

# Reversed Sural Flap for Coverage of Heel Defect Following Marjolin's Ulcer on Frostbite

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## Abstract

Marjolin's ulcer following frostbite is a rare occurrence. Our review of literature revealed that only 23 cases have been reported. In most instances heel is involved and the most common associated malignancy is squamous cell carcinoma.

We present a 69-year-old male patient with squamous cell carcinoma arising over a frostbite scar in heel 45 years after cold injury. This case is unique with respect to the treatment modality performed: resection of tumor with free margins and reconstruction with pedicled reverse sural flap with good result and no evidence of recurrence during the follow up period.

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**Keywords** • Frostbite • heel • sural nerve • flaps

## Introduction

Coverage of distal defects of lower extremity has always been challenging to plastic surgeons. Masquelet et al were the first to describe skin island flaps supplied by the vascular axis of the sural nerve in 1992.<sup>1</sup> Since their description, several reports have mentioned the application of sural fasciocutaneous flaps for coverage of defects in lower third of leg, heel, and hind foot. It has been used for defects following trauma, diabetic ulcer, osteomyelitis, trophic ulcer, pressure sore, postoperative non-healing ulcer, burns including electrical burns, malignancies including Marjolin's ulcer, and frostbite.<sup>2-10</sup> Because of its reliability and easier technique compared with cross-leg flap or free flaps, the indications for its use is rapidly expanding.

Long-standing chronic wounds may induce malignant change that is termed a Marjolin's ulcer. It is a rare neoplasm that was originally described by Jean-Nicolas Marjolin in the unstable scar of a full thickness burn, although it is now synonymous with malignant transformation of chronic ulcers and sinus tracks as well as burn scars.<sup>11-15</sup>

There are different reported statistics about the most common causes of Marjolin's ulcers: 49% burn scars, 84% burn scars and chronic fistulas, 44% trauma scars, 55% varicose ulcers and 32% chronic fistula and osteomyelitis.<sup>12,16</sup> Some reported rare causes are syphilis, lupus vulgaris, hidradenitis suppurativa, vesicovaginal fistulas, lymphogranuloma venarum, suprapubic cystostomy, and frostbite.<sup>16-18</sup>

Malignant degeneration after physical and chemical frostbite is a quite rare entity. The published articles usually include case reports with involvement of extremities. Overall, 23 cases have been reported. Most cases occurred on the foot, particularly on the heel.<sup>16-20</sup> Two cases of Marjolin's ulcers

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were basal cell carcinoma, one was malignant endothelioma,<sup>20</sup> and the rest were squamous cell carcinoma.<sup>16</sup> The latent period between frostbite and malignancy was varied from 2 months to 75 years in reported cases.<sup>16,21</sup>

We present a case of Marjolin's ulcer of the heel after frostbite and the results of surgical management with reverse sural flap after three years follow-up.

### Case Report

A 69-year-old male patient was presented with a chronic ulcer in the left heel for 2 years. His history revealed frostbite of hands and feet including heels 45 years ago, leading to amputation of all toes and most fingers. He had no other significant medical history or any symptom of vascular disorder.

On physical examination, most fingers of the hands and all toes were amputated. There was an ulcer measuring 6 × 6 cm in the left heel. Incisional biopsy revealed squamous cell carcinoma. The ulcer was tender, vegetative, and endured, with necrotic foci (figure 1a). Regional lymph nodes were not palpable.

Laboratory tests, including complete blood count, blood urea nitrogen, and blood sugar were normal. Chest radiography and abdominal ultrasonography were also normal.

Complete excision of the lesion, with 1 cm margin was performed (figure 1b). Calcaneus was exposed after the excision. The course of sural nerve was traced with a line drawn from a point midway between the Achilles tendon and the lateral malleolus to the mid-line point between the two heads of the gastrocnemius muscle. The pivot point was defined approximately 5 cm superior to the tip of lateral malleolus. The flap, centered over the sural nerve, was elevated in a subfascial plane distally together with sural nerve after ligation and section of the nerve in the proximal extent of the flap. After elevation of the flap, the distal pedicle was dissected to the pivot point and the defect was reconstructed with the rotation of the pedicled reverse sural flap. The donor site of the flap was covered by split-thickness skin graft.

Left inguinal node dissection was negative. Pathologic exam of excised tissue showed features of verrucous carcinoma confined to skin with no bone invasion and secondary inflammatory process at the dermis. Lateral and deep margins were clear. One year later, the wounds were well and the patient was able to walk without difficulty (figure 2). There was no complication or local/regional recurrence during the follow-up period for 3 years.



**Figure 1:** A. Preoperative view of the ulcer of left heel. B. The view after excision of the ulcer.



**Figure 2:** Healed left heel with ability to walk one year after operation.

### Discussion

Marjolin's ulcer is a malignant tumor occurring in areas of chronic injury or irritation. It is generally more aggressive than traditional skin cancers, and the rate of regional metastasis is

higher.<sup>11,21-23</sup> All chronic and recurrent ulcers should be biopsied. In patients with malignant lesions, evaluation should be performed for involvement of regional lymph nodes or systemic metastases. Wide excision of the lesion and regional lymph nodes is the recommended treatment. Amputation should be performed if involvement of bone is suspected or documented.<sup>20</sup>

This type of SCC has a greater tendency to metastasize than squamous cell carcinomas (SCCs) resulting from sun exposure.<sup>24</sup> This rate is as high as 38% to 49%.<sup>25</sup> A local recurrence rate of 25% in the patients treated with surgical measures has been reported.<sup>26</sup> Recurrence is almost always in the local area or regional lymph nodes and usually occurs in the first 3 years.<sup>13,25</sup> Five years survival is 52% to 70%, and patients with nodal metastasis have a 5-year survival of 35%.<sup>12,26</sup>

Frostbite is a rare cause of Marjolin's ulcer. The most common late sequelae of frostbite include altered vasomotor function, hyperhidrosis, and cyanosis. Cold induced neuropathy, chronic pain, hyperesthesias and phantom pain have been described. In children, growth plate abnormalities may occur.<sup>27</sup>

Our review of literature revealed that only 23 cases of Marjolin's ulcer after frostbite have been reported. Heel is involved in most instances and SCC is the most common malignancy.

In reported cases of Marjolin's ulcers in foot following frostbite, various techniques for treatment have been used depending on the patients' condition. These include excision and reconstruction with a medial plantar flap, lateral-pedicled transposition flap harvested from the distal cruris,<sup>16</sup> and below the knee amputation followed by hip disarticulation.<sup>20</sup> The presented case was a squamous cell carcinoma arising over a frostbite scar in heel 45 years after cold injury. Several reconstructive options can be done for such defect, however, each option exerts drawback. Skin grafts do not provide a stable coverage in the heel area. Additionally, our case had calcaneus bone exposed after tumor resection and this precluded graft take. Medial plantar flap or distal cruris flap are not applicable in many situations especially when there is a large defect similar to our case. Cross-leg flap is a historical technique that leads to great discomfort for the patient. It is abandoned with the introduction of microvascular surgery. Particularly, in the elderly, like our patient, it leads to loss of range of motion and ankylosis of lower extremity joints. Microvascular free flap, although a choice for distal lower extremity reconstruction, has limited use in the elderly. Amputation is indicated in the cases of Marjolin's ulcer if

the bone is involved. Our patient had no bone or lymphatic involvement. This case was unique in respect to the treatment modality performed: resection of tumor with free margins and reconstruction with pedicled reverse sural flap. The distally based sural nerve fasciocutaneous flap is an excellent option for covering defects of the lower third of the leg extending as far distally as the forefoot.<sup>2,3</sup> It allows rapid and reliable coverage of challenging defects that would otherwise need free flap for reconstruction. It is a valuable choice when the extent and depth of defect precludes coverage with skin graft or local flaps and the patient's condition is not suitable for cross-leg or microvascular free flap. It has been used for the treatment of electrical burn, acute frostbite, and Marjolin's ulcer,<sup>2,5-7</sup> as well as trauma, diabetic ulcer, osteomyelitis, trophic ulcer, pressure sore, postoperative non-healing ulcers, burns, and malignancies.<sup>2-4,7-10</sup> However, it has not yet been reported for the treatment of Marjolin's ulcer after frostbite. In the presented case, good results were achieved and no evidence of recurrence was present during the follow-up period.

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