

Squamous cell carcinoma of the heel developing at site of previous frostbite¹

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Summary: Ten cases of squamous cell carcinoma of the heel previously affected by frostbite are reported. They had a similar natural history, location and histological appearance. All were treated by excision, and follow up over periods of 2–5 years has not revealed metastases.

Introduction

During the Second World War the Greek army fought a defensive war against the invading armies of Italy and Germany in the mountainous region of Northern Greece. The Greek army was poorly equipped and, among other hardships, many soldiers suffered severe frostbite (Katsas *et al.* 1977). A rough estimate puts the number of amputations due to frostbite lesions alone at approximately 25 000.

A number of frostbite victims escaped amputation but, over the years, have borne various sequelae of their healed frostbite, these being mainly scars and contractures. Precise statistics are not available concerning the numbers of people affected or the severity of disabilities.

Methods and results

Between 1970 and 1978, 10 patients were referred with lesions on the heel at the site of previous frostbite (Table 1). Their histories were very similar. They were all veterans of the

Table 1. Details of patients with squamous cell carcinoma on previously-frostbitten heels

Cases	Age (years)	Type of lesion macroscopically	Size (cm)	Break-down	Local recurrence	Groin lymphadenopathy
1	55	Fungating	5 × 5	Yes	No	No
2	52	Fungating	3 × 3	Yes	No	No
3	55	Ulcerated	2 × 2	Yes	No	No
4	62	Fungating	6 × 6	Yes	No	No
5	54	Fungating	5 × 5	Yes	No	Yes (inflammatory)
6	56	Fungating	5 × 4	Yes	No	No
7	52	Fungating	8 × 8	Yes	No	No
8	52	Ulcerated	2 × 3	Yes	Yes	No
9	53	Ulcerated	3 × 3	Yes	No	No
10	53	Fungating	5 × 6	Yes	No	No

Second World War and 7 were known to have had recurrent breakdown of the scarred heel. Three patients had no symptoms until breakdown took place and there was then no healing in spite of meticulous conservative management. At examination, 7 patients had macroscopically fungating tumours and 3 had ulceration (Figures 1 and 2). From the histories it appeared that 5 of the 7 patients who presented with fungating lesions had started with

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Figure 1. Typical appearance of fungating squamous cell carcinoma of the heel

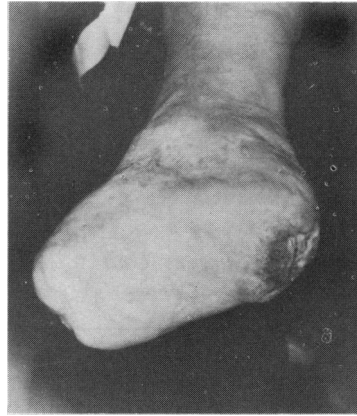


Figure 2. Ulceration on the heel of a previously amputated foot which proved to be squamous cell carcinoma

ulceration. In the 3 patients in whom healing had not occurred, the time to referral since breakdown of the lesions was about two years. In the 7 patients with recurrent breakdowns, it was difficult to determine how long it had taken for the tumour to develop since their last breakdown.

Each patient had a biopsy of the lesion at the margin of the tumour and subsequently an excision, performed with a margin of 1–1.5 cm. In 4 cases some bone had to be resected in order to obtain clearance, and in these a local skin flap was used to cover the defect (Figure 3). For the remainder a thick split skin graft sufficed (Figure 4).

Histological examination of all specimens showed the tumours to be Grade I and Grade II squamous cell carcinomas. In the Grade I tumours (7 patients) the cells of the invading tumour masses were predominantly squamous cells with well developed intercellular bridges. A small number of squamous cells were atypical and horn pearls were present in fairly large numbers (Figure 5). In the Grade II tumours (3 patients) there was less evident keratinization, fewer horn pearls and a fairly large number of atypical squamous cells. The cells invading the dermis and subcutaneous fat tumour masses were surrounded by a moderate-to-marked inflammatory infiltrate composed of lymphocytes and plasma cells (Figure 6). Thick-walled blood vessels were found in the dermis and subcutaneous tissues of all tumours. Extensive



Figure 3. Local skin flap repair following excision of squamous cell carcinoma of the heel, including resection of some underlying bone



Figure 4. Skin grafted area of the heel three years following excision and repair



Figure 5. The dermis is invaded by epidermal masses composed of mature squamous cells. Several horn pearls are present. (H & E $\times 25$)

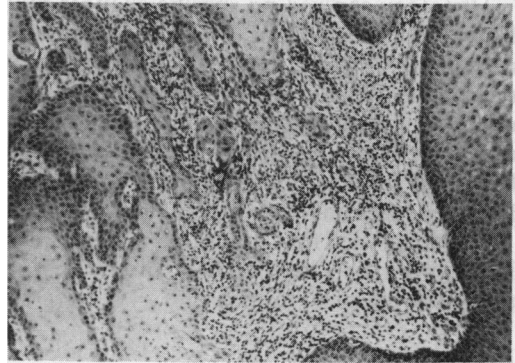


Figure 6. Cells invading the dermis tumour masses are surrounded by a moderate inflammatory infiltrate. (H & E $\times 63$)

investigations did not reveal features that would distinguish these carcinomas from those that arise in other types of pre-existing scars.

Six patients have now been followed up for 5 years since surgery and 4 patients for lesser periods, the shortest follow up being 2 years in one patient. Following surgery there were only minor problems with management of the operated areas, which was probably due to careful protection of the heel by thick padding with polyurethane sponge and close follow up.

One patient developed local recurrence 3 months postoperatively which was treated by further excision and grafting. In another patient an enlarged lymph node in the groin was found at biopsy to be due to inflammation. None of the patients has developed clinical evidence of lymph node groin metastases.

Discussion

Squamous cell carcinoma of the lower leg is a rare tumour (Glass *et al.* 1964, 1966). It is usually the result of chronic skin conditions and persistent irritation. The most widely known similar condition is that of the Marjolin's ulcer, which develops on old burn scars. From the natural histories of our cases it would appear that the same aetiology should be incriminated for squamous cell carcinoma developing after frostbite.

Old frostbitten areas covered by unstable scarry skin resemble old burn scars. Unless effective and continuous protection is provided, breakdown may result. This often occurs in areas of constant irritation or pressure. These breakdown areas invariably respond to conservative measures such as bed rest and dressings. Faster healing may be achieved by skin grafting.

The total number of patients seen in the various military and civilian hospitals in Greece because of problems associated with old frostbite is not known. Patients have been referred to us because of general unresponsiveness to conservative management and therefore the incidence of carcinoma developing at sites of previous frostbite has not been evaluated.

All the tumours in this series developed on the heel and not on other frostbitten areas of the foot, which may be explained by the greater pressure and irritation sustained by the heel. Carcinoma developing on frostbitten sites other than the foot was not seen in this series, although cases affecting the ears, the temple and the hand have been reported previously (Treves & Pack 1930, Hasenbach 1941).

It has been our practice to biopsy only those areas of breakdown that clinically show signs of malignancy. These features are fungation, lack of marginal epithelialization, increase of induration, appearance of nodules and general unresponsiveness to conservative management. This series of patients is highly selective as most of the patients were referred because of these features. However, we have seen some patients with areas of breakdown but negative biopsies.

Histology showed no specific changes that could explain the genesis of malignancy of old frostbitten areas. This type of carcinoma is well differentiated and therefore of low malignancy, which suggests that it might be treated less radically than has been recommended by others (Katsas *et al.* 1977, Di-Pirro & Conway 1966). Amputation seems unnecessary and lymph node block dissection should be reserved for proven lymph node metastases. In this series, which we believe is the largest so far reported, none of the patients has developed regional lymph node metastases and consequently none has undergone radical lymphadenectomy.

It is concluded that squamous cell carcinoma developing on unstable, previously-frostbitten heels appears to be the result of chronic irritation; it is of low malignancy and should be treated by surgical excision.

References

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