CASE STUDY

Old War Scar Revisited

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Abstract In 1828, Jean Nicholas Marjolin, a French surgeon, first described the findings of a neoplastic development arising from a burn scar, now more commonly referred to as a Marjolin's ulcer. A Marjolin's ulcer describes malignant degeneration in any chronic wound. The majority of cases arises in burn scars and are often latent for decades. Marjolin ulcers have been widely identified in post-war time injuries. These ulcers may arise in almost any anatomical location. We report a case of an 82-year-old male that presented with a painful fluctuating mass on the right arm localized to the site of an old grenade blast injury he sustained many years earlier. While the presentation of these cases may be variable, the significance of proper management of the wounds is essential to optimal patient outcomes. An aggressive course and poor prognosis is associated with Marjolin's ulcers that degenerate into squamous cell carcinoma. Early detection and aggressive treatment/management with wide local excision and prompt coverage yield the best results when treating patients with Marjolin's ulcers.

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Introduction

Malignant skin tumors have been known to develop several decades after a previously incurred injury. Such carcinomas are named after the French surgeon, Jean Nicholas Marjolin, who first described the phenomena in 1828 in burn wounds. Thus, the term, "Marjolin's ulcer," describes a malignant and aggressive degeneration occurring in unstable scar tissue and is associated with poor prognosis. Most Marjolin's ulcers are squamous cell carcinoma (SCC) in origin (over 75%) and have been associated with various types of chronic wounds, including pressure sores, osteomyelitis and venous stasis ulcers.^{1,2} Few case reports in the literature exist regarding the

malignant transformation of old war scars. We present a case of SCC arising from a grenade shrapnel injury sustained over 60 years prior in a Korean War veteran. Additionally, we review similar cases in the literature and discuss the prevalence of Marjolin's ulcer in old war injuries.

Case Report

An 82-year-old male was referred to our clinic for evaluation of an erythematous soft tissue mass of two months duration at the medial aspect of the right epicondyle (Fig. 1). Of note, the patient's right elbow sustained a shrapnel injury from a grenade roughly 60 years ago during his service in the Korean War. The patient complained of generalized discomfort at the site which coincided with the change in his scar.

His past surgical history included previous surgical resection of basal cell carcinoma on his left ear, which is

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Fig. 1 Marjolin's ulcer.

without recurrence to date. His past medical history included hypothyroidism, hypertension, and atrial fibrillation. In addition, he sustained the shrapnel injury to the right elbow resulting in a 4 × 4 cm lesion 60 years ago.

On presentation, an indurated, erythematous, raised lesion, 6 × 4 cm in size, was noted at the right elbow with minimal serosanguinous drainage. The area was tender to palpation with no evidence of sensory or motor deficits. There was no evidence of lymphadenopathy.

A core needle biopsy completed at the clinic showed concern for keratinizing squamous cell carcinoma with moderate differentiation. MRI with contrast showed a 2.4 × 2.6 × 3.3 cm elliptical mass with subcutaneous edema, suggesting possibly inflammatory changes. PET/CT scan showed heterogeneous hyper-metabolic uptake at the right distal arm mass with no evidence of metastases.

Thus, the patient underwent a 10 × 5 cm wide local excision of the soft tissue mass. The tumor was found to involve both the ulnar nerve and brachialis muscle. Pathological examination revealed keratinizing squamous cell carcinoma arising from the dermis and subcutaneous tissue without epidermal involvement. The specimen contained an invaded lymph node, clinically significant for possible metastasis from a primary site.

The patient returned for follow-up 1-month post-operatively to rule out a primary malignancy via flexible bronchoscopy and esophagogastroduodenoscopy. No areas of malignant potential were identified. As of the 6-month post-operative interval, there remains no focal recurrence or evidence of metastasis.

Discussion

Marjolin's ulcer is the malignant transformation of any chronic wound.³ This was first described in 1828 by Jean Nicholas Marjolin as an indolent ulcer arising in a burn scar.⁴ Although initially described as a malignant transformation from a burn wound, the term Marjolin's ulcer has

been used interchangeably for malignant transformation in any chronic wound, including pressure ulcers, osteomyelitis, venous stasis ulcers, urethral fistulas and anal fistulas.²

Marjolin's ulcer may develop in various anatomical locations, although the highest incidence is in the lower extremities.^{1,5} The predilection of these lesions may be due to injuries that affect the arms and legs, such as a grenade shrapnel injury in this case. The transformation from ulcer to malignancy is typically slow and the pathogenesis is unclear,^{5,6} but it is most likely multifactorial.⁷ Chronic foreign body induced inflammation from retained shrapnel fragments appears to be the cause in our patient's case.

Unfortunately, wartime injuries can have late complications. In 1951, Gillis published a review article discussing, "cancer as a sequel to war wounds," based on a case series of 24 patients.⁸ Our review of the literature details a total of 39 patients in whom wartime injury ultimately presented as a Marjolin's ulcer (Table 1).⁸⁻³⁴

Of these cases, we found 6 patients (15%) in whom shrapnel injury from a grenade was the original cause of their chronic wound.

We found that in war veterans diagnosed with Marjolin's ulcer, the latency period from insult to onset ranged from 14 to 65 years with an average of 41 years. General reviews of Marjolin's ulcer cases have found latency periods as high as 75 years.⁸ The majority of cases in our review were diagnosed as squamous cell carcinoma, though several reports noted basal cell carcinoma, angiosarcoma, and laryngeal carcinoma arising from wartime injury.

The majority of cases of Marjolin's ulcer in our review were treated with excision or amputation and in some cases, additional radiation and/or chemotherapy. Few case reports of Marjolin's ulcer in old war injuries showed recurrence, but those that did were within 7 months. The recommended management of Marjolin's ulcer remains controversial, though several reviews refer to surgery as the mainstay of treatment.³⁵

In this case of an 82-year-old war veteran, the presence of a lymph node in the biopsy specimen lends more credibility to the diagnosis of a Marjolin's ulcer due to the lymphatic invasion often seen in these cases. The presence of perineural infiltration of the ulnar nerve requiring neurolysis presents another key feature of squamous cell carcinomas arising from Marjolin's ulcers. Other common pathologic findings include keratin pearl formation, evidence of chronic inflammation, and pseudoepitheliomatous hyperplasia. Treatment with wide radical excision appeared to be effective with recommended lifelong follow-up.

While the literature only contains a handful of cases reporting wartime injuries associated with malignant degeneration, it is important for a practitioner to be aware of the possibility of malignancy in old war scars as early diagnosis remains essential.

Table 1 Marjolin's ulcers in war time injuries: Review of the literature.

Name	Year	#	Age (M/F)	Initial insult	Disease free interval (years)	Duration of wound	Type of neoplasm	Location	Metastasis	Treatment	Recurrence
Gillis ⁸	1951	2	63 (M), 52 (M)	Bomb fragments, GSW	29, 32	2 years, 8 years	SCC	L thigh, R cheek	No	None, resection	–
Peter ⁹	1966	1	–	Grenade splinter injury	–	–	Pulmonary carcinoma	Lung	–	–	–
Tolle ¹⁰	1967	1	–	Grenade splinter injury	–	–	BCC	–	–	–	–
Buethner ¹¹	1973	1	–	GSW	28	–	Laryngeal carcinoma	Larynx	–	–	–
Buchholz ¹²	1978	1	50 (M)	GSW	27	–	Bronchogenic carcinoma	Lung	–	–	–
Pusey ¹³	1981	1	–	GSW	–	–	SCC	–	–	–	–
Philip ¹⁴	1982	1	–	GSW	–	–	SCC	–	–	–	–
Rossis ¹⁵	1982	10	55, 52, 55, 62, 54, 56, 52, 52, 53, 53	Frostbite	–	2 years	SCC	Heel	No	Excision	No
Ragsdale ¹⁶	1983	1	–	GSW	–	–	SCC	–	–	–	–
Hayman ¹⁷	1983	1	86 (M)	Grenade fragments	65	1 week	Angiosarcoma	Axilla	Yes	Resection/ chemotherapy	Yes (2 months)
Patel ¹⁸	1984	1	58 (F)	GSW	33	6 weeks	Epidermoid carcinoma	Face	No	–	–
Lambert ¹⁹	1984	1	70 (M)	GSW	–	–	BCC	Shoulder	Yes	–	–
Dubeau ²⁰	1984	1	–	Shrapnel injury	38	–	Pulmonary carcinoma	Lung	–	–	–
Eistert ²¹	1989	2	–	GSW	–	–	Laryngeal carcinoma	–	–	–	–
Maier ²²	1992	1	–	GSW	49	–	Laryngeal carcinoma	Larynx	–	–	–
Coy ²³	1994	1	–	Penetrating injury	–	–	SCC	Extremity	–	–	–
Meyer ²⁴	1995	1	–	War accident	2 years	–	SCC	–	–	–	–
Schneider ²⁵	1997	1	–	Injury with foreign body	46	–	Angiosarcoma	–	–	–	–
Teltzraw ²⁶	2006	1	84 (M)	Shell splinter injury	60	–	Angiosarcoma	Lateral temporal fossa	–	Resection	–
Surov ²⁷	2006	1	84 (M)	Grenade splinters	60	–	Pseudotumor	R supra-clavicular area	No	Resection	No
Rieger ²⁸	2006	1	79 (M)	Grenade fragments	61	4 years	BCC	L calf	No	Resection/STSG	No
Guenther ²⁹	2007	1	70 (M)	Tissue contusion	61	3 years	SCC	R popliteal region	No	Amputation	No
Hatzis ³⁰	2007	1	76 (M)	Flash burn from jet engine	–	–	SCC, BCC	Multiple	No	Resection/STSG, CO2 laser	No
Kandamany ³¹	2009	1	68 (M)	GSW (shotgun pellets)	14	–	BCC	–	–	–	–

(continued on next page)

Table 1 (continued)

Name	Year	#	Age (M/F)	Initial insult	Disease free interval (years)	Duration of wound	Type of neoplasm	Location	Metastasis	Treatment	Recurrence
Host ³²	2012	2	55 (M), 61 (M)	Landmine injury	38, 40	2 years	SCC	R proximal tibia, L ankle	No	Resection/debridement, amputation	Yes (6 weeks), No
Kim ³³	2012	1	-	GSW (bullet splinters)	60	-	SCC	Maxillary sinus	-	-	-
Tobin ³⁴	2014	1	61 (M)	Helicopter crash	40	3 years	SCC	Leg	Yes	Amputation/radiation	Yes (30 weeks)

Note: GSW (gunshot wound), SCC (squamous cell carcinoma), BCC (basal cell carcinoma), STSG (split-thickness skin graft).

Conclusion

Marjolin's ulcers typically present as squamous cell carcinomas arising from post-injurious scar sites and chronic wounds. While the presentation of these cases may be variable, the significance of proper management of the wounds is essential to optimize patient outcomes. In patients with chronic lesions, the clinical index of suspicion for Marjolin's ulceration with malignant transformation should remain high until proven otherwise.

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