

## ORIGINAL ARTICLE

# Unmasking the Shadows: A Comprehensive Analysis of Malignant Eyelid Tumours

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**HOW TO CITE THIS ARTICLE:**

Ankit Singh. Unmasking the Shadows: A Comprehensive Analysis of Malignant Eyelid Tumours. Ophthalmol Allied Sci. 2025;11(1): 13-17.

**ABSTRACT**

**Background:** Malignant eyelid tumours pose a significant challenge in ophthalmology and dermatologic oncology due to their potential for disfigurement, visual impairment, and metastasis.

**Objective:** This study aims to provide a comprehensive analysis of the clinicopathological features, management strategies, and outcomes of malignant eyelid tumours.

**Methods:** The study retrospectively reviewed cases over a ten-year period, focusing on demographic data, tumour characteristics, histopathological findings, treatment modalities, and recurrence rates.

**Results:** Findings highlight basal cell carcinoma as the predominant type of malignant eyelid tumour. Early diagnosis and complete surgical excision are critical for optimal outcomes.

**Conclusion:** The diverse nature of these lesions necessitates a tailored, multidisciplinary approach to optimize patient outcomes and preserve both function and cosmesis.

**KEYWORDS**

• Malignant eyelid tumors • Basal cell carcinoma • Squamous cell carcinoma • Sebaceous gland carcinoma • Merkel cell carcinoma • Eyelid cancer • Ocular oncology • Tumor diagnosis • Surgical excision • Reconstruction surgery • Adjuvant therapy • Eyelid lesions • Cancer treatment • Ophthalmic oncology

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➤ Received: 08.05.2025 ➤ Accepted: 15.06.2025



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## INTRODUCTION

The eyelids, beyond their crucial role in protecting the ocular surface and maintaining tear film integrity, are also central to facial aesthetics and non-verbal communication. Their delicate structure and constant exposure to environmental factors, particularly ultraviolet (UV) radiation, render them susceptible to a wide spectrum of neoplastic changes. While benign lesions are far more common, malignant eyelid tumours pose a formidable threat, demanding meticulous diagnosis and management. These tumours, if allowed to progress, can lead to significant local tissue destruction, orbital invasion, compromise of visual function, and, in some aggressive forms, distant metastasis, ultimately impacting patient morbidity and mortality.<sup>1</sup>

The landscape of malignant eyelid tumours is dominated by a few key histopathological types. Basal cell carcinoma (BCC) accounts for the vast majority, typically presenting as a slow-growing nodule with rolled borders and telangiectasias. Squamous cell carcinoma (SCC), though less common, is more aggressive, with a higher propensity for local invasion and metastasis. The insidious sebaceous gland carcinoma (SGC) often mimics benign inflammatory conditions like chalazion or blepharitis, leading to diagnostic delays that can have dire consequences due to its highly aggressive nature. Malignant melanoma, while rare, is exceptionally virulent, characterized by its rapid growth and high metastatic potential. Other less frequent malignancies include Merkel cell carcinoma and lymphoma.<sup>2,3</sup>

The management of malignant eyelid tumours is complex, requiring a nuanced understanding of their biological behavior, precise surgical techniques, and reconstructive strategies that prioritize both oncological clearance and functional and aesthetic restoration. Given the intricate anatomy of the eyelids, achieving clear surgical margins while preserving critical structures such as the lacrimal system and eyelid margin is paramount. This paper presents a hypothetical comprehensive analysis, aiming to illuminate the epidemiological patterns, clinical presentations, histopathological nuances, treatment paradigms, and long-term prognoses associated with malignant eyelid tumours,

thereby contributing to improved diagnostic accuracy and therapeutic outcomes.<sup>5</sup>

## METHODS AND MATERIAL

This hypothetical study involved a retrospective review of all patients diagnosed with malignant eyelid tumours who underwent surgical excision at a tertiary ophthalmic oncology center between January 2013 and December 2022. The study protocols adhered to the tenets of the Declaration of Helsinki and received ethical approval from the institutional review board.<sup>6</sup>

**Study Population:** Patients of all ages and genders with histologically confirmed primary malignant eyelid tumours were included. Patients with metastatic lesions to the eyelid from distant primaries or those receiving incomplete data were excluded.

**Data Collection:** A standardized data collection form was utilized to extract information from electronic medical records and histopathology reports. Variables collected included:

- **Demographics:** Age at diagnosis, sex, race/ethnicity.
- **Clinical Presentation:** Tumour location (upper eyelid, lower eyelid, medial canthus, lateral canthus), greatest dimension of the tumour (mm), duration of symptoms, presence of ulceration, pigmentation, telangiectasia, induration, madarosis.
- **Histopathological Diagnosis:** Specific tumour type, histological subtype, presence of perineural invasion, lymphovascular invasion, tumour differentiation, and status of surgical margins (clear, involved, close <1mm).
- **Treatment Modalities:** Primary surgical technique (conventional excision, Mohs micrographic surgery), extent of resection, type of reconstruction (primary closure, skin graft, local flap, composite graft), use of adjuvant therapy (radiotherapy, chemotherapy).
- **Follow-up and Outcomes:** Duration of follow-up, presence and date of local recurrence, regional lymph node metastasis, distant metastasis, and overall survival.

**Statistical Analysis:** Descriptive statistics were employed to summarize demographic and clinical characteristics. Frequencies and percentages were used for categorical variables, while means, standard deviations, and ranges were calculated for continuous variables. Recurrence-free survival rates were analyzed using Kaplan-Meier curves, and differences between groups were assessed using log-rank tests. All statistical analyses were performed using hypothetical statistical software, with a p-value < 0.05 considered statistically significant.<sup>7,8</sup>

RESULT

A total of 385 patients with histologically confirmed malignant eyelid tumours were identified and included in this hypothetical study. The mean age at diagnosis was 68.2 ± 11.5 years (range: 32-94 years), with a slight female predominance (53.8%).<sup>9</sup>

**Table 1:** Demographic and clinical characteristics of malignant eyelid tumours (n=385)

| Characteristic                      | Number (n) | Percentage (%) |
|-------------------------------------|------------|----------------|
| Sex                                 |            |                |
| Male                                | 178        | 46.2           |
| Female                              | 207        | 53.8           |
| Tumour Location                     |            |                |
| Lower Eyelid                        | 225        | 58.4           |
| Medial Canthus                      | 98         | 25.5           |
| Upper Eyelid                        | 40         | 10.4           |
| Lateral Canthus                     | 22         | 5.7            |
| Mean Tumour Size (mm) ± SD          | 10.8 ± 4.2 | —              |
| Mean Symptom Duration (months) ± SD | 12.5 ± 8.1 | —              |

As shown in Table 1, the lower eyelid was the most frequently affected site (58.4%), followed by the medial canthus (25.5%). The average tumour size at presentation was 10.8 mm (SD 4.2 mm), and patients reported symptoms for an average of 12.5 months prior to diagnosis.

**Table 2:** Histopathological Distribution and Primary Treatment Modalities (n=385)

| Tumour Type                     | Number (n) | Percentage (%) | Primary Treatment Modality | Number (n) | Percentage (%) |
|---------------------------------|------------|----------------|----------------------------|------------|----------------|
| Basal Cell Carcinoma (BCC)      | 288        | 74.8           | Conventional Excision (CE) | 165        | 57.3           |
|                                 |            |                | Mohs Surgery (MS)          | 123        | 42.7           |
| Squamous Cell Carcinoma (SCC)   | 52         | 13.5           | Conventional Excision (CE) | 28         | 53.8           |
|                                 |            |                | Mohs Surgery (MS)          | 24         | 46.2           |
| Sebaceous Gland Carcinoma (SGC) | 27         | 7.0            | Conventional Excision (CE) | 20         | 74.1           |
|                                 |            |                | Exenteration               | 7          | 25.9           |
| Malignant Melanoma              | 10         | 2.6            | Wide Excision              | 8          | 80.0           |
|                                 |            |                | Exenteration               | 2          | 20.0           |
| Others (e.g., Merkel Cell)      | 8          | 2.1            | Various                    | 8          | 100.0          |

**Table 2** illustrates that BCC was the most prevalent malignancy (74.8%), followed by SCC (13.5%) and SGC (7.0%). Malignant melanoma constituted 2.6% of cases. The primary treatment for most BCC and SCC cases involved surgical excision, with Mohs micrographic surgery being increasingly utilized (42.7% for BCC, 46.2% for SCC) due to its high cure rates and tissue-sparing benefits. For SGC and melanoma, a significant proportion required more aggressive interventions, including exenteration, reflecting their more invasive nature.

**Table 3:** Recurrence and metastasis rates by tumour type (Mean Follow-up: 5.2 years)

| Tumour Type               | Total Cases (n) | Local Recurrence (n) | Recurrence Rate (%) | Regional Metastasis (n) | Distant Metastasis (n) |
|---------------------------|-----------------|----------------------|---------------------|-------------------------|------------------------|
| Basal Cell Carcinoma      | 288             | 17                   | 5.9                 | 0                       | 0                      |
| Squamous Cell Carcinoma   | 52              | 6                    | 11.5                | 2                       | 1                      |
| Sebaceous Gland Carcinoma | 27              | 5                    | 18.5                | 4                       | 3                      |
| Malignant Melanoma        | 10              | 2                    | 20.0                | 3                       | 4                      |
| Others                    | 8               | 1                    | 12.5                | 1                       | 1                      |

Over a mean follow-up period of 5.2 years, the overall local recurrence rate was 7.5%. BCC demonstrated the lowest recurrence rate (5.9%), while SGC (18.5%) and Malignant Melanoma (20.0%) presented the highest rates. Regional lymph node metastasis was observed in SCC (2 cases), SGC (4 cases), malignant melanoma (3 cases), and others (1 case). Distant metastasis was rare but occurred in SCC (1 case), SGC (3 cases), malignant melanoma (4 cases), and others (1 case), underscoring the aggressive potential of these less common tumour types.

## DISCUSSION

The findings of this hypothetical study largely corroborate established knowledge regarding malignant eyelid tumours, while also providing specific insights into our hypothetical cohort. The predominance of BCC, particularly on the lower eyelid and medial canthus, is consistent with global epidemiological data, largely attributable to chronic sun exposure in these anatomically vulnerable areas. The relatively advanced mean tumour size (10.8 mm) and duration of symptoms (12.5 months) at presentation underscore the need for enhanced public awareness and earlier clinical suspicion among primary care providers. Delays in diagnosis can complicate management, necessitating more extensive resections and potentially compromising reconstructive outcomes.<sup>10</sup>

The high utilization of Mohs micrographic surgery for BCC and SCC cases reflects a contemporary shift towards tissue-sparing techniques, particularly crucial in the periocular region where functional and aesthetic preservation is paramount. Its ability to achieve complete tumour clearance with minimal tissue sacrifice translates to lower recurrence rates and superior cosmetic results. Our hypothetical 5.9% recurrence rate for BCC, while higher than some Mohs-specific series, likely reflects the inclusion of conventional excisions and the varying complexity of cases.

The significantly higher recurrence and metastatic rates observed for SCC, SGC, and malignant melanoma highlight their aggressive biological behavior. SGC, often misdiagnosed as benign inflammatory lesions, demonstrates a troubling 18.5% recurrence rate and substantial metastatic potential in our cohort. This emphasizes the critical importance of a high index of suspicion for persistent or recurrent chalazion-like lesions, particularly in older patients, and the necessity for incisional

biopsy in such cases. Similarly, the high metastatic rates for malignant melanoma, even with wide excisions, reinforce the need for meticulous staging, sentinel lymph node biopsy in appropriate cases, and the potential inclusion of systemic therapies.

Reconstructive challenges post-excision are immense. The choice of repair technique, ranging from primary closure to complex flaps and grafts, is dictated by the defect size, location, and depth, as well as the surgeon's expertise. The balance between maintaining eyelid function (e.g., blink reflex, lacrimal drainage) and achieving an acceptable cosmetic outcome is a constant consideration. Adjuvant therapies, such as radiotherapy, were sparingly used in this cohort, primarily reserved for cases with positive margins, perineural invasion, or inoperable tumours, reflecting a preference for complete surgical extirpation as the primary treatment.

A limitation of this hypothetical study is its retrospective nature and single-center design, which may introduce selection bias and limit generalizability. Future prospective, multi-center studies with larger cohorts are needed to validate these findings and explore the impact of emerging molecular and targeted therapies. Investigation into genetic predispositions and environmental risk factors across diverse populations would also enrich our understanding of these challenging malignancies.<sup>11</sup>

## CONCLUSION

Malignant eyelid tumours represent a diverse group of neoplasms requiring precise diagnosis and individualized management. Basal cell carcinoma remains the most common, but the aggressive nature of squamous cell carcinoma, sebaceous gland carcinoma, and malignant melanoma demands particular vigilance. Early diagnosis, comprehensive histopathological evaluation, and complete surgical excision, often facilitated by Mohs micrographic surgery, are paramount to achieving optimal oncological and functional outcomes. A multidisciplinary approach, integrating the expertise of ophthalmic plastic surgeons, dermatologists, pathologists, and oncologists, is crucial for effective patient care and long-term surveillance. Continued

research into novel diagnostic markers and therapeutic strategies is essential to further improve the prognosis for individuals affected by these unmasking shadows on the eyelid.<sup>12</sup>

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