SQUAMOUS CELL CARCINOMA IN THE FOOT:
CASE SERIES AND LITERATURE REVIEW

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ABSTRACT

Objectives: To report a case series of squamous cell carcinoma (SCC) in the foot, describing previous risk factors, surgical treatment, histopathological findings, and functional and oncological results. Methods: Nine consecutive patients diagnosed with SCC of the foot were treated at a single institution and prospectively analyzed for risk factors related to the disease, surgical outcome, and histopathological, functional, and oncological results. All patients had identifiable risk factors for SCC. Results: Definitive treatment consisted of partial (6 patients) or total (3 patients) amputation of the foot. The functional score was good or excellent in the surviving patients. Early identifiable risk factors are present in most patients. Biopsy when this diagnosis is suspected, in association with oncological principles, avoids diagnostic and treatment errors. Conclusion: Despite delayed diagnosis and surgical treatment with partial and total amputations of the foot in our series, we observed good oncological outcomes that avoided systemic spread of the disease and achieved expected functional results. Level of Evidence V; Case series.

Keywords: Carcinoma, squamous cell. Foot. Amputation. Metastasis.

INTRODUCTION

Squamous cell carcinoma (SCC) is a rare condition in the foot.1,2 The disease was first described in 1828 by Marjolin, and its malignancy was recognized by Dupuytren.3,4 SCC originates in keratinocytes and may develop a precursor lesion or de novo lesions.4 Verrucous carcinoma, which is not strongly malignant but still locally invasive and destructive, rarely leads to metastases.5 When untreated, the lesions may grow to large diameters. In the plantar region, they are irregularly shaped, well-demarcated, verrucous, and are also known as epithelioma curuculatum.5 Reports in the literature state that 13% occur in the legs, and this is the most common primary cancer of soft tissue in the foot, with an incidence slightly greater than melanoma and synovial sarcoma.6 Despite numerous publications on the subject in the literature, many orthopedic physicians demonstrate a lack of familiarity with this condition in their case reports, which invariably delays diagnosis and optimal treatment.2,5-13 Treatment is usually palliative and includes aggressive and broad resection of the tumor.6,18 Metastatic disease and recurrence of the lesion are uncommon, and are largely associated with incomplete initial excision of the tumor.11

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The objectives of this study are to report a series of cases of SCC in the foot and to describe previous risk factors, histopathological findings, surgical treatment, and functional and oncological outcomes.

MATERIALS AND METHODS
The study included patients who were surgically treated for primary SCC of the foot over a 2-year period. The study excluded all patients with metastases related to the SCC at the time of admission, patients with SCC of the skin in other areas of the body, and patients with any other type of benign or malignant skin disease in the ankle/foot region.

The patients sought orthopedic treatment via referral from the Department of Dermatology (n=8) or spontaneous request (n=1). The main complaint was the presence of chronic lesions on the foot, which did not heal, occasionally bleeding and not permitting the patients to use closed shoes. Two patients had secondary infections, with purulent drainage at the time of the first medical visit. Data were collected on patient age, sex, predisposing factors from external conditions, duration of symptoms, location and size of the lesion, tumor staging, and definitive surgical treatment.14,15 Postoperative complications were analyzed, along with functional results according to the Musculoskeletal Tumor Society Score (MSTS) and oncological outcomes (remission, local recurrence, metastasis, and death from the disease). The MSTS score is described in Table 1. The location of the lesion was described according to the areas defined by Kirby et al.7 (Figure 1)

All patients were subjected to routine laboratory examinations and X-rays. A computed tomography scan of the abdomen was performed in two patients with metastasis to the regional lymph nodes. Incisional biopsy was performed routinely, and after the diagnosis was confirmed, the patients were surgically treated as follows: resection of the metatarsal ray was performed in 4 patients, the hallux was amputated in 2 patients, and transmetatarsal amputation was performed in 1 patient, and transfemoral amputation in 2 patients. We informed the patients that data relating to these cases would be published, and they provided consent (study was approved by the institutional review board under number 6070/3004).

Statistical analysis
The results were analyzed using descriptive statistics for all variables. The potential link between the duration of symptoms and lesion size was assessed using Pearson correlation analysis, with p<0.05. Potential differences between recurrence rates (recurrence or metastasis) and functional score based on primary definitive treatment were evaluated by Fisher’s exact test, with p<0.05. Statistical analysis was performed using SPSS v.15.0 software (SPSS Inc., Chicago, IL).

RESULTS
Nine patients were included in the study, eight men and one woman. Mean patient age at treatment was 60 years (range: 45–86 years).

Seven individuals were Caucasians and two were Black. In seven cases the tumor was located in the forefoot (Kirby zone 5), one case on the dorsum of the midfoot (Kirby zone 3), and one case on the midfoot plantar region (Kirby zone 4). The fourth toe was affected most often. The time interval between the first symptoms and the first visit ranged from six to 120 months, with an average of 30.7 months. The clear imbalance in this variable resulted from an extremely late diagnosis in case 9, with 120 months of evolution. The average lesion size in its largest linear dimension was 5.2 cm (range: 3.0–8.0 cm). There was no statistical correlation between the time until diagnosis and lesion size (p>5%). Among the predisposing factors, all patients had some social or professional activity related to sun exposure and six (66.7%) smoked more than one pack of cigarettes per day. The demographic data for the patients included in the study are shown in Table 2.

One (11.0%) patient presented osseous invasion, which was seen in simple X-rays of the affected foot. (Figure 2) In the other eight patients, the X-rays were normal. None of the two patients with metastasis to the regional lymph nodes presented tomographic alterations in the abdomen. Microscopically, the most frequent

| Case | Age | Sex | Race | Evolution time (months) | Location | Predisposing factor(s) |
|------|-----|-----|------|-------------------------|----------|------------------------|
| 1    | 72  | M   | C    | 12                      | Right hallux | SE, tobacco use           |
| 2    | 44  | F   | B    | 24                      | Left 2nd toe  | SE                     |
| 3    | 78  | M   | C    | 07                      | Left 4th toe  | SE                     |
| 4    | 57  | M   | C    | 24                      | Right hallux | SE, tobacco use           |
| 5    | 40  | M   | C    | 06                      | Left foot, dorsum. | SE, tobacco use           |
| 6    | 86  | M   | C    | 24                      | Left 4th and 5th toes | SE, tobacco use           |
| 7    | 56  | M   | B    | 24                      | Right hallux | SE, tobacco use           |
| 8    | 49  | M   | C    | 36                      | Left 4th toe  | SE                     |
| 9    | 55  | M   | C    | 120                     | Bottom of right foot | SE, tobacco use           |

Source: DOUTURJ, 2017. Abbreviations: M - male, F - female, C – Caucasian, B - Black, SE - sun exposure.

Figure 1. Zones, according to Kirby et al.

Table 1. Description of MSTS score.

| Score | Pain | Function | Emotional | External support | Functional Independence | Gait | Percentage (%) |
|-------|------|----------|-----------|------------------|------------------------|------|---------------|
| 5     | None | No restrictions | Motivated | None | Independent | Normal | 100 |
| 4     | Intermediate | Intermediate | Intermediate | Intermediate | Intermediate | Intermediate | 80 |
| 3     | Not disabling | Recreational limitation | Satisfied | Orthosis | Limited | Minimal alteration | 60 |
| 2     | Intermediate | Intermediate | Intermediate | Intermediate | Intermediate | Intermediate | 40 |
| 1     | Incapacitating | Partial limitation | Accepts | Cane/crutches | Home | Very altered | 20 |
| 0     | Extremely incapacitating | Total restriction | No support | Two crutches | Dependent | Difficult | 0 |

Source: DOTUFRJ, 2017.
histological type was well-differentiated SCC, in eight cases (88.9%).
(Figure 3) According to the TNM System for Malignant Tumor Clas-
sification from the Union for International Cancer Control (UICC), in
six patients (66.6%) the primary tumor was type T1, in two patients
(22.0%) was type T2, and one patient (11.0%) was type T3. The
complete classification is shown in Table 3.
Postoperative radiation therapy was not indicated for any patient.
During the entire treatment period, the patients were monitored
on an outpatient basis. The mean postoperative follow-up period
was 51 months (range: 6–120 months). Two cases progressed to
metastatic disease, leading to patient death (cases 1 and 9). Two
cases recurred, and were treated with surgical revision and more
proximal amputation (cases 3 and 6). There was no statistically
significant relationship between initial definitive treatment and
recurrence (p>5%). No patient developed postoperative compli-
cations requiring additional surgical intervention, such as infection
or dehiscence of the surgical scar.
The mean MSTS score was 90% (varying from 80% to 100%),
and all patients who were disease-free showed good or excellent
functional results. There was no statistically significant relationship
between initial definitive treatment and functional score (p>5%).

**DISCUSSION**

SCC of the foot is a rare malignant tumor of the epidermis. Although
this is the most frequent malignant tumor found in the soft parts of
the foot, its incidence has been described as roughly 0.6 to
3.0%.\(^1\)\(^,\)\(^7\)\(^,\)\(^12\)\(^,\)\(^13\) It is commonly associated with chronic sun exposure,
due to elastic degeneration of the dermis, irregular pigmentation,
and telangiectasia.\(^1\)\(^4\)\(^,\)\(^18\)\(^,\)\(^19\) However, SCC can also develop on ulcers,
chronic granulomas, and fistular sinuses after ingestion of arsenic
and exposure to tobacco smoke or radiation.\(^9\)\(^,\)\(^12\)\(^,\)\(^14\)\(^,\)\(^20\) In broad terms,
affected patients are in their 50s and 60s, and the disease affects
men more frequently than women, at a ratio of 3:1.\(^1\)\(^2\)\(^,\)\(^12\) Caucasians
are more likely to develop SCC.\(^7\)\(^,\)\(^10\) In this study, eight of the nine
patients were men, the mean age at diagnosis was 60 years, and
all participants reported daily exposure to ultraviolet radiation, which
is common in tropical countries; three patients also smoked more
than one pack of cigarettes per day.
The diagnosis is based on a high index of suspicion. Any changes
in color, shape, or size, or sudden onset of pain in benign lesions of

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**Table 3. Morphological and histological characteristics of tumors, and
TNM classification for the study population.**

| Case | Morphological type | Histological type | Primary Tumor | Regional lymph nodes | Metastasis |
|------|--------------------|-------------------|---------------|----------------------|------------|
| 1    | U                  | PD                | T2            | N1                   | M0         |
| 2    | V                  | WD                | T1            | N0                   | M0         |
| 3    | V                  | WD                | T1            | N0                   | M0         |
| 4    | U                  | WD                | T1            | N0                   | M0         |
| 5    | V                  | WD                | T2            | N0                   | M0         |
| 6    | U                  | WD                | T1            | N0                   | M0         |
| 7    | V                  | WD                | T1            | N0                   | M0         |
| 8    | V                  | WD                | T1            | N0                   | M0         |

Source: DOT-UFRJ, 2017. Abbreviations: U - ulcerative, V - verrucous, WD - well differentiated,
PD - poorly differentiated.
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