. Goldschmidt H, Breneman JC, Breneman DL. Ionizing radiation therapy in dermatology. Journal of the American Academy of Dermatology. 1994 Feb; 30(2 Pt 1):157–82. quiz 83–6. [PubMed: 8288778]
8. Buzurovic I, Bhagwat MS, St James S, et al. Numerical Comparison between High-Dose-Rate Brachytherapy and Electron Beam Therapy in Cutaneous Oncology. Brachytherapy. 2014; 13(Supplement 1)(0):S24.

Learning Points

- Palmoplantar pustulosis is a chronic, refractory dermatitis that can present with severe pruritus and pain, often limiting daily activities.
- Few therapeutic options are available when standard medical interventions fail.
- Brachytherapy can provide a conformal dose distribution over complex curved surfaces, such as the foot and ankle, and should be considered for individuals with severe, refractory palmoplantar pustulosis.

Fig. 1. Dorsal and plantar feet following failed medical management demonstrating diffuse erythematous hyperkeratotic plaques with focal pustulosis prior to initiating radiation therapy.

Fig. 2.

A. Freiburg Flap applicators were placed over the treatment area. B. The applicators were affixed to the area with bandages so that the dose prescribed ($400 \text{ centigray} \times 2 = 800 \text{ centigray}$) was fully delivered. The total treatment time for each session was 10 minutes. C. 3D reconstruction of brachytherapy catheters around the left dorsal foot and ankle. D. 3D dose distribution to the superficial complex target using high-dose rate computer optimized brachytherapy. The dose was given at a depth of 3 mm with rapid fall-off of dose intensity.

Fig. 3. Dorsolateral, dorsomedial, and plantar left foot demonstrating marked improvement one month following high-dose rate brachytherapy.