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# Maintaining Functionality in Temporal Skin Tumor Surgery: A Focus on Nerve Injury and Excision Margins

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**Background:** Operating on temporal cutaneous tumors is challenging because of the intricate facial nerve system, particularly the frontal branches, and the possibility of brow dysfunction. Surgery for deep margin clearance is difficult because of the fragile and sensitive soft tissue in the temporal region. To address this research gap, this study assessed clearance margins, types of skin tumors, and nerve injuries in this critical anatomical position. This retrospective study assessed temporal skin cancer surgery, malignancy types, and clearance margins in patients with frontal-branch facial nerve injuries.

**Methods:** Forty-five patients with temporal skin carcinoma biopsies were analyzed. The deep and peripheral excision margins of skin malignancies were examined. Medical records were reviewed for clinically injured frontal nerve.

**Results:** Thirty-four patients were men (75%), and basal cell carcinoma was the most prevalent histological malignancy, followed by squamous cell carcinoma. The mean age of the patients was 77.8 years (39–107 years). Two patients experienced damage to the frontal branch nerve. Twenty-six percent of the skin malignancies had inadequate deep margin excision.

**Conclusions:** Removing temporal skin lesions is difficult. We discovered a 26% and 4% probability of inadequate deep margin excision and frontal branch facial nerve injury, respectively. Temporal skin lesions must be removed safely by surgeons to preserve the branches of the facial nerves. Insufficiently removed tumors require multidisciplinary teamwork and patient discussions regarding the advantages and risks to improve results. *(Plast Reconstr Surg Glob Open 2024; 12:e5642; doi: 10.1097/GOX.0000000000005642; Published online 8 March 2024.)*

## INTRODUCTION

The incidence of skin cancer is increasing, which is attributed to increased exposure to sunlight and an increased older population, among other factors.[1,2] In general, the management of suspected skin cancer after obtaining a history and clinical examination is primarily surgical. This includes both therapeutic excision and diagnostic biopsy.

The face is a common site of skin cancer. However, temporal cutaneous malignancies, overlying the temporal fossa, are challenging for surgeons.[1,2] This is mainly due to the risk of injury to the temporal (frontal) branches of the facial nerve, with a possible loss of ability to lift the eyebrow. Furthermore, the temple's relatively thin, soft tissue may compromise the deep-margin clearance during surgery.[3] A balance is needed between curative excision with adequate clear margins, and avoidance of nerve damage.

Understanding the surgical anatomy of the frontal branch of the facial nerve is therefore crucial. The frontal branch of the facial nerve is located using the Pitanguy line, which extends from a point 0.5 cm inferior to the tragus to a point 1.5 cm lateral to the supraorbital rim. Another topographic marking is a point 4 cm lateral to the lateral canthus, at the level of the helical root. The frontal branch rami travel deep to the orbital rim

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along the middle third of the zygomatic arch and transition to the underside of the superficial temporal fascia (layer 3) at least 1.5–3 cm above the zygomatic arch. This transition occurs before the frontal branch reaches the sentinel vein. There can be three to five rami. The rami commonly travel along the inferior temporal septum and the anterior branch of the superficial temporal artery. Furthermore, the frontal rami transition superficially at the SMAS level, reaching the underside of the orbicularis oculi and frontalis muscles.[4] A broad range of tumor types can arise within these layers, including neoplasms, hamartomas, malformations, and benign or malignant cysts.[5]

Basal cell carcinoma (BCC) is the world's most prevalent type of skin cancer, accounting for 80% of all facial skin cancers.[6] Squamous cell carcinoma (SCC) is the second most common type of skin cancer worldwide. These tumors have the potential to metastasize if left untreated. Malignant melanoma is one of the most aggressive tumors that can occur at a younger age.[6] Good knowledge of skin cancer presentation, prognosis, adherence to the national guidelines for skin cancers, and a multidisciplinary approach with inputs from oncology, pathology, and radiology are essential for choosing the most appropriate management for these patients and achieving good results.

According to the British Association of Dermatologists (BAD) guidelines for managing adults with BCC from 2021, surgical excision should use 4- and 5-mm peripheral margins for low- and high-risk lesions, respectively.[7] If needed, deep margin excision should be performed down to a clear plane, including the fat layer and other deeper structures.[7] BCC in the temporal region is considered a high risk.[7] According to the BAD guidelines for SCC, surgical excision should be with 4- to 10-mm peripheral margins based on the risk stratification of the tumor. Deep-margin excisions should be performed within the next clear surgical plane and should include galea on the scalp. A histological clearance of at least 1 mm should be achieved.[8] According to the BAD guidelines (zone H), the temporal region is a high-risk area for BCC.[7] Any surgery or trauma to the temporal area carries the risk of damaging the frontal branch of the facial nerve, depending on the extent of the surgery, and a shave or incisional biopsy has a lower risk than an excision or wide local excision.[9]

According to the above BAD guidelines for BCC, temporal skin cancer lesions of the superficial temporal fascia are excised[7]; however, intraoperatively, some lesions are found to invade the fascia, and the fascia needs to be excised with the lesion to achieve clear deep margins, which significantly increases the risk of nerve damage.

The consequences of frontal branch nerve injury depend on the severity of the injury, varying from neuropraxia to complete division, as well as on the individual anatomy in which single or multiple branches are damaged.[10] Some studies have examined safe zones for surgical approaches to avoid frontal branches; however, this is not possible in skin cancer surgery due to the random nature of skin cancer location.[9]

### Takeaways

**Question:** How can functionality be preserved during surgery for temporal skin tumors, with a focus on minimizing nerve damage and optimizing excision margins?

**Findings:** This study highlights that a significant proportion of temporal skin cancer cases exhibit inadequate deep margin clearance, while the risk of frontal branch nerve injury remains low.

**Meaning:** To safeguard facial nerve branches and improve deep margin resections, it is imperative for surgeons to emphasize the safe removal of temporal skin lesions.

After frontal nerve injury, some patients are not disturbed by the droopy eyebrow; however, in some cases, it has a significant effect and the patient may require a brow-lift procedure.[11–13] Another factor to consider is the age of the patient, as in younger patients, there is an argument to perform immediate nerve repair under the microscope if removal of the lesion is suspected to likely cause frontal branch injury.[14] It is challenging to visualize the frontal nerve branch, even under loupes magnification, and it may require surgical microscopic magnification.[15]

For some BCC and in situ nonmelanoma skin cancer lesions, other treatment modalities are available, such as photodynamic therapy and topical treatment with 5-fluorouracil and imiquimod.[7,8] Radiotherapy may have a favorable outcome compared with complex surgery, especially in patients who cannot tolerate surgery.[8] The role of Mohs micrographic surgery in managing skin cancer on the face is of paramount importance for achieving clearance with adequate margins and maximal tissue preservation[7] or where lesion margins are not clear.[1]

## METHODS

This retrospective study assessed the surgical management of 45 patients, treated at Oxford University Hospitals, who underwent temporal skin cancer biopsies. Lesions, including size, mobility, and lymphadenopathy, were carefully examined for features suggestive of malignancy. The patients were counseled regarding the procedure, which included shaving, incision biopsies, excision biopsies, and wide local excisions. The risks and benefits of the procedure, including nerve damage, were discussed with patients. All excisions were performed under local anesthesia in accordance with the guidelines recommended by the BAD. Patients' clinical notes were reviewed, and demographics, histology, excision margins where applicable, and any documented nerve injury upon follow-up in the clinic were collected.

## RESULTS

Forty-five skin lesion procedures were performed in the temporal area between February 2022 and February 2023. The mean age of the patients was 77.8 years (39–107 years). Thirty-four patients were men (75%).

These procedures included 34 excisional biopsies, five wide local excisions, three incision biopsies, and three

shave biopsies (Table 1). Thirty-one lesions were malignant, 11 were precancerous or in situ, and three were benign (Table 2).

Histopathological reports revealed thirty-one lesions to be malignant (Table 3). This included SCC, BCC, malignant melanoma, and sinonasal carcinoma, which accounted for 69% of the excisions. Eleven lesions were precancerous or in situ (actinic keratoses and Bowen disease), accounting for 24% of excisions (Table 4). Among the three benign lesions, one seborrheic keratosis, one wart, and one nevus were discovered (Table 5).

For malignant excisions, the deep margin clearance ranged between 0 and 3.6 mm. Eight lesions (26%) had inadequate deep margin excision. These included one involving a deep margin and seven with less than 1 mm of clear deep margins. The peripheral margin clearance was between 0 and 6.6 mm, with an average of 3.93 mm. Two excisions showed involvement of the peripheral margins.

**Table 1. Demographics of Temporal Skin Lesions**

| Age | Sex | Pathology | Peripheral Margins | Deep Margins | Nerve Injury | Procedure Type |
|---|---|---|---|---|---|---|
| 80 | M | AK | Clear | Clear | N | EB |
| 81 | M | AK | Clear | Clear | N | EB |
| 81 | M | AK | Clear | Clear | N | EB |
| 87 | F | AK | Clear | Clear | N | EB |
| 88 | M | AK | Clear | Clear | N | EB |
| 58 | M | AK | N/A | N/A | N | Shave |
| 75 | F | AK | N/A | N/A | N | IB |
| 78 | M | AK | N/A | N/A | N | Shave |
| 81 | M | BCC | 3.7 | 0 | N | EB |
| 78 | F | BCC | 4.5 | 0.4 | N | EB |
| 78 | F | BCC | 4.5 | 0.4 | N | EB |
| 69 | M | BCC | 3 | 0.6 | N | EB |
| 86 | M | BCC | 3.5 | 0.8 | Y | EB |
| 78 | M | BCC | 5.4 | 0.9 | N | EB |
| 80 | F | BCC | 2.7 | 1.1 | N | EB |
| 74 | F | BCC | 0 | 1.3 | N | EB |
| 88 | M | BCC | 2.8 | 1.5 | N | EB |
| 82 | M | BCC | 6.6 | 1.6 | N | EB |
| 68 | M | BCC | 3.7 | 1.7 | N | EB |
| 88 | M | BCC | 4.3 | 1.7 | N | EB |
| 76 | M | BCC | 5 | 2 | N | EB |
| 84 | M | BCC | 5.1 | 2.3 | N | EB |
| 86 | M | BCC | N/A | N/A | N | IB |
| 86 | M | BCC | N/A | N/A | N | IB |
| 60 | M | Bowen disease | Clear | Clear | N | EB |
| 77 | M | Bowen disease | Clear | Clear | N | EB |
| 86 | M | Bowen disease | Clear | Clear | N | EB |
| 39 | F | MM | Clear | Clear | Y | WLE |
| 75 | M | MM | Clear | Clear | N | WLE |
| 79 | M | MM | Clear | Clear | N | WLE |
| 81 | M | MM | Clear | Clear | N | WLE |
| 39 | F | Naevus | Clear | Clear | N | EB |
| 78 | F | SCC | 3.4 | 0.3 | N | EB |
| 83 | M | SCC | 1.1 | 1 | N | EB |
| 107 | M | SCC | 6 | 1 | N | EB |
| 81 | M | SCC | 0 | 1.5 | N | WLE |
| 93 | F | SCC | 3.5 | 1.8 | N | EB |
| 66 | M | SCC | 5.7 | 2 | N | EB |
| 87 | M | SCC | 6 | 2.3 | N | EB |
| 68 | M | SCC | 6.6 | 3.3 | N | EB |
| 88 | M | SCC | 6.1 | 3.6 | N | EB |
| 87 | F | SCC | 3.4 | 0.4 | N | EB |
| 67 | M | Seborrheic keratoses | N/A | N/A | N | Shave |
| 94 | M | Seborrheic wart | Clear | Clear | N | EB |
| 57 | M | Sinonasal carcinoma | 1.7 | 1 | N | EB |

AK, actinic keratoses; EB, excisional biopsy; F, female; IB, incisional biopsy; M, male; MM, malignant melanoma; N, no; N/A, not applicable; Y, yes; WLE, wide local excision.

**Table 2. Types of Temporal Skin Lesions**

| Tumor Type | No. Lesions | Percentage |
|---|---|---|
| Invasive malignancy | 31 | 69% |
| Precancerous or in situ | 11 | 24% |
| Benign lesions | 3 | 7% |

**Table 3. Malignant Temporal Lesions**

| Invasive Malignancy Tumour Type | 31 Lesions | Percentage |
|---|---|---|
| BCC | 16 | 36% |
| SCC | 10 | 22% |
| MM | 4 | 9% |
| Sinonasal carcinoma | 1 | 2% |

MM, malignant melanoma.

**Table 4. Precancerous or In Situ Temporal Lesions**

| Precancerous or In Situ Tumour Type | 11 Lesions | Percentage |
|---|---|---|
| Actinic keratoses | 8 | 17% |
| Bowen disease | 3 | 7% |

**Table 5. Benign Temporal Lesions**

| Benign Lesions Tumour Type | 3 Lesions | Percentage |
|---|---|---|
| Seborrheic keratosis/wart | 2 | 5% |
| Naevus | 1 | 2% |

There were two cases of documented frontal branch injury of the facial nerve, one after wide local excision of malignant melanoma in a 39-year-old woman and the second in an 86-year-old man after excision of a BCC. This results in 6% of malignant excisions and 4% of total excisions.

## DISCUSSION

Temporal cutaneous malignancies pose a significant challenge to dermatologists, surgeons, and oncologists. Managing these high-risk cancers requires careful assessment, planning, and counseling regarding associated risks, particularly nerve damage and incomplete removal. BCC was the most common malignancy in the temple area, followed by SCC, which is consistent with previous studies on skin cancer of the face and scalp.[6,16] There was inadequate deep margin excision in eight of 31 cases with malignant histology. It accounts for approximately 26% of all cancers and a high percentage of patients. Therefore, these patients may have required further treatment. Further surgery carries a higher risk of frontal branch nerve damage, and different options depend on the type of histology, patient's age, and comorbidities. A discussion with a pathologist to assess the completeness of the deep margin excision after reviewing the slides is recommended. In some cases, observation of BCC might be an option; however, in other instances such as SCC, further intervention is required. Currently, alternative treatment options are available. Radiotherapy might be an option to avoid further surgery if the type of cancer responds to it. In terms of documented nerve damage after skin cancer surgery, it was 4%, although it seemed to be low. However, patient morbidity was significant. The complexity of the procedure plays a role in increasing the risk. In our study, a nerve injury was noted after wide local excision for malignant melanoma; however, the other case occurred after BCC excision. The main risk of nerve damage could be related to the thickness of the lesion, the invasive nature of the skin cancer, and the surgeon's experience playing a role. This study highlights the importance of a thorough discussion with patients regarding the possible risks associated with surgery in the temporal area, especially regarding nerve damage and further surgery or other treatment modalities. Surgical intervention for managing skin malignancies in the temporal area carries the risk of nerve injury that could be significant to the patient, especially for large or thick lesions (Fig. 1).

### Limitations of the Study

This study had a few limitations, including the difficulty of following up skin cancer patients suspected of nerve damage. Due to their complexity, nerve injuries must be closely monitored to determine their course and resolution after surgery. The study also highlights the difficulties of standardizing a pathway for nerve injury patients, underlining the need for a nuanced approach given the different reactions and degrees of nerve involvement. To overcome these constraints, thorough follow-up methods and personalized paths must include modern diagnostic and intraoperative monitoring systems. The study highlights skin tumor surgery's limitations and underlines the need for continued research and multidisciplinary collaboration to improve protocols and patient outcomes.

## CONCLUSIONS

Skin lesion excision in the temporal area is challenging. Excisions in this area showed a 26% risk of inadequate deep margin and 4% of injury to the frontal facial nerve. These mandates carefully deal with skin lesions in this region and the use variable management strategies to balance clear excision and facial nerve preservation.

### Recommendations

The following things are recommended: (1) thorough discussion with patients presenting with possible skin cancer lesions in the temporal area, about the higher risk of inadequate excision owing to the characteristics of this anatomical location; and (2) counseling patients about the risk of nerve damage, droopiness of the eyebrow, and possible corrective surgery in the future. MOHS surgery is an option, particularly for large lesions with indistinct margins. Consider involving the multidisciplinary team in the management of temporal lesions that have been surgically excised with involved or close margins. Alternative treatment options such as radiotherapy or topical or photodynamic therapy may be advisable. Consider

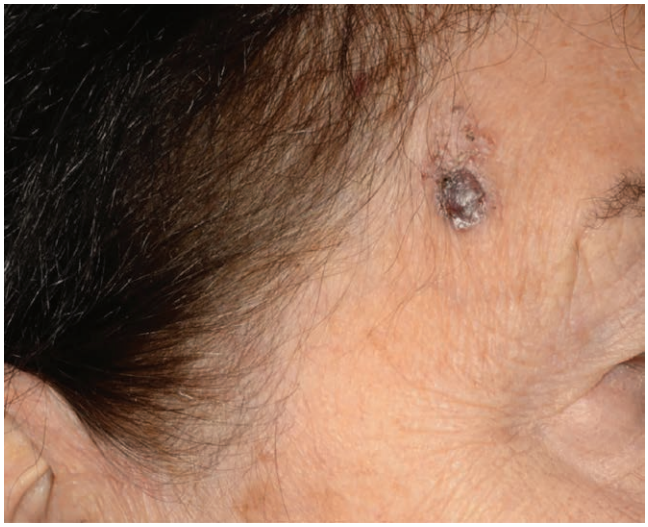

**Fig. 1.** An example of the temporal area is shown.

immediate nerve repair in younger populations with anticipated nerve injury.

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## DISCLOSURE

*The authors have no financial interest to declare in relation to the content of this article.*

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