

# Burn Scar Carcinoma: Patients With Marjolin's Ulcer

George S. Midla, MPAS, MAED, PA-C, CP; Misty Carrillo, MLIS; and Reginald Richard, MS, PT

Marjolin's ulcer is a malignant tumor often associated with thermal injuries. While this tumor has a long latency period, early identification and management of Marjolin's ulcer is paramount to a good prognosis.

**T**hermal injuries are common in the battlefields of Afghanistan and Iraq. As a result, medical training and treatment for burns has advanced, improving functional and cosmetic outcomes for burn survivors. However, despite these advances, serious complications from thermal injuries still occur and elude diagnosis. Marjolin's ulcer is an example of a late, malignant complication of scars from burn sites, which are at a risk of developing this aggressive carcinoma.<sup>1,2</sup> Both patients and providers need to be aware of Marjolin's ulcer in order to ensure effective screening, diagnosis, and treatment of these tumors.

Jean-Nicolas Marjolin described the development of tumors in burn scars in a seminal report in 1828.<sup>3</sup> Case reports eventually established that the tumors Marjolin identified were malignant. Marjolin's ulcers are most frequently associated with thermal injuries but have also been reported in discoid lupus erythematosus, pilonidal sinus, operative scars, chronic osteomyelitis, chronic venous ulcers, chronic fistulae, chronic radiation dermatitis, leprosy, diabetic

ulcers, tropical ulcers, frostbite, vaccination sites, hidradenitis suppurativa, gunshot wounds, puncture wounds, and dog bites.<sup>4,5,6</sup> Marjolin's ulcers are usually slow to develop, appearing, on average, 31 years after the injury.<sup>7</sup> Although very rare, reports have identified tumors arising from scar tissue in < 1 year.<sup>8</sup> Marjolin's ulcers are classified as acute when development is < 1 year and chronic when their occurrence is > 1 year postburn.<sup>2,8</sup>

Marjolin's ulcer develops in about 2% of burn scars and accounts for about 1% of all skin cancers.<sup>8,9</sup> Cancers arising from burn tissue demonstrate different histologic trends compared with other skin cancers. Nonmelanoma skin cancers in the United States are 80% basal cell carcinoma (BCC) and 20% squamous cell carcinoma (SCC).<sup>10</sup> A literature review by Kowal-Vern and Criswell examined 412 cases of Marjolin's ulcers and found that 71% were SCC, 12% BCC, 6% malignant melanoma, 5% sarcoma, 4% other neoplasms, 1% squamous-basal cell, and 1% squamous cell-melanoma.<sup>7</sup> It has been suggested that in Marjolin's ulcer, SCC develops from locations that have full thickness burns, whereas BCC develops when a burn leaves the sweat glands and hair follicles intact.<sup>8</sup>

The most common sites for Marjolin ulcers are the extremities and scalp. The distribution pattern is 60% on the extremities (lower extremi-

ties more often than upper extremities), 30% on the head and neck, and 10% on the trunk. The flexor surfaces are also more prone to the development of these malignancies due to the constant trauma associated with movement and a compromised blood flow.<sup>3,11</sup> Men are more likely than women to develop the condition at a ratio of 3 to 1.<sup>1,5</sup> Burned areas healed by secondary intention have been identified as a major risk factor in the development of Marjolin's ulcers. Wounds that are resurfaced with a skin graft or flap are less likely to become cancerous.<sup>12</sup> Burns that have difficulty healing after initial treatment should be observed carefully for any lesions, as these sites are also more likely to produce Marjolin's ulcers.<sup>7</sup> All treatments that promote quick and suitable healing will lessen the risk of the disease.

## **PATHOLOGY**

The pathophysiology of carcinoma development in burn scars is not known, although multiple theories have been suggested. Toxins released slowly over time, due to the unstable nature of the tissue, might contribute to malignant changes.<sup>13</sup> Burn scar sensitivity to sunlight and chronic foreign body reaction are also suspected in the development of Marjolin's ulcer.<sup>8</sup> The scar may be subjected to ongoing microtrauma as a result of being elevated above the surrounding skin, being unable to slide over

**MAJ Midla** is an associate professor of dermatology at the Interservice Physician Assistant Program and a physician assistant at Brook Army Medical Center, **Ms. Carrillo** is a librarian at Stimson Library at the US Army Medical Department Center and School, and **Mr. Richard** is a burn rehabilitation clinical research coordinator for the US Army Burn Center, all in Fort Sam Houston, Texas.



Figure 1. A 55-year-old male with previous burn to left lower leg at age 6 years. A well-differentiated SCC (Marjolin's ulcer) of the inferior ulcer margin was identified after previous biopsies were negative for carcinoma.

subcutaneous tissue, and having decreased elasticity. All these conditions may cause repeated micro-injuries, triggering the development of a carcinoma.<sup>7,13</sup> Continued pruritus of the scar promotes repetitive trauma, which could lead to a malignant tumor. Decreased vascularity and a depressed immunologic state in the damaged tissue may also lead to a malignant development.<sup>12</sup> Finally, heredity may also be a factor in the occurrence of Marjolin's ulcer.<sup>7</sup>

### IDENTIFICATION

Timely identification of Marjolin's ulcer is paramount to a good prognosis. This aggressive carcinoma can be detected early only if there is a high level of suspicion by both the clinician and patient. To be diagnosed as a Marjolin's ulcer, the tumor must appear within the boundaries of the scar tissue, and there should be no previous history of a tumor at the site. The cell types of the tumor and the skin should be similar, and the time of tumor development postinjury should be sufficient to support the di-

agnosis. The average latency period is 31 years, but there have been rare cases of earlier development.<sup>7</sup> To exclude previous conditions, the minimum time to tumor development is 1 month to 3 years postburn.<sup>5</sup>

Marjolin's ulcer should be ruled out if a patient describes the development of an ulcer within the boundaries of a burn scar that increases in size, persists, crusts, bleeds, or is painful. Furthermore, prescribing antibiotics and regular dressing changes for a burn scar ulcer will only delay diagnosis and complicate treatment later in the course of the disease. Multiple punch biopsies should be taken from the tumor and at the outer edge to confirm a diagnosis (Figure 1).<sup>5</sup> Magnetic resonance imaging will provide a better understanding of the extent of bone, neurovascular, and soft-tissue involvement and may be indicated before surgery.<sup>9</sup> Once the tumor is identified, a wide excision with a 2-cm margin should be performed.<sup>1,2</sup> Reconstructive surgery may be necessary for tumors that are extensive.

This aggressive carcinoma has

been reported to be metastatic in 20% to 36% of cases.<sup>14</sup> Regional lymph nodes are the most common site of metastasis, although other locations may occur.<sup>12</sup> It has been suggested that lymph-node dissection should be carried out only if they are palpable during an exam. However, early metastasis may not afford palpable lymph nodes, and routine dissection may be warranted in this aggressive carcinoma.<sup>2,4,14,15</sup> Sentinel lymph-node biopsy may also be used to correctly evaluate this condition. In this procedure, a tracer substance is injected into the dermis at the site of the cancer; this substance is then followed to the sentinel lymph node(s). This procedure is minimally invasive and allows for correct staging.<sup>16</sup> Radiotherapy has also been used in treatment but is considered controversial.<sup>2,5</sup>

After surgical correction of a Marjolin's ulcer, a plan should be developed for home screening and regular visits to a provider to monitor for new ulcers or metastases. If a new ulcer develops, the lesion should be surgically removed, even if it has not been diagnosed as malignant.<sup>4</sup> Overall survival rates have been reported to be 52% at 5 years and 34% at 10 years.<sup>6</sup>

### CONCLUSION

The delay in the diagnosis of Marjolin's ulcers continues to be an obstacle to the proper care and the positive outcome of patients. A good outcome requires a high index of suspicion, familiarity with the risk factors, and recognition of the early signs of the disease. The importance of the early diagnosis of Marjolin's ulcer cannot be overemphasized. Treatment with a wide surgical excision and regular visits to a provider for monitoring should be included in the medical plan. Finally, those returning from U.S. current conflicts with burn in-

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juries should be advised of the importance of monitoring their skin for changes.

### Author disclosures

The authors report no actual or potential conflicts of interest with regard to this article.

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verse effects—before administering pharmacologic therapy to patients.

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