

# Malignant transformation of erythema ab igne



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**Key words:** erythema ab igne; squamous cell carcinoma; occupational dermatoses; Mohs micrographic surgery.

## INTRODUCTION

Erythema ab igne (EAI), also known as “toasted skin syndrome” or “fire stains,” is a chronic dermatitis occurring in response to long-term exposure to a heat source below the threshold of causing a thermal burn (below 45 °C or 113 °F). This condition was first described as occurring because of exposure to peat stoves in Europe but more recently has been associated with various heat-emitting modern devices such as heating pads, heated car seats, and laptop computers.<sup>1-4</sup> People at risk for EAI include those with chronic pain and those with chronic occupational exposure to heat. Early lesions of EAI are characterized by blanching erythematous reticulated patches that correlate to the area of skin exposed to the heat source. Early lesions may resolve with cessation of exposure to the heat source. With ongoing heat exposure, lesions become fixed, non-blanching, hyperpigmented patches or plaques and may develop atrophy, hyperkeratosis, or bullae. Lesions are typically asymptomatic or associated with mild burning. Histopathologic findings include epidermal atrophy, dilated dermal blood vessels, sparse inflammatory infiltrate, keratinocyte apoptosis, and atypia.<sup>5</sup> The primary treatment of EAI involves discontinuation of the heat source, and topical 5-fluorouracil may be beneficial for preventing progression to squamous cell carcinoma (SCC).<sup>1</sup> Rarely, development of SCC, basal cell carcinoma, Merkel cell carcinoma, and even cutaneous marginal zone lymphoma has been reported 10 to 30 years after the onset of EAI.<sup>6-9</sup> We describe a severe case of EAI with the development of multifocal SCC.

## CASE REPORT

A 48-year-old man with a history of chronic lower back pain presented to Dermatology for a long-standing rash on the lower back. The patient had

### Abbreviations used:

EAI: erythema ab igne  
SCC: squamous cell carcinoma



**Fig 1.** On initial presentation to Dermatology, the patient underwent biopsy of two ill-defined, hyperkeratotic, indurated eroded plaques on the lower back, both consistent with moderately-differentiated SCC.

been using a heating pad for the past 22 years to alleviate his lower back pain, which was due to a work-related injury. He noted a 15-year history of a rash on the lower back at the site of heating pad use. He also reported a heating pad-induced burn in the same area 17 years prior that healed without scarring. Four years before presentation, he developed a tender exophytic lesion within the rash that was biopsied by his primary care physician. Pathology demonstrated a well-differentiated SCC; however, this was never treated as the patient felt that it had

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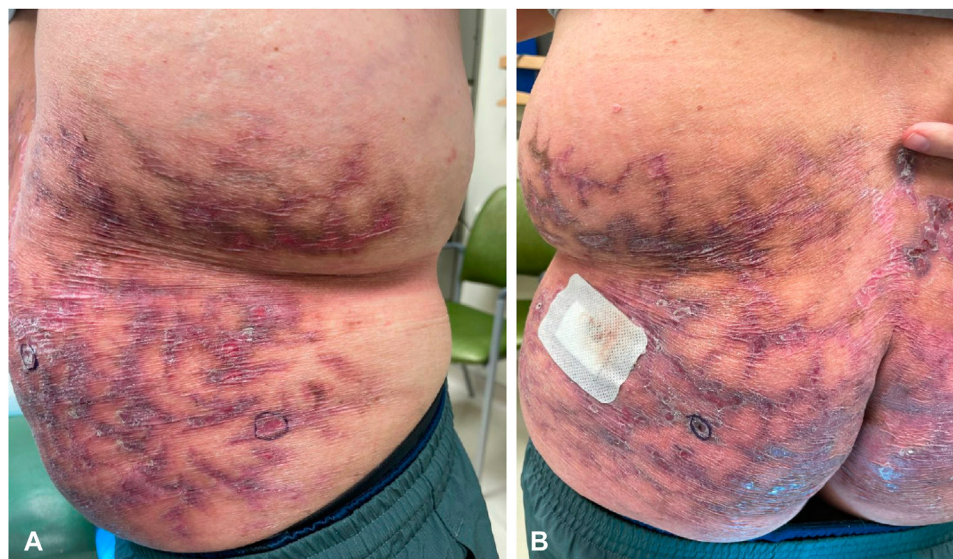
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**Fig 2.** **A**, At preoperative consult visit, scouting biopsies were performed to rule out multifocal SCC. All showed changes of erythema ab igne without signs of malignancy. **B**, Multiple scouting biopsies were performed to rule out multifocal SCC.



**Fig 3.** On the day of surgery, the inferior tumor had grown significantly since biopsy. Due to proximity, both tumors were treated as a single lesion and removed en bloc with clear micrographic margins.

self-resolved after the biopsy. Three years later, he again presented with a tender plaque of the lower back near his prior biopsy site, which was again biopsied by his primary care provider. Pathology showed SCC and he was referred to our academic center for further management.

On presentation to Dermatology several months later, the patient was noted to have diffuse reticulated erythematous, hyperpigmented, and atrophic plaques involving the lower back and buttocks and extending onto the lateral flanks. Centrally, over the

sacrum, there were two ill-defined, hyperkeratotic, indurated, and eroded areas (Fig 1). He noted significant pain and gradual growth of these lesions in the central lower back. Two punch biopsies were performed on the eroded areas, both consistent with moderately-differentiated SCC. The patient was referred for Mohs micrographic surgery for treatment of these malignancies. Upon presentation for his preoperative consult, the patient was noted to have two ill-defined plaques at the biopsy sites, measuring  $1 \times 2.3$  cm and  $1.5 \times 1$  cm. Given the prominence of the patient's EAI and the concern for multifocal SCC, four scouting biopsies were performed on the buttocks and flank in areas with the greatest prominence of EAI (Fig 2). These biopsies showed “dermal mixed inflammation, edema, fibrosis, and vascular ectasia with stellate fibroblasts,” but no evidence of SCC. The patient denied constitutional symptoms of metastatic disease and there was no clinically appreciable lymphadenopathy. After evaluation by a multidisciplinary Cutaneous Oncology Tumor Board, the SCCs were considered amenable to surgical resection and the patient was referred for Mohs micrographic surgery. When the patient presented for surgery, the inferior tumor had grown significantly since biopsy. Because of proximity, both tumors were treated as a single lesion and removed en bloc with clear micrographic margins (Fig 3). The patient was counseled extensively on the risks of continuing heating pad use in his lower back, including a high risk of developing new SCCs. However, the patient reported continued daily

use of a heating pad, expressing that he would not discontinue its use despite the risk as he felt it was the only treatment that helped with his chronic back pain.

## DISCUSSION

Cutaneous malignancy arising within EAI is a well-known but rare phenomenon. The time of the onset of malignancy after the development of EAI is poorly defined but has been reported to be on the order of decades.<sup>1</sup> In this case, it was approximately 11 years, although this is based on the patient's reported onset of the cutaneous findings. The pathophysiology of SCC formation in EAI is poorly understood. The role of infrared radiation (heat) in carcinogenesis may be linked to the activation of heat shock proteins, which prevent apoptosis and may lead to activation of oncogenic pathways, including down-regulating the c-Jun N-terminal kinase pathways and activation of the *NRAS* and *BRAF* pathways.<sup>10</sup> In this case, a diagnosis of Marjolin ulcer was also considered because of the history of prior heating pad-induced burn at this site. Marjolin ulcer is characterized by aggressive SCC arising in the setting of a prior scar or chronically ulcerated or inflamed tissue.<sup>11</sup> However, given the absence of a burn scar or a chronic ulceration at the site of the patient's SCC, this was felt to be less likely. The clinical presentation was felt to be most consistent with carcinogenesis from chronic exposure to infrared radiation over a period of 20 years. This striking case highlights the risks of exposure to heating devices, especially in the context of chronic pain, as well as underlining the importance of educating patients, as well as medical providers, of this risk. For this patient, his continued use of a

heating pad was felt to be a significant risk factor for developing additional SCCs within his extensive EAI.

## Conflicts of interest

None disclosed.

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